

# ABSTRACTS

Animal Physiotherapy Group  
Conference

## Animal Physiotherapy in Practice



APA Conference Week  
4–8 October 2007  
Cairns, Australia



AUSTRALIAN PHYSIOTHERAPY ASSOCIATION

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### **Diffuse noxious inhibitory control and the use of a noxious stimulus to improve canine gait**

Davidson PT

*Canine and Equine Physiotherapy Victoria,  
Melbourne*

One of the most important challenges for animal physiotherapists is to get injured dogs to weight bear on painful limbs. Otherwise, uneven weight bearing on three limbs may result in spinal scoliosis, muscle atrophy and contracture of lame leg muscles, increased compression of the alternate good limb and possibly injury to one of the three good legs, which would be diabolical in outcome. A heterotopic noxious stimulus is a stimulus occurring in an abnormal place. This could be the use of a bottle or syringe top under the paw, or a piece of silver foil under the pad. A noxious stimulus anywhere in the body can reduce the perceived intensity of pain of a concomitant noxious stimulus elsewhere. This study hypothesised that the use of a noxious stimulus to the contralateral 'good' leg would encourage more weight bearing on the lame leg of a dog. Four lame dogs were used in this study and one normal dog for comparison. Video analysis and Millis' grade of lameness pre- and post-noxious stimulus was established. This study showed that a noxious stimulus under the pad of the 'good' leg did encourage the dogs to weight-bear more evenly on the lame leg ( $p = 0.046$ ). The neurophysiological reason for this may be diffuse noxious inhibitory control, spinal cord inhibition, opioid mediated analgesia system, or withdrawal reflex.

### **Labrador elbow dysplasia and anthropometric measurements of scapula, humerus, radius and ulna**

Davidson PT,<sup>1</sup> Bullock-Saxton J<sup>2</sup> and Lisle A<sup>2</sup>

<sup>1</sup>Canine and Equine Physiotherapy Victoria, Melbourne <sup>2</sup>The University of Queensland, Gatton

The aim of this study was to determine if anthropometric measurements of labrador scapula, humerus, ulna and radius, or their ratios, are related to the presence of elbow dysplasia (ED). There were 103 'volunteer' Labradors: 41 male dogs and 62 bitches. Digital caliper measurements of the lengths of the left scapula, humerus, radius and ulna, and their ratios, were analysed by gender, against International Elbow Working Group derived elbow dysplasia radiological scores. The International Elbow Working Group score is an umbrella score used to classify for elbow dysplasia and includes fragmented coronoid process, osteochondritis dissecans and un-united anconeal process, the last of which occurs rarely in labradors and was excluded in this study. The researcher was blind to the radiological scores until after taking the measurements. Of the 103 Labradors studied, 31 were diagnosed radiographically with elbow dysplasia: 20 bitches (32%), 11 (27%) male dogs. Scapula length was significantly shorter for bitches with ED ( $p = 0.02$ ), but not for male dogs. However, male dogs showed a trend for a difference in ulna: radius ratio ( $p = 0.06$ ) but bitches did not. Although a greater percentage of bitches than male dogs had elbow dysplasia in this study, the difference was not statistically significant. This study demonstrated that a

shorter scapula exists in bitches diagnosed with Labrador elbow dysplasia. This is a new finding associated with this condition. The difference in presentation associated with gender is unexpected. Further research is recommended.

### **Splinting and carts in the small animal patient**

Monk ML

*Dogs In Motion Canine Rehabilitation, Melbourne*

Animal physiotherapy is rapidly emerging as a special interest area in physiotherapy in Australia, Europe and America. Just as with human physiotherapy, animal physiotherapists are aiming to improve the mobility of animal patients and maximise their quality of life. The use of splints, orthotics and aids to assist mobility are commonplace in human physiotherapy. Many of the same materials and principles of splinting used in humans can be applied directly to animals. This presentation discusses the application of splinting in the small animal patient and the use of canine carts and various assistive devices to enhance mobility. Cases are presented to demonstrate the application of various types of splinting, assistive devices and carts.

### **The role of physiotherapy in the thoroughbred racing industry**

Sagar KN

*Melbourne Animal Physiotherapy P/L*

The aim of this paper is to provide an informative session on the role of physiotherapy within the thoroughbred racing industry. The paper will provide physiotherapists with the general knowledge and basic skills to work within the extensive industry of thoroughbred racing. The author will draw upon her 16 years experience working with elite racehorses to provide the novice physiotherapist with the 'tricks of the trade'. Topics covered will include: an overview of the racing industry, its' controlling bodies and regulations; the set-up of training centres and race tracks; existing professionals working in the industry; the average training and pre-training regime; horses' schedules during racing; racing terminology including speeds and paces used in training and racing; getting started with a race horse trainer; managing a regular relationship with a racehorse trainer; common injuries treated by the physiotherapist; treatment and management of injuries and the hazards to avoid if you are to survive as a physiotherapist working with thoroughbred racehorses.

### **Objective measures, palpation and a soft tissue physiotherapeutic technique to reduce muscle tension in horses**

Varcoe-Cocks K

As physiotherapists we rely heavily on both our subjective and objective assessments of patients. Without the subjective feedback from our animal patients, a large part of that assessment is missing. It is therefore imperative that we do our best to investigate what it is that we are feeling and

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seeing so that we can justify the benefits of our treatment. The aim of this presentation is to discuss some possible objective measures for soft tissue palpation and treatments of the horse. This will be extrapolated from human physiotherapy, recent research into the equine patient and the clinical experience of the presenter. Pressure algometry and palpation scoring system are two examples of useful assessment tools that animal physiotherapists may use. The presentation will also include a demonstration of the Melbourne Animal Physiotherapy technique and discussion of its clinical uses. An investigation of its possible human equivalent techniques to explain it more clearly and literature search to support its use will also be included.

### Physiotherapy treatment of canine vestibular disease: a case study

Mc Phail S<sup>1</sup> and Windred T<sup>2</sup>

<sup>1</sup>Princess Alexandra Hospital, Brisbane <sup>2</sup>Noah's Ark Animal  
Physiotherapy, Brisbane

This retrospective single case study describes the successful physiotherapy treatment of a canine patient with vestibular disease signs. A nine-year old male Newfoundland presented with an acute history of one

day inability to walk and reluctance to change position. A veterinary examination found no pain on palpation or manipulation throughout the spine or extremities, no loss of proprioception, reflexes, muscle tone or deep pain sensation. No clear diagnosis was concluded, although a tumour or progressive degenerative neurological condition was suggested as most likely. The veterinarian gave a poor prognosis for the canine recommending further diagnostic scanning or euthanasia if symptoms continued or worsened. Over the next two days symptoms remained unchanged. However the owner, a physiotherapist, noted symptoms were more severe in darkness, the dog resisted rolling onto one side, and nystagmus was present with specific head movements. The presentation of signs appeared similar to those found in human benign paroxysmal positional vertigo. After a vestibular assessment the treatment selected was a modified Epley manoeuvre—a sequence of movements aimed at moving the debris in the semi circular canals back to the utricle for reabsorption. After the initial treatment, gait immediately improved to walking with mild ataxia but no falls. A further three treatments over the next two days resulted in full recovery. The immediate success of a modified Epley manoeuvre in this case study illustrates that canine patients with similar presentations may be amenable to physiotherapy intervention in the veterinary management of vestibular disease.

## Join an APA National Group

The Australian Physiotherapy Association has 14 National Groups. Each group represents a discrete area of physiotherapy and provides members with access to a wide range of educational and research materials. If you have an interest, or work, in a particular field of physiotherapy, membership of the relevant group will provide you with an opportunity to develop and maintain high-level knowledge and skills, and remain abreast of key issues in that area of physiotherapy. Membership automatically adds your name to a network of your professional peers – providing opportunities to discuss issues or seek advice from other members of the group.

### Key Benefits of Membership

- Access to quality professional development courses, symposia, and conferences, at discounted prices, enhancing your knowledge of your chosen physiotherapy speciality area
- Group newsletters at least twice a year, plus regular email news and notices
- Access to evening lectures and social functions, providing you with the chance to touch base with other physiotherapists, discuss ideas, and develop a peer support network

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AUSTRALIAN PHYSIOTHERAPY ASSOCIATION

# ABSTRACTS

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Conference



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AUSTRALIAN PHYSIOTHERAPY ASSOCIATION

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### **Aquatic physiotherapy and acute back pain: why get wet?**

Rahmann AE

*The University of Queensland, Brisbane*

Pain and bed rest have been shown to significantly inhibit activation of the deep multifidus (DM) and transversus abdominus (TrA) muscles. Considerable evidence supports the importance of retraining these muscles early after the onset of back pain. When admitted to hospital with acute back pain, usual management includes a period of bed rest with restricted mobility, further inhibiting the activation of these muscles. Aquatic physiotherapy can be used in this acute phase, combined with ward-based physiotherapy to begin the process of relearning normal motor control. In water, patients report significantly less pain and the superficial muscles, like the erector spinae, have less spasm on palpation. Activation of the DM and TrA is easier when pain is reduced and can be incorporated into functional activities earlier than is possible on land. An understanding of the principles of hydrodynamics, combined with a clinical reasoning framework, underpins effective aquatic physiotherapy treatment in this acute phase. Two cases studies will highlight both the principles of the aquatic physiotherapy management and the precautions necessary with these acute patients. The first case has an acute lumbar disc protrusion with nerve root involvement and the second has multiple crush fractures due to secondary bone cancer. At The Wesley Hospital in Brisbane, this combination of aquatic and land-based physiotherapy treatment has allowed some inpatients with acute back pain to avoid the surgery that was their only other treatment option.

### **Aquatic physiotherapy in paediatrics: more than swimming and recreation**

Harrison JA

*The Wesley Hydrotherapy Clinic, Brisbane, Hydrotherapy Consulting and Training, Brisbane*

Aquatic physiotherapy has been used in many different ways over the years in paediatric neurological management. There has been varying support from different schools of paediatric neurological thought coupled with a definitive lack of evidence and widespread lack of any undergraduate paediatric aquatic training. Yet, hydrotherapy is a common component of special school and paediatric programs. Many traditional methods of paediatric aquatic management have focused purely on swimming and water safety strategies. These can be vital for some students but for many, who will never be independent in water, there is often no long term benefit. Teachers, including physical educationalists, sometimes focus on traditional swimming techniques, often emphasising movement that may in fact be detrimental to land function. Physiotherapists are now analysing skilled movement in water and relating that to skilled movement on land, function and fitness. The aquatic environment has the added benefit of improved compliance and enjoyment, which are of value not only to the physiotherapist but to the parent. It is also a medium that a child may be exposed to more often than exposure to land based physiotherapy.

With financial restraints in public and community health and the education department, regular physiotherapy for neurological conditions such as cerebral palsy can be very limited. Physiotherapists find themselves setting aquatic programs for parents, teachers and carers and, whether as treatment or as recreation in the home or school pool, handling and management must be consistent. The exercises and activities need to be prescribed and outcome focused.

### **A randomised trial comparing outcomes between land and water-based sub-acute physiotherapeutic rehabilitation following primary total knee replacement**

Russell T,<sup>1,2</sup> Naylor JM,<sup>1,2,3</sup> Harmer AR<sup>1</sup> and Crosbie J<sup>1</sup>

*<sup>1</sup>The University of Sydney, Sydney, <sup>2</sup>Fairfield Hospital, Sydney, <sup>3</sup>UNSW Clinical School, Sydney*

This study examined the effectiveness of land-versus water-based rehabilitation following primary total knee replacement. A single-blind randomised trial was carried out in a physiotherapy outpatient gym and a community pool. One hundred and two consecutive patients were randomised to receive either a land-(n = 59) or water-based (n = 53) physiotherapeutic rehabilitation program. Patients received one hour of group exercise twice a week for 6 weeks. Both the land and water-based programs were standardised to facilitate the matching of strength, flexibility, endurance, cardiovascular and mobility components. Two-way (group, time) analysis of variance was used to detect differences. Main outcomes included visual analogue scale for pain, range of motion, 6-minute walk test, and the Western Ontario and McMaster Universities Osteoarthritis Index. These measures were assessed pre-training, post-training and at six months post-surgery. Significant improvements ( $p < 0.001$ ) were observed across time for the visual analogue scale for pain ( $> 80\%$ ), the 6-minute walk test (100%), all self-reported pain, stiffness and function scores ( $> 75\%$ ) and knee flexion range ( $> 25\%$ ), but there were no significant between-group interactions. As neither program appears to be associated with superior outcomes, patient preference, service access and relative costs may be the most relevant issues in selecting delivery mode.

### **Better range of movement and function for shoulder patients post-surgery with six weeks of aquatic physiotherapy: pilot randomised controlled trial**

Govier AA,<sup>1</sup> Nolan JS,<sup>1</sup> Crawshaw N<sup>1</sup> and Esterman AJ<sup>2</sup>

*<sup>1</sup>Flinders Medical Centre, Adelaide, <sup>2</sup>University of South Australia, Adelaide*

Aquatic physiotherapy is becoming increasingly used in post-operative rehabilitation but with little high level evidence demonstrating effectiveness. In this single-blinded pilot randomised controlled trial on patients after shoulder surgery, intervention group (n = 9) received early aquatic physiotherapy twice weekly for six weeks and usual physiotherapy compared to control group (n = 9) who received usual physiotherapy. Participants' age ranged from

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19–73 years, average  $49.0 \pm 16.5$ . The intervention group showed a smaller median increase in disability, comparing Disability of Arm, Shoulder Hand (DASH) scores from pre-operative to six weeks postoperatively, than the control group which showed a median difference of 15.2 (Mann-Whitney U test:  $z = 1.470$ ,  $p = 0.14$ ). Comparison of active range of movement (ROM) six weeks after surgery with pre-operative ROM showed greater median improvements in the intervention group in comparison with control group. Over this period, in the intervention group, median ROM of flexion increased  $12^\circ$ , abduction increased  $22^\circ$ , external rotation increased  $12^\circ$ , whereas in the control group median flexion ROM decreased  $49^\circ$ , abduction decreased  $38^\circ$  and external rotation decreased  $49^\circ$ . Using the Mann-Whitney U test, median differences were not statistically significant for flexion ( $z = -1.636$ ,  $p = 0.10$ ); abduction ( $z = -1.879$ ,  $p = 0.06$ ); or external rotation ( $z = 1.636$ ,  $p = 0.10$ ). Results suggest the addition of early aquatic physiotherapy may improve ROM and function at six weeks in comparison to usual physiotherapy, with a trend towards significance warranting investigation in a fully powered study.

### Contraindications/precautions for aquatic physiotherapy may need more research: an example regarding blood pressure in pregnant women

Ward E,<sup>1,3</sup> McIntyre A,<sup>2</sup> Van Kessel G<sup>1</sup> and Hague W<sup>2</sup>

<sup>1</sup>University of South Australia, Adelaide, <sup>2</sup>Women's and Children's Hospital, Adelaide, <sup>3</sup>Flinders Medical Centre, Adelaide

A number of contraindications exist for aquatic physiotherapy (AP) with pregnant women, however there is little specific research to prove the validity of some contraindications. Some therapists may believe the guidelines are excessive, however it is accepted that pregnant women are a special population. A study was completed at the Women's and Children's Hospital in 2002 to investigate the effect of AP on blood pressure (BP) in pregnant women. Uncontrolled blood pressure, hypertension and pre-eclampsia are listed as precautions/contraindications, however little was known about how participation in AP affected blood pressure in normal pregnant women. An experimental same-subject, repeated measures design was used and 45 sets of data collected from pregnant women attending routine, nonaerobic AP classes. Blood pressure measurements were taken preimmersion, 2–5 minutes after entering the pool, immediately following the 50-minute AP class (while immersed), and 8–12 minutes after exiting the water. Blood pressure data were analysed using a repeated measures ANOVA, and a highly significant difference was observed ( $p = 0.0000$ ). Post-hoc analysis showed BP to decrease significantly on entering the water (Mean Arterial Pressure, mean difference of 10.52 mm Hg, 95% CI 8.75–12.29), to remain at this low level post-exercise while still immersed, and then return to preimmersion values 8–12 minutes after exiting the water. These findings raised the question as to whether aquatic physiotherapy may in fact be beneficial to pregnant women with hypertensive pregnancy related conditions. This example highlights the need for more research regarding precautions/contraindications in aquatic physiotherapy.

### Evaluation of aquatic therapy following rotator cuff repair

Brady B,<sup>1</sup> Redfern J,<sup>1</sup> Williams J<sup>2</sup> and MacDougall G<sup>3</sup>

<sup>1</sup>The University of Sydney, <sup>2</sup>Delmar Private Hospital, <sup>3</sup>Mona Vale Orthopaedic Surgery

Rotator cuff tears are frequently encountered in medical outpatient settings and often require surgical repair to achieve desirable functional outcomes. However, the optimal form of post-operative rehabilitation of rotator cuff repairs remains unidentified by the research literature. The aim of this study was to investigate the role of aquatic therapy in the post-operative rehabilitation of rotator cuff tears and the feasibility of implementing a clinical trial. A cohort of 18 subjects undergoing rotator cuff repair were examined over a treatment period of 12 weeks. Twelve subjects participated in a combined aquatic and land-based program, while six subjects received a standard land-based protocol. Passive range of motion and the Western Ontario Rotator Cuff Index outcomes were measured pre-operatively and at three, six and 12 weeks post-operatively. The results demonstrated a significant improvement in both range of motion and Western Ontario Rotator Cuff scores in all subjects with treatment ( $p < 0.001$ ). Furthermore, participation in aquatic therapy significantly improved passive flexion range of motion measures at three weeks (mean  $46^\circ$ , 95% CI 17–75,  $p = 0.005$ ) and six weeks ( $30^\circ$ , 95% CI 8–51,  $p = 0.01$ ). There was no significant difference between the groups on any of the outcome measures at 12 weeks. The implementation of a combined aquatic and land-based physiotherapy program following surgical repair of the rotator cuff is feasible and shows promise of being more effective at accelerating the restoration of passive shoulder flexion range of motion than conventional land-based exercise.

### Keeping your head above water: considerations for aquatic physiotherapy in ventilator dependent children and children with tracheostomies

Pacey V and Evans K

The Children's Hospital at Westmead, Sydney

Ventilator dependent children form an emerging population in the community, presenting physiotherapists with a unique challenge to optimise development and quality of life. This population suffers a lack of opportunities for age appropriate activities contributed largely to by prolonged hospitalisation. There is little evidence to date discussing the role of aquatic physiotherapy in children with tracheostomies. Experience at The Children's Hospital at Westmead has shown that aquatic physiotherapy in this population is safe as an adjunct to traditional physiotherapy treatment and provides a unique opportunity for parents, patients and staff. Over the last three years we have had nine children with tracheostomies, five of whom are ventilator dependent, participating in aquatic physiotherapy. The benefits resulting in this population may include fine and gross motor skill acquisition, sensory and vestibular stimulation, psychosocial development and improved respiratory function. For these goals to be achieved in aquatic therapy, multi-disciplinary participation was utilised. Aquatic physiotherapy is also considered a



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high priority by the parents of these children as evidenced through the Canadian Occupational Performance Measure. Specific safety considerations for aquatic physiotherapy in children with tracheostomies are essential at all times. As a result, strict policy and procedures to maximise safety and minimise risks to patients, staff and families have been developed. To date we have had no adverse events. Initial hesitance of aquatic physiotherapy in children with tracheostomies and ventilator-dependant children has now developed into a safe, efficacious, regular, challenging and rewarding experience for patients, family and staff.

### **Outcomes of patients with total knee replacements with or without hydrotherapy included in their rehabilitation**

Ng ML, James J, Pearce K and Bird M

*Donvale Rehabilitation Hospital, Melbourne*

The aim of the study was to determine if improved outcome occurred with inclusion of hydrotherapy in the inpatient rehabilitation program of patients following total knee replacement. Fifty patients admitted for an inpatient rehabilitation program following total knee replacement were studied. A group of twenty-five patients had physiotherapy twice daily, and another group of twenty-five patients had physiotherapy and hydrotherapy daily. Admission and discharge measures were collected. These measures were: age, body mass index, length of stay, interval between surgery and start of rehabilitation, subjective measures on pain and confidence with exercise and walking (using visual analogue scales), range of knee flexion and extension, quadriceps lag, gait aid used, 6-minute walk test, and timed stairs climbing. All goniometric measures were blinded. The two groups (hydrotherapy versus no hydrotherapy) were well matched. Discharge measures showed significant improvement in all objective measures in both groups. The group receiving hydrotherapy showed greater improvements in the areas of quadriceps strength ( $p = 0.040$ ), confidence with exercising ( $p = 0.033$ ) and were more likely to continue exercising on discharge ( $p = 0.046$ ). This relatively small study was able to demonstrate benefit of hydrotherapy in rehabilitation following total knee replacement.

### **Reviewing practice guidelines relating to water temperature for antenatal women attending aquatic physiotherapy and implication in Women's health practice**

Larsen JA

*The Wesley Hydrotherapy Clinic, Brisbane, Hydrotherapy Consulting and Training, Brisbane*

Risk management for pregnant women attending aquatic physiotherapy for antenatal classes requires that practitioners consider carefully water temperature and intensity of activity. Unfortunately, many of the studies in this area have been carried out on rat populations or are retrospective

studies. The Wesley Hydrotherapy Clinic in Brisbane has for 18 years supported the running of antenatal aquatic physiotherapy classes, including immersion in a 34° pool. This population has provided the practice with a wealth of information and we have monitored (as part of a clinical risk management/quality improvement strategy) aural temperatures of pregnant women before during and after their aquatic physiotherapy including immersion at 34°. Results of this clinical practice improvement project are presented and discussed along with a literature review that looks at the evidence base from which commonly quoted information on water temperature related to pregnant women is obtained. Suggestions for practice guidelines are made.

### **Taking the plunge: the effect of land-based combined with aquatic physiotherapy on fall-related self-efficacy in community dwelling older adults**

Jayalath V, Smith J, Smith R and Wass E

*Northern Health Service, Melbourne*

In Australia, it has been reported that 30% of community dwelling older adults report some degree of fear of falling. Fear of falling results in self-induced activity restrictions leading to physical deconditioning, thereby increasing falls risk. Water has been proposed as a safe environment in which the elderly are potentially more willing to move and challenge their balance. Despite this, few studies have investigated the effect of aquatic physiotherapy on fall-related self-efficacy. The aim of this presentation is to describe the outcomes of our clinical research into this question, using a randomised controlled pilot study. Community dwelling older adults who had experienced a fall in the last 12 months were randomised to receive 10 weeks of physiotherapy: either two land-based sessions per week, or one land and one aquatic-based session per week. The Modified Falls Efficacy Scale, Human Activity Profile and Step Test were taken at baseline, six weeks and 10 weeks, by an assessor blinded to the subject's intervention allocation. In addition, the clinicians kept written reflections on their research experiences. This project offers insights into the management of falls-related self-efficacy in community dwelling older people, as well as reflections on the challenges of conducting research in the clinical setting, particularly with frail elderly people. Subjects' demographic profile and preliminary outcome results will be presented, together with discussion of the implications for physiotherapy practice.

# ABSTRACTS

Cardiorespiratory Physiotherapy Australia  
10th Biennial Conference

## Merging Education into Practice



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### An audit of current physiotherapy management and patient outcomes in one thoracic surgical unit

Reeve J,<sup>1</sup> Nicol K<sup>2</sup> and Denehy L<sup>3</sup>

<sup>1</sup>Auckland University of Technology, Auckland, New Zealand <sup>2</sup>Auckland City Hospital, Auckland, New Zealand <sup>3</sup>University of Melbourne, Melbourne

Limited data are published which consider the physiotherapy management of patients undergoing thoracic surgery. This study prospectively audited patients undergoing open thoracic surgery in one surgical unit, investigating physiotherapy management, postoperative pulmonary complication rate and length of postoperative stay. Fifty-four patients with a mean age of 61.9 years (SD 12.9, range 18–85 years) were studied. The majority of patients underwent lung resection ( $n = 45$ , 81.8%). No patient received preoperative physiotherapy. The mean physiotherapy time spent with patients postoperatively in total was 12.6 units (SD 7.1, range 4–39 units), with each unit representing a 15-minute time period. On postoperative day one the majority of patients used forced expiratory manoeuvres ( $n = 41$ , 74.5%) with lung expansion manoeuvres used in 25 (45.5%) patients. Ten (18.5%) patients developed a postoperative pulmonary complication. Six (10.9%) patients received early ambulation only and none of these developed a postoperative pulmonary complication. The median (IQR) postoperative length of stay was 7 (3) days. Twenty-one (38.2%) patients had a length of stay over nine days. Most common reasons for an increased postoperative length of stay were persistent air leak from the chest drains ( $n = 9$ , 16.7%) and respiratory complications ( $n = 4$ , 7.3%). The median (IQR) length of postoperative stay in patients developing a pulmonary complication was 10 (2.3) days which was significantly higher than those not developing a pulmonary complication ( $p = 0.003$ ). Despite limited supporting evidence, this patient group utilises considerable physiotherapy resources. Future studies should consider the efficacy of these interventions.

### A retrospective analysis of patient outcomes from an exercise only pulmonary rehabilitation program

Zimmermann F,<sup>1,2</sup> Berlowitz DJ,<sup>1,2</sup> Graco M<sup>1,2</sup> and Smith JS<sup>1</sup>

<sup>1</sup>The Northern Hospital, Melbourne <sup>2</sup>Northern Clinical Research Centre, Melbourne

Comprehensive pulmonary rehabilitation targeting clients with chronic obstructive pulmonary disease, results in clinically significant improvements in health related quality of life, exercise capacity and dyspnoea. We examined whether similar gains were observed across all clients, not simply those included in published research, following an exercise only pulmonary rehabilitation program. Clients attended an outpatient physiotherapy gymnasium twice weekly for 6–8 weeks, to participate in an individually tailored, supervised exercise program at an acute tertiary teaching hospital in Melbourne's outer-north. Demographic details, Incremental Shuttle Walk Test, Medical Research Council dyspnoea scale, St. George Respiratory Questionnaire, and the Assessment of Quality of Life were recorded. Since May 2003 206 clients have attended an initial assessment (55% male, mean age 68.7, 55% born overseas, and mean FEV<sub>1</sub>

%pred 52.6%). One hundred and seventeen completed both pulmonary rehabilitation and the post-program assessment. Fifty (43%) significantly increased their exercise capacity (Incremental Shuttle Walk Test,  $p < 0.001$ ) and 46 (40%) had a clinically significant reduction in chronic dyspnoea on the Medical Research Council scale ( $p < 0.001$ ). Both disease specific (St. George Respiratory Questionnaire,  $p = 0.005$ ) and generic (Assessment of Quality of Life measure,  $p = 0.04$ ) quality of life increased. Neither measure attained the minimal clinically important difference, although both fell within the 95% confidence intervals. These data suggest that in a heterogeneous, predominately immigrant population with chronic obstructive pulmonary disease, significant improvements in exercise capacity, dyspnoea and quality of life may be observed with exercise training alone. These results require examination in a prospective, controlled experiment.

### A retrospective chart audit to test the validity of an outcome tool in predicting the outcomes of open heart surgery

Caruana LR,<sup>1</sup> Bellet RN,<sup>1</sup> Mullany D,<sup>1</sup> Bartlett H,<sup>1</sup> Carter C,<sup>2</sup> Spencer S,<sup>2</sup> Paxman N,<sup>2</sup> Rash J<sup>2</sup> and Mair E<sup>2</sup>

<sup>1</sup>The Prince Charles Hospital, Brisbane <sup>2</sup>Griffith University, Gold Coast

This study aimed to validate a newly developed outcome measure index (OMI) to assess the effectiveness of cardio-respiratory physiotherapy (CP) in intensive care (ICU). The OMI scored the following parameters respiratory rate, ventilation, oxygen requirements, cough, Glasgow Coma Scale, A-a gradient, and sputum. A total of 56 charts of patients who underwent open heart surgery were audited and scored at various intervals during the first 24 hours after surgery. Twenty-four patients who died (deceased) were compared to 32 patients who survived without need for transfer to the general ICU (survivors). Patients were matched by age, gender, and surgery. Comparison between survivors and deceased showed a significant difference in average OMI values between these groups as early as four hours post-operatively. Logistic regression indicates that the patients' OMI values from 4 hours onwards were significantly related to their odds of survival ( $p = 0.006$  for the OMI values at 4 hours), with higher OMI values associated with increased odds of survival. Bypass time also significantly predicted outcome after allowing for the OMI value ( $p = 0.015$ ), but with increased bypass time related to increased odds of survival (for a given OMI value). Odds ratios for a five point change in the OMI is 2.32 (95% CI 1.27–4.31), thus the odds of a patient's survival may increase noticeably if a five point increase in the OMI can be achieved. Future studies are being planned to see if CP can change the OMI and therefore alter patient outcomes.

### Awful versus labour: differences in the language of breathlessness before and after an exercise challenge

Garrard A,<sup>1</sup> Williams M,<sup>1</sup> Cafarella P<sup>2</sup> and Petkov J<sup>3</sup>

<sup>1</sup>School of Health Sciences and <sup>3</sup>Centre for Regional Engagement, University of South Australia, Adelaide, <sup>2</sup>Respiratory Medicine, Repatriation General Hospital, Adelaide

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The aim of this study was to determine how consistently people with chronic respiratory disease describe their sensation of breathlessness. A repeated measures design was used to compare the language of breathlessness between rest (recalling the sensation) and immediately following an exercise test (currently experiencing the sensation). Participants were asked to volunteer words to describe their sensation of breathlessness and endorse up to three statements from a pre-existing list of 15 statements. Two 6-minute walk tests (6MWT) were undertaken with half an hour break between tests. The breathlessness interview was repeated immediately following each 6MWT. Consistency of descriptions (volunteered and endorsed) was assessed using mixed model logistic regression. Fifty-seven participants completed the protocol ( $71 \pm 9.5$  years, 41 Males,  $FEV_1$  %pred  $66 \pm 30$ ). For volunteered descriptors, the frequency of affective language categories was significantly greater at rest than following exercise (uncomfortable  $p = 0.001$ , worried  $p = 0.007$ , annoying  $p < 0.0001$ , regret  $p = 0.012$ , awful  $p = 0.004$ , frightening  $p = 0.001$ , suffocating  $p = 0.012$ ). The frequency of physical language categories were greater immediately after exercise (labour  $p = 0.042$ , deep  $p = 0.027$ ). Three of the endorsed statements differed significantly between rest and after exercise (frequency decreased for constricted ( $p = 0.008$ ) and cannot get enough air in ( $p = 0.01$ ) and increased for breathing more ( $p = 0.009$ )). These results suggest that on recall, people describe severe experiences of breathlessness which may not reflect the sensation experienced with moderate exercise.

### Behaviour of transversus abdominus during the unsupported upper limb exercise test in people with and without chronic obstructive pulmonary disease

Williams MT,<sup>1</sup> McEvoy M,<sup>1</sup> Fulton I,<sup>1</sup> Vuckov M,<sup>1</sup> Cafarella P<sup>2</sup> and Petkov J<sup>3</sup>

<sup>1</sup>School of Health Sciences and <sup>3</sup>Centre for Regional Engagement, University of South Australia, Adelaide, <sup>2</sup>Respiratory Medicine, Repatriation General Hospital, Adelaide

Transversus abdominus (TrA) has been shown to play an important role in increasing stability of the spine through increasing intra-abdominal pressure. Previous studies of people with chronic obstructive pulmonary disease (COPD) report earlier and consistent activity in TrA at rest and during exercise (cycling and walking). The behaviour of TrA during upper limb activities has not been reported. This study aimed to describe and compare TrA activity using rehabilitative ultrasound imaging (RUSI) during an incremental unsupported upper limb exercise test (UULEX) between people with and without COPD. Images of TrA were assessed continuously using RUSI while participants completed the UULEX. Measures of TrA thickness were recorded before, during and after the UULEX at minute intervals. Seven COPD subjects completed the test on two occasions separated by 30 minutes. Differences between groups were calculated using mixed model analysis. Two groups ( $n = 11$ ) completed this study (COPD  $68.5 \pm 7.6$  years,  $FEV_1$  %pred  $58 \pm 34$ , Non-COPD  $61.2 \pm 5.1$  years,  $FEV_1$  %pred  $109 \pm 15$ ). No significant differences were calculated for TrA between occasions of testing for people with COPD ( $p = 0.57$ ). People with COPD demonstrated greater increases in TrA thickness during the early phases

of the UULEX (minutes 4, 5 and 7  $p = 0.02$ ) and TrA thickness was significantly associated with severity of airflow impairment ( $p < 0.001$ ). The earlier and sustained increases in TrA thickness during the UULEX in people with COPD may reflect increased ventilatory work or an increased need for spinal stiffness or both.

### Bi-level positive airway pressure increases minute ventilation in normal and patient groups during wakefulness and sleep

Chesworth W,<sup>1</sup> Piper A,<sup>2</sup> Becker H,<sup>3</sup> and Sullivan C<sup>4</sup>

<sup>1</sup>University of Canberra, Canberra <sup>2</sup>Royal Prince Alfred Hospital, Sydney <sup>3</sup>Pneumologie and Internistische Intensivmedizin, Marburg, Germany <sup>4</sup>The David Read Laboratory, Sydney University

The aim of this study was to measure the effect of a bi-level positive pressure device on minute ventilation during wakefulness, NREM and REM sleep, in normal subjects and patients with either chronic obstructive pulmonary disease or obesity hypoventilation syndrome. Both patient groups had hypercapnic respiratory failure. Bi-level positive airway pressure was delivered via a nasal mask in 18 normal subjects, 7 COPD and 8 obese patients. Minute ventilation was measured using a system which included a pneumotachograph and a nasal mask. Bi-level positive airway pressure increased minute ventilation in normal subjects during wakefulness, NREM and REM sleep,  $p < 0.001$ . The increases in minute ventilation were predominately due to increases in tidal volume for each state,  $p < 0.003$ . Bi-level positive airway pressure also increased minute ventilation in COPD patients during NREM ( $p = 0.01$ ) and REM sleep ( $p < 0.01$ ). This was predominately due to an increase in tidal volume (0.37L/min vs 0.44L/min NREM,  $p = 0.01$ ; 0.36L/min vs 0.46L/min REM sleep,  $p < 0.01$ ). Bi-level positive airway pressure increased minute ventilation in the obesity hypoventilation syndrome group in NREM sleep, ( $p < 0.01$ ) and in REM sleep ( $p < 0.01$ ). These increases were predominately due to increases in tidal volume,  $p = 0.01$ . Bi-level positive airway pressure devices are effective in increasing minute ventilation predominately via increases in tidal volume during NREM and REM sleep in the groups measured. No adverse effects were noted.

### Breathing control: it changes short term physiological measures but does it improve the sensation of shortness of breath?

Lewis LK, Williams MT, Olds T

University of South Australia, Adelaide

This study aimed to identify the current research evidence underpinning the technique of breathing control. A systematic search strategy of six databases was undertaken using search terms synonymous with breathing control. Hand searching of reference lists was conducted and experts contacted to identify additional references. Two assessors independently allocated each reference to a hierarchy of evidence and assessed methodological quality of experimental studies. Seventy articles were identified and, of these, 24 studies reporting primary data on the isolated technique of breathing control were included

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(1954 to 2003) including several high level, low risk of bias studies. Nineteen studies presented results which allowed for effect size calculation and subsequent meta-analysis. Sample weighted mean effect sizes (ES) calculated across studies showed no change in oxygen consumption ( $ES = -0.17$ ), consistent declines in respiratory rate ( $ES = -0.76$ ), and increases in indirect oxygen saturation ( $ES = 0.75$ ) and tidal volume ( $ES = 1.10$ ) while the technique was being performed. Only two studies reported outcomes directly relating to dyspnoea. There was no evidence of prolonged benefit related to breathing control training in people with chronic respiratory disease. The majority of studies (79%) demonstrated good generalisability to the target population for breathing control. Assessing the body of evidence underpinning breathing control was problematic due to the diversity of research designs and outcomes used. While breathing control demonstrated an effect on some physiological variables, there is a need for studies to determine the impact of this technique on patient related outcomes for shortness of breath.

### Demystifying the ups and downs of gastro-oesophageal reflux: why it is important for physiotherapists?

Lee A,<sup>1</sup> Denehy L,<sup>1</sup> Wilson J<sup>2,3</sup> and Button B<sup>1,2</sup>

<sup>1</sup>The University of Melbourne, Melbourne <sup>2</sup>The Alfred Hospital, Melbourne <sup>3</sup>Monash University, Melbourne

Gastro-oesophageal reflux (GOR) is recognised as a co-morbidity in patients with chronic lung disease but the relevance is not clearly understood. The current gold standard for diagnosing GOR is using 24-hour oesophageal pH monitoring which measures the frequency and duration of gastric regurgitation in the proximal and distal oesophagus. A diagnosis of GOR is based on the proportion of oesophageal acid exposure time (total, upright and supine position) and the DeMeester score, a weighted composite score of distal GOR. As GOR is a common physiological phenomenon, the extent of GOR in patients with chronic lung disease can be determined only by quantifying the degree of reflux in normal individuals. Studies measuring GOR in normal subjects (total  $n = 274$ ), defining abnormal reflux based on the 95<sup>th</sup> percentile values were compared. The reported proportions of proximal and distal oesophageal acid exposure times varied considerably while the commonly used DeMeester score values ranged from 14.72–20.2. Diagnosing GOR based upon this range of normal values may therefore be questionable. Although the prevalence of GOR in patients with asthma is reported to be 82%, chronic obstructive pulmonary disease 62%, cystic fibrosis 90%, idiopathic pulmonary fibrosis 87% and bronchiectasis 55%, the causality between GOR and chronic lung disease has not been identified. Measures of reflux in normal populations may influence the criteria defining GOR in chronic lung disease, including parameters indicative of pulmonary aspiration. Accurate identification of provocation of increased reflux during physiotherapy has important implications for physiotherapists managing patients with chronic lung disease.

### Development of an exercise outcome measure for use in intensive care: a pilot study

Skinner E,<sup>1,2</sup> Berney S,<sup>2</sup> Denehy L<sup>1</sup> and Warrillow S<sup>2</sup>

<sup>1</sup>The University of Melbourne, Melbourne <sup>2</sup>Austin Health, Melbourne

Exercise in the ICU aims to mobilise patients early and facilitate ventilator weaning and optimise function. There are no previously described exercise outcome measures for critically ill patients. This pilot study aimed to develop a four-part outcome measure (the MUSCLE) incorporating strength, endurance and function for use in patients receiving mechanical ventilatory support. The reliability and responsiveness of the measure was assessed in subjects with a tracheostomy. The test was performed at baseline and on the day of successful weaning from mechanical ventilation. It included measurement of: number of assistants required to move subjects from sitting to standing, the number of steps and cadence during marching on the spot, upper limb endurance using bilateral shoulder flexion repetitions and knee and shoulder flexion strength using the oxford scale. The mean age (SD) of the 12 subjects was 56.8 (12.5) years. There was a mean difference (95% CI) of 54 seconds (–103.2 to 4.8,  $p < 0.05$ ) in marching on the spot and of 27 steps/sec (–47.7 to 6.4,  $p < 0.05$ ) in cadence between measurements. This represented a 257% and 150% improvement respectively. Patients also increased their shoulder flexion repetitions by a mean difference (95% CI) of 8 (–14.2 to 1.8,  $p < 0.05$ ). The mean assistance required to move from sit to stand decreased from two people to no assistants required ( $p < 0.05$ ). The inter-rater reliability of the test components was excellent. The MUSCLE is reliable and responsive to change in patients with a tracheostomy who are weaning from mechanical ventilation.

### Does non-invasive ventilation during walking improve exercise performance and reduce dyspnoea in acutely unwell patients with hypercapnic respiratory failure?

Menadue C,<sup>1,2</sup> Alison JA,<sup>1,2</sup> Ellis ER,<sup>1</sup> Piper AJ<sup>2</sup> and Flunt D<sup>2</sup>

<sup>1</sup>The University of Sydney, Sydney <sup>2</sup>Royal Prince Alfred Hospital, Sydney

The aim of this study was to determine the effect of non-invasive ventilation during walking on six-minute walk distance, time and distance to first rest, and dyspnoea in acutely unwell patients with respiratory failure. A randomised crossover study with repeated measures was conducted at Royal Prince Alfred Hospital, Sydney. Twenty acutely unwell inpatients (M:F = 9:11, with hypercapnic respiratory failure (pH 7.38 (0.04); PaCO<sub>2</sub> 60.4 (10.3) mmHg) on non-invasive ventilation were recruited. Respiratory failure was related to chronic obstructive pulmonary disease in twelve participants, other chronic lung disease in three, and chest wall restriction in five. Participants were asked to perform a 6-minute walk test with non-invasive ventilation and oxygen, and oxygen alone in random order. A forearm support frame was used during each test. Primary outcome measures were distance walked, time and distance to first rest and isotime dyspnoea. Results are expressed as mean (SD). Non-



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invasive ventilation during walking significantly increased distance walked, time and distance to first rest compared to unassisted exercise [222 (114) metres vs 180 (89) metres,  $p = 0.040$ ; 303 (100) seconds vs 233 (113) seconds,  $p = 0.011$ ; 212 (120) metres vs 154 (95) metres,  $p = 0.005$  respectively]; and reduced isotime dyspnoea [2.8 (2.0) vs 3.9 (2.2),  $p = 0.019$ ]. Non-invasive ventilation during walking enables acutely unwell patients with hypercapnic respiratory failure to walk further with less dyspnoea compared to walking with oxygen alone. Non-invasive ventilation should be used during walking to improve exercise performance in acutely unwell patients with hypercapnic respiratory failure.

### Effect of non-invasive ventilation during unsupported arm exercise on endurance and dyspnoea in patients with chronic hypercapnic respiratory failure

Menadue C,<sup>1,2</sup> Alison JA,<sup>1,2</sup> Ellis ER,<sup>1</sup> Piper AJ,<sup>2</sup> and Flunt D<sup>2</sup>

<sup>1</sup>The University of Sydney, Sydney <sup>2</sup>Royal Prince Alfred Hospital, Sydney

Non-invasive ventilation during unsupported arm exercise appears to unload the inspiratory muscles. However, its effect on arm exercise endurance time and dyspnoea is unknown. The aim of this study was to determine the effect of non-invasive ventilation during unsupported arm exercise on endurance time and dyspnoea in patients with chronic hypercapnic respiratory failure. A randomised crossover study with repeated measures was conducted at Royal Prince Alfred Hospital, Sydney. Twenty one patients (M:F = 9:12) with chronic hypercapnic respiratory failure (daytime PaCO<sub>2</sub> 53 (6) mmHg) on domiciliary nocturnal non-invasive ventilation were recruited. Chronic hypercapnic respiratory failure was related to chronic obstructive pulmonary disease in nine participants, severe kyphoscoliosis in eight, and other variants of lung disease in four. Participants were asked to perform unsupported arm exercise tests with and without non-invasive ventilation in random order. Primary outcome measures were arm endurance time and isotime dyspnoea. Isotime was defined as the duration of the shortest test. Dyspnoea scores from each test were compared at this time point. Results are expressed as mean (SD). Non-invasive ventilation during unsupported arm exercise significantly increased arm endurance time compared to unassisted exercise [366 (288) seconds vs 307 (241) seconds,  $p = 0.024$ ]; and reduced isotime dyspnoea [3.9 (2.9) vs 5.8 (3.0),  $p = 0.005$ ]. Non-invasive ventilation during unsupported arm exercise increases arm endurance time and reduces dyspnoea in patients with chronic hypercapnic respiratory failure. Further studies are needed to assess whether the use of non-invasive ventilation during an arm exercise training program can provide additional benefits.

### Engaging with ethics: a cardiorespiratory case study

Delany C and Skinner E

The University of Melbourne, School of Physiotherapy

Physiotherapists who work in the cardiorespiratory area are integral members of healthcare teams who make a range

of decisions concerning the best interests of patients. The aim of this single case study was to use a narrative case scenario involving physiotherapy treatment of a patient with chronic neuropathy, to introduce a framework for engaging with ethical problems in everyday inpatient healthcare practice. The case highlights a range of ethical issues and dilemmas for physiotherapists treating patients with chronic illness including respiratory complications. These include communicating truth to patients and their families about diagnoses and prognoses, continuing with futile (in terms of active physiotherapy) treatments, dealing with different health professionals' views of what constitutes a patient's best interests, and working within the hierarchical organisation that is the hospital environment. The proposed ethical framework is derived from an integration of established bio-medical ethical principles, including beneficence, non-maleficence, autonomy and justice, and a narrative ethics approach that promotes ethical mindfulness. Ethical mindfulness uses analysis of everyday clinical stories to highlight ethically important moments within clinical practice. The process of engaging with the details of clinical scenarios or stories results in greater recognition of ethically important moments in clinical practice. Recognising ethics within practice is an important first step in developing responsiveness in the form of practical strategies including communicating with patients, families and other members of the health team, understanding and managing emotional responses to clinical scenarios and demonstrating leadership in professional ethical practice.

### Exercise training in interstitial lung disease: a randomised controlled trial

Holland AE,<sup>1,4</sup> Hill C,<sup>2</sup> Conron M,<sup>1</sup> Munro P,<sup>1</sup> Brazzale D<sup>2</sup> and McDonald CF<sup>2,3</sup>

<sup>1</sup>Alfred Hospital, <sup>2</sup>Austin Health, <sup>3</sup>Institute for Breathing and Sleep, <sup>4</sup>La Trobe University; Melbourne

Interstitial lung disease is characterised by exertional dyspnoea and exercise limitation. Exercise training has been recommended for all patients with chronic respiratory disease, however its safety and efficacy in this complex group has not been established. The aim of this study was to establish the effects of exercise training on exercise capacity, dyspnoea and quality of life in patients with interstitial lung disease. Symptomatic patients with interstitial lung disease of any aetiology were recruited from two centres. Subjects were randomised to receive eight weeks of supervised exercise training or once-weekly telephone support. At baseline and following intervention subjects underwent measurement of respiratory function and 6-minute walk distance, an incremental exercise test was performed and the Chronic Respiratory Disease questionnaire administered. Measurements were obtained by a blinded investigator and intention-to-treat analysis was performed. Fifty-seven subjects (36 with idiopathic pulmonary fibrosis) with mean forced vital capacity 73% predicted, carbon monoxide transfer factor 50% predicted and pulmonary artery pressure 36 mmHg were enrolled. Lung function remained stable over the study period. Twenty-three subjects (77%) completed the exercise program and no adverse events were reported. Exercise training significantly increased 6-minute walk distance compared to control (mean difference 35 m,

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95% CI 6–64 m) and reduced dyspnoea ( $p = 0.04$ ) and fatigue ( $p = 0.009$ ). No change in peak oxygen consumption was observed however exercise training reduced heart rate at iso-workload ( $p = 0.01$ ). Exercise training in interstitial lung disease improves functional exercise capacity and symptoms. Ongoing follow-up will assess whether these benefits are sustained over time.

### Extending the role of the physiotherapy assistant: the development of a training program for assisted mobilisation following abdominal surgery

Browning L,<sup>1,2</sup> Denehy L,<sup>1</sup> Scholes RL<sup>3</sup> and Munro D<sup>2</sup>

<sup>1</sup>The University of Melbourne, Melbourne <sup>2</sup>The Royal Melbourne Hospital, Melbourne <sup>3</sup>Monash University, Melbourne

Workforce shortages remain a significant problem for the profession resulting in a need to re-evaluate current practice. One possible solution is extending the role of physiotherapy assistants to include tasks previously performed by physiotherapists. An example of such a task is the assisted mobilisation of patients following abdominal surgery. Early mobilisation is essential for optimisation of postoperative recovery. A recent survey demonstrated that 92% of physiotherapists always include mobilisation in their postoperative intervention. Physiotherapists often have access to the services of a physiotherapy assistant, however many are reluctant to allow assistants to mobilise patients early after surgery, or for them to handle intravenous lines and surgical drains. Therefore extra training is essential to prepare assistants for this task. A comprehensive training package with clear guidelines for mobilisation was developed. The training aimed to provide the physiotherapy assistant with a satisfactory level of competence in completing this new task. Three physiotherapy assistants with prior experience in acute care completed a seven-week training program followed by a period of supervised clinical practice and formal competency assessment. The assistants were instructed in recording basic observations and handling surgical attachments, allowing them to assist mobilisation from the second postoperative day. Mobilisation was administered at a fixed intensity and frequency. The physiotherapy assistants demonstrated an ability to safely and competently provide mobilisation assistance under the direction of a physiotherapist, confirming that extending the role of the physiotherapy assistant is achievable with additional training. This finding has implications for the future practice of physiotherapy in abdominal surgery.

### Extreme affective descriptions of breathlessness are significantly associated with impairment in Australians with COPD

Williams MT,<sup>1</sup> Cafarella P,<sup>2</sup> Olds T<sup>1</sup> and Petkov J<sup>3</sup>

<sup>1</sup>School of Health Sciences, University of South Australia, Adelaide

<sup>2</sup>Respiratory Medicine, Repatriation General Hospital, Adelaide

<sup>3</sup>Centre for Regional Engagement, University of South Australia, Adelaide

Little information exists concerning relationships between the language of breathlessness and severity of respiratory impairment. Using a cross sectional descriptive design, this study assessed relationships between severity of

impairment and the language used by Australians with chronic obstructive pulmonary disease (COPD) to describe their sensation of breathlessness. During a structured interview, people with COPD volunteered words or phrases to describe their sensation of breathlessness which were transcribed verbatim. Each word or phrase was allocated into categories by two assessors independently until consensus had been reached. Impairment was assessed by the body-mass index, airflow obstruction, dyspnoea and exercise capacity index (BODE index). Relationships between language categories and BODE index scores were calculated using logistic regression analysis. In this group of 107 people (51 males,  $70.5 \pm 9.7$  years,  $FEV_1$  %pred  $59 \pm 27$ ), the most frequently volunteered language categories were 'frightening' (53%), 'annoying' (41%) and 'awful' (31%), with the least common categories reflecting physical sensations (difficulty taking a deep breath 7%, difficulty breathing out 2%). Frightening ( $p = 0.03$ ) and awful ( $p = 0.04$ ) were the only language categories significantly associated with greater global impairment (BODE index). These findings suggest that fear and anxiety are commonly part of the sensation of breathlessness in people with COPD and that people who describe the sensation of breathlessness using extreme affective terms generally have greater impairment. Affective components of the sensation of dyspnoea may represent a significant 'missing' factor which could explain the variance in overall disease severity, impairment and individual burden.

### How would you describe your sensation of breathlessness? Differences between older people with and without chronic obstructive airways disease

Williams MT,<sup>1</sup> Cafarella P,<sup>2</sup> Olds T<sup>1</sup> and Petkov P<sup>3</sup>

<sup>1</sup>School of Health Sciences and <sup>3</sup>Centre for Regional Engagement, University of South Australia, Adelaide <sup>2</sup>Respiratory Medicine, Repatriation General Hospital, Adelaide

Dyspnoea involves central modulation of physical, affective and cognitive factors. There are few data available which report qualitative differences in this sensation between people with and without respiratory disease. This study describes the sensation of breathlessness in older Australians with and without chronic obstructive pulmonary disease (COPD). Using a parallel group design, COPD participants were recruited prior to commencing a pulmonary rehabilitation program. Non-COPD participants were recruited from community recreational groups. Participants completed a structured interview where words or phrases were volunteered in response to the question, 'Which words would you use to describe your breathing when it is uncomfortable?' Each word or phrase was transcribed verbatim and allocated into language categories by two assessors independently until consensus had been reached. Differences between groups were assessed using logistic regression where the frequency of descriptors within language categories was treated as binary data (yes/no). The two groups were similar for age and gender mix; COPD ( $n = 107$ , 51 males,  $70.5 \pm 9.7$  years,  $FEV_1$  %pred  $59 \pm 27$ ) versus Non-COPD ( $n = 60$ , 24 males,  $68 \pm 13$  years). COPD participants volunteered a greater frequency of descriptors classified as 'frightening, annoying, can't breathe in, awful' ( $p < 0.001$ ), 'can't breathe' ( $p = 0.04$ ) and 'suffocating' ( $p$



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= 0.05). Non-COPD participants volunteered a greater frequency of descriptors classified as 'does not bother me' ( $p < 0.001$ ). In people with COPD, dyspnoea is not simply a more intense physical experience of breathlessness but, like chronic pain, appears to be dominated by affective components.

### **Influence of dyspnoea as classified by the MRC dyspnoea scale in pulmonary rehabilitation and change in 6-minute walk test**

**Walsh JR,<sup>1,2</sup> Seale HE,<sup>1</sup> Chang AT<sup>2</sup> and Paratz J<sup>2</sup>**

<sup>1</sup>The Prince Charles Hospital, Brisbane <sup>2</sup>Division of Physiotherapy, The University of Queensland, Brisbane

The Medical Research Council (MRC) dyspnoea scale can be used for assessing disease severity in individuals with chronic obstructive pulmonary disease (COPD) and has been demonstrated to influence response to exercise training. However, different training regimes were utilised depending upon the MRC stratification and therefore it is difficult to isolate the effect of the MRC alone. The aim of this current study is to evaluate the effects of MRC classification on the response to pulmonary rehabilitation as assessed by the 6MWD. All participants underwent the same outpatient based program. A retrospective analysis was performed on 184 individuals with COPD (94 males), aged  $68.6 \pm 9.3$  years, who attended outpatient pulmonary rehabilitation between 2004 and 2006. Participants mean baseline 6MWD as categorised by MRC grade were: mild dyspnoea MRC Grade 1–2 ( $n = 60$ )  $443.0 \text{ m} \pm 107.1 \text{ m}$ ; moderate dyspnoea MRC Grade 3 ( $n = 28$ )  $393.9 \text{ m} \pm 76.2 \text{ m}$ ; severe dyspnoea MRC Grade 4–5 ( $n = 27$ )  $287.1 \text{ m} \pm 105.7 \text{ m}$ . The mean improvements in 6MWD were: mild dyspnoea 12.1% (95% CI  $\pm 14.8\%$   $p < 0.0001$ ); moderate dyspnoea 11.3% (95% CI  $\pm 8.02\%$   $p = 0.0001$ ); severe dyspnoea 16.2% (95% CI  $\pm 8.9\%$   $p = 0.00084$ ). This trend towards greater improvement in 6MWD for the severe dyspnoea group of 16.2%, compared to the mild to moderate groups was not significant ( $p = 0.63$ ). These results demonstrate that all individuals as classified by their baseline MRC dyspnoea scale can potentially improve their 6MWD with pulmonary rehabilitation.

### **Mucociliary clearance in ventilated adult patients: factors which may affect physiotherapy research**

**Jones A and Innes N**

James Cook University, Townsville

Mucociliary clearance (MCC) is an important defence system, giving protection for the body against inhaled pathogens with the potential to incite infection. During mechanical ventilation patients often receive therapy with the premise that a deficiency in MCC exists. To effectively administer therapy to individuals receiving mechanical ventilation it is necessary to determine if a deficit in MCC is present. Physiotherapy research into treatment of ventilated patients tends to be inconclusive in determining if physiotherapy decreases complications, length of ventilation time and stay in ICU. By determining the factors which may affect MCC physiotherapy research can be better targeted

to those populations which are shown to have decreased MCC. A literature review was undertaken of Medline and PEDro databases using key terms of mucociliary clearance, artificial airways, ventilated and mucoregulating. The search was limited to articles published within the last twelve years: eighty-seven articles were found which met the search strategy. MCC was found to depend upon cilia beat frequency, mucous rheology and load, and the properties of the periciliary fluid layer. Important factors which affect MCC include medications, temperature, air pressure, osmolality, age, humidity, pH, high oxygen concentrations, disease state and sleep. When researching the effectiveness of physiotherapy techniques on adult ventilated patients, researchers should document and/or stratify for the factors noted above. This is likely to demonstrate that physiotherapy does decrease ventilator time, pulmonary complication rates and length of stay in ICU.

### **Opinions and attitudes to exercise in chronic obstructive pulmonary disease subjects following involvement in a 12-month maintenance exercise study**

**Spencer LM,<sup>1,2</sup> Alison JA,<sup>1,2</sup> and McKeough ZJ<sup>1</sup>**

<sup>1</sup>The University of Sydney, Sydney <sup>2</sup>Royal Prince Alfred Hospital, Sydney

The aim of this study was to collect information on opinions and attitudes to exercise from chronic obstructive pulmonary disease (COPD) subjects after completion of either a 12-month supervised or unsupervised maintenance exercise program. Following eight weeks of pulmonary rehabilitation, COPD subjects were recruited and randomised into a 12-month maintenance exercise program of either once weekly, supervised, hospital-based exercise (SE) [ $n = 18$ ; mean age (SD) = 65 years (8); mean FEV<sub>1</sub> %pred = 58% (20)] or unsupervised, home exercise (UE) [ $n = 14$ ; mean age = 66 years (8); mean FEV<sub>1</sub> %pred = 67% (17)]. A questionnaire was given to subjects at the completion of their 12-month program. The questionnaire included closed-ended questions with visual analogue scales (100 mm). The questionnaire was designed to determine subjects' opinions on exercise adherence, the importance of exercise, enjoyment of their program and whether subjects thought that maintenance of exercise was beneficial. Information from the questionnaire was collated using mean scores in millimetres (mm) measured from the 100 mm visual analogue scales. The results showed that the SE group exercised more regularly during the 12 months [SE = 63 mm (25); UE = 42 mm (24),  $p = 0.02$ ] and reported more enjoyment at being involved in the study than the UE group [SE = 96 mm (9); UE = 86 mm (16),  $p = 0.02$ ]. Both groups reported that exercise was important [SE = 97 mm (5); UE = 92 mm (14),  $p = 0.2$ ] and that their 12-month program was beneficial in improving some aspect of their life [SE = 89 mm (11); UE = 80 mm (25),  $p = 0.1$ ]. In conclusion these data show that COPD subjects have positive attitudes towards both supervised and unsupervised maintenance exercise programs. However, exercise adherence may be better maintained with supervision.

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### Patient-centred modular secondary prevention following acute coronary syndrome: a randomised controlled trial

Redfern J,<sup>1</sup> Briffa T,<sup>2</sup> Ellis E<sup>1</sup>  
and Freedman B<sup>3</sup>

<sup>1</sup>School of Physiotherapy, University of Sydney, Sydney <sup>2</sup>  
School of Physiotherapy, Curtin University of Technology,  
Perth WA <sup>3</sup>Department of Cardiology, Concord Repatriation  
General Hospital, Sydney

Cardiac rehabilitation as secondary prevention of heart disease is problematic given low participation rates, short exposure and lower initial risk. The aim of this study was to test the effectiveness of a patient-centred modular program on coronary risk factor levels and prevalence in acute coronary syndrome survivors not accessing rehabilitation. Acute event survivors were randomly allocated to either control (n = 72) receiving conventional care or a modular group (n = 72) receiving a module to lower blood cholesterol and up to two other modules including blood pressure lowering, quit smoking or increased physical activity, according to need and preference. Modules were based on patient-centered choice of care and goal setting. Outcome measures included blinded assessment coronary risk factors at baseline and 12 months. Although well-matched at baseline, at three and 12 months the modular group had significantly lower levels for most risk factors, better knowledge of their risk factors and fewer scored moderate-high on the LIPID risk score than controls (37% v 58%,  $p = 0.02$ ). At 12 months, the modular group had lower mean total cholesterol (4.0 vs 4.7 mmol/L,  $p < 0.001$ ), systolic blood pressure (131.6 vs 143.9 mmHg,  $p < 0.001$ ), body mass index (28.9 vs 31.2 kg/m<sup>2</sup>,  $p = 0.02$ ), fewer smokers (6% vs 23%,  $p < 0.01$ ) and fewer participants were inactive (28% vs 68%,  $p < 0.001$ ) than in the control group. In conclusion, patient-centred modular secondary prevention emphasising patient choice significantly improved coronary risk profile compared with conventional care and therefore provides an effective alternative for patients who do not access cardiac rehabilitation.

### Pilot study of a lifestyle intervention: exercise and diet for weight loss in patients with obstructive sleep apnoea

Hill CJ,<sup>1,2</sup> Goldsworthy U<sup>2</sup> and Barnes M<sup>2,3</sup>

<sup>1</sup>Department of Physiotherapy, Austin Health, Melbourne, <sup>2</sup>Institute  
for Breathing and Sleep, Melbourne, <sup>3</sup>The University of Melbourne,  
Melbourne

The aim of this study was to implement an effective weight loss program in patients with obstructive sleep apnoea (OSA). Patients with mild to moderate OSA with a BMI > 30 kg/m<sup>2</sup> were recruited from the Austin Health Sleep Clinic. Exclusions were significant medical or psychological co-morbidities, daytime sleepiness and sleep hypoxaemia. All subjects participated in a 4-month exercise and diet program. Diet consisted of a commercial very low energy diet and advice from a dietician. Exercise consisted of resistance training three times a week for 16 weeks and aerobic training five times a week for 12 weeks commencing at week five. Resistance training used three sets of 8 to 12 repetitions prescribed at 80% of 1-RM predicted from the 5-RM which was measured weekly. Aerobic training used a combination of cycling, walking ±

incline, and jogging for up to 40 minutes. Initial intensity was prescribed at 80% of VO<sub>2</sub> max measured on a baseline maximal cardiopulmonary exercise test, and progressed weekly to maintain the equivalent target heart rate. Twelve subjects (three male) were recruited, mean ± SD age 42.3 ± 10.3 years. Two subjects withdrew from the study. In ten subjects following 12.1 ± 3.2 weeks of training, weight reduced from 95.9 ± 16.5 kg to 82.9 ± 13.8 kg ( $p < 0.001$ ). These data suggest that weight loss in an individualised and supervised program is feasible in patients with mild to moderate OSA. It is anticipated that completion of data collection will demonstrate an associated improvement in daytime function, blood pressure and sleep-disordered breathing.

### Pulmonary rehabilitation: a survey of current practice in Australia

Johnston C,<sup>1,2</sup> Alison J,<sup>2,3</sup> and Maxwell L<sup>2</sup>

<sup>1</sup>The University of Newcastle, Newcastle <sup>2</sup>The University of Sydney,  
Sydney <sup>3</sup>Royal Prince Alfred Hospital, Sydney

Pulmonary rehabilitation has proven efficacy in the management of patients with chronic respiratory disease. However, there is no published information regarding what constitutes current practice in pulmonary rehabilitation in Australia and it is unknown whether programs meet evidence-based recommendations. The aim of this study was to describe the current provision of pulmonary rehabilitation in Australia. A questionnaire was sent to all pulmonary rehabilitation programs listed on the Australian Lung Foundation national database (n = 193). The response rate was 83% with 60% of respondents from regional/rural areas. Pulmonary rehabilitation programs were commonly provided in hospital outpatient (67%) or community (26%) settings; coordinated by physiotherapists and/or nurses (95%); and contained both exercise training and group education (74%). The majority of programs were at least six weeks duration (96%), included assessment (99%), at least two exercise sessions per week (74%) and re-assessment at program completion (96%). The most common assessments undertaken were general observations (99%), medical history (98%), exercise testing (93%) and completion of a disease specific quality of life questionnaire (79%). The 6-minute walk test was the most frequently used assessment of exercise capacity (94%) with 53% of programs using one 6-minute walk test and 41% using two or more tests at program entry. An upper limb exercise test was used in 9% of programs. These results suggest that the majority of the pulmonary rehabilitation programs surveyed comply with current recommendations in terms of pre and post program assessment procedures, number of exercise sessions and program duration.

### Respiratory and thoracic function in elite singers: a new perspective?

Skinner MA and Johnson GJ

The University of Otago, Dunedin, New Zealand

The study aimed to compare respiratory and thoracic function, including spirometry, thoracic circumferential

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measures, and segmental thoracic spinal angles, in elite female singers with data for a matched sample of controls. Eight participants (mean age  $22.11 \pm 4.9$ y) accepted for voice training at the Department of Music, volunteered to participate. Twenty healthy females matched for age and anthropometrics comprised the control group. Forced expiratory volume in 1s ( $FEV_1$  %pred), forced vital capacity (FVC),  $FEV_1$  %pred/FVC and peak expiratory flow rate (PEFR) were measured using an electronic spirometer (Vitalograph-COMPACT). Thoracic circumference was measured at rest, on full inspiration and full expiration at three levels. An external computer-aided device (SpinalMouse®) licensed to the school of physiotherapy, was used to measure segmental thoracic spinal angles in three positions: upright standing, full flexion and full extension. Mean FVC for elite singers ( $4.24 \pm 0.05$  L) was significantly greater than the mean FVC for controls ( $3.61 \pm 0.73$  L), ( $p = 0.01$ ) and mean predicted FVC ( $3.65 \pm 0.33$  L) ( $p = 0.01$ ). There were no significant differences in anthropometric measures or thoracic circumferential measures. However when segmental thoracic values (T1–L1) were analysed the mean ranges of motion between flexion and extension in the lower thoracic spine of the singers were significantly greater than those for the controls ( $p < 0.001$  at T11/12), suggesting an association between the physical tasks undertaken by the singers and lower thoracic spinal mobility. A device such as the SpinalMouse® has potential clinical application for the assessment of thoracic function in patients with respiratory disease.

### Reviewing practice guidelines relating to water temperature for antenatal women attending aquatic physiotherapy and implication in women's health practice

Larsen JA

*The Wesley Hydrotherapy Clinic, Brisbane, Hydrotherapy Consulting and Training, Brisbane*

Risk management for pregnant women attending aquatic physiotherapy for antenatal classes requires that practitioners consider water temperature and intensity of activity carefully. Unfortunately many of the studies in this area have been carried out on rat populations or are retrospective studies. The Wesley Hydrotherapy Clinic in Brisbane has for 18 years supported the running of antenatal aquatic physiotherapy classes, including immersion in a  $34^\circ$  pool. This population has provided the practice with a wealth of information and we have monitored (as part of a clinical risk management/ quality improvement strategy) aural temperatures of pregnant women before during and after their aquatic physiotherapy including immersion at  $34^\circ$ . Results of this clinical practice improvement project are presented and discussed along with a literature review that looks at the evidence base from which commonly quoted information on water temperature related to pregnant women is obtained. Suggestions for practice guidelines are made.

### Short-term effects of incentive spirometry and inspiratory flow rates on chest wall motion

Palmer KR,<sup>1</sup> Chang AT<sup>1</sup> and Thomas PJ<sup>2</sup>

<sup>1</sup>Division of Physiotherapy, The University of Queensland <sup>2</sup>Department of Physiotherapy, Royal Brisbane and Women's Hospitals

The aim of this study was to investigate the effects of different breathing exercises with incentive spirometry devices on chest wall motion in healthy individuals. Twenty-one healthy volunteers participated in a randomised, repeated measures study.

Subjects were asked to perform breathing exercises inspiring to either two times tidal volume ( $2 \times TV$ ) or inspiratory capacity (IC), at high, low or natural flow rates, using a volume or flow-oriented spirometer. The proportion of rib cage movement to tidal volume (% RC/TV), anteroposterior and lateral chest wall diameters was compared using linear mixed models. Low and natural flow rates resulted in significantly decreased % RC/TV when compared to high flow rate trials ( $p = 0.001$ ) at  $2 \times TV$ . Low flow trials also resulted in significantly less chest wall motion in the upper anteroposterior direction than high and natural flow rates ( $p < 0.001$ ). At IC, significantly greater movement occurred in the abdominal lateral direction during low versus high flow ( $p < 0.001$ ) and natural versus high flow trials ( $p = 0.002$ ). In healthy individuals, inspiratory flow, not device type, during breathing exercises using incentive spirometry devices has a significant impact on breathing pattern in the short-term, with low flow rate reducing the upper anteroposterior chest wall movement and increasing abdominal excursion.

### Should the BODE index be used as an outcome measure for pulmonary rehabilitation?

Walsh JR,<sup>1,2</sup> Seale HE,<sup>1</sup> Tuppin M,<sup>1</sup> Paratz J<sup>2</sup> and Chang AT<sup>2</sup>

<sup>1</sup>The Prince Charles Hospital, Brisbane <sup>2</sup>Division of Physiotherapy, The University of Queensland, Brisbane

The BODE index measures the systemic nature of COPD by integrating measures of dyspnoea, respiratory function, body mass index (BMI) and exercise tolerance (6MWD) into a 10-point scale, with higher scores indicating greater severity. The BODE index is a better predictor of mortality and hospital readmissions than  $FEV_1$  %pred alone. Pulmonary rehabilitation improves exercise tolerance and dyspnoea, which are components of the BODE index. One study (98% male, baseline mean BODE index 5.07) demonstrated improvement in the BODE index with 71% of participants improving their score by at least one unit, which is considered significant. The purpose of the current study was to further examine the effect of pulmonary rehabilitation on the BODE index. A retrospective analysis was performed on the results of all COPD participants enrolled in an outpatient pulmonary rehabilitation program. From 2004 to 2006 inclusive, 169 COPD patients (86 male) attended pulmonary rehabilitation, mean age  $68.4 \pm 9.5$  years and mean  $FEV_1$  %pred  $50.8 \% \pm 22.2\%$  predicted. Only 28 participants (27.5%) improved their BODE index by at least one unit. The mean BODE index at baseline was 3.01, and on completion 2.82 ( $p = 0.041$ ). Participants who improved their BODE index by at least one unit had a



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higher mean baseline score of 3.93, compared with 2.66 ( $p = 0.005$ ), for participants who did not improve. This study's results suggest pulmonary rehabilitation has a limited effect on the BODE index. Further research is required to examine the ability of pulmonary rehabilitation to improve the BODE index.

### **Sustainable teaching: education fitness for a health professional**

**Chesworth W and McCormack C**

*University of Canberra,  
Canberra*

This study reports the experiences of staff and students when the traditional weekly face-to-face teaching model was replaced with intensive delivery of lectures in a cardiothoracic unit within the masters of physiotherapy program at The University of Canberra. End of semester focus groups for academic staff, for students and for clinical supervisors were conducted by an independent facilitator. Students were supportive of the new mode of delivery and quickly saw possibilities for the transfer of this model to other units within the course. Balancing university, other paid employment and life commitments was an issue for participants in all focus groups. Nevertheless, students expected high quality learning experiences, occupation specific teaching and integration of theory and clinical experience, of which staff were aware. While student concerns are increasingly being documented, what appears to be overlooked are the concerns of those managing part-time academic positions and other commitments. The current concentrated physiotherapy courses necessitate intense learning experiences with high levels of perceived student and staff stress. While students study for two years and then graduate from the intense learning environment, academic staff remain and continue to be exposed to the pressure of delivery of an intense learning program and its associated expectations. The issue of methods of delivery that will enable staff to continue high standard, high pressure teaching in a sustainable manner needs to be identified. The issue of sustainability should be considered in university course planning, development, content and delivery.

### **Tactile and verbal facilitation alters chest wall motion during incentive spirometry in healthy individuals**

**Chang AT,<sup>1</sup> Nicoll L,<sup>1</sup> Bluett E,<sup>1</sup> Chow C,<sup>1</sup> Atthow M<sup>1</sup> and Hodges PW<sup>1</sup>**

*<sup>1</sup>Division of Physiotherapy, School of Health and Rehabilitation Sciences, The University of Queensland*

This study aimed to investigate the effects of tactile and verbal facilitation on chest wall motion during incentive spirometry in healthy individuals. A randomised, repeated measures study involving 21 healthy volunteers was undertaken in a research laboratory. Subjects were asked to perform breathing exercises inspiring to either two times tidal volume or inspiratory capacity, at high, low or natural flow rates, using a volume or flow-oriented spirometer, with and without verbal and tactile facilitation. The proportion

of rib cage movement to tidal volume (% RC/TV), anteroposterior and lateral chest wall diameters during each of the above conditions was recorded and compared using a linear mixed model. With verbal and tactile facilitation, the % RC/TV increased, suggesting greater proportion of rib cage movement compared to without facilitation (0.922 vs. 0.878,  $p < 0.001$ ). Similarly, facilitation increased mediolateral motion at the level of the axilla (16.62 mm vs. 11.50 mm,  $p < 0.001$ ), 9<sup>th</sup> rib (16.74 mm vs. 11.71 mm,  $p < 0.001$ ) and umbilicus (2.23 mm vs. 1.02 mm,  $p < 0.001$ ), all data with versus without facilitation. There was no change in anteroposterior diameters. Interestingly, these changes in chest wall motion were independent of other variables such as type of spirometry device (flow vs volume oriented), depth of inspired breath or inspiratory flow rate used by the participant. In healthy individuals, verbal and tactile facilitation during incentive spirometry has a short-term direction and location specific effect on chest wall motion, increasing rib cage movement in the lateral direction.

### **The effectiveness of a mobilisation program administered by physiotherapy assistants following abdominal surgery: a pilot study**

**Browning L,<sup>1,2</sup> Denehy L<sup>1</sup> and Scholes RL<sup>3</sup>**

*<sup>1</sup>University of Melbourne, Melbourne <sup>2</sup>The Royal Melbourne Hospital, Melbourne <sup>3</sup>Monash University, Melbourne*

Early mobilisation is an important component of care following abdominal surgery; however low levels of postoperative mobilisation have been observed. This study aimed to trial an intensive postoperative mobilisation program administered by physiotherapy assistants under the direction of a physiotherapist. Thirty-nine subjects were randomly allocated to either standard physiotherapy care (Group 1,  $n = 19$ ) or a mobilisation program in addition to standard care (Group 2,  $n = 20$ ). The mobilisation program entailed supervised mobilisation assistance twice daily on postoperative days two to four. Data collected included: length of stay; physical status at baseline and at one, three and six weeks postoperatively; and a survey of patient satisfaction. Additional data regarding distance walked and duration of mobilisation were recorded for subjects in Group 2. Median (IQR) length of stay was 9.0 (9.0) days in Group 1 and 7.0 (7.0) days in Group 2 ( $p = 0.87$ ). A significant reduction in physical status from baseline occurred at one, three and six weeks postoperatively ( $p < 0.05$ ) however there were no significant differences between groups. Subjects in Group 2 reported greater satisfaction with the physiotherapy they received ( $p = 0.005$ ), and the quantity of mobilisation assistance ( $p = 0.007$ ). During the mobilisation program, subjects in Group 2 mobilised for a mean (SD) duration of 9.4 (5.3), 7.7 (4.3) and 8.6 (4.6) minutes on days two, three and four respectively. The results of this study suggest that patients were highly satisfied with receiving additional mobilisation assistance; however this did not have a significant effect on postoperative outcomes.

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### The number needed to treat statistic: can it assist in interpretation of likely benefit?

Hilton D<sup>1</sup> and Paratz J<sup>2</sup>

<sup>1</sup>Private ABN, Basic Statistical Consultancy <sup>2</sup>Department of Anaesthesiology & Intensive Care, University of Queensland, Herston

Physiotherapists utilise evidence-based physiotherapy/medicine principles routinely and hence need to interpret literature and research evidence outcomes, reported in systematic reviews and randomised controlled trials, quickly and efficiently. Subsequent decision-making involves using this evidence in conjunction with professional expertise and experience as it relates to individual patients. Various statistics and summary measures are reported in the literature and outcomes may be continuous or dichotomous in nature and hence reported statistics vary. Commonly calculated statistics include the relative risk, relative risk reduction and absolute risk reduction. The number needed to treat statistic is another option that may aid interpretation, and describes the number who need to be treated with the intervention for one to improve who would not have improved otherwise with control treatment. While reported to varying degrees in the scientific literature, more recently it can be efficiently and reliably calculated using one of many downloadable spreadsheets. Using the PEDro spreadsheet and three clinical trials as examples (two from cardiorespiratory physiotherapy) the authors show how this statistic can be calculated without effort. The number needed to treat statistic for one of the cardiorespiratory studies had a value of 7 while the other example from the cardiorespiratory literature produced a number needed to harm value of 34. Issues such as intention to treat analysis, confidence intervals, number needed to harm, interpretation and applicability are discussed. This statistic with the plethora of internet-based tools available online can be easily calculated and subsequently applied in the clinical setting.

### The use of normal saline instillation in the intensive care unit by physiotherapists: a review of practice in New Zealand

Reeve J, Davis N, Freeman J and O'Donovan B

Auckland University of Technology, Auckland, New Zealand

Normal saline instillation is used by health professionals during the treatment of intubated patients within the intensive care unit, usually to enhance sputum yield. Its use is controversial; detrimental effects have been documented and evidence of any benefit is limited. Studies have suggested routine use be discontinued. The aim of this study was to investigate the use of normal saline instillation in the intensive care unit by physiotherapists throughout New Zealand. A purpose-designed postal survey was administered to the senior physiotherapist in all intensive care units in New Zealand (n = 25). A response rate of 76% (n = 19) was obtained. Instillation of normal saline was reported as being practised in 78.9% (n = 15) of hospitals, however physiotherapists reported being involved in this practise in only 52.6% (n = 10) of cases. Of the respondents who reported never using normal saline instillation (47.4%, n = 9) the majority of these based this on a lack of supporting

evidence (36.8%, n = 7). Whilst most respondents reported having the autonomy to use normal saline instillation with their patients, three respondents (15.8%) reported requiring permission from an intensivist before use. A written protocol for use of normal saline instillation was rare with only 15.8% (n = 3) of respondents reporting using these. Techniques used for administering normal saline were ascertained. Despite a lack of supporting evidence of any benefit, normal saline instillation continues to be widely practised in intubated patients in intensive care units in New Zealand.

### What is the effect of percussion and vibration on respiratory flow in participants with cystic fibrosis?

McCarren B<sup>1</sup> and Alison JA<sup>1,2</sup>

<sup>1</sup>The University of Sydney, Sydney <sup>2</sup>Department of Respiratory Medicine, Royal Prince Alfred Hospital, Sydney

What forces are applied to participants with cystic fibrosis during percussion and vibration? What is the relationship between forces applied during percussion and vibration of the chest wall and the resulting respiratory flow rate? This randomised, within-subject, experimental study was carried out in 18 young adult participants with cystic fibrosis. One physiotherapist applied percussion and vibration to the chest walls of participants with cystic fibrosis. The application of these interventions and the resultant effects on respiratory flow were compared. Chest wall force and respiratory flow rates were the outcome measures. During percussion the mean resultant force applied during percussion was 34.9 (SD 2.00) N and the mean total force applied during percussion was 47.5 (SD 13.0) N. During vibration the mean resultant force was 94.5 (SD 20.5) N with a mean oscillation force of 53.5 (SD 19.3) N. During percussion, every Newton of force applied to the chest wall altered inspiratory and expiratory flow by 0.007 (SD 0.002) L/s/N, whereas during vibration every Newton of force applied to the chest wall altered expiratory flow by 0.005 (SD 0.009) L/s/Ns. This is the first study to describe the application of percussion and vibration in patients with cystic fibrosis and the effects on respiratory flows.

## POSTER PRESENTATIONS

### A prospective randomised trial comparing airway clearance strategies following lung transplantation

Munro PE,<sup>1</sup> Button BM,<sup>1</sup> Bailey M,<sup>2</sup> Whitford H,<sup>1</sup> Holland AE,<sup>3</sup> Ellis SJ<sup>1</sup> and Snell GI<sup>1</sup>

<sup>1</sup>The Alfred, Melbourne, <sup>2</sup>Monash University, Melbourne, <sup>3</sup>La Trobe University, Melbourne

Despite the widespread use of airway clearance (AC) techniques to clear excessive secretions and improve lung function, little is known about their efficacy following lung transplantation (LTx). The aim of this study was to compare the effects of two AC strategies (proactive vs reactive) on a range of clinical outcomes following LTx. A prospective randomised trial design was used. Uncomplicated patients were recruited one month post operatively. Patients



## POSTER PRESENTATIONS – *continued*

performed AC using positive expiratory pressure (PEP) either twice daily (proactive strategy) or only in the presence of chest infection (reactive strategy). Lung function ( $FEV_1$  and FVC), chest radiography (Brasfield score), and bronchoscopic airway characteristics (anastomotic healing, patency and secretions) were assessed at one, two and three months post operatively. Adherence was measured. Of 60 consecutive patients, 36 (18 proactive, 18 reactive) were recruited and completed the study. Both groups improved lung function ( $FEV_1$   $72 \pm 4\%$  to  $81 \pm 4\%$   $p < 0.0001$ ; FVC  $69 \pm 3\%$  to  $81 \pm 3\%$   $p < 0.0001$ ) and Brasfield scores ( $17.8 \pm 0.5$  to  $19.8 \pm 0.5$   $p < 0.002$ ) over the study period. No significant differences between groups for any outcome were found. The vast majority had fully healed, 100% patent anastomoses without secretions at 3 months. There were no significant differences between airway characteristics and incidence of chest infection. Adherence to both strategies was high (84% proactive, 100% reactive). In the absence of significant differences in outcomes, it can be recommended that lung transplant recipients perform AC using PEP only in the presence of chest infection in the post operative phase.

### Assessment of nutritional status in patients attending pulmonary rehabilitation using a malnutrition screening tool

McNamara R<sup>1</sup> and Daniells S<sup>2</sup>

<sup>1</sup>Departments of Respiratory and Sleep Medicine and Physiotherapy, Prince of Wales Hospital, Sydney <sup>2</sup>Department of Nutrition and Dietetics, Prince of Wales Hospital, Sydney

Nutrition screening identifies individuals who are malnourished or at risk of becoming malnourished and who may benefit from nutrition support. The incidence of malnutrition in lung disease has been reported as 25–70%. Malnutrition is an independent risk factor for mortality, therefore early screening, assessment and treatment of malnutrition is crucial. The aim of this study was to evaluate the ease of using a simple, validated malnutrition screening tool (MST) and determine the rate of malnutrition in chronic respiratory patients attending an outpatient pulmonary rehabilitation program. The screening tool included six questions covering body mass index (BMI), unintentional weight loss, age, gastrointestinal symptoms, recent hospitalisation and surgery. Each question produced a variable score with a total score of 4 or more being the criterion for malnutrition risk. Two hundred and eighty-nine chronic respiratory patients (mean age =  $71 \pm 10$  years; 131 male) attending pulmonary rehabilitation were screened for malnutrition using the MST. The MST selected was simple, inexpensive and easy to administer. The mean BMI was  $28 \text{ kg/m}^2$  (range 14–55). Low BMI was not directly associated with high MST scores. The prevalence of malnutrition in this group of patients was 13.2%, which is lower than previously reported in the literature. It is possible that malnourished patients are less likely to attend pulmonary rehabilitation programs and the screening tool selected also differs to tools used in other studies. Malnutrition screening is easy to incorporate in a pulmonary rehabilitation program, however care needs to be taken as to the selection of the screening tool.

### Can a simple field walking test be used for cycle exercise prescription in chronic obstructive pulmonary disease?

Alison J,<sup>1,2</sup> Mackey M,<sup>1</sup> Zainuldin M,<sup>1</sup> Knoke D<sup>1</sup> and Luxton N<sup>1</sup>

<sup>1</sup>Discipline of Physiotherapy, The University of Sydney, Sydney

<sup>2</sup>Department of Physiotherapy, Royal Prince Alfred Hospital, Sydney

Field walking tests are readily available to clinicians in pulmonary rehabilitation. Previous research has shown that peak oxygen consumption ( $VO_2$ ) from a 6-minute walk test (6MWT) is equivalent to that on an incremental cycle test (ICT) in subjects with chronic obstructive pulmonary disease (COPD). Using this relationship, the aim of this pilot study was to evaluate whether a 6MWT could be used as a determinant of cycle training intensity in subjects with COPD. A prospective, repeated measures study of 12 participants with stable COPD and mild to severe lung disease (mean  $\pm$  SD  $FEV_1$  %pred =  $49 \pm 19\%$ ) was carried out. Participants performed two 6MWTs followed by ten minutes of constant-load cycle exercise at 60% of the peak work rate, calculated from a previously developed regression. Metabolic and respiratory parameters were measured continuously throughout all exercise tests using a portable system (Cosmed k4b2). To quantify the intensity of cycle exercise,  $VO_2$  measured at the end of cycle exercise ( $VO_{2bike}$ ) was compared to the peak oxygen consumption of the 6MWT ( $VO_{2walk}$ ) in order to determine whether  $VO_{2bike}$  was of an intensity known to produce physiological training effects in people with COPD (i.e.  $> 50\%$  peak  $VO_2$ ). Three participants with severe lung disease did not complete the cycle exercise due to breathlessness.  $VO_{2bike}$  was significantly correlated with  $VO_{2walk}$  ( $r = 0.701$ ,  $p = 0.01$ ). The mean  $VO_{2bike}/VO_{2walk}$  was  $82 \pm 14\%$ . This pilot study showed that cycle exercise prescription based on the 6MWT resulted in an exercise intensity known to produce physiological training effects.

### COPD community linkage service: linking tertiary, secondary and community care for patients with chronic obstructive pulmonary disease

Watson C,<sup>1</sup> Ganderton L,<sup>1</sup> Hyde E,<sup>2</sup> Thomas K,<sup>3</sup> Mukherjee S<sup>1</sup> and Lake FR<sup>1,4</sup>

<sup>1</sup>Royal Perth Hospital, Perth, <sup>2</sup>Canning Division of General Practice, Perth, <sup>3</sup>Perth and Hills Division of General Practice, Perth, <sup>4</sup>University of Western Australia, Perth

In 2005, Royal Perth Hospital in collaboration with two divisions of general practice (Canning and Perth & Hills) established the COPD Community Linkage Service, with the aim of reducing hospital admissions and costs, and optimising care for chronic obstructive pulmonary disease (COPD) patients according to best practice guidelines. A key element of the service was a community based clinical team consisting of a senior physiotherapist, a sessional respiratory physician and two respiratory nurses. The team provided patient care and support (home, clinic, telephone), patient education, rehabilitation programs (home and group), and facilitated links between general practitioners and hospitals. Apart from individual patient assessment and treatment, the COPD Community Linkage Service has established community-based multi-disciplinary COPD clinics,

## POSTER PRESENTATIONS – *continued*

expanded and improved hospital and community pulmonary rehabilitation programs, provided education events for general practitioners and practice nurses on spirometry and best practice management of COPD, developed patient lead support groups in the two geographical areas and linked to Chronic Disease Self Management and other programs. Evaluation of the service for the period November 2005 to December 2006 shows 409 patients were referred. Forty percent of patients had severe disease ( $FEV_1 < 40\%$ ). The majority were ex-smokers. Nineteen percent of patients were current smokers. Twelve-month evaluation demonstrates a reduction in hospital admissions and bed days, in particular in the severe group. Knowledge of inhaler use improved with education. The 6-MWT and quality of life improved after rehabilitation. The service was extremely well received by patients. Challenges, which have relevance to other services, will be discussed.

### **Correlation of six-minute walk test to DLCO and $VO_2$ max in cardiopulmonary exercise testing in usual interstitial pneumonitis**

**Seale H, Walsh J and Hopkins P**

*The Prince Charles Hospital, Brisbane*

The six-minute walk test (6MWT) is a simple and inexpensive tool relative to cardiopulmonary exercise testing to measure functional capacity. Correlation of the 6MWT and  $VO_2$  max in exercise testing has been reported for COPD and patients awaiting lung transplantation. Usual interstitial pneumonitis (UIP) is the most common form of idiopathic pulmonary fibrosis with a poor prognosis and an estimated five-year survival of 32%. Carbon monoxide diffusing capacity (DLCO) is commonly used to monitor disease progression in this patient population. There is a paucity of data on correlation to functional capacity of patients with UIP. The aim of this study is to determine if a correlation exists between 6MWT and  $FEV_1$ , DLCO and  $VO_2$  max through a prospective evaluation of UIP patients recruited from an existing randomised controlled trial. Twenty-four individuals (male = 17) of mean age  $59.5 \pm 4.9$  years were analysed with the baseline parameters as follows:  $FEV_1$   $2.2 \pm 0.6$  L, TLC  $4.3 \pm 0.9$  L, RV  $1.5 \pm 0.3$  L, DLCO  $10.5 \pm 4.5$  ml/min/mmHg, 6MWT  $489 \pm 92$  metres and  $VO_2$  max of  $19.3 \pm 6.3$ . Six minute walk distance (6MWD) was correlated to  $FEV_1$ , DLCO,  $VO_2$  max with  $r = 0.48$ ,  $r = 0.69$  and  $r = 0.59$  respectively. Our results demonstrate a stronger correlation between 6MWD and DLCO than either  $FEV_1$  or cardiopulmonary exercise test of individuals with UIP. Therefore, the 6MWT can be useful to monitor functional capacity and disease severity in conjunction with DLCO in this patient population.

### **Exercise training in pulmonary rehabilitation: a survey of current Australian practice**

**Johnston CL,<sup>1,2</sup> Alison J<sup>2,3</sup> and Maxwell L<sup>2</sup>**

<sup>1</sup>The University of Newcastle, Newcastle <sup>2</sup>The University of Sydney, Sydney <sup>3</sup>Royal Prince Alfred Hospital, Sydney

Exercise training is an essential component of comprehensive pulmonary rehabilitation and has been demonstrated to

increase patient exercise capacity, improve quality of life and reduce symptoms. In order to describe current practice in exercise training a questionnaire was sent to all pulmonary rehabilitation programs listed on the Australian Lung Foundation national database ( $n = 193$ , response rate 83%). Exercise training was reported as a component of 97% of programs. The majority of programs (74%) contained two or more exercise sessions per week and 97% of respondents reported encouraging patients to perform unsupervised exercise at least twice a week in addition to the supervised exercise sessions. It was reported that most patients (80%) undertook at least thirty minutes of actual exercise time per supervised session. Exercise prescription was performed by physiotherapists (82%) and nurses (7%). Most respondents (74%) described their exercise program as 'an individual program with varying times for each activity/piece of equipment'. The most commonly prescribed activities were reported as unsupported upper limb exercises (97%), stretching/flexibility exercises (92%), stationary cycling (90%), stepping up and down (87%), walking inside (87%), treadmill walking (73%) and general whole body exercises, for example lunges/squats (71%). Most respondents (97%) indicated that exercise intensity and duration were progressed during their program with progression frequently based on patient symptoms. Exercise training was included in the majority of pulmonary rehabilitation programs surveyed with unsupported upper limb, stretching and flexibility and lower limb endurance exercises being the most commonly prescribed.

### **Impact of postural restoration on exercise tolerance, dyspnoea and quality of life in patients with musculoskeletal impairments associated with chronic obstructive pulmonary disease**

**Boyle KL, Bailey S, Lewis C, Davis K, Doering K and Rothe AA**

*Elon University, Elon, USA*

The aim of this study was to examine the effectiveness of postural restoration, consisting of exercises and manual therapy on exercise tolerance and quality of life in patients with musculoskeletal impairments associated with chronic obstructive pulmonary disease. A pilot study was done in the pulmonary rehabilitation unit. Three subjects who had completed four weeks of traditional pulmonary rehabilitation were recruited to receive postural restoration. In addition to their usual rehabilitation program, subjects also participated in four weeks of physical therapy scheduled three times a week, one hour before the traditional pulmonary rehabilitation. The aim of the postural restoration was to improve the mechanical aspects of respiration such as chest flexibility, diaphragm length, (specifically in the region of the zone of apposition), respiratory muscle strength, and abdominal muscle strength for diaphragm opposition in order to improve exercise tolerance and quality of life. Outcomes were the distance walked during the 6-minute walk test as a measure of exercise tolerance and SF-36 physical component scores as a measure of perceived quality of life. Baseline, pre- and post-training measurements were made. The four-week program of postural restoration and traditional rehabilitation following the initial four weeks of traditional rehabilitation only, resulted in improvements

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in exercise tolerance of 32% ( $x = 298$  feet) and quality of life 15% ( $x = 48.6$ ). Postural restoration techniques may be an important additional component of rehabilitation for patients with musculoskeletal impairments related to chronic obstructive pulmonary disease for increasing exercise tolerance and quality of life.

### Inhaled nitrous oxide during airway clearance in cystic fibrosis: two case history reports

Hall K,<sup>1,2</sup> Cobb R,<sup>1,2</sup> Tuppin M,<sup>2</sup> Seale H,<sup>2</sup> Bunting J,<sup>1</sup> Moore V,<sup>1</sup> Masel P<sup>1</sup> and Bell S<sup>1</sup>

<sup>1</sup>Adult Cystic Fibrosis Centre, The Prince Charles Hospital, Brisbane

<sup>2</sup>Physiotherapy Department, The Prince Charles Hospital, Brisbane

Increased levels of chronic chest pain during acute exacerbations of cystic fibrosis remain challenging to manage. The reported incidence of chest pain varies from 32% to 64%, increasing with severity of lung disease and age. Pain can significantly restrict effective airway clearance. Acute and long term narcotic use for physiotherapy treatment can have undesirable side effects including respiratory depression that may hinder airway clearance. Entonox, an inhaled gaseous mixture of 50% nitrous oxide and oxygen, has been used as an adjunct to pain management regimens to cover repeated invasive medical procedures in the cystic fibrosis population. Entonox is a potent analgesic, which does not depress respiration. Pain relief occurs quickly but is not sustained once inhalation is ceased. There are no reports in the literature outlining the use of Entonox during airway clearance in the cystic fibrosis patient cohort. Two case histories from The Prince Charles Hospital describe the introduction of inhaled nitrous oxide during airway clearance. This has enabled effective respiratory physiotherapy for these patients. Discussion of our centre's experience including the potential adverse effects of patient sedation, possible ongoing drug dependence and vitamin B<sub>12</sub> changes are included. Challenges for patients and staff, including the medicolegal implications for inhaled drug administration has resulted in the development of strict work unit guidelines by our centre to ensure safe practice.

### Inspiratory muscle strengthening in a child with neuromuscular weakness

Depiazzi JE

Princess Margaret Hospital for Children, Perth

Respiratory muscle weakness and fatigue in the patient with neuromuscular disease commonly leads to pulmonary complications, morbidity and mortality. Using a single case study design a trial was undertaken over eight weeks to achieve a measurable improvement in maximal inspiratory pressure of a five-year old girl with hereditary motor and sensory neuropathy requiring nocturnal non-invasive ventilation. The subject inspired through a threshold inspiratory muscle training device for one minute, followed by 20 seconds rest, for 15 cycles. Air-flow was only achieved at a generated pressure equal to 40% of repeatable maximal inspiratory pressure, increasing to 60% over six weeks. No resistance was given to expiration. Training was performed five times a week for 20 minutes. Over the course of

training, the child's median maximal inspiratory pressure increased from 21 to 60 cm H<sub>2</sub>O and was maintained over a period of 11 months. Her maximal expiratory pressure showed a similar improvement. Hospital admissions for respiratory illness decreased from five at four years of age to nil since the commencement of training 20 months ago, with no significant deterioration in nocturnal ventilation since commencement of the study. On a parental quality of life questionnaire modest improvements were felt in the areas of general health, behaviour, self-esteem and parental concern. Results indicate that it is possible to improve the inspiratory muscle strength of a five-year old child with hereditary motor and sensory neuropathy, with no adverse neuromuscular effects and with similar results to those achieved in adult chronic obstructive pulmonary disease and neuro-muscular disease populations.

### Inspiratory muscle training improves respiratory muscle weakness in patients with chronic renal failure

Nataatmadja N,<sup>1</sup> Thomas P,<sup>2</sup> Kark A<sup>2</sup> and Paratz J<sup>1,2</sup>

<sup>1</sup>University of Queensland, Brisbane, <sup>2</sup>Royal Brisbane & Womens' Hospital, Brisbane

Patients with chronic renal failure (CRF) have a direct weakness of respiratory muscles, which impacts on quality of life, or ability to recover from a respiratory infection. Inspiratory muscle training (IMT) has increased inspiratory muscle strength and functional ability in patients with chronic respiratory disease and heart failure. We wished to investigate IMT in patients with CRF in a double blinded RCT. Eighteen people with CRF were randomly allocated to experimental ( $n = 9$ ,  $72 \pm 7.9$  years, 7 males) or sham training group ( $n = 9$ ,  $66 \pm 5.4$  years, 4 males), assessed at baseline and trained with a threshold training device for 6 weeks, with resistance increased weekly. Outcome measures were maximal inspiratory pressure (MIP) and the Frenchay activities index (FAI). Sixteen patients completed. An ANCOVA, using intention to treat, found a significant increase in MIP for the experimental group only (control –  $54.3 \pm 26.2$  cmH<sub>2</sub>O to –  $50.9 \pm 22.0$  cmH<sub>2</sub>O; experimental –  $58.1 \pm 26.2$  cmH<sub>2</sub>O to –  $71.2 \pm 21.2$  cmH<sub>2</sub>O) ( $F_{(1,15)} = 7.2$ ,  $p = 0.019$ ,  $\delta = 0.35$ ). There was no significant improvement in FAI. A significant negative correlation was found between post dialysis urea and MIP ( $r = 0.61$ ,  $p < 0.05$ ) and a significant positive correlation was found between haematocrit levels and MIP ( $r = 0.70$ ,  $p < 0.01$ ). A 6-week inspiratory muscle training program can improve respiratory muscle strength in people with CRF. There was insufficient evidence to suggest a carry-over effect into functional ability, but a larger study may demonstrate this. Important information was found on the impact of biochemical markers on respiratory muscle strength.

### Integration of theory, assessment, practice and the problem-oriented approach

Chesworth W

The University of Canberra, Canberra

This abstract describes the use of a card as a teaching and learning framework which incorporates the primary



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principles of physiotherapy practice (assessment, interpretation, planning, implementation and evaluation). This framework has been used to assist physiotherapy students to integrate theory, assessment and practice using the problem-oriented approach to clinical cases in cardio-respiratory units. It provides a format which challenges students to integrate, in a systematic manner, information from the subjective and objective patient assessment into a problem list against which goals, treatment choices and measures to evaluate the treatment must be set. Problems or issues are separated into those that are directly amenable to physiotherapy treatment and those that are not, but may influence treatment choice. Goals, treatment choices and measures to evaluate the treatment must be related to the problem list. This avoids the prescription and practice of so-called 'routine' treatments and aids students in planning tailored individual treatments. It also improves documentation. For examination purposes an additional section—the rationale for treatment—requires students to justify their choice of treatment based on the student's theoretical understanding and evidence-based treatments. This system uses the primary principles of physiotherapy (assessment, interpretation, planning, implementation and evaluation) recommended for entry-level graduates. Students, supervisors and academics can successfully track student thinking, promoting a patient-centred and quality clinical practice, including documentation across the two cardio-respiratory units offered at the University of Canberra and their corresponding clinical education.

### **Perspectives of people with chronic obstructive pulmonary disease (COPD): a qualitative study of outcomes of pulmonary rehabilitation for everyday life**

**Marzano V, Smith M and O'Shea, S**

*Charles Sturt University, Albury*

Pulmonary rehabilitation (PR) is an effective intervention in improving quality of life for people with chronic obstructive pulmonary disease (COPD). Benefits of PR have largely been identified using quantitative research methods. This study used a qualitative approach to more deeply investigate individuals' experience of participating in PR. Six participants with COPD who had undergone a comprehensive PR program 6–18 months prior to the study were recruited. Data were collected from each participant using two in-depth semi-structured interviews. Interviews were transcribed verbatim and participant checking undertaken to ensure data authenticity. Data analysis involved a reflexive process of immersion by the researcher in the data, through a repeated cycle of in-depth reading and interpretation. Common themes were identified in the experience of the participants in PR. Participants in this study experienced benefits meaningful to them from PR including: a) increased knowledge, b) increased feelings of control over symptoms, c) changed perception of themselves and disease, and d) increased activity tolerance. Factors contributing to benefits were being in a group environment, the type and level of interaction with health professionals, and factors related to individuals intrinsic being. Participants less often attributed the outcomes of PR to specific exercise training. Participants reported that many positive outcomes such as feelings of control persisted over time. These findings imply

the importance of increasing collaborative reasoning with clients to achieve results meaningful to them. Incorporating qualitative methods may allow a greater understanding of how the effects of PR for individuals are achieved and maintained over time.

### **Physical activity and Human Immunodeficiency Virus (HIV): who is doing how much?**

**Fillipas S,<sup>1,4</sup> Bowtell-Harris CA,<sup>1</sup> Ciccutini F,<sup>1,4</sup> Holland AE<sup>1,3</sup> and Cherry CL<sup>1,2,4</sup>**

*<sup>1</sup>The Alfred, Melbourne, Australia, <sup>2</sup>Burnett Institute, Melbourne, Australia, <sup>3</sup>La Trobe University, Melbourne, Australia, <sup>4</sup>Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia*

The prevalence and degree of physical activity undertaken by HIV-infected Australians has not been described. The aims of this study were to describe physical activity in an Infectious Diseases (ID) clinic (both HIV and non-HIV), assess compliance with the American College of Sports Medicine physical activity guidelines, and to assess demographic associations. All outpatients attending the Alfred Hospital ID clinic over four weeks were invited to complete the International Physical Activity Questionnaire Short Form (IPAQ) to measure physical activity. Three hundred and forty-seven outpatients attended during the study period, and 261 (75%) participated. This included 191 HIV-infected outpatients (87% response rate) and 70 non-HIV outpatients (55% response rate). Age (mean and range) was similar in both groups. HIV-infected outpatients were more likely to be male ( $p < 0.001$ ). Activity categories on the IPAQ were not different between groups nor were the intensity, frequency and duration of physical activity. Overall, 75% of HIV-infected and 77% of non-HIV participants met recommended guidelines. There were no significant differences in age or gender between those who did and did not meet guidelines in either group. This cross sectional study found that 75% of HIV-infected outpatients meet physical activity guidelines. Twenty-five percent of patients were classified as 'inactive'. Given the likely benefits of physical activity in this population, these data demonstrate a need to improve the uptake of appropriate physical activity and to identify barriers to this. As neither age nor gender was associated with reduced physical activity, interventions will need to be directed at the whole population.

### **The colour change in cyanosis and its relationship to the confusions of congenital colour vision deficient observers**

**McNamara R,<sup>1</sup> Taylor CM,<sup>2</sup> McKenzie DK,<sup>1</sup> Coroneo M<sup>3</sup> and Dain SJ<sup>2</sup>**

*<sup>1</sup>Department of Respiratory and Sleep Medicine, Prince of Wales Hospital, Sydney <sup>2</sup>Optics and Radiometry Laboratory, School of Optometry and Vision Science, UNSW, Sydney <sup>3</sup>Department of Ophthalmology, Prince of Wales Hospital, Sydney*

Visual recognition of cyanosis is an important clinical activity. Cyanosis recognition is affected by lighting colour and there is anecdotal evidence that people with significant colour vision deficiencies (CVDs) have particular difficulty. Studies to date have centred on the colour change with



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oxygenation of isolated blood but it is not clear how this extrapolates to cyanotic patients *in vivo*. Ten patients known to be chronically hypoxaemic and showing signs of cyanosis were recruited from the chronic respiratory program. Ten normal subjects were recruited as controls. The spectral reflectances of their lips, nail beds and palm creases were measured using a Topcon SR-3 telespectroradiometer. The patients were measured at rest and after exercise to lower their saturation a further 5–10%. The chromaticities were calculated and plotted. Both groups showed a spread of colours but they fell into two distinct ranges. The colour difference between the groups lies very close to the colour confusions made by congenital CVDs. Within the cyanosed group the colour shift was not tightly related to decreasing oxygen saturation. This is most likely due to interpersonal factors such as pigmentation and vascular perfusion that affect colour and the difficulties in measuring the colour of heterogeneous anatomical features. These results quantify the anecdotal difficulties in detecting cyanosis and suggest that observers with CVD would have problems recognising the condition. The photographs obtained from this study will be used to compare the ability of subjects with and without CVD to detect cyanosis.

### **The effects of musculoskeletal physiotherapy and massage on pain and ease of breathing in adults with cystic fibrosis**

Lee A,<sup>1</sup> Button B,<sup>1</sup> Holdsworth M<sup>1</sup> and Holland A<sup>2</sup>

<sup>1</sup>The Alfred Hospital, Melbourne <sup>2</sup>La Trobe University, Melbourne

Musculoskeletal pain is prevalent in cystic fibrosis (CF). The aim of this study was to examine the effect of musculoskeletal physiotherapy techniques and soft tissue therapy, including remedial massage on pain and ease of breathing (EOB) in adults with CF. One hundred and twenty-nine adults with CF (60 males, 70 with acute exacerbation, 24 post lung transplant) aged  $31 \pm 9$  years (mean  $\pm$  SD) with FEV<sub>1</sub> of  $51 \pm 21\%$  participated in this study. Following assessment of primary pain regions, each subject underwent a single individualised session including spinal joint/intercostal mobilisation, soft tissue therapy, exercises and postural advice of one hour duration. Pain and EOB on a visual analogue scale were measured before and after treatment. Changes were compared using paired-samples *t*-tests. Pain was most commonly reported in the thoracic spine region (38% of subjects), followed by the shoulder region (31%), cervical spine region (16%) and chest wall region (9%). EOB rating prior to treatment were worse in those with low BMI ( $r = -0.21$ ,  $p = 0.02$ ) and low FEV<sub>1</sub> % ( $r = -0.24$ ,  $p = 0.01$ ). A single treatment session was associated with reduction in pain (95<sup>th</sup> CI 1.6–2.1,  $p < 0.05$ ) and improvement in EOB (95<sup>th</sup> CI 0.4–0.7,  $p < 0.05$ ), irrespective of clinical status. Improvement in pain was equivalent for all primary pain regions. However, greater improvement in EOB was evident in subjects with shoulder pain compared to other regions (95<sup>th</sup> CI –1.1 to 0.02,  $p = 0.04$ ). A combination of musculoskeletal physiotherapy techniques, exercise prescription and soft tissue therapy reduces musculoskeletal pain and improves EOB in adults with stable CF, during an acute exacerbation and post lung transplantation. Pain was most commonly reported in the thoracic spine region (38% of subjects), followed by the

shoulder region (31%), cervical spine region (16%), chest wall (9%) and lumbar spine (9%). EOB rating prior to treatment were worst in those with low BMI ( $r = -0.214$ ,  $p = 0.015$ ) and low FEV<sub>1</sub> ( $r = -0.24$ ,  $p = 0.006$ ). A single treatment session was associated with reduction in pain ( $p < 0.05$ ) and improvement in EOB ( $p < 0.05$ ), irrespective of clinical or transplant status. Improvement in pain was equivalent for all pain regions. However, greater improvement in EOB was evident in subjects with shoulder pain compared to other regions ( $p = 0.04$ ). In the five primary regions, the following number of subjects (%) reporting pain: shoulder (Sh) 40 (31%), cervical spine (Csxp) 20 (16%), thoracic spine (Txsp) 49 (38%), lumbar spine (Lxsp) 11 (9%) and chest wall (CW) 11 (9%). EOB ratings prior to treatment were modestly related to BMI ( $r = -0.214$ ,  $p = 0.015$ ) and FEV<sub>1</sub> % pred ( $r = -0.24$ ,  $p = 0.006$ ). A single treatment session was associated with reduction in pain ( $t = 12.63$ ,  $p < 0.05$ ), and improvement in EOB ( $t = 6.32$ ,  $p < 0.05$ ), irrespective of clinical or transplant status. The extent of change in pain was equivalent for all primary pain regions. However, greater improvement in EOB was evident in subjects with Sh pain compared to those Cxsp pain ( $p = 0.042$ ).

### **The lung transplantation service in Western Australia: review of the first two years**

Lunt D, Fowler R, Lawrence S, Chambers D and Gabbay E

Royal Perth Hospital, Perth

A new lung transplantation service was established at Royal Perth Hospital in November 2004. The rationale was to achieve outcomes and survival rates similar to those of other lung transplant programs in Australia, to allow Western Australian patients to remain in WA while actively listed, and to improve utilisation rates of local donor lungs. A multidisciplinary team was appointed at the outset following recommendations and experience from other centres. The physiotherapy component of the team includes provision of pulmonary rehabilitation exercise classes pre and post transplant, and inpatient care in addition to existing ward staffing hours. Two patients awaiting transplant have used a BiPAP Vision unit during exercise to enable them to continue working at an optimal level while attending rehabilitation classes. The availability of twenty-four hour physiotherapy care to donors and recipients at Royal Perth Hospital, may have contributed to the successful outcomes in this population. The existence of a local service has affected donor rates, with WA and particularly Royal Perth Hospital now having one of the highest rates of donation in Australia. By February 2007 seventeen patients had surgery, with one heart-lung, eight bilateral and eight single lung transplants performed. Data for disease types, mean waiting times, length of inpatient hospital stay, survival rates, and functional outcomes will be presented. Despite concerns about establishing a service in a region with a relatively small population, the unit has demonstrated outcomes comparable to those achieved by national and international transplant centres.

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### **The partners in health (PIH) scale: assessing self management capacity following pulmonary rehabilitation**

McNamara R

*Departments of Respiratory Medicine and Physiotherapy,  
Prince of Wales Hospital, Sydney*

The Partners in Health (PIH) scale is a generic instrument developed as part of the Flinders Model of Chronic Condition Self-Management to assess self-management capacity. The PIH scale contains 12 questions covering the six principles of self-management. The client completes the questionnaire by scoring their response to each question on a 9-point scale, zero being the best response (good self-management) and eight being the worst (poor self-management). The PIH scale was used as an outcome measure to assess the self-management practice for 48 chronic respiratory patients (mean age = 72 ± 11 years; 20 male) attending an eight-week pulmonary rehabilitation program. The PIH scale was completed at baseline and at eight weeks. The PIH scale was simple and easy to administer. The PIH scale scores indicated a 2-point improvement in knowledge about the treatment of their health condition. All patients indicated at both baseline and at eight weeks that they always take their medication as asked by their doctor. Items relating to monitoring and managing signs and symptoms of their condition, and managing the effect of their health condition on physical activity, emotions and lifestyle showed a decrease in the PIH score from baseline ratings. Improvements in PIH scores were related to improvements in exercise capacity (47 m average change in 6-minute walk distance) and quality of life (5% improvement in St George Respiratory Questionnaire score). Measurement of self-management behaviour using the PIH scale is easy to incorporate in pulmonary rehabilitation. Improvements in PIH scores correlate with improved health outcomes.

### **The physiotherapy management of patients with bronchiectasis: a survey of current practice**

Lee A,<sup>1</sup> Button B<sup>1,2</sup> and Denehy L<sup>1</sup>

*<sup>1</sup>The University of Melbourne, Melbourne <sup>2</sup>The Alfred Hospital, Melbourne*

Physiotherapy is an important component of the management of patients with bronchiectasis, yet the types of interventions commonly utilised and measures of efficacy have not been reported. This study aimed to determine the current clinical practice of airway clearance therapy and exercise prescription for patients with bronchiectasis. A previously piloted purpose designed questionnaire was distributed to senior physiotherapists responsible for the physiotherapy management of patients with bronchiectasis throughout Australia and New Zealand (n = 120) with a response rate of 85% (n = 102). The most commonly used airway clearance techniques included modified gravity-assisted drainage (n = 51, 53%), active cycle of breathing techniques (n = 46, 48%), PEP therapy (incorporating bottle and mouthpiece PEP) (n = 56, 55%) and walking (n = 38, 39%). Measures of airway clearance efficacy routinely utilised were sputum volume (n = 53, 55%) and auscultation findings (n = 57, 59%). Respondents indicated that published research, therapist

experience, patient capacity and equipment were the factors that most influenced the clinical practice of airway clearance therapy. Physical exercise was recommended by most respondents (n = 95, 98%), with walking, cycling, upper limb exercise and pulmonary rehabilitation regularly prescribed. Respondents primarily measured the efficacy of exercise with the 6-minute walk test (6MWT) (n = 30, 31%), time spent on physiotherapy, patient reported adherence and oxygen saturation (all n = 33, 34%). This survey demonstrates that the most frequently employed airway clearance techniques were selected in similar proportions. Assessment of exercise efficacy includes measurements which serve as evaluation tools within pulmonary rehabilitation programs. Further research to justify the selection of these interventions is required.

### **The real cost of effective treatment: a single case study of a patient with hyperventilation syndrome**

Mooney S and Candy S

*Counties Manukau District Health Board, Auckland, New Zealand*

Hyperventilation is a normal physiological response to acute stress. Chronic hyperventilation syndrome (HVS) however, is often undiagnosed due to the extensive and often seemingly unrelated symptoms. These patients often undergo extensive yet inconclusive costly investigations and are high healthcare users. This has financial implications for both healthcare providers and consumers. This single case study highlights the multi-faceted nature of HVS, its cost and the role of physiotherapy in the management of this complex patient group. A 39-year old woman (SS) presented to ED on 3 occasions within 10 days. Each presentation resulted in the patient undergoing a battery of tests. Following a respiratory consultant review, a referral was made to the physiotherapy clinic. She was assessed and found to have a Nijmegen score of 37/64. Her symptoms directly impacted on her job, sleep pattern and relationship with her family. Objective signs supported the diagnosis of HVS. Physiotherapy consisted of exercise, education and advice regarding HVS and its management. Attention was also paid to voice control and life changes to promote a healthy lifestyle. After seven sessions over a 3-month period (4 hours treatment time in total), SS was able to maintain a quality pattern of breathing throughout a range of positions and activities. Her Nijmegen Score was reduced to 5/64. She was back to full-time employment, had made lifestyle changes and had started to exercise regularly. The cost and therapeutic effectiveness of physiotherapy based treatment cannot be underestimated, to healthcare providers, patients and their families.

### **Urinary incontinence in female adolescents with cystic fibrosis**

Depiazzi JE and Johnston KN

*Princess Margaret Hospital for Children, Perth*

Urinary incontinence in female adolescents with cystic fibrosis is a common problem. The aim of this study was to determine the prevalence, severity and impact on daily life of urinary incontinence in female adolescents with cystic

## POSTER PRESENTATIONS – *continued*

fibrosis in Western Australia. A written questionnaire was sent to females aged 12–18 years who attended the Cystic Fibrosis clinic at Princess Margaret Hospital for Children in Perth, Western Australia. Twenty of 24 eligible adolescents (83%) completed and returned the questionnaire. Six adolescents (33% of respondents) reported having been incontinent of urine at least once a year. In four cases (20%) incontinence was reported to occur at least once a week. Of those who reported incontinence, four (67%) reported mild (damp/a few drops) and the other two (33%) described moderate (wet/a small amount) incontinence. All of the adolescents with incontinence reported that their symptoms were caused by coughing. Fifty percent of these adolescents reported suppressing their cough and doing less physiotherapy to manage their incontinence symptoms. None of the six adolescents with incontinence had reported the problem to a physician. Three of the adolescents with incontinence had spoken about it with a physiotherapist, were aware of available treatment and had commenced pelvic floor muscle exercises. Of concern in this survey was the impact of incontinence symptoms on effective cough and performance of physiotherapy techniques. However, physiotherapists were also likely to be consulted by patients about the problem, and to provide information and treatment options.

### **Virtual hospital for cardiorespiratory physiotherapy: closing the gap between theory and practice**

**Chesworth W, Fletcher S and Donnan P**

*University of Canberra, Canberra*

The aim of this project was to integrate theory and practice in the teaching of cardiothoracic physiotherapy students at the University of Canberra by creating a rich multi-media learning environment. A series of evaluations of the cardiothoracic units taught at The University of Canberra established that there were areas of practice difficult to comprehend without the use of visual images (e.g. the intensive care unit of a hospital). Students experienced difficulty visualising a patient in hospital, particularly in high dependency units such as intensive care, and this resulted in recommendations for inappropriate and dangerous interventions for mock seriously ill cardiothoracic patients. On clinical education placements students were surprised at how unwell hospital patients were. Closure of the gap between theory and practice is being achieved through development of multi-media tools, such as video footage of patients and procedures related to case studies used during theory and examination components. These are being combined with patient data, similar to that found in a hospital, to allow students to integrate theory, clinical skills and practice. While this is essentially an educationally driven project, it is heightened by an environment of resourcing constraints, including time and access to lengthy periods of clinical education. Anticipated outcomes of this project are higher levels of understanding and standards of practice amongst graduates.

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AUSTRALIAN PHYSIOTHERAPY ASSOCIATION



# ABSTRACTS

Continence and Women's Health Group  
Conference

## The Core, the Floor, and the Cortex



APA Conference Week  
4–8 October 2007  
Cairns, Australia



AUSTRALIAN PHYSIOTHERAPY ASSOCIATION

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## FREE PAPERS

### Assessment and treatment of pregnancy-related diastasis and instability of the pubic symphysis

**Hungerford B** and Lambridis A

*Sydney Spine and Pelvis Physiotherapy Centre*

Up to 25% of women will suffer from some degree of postpartum pelvic girdle pain following labour, though this figure decreases to 5% once mild complaints are eliminated. Relaxation of pubic and sacroiliac ligaments occurs during pregnancy, as does diastasis of the pubic symphysis. A diastasis greater than 20 mm during childbirth however, will cause significant stresses and possible damage to pubic and anterior sacroiliac joint (SIJ) ligaments. The effect of such damage will be difficulty with all weight-bearing activities, lifting, pain in the pubic region plus posterior pelvic girdle pain due to a lack of pubic stability. The literature pertaining to this problem is limited, and retrospective patient reviews suggest this injury occurs more frequently than the current literature suggests. Injury to the pubic symphysis needs to be assessed in the larger context of pelvic stability looking at both form and force closure. Recent research has shown that pelvic belts are effective in improving pelvic girdle pain, including pubic pain. Application of a specific lumbo-pelvic stabilisation exercise program has also been shown to reduce pain and improve function for patients with pelvic girdle pain. This presentation presents a clinical protocol for assessment of pubic instability following a pregnancy-related diastasis with consideration of treatment options and exercise prescription, using a case presentation.

### Audit of physiotherapy management of gynaecological oncology surgery patients and incidence of postoperative pulmonary complications

**Fernandes P** and Sherburn M

*Royal Women's Hospital, Melbourne*

Chest physiotherapy for major abdominal surgery aims to counteract pulmonary changes produced by anaesthesia and surgery. Improvements in anaesthetics and post-operative pain management have reduced the need for chest physiotherapy unless post-operative pulmonary complications arise. However, the incidence of post-operative pulmonary complications is 2% to 4% in lower abdominal surgery. The aims of this project were to establish the incidence of post-operative pulmonary complications in a population of women undergoing major gynaecological oncology surgery, to alter ward practice, and re-audit the post-operative pulmonary complication rate nine months after change of practice. Forty-four patients were included in the initial two month audit. The incidence of post-operative complications was 2.3% (n = 1). Three (range 1–6) physiotherapy treatments were given over three days, consisting predominantly of deep breathing exercises and mobilisation. Early mobilisation was shared equally between nurses and physiotherapist (50%). Mean length of stay was 5.4 (range 2–18) days. Following the audit, physiotherapy management altered to one pre-operative consultation, which included information on early mobilisation, and a post-operative discharge consultation including pelvic floor and abdominal function, lifestyle and lymphoedema

precautions, safe general exercise, and return to full activity information. A re-audit (n = 35) was undertaken nine months later and revealed a post-operative pulmonary complication rate of 2.8% (n = 1) (NSD), and mean length of stay 6.3 (3–15) days (NSD). Acute chest physiotherapy does not alter the progress of a patient after uncomplicated gynaecological oncology surgery. Improvements in cancer care mean that many women will live with cancer as a chronic condition. Inpatient physiotherapy treatment should reflect this.

### Comparison of changes in bladder base movement after different training models in female urinary incontinence

**Hung HC, Chih SY, and Tsao JY**

*School and Graduate Institute of Physical Therapy,  
College of Medicine, National Taiwan University*

No randomised study examined the effects on bladder base movement of training of pelvic floor muscles for women with stress urinary incontinence. This study aimed to compare change in bladder base position evaluated by transabdominal ultrasound after different interventions. Seventy-one women with stress urinary incontinence were assigned randomly to two groups. Group 1 received specially designed training oriented by transversus abdominis contraction which needed instruction eight times through a 4-month period. Group 2 received pelvic floor muscle contraction instruction and practiced at home. Direction and magnitude of bladder base movement were assessed by transabdominal ultrasound during contraction of pelvic floor muscles and transversus abdominis at baseline and after 16-week intervention. After intervention, it showed significant improvement on bladder base elevation during pelvic floor voluntary contraction in both group ( $p < 0.001$ ). There was no significant difference between groups in magnitude ( $p = 1.000$ ). However, while instructing contraction of transversus abdominis, only Group 2 showed significant difference on bladder base elevation ( $p = 0.002$ ). Pelvic floor muscle training is the direct and effective way to elevate the bladder base.

### Contraindications/precautions for aquatic physiotherapy may need more research: an example regarding blood pressure in pregnant women

**Ward E,<sup>1,3</sup> McIntyre A,<sup>2</sup> Van Kessel G<sup>1</sup> and Hague W<sup>2</sup>**

*<sup>1</sup>University of South Australia, Adelaide <sup>2</sup>Women's and Children's Hospital, Adelaide <sup>3</sup>Flinders Medical Centre, Adelaide*

A number of contraindications exist for aquatic physiotherapy (AP) with pregnant women, however there is little specific research to prove the validity of some contraindications. Some therapists may believe the guidelines are excessive, however it is accepted that pregnant women are a special population. A study was completed at the Women's and Children's Hospital in 2002 to investigate the effect of AP on blood pressure in pregnant women. Uncontrolled blood pressure, hypertension and pre-eclampsia are listed as precautions/contraindications, however little was known about how participation in AP affected blood pressure in

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normal pregnant women. An experimental same-subject, repeated measures design was used and forty-five sets of data collected from pregnant women attending routine, nonaerobic AP classes. Blood pressure measurements were taken pre-immersion, 2–5 minutes after entering the pool, immediately following the 50 minute AP class (while immersed), and 8–12 minutes after exiting the water. Blood pressure data were analysed using a repeated measures ANOVA and a highly significant difference was observed ( $p = 0.0000$ ). Post-hoc analysis showed BP to decrease significantly on entering the water (mean arterial pressure, mean difference of 10.52 mm Hg, 95% CI 8.75–12.29), to remain at this low level post-exercise while still immersed, and then return to pre-immersion values 8–12 minutes after exiting the water. These findings raised the question as to whether aquatic physiotherapy may in fact be beneficial to pregnant women with hypertensive pregnancy related conditions. This example highlights the need for more research regarding precautions/contraindications in aquatic physiotherapy.

### Does postoperative physiotherapy improve pelvic floor muscle strength in women undergoing prolapse surgery?

Frawley HC,<sup>1</sup> Galea MP,<sup>1</sup> Phillips BA<sup>2</sup> and Bø K<sup>3</sup>

Rehabilitation Sciences Research Centre, The University of Melbourne, Melbourne <sup>2</sup> Faculty of Health Sciences, LaTrobe University, Melbourne <sup>3</sup> Norwegian School of Sports Sciences, Department of Sports Medicine, Oslo, Norway

The aim of this study was to investigate the effect of a pelvic floor physiotherapy exercise program on pelvic floor muscle strength, in women undergoing prolapse surgery, at 3, 6 and 12 months post-operative. A single-blind randomised controlled trial was conducted. Included were women of any age undergoing vaginal or laparoscopic-assisted vaginal surgery for either prolapse repair, and/or hysterectomy. Forty-eight women were randomised equally into treatment and control groups. Physiotherapy assessments of pelvic floor muscle strength were performed by a blinded investigator at 4 time points: pre-operatively, and at 3, 6 and 12 months post-operatively. Pelvic floor muscle strength was assessed by manometry, using a Peritron™ unit, and by digital muscle strength grading. The treatment group received one pre-operative and eight post-operative consultations with a pelvic floor physiotherapist, over a twelve month period. The mean and standard deviations for maximum voluntary contraction strength (cm H<sub>2</sub>O) for the treatment group at the 4 time points were: 22.9 ± 18.2, 27.2 ± 18, 27.2 ± 17.7, and 27.5 ± 16.3. For the control group they were: 22.8 ± 23.1, 22.8 ± 16.7, 23.6 ± 16.1, and 24.2 ± 17.1. The difference between the groups was not significant (ANOVA analysis time by group:  $p = 0.6$ ) at any time point. The wide variance in the data, as well as inadequate training dosage could be explanations for this finding. The program employed in this study did not result in an improvement in pelvic floor muscle strength post-operatively in women beyond that achieved by surgery alone.

### Displacement and endurance of the pelvic floor muscles in healthy males and females: a comparison between standing and crook-lying

Kelly M,<sup>1</sup> Tan BK,<sup>2</sup> Carroll S,<sup>1</sup> Follington M,<sup>1</sup> Arndt A,<sup>1</sup> Seet M<sup>1</sup> and Thompson J<sup>1</sup>

<sup>1</sup>School of Physiotherapy, Curtin University of Technology, Perth, Western Australia <sup>2</sup>Centre for International Health, Curtin University, Perth, Western Australia

The purpose of this study was to determine if there were any differences in the displacement and endurance of a voluntary pelvic floor muscle (PFM) contraction in an asymptomatic male and female population in standing and crook-lying. Subjects included 66 (46 female, 20 male) participants (mean age 22.8 (± 3.4) years). Transabdominal (TA) ultrasound was used to measure the displacement of the bladder base during PFM contractions and the ability to hold the pelvic floor in an elevated position whilst breathing normally in the two positions. Two-way ANOVA with repeated measures was used to compare the mean displacement and endurance between males and females in standing and crook-lying. Displacement was significantly greater in standing (mean 7.4 ± 5.0mm) compared to crook-lying (mean 4.8 ± 4.9mm) ( $p < 0.001$ ). Similarly, the duration of a pelvic floor contraction was significantly greater in standing (mean 31.6 ± 24.4s) than crook-lying (mean 14.6 ± 18.9s) ( $p < 0.001$ ). There was no difference in displacement or hold time between genders. Standing was found to be a more effective position for achieving and sustaining an elevation of the pelvic floor compared to crook-lying, regardless of gender and this could have implications for the assessment of the pelvic floor muscle contractions using TA ultrasound.

### Pelvic floor muscle training is superior to bladder training for stress urinary incontinence in elderly women

Sherburn M,<sup>1</sup> Galea MP<sup>1</sup> and Bo K<sup>1</sup>

<sup>1</sup>Rehabilitation Sciences Research Centre, School of Physiotherapy, The University of Melbourne <sup>2</sup>Norwegian School of Sport Sciences, Department of Sports Medicine, Oslo, Norway

Pelvic floor muscle training is effective for women with stress urinary incontinence, however there are few randomised controlled trials for this training in elderly women. Bladder (behavioural) training has also been suggested as effective for older women with stress urinary incontinence, but bladder training protocols include pelvic floor muscle contractions for urgency control. It is important to distinguish the relative effectiveness of these two interventions to manage stress urinary incontinence effectively. The aim of this study was to compare pelvic floor muscle training to bladder training without pelvic floor muscle contractions, in women over 65 years of age with urodynamic stress incontinence. A two centre, single blind, randomised controlled trial of 20 weeks intervention and seven months follow-up was undertaken. Eighty-three women aged 65 years and over were randomised to pelvic floor muscle training ( $n = 43$ ) or behavioural training ( $n = 40$ ). They attended weekly education and exercise sessions, undertook a home program, and were assessed at baseline,



## FREE PAPERS – continued

20 weeks (primary endpoint) and 12 months. Outcomes were leakage (gm) on a cough stress test, performed with and without a pre-contraction of the pelvic floor muscles, quality of life (ICIQ-UI SF) score and global perception of symptom change. At 20 weeks, participants in the pelvic floor muscle training group had less leakage on the stress test with ( $p = 0.008$ ) and without ( $p = 0.034$ ) a pelvic floor pre-contraction, improved quality of life ( $p = 0.003$ ), and greater overall symptom change ( $p = 0.004$ ) than the behavioural group. Pelvic floor muscle training is more effective than bladder training in older women with stress urinary incontinence.

### Physiotherapy-based exercise together with allied health education: its effect on new mothers' wellbeing and depressive symptoms

Ashby E,<sup>1,2</sup> Galea M<sup>2</sup> and Sherburn M<sup>2,3</sup>

<sup>1</sup>Angliss Hospital, Ferntree Gully <sup>2</sup>Rehabilitation Sciences Research Centre, School of Physiotherapy, The University of Melbourne, Parkville <sup>3</sup>Royal Women's Hospital, Carlton

The aim of this clinical trial was to determine the effect of the Mother and Baby Program, an eight week physiotherapy exercise program with allied health education, on the psychological well-being and depressive symptoms of new mothers. The outcome measures of psychological well-being, depressive symptoms and physical activity levels were collected at baseline, at the conclusion of the eight week program, then again four weeks after the program. The exercise group ( $n = 62$ ) had significantly higher well-being scores ( $p < 0.001$ ) and lower depressive symptoms ( $p < 0.001$ ) post-program when compared with the control group ( $n = 70$ ). The proportion of women in the exercise group who were at risk of postnatal depression at baseline had reduced by 50% post-program. Results revealed that the well-being and depression scales used were well-correlated ( $p = 0.003$ ), indicating that a high well-being score reflected low symptoms of post-natal depression. Analyses also revealed that the intervention did not significantly increase participants' physical activity levels. However, membership of the Mother and Baby Program was a strong predictor of well-being scores and depression symptoms. The significant results of this trial, the first of its kind, demonstrate the effectiveness of the Mother and Baby Program on new mothers' psychological well-being and risk of depression. This specialised physiotherapy-based exercise intervention, provided by a women's health physiotherapist with allied health education, can be provided at relatively little cost in a wide variety of settings within the community.

### Positional plagiocephaly prevention campaign: 1-year and 3-year outcomes

Leung AY

*Therapy and Support Service for Children, Ipswich*

A positional plagiocephaly prevention campaign has been launched in the West Moreton South Burnett Health Service District. The prevention campaign included: development of educational materials; training delivered to child health nurses and midwives; implementation of prevention strategies in the maternity ward of a local government hospital; and the promotion of prevention strategies in new parents group meetings. The purpose of this study was to investigate the impact of this prevention campaign on the community after one year and three years post-implementation. Pre- ( $n = 86$ ), 1-year ( $n = 99$ ) and 3-year ( $n = 85$ ) post-campaign questionnaires were completed by separate samples of mothers from the community with healthy babies who were under twelve month of age. While the 1-year survey did show an increase in awareness of positional plagiocephaly prevention compared to pre-campaign levels, this came at the cost of an increase in the number of mothers who reported putting their babies to sleep on their sides, which is not a prevention strategy. This was rectified in further health promotional activities. In the 3-year survey, the number of mothers reporting putting their babies to sleep on their sides had reverted to pre-campaign levels. There was no significant increase in mothers' changing a baby's head position during sleep and putting the baby on the tummy in the 1-year survey but a significant increase was reported in the 3-year survey. In the pre- and post-campaign studies, about 80% of the mothers reported that they would seek advice from their general practitioner and child health nurse if their babies showed signs of plagiocephaly.

### The treatment effect of decongestive lymphatic therapy combined with kinesio taping for breast-cancer-related lymphoedema

Hung HC,<sup>1</sup> Tsai HJ,<sup>2</sup> Huang CS,<sup>3</sup> Chang JY<sup>1</sup> and Tsao JY<sup>1</sup>

<sup>1</sup>School and Graduate Institute of Physical Therapy, College of Medicine, National Taiwan University, Taipei, Taiwan <sup>2</sup>Department of Rehabilitation, National Taiwan University Hospital Bei-Hu Branch, Taipei, Taiwan <sup>3</sup>Department of Surgery, National Taiwan University Hospital

The purpose of this study was to investigate whether adding kinesio taping applied to the trunk could improve the treatment effect of decongestive lymphatic therapy. Forty patients with unilateral breast-cancer-related lymphoedema for at least 3 months were recruited and allocated to intervention group (received decongestive lymphatic therapy combined with kinesio taping) or control group (received decongestive lymphatic therapy only). Each subject went through a 4-week control period and a

## FREE PAPERS – *continued*

4-week intervention period. The evaluation was executed before and after the control period and after the intervention period. The evaluation items included physical therapy assessment, the severity of swelling, water composition of the upper extremity, lymphoedema related symptoms, and quality of life. Skin care, 30-minute manual lymphatic drainage, 1-hour pneumatic compression therapy, short-stretch bandage applied to upper extremity, and 20-minute exercise were given for both groups during every treatment session. The intervention group received kinesiio taping applied to trunk additionally. Participants were treated in 2-hour sessions, 5 sessions a week in the 4-week intervention

period. Independent two samples, t-test or Mann-Whitney U test, and chi square test were used to analyse the differences of all confounders, outcome variables at baseline and total improvement between the groups. All basic characteristics at baseline were comparable between groups. There was no significant difference between the groups in most outcome variables ( $p > 0.05$ ). However, the improvement of tightness and tingle symptom of the intervention group was less than the control group ( $p = 0.039$  for both). Findings suggested that applying kinesiio taping to the trunk might not improve the treatment effect of decongestive lymphatic therapy.

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# ABSTRACTS

Gerontology Physiotherapy Group  
4th Biennial Conference

## Maximising Participation for Older People



APA Conference Week  
4–8 October 2007  
Cairns, Australia



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### **A break-even analysis of a community rehabilitation falls prevention service**

Comans TA,<sup>1,2</sup> Haines T,<sup>1,3</sup> Doran C<sup>1</sup> and Brauer S<sup>1</sup>

<sup>1</sup>The University of Queensland <sup>2</sup>Community Rehabilitation Service, Southside HSD, QHealth <sup>3</sup>The Princess Alexandra Hospital

Falls cost the Australian community in the vicinity of one to two million dollars per year. Falls prevention is an important and growing field of study for physiotherapists. Break-even analysis is a tool useful for analysing business decisions. For this study we have used break even analysis to estimate the number of clients required to be seen by a community rehabilitation service in order to prevent enough falls to make the service cost neutral from a societal perspective. Costs were based on the actual cost of running a community rehabilitation team located in Brisbane. This team consists of a team leader, physiotherapist, occupational therapist and therapy assistant. The team delivers two falls prevention programs: either a centre-based group exercise and education program or a similar program delivered individually in the client's home. Benefits were obtained by estimating the savings gained to society from the number of falls prevented by the program on the basis of the falls reduction rates obtained in similar multidisciplinary programs. It is estimated that a community team consisting of a team leader, occupational therapist, physiotherapist and therapy assistant would need to see between 80–150 clients per year to make the service break even, The service the study was based on has the capability to see around 150–180 clients per year. The process of identifying costs and benefits for break even analysis will be described. This tool is applicable to many other services offered by physiotherapists.

### **A better practice idea to maximise resident participation and functional performance in a low care residential facility**

Francis-Coad J

*The University of Notre Dame Australia,  
Fremantle Meath Care Inc., Perth*

Providing interventions for elderly individuals that engage participation in a timely and economic way is a challenge facing physiotherapists working in low care residential facilities. On assessment, many present with common impairments that impact on their functional performance; these could be individually targeted using a circuit group format. This paper reports on a 10-station circuit exercise program designed by the physiotherapist to improve functional performance as measured by the timed up and go test. The intervention was performed twice weekly over a three month period. Eighteen residents provided pre and post intervention measures and the results showed a trend of improvement with minimal attrition. Residents also provided qualitative feedback through self report, quotes included 'this makes me feel young again' and 'I look forward to the circuit club, its good fun'. Following an Aged Care Standards and Accreditation Agency facility audit the program received a better practice commendation and is easily replicable in similar settings.

### **Australian physiotherapy students' career aspirations: do they match health services demands?**

Hobbs C, Higgs J, Dean CM and Adamson B

*Discipline of Physiotherapy, Faculty of Health Sciences,  
The University of Sydney*

This longitudinal study investigated a cohort of Australian undergraduate physiotherapy students' career aspirations over a 3-year timeframe to ascertain if working with older people was viewed by them as a viable career option. In 1997 the Australian Federal government responded to the changing health care needs, generated by population ageing, with a number of health care reforms including community-based care. As a result, roles for health care professionals such as physiotherapists greatly expanded and the number of staffing positions did not keep pace with the increased demand for aged care services. One hundred and ninety-eight students volunteered and an 80% participation rate was maintained throughout the study. A repeated question-response questionnaire was used to obtain and track participants' views about their career aspirations with regard to their workplace sector preference, specific area of work and age of clientele at three designated points of time. Focus groups were used for points of validation, clarification and illumination following the final administration of the questionnaire. Further in-depth knowledge was sought about the responses obtained in the surveys. Findings revealed that although students believed they had sufficient skills to work with older people, this option was not a career aspiration at the commencement of their career. These findings suggest that beginning physiotherapy practitioners are willing to consider working with older people at a later date in their career. A niche of beginning practitioners who would be interested in working with older people does exist provided they are given positive input during their training. In addition, following graduation physiotherapists could choose, if encouraged, to work with older people. Based on this study it is envisaged that the supply of physiotherapists to work with older people will continue to be insufficient for the predicted expansion in health services without active intervention. As a consequence, educationalists and physiotherapy managers need to address the gap that exists within professional entry education in relation to promoting this field of work and provide opportunities and encouragement for working with older people.

### **Can exercise control the decline in balance occurring across the menopause? A follow-up study**

Fu SS,<sup>1,2</sup> Low Choy NL<sup>2</sup> and Nitz JC<sup>2</sup>

<sup>1</sup>DAART Mater Hospital, Brisbane <sup>2</sup>The University of Queensland, Brisbane

A specific balance strategy training program has been shown to effectively improve balance and physiological parameters across the menopause transition for healthy women aged between 40 and 60 years. This follow-up study determined the long term benefits of this exercise program compared to other commonly self prescribed programs. Three groups of women were recruited. Sedentary women were randomly allocated to intervention and non-intervention. A group

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of women who exercise at a moderate to high level were also recruited. Intervention was a 12-week twice-weekly program. Non-intervention subjects continued their usual lifestyle. Assessments were at baseline, 3 months and 9 months (follow-up). Sixty-five of the eighty-four healthy women completed testing. The intervention group showed significant improvement in clinical balance measures ( $p < 0.018$ ), joint repositioning sense ( $p < 0.004$ ), ankle flexibility ( $p < 0.000$ ) and muscle strength ( $p < 0.011$ ) of quadriceps, hip abductors and external rotators compared to the other groups immediately after intervention. At follow-up, the intervention group effects were maintained for all measures except quadriceps muscles strength (right  $p < 0.000$ ; left  $p < 0.018$ ) and left lateral reach ( $p = 0.002$ ). The intervention group had also adopted a more active lifestyle ( $p = 0.000$ ) and lost more weight ( $p = 0.017$ ). Physiological measures such as tactile acuity of ankle and big toe ( $p < 0.042$ ) and vibration threshold of left knee ( $p < 0.017$ ) had continued to improve when compared to baseline assessments. These results provide evidence that this alternative exercise approach designed by a physiotherapist may help to control the detrimental balance decline associated with age, and the adoption of a more active lifestyle.

### Can moderate physical activity lead to clinically measurable signs of fatigue in frail elderly and healthy older people?

Egerton T<sup>1</sup>, Brauer S<sup>1</sup>  
and Cresswell AG<sup>2</sup>

<sup>1</sup>School of Health and Rehab Sciences, University of Qld <sup>2</sup>  
School of Human Movement Studies, University of Qld

Whilst much is known about fatigue following high intensity and long duration exercise, the level of fatigue resulting from the type of physical activity experienced during usual daily activities is not known. The aim was to determine whether moderate intensity, short duration physical activity leads to clinical signs and/or symptoms of fatigue. Our hypothesis was that fatigue would not be demonstrated by young healthy adults but may be evident in older people. Ten healthy older, OH, (65–79 yrs), ten frailer elderly, OF, (75–90 yrs) and ten healthy young, YH, (21–41 yrs) were tested before and immediately after 14mins of moderate intensity (level 13 on Borg Scale of Perceived Exertion) mobility exercises including step-ups, carrying bags, mini-squats and obstacle avoidance. Whilst time and perceived intensity were standardised, the amount of work performed was different between individuals as indicated by heart rate measurements. Fatigue was measured subjectively using a Visual Analogue Scale (VAS) of general tiredness and a twelve-category scale of leg fatigue (CR-10); and objectively by maximum voluntary isometric torque measurement of knee extension and hip abduction strength, and temporal-spatial gait variables. Data was analysed with repeated measures ANOVA. There was no significant difference in pre-activity heart rate, however post-activity, YH subjects' heart rates had increased significantly more than the other two groups (mean post-activity HR for YH, OH and OF

was 139, 103 and 97 beats/min respectively). The activity led to the whole group reporting significantly increased levels of general tiredness (mean VAS increase 30.1) and leg fatigue (mean CR-10 increase 2.1). The OF subjects reported significantly more post-activity leg fatigue than the other groups (mean increase 2.8). Thus, despite the same subjective level of intensity while exercising, the frailer older subjects did less work but felt more tired afterwards. Whilst the groups had different pre-activity leg strength, the whole group had slight but significantly reduced knee extensor strength post-activity (mean decrease 5.2% of pre-activity torque). There was a significant group  $\times$  time effect for cadence, where OF subjects had slower cadence post activity (mean decrease 6.7 steps/min) whilst YH and OH groups had non-significant increases. In addition there was a trend for a group  $\times$  time effect for double support time as OF subjects increased (mean increase of 0.04 sec) whilst YH and OH groups had non-significant decreases. The frail elderly group showed most changes following activity with greater feelings of leg fatigue, slower cadence, and increased double support time post-activity compared to the other groups. Whether these factors contribute to functional decline or falling requires further investigation.

### Do workstations work for frail, elderly hospital inpatients: preliminary findings?

Bew P,<sup>1,2</sup> Low Choy N<sup>2</sup> and Nitz J<sup>2</sup>

<sup>1</sup>The Prince Charles Hospital, Brisbane <sup>2</sup>The University  
of Queensland, Brisbane

The aim of this study was to examine the effectiveness of workstations circuit training on balance and functional mobility in frail elderly hospital inpatients. A randomised controlled trial was carried out in a subacute extended care unit of a large metropolitan hospital. Preliminary findings are presented. Thirty-six patients were randomised into an experimental ( $n = 22$ ) or a control ( $n = 14$ ) group. Patients in the experimental group participated in a daily one-hour circuit class whilst an inpatient of the unit. The class consisted of individualised training activities emphasising functional task retraining. Control subjects continued usual care one-on-one sessions with the physiotherapist for approximately one hour a day. Outcomes were the Clinical Outcomes Variable Scale as a measure of functional mobility, functional reach, step test and timed up and go test as measures of functional balance and the six minute walk test as a measure of walking capacity. A Quality of Life measure was also administered. No major adverse events were reported. Measures were taken on admission to the unit, on discharge and at one-month post discharge. Preliminary results show at baseline the groups were homogenous ( $p = 0.05$ ). No significant differences were seen between groups for response to intervention for any measures ( $p = 0.05$ ). A large drop-out rate was noted at the one month follow-up. These early results suggest functional task circuit training is safe and effective in improving functional balance and mobility in frail elderly inpatients when compared to one-on-one treatment.

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### **Enhancing function among older people living in residential aged care**

Josephson DL<sup>1</sup> and Nitz JC<sup>2</sup>

<sup>1</sup>Brookfield Village, Brisbane <sup>2</sup>Division of Physiotherapy, The University of Queensland

Decline in community ambulation, functional decline in ADL and frequent falls often facilitates the move into residential care. Our study evaluates an exercise program that was designed by a physiotherapist and aimed to improve function and reduce falls in a cohort of low and high care residents living in a residential care facility. Fifty-one residents enrolled into the classes. Of these, 34 (7 men and 27 women) residents completed pre and post intervention assessment. Ages ranged from 62–100 years ( $85.4 \pm 8.7$  years). Assessments measured static and dynamic balance and lower limb power. Falls were monitored for the 12-week period before starting the classes and for the subsequent 12 weeks after completion. The classes were one hour twice a week for 12 weeks. Post-intervention time to complete 5 sit-to-stands significantly reduced ( $p < 0.000$ ) and functional reach increased significantly ( $p = 0.046$ ). Timed Up and Go showed a trend for improvement ( $p = 0.08$ ). Five participants had fallen in the 3 months prior to the classes, 3 of these had not fallen in the six months since starting exercise. All six participants who fell after commencing exercise had an acute infection when they fell. The results show that increased physical activity can improve function in tasks such as moving from sitting to standing and reaching, often associated with falling among frail older people. The effect on reducing falls was not able to be demonstrated in this short time but the confounding influence of illness on falls for this cohort of elders was obvious.

### **Exercise which challenges balance can prevent falls in older people: meta-analysis of RCTs with meta-regression.**

Sherrington C,<sup>1,2</sup> Whitney JC,<sup>3</sup> Lord SR,<sup>2</sup> Close JCT,<sup>2</sup> Herbert RD<sup>1</sup> and Cumming RG<sup>1</sup>

<sup>1</sup>University of Sydney, Sydney <sup>2</sup>Prince of Wales Medical Research Institute, Sydney <sup>3</sup>King's College Hospital London, UK.

This review sought to determine the effect of exercise on falls rates in older people and establish whether different features of exercise programs and trial populations were associated with larger reductions in falls rates. A systematic review with random effects meta-regression was undertaken. Studies were identified by searching Medline, CINAHL, Cochrane Bone Joint and Muscle Trauma Group and PEDro databases. Included studies were randomised trials comparing falls rates among older people who received exercise programs with falls rates among those who did not receive exercise. The overall effect of exercise on falls (pooled incidence rate ratio) was 0.83 (95% CI 0.75–0.93,  $p = 0.001$ ,  $I^2 = 57\%$ ). There was a greater effect of programs which included high intensity balance training (19 trials, pooled RR = 0.71, 95% CI 0.63–0.80,  $p = 0.00$ ,  $I^2 = 31\%$ ). The pooled effect on falls rates for the 21 studies in which the exercise programs presented a relatively low challenge to balance abilities did not indicate a reduction in falls rates (pooled RR = 0.98, 95% CI 0.84–1.14,  $p = 0.79$ ,  $I^2 =$

55%). No other aspects of intervention programs or study populations were associated with a greater reduction in falls. Exercise can prevent falls in older people and greater effects are seen from programs which include high intensity balance training.

### **Falling is not just for older women**

Nitz JC and Low Choy NL

The University of Queensland, Brisbane

The aim was to identify factors that might predict a fall in community-living women in good health and aged 40–80 years. A prospective cohort study design over 5 years including assessments at baseline, 3-year and 5-year was used. Data regarding personal demographics of age, co-morbidities, number of prescribed medications, and numbers of falls in the previous 12 months, BMI, activity level and living situation were obtained at face-to-face interviews. Postural stability and balance were measured. Women were categorised into age decade cohorts and numbered 503 at baseline with 463 remaining at 5-year assessment. Eight percent of women in their 40s, 14% in their 50s, 25% in their 60s and 40% in their 70s had fallen at baseline assessment time. Over the 5-year study 21% of women in their 40s and 50s, 31% in their 60s and 40% in their 70s had fallen. Multiple fallers comprised women in their 60s and 70s. Age and number of co-morbidities were most predictive of a fall using parametric modelling and the classification tree approach. Women < 60 years of age had an increased risk of a fall by 8% and women > 60 years of age had an increased risk of a fall by 35% with every extra co-morbidity added. All demographics including stability, activity level and living situation except BMI were associated with falling. For healthy women aged over 40 the number of co-morbidities increases the risk of a fall and magnifies if aged over 60 with any additional morbidity. Thus health maintenance through preventive programs beginning by the 40s is vital to prevent falls.

### **Maximising outcomes for older people in the acute hospital setting: translating evidence into practice**

Yiu C, Bramley A, Clough L, English V, and Wilson B

Allied Health Department, Royal Melbourne Hospital, Melbourne

A randomised controlled trial of additional physical activity for older hospitalised general medical patients at the Royal Melbourne Hospital was conducted in 2003–2004. This trial demonstrated a trend in decreased health care utilisation and improved functional outcomes in the group who participated in additional physical activity. In January 2007, the Royal Melbourne Hospital Functional Maintenance Program was launched to translate this evidence into everyday practice on the acute general medical wards. Implementation of the program has also included the integration of best practice guidelines for nutrition, cognition, mobility, vigour and self care to prevent functional decline. In conjunction with usual allied health intervention, this program provides additional individual and group exercise, activities to enhance cognitive and occupational performance, and nutritional support to maximise outcomes for older people at risk of functional



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decline. A collaborative interdisciplinary approach to care was adopted through the innovative use of allied health assistants in dual skilled roles to deliver physiotherapy and occupational therapy interventions. A new role for an allied health assistant specialising in nutrition was also established to maximise outcomes. This presentation will outline the process taken to translate evidence into practice in a typical acute hospital setting, including how the program was developed, its implementation, the challenges that were faced and progress of the program to date.

### Physical activity patterns in the hospitalised elderly

Smith P,<sup>1,2,3</sup> Galea M,<sup>1,2,3</sup> Woodward M,<sup>1,3</sup> Dorevitch M<sup>1,3</sup> and Said C<sup>1,2,3</sup>

<sup>1</sup>Austin Health, Melbourne <sup>2</sup>Rehabilitation Sciences Research Centre, Melbourne <sup>3</sup>University of Melbourne, Melbourne

This study investigated physical activity patterns of 25 elderly patients admitted for rehabilitation to the Austin Health Age Care Service, using an automated activity monitor, the Positional Activity Logger Version 1 (PAL1). Results were compared with those of a group of subjects living independently in the community who were matched for age and gender. The PAL1 is a small device, worn on the thigh, which measures the frequency and duration of standing (uptime) and sitting and lying (downtime). Subjects wore a PAL1 for three consecutive days, including a weekend day. The results of this study demonstrate that elderly patients undergoing rehabilitation have significantly less uptime than their age- and gender-matched community peers with a median daily uptime of 1.31 hours (Interquartile range 1.17 hours, range 0.04–3.53 hours) compared to 5.52 hours (Interquartile range 1.82 hours, range 3.55–10.36 hours),  $p < 0.001$ . Physical activity for inpatients was significantly greater on weekdays when therapy is available, than weekend days when therapy is generally not available (median uptime 1.57 hours compared to 1.05 hours at the weekend),  $p < 0.001$ . Conversely, community subjects showed no significant difference in physical activity between weekdays and weekend, (median weekday uptime 5.88 hours compared to 4.79 hours at the weekend), (Wilcoxon Signed Ranks Test (2 tailed)  $Z = -2.01$ ;  $p = 0.045$ ). It is of concern that hospitalised elderly patients spend so much time inactive compared to their community age- and gender-matched peers. Would increasing patient activity levels result in better patient outcomes? Further studies are warranted.

### Preventing avoidable functional decline in older patients in the acute hospital setting

Mudge A and Giebel A

Royal Brisbane and Women's Hospital, Brisbane

This study aimed to evaluate the impact of a structured, multi-component, early rehabilitation program on functional status and discharge outcomes of older acute medical inpatients. A prospective controlled trial with blinded outcome evaluation was conducted in the internal medicine service of a metropolitan hospital. Participants

included 124 consecutive inpatients aged over 65 years admitted via the emergency department to a control ( $n = 62$ ) or intervention medical ward ( $n = 62$ ). Exclusions included patients from nursing homes; patients too ill to participate or terminally ill; and patients with length of stay less than 72 hours. Intervention subjects received early physiotherapy review with provision of a tailored exercise program and activity diary; progressive encouragement of functional independence by multidisciplinary team members; and attendance at cognitive stimulation sessions. Outcome measurements included: Modified Barthel Index, as a measure of functional status, at admission and discharge; incidence of falls and delirium; length of hospital stay; discharge destination; 30 day readmissions; and activity patterns. The intervention group had greater improvement in functional status than the control group, with a median improvement of 8.5 versus 3.5 points ( $p = 0.025$ ). There was a trend to reduced falls (4.8% versus 11.3%,  $p = 0.19$ ) and delirium (8.1% versus 14.5%,  $p = 0.26$ ). Activity patterns improved on the intervention ward but not the control ward over the intervention period. Length of stay, discharge destination and readmissions did not differ between the groups. The results suggest that this intervention was effective in improving function in a vulnerable patient group.

### Self-reported upper extremity disability and health status in adults with diabetes-associated hand disorders

Redmond CL<sup>1</sup>, McNeil JD<sup>1</sup>, Bain GI<sup>2</sup> and Laslett LL<sup>1</sup>

<sup>1</sup>The University of Adelaide, Adelaide <sup>2</sup>Modbury Public Hospital, Modbury

This study investigated the relationships between upper extremity disability and general health in adults with the hand disorders associated with diabetes mellitus. In addition, relationships between upper extremity disability and other factors, such as obesity, that could explain the development of disability were explored. Hand assessments were performed on 33 adults with Type 1 or Type 2 diabetes and carpal tunnel syndrome, trigger finger, Dupuytren's disease or the syndrome of limited joint mobility. The examination included measurement of self-reported health status and upper extremity function using the SF-36 v2 and the DASH questionnaires. The relationships between DASH scores, SF-36 scores and factors associated with the development of physical disability were analysed using correlation and regression. Differences between the study cohort and population norms were analysed using  $t$ -tests. A wide range of disability scores of the upper extremity, as measured by the DASH questionnaire, was present in the study cohort. Higher disability scores were associated with older age and obesity. The cohort also had poorer general health, as measured by the SF-36. The mean DASH score as well as the physical summary score, but not the mental summary score of the SF-36 were significantly different to the population norms ( $p < 0.001$ ). The DASH questionnaire correlated well to the physical summary score ( $-0.8$ ,  $p < 0.001$ ) and weakly to the mental summary score ( $-0.34$ ,  $p = 0.05$ ). Upper extremity disability levels were closely related to overall physical functioning in adults with the hand disorders associated with diabetes.



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### Relationships between physical activity and sun protection in an adult study population

Wilson CM,<sup>1</sup> Neale R,<sup>2,3</sup> Pandeya N<sup>3</sup> and Green A<sup>1,3</sup>

<sup>1</sup>The University of Queensland (UQ) Brisbane <sup>2</sup>The Queensland Cancer Fund, Brisbane <sup>3</sup>Queensland Institute of Medical Research (QIMR) Brisbane

The aim of this study was to assess the physical activity practices in adults, with the objectives of examining associations between skin cancer, sun protection (sunscreen and hat use in particular) and physical activity, and analysing other associations with physical activity, including demographic factors and body mass index. This study was nested within the Nambour skin cancer prevention trial in Queensland, a longitudinal study ongoing since 1986. A total of 963 people (99.2% response rate) completed a self-administered questionnaire. Multinomial logistic regression was used to verify the associations between individual variables and the outcome variable (physical activity) whilst controlling for predictor variables. Results were reported with adjusted odds ratios, confidence intervals and significance levels for associations with 'sufficient' physical activity. Only 29% of people were sufficiently active to acquire health benefits ( $p = 0.01$ ). Meeting this health guideline for sufficient physical activity was associated with a highly significant increase in the use of sunscren and hats ( $p = <0.001$ ). Twenty six per cent ( $p = 0.05$ ) were physically inactive or sedentary. The association of skin cancer with level of physical activity was examined after adjusting for age. People who met the guideline for sufficient activity were significantly almost twice as likely to have skin cancer compared to sedentary people (AOR = 1.92, 95% CI = 1.21–2.75). Physical activity is a cornerstone of chronic disease prevention strategy. The need to promote greater participation in physical activity in healthy settings is urgent and physiotherapists have a vital role in providing this expertise and in leading public health initiatives.

### Severe other joint disease and obesity are associated with poorer outcomes following joint replacement

Naylor JM,<sup>1,2,3</sup> Harmer AR<sup>2</sup> and Heard RC<sup>2</sup>

<sup>1</sup>Whitlam Joint Replacement Centre, Sydney <sup>2</sup>The University of Sydney, Sydney <sup>3</sup>UNSW Clinical School, Sydney

This study reports outcomes after joint replacement surgery according to the presence or absence of severe other joint disease and obesity. A prospective, observational study of 99 patients ( $n = 55$  total knee replacement,  $n = 44$  total hip replacement) before and up to 52 weeks post-surgery was undertaken. Outcomes included timed 15m walk, timed 'up-and-go', operated joint pain, and walking aid utilisation. Assessments were conducted pre-surgery and at 2, 6, 12, 26 and 52 weeks post-surgery. In a subset, generic and disease-specific health-related quality of life surveys were obtained. Patients were stratified according to the presence or absence of severe other joint disease at baseline and at 52 weeks, and by the presence or absence of obesity (body mass index  $> 30$ ). Patients with ( $n = 43$ ) severe other disease demonstrated significant improvements and recovery patterns in walk times and joint pain. However, walk times were slower (by + 27% to + 33%), and walking aid use was more likely at one year (OR 6.2, CI 2.5–15.0) than patients

without severe other disease ( $n = 56$ ). Patients with severe other disease reported less improvement and worse scores overall in most survey subscales. Obese patients ( $n = 50$ ) improved, but overall demonstrated slower walk times (+ 15%), and reported higher pain scores (+ 26%) and poorer survey scores in several domains than non-obese patients. The apparent influence of severe other joint disease was generally larger than that of obesity. Expectations from surgery, rehabilitation strategies, and benchmarking activities should be guided by these results.

### The de Morton Mobility Index (DEMMI): a critical health index for an ageing world

de Morton NA,<sup>1,2</sup> Davidson M<sup>3</sup> and Keating JL<sup>1</sup>

<sup>1</sup>Department of Physiotherapy, Monash University, Victoria <sup>2</sup>The Northern Clinical Research Center, Northern Health, Victoria <sup>3</sup>School of Physiotherapy, La Trobe University, Victoria

Existing instruments for measuring mobility are inadequate for assessing older people across the broad spectrum of abilities. Like other important indices of health, such as a blood pressure test, an accurate mobility test that can be applied to all older people across health care settings provides essential data about a fundamental characteristic of health that has relevance to all aging people. Mobility items were generated from existing scales, patient interview and focus groups with experts. A total of 51 items were pilot tested. Older acute medical patients ( $> 65$  years) were tested every 48 hours during hospital admission. Rasch analysis was performed to construct a uni-dimensional measure of mobility that has minimal equipment requirements and is quick to administer. The DEMMI was tested on an independent sample of older acute medical patients and its clinimetric properties investigated. More than 500 mobility assessments were performed to develop and validate the DEMMI. The DEMMI is a uni-dimensional measure of mobility that consists of 15 items that range from sit unsupported (easiest item) to tandem standing eyes closed (hardest item). The measurement properties of the DEMMI were consistent across independent samples (Rasch, reliability, validity and responsiveness to change). The DEMMI is without practical limitations in an older acute medical population and will therefore have application across clinical settings and in the community. The DEMMI provides clinicians and researchers with an advanced method for measuring and monitoring changes in mobility. Given the ageing population, there has never been a greater need to for this instrument.

### Using the Delphi technique to develop a modified Berg Balance Scale for use with community-dwelling older adults: the MoBerg

Cains G, Mackintosh S and Langley F

University of South Australia, Adelaide

The aims of this study were to address problems observed with administration of the Berg Balance Scale for community-dwelling older adults by developing a modified Berg Balance Scale (MoBerg) with shorter administration time, improved scoring criteria and reduced ceiling effects. A panel of 15

female Australian physiotherapists participated in three rounds of the Delphi technique. This resulted in removing some Berg Balance Scale items, modifying some items, reducing similar components, simplifying and standardising instruction and scoring criteria, and introducing more dynamic tasks. Field testing of the MoBerg was then carried out with 30 independently ambulant community-dwelling older adults. Mean administration time of the MoBerg (7 min 17 sec) was significantly less than the time required to perform the Berg Balance Scale (9 min 40 sec,  $p < 0.05$ ). A concurrent test-retest indicated excellent inter-rater reliability for total MoBerg scores ( $r_s = 0.953$ ). Individual scale items had moderate to excellent inter rater reliability (weighted kappa range 0.647–1.00). Concurrent validity with the BBS indicated an excellent correlation between the two balance tests ( $r_s = 0.910$ ). From this limited testing, the MoBerg demonstrated a wider range of scores than the Berg Balance Scale suggesting less ceiling effect. From these preliminary studies the MoBerg shows promise as a practical, functional balance assessment tool and outcome measure for ambulant community-dwelling older people.

## POSTER PRESENTATIONS

### **Cognitive status at admission does not impact on physical gains made during sub acute admission**

**Manins MJ<sup>1</sup> and Holland A<sup>12</sup>**

<sup>1</sup>Caulfield General Medical Centre, Bayside Health, Melbourne <sup>2</sup> La Trobe University, Melbourne

The aim of this study was to determine whether cognitive status at admission impacts on physical gains during a sub-acute admission. Patients admitted to sub-acute aged care wards were enrolled prospectively over one year. Physical status was assessed at admission and discharge using the Elderly Mobility Scale, Timed Up and Go and 6-metre walk test. Of the 803 patients admitted, 66.5% (534 patients) had a mini mental state examination performed on admission and were included in the analysis. Sixty-seven patients (12%) scored in the severe dementia range, 191 (36%) had moderate dementia, 133 (25%) had mild dementia and 143 (27%) scored in the normal range. At admission, those with severe dementia had lower Elderly Mobility Scale scores ( $p < 0.001$ ) and were less likely to be able to perform the Timed Up and Go ( $p < 0.001$ ). All groups showed significant improvements on the Elderly Mobility Scale ( $p < 0.001$ ) and 6-metre walk ( $p < 0.001$ ) over the course of admission, with a trend towards improvement in Timed Up and Go ( $p = 0.07$ ). All groups showed a similar degree of improvement in physical status over the course of admission. At discharge, patients with less severe dementia still had better Elderly Mobility Scale scores than those with more severe dementia ( $p < 0.001$ ) however there were no differences in other physical measures. We conclude that the severity of dementia does not significantly impact on the degree of physical improvement during sub-acute aged care inpatient stay.

### **Neurological and functional outcome following decompressive surgery in patients with lumbar spinal stenosis**

**Lin CC, Lin SI and Lin RM**

*Department of Physical Therapy, National Cheng Kung University, Tainan, Taiwan*

Patients with lumbar spinal stenosis (LSS) are often afflicted with nerve root compression which can lead to neurological deficits and functional disability. Decompressive surgery has been demonstrated to have positive short- and long-term effects and is deemed as an effective approach to this problem. However, it is not clear if functional recovery is associated with neurological recovery. The purpose of this study was to investigate the association between the neurological and functional outcome after decompressive surgery in patients with LSS. Ten patients with degenerative LSS were evaluated 1 month and 1 day (PRE-1D) before, and 2 weeks (POST-2W), 6 weeks (POST-6W) and 3 months (POST-3M) after decompressive surgery on subjective, neurological and functional outcome. Subjective outcome was evaluated by pain visual analog scale. Neurological outcome included deep tendon reflex, vibration sense, and conduction velocity of the common peroneal, sural and tibial nerves. Functional outcome included disability scale, lower extremity isometric muscle strength, postural sway and functional reach test. It was found that outcome variables did not change significantly within one month prior to the surgery. After the surgery, pain intensity decreased at POST-6W and POST-3M, compared with PRE-1D. Comparing PRE-1D and POST-3M, functional outcome, including disability, postural sway, and functional reach, improved significantly. However, neurological outcome didn't change significantly after surgery. These findings show that functional recovery and symptom relief brought about by decompressive surgery were not accompanied by neurological recovery. It seems that the benefits provided by the surgery could not be attributed to improved nerve root integrity.

### **Outcomes of patients with total knee replacements with or without hydrotherapy included in their rehabilitation**

**Ng ML, James J, Pearce K and Bird M**

*Donvale Rehabilitation Hospital, Melbourne*

The aim of the study was to determine if improved outcome occurred with inclusion of hydrotherapy in the inpatient rehabilitation program of patients following total knee replacement. Fifty patients admitted for an inpatient rehabilitation program following total knee replacement were studied. A group of twenty-five patients had physiotherapy twice daily, and another group of twenty-five patients had physiotherapy and hydrotherapy daily. Admission and discharge measures were collected. These measures were: age, body mass index, length of stay, interval between surgery and start of rehabilitation, subjective measures on pain and confidence with exercise and walking (using visual analogue scales), range of knee flexion and extension,

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quadriceps lag, gait aid used, 6-minute walk test, and timed stairs climbing. All goniometric measures were blinded. The two groups (hydrotherapy versus no hydrotherapy) were well matched. Discharge measures showed significant improvement in all objective measures in both groups. The group receiving hydrotherapy showed greater improvements in the areas of quadriceps strength ( $p = 0.040$ ), confidence with exercising ( $p = 0.033$ ) and were more likely to continue exercising on discharge ( $p = 0.046$ ). This relatively small study was able to demonstrate the benefit of hydrotherapy in rehabilitation following total knee replacement.

### **Strength and fatigability of knee extensors after free anterolateral thigh flap reconstructive surgery**

Kuo TY,<sup>1</sup> Cheng CC,<sup>1</sup> Chen WL,<sup>1</sup> and Shieh SJ<sup>2</sup>

<sup>1</sup>School and Graduate Institute of Physical Therapy, National Cheng-Kung University, Tainan, Taiwan <sup>2</sup>Section of Plastic Surgery, Department of Surgery, National Cheng-Kung University Hospital, Tainan, Taiwan

Free anterolateral thigh flap has been recommended as an important perforator flap for soft-tissue defect reconstruction, and apparent weakness of the quadriceps has been reported in the donor legs after surgery. However, no study has investigated the endurance of residual quadriceps. The aim of this study was to examine the changes in the strength or the endurance of quadriceps after free anterolateral thigh flap reconstruction. Eleven patients undertaking reconstruction participated in quadriceps strength evaluation and electromyographic analysis for residual quadriceps during a squatting endurance test before and three months after surgery. Median frequencies of electromyographic signals were calculated as an indicator of muscle fatigue. Several paired-*t* tests were conducted for comparing the differences bilaterally and the changes after surgery. While no significant bilateral differences were found between legs at initial evaluation, significantly weaker quadriceps ( $p = 0.012$ ) and lower median frequencies of vastus medialis oblique ( $p = 0.007$ ) were found in the donor legs compared with the unaffected legs after surgery. The donor legs showed significantly weaker quadriceps ( $p = 0.004$ ) and decreased median frequency at vastus medialis oblique ( $p = 0.024$ ) after surgery. In addition, the unaffected legs were also found with significantly weaker quadriceps after surgery ( $p = 0.007$ ). The results of present study have supported quadriceps weakness reported after anterolateral thigh flap in previous studies. Furthermore, it is of clinical significance to be aware that the unaffected legs still demonstrated significantly weaker quadriceps at three months after surgery and that the residual quadriceps in the donor legs fatigue more easily.

### **Sexual function following stroke: the ups and downs**

Densem SJ

QEII Jubilee Hospital, Brisbane

Sexual health is an important and fundamental part of our overall well-being. Stroke is generally associated with older people, however age is not an indicator of sexual function, interest or potential and at least 40% of 60-year olds are sexually active. Furthermore, evidence suggests there is an increasing number of younger stroke victims with 50% under 75 years of age. It is suspected that few staff are aware of or knowledgeable about sexual function impairments and that the subject is not included in the patient's rehabilitation. This study sought to investigate current practice regarding sexual function following stroke. A survey was developed following an extensive literature search. The survey, comprising open and closed questions sought information regarding clinician's knowledge, information provided to patients and barriers to provision of this information. The survey was distributed to clinicians working on a hospital rehabilitation ward, Brisbane. The evidence suggests that sexual function is affected following stroke, and clinicians report that this is rarely discussed prior to discharge as part of their rehabilitation program. This poster will present details of how stroke affects sexual function and the limitations and difficulties encountered in providing such information to stroke patients and relatives. Recommendations are made to improve understanding of sexual function following stroke and guidelines suggested to ensure sexual function following stroke is included as part of rehabilitation.

### **Taking the plunge: the effect of land-based combined with aquatic physiotherapy on fall-related self-efficacy in community dwelling older adults**

Jayalath V, Smith J, Smith R and Wass E

Northern Health Service, Melbourne

In Australia, it has been reported that 30% of community-dwelling older adults report some degree of fear of falling. Fear of falling results in self-induced activity restrictions leading to physical deconditioning, thereby increasing falls risk. Water has been proposed as a safe environment in which the elderly are potentially more willing to move and challenge their balance. Despite this, few studies have investigated the effect of aquatic physiotherapy on fall-related self-efficacy. The aim of this presentation is to describe the outcomes of our clinical research into this question, using a randomised controlled pilot study. Community-dwelling older adults who had experienced a fall in the last 12 months were randomised to receive 10 weeks of physiotherapy: either two land-based sessions per week, or one land and one aquatic-based session per week. The Modified Falls Efficacy Scale, Human Activity Profile and Step Test were taken at baseline, six weeks and 10 weeks, by an assessor blinded to the subject's intervention allocation. In addition, the clinicians kept written reflections on their research experiences. This project offers insights into the management of falls-related self-efficacy in community-dwelling older people, as well as



## POSTER PRESENTATIONS – *continued*

reflections on the challenges of conducting research in the clinical setting, particularly with the frail elderly. Subjects' demographic profile and preliminary outcome results will be presented, together with discussion of the implications for physiotherapy practice.

### **The Austin Health Transition Care Model: improving the level of care and quality of life in our aged population**

**Moor ER, Daly S and Salter S**

*Austin Health, Melbourne*

The Commonwealth Department of Health and Ageing Transitional Care Program was established following the announcement of funding in the Federal Budget 2004–05. Since this time the number of flexible aged care places has expanded, the government committing to 2000 places by 2006–07. This goal oriented, time limited service targets older people to provide support and active management at the conclusion of their hospital stay with the aim to minimise premature admission to residential care and avoid inappropriate, extended hospital stays. The Austin Health Transition Care Program is co-located with other aged care services at the Heidelberg Repatriation Hospital of Austin Health. It uses a collaborative multidisciplinary case management model, with a team comprised of allied health, case managers, nursing, pharmacy and medical staff. The program has 25 community places and 17 residential places in a low/high care residential care facility. The program employs physiotherapy 1.6 EFT as a part of the multidisciplinary team to support the low intensity therapy program that aims to maintain client function, facilitate independence and improve quality of life. The program's success in reducing client level of care is reflected in improvements in client's DHS Modified Barthel Scores. Over a four-month period in 2006, 35% of client discharge scores showed improvement when compared with their scores on admission. Concurrently, during the period from July 1 to December 31 2006 fifteen residential care clients moved back into the community and three clients were admitted to inpatient rehabilitation to maximise gains being made in therapy.

### **The comparison of immediate effect for subacromial injection and myofascial release on scapulohumeral rhythm in patients with subacromial impingement syndrome**

**Chen PT, Chen WL,<sup>1</sup> Kuo TY,<sup>1</sup> Jou IM<sup>2</sup>  
and Chern TC<sup>3</sup>**

<sup>1</sup>Department of Physical Therapy, Medical College,  
National Cheng Kung University, Tainan, Taiwan <sup>2</sup>Department  
of Orthopaedics, National Cheng Kung University Medical  
Center, Tainan, Taiwan <sup>3</sup>Chern Tai Chang Orthopaedic Clinic,  
Pingtung, Taiwan

Patients with subacromial impingement syndrome have been reported to demonstrate increased upper trapezius and reduced serratus anterior muscle activities. While upper trapezius release manoeuvres were recommended to decrease local muscle spasm, and subacromial injection is commonly used in clinical orthopedics for the reduction of pain and inflammation, no studies have investigated the effect of myofascial release or subacromial injection on scapulohumeral rhythm in patients with subacromial impingement. The study aimed to examine the immediate effect of subacromial injection or myofascial release on muscle activation patterns and scapula kinematics in impinged shoulders. Twenty-four subjects with subacromial impingement were included to take subacromial injection ( $n = 13$ ) or upper trapezius release ( $n = 11$ ). Shoulder kinematic and electromyographic measurements were performed during scaption movements before and after treatments. Several paired-samples  $t$  tests were conducted to examine the treatment effects. Significantly increased serratus anterior muscle activities were found during scaption after myofascial release treatment ( $p = 0.013$ – $0.093$ ) especially in the range from  $30^\circ$ – $60^\circ$  ( $p = 0.013$ ) but not after injection ( $p = 0.112$ – $0.680$ ). On the other hand, none of the treatment groups showed significantly reduced upper trapezius activities after treatment, however the injection group exhibited significantly increased maximal scapular upward rotation during scaption after injection ( $p = 0.046$ ). Although direct evidence of decreased muscles activities were not provided, significantly increased muscle activities in serratus anterior during shoulder scaption have been demonstrated immediately after myofascial release. In addition, our study showed that myofascial release manoeuvres provided more acute effect on increasing serratus anterior firing during scaption in comparison of subacromial injection.



# ABSTRACTS

Musculoskeletal Physiotherapy Australia  
15th Biennial Conference

## Science in Motion



APA Conference Week  
4–8 October 2007  
Cairns, Australia



AUSTRALIAN PHYSIOTHERAPY ASSOCIATION

## INTRODUCTION

Musculoskeletal Physiotherapy Australia (MPA) is proud to present the abstracts of presentations from the 15<sup>th</sup> MPA Biennial Conference. As it has been 29 years since the first Biennial Conference it may be useful to reflect upon some of the changes that have occurred over time.

The proceedings of the inaugural conference were published in 1978 and since then the proceedings have changed substantially in their nature and content. Originally the proceedings contained full papers and were considered as educational texts in their own right that practitioners and researchers would refer to. This action was no doubt influenced by prevailing publication practices where very few, if any, of the presentations were eventually published in peer-reviewed journals.

The biggest change in the format of the proceedings occurred in 2000 with the joint IFOMT/MPA conference in Perth. Under Professor Kevin Singer's editorship the proceedings were published for the first time as a CD. Additionally, acknowledging the trend for many presenters to want to publish their work in a peer-reviewed journal, Kevin allowed authors the option of providing only an abstract, so that later publication of the full paper would be possible in a journal. Another major change occurs in 2007 with the MPA joining with the other special interest groups to publish the conference abstracts as an eSupplement to the AJP.

The content of the MPA proceedings has also changed substantially over the years. Initially proceedings were predominantly the reports of clinicians sharing their clinical experiences, their treatment models for how manipulative treatments should be selected and applied, or offering theories

for how manipulative treatments worked. In more recent times the proceedings have been predominantly reports of original research. What has not changed over time is the vision of the presenters at MPA conferences and we would like to share an example from the very first conference.

At the inaugural conference in 1978, Geoffrey D Maitland argued that there was an urgent need for the creation of a specialty in manipulative physiotherapy. Maitland's vision was that these physiotherapists would act as consultants to other physiotherapists and medical practitioners. He also suggested that the scope of practice of a specialist manipulative physiotherapist should not be limited to manipulative techniques but instead should include the range of physiotherapy treatments needed to best manage musculoskeletal conditions.

Maitland's vision was certainly quite bold because up until 1976, Australian physiotherapists could only treat patients on referral. This MPA conference, where we celebrate a large number of musculoskeletal physiotherapists being recognised as clinical specialists by The Australian College of Physiotherapists, is probably the first where we can truly say that we have caught up with Geoff's vision for the profession.

Among the presenters at the MPA 15<sup>th</sup> Biennial Conference, there are individuals who certainly displayed the revolutionary vision embodied by Maitland. Hopefully their presentations will lay the foundations for even greater advances in musculoskeletal physiotherapy in the next 30 years.

**Chris Bartram, Chris Maher, Peter Osmotherly, Suzanne Snodgrass, Henry Tsao**  
MPA Conference Scientific Committee

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### **A biopsychosocial perspective of teenagers with non-specific chronic low back pain**

**Astfalck RG, O'Sullivan PB, Smith A, Straker LM and Burnett A**

*Curtin University of Technology, Perth*

The aim of the study was to characterise adolescent non-specific chronic low back pain within a biopsychosocial framework. Fourteen male and 14 female adolescents (14–16 years old) with non-specific chronic low back pain and 28 matched controls were drawn from a large cohort study. Each subject underwent various physical and psychological assessments. Each pain subject was clinically sub-classified based on their pain and movement behaviour into active extension, flexion control and multi-directional movement disorder groups. Adolescents with pain reported considerable levels of: pain duration ( $26.6 \pm 12.0$  months), pain severity (VAS  $4.4 \pm 1.9$ ), disability (Oswestry  $17.9 \pm 10.1\%$ ) and kinesiophobia (Tampa  $36.1 \pm 7.1$ ). Significant deficits were noted in timed trunk ( $p = 0.03$ ) and squat ( $p = 0.03$ ) endurance tests in the pain subjects. No significant differences were found between pain subjects and controls on physical activity levels ( $p = 0.24$ ), depression ( $p = 0.96$ ) and sitting posture ( $p = 0.28$ ). When pain subjects were sub-classified, there were significantly different proportions of males and females in the sub-groups ( $p = 0.009$ ) so gender was included as a covariate for subgroup analysis. Significant differences in spinal posture were noted between the control and sub-classified pain groups (Lumbar Angle  $p = 0.004$ ), (Trunk Angle  $p = 0.03$ ). The pattern of results in this adolescent data mirrors previous adult research. Non-specific chronic low back pain disorders that present in early adolescence therefore appear to be similar to those of adulthood. This research provides a description of the clinical presentation of adolescent non-specific chronic low back pain, and demonstrates the importance of sub-classification of these patients.

### **A randomised trial comparing outcomes between land-and water-based sub-acute physiotherapeutic rehabilitation following primary total knee replacement**

**Russell T,<sup>1,2</sup> Naylor JM,<sup>1,2,3</sup> Harmer AR<sup>1</sup> and Crosbie J<sup>1</sup>**

<sup>1</sup>The University of Sydney, Sydney<sup>2</sup>Fairfield Hospital, Sydney<sup>3</sup>UNSW Clinical School, Sydney

This study examined the effectiveness of land-versus water-based rehabilitation following primary total knee replacement. A single-blind randomised trial was carried out in a physiotherapy outpatient gym and a community pool. One hundred and two consecutive patients were randomised to receive either a land- ( $n = 59$ ) or water-based ( $n = 53$ ) physiotherapeutic rehabilitation program. Patients received one hour of group exercise twice a week for 6 weeks. Both the land and water-based programs were standardised to facilitate the matching of strength, flexibility, endurance, cardiovascular and mobility components. Two-way (group, time) analysis of variance was used to detect differences. Main outcomes included visual analogue scale for pain, range of motion, six-minute walk test, and the Western

Ontario and McMaster Universities Osteoarthritis Index. These measures were assessed pre-training, post-training and at six months post-surgery. Significant improvements ( $p < 0.001$ ) were observed across time for the visual analogue scale for pain ( $> 80\%$ ), the six minute walk test (100%), all self-reported pain, stiffness and function scores ( $> 75\%$ ) and knee flexion range ( $> 25\%$ ), but there were no significant between-group interactions. As neither program appears to be associated with superior outcomes, patient preference, service access and relative costs may be the most relevant issues in selecting delivery mode.

### **A qualitative study to explore if patient held beliefs influence recovery following whiplash injury**

**Williamson E**

*University of Warwick, UK*

The aim of this qualitative study was to explore the influence of patient held beliefs about pain and injury on recovery following whiplash injury. Semi-structured interviews were carried out with 20 patients taking part in a randomised controlled trial investigating the management of acute whiplash injuries. Patients were invited to take part in the interviews when they attended for an initial assessment as part of the trial approximately 4–6 weeks post injury. Purposive sampling was used to select patients with range of symptom severity (based on the Neck Disability Index). Patients were then interviewed approximately 3–4 months post injury. Interpretive Phenomenological Analysis was used to explore the beliefs held by patients who were recovering well and those who were experiencing ongoing problems. Patients who were recovering well emphasised the importance of taking responsibility for their own recovery, the need to do regular exercises and to return to their normal activities. Patients who had ongoing problems were more likely to express concerns about doing damage with exercises or when returning to activities. The beliefs of both groups appeared to be influenced by previous experiences. This study highlights the need to assess patient held beliefs about injury and recovery. Addressing unhelpful beliefs such as fear-avoidance beliefs as part of physiotherapy management may improve patient outcomes.

### **Addition of NSAIDs and/or manipulation to advice and paracetamol does not speed recovery from acute low back pain**

**Hancock M,<sup>1</sup> Maher CG,<sup>1</sup> Latimer J,<sup>1</sup> McLachlan AJ,<sup>1</sup> Cooper CW,<sup>1</sup> Day RO,<sup>2</sup> Spindler MF<sup>1</sup> and McAuley JH<sup>1</sup>.**

<sup>1</sup>The University of Sydney, Sydney<sup>2</sup>The University of New South Wales, Sydney

The efficacy of non steroidal anti-inflammatory drugs (NSAIDs) and/or spinal manipulation has not been investigated in patients with acute low back pain who have been prescribed the first line care recommended by international guidelines (advice and 4gms per day of paracetamol). Patients with acute low back pain who had received advice and paracetamol from a general practitioner were then randomly allocated to one of 4 groups (diclofenac

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group and placebo manipulation, manipulation and placebo diclofenac group, diclofenac and manipulation group or the double placebo group). The primary outcome was days to recovery from pain assessed using survival curves (log-rank test). Secondary outcomes were pain, disability and global perceived effect measured at 1, 2, 4 and 12 weeks. Of the 240 participants enrolled at least 98% provided data for the primary and secondary outcomes. The primary analysis revealed no effect of diclofenac (Hazard ratio = 1.09, 95% CI, 0.84–1.42,  $p = 0.504$ ) or manipulation (Hazard ratio = 1.01, 95% CI, 0.77–1.31,  $p = 0.954$ ). There was no effect of diclofenac or manipulation on pain, disability or global perceived effect at almost all time points. For example week one pain scores were 0.2 (95% CI -0.7 to 0.3) points less for patients receiving diclofenac compared to placebo and 0.2 (-0.3 to 0.7) points more for patients receiving manipulation compared to placebo. In patients receiving advice and paracetamol the addition of diclofenac 50mg twice daily or up to 12 sessions of manipulation over 4 weeks does not result in more rapid recovery.

### Asymmetry of vastus lateralis onset and activation during squatting

Gupta S,<sup>1,2</sup> Nicholson L,<sup>1</sup> Shirley D<sup>1</sup> and Adams R<sup>1</sup>

<sup>1</sup>The University of Sydney, Sydney<sup>2</sup>Royal Prince Alfred Hospital, Sydney

Onset and activation of the vastus medialis obliquus (VMO) and vastus lateralis (VL) muscles were measured during a 90° squat with knees in neutral, varus and valgus alignments using surface electromyography (EMG). Twenty volunteers without a history of lumbar or lower limb pain had surface EMG electrodes applied over VMO and VL of both limbs and an electrogoniometer attached to one knee. Data were collected as subjects squatted to 90° of knee flexion, repeated in each of the three alignments. EMG signals were rectified, normalised to maximum voluntary isometric contraction and divided into six 15° epochs for both descent and ascent. Analysis revealed significantly earlier onset of VL compared to VMO ( $p = 0.001$ ) and earlier onset on the right (dominant) limb compared to the left ( $p = 0.02$ ). Furthermore, the activation of VL as a percentage of maximum was greater than that of VMO ( $p = 0.002$ ), greater on the right limb compared to the left ( $p = 0.01$ ) and greater during ascent than descent ( $p < 0.001$ ). The results suggest that, despite the visually apparent side-to-side symmetry of lower limb action during squatting, earlier onset and greater activation of VL occurs in the dominant limb of asymptomatic participants. These findings contradict the belief that normal patellofemoral functioning is synonymous with earlier onset and greater activation of VMO than VL. If further research confirms a 'controller' role for the dominant lower limb, exercise programs may need to focus more on its activation during squatting.

### Changes in motor patterning in subjects with pelvic girdle pain during an active straight leg raise

Beales DJ, O'Sullivan PB and Briffa NK

Curtin University of Technology, Perth

Motor learning intervention has efficacy in treating pelvic girdle pain disorders, although not all subjects respond. A better understanding of motor patterns is necessary to help classify these patients and to inform appropriate management strategies. Fourteen pain free and 12 pelvic girdle pain subjects performed an active straight leg raise. Motor patterns were examined within these groups independently by comparing electromyography of the trunk muscles, intra-abdominal pressure and intra-thoracic pressure, between inspiration and expiration, whilst lifting each leg. Repeated measure analysis of variance was utilised for the myographic data and paired t-tests for the pressure variables. In normal subjects internal oblique (right  $p < 0.001$ , left  $p = 0.004$ ) and external oblique (right  $p = 0.069$  (trend), left  $p = 0.026$ ) demonstrated predominant ipsilateral tonic activation. For pain subjects lifting the non-affected leg internal oblique displayed this same pattern ( $p = 0.026$ ), however lifting the affected side bilateral tonic activation was observed. For external oblique in pain subjects bilateral tonic activation was observed lifting either leg. In normal subjects the chest wall displayed tonic activation on the leg lift side but phasic activation contra-laterally (right  $p = 0.05$ ). This phasic activity became tonic in the pain subjects. Although pain subjects were able to maintain normal respiratory fluctuation of intra-abdominal and intra-thoracic pressures lifting the affected side, the baseline of this fluctuation increased ( $p = 0.039$ ). These findings demonstrate increased stabilising function of the motor system in pain subjects which requires consideration in formulating motor control interventions for these subjects.

### Current practice in neck manipulation: perspectives from a randomised controlled trial

Leaver AM,<sup>1</sup> Refshauge KM,<sup>1</sup> Maher CG,<sup>1</sup> Latimer J,<sup>1</sup> Herbert RD,<sup>1</sup> Jull G<sup>2</sup> and McAuley JH<sup>1</sup>

<sup>1</sup>Back Pain Research Group, University of Sydney, Sydney<sup>2</sup> University of Queensland, Brisbane

A multi-centre, randomised controlled trial comparing the effectiveness of cervical manipulation with mobilisation for recent onset neck pain has provided insights about current practice of cervical manipulation in metropolitan Sydney. Recruitment of physiotherapists has been challenging with many Sydney based practitioners choosing not to manipulate the cervical spine. Eighty-seven of the 138 manipulative physiotherapists listed in the 2005-06 MPA directory were invited to participate in the study. Of this sample 57 (65.5%) indicated that they did not use neck manipulation in their clinical practice. The trial uses a model of late randomisation where participants are randomised only after the treating practitioner decides that manipulation is a suitable treatment for that particular patient. To date 72 participants have



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enrolled in the trial. The baseline characteristics of these participants provide a profile of patients deemed suitable for treatment with manipulation by the participating physiotherapists, chiropractors and osteopaths. Patients selected for treatment with manipulation to date range in age from 18–65 years, with more females 43 (60.6%) recruited than males. These participants had moderate pain of 5.91 (2.04) mean (SD) on an 11 point scale, and relatively low level disability with a mean Neck Disability Index score of 29.76 (12.19). Pain and disability profiles were not different between the patients of physiotherapists and chiropractors. Manipulation was deemed suitable at the initial treatment session by the participating practitioners in 64 (87.7%) cases, with the remaining practitioners electing to introduce manipulation at the second or third treatment.

### Diagnosis of serious spinal pathology in patients presenting to primary care with acute low back pain

Henschke N,<sup>1</sup> Maher CG,<sup>1</sup> Refshauge KM,<sup>1</sup> **Herbert RD,**<sup>2</sup> Cumming RG,<sup>2</sup> Bleasel J,<sup>3</sup> York J,<sup>3</sup> Das A<sup>1</sup>, and McAuley JH<sup>1</sup>

<sup>1</sup>Back Pain Research Group, The University of Sydney, Sydney<sup>2</sup>The University of Sydney, Sydney<sup>3</sup>Royal Prince Alfred Hospital, Sydney

The identification of serious spinal pathologies is a main purpose of the low back pain clinical assessment. Red flag questions are widely endorsed to achieve this purpose even though there are few data to support their use. To determine the diagnostic accuracy of red flag questions we performed a delayed-type cross-sectional study. Participants were consecutive patients attending primary care for acute low back pain. Clinicians recorded responses to 25 red flag questions and then provided an initial diagnosis. The reference standard was a 12 month follow-up supplemented with review by a rheumatologist of a random sub-sample of participants. 1,172 patients entered the study and follow-up over 12 months was > 97%. There were 11 cases (0.9%) of serious spinal pathology, of which eight were fractures. Despite the low prevalence of serious pathology, most patients (80.4%) had at least one red flag (median 2, IQR 1–3). Red flags were of little help in ruling out serious pathology; no red flags had negative likelihood ratios < 0.48. Only three of the red flags had informative positive likelihood ratios: prolonged use of corticosteroids (LR+ = 63), acute urinary retention (LR+ = 26) and age > 70 years (LR+ = 10). Clinicians identified 5 of the 11 cases of serious pathology at the initial consultation, and made only 6 false-positive diagnoses (LR+ = 88). Serious pathology is a rare cause of low back pain in primary care, and only 3 red flag questions were found to raise the suspicion of serious pathology: a history of prolonged use of corticosteroids, acute urinary retention and age > 70.

### Differential activation of the deep and superficial paraspinal muscles in response to trunk unloading

**McCook D,** Vicenzino B, and Hodges P

CCRE in Spinal Pain, Injury and Health, University Of Queensland

Recent data suggest that alterations in timing of the trunk muscle response to unloading may predict back pain. However, due to cross talk between muscle layers with surface electromyographic (EMG) recordings it was not possible to determine the muscles responsible for the change in latency. This study investigated the response of deep and superficial lumbopelvic muscles to unloading. Ten healthy participants isometrically extended and flexed the trunk against a transducer placed in front or behind to four sub-maximal targets between 50 and 200 N. After 3–10s the load was released unpredictably. EMG recordings were made from the lumbar and thoracic erector spinae with surface electrodes, and the deep (DM) and superficial (SM) multifidus with intramuscular electrodes. EMG amplitude (normalised to the peak across tasks) was calculated during 10 ms epochs between 20 ms before to 200 ms after load release. All paraspinal muscles (except LES and TES at 50N) responded with short latency after release of the flexion load. Although paraspinal muscle EMG was reduced with short latency after the release of extension loads greater than 100 N, only multifidus EMG was reduced after the 50 N load release. This was largely explained by the generation of the 50 N force primarily by the multifidi prior to load release. Subsequent reactivation of the paraspinal muscles was 10–30 ms earlier for multifidus. This study provides further evidence that the multifidi discreetly contribute to lumbopelvic stability, particularly at low forces. This may help determine the critical factors in the prediction of back pain.

### Differential atrophy of trunk muscles during prolonged bed rest

**Hides JA,**<sup>1,2</sup> Belavý DL,<sup>1,3,4</sup> Stanton WR,<sup>1,2</sup> Wilson SJ,<sup>3</sup> Rittweger J,<sup>5</sup> Felsenberg D<sup>4</sup> and Richardson CA<sup>1</sup>

<sup>1</sup> Division of Physiotherapy, School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane<sup>2</sup> Mater Health Services Brisbane Limited, South Brisbane<sup>3</sup> School of Information Technology and Electrical Engineering, The University of Queensland, Brisbane<sup>4</sup> Zentrum für Muskel- und Knochenforschung, Charité Campus Benjamin Franklin, Hindenburgdamm 30, 12200 Berlin, Germany<sup>5</sup> Institute for Biophysical and Clinical Research into Human Movement, Manchester Metropolitan University, Hassall Rd, Alsager, Cheshire, ST7 2HL, England

The aim of this study was to investigate the influence of bed rest on the lumbo-pelvic musculature. Ten healthy male subjects underwent 8 weeks of supervised bed rest. Magnetic resonance imaging (MRI) of the lumbo-pelvic region was conducted at regular time-points during bed rest. Using uniplanar images at L4, cross-sectional areas (CSAs) of the multifidus, lumbar erector spinae, quadratus lumborum, psoas, antero-lateral abdominal and rectus abdominis

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muscles were measured. Results showed that the CSA of the multifidus muscle decreased by day 14 of bed rest ( $F = 7.4, p = 0.04$ ). The CSAs of the lumbar erector spinae and quadratus lumborum muscles showed no statistically significant difference to baseline across the time of bed rest ( $p > 0.05$ ). The CSAs of the antero-lateral abdominal, rectus abdominis and psoas muscles all increased over this time. The CSA of the psoas muscle increased by Day 14 ( $F = 6.9, p = 0.047$ ) and remained so until day 56, whereas the CSAs of the antero-lateral abdominal ( $F = 29.4, p = 0.003$ ) and rectus abdominis muscles ( $F = 8.9, p = 0.03$ ) were not statistically larger than baseline until day 56. Bed rest resulted in selective atrophy of the multifidus muscle. An increased CSA of the trunk flexor musculature (increases in psoas, antero-lateral abdominal and rectus abdominis muscles) may reflect muscle shortening or possible overactivity during bed rest. Some of the changes seen in trunk muscles in response to prolonged bed rest resemble those seen in subjects with low back pain. These results may in part explain the negative effects of bed rest seen in low back pain sufferers.

### Differences in cervical mobilisation force application between students and physiotherapists: implications for teaching manual therapy skills

**Snodgrass SJ, Rivett DA, Robertson VJ and Stojanovski E**

*The University of Newcastle, Newcastle*

Cervical mobilisation is commonly used to treat neck problems, with instruction in these techniques usually standard in physiotherapy curricula. Quantifying differences in manual force application between students and practising therapists should lead to more effective strategies for learning to apply cervical mobilisation. This study compared cervical mobilisation forces applied by 120 undergraduate students to those by 116 practising physiotherapists. Manual forces applied in three directions were measured using an instrumented treatment table fitted with load cells. Each participant applied grades I-IV central and unilateral posteroanterior mobilisation to C2 and C7 of one asymptomatic subject, with one technique repeated after 20 minutes. Spinal stiffness of C2 and C7 in mobilised subjects was measured using a mechanical device, and defined as the mean slope of the linear portion of the force-displacement curve. Mean peak force, force amplitude and oscillation frequency were calculated from 10 seconds of mobilisation for each grade, direction, and technique. Students used lower mobilisation forces than therapists, particularly for grades III and IV (resultant mean difference 15.7 N, 95% CI 12.6 to 18.9,  $p < 0.001$ ), and slower oscillation frequencies (mean difference all grades 0.12 Hz, 95% CI 0.09 to 0.14,  $p < 0.001$ ). Both inter- and intra-therapist repeatability was slightly less for students. For students and therapists, lower forces were associated with increasing C2 stiffness and higher forces with male gender. These results suggest that students apply cervical mobilisation in a different manner from therapists, particularly higher mobilisation grades. This research contributes a basis for developing improved feedback strategies for students learning cervical mobilisation.

### Do baseline characteristics of patients with tennis elbow influence treatment effects?

**Bisset L,<sup>1,2</sup> Smidt N,<sup>3</sup> Van der Windt D,<sup>4</sup> Bouter L,<sup>4</sup> Jull G,<sup>2</sup> Brooks P<sup>2</sup> and Vicenzino B<sup>2</sup>.**

<sup>1</sup> School of Physiotherapy and Exercise Science, Griffith University, Gold Coast<sup>2</sup> School of Health and Rehabilitation Sciences, University of Queensland, Brisbane<sup>3</sup> Department of Clinical Epidemiology and Biostatistics, Academic Medical Centre, University of Amsterdam, Amsterdam, The Netherlands. <sup>4</sup> EMGO Institute, VU University Medical Center, Amsterdam, The Netherlands

The aim of this study was to determine if subgroups of patients with tennis elbow respond differently to treatment. We used individual patient data ( $n = 383$ ) from two randomised controlled trials that investigated a wait-and-see policy, corticosteroid injections and physiotherapy. Outcome measures common to and homogeneous in both trials were pain severity and global improvement. Subgroup analyses for previous history of elbow pain, baseline pain severity, duration of the current episode and employment status were performed at six and 52 weeks. Based on individual patient data from both trials, we found that corticosteroid injections were statistically and clinically superior at six weeks ( $p < 0.001$ ), but significantly worse at 52 weeks compared to both wait and see and physiotherapy ( $p < 0.001$ ). Subgroup effects were small and limited to the following: (a) patients with higher baseline pain showed no significant difference on pain outcomes between physiotherapy and wait-and-see at six weeks; and (b) it also appeared that non-manual workers who had an injection were the only work subgroup to demonstrate differential effects between injections and wait-and-see on global improvement at 52 weeks. The treatment outcomes were largely similar between trials and not different between most subgroups studied. In tennis elbow, it would appear that treatment outcomes are only minimally dependent on baseline patient characteristics, which supports the generalisability of individual trial results.

### Do patient or clinician treatment preferences moderate the effect of treatment? Results from a trial of exercise for chronic whiplash

**Stewart M, Maher CG, Refshauge KM, Herbert RD and Nicholas MK**

*The University of Sydney, Sydney*

An issue that arises when selecting therapy is whether patient or clinician preferences for treatment moderate the effect of treatment. To evaluate this question we conducted a secondary analysis of a randomised controlled trial of exercise treatment of chronic whiplash. Immediately prior to randomisation, treatment preference ratings (possible score range -10 to +10) were collected from each patient and from the physiotherapist who assessed each patient. Patients were then randomised to receive advice alone or exercise and advice, with the primary treatment outcomes of pain and function measured immediately after conclusion of treatment. Treatment effect modification was evaluated with a treatment group by preference interaction term in the regression analyses. The analysis revealed that neither patient nor therapist treatment preferences moderated the

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effect of exercise treatment for chronic whiplash. The interaction effect of treatment group by patient preference was 0.09 (−0.32 to 0.50,  $p = 0.68$ ) on the 0–10 pain intensity scale and −0.09 (−0.46 to 0.29,  $p = 0.64$ ) on the 0–10 function scale. The interaction effect of treatment group by therapist preference was 0.04 (−0.28 to 0.36,  $p = 0.786$ ) on the 0–10 pain intensity scale and −0.15 (−0.44 to 0.14,  $p = 0.29$ ) on the 0–10 function scale. Our findings indicate that patient or therapist treatment preferences do not substantially moderate the effect of exercise treatment for chronic whiplash. Identifying patients who respond best to a particular intervention seems a complex and elusive goal.

### Evaluation of the clinical outcomes of two different surgical approaches to total knee replacement: preliminary data from a prospective double blind randomised controlled trial

**Bourke MG,<sup>1</sup> Buttrum PJ,<sup>1</sup> Vicenzino W<sup>2</sup> and Russell TG<sup>2</sup>**

<sup>1</sup>QEH Jubilee Hospital, Queensland Health, Brisbane<sup>2</sup>  
The University of Queensland, Brisbane

The subvastus approach to total knee replacement (TKR) is predicted to produce better patient outcomes with less cost than the medial parapatella approach. A double-blind randomised controlled trial is underway at a tertiary hospital in Brisbane, Australia. To date, 48 participants (males = 22, females = 26, mean age = 69 years, age range = 58–87 years) undergoing TKR have been randomised to receive either a subvastus approach ( $n = 23$ ) or a medial parapatella approach ( $n = 25$ ). Outcomes of the procedures are sampled pre-operatively, intra-operatively by each of the seven participating surgeons, post-operatively on days 1, 2 and 3, day of readiness for discharge, 6 weeks, and 6, 12 and 18 months. Outcome measures include: the American Knee Society Score, Oxford Knee Score, length of stay, knee girth and functional mobility. Data is currently available for the pre-operative ( $n = 37$ ), intra-operative ( $n = 28$ ), day 1 ( $n = 27$ ), day 2 ( $n = 26$ ), day 3 ( $n = 24$ ), discharge ( $n = 26$ ), 6 week ( $n = 22$ ) and 6 month ( $n = 11$ ) assessment points. Analysis of variance statistics on the preliminary data suggests no significant difference ( $p > 0.05$ ) between the two approaches on any of the outcomes measurements; however some interesting trends are emerging and will be discussed. As well as informing surgeons on the benefits of these surgical approaches, this study has many implications for the optimisation of inpatient and outpatient rehabilitation following TKR.

### Evaluation of the core outcome measure in whiplash

**Rebbeck TJ, Refshauge KM, Maher CG and Stewart M**

Discipline of Physiotherapy, Faculty of Health Sciences,  
University of Sydney, Sydney

The aim of this study was to comprehensively evaluate the psychometric properties of a 5-item version of the Core Outcome Measure (COM) in people with whiplash. The 7-item COM was initially proposed as a brief health outcome measure for use in low back pain. To date this measure has not been comprehensively assessed in a whiplash population.

Data were sourced from three separate whiplash cohorts (total  $n = 481$ ) encompassing acute, early-chronic and late-chronic whiplash among primary care and insurance populations. Subjects completed a 5-item version of the COM for whiplash (Core Whiplash Outcome Measure; CWOM), the Functional Rating Index, the Neck Disability Index, the SF36 and perceived recovery questionnaires at baseline and short and long-term follow-up periods. Psychometric evaluation of the CWOM included assessing questionnaire responses, internal consistency, construct validity and internal and external responsiveness. Internal consistency was excellent at all stages of whiplash (Cronbach's  $\alpha = 0.76$  in the acute stage and 0.83 in the late-chronic stage). Convergent validity was observed between the CWOM and the Functional Rating Index (Pearson's  $r = 0.81$ ), the Neck Disability Index (Pearson's  $r = 0.76$ ) and the SF36 Physical Health Summary Measure (Pearson's  $r = -0.65$ ). Divergent validity was observed between the CWOM and the SF36 Mental Health Summary Measure (Pearson's  $r = -0.45$ ). The internal and external responsiveness of the CWOM was similar to other neck-specific outcome measures. We recommend the 5-item CWOM as a brief clinical measure for whiplash because it is quick to administer and score, and has excellent measurement properties.

### Exaggerated flexor reflexes observed with knee osteoarthritis are diminished following joint mobilisation

**Courtney C,<sup>1</sup> Lewek M,<sup>2</sup> Witte P<sup>1</sup> and Hornby TG<sup>1,3</sup>**

<sup>1</sup>University of Illinois at Chicago, USA <sup>2</sup>Physical Therapy, University of North Carolina at Chapel Hill, USA <sup>3</sup>Sensory Motor Performance Program, Rehabilitation Institute of Chicago, USA

Patients with chronic pain often present with hyperalgesia, possibly due to hyperexcitability of pain pathways. The aim of the present study was to investigate alterations in spinal flexor reflex excitability in individuals with knee osteoarthritis and to examine the potential effect of joint mobilisation on this reflex. Ten subjects with and ten without knee osteoarthritis (age 53–74) were recruited. Subjects were seated with their tested limb attached to a footplate instrumented with a 6 degree of freedom load cell, with surface electromyographic recordings obtained from the tibialis anterior, rectus femoris and hamstrings. Noxious electrocutaneous stimulation was applied at the medial arch of the foot (monophasic, 1 ms pulses, 50 Hz for 200 ms) at 1 ×, 2 × and 3 × threshold of tibialis anterior electromyographic response. Joint torques at hip, knee and ankle were calculated, with peak reflex torques normalised to body mass. Responses at 2 × threshold were also recorded after each following condition: a forceful co-contraction leg press task, a sham hands-on treatment, and Grade III accessory joint mobilisation. Decreased threshold to flexor withdrawal response was found in the osteoarthritis group (mean =  $11.2 \pm 4.4$ ) as compared to the control group (mean =  $15.5 \pm 2.2$ ;  $p = 0.04$ ), with increased knee torques. Responses were augmented in the osteoarthritis group following the forceful co-contraction task yet remained unchanged or diminished in controls ( $p = 0.04$ ). Joint mobilisation reduced reflex responses to 50% baseline levels. Joint compression in an osteoarthritic



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knee may enhance nociceptive reflex responses, while joint mobilisation may diminish these responses.

### Factors involved in the development of osteoarthritis following anterior cruciate ligament reconstruction

Keays S,<sup>1,2</sup> Bullock-Saxton J,<sup>1,2</sup> Newcombe P,<sup>1</sup>  
Bullock M<sup>1</sup> and Keays A<sup>2</sup>

<sup>1</sup>University of Queensland, Brisbane, Australia <sup>2</sup>  
Private Practice, Queensland

This study aimed to determine the factors involved in the development of osteoarthritis of the knee following anterior cruciate ligament reconstruction. Fifty-six patients (29 with patellar tendon and 27 with semitendinosus/gracilis grafts) were followed from pre-surgery to six years post-surgery. Assessment included strength (Cybex 11 dynamometer), stability (KT 1000) and radiology. Six-year assessment also addressed injury–surgery and musculoskeletal factors that may have contributed to the development of osteoarthritis: Injury–surgery factors included time delay from injury to surgery; age at the time of surgery; family history; meniscectomy; chondral/bony injury; and graft type. Musculoskeletal factors included quadriceps and hamstring strength and anteroposterior stability. Discriminant analyses were performed separately on the injury–surgery and musculoskeletal factors in order to assess which were relevant in the development of osteoarthritis. Forty-eight percent of patients developed tibio-femoral osteoarthritis and 36% developed patello-femoral osteoarthritis. Analysis found a group of three injury–surgery variables that would reliably discriminate patients with and without tibio-femoral osteoarthritis [Chi-square (6,  $n = 56$ ) = 22.6;  $p < .0001$ ]. These were the presence of bony/chondral damage, meniscectomy, and reconstruction using the patellar tendon. Older age at the time of surgery as well as meniscectomy and chondral/bony damage were discriminators for patello-femoral osteoarthritis [Chi square (6,  $n = 56$ ) = 14.4,  $p = 0.013$ ]. An important finding was that a lower quadriceps to hamstring strength ratio in addition to lower quadriceps strength were identified as musculoskeletal discriminators for tibio-femoral osteoarthritis [Chi square (5,  $n = 44$ ) = 14.87;  $p = 0.005$ ]. This knowledge of factors implicated in the development of osteoarthritis following injury and surgery enables improved preventive and therapeutic strategies.

### Fatty infiltrate in the cervical extensor musculature in chronic whiplash: an MRI study

Elliot J,<sup>1,2,3</sup> Jull G,<sup>1</sup> Noteboom JT<sup>2</sup> and Galloway G<sup>3</sup>

<sup>1</sup>Division of Physiotherapy, The University of Queensland, Brisbane

<sup>2</sup>Department of Physical Therapy, Regis University, Denver, USA

<sup>3</sup>Centre for Magnetic Resonance, The University of Queensland, Brisbane

The purpose of this study was to determine if chronic WAD (whiplash associated disorder) subjects demonstrate significantly larger amounts of fat in the cervical extensor musculature compared to controls. It was hypothesised that chronic WAD subjects would demonstrate higher fatty infiltrate in the cervical musculature than controls. Subjects consisted of 79 females with chronic WAD (age: 29.75 ±

7.8 years) and 34 healthy female controls (age: 27.0 ± 5.6 years) within the age range of 18–45 years. MRI of the cervical spine was performed on all subjects. A measure of relative fat within muscle was created by developing a pixel intensity profile with MRIcro. Repeated Measures ANOVAs were performed to determine if MRI measures were different by group, muscle and spine level. Chronic WAD subjects had significantly higher MRI fatty infiltrate in the cervical musculature compared to healthy controls ( $p < 0.001$ ). Significant differences were seen in the two groups based on muscle and level ( $p < 0.001$ ). Results indicate that chronic WAD subjects demonstrate significantly larger amounts of fat within the cervical musculature when compared to healthy controls. The findings of fatty infiltrate were widespread but were present to a larger extent in the deeper muscles in the upper cervical spine and this may be related to persistent pain and disability. Identifying MRI changes in the cervical musculature provides a quantifiable measure of muscular alterations in those suffering from chronic WAD. The causes of fatty infiltrate and whether these changes can be reversed with therapeutic exercise are yet to be determined.

### Feedforward transversus abdominis is directional specific and acts unilaterally during arm raising: a different interpretation of the role of deep abdominals

Allison GT<sup>1</sup> and Morris SL<sup>2</sup>

<sup>1</sup>School of Surgery and Pathology, University of Western Australia

<sup>2</sup>Human Movement and Exercise Science, University of Western Australia

There is widespread belief that transversus abdominis (TrAb) acts bilaterally in the feedforward window independent of direction of arm movement. This is the basis for various rehabilitation programs and research investigations. The foundations of these assumptions rely on generalisations mostly from unilateral data. Bilateral data has been reported previously with mixed findings suggesting variance in the EMG profile of the deep abdominals. This study examined the 7 normal controls utilising finewire EMG profiles recorded at 2 kHz of the deep abdominals during a series of left and right unilateral arm raises. The results show that TrAb and internal oblique are clearly directional specific (laterality effect) for rotation, with onset of activation and EMG amplitude responses showing clear laterality effects ( $p < 0.01$ ), the contralateral side being activated earlier ( $p < 0.01$ ). This laterality response is reversed when the opposite arm is used. These results support the inference that contralateral TrAb is a feedforward muscle that is sensitive to the direction of perturbation and functions unilaterally in the feedforward window. The loss of laterality response has been reported previously in spinal pain and these findings suggest that the motor control changes observed could be a central manifestation of movement control rather than any indication of changes in spinal stability. This study is consistent with previous research but the finding of laterality responses clearly implies that bilateral activation of TrAb in the feedforward window is not a normal strategy under these conditions. This has significant implications to the overall interpretation of TrAb function and rehabilitation.



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### Further evidence of a neuropathic component to whiplash pain: a comparison with cervical radiculopathy using quantitative sensory testing

Chien A,<sup>1</sup> Eliav E<sup>3</sup> and Sterling M<sup>1,2</sup>

<sup>1</sup>CCRE Spinal Injury, Pain and Health, The University of Queensland, Brisbane <sup>2</sup>CONROD, The University of Queensland <sup>3</sup>University of Medicine and Dentistry School of New Jersey, USA

Recent research has identified the co-existence of generalised sensory hypersensitivity and hypoaesthetic changes in chronic whiplash associated disorders. The current study aimed to compare whiplash patients to those with cervical radiculopathy, using quantitative sensory testing (QST). Fifty patients with chronic whiplash (> 3 months, Neck Disability Index (NDI):  $47 \pm 16$ ), 38 patients with radiculopathy (NDI:  $37 \pm 19$ ), and 31 controls age and gender matched to whiplash participants participated in the study. QST including electrical, thermal and vibration detection as well as pain thresholds (pressure, thermal) were measured from bilateral hand sites corresponding to innervation areas of the lower cervical nerve roots. Measures were also taken from a remote site in the lower limb. Significant main effects were found for all detection measures between the three groups ( $p < 0.05$ ). Both the whiplash and radiculopathy groups demonstrated elevated detection thresholds when compared to the controls. The radiculopathy group showed significantly higher detection thresholds when compared to whiplash patients ( $p < 0.05$ ). Significant main effects were found for all pain measures between the neck pain groups and the controls ( $p < 0.01$ ), with the exception of heat pain thresholds ( $p > 0.05$ ). The whiplash group showed greater sensitivity than the radiculopathy group, particularly at the remote site ( $p < 0.01$ ). The current study confirms the presence of hypoaesthetic changes in chronic whiplash. The similarities in responses to the sensory stimuli between the two neck pain groups may suggest a shared underlying neuropathic mechanism. The involvement of the central hyperexcitability appears to play a role, however, the dysfunction of peripheral nerve tissue can not be ruled out.

### Habitual sitting posture is related to lower lumbar spine posture across a range of functional tasks: clinical implications for low back pain

Mitchell T,<sup>1</sup> O'Sullivan PB,<sup>1</sup> Burnett AF,<sup>1</sup> Straker L<sup>1</sup> and Rudd C<sup>2</sup>

<sup>1</sup>School of Physiotherapy, Curtin University, Perth <sup>2</sup>School of Nursing, Midwifery & Postgraduate Medicine, Edith Cowan University, Perth

Evidence for a link between spinal posture and low back pain is growing. Spinal posture is commonly addressed in the clinical management of non-specific low back pain patients. The aim of this study was to investigate habitual lumbar spine postures across a range of functional tasks. One hundred and seventy female undergraduate nursing students, with or without low back pain, participated in this cross-sectional study. Lumbar spine kinematics were measured using an electromagnetic tracking system across a range of functional tasks. Subjects' lower lumbar spine posture in habitual sitting showed moderate to strong correlations with

their lower lumbar spine posture in standing ( $r = 0.578$ ,  $p < 0.001$ ), bending ( $r = 0.645$ ,  $p < 0.001$ ), lifting from floor ( $r = 0.695$ ,  $p < 0.001$ ), lifting from bench ( $r = 0.641$ ,  $p < 0.001$ ), and squatting ( $r = 0.635$ ,  $p < 0.001$ ). These findings show that habitual lower lumbar spine sitting posture is highly predictive of lower lumbar spine postures across a range of functional tasks. These relationships held for both no pain and pain groups. Those subjects who habitually posture their spine in a pain provocative manner, may be doing so across a range of tasks, representing a cumulative stress on the lumbar spine. These findings may also have implications for how posture is retrained in low back pain patients.

### Headache and cervical musculoskeletal impairment in elders

Uthakhup S, Jull G and Sterling M

Division of Physiotherapy, The University of Queensland, Brisbane

Recurrent headache is common in elders, reducing quality of life. Opinion, but not evidence, suggests that cervicogenic headache incidence increases in elders, concomitant with degenerative joint disease. This study investigated neck function in a population aged 60–75 years (118 subjects with recurrent headache and 44 non-headache controls), to determine if cervical musculoskeletal impairment was generic to this population or was more specific to cervicogenic headache. Measures included cervical range of motion (ROM), manual examination for symptomatic cervical joint dysfunction (SCJD), cranio-cervical flexion muscle test (CCFT), joint position sense, muscle strength, cross-sectional area of selected cervical extensors (ultrasound) and cervical posture. A questionnaire was developed to document the symptomatic characteristics of headaches for headache classification. A cluster analysis based on measures of ROM, SCJD and CCFT was used to classify subjects into two groups. Cluster 1 consisted of 64 headache and 8 control subjects and cluster 2 of 54 headache and 36 control subjects. The differences between the clusters were evident in ROM, SCJD, postural angle, extensor strength and cross sectional area of the semispinalis capitis ( $p < 0.05$ ). Musculoskeletal impairment was greatest in subjects in cluster 1. Nevertheless, headache classification from questionnaires revealed an incidence of cervicogenic, migraine, tension-type and mixed headaches in both clusters, noting that classification was challenging in these elders. Although 54% of headache subjects had musculoskeletal impairment, it was difficult to ascribe a diagnosis of cervicogenic headache and data may reflect the transitional nature of headache in elders, which challenges diagnosis and thus relevant management options.

### How are the abdominal muscles organised at the motor cortex?

Tsao H,<sup>1</sup> Hodges PW<sup>1</sup> and Galea MP<sup>2</sup>

<sup>1</sup>NHMRC Centre of Clinical Research Excellence in Spinal Pain, Injury and Health, The University of Queensland, Brisbane <sup>2</sup>School of Physiotherapy, The University of Melbourne, Melbourne

Coordinated activation of abdominal muscles during tasks

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that involve postural perturbation contributes to trunk stability. It is unclear how this control is organised within the central nervous system (CNS). The study investigated the excitability and cortical representation of transversus abdominis using transcranial magnetic stimulation (TMS). Recordings of electromyographic activity (EMG) of TrA were made bilaterally using intramuscular fine-wire electrodes in eleven healthy volunteers. Motor cortical excitability was tested through evaluation of motor thresholds (MT) to elicit a response in the muscle contralateral and ipsilateral to the stimulated hemisphere at rest and during 10% contractions. To determine the representation of TrA at the motor cortex, TMS was delivered over pre-marked scalp sites on a grid positioned anterolateral to the vertex. EMG amplitude of the responses to TMS at each site was superimposed over the grid to produce a map of response amplitude relative to scalp site. TMS maps demonstrated that the representation of TrA was approximately 2 cm anterior and lateral to the vertex, and was not different between sides. In addition, data showed that ipsilateral responses had a higher MT and longer latency compared to contralateral responses, and were easier to evoke over one hemisphere than the other. The results provide insight into organisation of TrA at the motor cortex, and form a model for future investigations into the plasticity of this organisation in individuals with musculoskeletal pain and following clinical intervention.

### Implementation of clinical guidelines for spinal pain: a systematic review

Rebbeck TJ, Maher CG and Refshauge KM

*Discipline of Physiotherapy, Faculty of Health Sciences, University of Sydney, Sydney*

Many clinical practice guidelines have been produced to improve the management of spinal pain. This systematic review investigates the effect of implementation strategies for these guidelines on professional practice, patient health and cost of treatment. Studies were eligible for inclusion if they were randomised controlled trials, evaluated an implementation strategy of a specified clinical guideline, and the participants had spinal pain. Trials were located by electronic searches of Medline, EMBASE, CINAHL and Cochrane databases, citation tracking and contact with experts. Effects of the intervention were expressed as relative risks (95% CI) for categorical data and mean differences (95% CI) for continuous data. Similar outcomes were pooled using a random effects model. Fourteen trials were included in the review. Implementation had small to moderate effects on professional practice. Individual relative risks varied from 0.34 (0.19–0.60) to 4.71 (1.29–17.2). The pooled relative risks ranged from 1.0 (0.97–1.04) for improving the prescription of adequate medications to 1.12 (1.04–1.21) for improving the prescription of activating information. There were no effects of implementation on patient health outcomes or treatment cost. In conclusion, implementation strategies for guidelines in spinal pain had small to moderate effects on improving specific aspects of professional health practice, but no effect on patient health outcomes or treatment cost.

### Is ideal sitting posture real? Measures of spinal curve to determine whether clinically recommended lumbar postures are achievable

Claus AP,<sup>1</sup> Hides JA,<sup>1</sup> Moseley GL<sup>2</sup> and Hodges PW<sup>1</sup>

<sup>1</sup>The University of Queensland, Brisbane <sup>2</sup>University of Oxford, Oxford, UK

Opinions about ergonomically ideal sitting postures have little quantitative basis. There is conflicting opinion as to whether a lumbar lordosis is achievable in sitting. Recent clinical textbooks variably describe ideal lumbar posture as thoracic kyphosis with lumbar lordosis (short lordosis), thoraco-lumbar lordosis (long lordosis), or flat. This study examined whether subjects could achieve four different sitting postures: short lordosis, long lordosis, flat and slumped. In 10 healthy male subjects, we compared spinal curves when subjects attempted to adopt each posture under two different conditions. First, by imitating pictures and descriptions of the postures and, second, with manual facilitation and feedback from a physiotherapist. Three-D motion sensors were adhered over T1, T5, T10, L3 and S2 spinous processes. Sagittal spinal curves were represented by angles between T1–T5 and T5–T10 (thoracic), T5–T10 and T10–L3 (thoraco-lumbar), T10–L3 and L3–S2 (lumbar). Repeated measures analysis of variance was used to compare spinal angles between the four postures and two facilitation conditions. Subjects were able to imitate postures with the same curve direction at thoraco-lumbar and lumbar regions of the spine for long lordosis, flat and slumped. Subjects did not differentiate short lordosis from flat (lumbar angle  $p = 0.14$ ) unless manual facilitation and feedback were provided (lumbar angle  $p = 0.001$ ). This study shows that the short lordosis posture is not intuitively achieved in sitting. Further study is needed to determine whether this posture provides clinical advantages.

### Is range of motion symmetrical? Does range of motion decrease with age?

Macedo LG<sup>1,2</sup> and Magee DJ<sup>1</sup>

<sup>1</sup>University of Alberta, Edmonton, Canada <sup>2</sup>The University of Sydney, Sydney

The objectives of this study were to compare the range of motion (ROM) between 4 different female age groups: 18–29, 30–39, 40–49, and 50–59 years of age and to compare the range of motion between body sides (right and left). ROM is generally assumed to reduce with age; however, there are insufficient data to confirm this theory. There has also been the suggestion that there is a difference in range of motion between body sides but findings regarding this difference are controversial. Ninety 'healthy' Caucasian women between 18–59 years of age were assessed in this study. The ROM was measured for ankle, knee, hip, shoulder, elbow and wrist using a standard goniometer. The order of the joints, motion, sides and active or passive motion tested were randomly selected. A comparison between body sides and age groups was performed using a two-way ANOVA. There was no general difference in active and passive ROM between age groups. However, there was a decrease of range of motion with age for: hip flexion, hip

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external rotation, shoulder external rotation and elbow extension especially between the younger and the older age groups. The results regarding the differences between sides showed a statistically significant difference for 29 of the 60 motions measured. The results showed that there is a significant difference between sides for some specific movements, however, the implications of these changes are still unknown.

### Longitudinal excursion and strain in the median nerve during novel nerve gliding exercises for carpal tunnel syndrome

**Coppieters MW and Alshami AM**

*Division of Physiotherapy, The University of Queensland, Brisbane*

The aim of this study was to investigate whether different types of nerve gliding exercises are associated with differences in longitudinal excursion and strain in the median nerve at the wrist. Six mobilisation techniques involving the wrist and elbow were evaluated, including a technique that is believed to result in a large excursion with minimal strain ('sliding technique'). With a 'sliding technique', it is assumed that an increase in strain due to nerve bed elongation at one joint (e.g. wrist extension) is counterbalanced by a simultaneous decrease in length of the nerve bed at an adjacent joint (e.g. elbow flexion). Longitudinal excursion (digital calliper) and strain (differential variable reluctance transducer) were measured in the median nerve of six human cadavers. Results were analysed with a one-way repeated-measures analysis of variance. Nerve gliding associated with wrist movements changed considerably with simultaneous movement of the elbow: the 'sliding technique' resulted in an excursion of 12.4 ( $\pm$  2.6) mm which was at least ~30% larger than other techniques (2–8.9 mm;  $p < 0.001$ ). Strain also differed between techniques ( $p < 0.001$ ). The 'sliding technique' was one of three techniques with the lowest strain values. This study revealed that different types of nerve gliding exercises have largely different mechanical effects on a peripheral nerve. This may have important implications for the selection of safe and effective exercises for CTS. The findings demonstrate that, at least from a biomechanical perspective, nerve gliding exercises should not be regarded as a homogenous group of exercises.

### MRI signal intensity change in the cervical extensor musculature is not a feature of persistent idiopathic neck pain

**Elliott J,<sup>1,2,3</sup> Jull G,<sup>1</sup> Sterling M,<sup>1</sup> Noteboom JT,<sup>2</sup> Darnell R<sup>1</sup> and Galloway G<sup>3</sup>**

<sup>1</sup>Physiotherapy-Whiplash and Diagnostic Unit, The University of Queensland, Brisbane, Australia <sup>2</sup>Physical Therapy, Regis University, Denver, USA <sup>3</sup>Centre for Magnetic Resonance, The University of Queensland, Brisbane, Australia

The purpose of this study was to investigate and quantify MRI measures for fatty infiltrate in the cervical extensor musculature in patients with chronic idiopathic neck pain. We have previously demonstrated the presence of widespread

fatty infiltrate in the cervical extensors in patients with chronic WAD (whiplash associated disorder) but we do not know if similar findings exist in a non-traumatic neck pain population. It was hypothesised that those subjects with persistent idiopathic neck pain would not demonstrate higher fatty infiltrate in the cervical extensor musculature. Twenty-three female subjects with persistent idiopathic neck pain (age:  $9.2 \pm 6.9$  years, mean duration of symptoms  $33.7 \pm 20.6$  months) were included in the study. T1-weighted MRI of the cervical spine was performed on all subjects. A measure of relative fat within the muscle was created by developing a pixel intensity profile with MRICro software. MRI measurements were obtained for seven different muscles: rectus capitis posterior minor, major, multifidus, semispinalis cervicis, capitis, splenius capitis and upper trapezius. These were measured across segmental levels (C0–C7). When compared to previous data using the same MRI measure for those with persistent whiplash, these data most closely match the fatty infiltrate values for healthy control subjects. These results indicate that fatty infiltrate in the cervical extensor musculature is not a feature of subjects with persistent idiopathic neck pain. The reasons for these differences in the cervical extensors detected with MRI are not fully understood but could suggest that different processes may be present in insidious onset and whiplash induced chronic neck pain.

### Opening the consultation: how is this achieved between patient and physiotherapist?

**Lamont-Mills A,<sup>1</sup> Schloss J<sup>2</sup> and Epsley S<sup>3</sup>**

<sup>1</sup>Centre for Rural and Remote Area Health, University of Southern Queensland, Toowoomba <sup>2</sup>University of Southern Queensland, Toowoomba <sup>3</sup>Peak Performance Sports Medicine, Toowoomba

Patients often give their reason for seeking health assistance in the opening phase of a health consultation. This opening phase normally involves two parts: first, an opening solicitation spoken by the health professional followed by the patient's reason for the visit. However, how this is accomplished in real-life physiotherapy consultations is not well understood. That is, there has been limited research that has focused on the detailed discursive practices and strategies physiotherapists and patients use to organise problem presentation within real-life consultations. The aim of this presentation is to address this by identifying the discursive practices and strategies that physiotherapists and patients use in the opening phase of an initial consultation. Digital audio-recordings of 98 real-life physiotherapy consultations between 94 patients and 3 physiotherapists comprised the data corpus. This data were analysed using conventions of conversation analysis and discursive psychology. Analysis revealed that physiotherapists opened initial consultations with an offer of service that took the form of either an open-ended general enquiry or closed-ended request for problem confirmation. When consultations were initiated with open-ended general enquiries, patients responded with an immediate presentation of their concerns. When consultations were initiated with closed-ended questions, the presentation of patients' concerns was delayed. The service implication is that how physiotherapists solicit patients' concerns can affect the manner in which patients



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present their problems. This in turn has the potential to affect health care outcomes as well as patient perceptions of physiotherapy.

### **Patient report outcome measures: balancing the dilemma of professional requirements and clinical practicality**

Gabel CP<sup>1,2</sup>

<sup>1</sup>University of the Sunshine Coast, Sunshine Coast <sup>2</sup>  
Access Physiotherapy, Coolumb

This paper presents three new short-form Functional Index patient report outcomes (PROs) that provide a simplified approach to balance professional requirements with clinical practicality. The use of PROs is an increasing demand for physiotherapists in order to meet the requirements of government, insurer and professional groups. Physiotherapists find PRO tools an integral part of patient management, apart from the practical dilemma of choice and time demands on both therapists and patients. The balance to this dilemma can be achieved through the use of a minimal number of tools that possess the critical methodological and practical characteristics, and are consistent in format across the critical regions of the spine and the upper and lower limbs. Three short-form PROs have been developed from the existing 25 item Spine, Upper and Lower Limb Functional Index series and are consistent in format and structure. These 10-item tools have an essential quantitative section and optional sections on qualitative patient specific items, duties and an 11-point VAS of overall status. Each tool has demonstrated methodological reliability (ICC 2:1 > 0.94), responsiveness (ES > 1.22), change scores (MDC < 8%), internal consistency (alpha range 0.83–0.91) and all forms of validity including criterion ( $r > 0.85$  with all preferred published regional tools). The practical characteristics show brevity (one page), simplicity (three point single line items), efficiency (completion and scoring < 2 minutes) and application across conditions and disease severity ranges. These tools offer a realistic method of recording and managing outcome measures in physiotherapy.

### **Peak forces on the buttocks in a backward fall and the influence of compliant flooring**

Sran MM and Robinovitch SN

Injury Prevention & Mobility Lab, Simon Fraser University,  
Burnaby, Canada

Fall-related vertebral fractures are common and backward falls result in impact to the buttocks and pelvis. Compliant flooring is a promising technique for reducing impact force and risk for vertebral fracture during a fall. However, we have little knowledge of the peak forces applied to the body during a backward fall, or how floor stiffness affects this force. Our goal was to measure the peak vertical force applied to the buttocks in a backward fall from standing, and to determine whether this force is lowered by reductions in floor stiffness. Participants included 11 males, mean age  $25 \pm 5$  (SD) years and body mass mean  $81 \pm 16$  (SD) kg. A tether and electromagnet suddenly released the participant

from a backward lean of  $15^\circ$ , causing him to fall backward onto the ground, which was covered with ethylene-vinyl acetate (EVA) foam rubber. We conducted five trials for each of three foam thicknesses (4.5cm; 7.5cm; 10.5cm). Participants were instructed to avoid contacting the ground with their hands until their buttocks had contacted the ground. We measured peak vertical impact forces applied to the buttocks at 96 Hz with a force plate. An 8-camera, 240 Hz motion measurement system was used to track peak velocity of a skin surface marker on the sacrum. We also modelled peak vertical force for falls onto a rigid (bare) floor. We used repeated measures ANOVA and post-hoc t-tests to compare peak forces between the 3 conditions ( $p = 0.016$ ). There was a significant difference in peak normalised force (N/kg) between falls onto the 10.5cm foam condition compared with the 7.5cm ( $p = 0.002$ ) and 4.5cm ( $p < 0.001$ ) conditions. Peak normalised force (N/kg) was (mean  $\pm$  SD)  $63.6 \pm 6.2$ ,  $59.9 \pm 6.2$ , and  $56.9 \pm 5.9$  for the 4.5, 7.5 and 10.5cm foam conditions respectively and estimated at  $75.3 \pm 7.6$  for the rigid (bare floor) condition. Compared to the rigid floor, falling onto the 4.5, 7.5 and 10.5cm foam floors provided, on average, 15, 20 and 24% force attenuation. This novel data improves our understanding of this mechanism of vertebral injury and is essential if we are to design techniques for the prevention of spine injury (i.e. protective equipment, safe movement environments). Peak forces were  $5099 \text{ N} \pm 868$  (SD) for the thinnest foam condition, similar to the force required to fracture elderly lumbar vertebrae in vitro [ $3009 \text{ N} \pm 1505$  (SD)<sup>1</sup>,  $6910 \text{ N} \pm 2480$  (SD)<sup>2</sup>]. A thin (4.5cm) layer of foam overlying the floor can provide 15% force attenuation during a fall onto the buttocks.

### **Physiotherapists' use of craniovertebral instability testing: a survey of members of Musculoskeletal Physiotherapy Australia**

Osmotherly PG,<sup>1</sup> Rivett DA<sup>1</sup> and Mercer SR<sup>2</sup>

<sup>1</sup>The University of Newcastle, Newcastle <sup>2</sup>  
The University of Queensland, Brisbane

All members of Musculoskeletal Physiotherapy Australia in 2006 were surveyed to ascertain their knowledge and understanding of craniovertebral instability (CVI) and their attitudes and current practice regarding screening for CVI. The survey was developed following an extensive review of literature and validated, peer reviewed and piloted. The questionnaire was returned by 538 members (30%). Respondents provided differing definitions of CVI with 54.9% describing it as an anatomical/structural disorder and 29.4% as a biomechanical problem. Whilst the majority of respondents were aware of the existence of published clinical tests for CVI, only 30% stated that they used any in clinical practice. Of 42 published signs and symptoms associated with CVI, only seven were associated with CVI by more than 50% of respondents, most notably dizziness, headache and increased mobility on passive testing. Of the published conditions associated with CVI, only four were judged worthy of testing by more than 30% of respondents, with history of neck trauma and whiplash associated disorders being strongly associated. Support for inclusion of information on CVI in pre-manipulative guidelines was given by 87% of respondents. However, any recommendation for screening



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tests received less support, clinicians with postgraduate qualifications in musculoskeletal physiotherapy less likely to adopt any such recommendation ( $p = 0.0002$ ). Whilst there is disagreement regarding the nature and presentation of CVI, it appears that physiotherapists primarily associate the disorder with a history of trauma and less so with congenital and inflammatory conditions. Clinical testing is inconsistent, reflecting underlying confusion about these disorders and CVI.

### Pillow prescription for the prevention of waking cervico-thoracic symptoms

Gordon SJ

*James Cook University, Townsville*

A comparative field study undertaken to investigate the overnight abolition and overnight production of waking cervical pain, cervical stiffness, headache and scapular pain reports when subjects slept on their usual pillow and the five most commonly used pillows: polyester, foam, feather and rubber pillows of a regular shape and foam contour pillows. Subjects ( $n = 106$ ) who reported preference for the side sleep position slept for one week on their usual pillow and then randomly on each of the trial pillows while completing a diary of their retiring and waking symptoms. Feather pillow use was significantly associated with increased waking symptom reports and production of symptoms overnight. Rubber pillow use was significantly protective of all waking symptom types and production of overnight symptoms. Regular shaped polyester pillows were significantly associated with waking headache reports and the abolition of cervical stiffness overnight. Regular foam pillows had no significant association with waking symptom reports, abolition or production of overnight symptoms. Comparison of contour and regular shaped foam pillows found no significant difference in waking symptom reports, abolition or production of overnight symptoms between these pillows. This study has found that rubber pillows perform the best in terms of waking symptom reports and overnight symptom production. Feather pillows performed the worst. No advantage has been identified in the use of a contour shaped foam pillow over a foam regular pillow for the management of cervico-thoracic symptoms.

### Prediction of delayed recovery in workers' compensation patients

Gabel CP,<sup>1,2</sup> Neller A,<sup>1</sup> Burkett B<sup>1</sup>  
and Yelland M<sup>2</sup>

<sup>1</sup> *University of the Sunshine Coast, Sunshine Coast*  
<sup>2</sup> *Griffith University Brisbane*

This study investigates the predictive capacity of the biopsychosocial 'Generic Screening Tool' (GST) in the early identification of delayed recovery in workers' compensation patients. Consecutive musculo-skeletal workers' compensation patients ( $n = 102$ , age =  $41 \pm 12$  years and 32% female) were prospectively screened and measured at baseline with follow-up measures at two to four week intervals. Insurer databases provided absentee and

costs whilst ISMAM<sup>®</sup> software provided global measures and the time required to reach 80% of pre-injury status ( $t^{80}$ ). Delayed recovery was measured by: 1) absenteeism at  $\geq 28$  paid days off; 2) claim cost at  $\geq \$10,000$ ; and 3)  $t^{80}$  at  $\geq 6$  weeks. Analysis at different GST cut-offs used sensitivity, specificity and subsequent Likelihood Ratios (LR). Mean GST-score was statistically higher ( $t$ -test,  $p < 0.001$ ) for delayed recovery in each outcome group. The use of a 110 GST-point cut-off score provided sensitivity and specificity levels with subsequent LRs for each outcome where: absenteeism  $\geq 28$  days showed 83%: 77% (LR = 3.6); cost  $\geq \$10,000$  showed 88%: 65% (LR = 2.5); and  $t^{80} \geq 6$  weeks showed 92%: 80% (LR = 4.5). These values were similar in the non-delayed trait but at a lower cut-off of 100 GST-points. Direct correlation between GST-score and each outcome was only significant for Log- $t^{80}$  ( $r = 0.72$ ,  $p < 0.001$ ). The GST provides reliable early identification of workers' compensation patients with a high risk of delayed recovery as measured by absenteeism of  $\geq 28$  days off, claim costs  $\geq \$10,000$  and  $\geq 6$  weeks to reach 80% of the individual's pre-injury status.

### Regular stretch does not increase muscle extensibility: a randomised controlled trial

Ben M<sup>1,2</sup> and Harvey L<sup>2</sup>

<sup>1</sup> *Royal Rehabilitation Centre Sydney*  
<sup>2</sup> *Rehabilitation Studies Unit, Northern Clinical School,  
Faculty of Medicine, University of Sydney*

The primary aim of this study was to determine the effectiveness of an intensive hamstring stretch program on tissue extensibility and stretch tolerance. The secondary aim was to determine whether stretching one leg has any effect on the contralateral untreated leg. A combination of within-and between-subject designs was used. Sixty healthy able-bodied individuals were recruited. The subjects were randomly allocated to an experimental and a control group. The experimental group attended supervised 30-minute stretch sessions daily for six weeks. They stretched the hamstring muscles of a randomly allocated leg. The control group did not attend any stretch sessions. The two primary outcomes were hip flexion angle measured with and without a standardised torque, reflecting changes in tissue extensibility and stretch tolerance respectively. The outcomes were measured with a purpose-built device. Stretch had no effect on hip flexion angle measured with a standardised torque (mean treatment effect =  $-1$  degrees; 95% CI  $-3$  to  $2$  degrees), indicating no change in tissue extensibility. However, stretch did increase hip flexion angle when measured without a standardised torque (mean treatment effect =  $10$  degrees, 95% CI  $6$ – $14$  degrees), indicating an increase in stretch tolerance. There was no contra-lateral treatment effect. That is, stretch administered to one leg did not have any effect on the opposite, untreated leg. These results are in keeping with previous trials and indicate that an intensive six-week stretch program does not change tissue extensibility. Any apparent increases in tissue extensibility can be explained by changes in stretch tolerance.

## FREE PAPERS – *continued*

### Screening for malignancy in low back pain patients: a systematic review

Henschke N, Maher CG and Refshauge KM

*Back Pain Research Group, The University of Sydney, Sydney*

The main purpose of the low back pain assessment in primary care is to identify cases of serious pathology. Red flag questions are recommended for this purpose, but their accuracy is unclear. A systematic review was performed in order to describe the accuracy of clinical features and tests used to screen for malignancy in patients with low back pain. All available records on MEDLINE, EMBASE, and CINAHL electronic databases were reviewed. Studies were considered eligible if they investigated a cohort of low back pain patients, used an appropriate reference standard, and reported sufficient data on the diagnostic accuracy of tests. Two authors independently assessed methodological quality and extracted data to calculate positive (LR+) and negative (LR-) likelihood ratios. Six studies evaluating 22 different clinical features and tests were identified. The prevalence of malignancy ranged from 0.1%–3.5%. A previous history of cancer (LR+ = 23.7), elevated ESR (LR+ = 18.0), reduced hematocrit (LR+ = 18.2), and overall clinician judgement (LR+ = 12.1) increased the probability of malignancy when present. A combination of age  $\geq 50$  years, a previous history of cancer, unexplained weight loss, and failure to improve after 1 month had a reported sensitivity of 100%. Overall, there was poor reporting of methodological quality items, and very few studies were performed in community primary care settings. Malignancy is rare as a cause of low back pain, and the most useful features and tests are a previous history of cancer, elevated ESR, reduced hematocrit, and clinician judgement.

### Self-report outcome measures for low back pain: searching for international cross-cultural adaptations

Costa LOP, Maher CG and Latimer J

*Back Pain Research Group, School of Physiotherapy, The University of Sydney, Sydney*

Self report measures are commonly used in clinical practice and in research studies. Most existing questionnaires were developed in English and it is not clear how many have been adapted to other languages. The aim of this study was to describe the available cross-cultural adaptations of low back pain self report outcome measures and the psychometric testing that has occurred for each adaptation. Two different searches on MEDLINE, EMBASE, CINAHL and LILACS were performed. The first search identified questionnaires specifically designed for low back pain. The second search combined the questionnaire's name with 35 different languages in order to locate cross-cultural adaptations of the questionnaire. Data on the psychometric testing of the translated questionnaires were extracted. Additionally psychometric properties were rated by the Quality Criteria for Psychometric Properties of Health Status Questionnaires. Forty questionnaires were identified of which only 16 had been adapted to a new language. Only 19 of the 35 different languages we searched for were represented in the search results. From 1400 possible

adaptations, only 65 have been completed. Psychometric testing of the adapted questionnaires was quite variable and in general sub-optimal with testing usually restricted to an assessment of reliability and construct validity. There are insufficient cross-cultural adaptations for low back pain questionnaires. Major differences in sample sizes, test-retest periods, statistical analysis and benchmarks considering reliability and validity were found. Without appropriately adapted measures the clinical management of LBP patients who do not speak English is potentially compromised.

### Sensory and motor characteristics of the female office worker with work-related neck pain

Johnston V,<sup>1</sup> Souvlis T,<sup>1</sup> Jull G<sup>1</sup> and Jimmieson NL<sup>2</sup>

<sup>1</sup>*Division of Physiotherapy, School of Health and Rehabilitation Sciences, Brisbane* <sup>2</sup>*School of Psychology, The University of Queensland, Brisbane*

A study was undertaken to better understand the sensory and motor features that differentiate female office workers with varying levels of musculoskeletal neck pain as measured by the Neck Disability Index. Eighty-five office workers who use a computer for more than four hours per day and 22 controls (women who do not work and use a computer for more than four hours/day) volunteered to participate in this study. Quantitative sensory measures (thermal and pressure pain threshold and vibration stimulus) were taken over various sites of the neck and upper limb bilaterally. Assessment of motor characteristics included range of motion and superficial neck flexor activity during cranio-cervical flexion, in addition to extensor muscle activity during a unilateral arm task using surface electromyography. Results showed linear relationships between pain levels and sensory measures with significant changes in response to temperature, pressure pain threshold and vibration which may be due to altered central nociceptive processing. Workers with neck pain had reduced neck rotation and increased activity of the superficial cervical flexors during cranio-cervical flexion. During the unilateral arm task, workers with pain demonstrated greater activity in the cervical extensor muscles. On task completion, the upper trapezius muscle demonstrated an inability to relax in workers with pain. These results suggest that office workers with neck pain present with a potentially complex neck disorder involving sensory disturbances and altered muscle recruitment strategies. Management of neck pain in office workers needs to address the pain and motor deficits as well as other potential risk factors.

### Severe other joint disease and obesity are associated with poorer outcomes following joint replacement

Naylor JM,<sup>1,2,3</sup> Harmer AR<sup>2</sup> and Heard RC<sup>3</sup>

<sup>1</sup>*Whitlam Joint Replacement Centre, Sydney* <sup>2</sup>*The University of Sydney, Sydney* <sup>3</sup>*UNSW Clinical School, Sydney*

This study reports outcomes after joint replacement surgery according to the presence or absence of severe other joint disease and obesity. A prospective, observational study of 99 patients (n = 55 total knee replacement, n = 44 total hip

## FREE PAPERS – continued

replacement) before and up to 52 weeks post-surgery was undertaken. Outcomes included timed 15 m walk, timed Up and Go, operated joint pain, and walking aid utilisation. Assessments were conducted pre-surgery and at 2, 6, 12, 26 and 52 weeks post-surgery. In a subset, generic and disease-specific health-related quality of life surveys were obtained. Patients were stratified according to the presence or absence of severe other joint disease at baseline and at 52 weeks, and by the presence or absence of obesity (body mass index > 30). Patients with (n = 43) severe other disease demonstrated significant improvements and recovery patterns in walk times and joint pain. However, walk times were slower (by + 27% to + 33%), and walking aid use was more likely at one year (OR 6.2, CI 2.5–15.0) than patients without severe other disease (n = 56). Patients with severe other disease reported less improvement and worse scores overall in most survey subscales. Obese patients (n = 50) improved, but overall demonstrated slower walk times (+ 15%), and reported higher pain scores (+ 26%) and poorer survey scores in several domains than non-obese patients. The apparent influence of severe other joint disease was generally larger than that of obesity. Expectations from surgery, rehabilitation strategies, and benchmarking activities should be guided by these results.

### The anatomical basis of biceps load tests I and II for superior labral anterior to posterior lesions

Shanley K,<sup>1</sup> Taylor NF,<sup>1</sup> Green RA<sup>2</sup> and Perrott M<sup>3</sup>

<sup>1</sup> School of Physiotherapy, Faculty of Health Sciences, La Trobe University, Bundoora <sup>2</sup> School of Human Biosciences, Faculty of Health Sciences, La Trobe University, Bundoora <sup>3</sup> Kilmore Physiotherapy Centre, Kilmore

We aimed to investigate the anatomical basis of Biceps Load tests I and II. Both clinical tests rely on an increase in tension in the long head of biceps to identify a superior labral anterior to posterior (SLAP) lesion. The tests involve the subject resisting isometric elbow flexion from a position of 90° (I) or 120° (II) shoulder abduction and external rotation. Active tension in the long head of biceps was measured in 12 healthy young participants using surface electromyography. Passive tension was measured using a load cell on five embalmed cadaver specimens. Active tension was significantly greater in both Biceps Load I (17.5% of maximal voluntary contraction–MVC), and II (17.7% of MVC), than in a rest position (4.6% of MVC) ( $p < .01$ ). There was more passive tension in the neutral position than in both positions I ( $p < 0.01$ ), and II ( $p < 0.02$ ). The anatomical basis of Biceps Load tests I and II could not be refuted. Passive tension in long head of biceps was decreased in both positions, however active tension was increased. Although active tension may be more important to test findings, it only produced a relatively modest increase in activity in long head of biceps (< 20% MVC). In the absence of convincing support for the anatomical basis of the test, investigations of diagnostic accuracy need to be replicated in order for the reported high accuracy of Biceps Load I and II tests to be supported with confidence.

### The effectiveness of joint mobilisation after ankle fracture: a randomised controlled trial

Lin CC,<sup>1</sup> Moseley AM,<sup>1</sup> Refshauge AM,<sup>1</sup> Herbert RD<sup>1</sup> and Hass M<sup>2</sup>

<sup>1</sup>Discipline of Physiotherapy, the University of Sydney, Sydney <sup>2</sup>Centre for Health Economics Research & Evaluation, University of Technology, Sydney

Physiotherapists commonly use joint mobilisation to address pain and joint stiffness, but there is little evidence for the use of joint mobilisation after ankle fracture. The primary aim of this trial was to determine the effectiveness of adding joint mobilisation to an exercise program in adults after ankle fracture. A secondary aim was to determine if treatment effects were influenced by fracture severity. Participants were recruited from the physiotherapy departments of three teaching hospitals in Sydney, and were randomly allocated to treatment (joint mobilisation plus exercise) or control (exercise only) groups using a concealed procedure. A blinded assessor measured outcomes at baseline, and at 4, 12 and 24 weeks. The primary outcomes were activity limitation (Lower Extremity Functional Scale) and quality of life (Assessment of Quality of Life). Secondary outcomes included measures of impairments, activity limitation and participation restriction. Ninety-four participants were recruited, and 91 (97%) completed the study. There were no significant differences between groups on the Lower Extremity Functional Scale (mean difference = -0.3, 95% CI = -5.1 to 4.5,  $p = 0.89$ ) or Assessment of Quality of Life (mean difference = 0.9, 95% CI = -0.5 to 2.3,  $p = 0.20$ ) at 4 weeks or any other time points. In addition, there were no between-group differences that favoured the treatment group in the secondary outcomes. Effects of joint mobilisation were not influenced by fracture severity. Our results showed conclusively that adding joint mobilisation to an exercise program did not improve outcomes more than exercise alone after ankle fracture.

### The influence of examiner experience on accuracy and interpretation of the cervical flexion-rotation test

Hall TM,<sup>1</sup> Robinson KW,<sup>1</sup> Fujinawa O,<sup>2</sup> Akasaka A<sup>3</sup> and Pyne EA<sup>4</sup>

<sup>1</sup>Curtin University of Technology, Perth <sup>2</sup>Saitama Prefectural University, Japan <sup>3</sup>Saitama Medical University College, Japan <sup>4</sup>BodyLogic, Perth

The aim of this study was to determine the effect of examiner experience on the diagnostic accuracy and agreement of the cervical flexion-rotation test (FRT). A single-blind comparative study was staged in two parts. In the first, two experienced examiners independently evaluated 20 subjects with C1/2 dominant cervicogenic headache (CGH), 10 asymptomatic subjects and 10 subjects with non-C1/2 dominant CGH for FRT dysfunction and agreement determined. Criteria for CGH were based on published guidelines. Cervical segmental level of involvement was determined by manual diagnosis. In the second part, two inexperienced and one experienced examiners evaluated the FRT in 12 subjects with CGH and 12 asymptomatic subjects and agreement determined. FRT range was measured using a goniometer placed on the apex of the skull. Examiners,



## FREE PAPERS – *continued*

blind to each other and to the subject's group allocation, independently measured FRT range, and were required to classify the FRT as positive or negative. Sensitivity and specificity of the FRT was 90% and 88% with 92% agreement for experienced examiners ( $p < 0.001$ ). Overall diagnostic accuracy was 89% ( $p < 0.001$ ) and Kappa 0.85. For inexperienced examiners, FRT range of motion was significantly greater than that determined by an experienced examiner, but sensitivity, specificity, agreement and kappa values were all within acceptable levels for clinical tests. In addition, accuracy of the FRT was not reduced, compared to published reports, by the presence of painful segments other than C1/2. The FRT can be used effectively by experienced and inexperienced examiners and is therefore recommended in CGH evaluation.

### The language of the persistent pain experience

**Wilson DJ,<sup>1</sup> Williams MT<sup>1</sup>  
and Butler D<sup>1,2</sup>**

<sup>1</sup>*School of Health Sciences, University of South Australia<sup>2</sup> Neuro Orthopaedic Institute, Adelaide, South Australia*

It is unclear whether descriptors included within the McGill pain questionnaire (MPQ) reflect the language people use to describe their experience of persistent pain. This study aimed to determine how well descriptors within the MPQ reflected the language of people with persistent pain and to determine relationships between specific pain descriptors and levels of pain, disability, fear of pain and pain catastrophising. People referred to a chronic pain management program participated in this descriptive cross-sectional study. A structured interview was undertaken where subjects volunteered and endorsed words from the McGill pain questionnaire (MPQ). Demographic details and scores for pain (Short Form McGill Pain Questionnaire: SF MPQ), disability levels (Roland-Morris Back Pain and Disability Scale: RMD), fear of pain (Tampa Scale of Kinesiophobia: TSK) and pain catastrophising (Pain Catastrophising Scale (PCS)) were collated. Relationships were assessed descriptively and with logistic regression. Thirty-four subjects (age  $46.5 \pm 8$ , 20 female, duration  $5.5 \pm 5$  years) volunteered 121 different descriptors with 50% unique to an individual. Only 21% of the volunteered descriptors appear within the MPQ. A significant gender ( $p < 0.03$ ) and age ( $p < 0.04$ ) effect was calculated for volunteered and endorsed descriptors. Significant effects were calculated between frequently occurring volunteered descriptors (excruciating, annoying, frustrated) and scores of disability levels, evaluation of pain and fear of pain. While the MPQ has been consistently reported to provide reliable information concerning the sensation of pain, it appears that the MPQ does not sensitively reflect the descriptors volunteered by people with persistent pain.

### The placebo effect: where is it hiding?

**Kamper SJ, Herbert RD, Machado LAC, Maher CG  
and McAuley JH**

*Back Pain Research Group, University of Sydney*

The aim of the study was to determine whether trial-design, patient-type or placebo-type factors influence the size of the placebo analgesic effect in clinical trials. Trials that measured pain outcomes in Hróbjartsson and Gøtzsche's meta-analysis of placebo effect sizes in clinical trials were retrieved and coded for eight trial-level factors. Random effects metaregression was used to explore the predictive power of the eight factors on placebo analgesic effect size. The factors investigated aspects of trial-design (non-standardised co-analgesia, co-intervention), patients (pain-type, patient group, residual pain score) and placebo (placebo-type, indistinguishability, structural equivalence). The meta-analysis undertaken in the original study was also repeated to confirm the results. The pooled effect of placebo was 3.2 points on a 100-point scale (95% CI 1.6–4.7). None of the selected factors influenced the size of placebo effect: the effect of all factors was close to zero, all confidence intervals spanned 0, and  $p$  values ranged from 0.13–0.90. This study confirms previous research that, at present, the evidence for large placebo analgesic effects in clinical trials is lacking. Importantly, this analysis also establishes that larger placebo effects are not associated with particular aspects of the trial methodology, patient or placebo type.

### The relationship between spinal kinematics, psychosocial factors, and low back pain in female nursing students

**Mitchell T,<sup>1</sup> O'Sullivan PB,<sup>1</sup> Burnett AF,<sup>1</sup> Straker L,<sup>1</sup>  
Smith A,<sup>1</sup> Thornton J<sup>2</sup> and Rudd C<sup>3</sup>**

<sup>1</sup>*School of Physiotherapy, Curtin University, Perth* <sup>2</sup>*School of Psychology, Curtin University, Perth* <sup>3</sup>*School of Nursing, Midwifery & Postgraduate Medicine, Edith Cowan University, Perth*

Currently, a history of previous low back pain is the strongest predictor of future back pain episodes. Personal physical risk factors have been unable to effectively account for new low back pain episodes in previous studies, leading to a shift in emphasis towards the influence of psychosocial factors. The outcomes of low back pain prevention strategies remain poor despite these efforts. Poor selection or ineffective measurement of predictor variables may in part explain these results. This prospective study on 170 female nursing students was designed to investigate the influence of psychosocial factors and physical factors on future low back pain episodes. At the initial screening stage, three groups of: 1) no low back pain, 2) mild back pain and 3) significant back pain were selected based on pain scores, pain impact measures and disability levels. Initial cross-sectional analysis has identified significant differences in both physical and psychosocial characteristics across the three groups. Nursing students with significant low back pain had statistically significant: higher stress levels, poorer coping strategies, higher physical activity levels, sat more upright and lifted and transferred loads with more extended spinal posturing of the lower lumbar spine when compared



with students with mild or no back pain. Single individual physical and psychosocial characteristics could explain up to 5% of the variance, and the combined characteristics explained up to 40% of the variance for having significant low back pain. This may be the first study to successfully explain a significant proportion of low back pain episodes by individual personal characteristics.

### **Thinking about having to stop a spinal perturbation changes the anticipatory postural adjustment (APA) response: a model for back pain**

Allison GT<sup>1</sup> and Henry SM<sup>2</sup>

<sup>1</sup>School of Surgery and Pathology, University of Western Australia

<sup>2</sup>University of Vermont, USA

Spinal instability in the clinical presentation is associated with recurrent episodic pain, aberrant movements and catching pain. Stabilisation training is more appropriate with individuals who are fearful to move. This raises the hypotheses that individuals with low back pain may change their motor patterns because underlying the command to move quickly is a parallel motor control mechanism ready to stop the movement if necessary. This study used rapid arm raising to test if the perception of need to stop alters trunk muscle APAs. A modified Go-Stop testing paradigm was used to force people to try to stop a rapid arm movement once the Go command had been initiated.

Four subjects performed over 1600 trials and EMG data were collected from anterolateral abdominals (ALA) and deltoid. The results show that in normal subjects the contralateral ALA is seen in the APA window and always occurs with the deltoid activation. As the perception of the need to stop increases the amplitude of the ALA is diminished ( $p < 0.05$ ). This shows that the ALA acts unilaterally in the APA window and the magnitude is modulated (and subsequently the onsets) according to the perceived need to stop the arm movement. This is consistent with other anxiety or pain research. Significantly, this can be explained by a temporal shift in the motor pattern and not an absence of the feedforward activation. This provides further evidence that APA of the deep abdominal muscles may not be related to spinal segmental stabilisation, but rather the generation of the movement.

### **When to implement low back pain prevention? A study of undergraduate nursing students and recently graduated nurses**

Mitchell T, O'Sullivan PB, Burnett AF and Straker L

School of Physiotherapy, Curtin University, Perth

Nurses are known to be a high risk group for occupational low back pain. The aim of this study was to determine low back pain characteristics, of undergraduate students and recently graduated nurses, in order to identify optimal timing for preventive interventions. A cross-sectional survey of 897 undergraduate nursing students and 111 recently graduated nurses in Western Australia was conducted. Lifetime (79%), annual (71%) and point (31%) prevalence rates were very high across all three groups of undergraduate nursing

students. Prevalence rates did not differ across the student year groups, but did significantly increase after 6 months of full-time employment ( $p = 0.01$ ), as did the number of back pain episodes ( $p = 0.004$ ). Around 45% of students had low back pain that required at least one of treatment, medication or a reduction in activity. This increased to 58% of graduate nurses. Most back pain episodes lasted less than 1 week for nursing students. Graduate nurses reported longer episodes of back pain, and also took more medication than nursing students ( $p = 0.005$ ). Bending or lifting were the most common back pain aggravating factors, which also rose significantly on commencing employment ( $p = 0.001$ ). Graduate nurses felt the back pain was more frequent and more severe since commencing work. There was a rise in perception that nursing duties contributed to back pain episodes from first year to third year and into full time employment. These results may suggest a rise in occupational exposure is the primary cause in the increase in low back pain from student to graduate nurse. This may be increased exposure to physical as well as psychological stressors. First episodes of back pain are occurring prior to commencing studies for the majority. Given that prevalence rates are very high prior to commencing work, nursing student populations should be the target group for low back pain preventive strategies.

## **5 × 5 PRESENTATIONS**

### **Accelerated rehabilitation of total knee arthroplasty**

Blake E and Clair D

Osborne Park Hospital, WA

Accelerated rehabilitation of joint arthroplasty has only been reported sparsely in the literature and only in the past few years. This accelerated rehabilitation has focused on total hip arthroplasty (THA) with only a few references to accelerated rehabilitation of total knee arthroplasty (TKA). At Osborne Park Hospital we have a new joint arthroplasty program (running since July 2006) and this has an accelerated rehabilitation model for both THA and TKA. This program has resulted in average length of stay (LOS) of 3.6 days for TKA. This decreased LOS has also resulted in functional recovery being actually better when benchmarked against the Joint Replacement Assessment Centre at Royal Perth Hospital and this better functional recovery occurred in a quicker time (3.5 months compared to over 6 months). This is consistent with the results of the only other accelerated rehabilitation study for TKA reported on in the literature at present. In conclusion, an analysis of this model of care has shown that the accelerated rehabilitation model of care, along with minor modifications in anaesthetic technique can reduce the length of inpatient stay after TKA with successful functional outcomes achieved at a quicker rate when benchmarked against standard rehabilitation procedures.

## 5 × 5 PRESENTATIONS – *continued*

### **A comparison of two continuous passive motion (CPM) protocols after total knee arthroplasty: a controlled and randomised study**

**Bennett LA,<sup>1</sup> Brearley SC,<sup>2</sup> Hart AL<sup>1</sup> and Bailey MJ<sup>3</sup>**

<sup>1</sup>The Alfred, Melbourne <sup>2</sup>Caulfield General Medical Centre, Melbourne <sup>3</sup>Monash University, Melbourne

In this prospective randomised controlled study, 147 patients were assigned to one of three treatment groups: 1) CPM from 0°–40° and increased by 10° per day, 2) CPM from 90° to 50° (early flexion) and gradually progressed into extension over a three-day period and a 3) no CPM. The CPM was administered twice a day for three hours over a five-day period. All patients participated in the same postoperative physiotherapy program. Patients were assessed preoperatively, day five, three months and one year postoperatively. The early flexion group had significantly more range of flexion than both the standard and control groups at day five. There was no significant difference between the groups for any other variable tested at any time frame.

### **Activation patterns of deep and superficial lumbar multifidus during forward bending in patients with non-specific chronic low back pain**

**Carroll S,<sup>1</sup> O'Sullivan P,<sup>1</sup> Burnett A,<sup>1</sup> Rodrigues J<sup>2</sup> and Dankaerts W<sup>1,3</sup>**

<sup>1</sup>School of Physiotherapy, Curtin University of Technology <sup>2</sup>Australian Neuromuscular Research Institute, University of Western Australia, Perth <sup>3</sup>Department of Health Care Sciences, AUHL-PHL, REVAL Research Center, Hasselt, Belgium

The absence of flexion relaxation during forward bending in standing, in patients with non-specific chronic low back pain (NSCLBP) has been well documented for the superficial fibres of lumbar multifidus. There is a common belief that differential motor patterns exist between the deep and superficial aspects of the muscle. However it is not known whether the same pattern exists in the deep fibres of lumbar multifidus (LM). The purpose of this pilot study was to examine for differential activation of the DLM and SLM in patients with NSCLBP (active extension pattern), during forward bending. Three volunteers with at least a two-year history of back pain were recruited. EMG was recorded bilaterally from SLM using surface electrodes over L4–5 and from DLM using fine wire electrodes (inserted at L4–5). Spinal kinematic data during the functional movements were recorded using the 3 Space Fastrak. An absence of the flexion relaxation response was observed bilaterally in both deep and superficial LM in two subjects; in the third subject the absence of this response was seen unilaterally. The results support the hypothesis that deep and superficial fibres of lumbar multifidus work in concert during forward flexion from standing and do not support the view that these muscles possess differential motor patterns.

### **An evaluation of the clinical outcomes of manually tensioned anterior cruciate ligament reconstructions compared to those tensioned with a tensioning device**

**Kirwan G, Dalton P, Dekkers M and Bourke M**

Physiotherapy and Orthopaedic Surgery Departments, QEII Jubilee Hospital, Brisbane

The aim of this study is to determine if anterior cruciate ligament grafts tensioned with a tensioning device attain better functional outcomes than those manually tensioned by the surgeon. A double-blind randomised controlled trial has commenced within the QEII orthopaedic and physiotherapy departments. With a plan to recruit 50 subjects undergoing anterior cruciate ligament reconstructions, individuals are randomised into either the experimental group (tensioned using a tensioning device) or the control group (manually tensioned by the surgeon). All subjects are rehabilitated post-operatively using a standardised accelerated rehabilitation protocol with both groups having outcomes collected pre-operatively, then at 2 weeks, 3, 6, and 12 months post-operatively. It is proposed in the literature that subjects in the experimental group will show improved restoration of knee joint mechanics as measured by the KT1000. Function and patient satisfaction will then be measured using the hop test, International knee documentation committee form, Tegner score, and modified Lysholm score. Improved knee joint mechanics and functional scores may be extrapolated to suggest that individuals will have an improved functional return. Preliminary results will be presented.

### **An investigation into differential function of deep and superficial lumbar multifidus during functional spinal movements**

**Carroll S,<sup>1</sup> Burnett A,<sup>1</sup> O'Sullivan P,<sup>1</sup> Rodrigues J<sup>2</sup> and Dankaerts W<sup>1,3</sup>**

<sup>1</sup>School of Physiotherapy, Curtin University of Technology <sup>2</sup>Australian Neuromuscular Research Institute, University of Western Australia, Perth <sup>3</sup>Department of Health Care Sciences, AUHL-PHL, REVAL Research Center, Hasselt, Belgium.

It has been proposed that the superficial fibres of lumbar multifidus (SLM) have a different function to the deep fibres (DLM), with the SLM acting more as extensor muscles and the DLM acting as multi-directional stabilisers. It is well known that a flexion relaxation phenomenon occurs in the SLM in healthy control subjects, both in sitting and in standing. Similarly it has been shown that the SLM relaxes when moving from upright to sway standing. There is, however, little evidence that the DLM demonstrates these same motor patterns. The purpose of this study was to examine for differential function between the DLM and SLM in healthy controls during sitting (lumbo-pelvic sitting to slump sitting) and standing (upright standing to forward bending, and upright to sway standing). Six healthy volunteers without a history of back pain were recruited.

## 5 × 5 PRESENTATIONS – *continued*

EMG was recorded bilaterally from SLM using surface electrodes over L4–5 and from DLM using fine wire electrodes (inserted at L4–5). Spinal kinematic data during the functional movements were recorded using the 3 Space Fastrak. Visual analysis demonstrated clear evidence of a flexion relaxation phenomenon in both the SLM and DLM during sitting and standing, and relaxation when moving from upright to sway standing. Our results indicate that, normally, the SLM and DLM act in the same manner during these movements and do not support a differential function in LM in a normal population during dynamic movement as previously suggested.

### **A proposed framework for standardising forces used to produce grades of movement of spinal passive accessory intervertebral movements**

Tuttle N

*Griffith University, School of Physiotherapy and Exercise Science*

One difficulty in providing consistent manual therapy treatment is that the forces applied to produce a particular grade of movement can vary by greater than a factor of ten. In the present study, forces that would correspond to the definitions of grades of passive accessory intervertebral movements (PAIVMs) were calculated by applying basic mechanical principles to previously reported data on dimensions and stiffness of the cervical spine. Moments of 0.66–1.0 Nm have been found to be sufficient to reach what would be considered to be the end of range of movements of the cervical spine. Depending on the individual, a PAIVM force of between 13 N and 26 N would therefore represent the ‘end of range’ and correspond to a grade III or IV movement. The concept of a ‘neutral zone’ of minimal stiffness (defined as the movement occurring with 20% of end of range force) could be seen to correspond to grades I and II. Less than 2.6 N–5.2 N of PAIVM force would therefore be used to produce grade I and II movements. An approximate ‘end of range’ PAIVM force can be calculated for any spinal region and could be considered to correspond to grades III and IV. Less than 20% of this force would then be considered to correspond with grades I and II. Application of a force-referenced definition of grades of movement would enable more effective teaching of manual therapy skills and more consistent treatment by manual therapy techniques.

### **Aquatic physiotherapy and acute back pain: why get wet?**

Rahmann AE

*The University of Queensland, Brisbane*

Pain and bed rest have been shown to significantly inhibit activation of the deep multifidus (DM) and transversus abdominus (TrA) muscles. Considerable evidence supports the importance of retraining these muscles early after the onset of back pain. When admitted to hospital with acute back pain, usual management includes a period of bed rest with restricted mobility, further inhibiting the activation of these muscles. Aquatic physiotherapy can be used in this acute phase, combined with ward-based physiotherapy

to begin the process of relearning normal motor control. In water, patients report significantly less pain and the superficial muscles, like the erector spinae, have less spasm on palpation. Activation of the DM and TrA is easier when pain is reduced and can be incorporated into functional activities earlier than is possible on land. An understanding of the principles of hydrodynamics, combined with a clinical reasoning framework, underpins effective aquatic physiotherapy treatment in this acute phase. Two case studies will highlight both the principles of the aquatic physiotherapy management and the precautions necessary with these acute patients. The first case has an acute lumbar disc protrusion with nerve root involvement and the second has multiple crush fractures due to secondary bone cancer. At The Wesley Hospital in Brisbane, this combination of aquatic and land-based physiotherapy treatment has allowed some inpatients with acute back pain to avoid the surgery that was their only other treatment option.

### **Can a specific soft tissue intervention improve range of motion in patients with cervicogenic headaches?**

Hopper DM, Bajaj Y, Choi CK, Jan O, Hall T Robinson and Briffa K

*Curtin University of Technology*

A five-week case control study investigated the effects of a specific soft tissue intervention in patients with cervicogenic headaches (CGH). Twenty-four volunteers were screened according to International Headache Society criteria (2004) and eight female subjects completed the study. A modified cervical range of motion tool measured rotation in a flexed position of the upper cervical spine and headache diaries recorded frequency, duration, intensity and medication intake. These outcomes were measured during the control (2 weeks), intervention (1 week) and post-intervention (2 weeks) phases. To determine if there were any differences in the intervention over time, repeated measures ANOVA were used ( $\alpha = 0.05$ ). A significant improvement was shown in the upper cervical flexion-rotation range to both sides after first ( $p < 0.004$ ), second ( $p < 0.004$ ) and whole-week interventions ( $p < 0.001$ ), from an average range of 27.5° at baseline to 45.9°. After the two-week post-intervention phase, range of motion had not significantly changed ( $p \geq 0.125$ ). Headache symptoms during the control and post-intervention phases showed no significant changes ( $p \geq 0.18$ ). The SSTM improved the flexion-rotation range of the upper cervical spine immediately after treatment. Normal range was maintained for two weeks with no further intervention. Clinically, SSTM could be effective in conjunction with other modalities in the treatment of CGH patients.

### **Change in patient perception of function after physical performance**

Larmer PJ, McNair PJ, Smythe L and Williams M

*Auckland University of Technology, Auckland, New Zealand*

The aim of this study was to investigate the difference between patients’ perceived level of function prior to and after actually performing tasks identified as being of



## 5 × 5 PRESENTATIONS – *continued*

difficulty after discharge from treatment for an ankle sprain. Participants completed the Lower Limb Task Questionnaire (20 physical tasks rated from 0–4 in a difficulty scale). This questionnaire identified two tasks which were of notable difficulty and were important to the patient. Participants scored their difficulty levels on three occasions: discharge from treatment, and at six weeks following discharge prior to and immediately after actual performance of the tasks. The scores of perceived function at discharge, 6 weeks following discharge and immediately after performance of the two tasks were compared. The scores were summed to give a total score of difficulty. The statistical analysis involved non parametric analysis (Freidman ANOVA) with planned contrasts thereafter. The significance level was set at 0.05. At discharge the mean score (/8) for perception of function was 5.8/8. At six weeks following discharge the mean score was not significantly different (mean: 5.6/8), however, perception of function increased significantly after performance of the two physical tasks (mean: 7.3/8). This study demonstrated that performing functional tasks has benefit in providing patients with a greater perception of their function. This finding indicates that clinicians should reevaluate their discharge criteria particularly in relation to using outcome measurements. It is recommended that functional tasks be identified and performed physically prior to discharge to ensure that patients have a better appreciation of their level of function.

### **Differences in posterior-anterior (PA) movements between painful and less painful sides of the cervical spine**

Tuttle N, Laakso L and Barrett R

*Griffith University, School of Physiotherapy and Exercise Science*

Manual testing of posteroanterior (PA) movements has demonstrated clinical utility but lacks repeatability. Instrumented assessment is repeatable, but has not demonstrated clinical utility. To determine characteristics of PA movements that might be clinically relevant, unilateral cervical PAs were compared side-to-side on asymptomatic subjects when there was a difference in tenderness between sides. Ten locations from ten participants (six females and four males; mean age 37.2, range 21–50) were assessed. In addition to measures of stiffness and displacement considered in previous studies, force-displacement and stiffness-force curves were compared in three ways: simultaneous confidence bands (SCBs) of painful and less painful (control) sides; SCBs of differences between painful and control sides; and individual curves from painful sides were compared to simultaneous prediction bands (SPBs) of the controls. No differences were detected in the means, but painful sides had greater variation in displacement and stiffness than controls. SCBs demonstrated that the individual painful sides were significantly stiffer than their matched control side for forces above 11.5 N. None of the stiffness-force curves were fully contained by the control SPBs indicating each had significant differences from the control group. The largest differences found using both SCBs and SPBs were for forces between 15 and 18 N. Analysis of the pattern of stiffness rather than single measurements of

stiffness or displacement used in previous studies may be necessary to detect clinically relevant differences. Possible relationships between patterns of stiffness and descriptors of PA movements such as endfeel and R1 will also be discussed.

### **Does idiopathic neck pain affect balance and mobility in community-dwelling women aged 65 years and over?**

Kajewski H,<sup>1,2</sup> and Low Choy N<sup>1</sup>

<sup>1</sup>*The University of Queensland, Brisbane* <sup>2</sup>  
*The Princess Alexandra Hospital, Brisbane*

This study was conducted to determine whether neck pain contributed to balance and mobility deficit beyond that expected for normal aging using clinical measures. A comparative study design was used, with 40 community-dwelling women aged 65 years and over divided into groups according to Neck Disability Index scores, a measure of the presence and severity of neck pain. Participants with a Neck Disability Index score of 8 and above formed the neck pain group (n = 21), while those without neck pain became the control group (n = 19). Participants completed the Activities Specific Balance Confidence scale, timed stance measurements, Step Test, Rapid Step Test, Dual-task Timed Up and Go, the Dynamic Gait Index, Timed 10m walk, and Timed 10m walk with head turns. Significant and trend differences were identified between the groups for the Activities Specific Balance Confidence scale ( $p < 0.001$ ), Dynamic Gait Index ( $p < 0.001$ ), Timed 10m walk with head turns ( $p = 0.01$ , steps required  $p = 0.03$ ), the Step Test ( $p = 0.01$ ) and the Timed Up and Go ( $p = 0.02$ ). These results suggest elders with neck pain demonstrate reduced balance confidence and decreased quality of functional balance and mobility, especially when cervical movement is required, compared to those without pain. This research highlights the need for physiotherapists to consider all aspects of an individual that may contribute to reduced dynamic balance and mobility to ensure effective holistic management.

### **Effects of variations of technique on cervical PAIVMs**

Tuttle N, Barrett R and Laakso L

*Griffith University, School of Physiotherapy and Exercise Science*

The aim of this study was to investigate the effect that variations in technique during the application of PAIVMs to the cervical spine have on movement of the underlying vertebra and on PAIVM stiffness behaviour. Real-time ultrasound images were captured while simultaneously measuring force and displacement during unilateral posterior-anterior (PA) movements to the mid cervical spines of asymptomatic subjects. Two variations of technique were assessed: the presence or absence of the therapist stabilising the contralateral side, and the movement with and without displacement of intervening soft tissue from between the point of contact and the underlying vertebra. When the contralateral side was stabilised, the movement of the underlying vertebra was predominantly in a PA direction (in one example 5.7 mm PA and 1.0 mm medial movement).



## 5 × 5 PRESENTATIONS – *continued*

When contralateral stabilisation was not employed, the direction of movement of the vertebra was often different (in the above example 3.1 mm PA and 4.5 mm medial). In addition, the stiffness recorded when contralateral stability was provided was greater and more repeatable than when unsupported. Manual displacement of soft tissue prior to the technique reduced the intervening depth of soft tissue by greater than 50% resulting in the measured PAIVM movement being stiffer, but more closely approximating the movement of the underlying vertebra. Supporting the opposite side and displacing intervening soft tissue during unilateral PAs to the cervical spine produces a more PA directed movement and provides clearer information about movement of the underlying vertebra than techniques performed without these variations.

### Evaluation of aquatic therapy following rotator cuff repair

Brady B,<sup>1</sup> Redfern J,<sup>1</sup> Williams J<sup>2</sup> and MacDougal G<sup>3</sup>

<sup>1</sup>The University of Sydney <sup>2</sup>Delmar Private Hospital <sup>3</sup>Mona Vale Orthopaedic Surgery

Rotator cuff tears are frequently encountered in medical outpatient settings and often require surgical repair to achieve desirable functional outcomes. However, the optimal form of post-operative rehabilitation of rotator cuff repairs remains unidentified by the research literature. The aim of this study was to investigate the role of aquatic therapy in the post-operative rehabilitation of rotator cuff tears and the feasibility of implementing a clinical trial. A cohort of 18 subjects undergoing rotator cuff repair were examined over a treatment period of 12 weeks. Twelve subjects participated in a combined aquatic and land-based program, while six subjects received a standard land-based protocol. Passive range of motion and the Western Ontario Rotator Cuff Index outcomes were measured pre-operatively and at three, six and 12 weeks post-operatively. The results demonstrated a significant improvement in both range of motion and Western Ontario Rotator Cuff scores in all subjects with treatment ( $p < 0.001$ ). Furthermore, participation in aquatic therapy significantly improved passive flexion range of motion measures at three weeks (mean 46°, 95% CI 17–75,  $p = 0.005$ ) and six weeks (30°, 95% CI 8–51,  $p = 0.01$ ). There was no significant difference between the groups on any of the outcome measures at 12 weeks. The implementation of a combined aquatic and land-based physiotherapy program following surgical repair of the rotator cuff is feasible and shows promise of being more effective at accelerating the restoration of passive shoulder flexion range of motion than conventional land-based exercise.

### Evaluation of physiotherapists' ability to palpate intra-pelvic motion using the Stork test on the support side

Hungerford B,<sup>1</sup> Gilleard W,<sup>2</sup> Moran M<sup>3</sup> and Emmerson C<sup>4</sup>

<sup>1</sup>Sydney Spine and Pelvis Centre <sup>2</sup>School of Exercise Science and Sports Management, Southern Cross University <sup>3</sup>Carlingford Physio Centre <sup>4</sup>Stanmore Physio and Sports Clinic

Clinical indicators of pelvic girdle dysfunction are limited,

however research has shown that patterning of intra-pelvic motion alters during single leg support in subjects with pelvic girdle pain (PGP). Functionally, no relative motion should occur within the pelvis during load transfer as the sacroiliac joint (SIJ) maintains its closed pack position. In subjects with PGP, however, anterior rotation of the innominate relative to the sacrum occurs during weight-bearing as the SIJ unlocks. The aim of this study was to investigate whether the pattern of intra-pelvic motion could be reliably detected during a new clinical assessment test for functional load transfer: the Stork test on the support side. Three therapists were randomly assigned to palpate bone motion of the innominates and sacrum in 33 subjects during the Stork test on the support side. The direction of bone motion was indicated on a 2-point and 3-point scale. Inter-therapist reliability to agree on the pattern of intra-pelvic motion occurring during load transfer showed good reliability (left  $\kappa = 0.67$  and right  $\kappa = 0.77$ ) and high percentage of agreement (left = 91.9%, right = 89.9%) when using a 2-point scale. A 3-point scale showed moderate reliability for both the left and right sides (left  $\kappa = 0.59$  and right  $\kappa = 0.59$ ), with the percentage of agreement decreasing to 82.8% (left) and 79.8% (right). This study showed that therapists could reliably palpate and recognise altered patterning of intra-pelvic motion during the Stork test on the support side. The ability to distinguish between no relative movement, versus anterior rotation of the innominate during a load bearing task, was good. Further research is required to determine the validity of this test in detecting pelvic girdle dysfunction.

### Facilitatory scapula taping for shoulder impingement: a pilot randomised controlled trial

Miller PA<sup>1</sup> and Osmotherly PG<sup>2</sup>

<sup>1</sup>NUMoves Physiotherapy, Newcastle <sup>2</sup>The University of Newcastle

The aim of this study was to examine the effectiveness of facilitatory scapula taping on pain and function in people undergoing rehabilitation for shoulder impingement symptoms. A pilot study using a single-blind randomised controlled trial design was employed in a regional hospital outpatient department. Twenty-two subjects experiencing unilateral shoulder pain of more than six weeks duration were randomised into a taping ( $n = 10$ ) or a control ( $n = 12$ ) group. In addition to usual treatment, the taping group received standardised scapula taping applied three times each week for two weeks. Outcomes were measured by Shoulder Pain and Disability Index (SPADI) questionnaire and pain VAS and range of motion during shoulder flexion and abduction at two and six weeks follow-up. At two weeks, the taping group demonstrated a strong trend toward reduced pain both on self reported activity (SPADI pain subscale mean for taping 27.0 versus 41.5 for control) and pain during measured abduction (mean VAS 22.8 for taped, 46.8 for control), statistical power being limited by small sample size. No similar trend was evident in the SPADI disability subscale. The magnitude of the differences was reduced at six weeks follow-up. Despite the effect on pain, the acceptability of the intervention is questionable. Five taping participants withdrew from the pilot study

## 5 × 5 PRESENTATIONS – *continued*

compared to one control subject. The predominant reason for withdrawal was the occurrence of skin reactions to the tape. Whilst taping may provide a method of reducing pain during rehabilitation, its use over extended periods should be viewed with caution.

### **Factor analysis of trunk muscle activation patterns shows transversus abdominis related to arm movement and not necessarily for trunk stiffening**

Morris SL,<sup>1</sup> Lay B<sup>1</sup> and Allison GT<sup>2</sup>

<sup>1</sup>Human Movement and Exercise Science UWA <sup>2</sup>  
School of Surgery and Pathology UWA

During asymmetrical arm movements an invariant diagonal motor pattern in the lower limbs and trunk muscles is apparent. Contradictory to this, the transversus abdominis (TrAb) has been advocated as a spinal stabiliser considered to stiffen the spine prior to movements through bilateral co-contraction. Current physiotherapy treatment of chronic low back pain (CLBP) patients to invoke more 'normalised motor patterns' involves training bilateral co-contraction of the TrAb prior to movement. The current study investigates if TrAb demonstrates symmetrical or asymmetrical patterns of use in healthy subjects across a range of asymmetrical to symmetrical arm movements. In this study both left and right TrAb were investigated since the majority of previous studies report only TrAb from one side. Patterns of muscle activity in the lower limb and trunk revealed through factor analysis reflected the rotational torque experienced by the thorax due to arm movement. These findings supported the concept of a diagonal motor pattern similar to that described by Yamazaki et al (2005) and Bouisset et al (2000). The rotational pattern was most consistently observed in the erector spinae and biceps femoris muscles (6/6 subjects) and was strongly evident also in 5/6 subjects for the TrAb. This finding does not support the concept of independent motor control pathway for TrAb in APAs associated with upper limb movement in standing. It also brings in to question the rationale for bilateral abdominal bracing prior to movement when retraining CLBP patients back to 'normal' rapid asymmetrical motor patterns.

### **Get fit for surgery: comparison of intensive facility-based exercise program with home-based program for those referred for joint replacement surgeries**

Ward BA,<sup>1</sup> McPhate M,<sup>2</sup> Cotton S<sup>3</sup> and Brock KA<sup>1</sup>

<sup>1</sup>St. Vincent's Hospital, Melbourne <sup>2</sup>Melbourne Sports Medicine Centre, Melbourne <sup>3</sup>University of Melbourne, Melbourne

This study investigates the effectiveness of physiotherapy interventions for people with severe hip or knee osteoarthritis referred for joint replacement surgeries. The purpose was to compare the efficacy of 3 × 6-week pre-operative physiotherapy interventions: an intensive facility-based program versus home-based program with telephone coaching. One hundred and forty patients awaiting hip or knee total joint replacement at St Vincent's Health Melbourne were allocated to one of the intervention groups. The primary outcome measure used was the 6-minute walk test

(6MWT). Secondary dependent variables included physical functional measures, the Western Ontario and McMaster Universities Osteoarthritis Index, Physical Activity Scale for the Elderly, and Lorig self-efficacy scales. These were measured at 0, 7, and 12 weeks post-intervention, and at 6 weeks post-operatively. Significance was set at  $p < 0.01$ . Significant gains in physical ability for both interventions were observed in the pre-operative period, with the facility-based program showing significantly greater improvements immediately post intervention. For the primary dependent variable, the 6MWT, the mean difference between interventions immediately post program was 33.3 m (95% CI 14.5–52.2 m). The differences between groups were not sustained at six weeks post intervention. There were no differences in post-operative outcomes. The results of this project may assist with joint replacement surgery wait list management.

### **Giving primacy to pain in the physiotherapy consultation: how is this achieved between patient and physiotherapist?**

Lamont-Mills A,<sup>1</sup> South, S<sup>2</sup> and Epsley S<sup>3</sup>

<sup>1</sup>Centre for Rural and Remote Area Health, University of Southern Queensland, Toowoomba <sup>2</sup>University of Southern Queensland, Toowoomba <sup>3</sup>Peak Performance Sports Medicine, Toowoomba

A perusal of the pain literature suggests that the need to communicate and understand pain means that primacy is automatically given to pain in the physiotherapy consultation. Despite this assumed primacy, few studies have critically examined this primacy role and how this primacy is achieved within real-life physiotherapy consultations. This presentation aims to address this issue by examining who gives pain primacy in the consultation and how is this achieved. The data for this paper is 98 real-life physiotherapy consultations between 3 physiotherapists and 98 patients. The data were analysed using conventions of conversation analysis and discursive psychology. Analysis revealed that it was the patient who introduced pain into the consultation and not the physiotherapist. However this introduction was initiated by the physiotherapist. An exemplar and deviant case will be presented that illustrates this finding with particular attention to how pain is initiated and how pain is given primacy. Thus it appears that both physiotherapist and patient co-jointly give pain primacy in the consultation thus making pain both physiotherapist and patient relevant business.

### **How reliable are visual assessments of standing posture?**

Harvie DS and Tomkinson GR

University of South Australia, Adelaide

Posture, defined as the relative arrangement of the parts of the body, is routinely assessed by clinicians using a categorical rating scale. The aim of this study was to quantify the intra- and inter-rater reliability of clinical assessments of standing posture. Fifty subjects (age 18–59 years), assuming a normal standing posture, were scanned using a VitusSmart

## 5 × 5 PRESENTATIONS – *continued*

3D whole body scanner. A 3D scan-derived, rotating movie file was generated for each subject. Ten experienced physiotherapists independently observed all 50 subject movies, and assessed 12 aspects of standing posture using a 6-point categorical rating scale. Postural assessments were compared among physiotherapists to determine inter-rater reliability. Duplicate postural assessments were blindly made on 15 subject movies to determine intra-rater reliability. Reliability was quantified as the absolute rating-point difference between postural assessments. On average, 58% (range 41–69%) and 92% (range 84–98%) of all intra-rater differences were zero, or within a single rating-point respectively. Spinal (e.g. thoracic kyphosis and lumbar lordosis) and hip (e.g. lateral and sagittal pelvic tilt) postures were the least reliable. Overall, inter-rater differences were more variable, with 34% (range 22–44%) and 78% (range 61–89%) of the inter-rater differences zero, or within a single rating-point respectively. The lack of agreement, particularly inter-rater agreement, may be due to: (a) the lack of a gold standard reference posture; (b) differences in the way in which posture is defined; and (c) the lack of accepted guidelines for rating posture.

### **Impact of introducing advanced practice physiotherapy roles in to orthopaedic outpatient services in Queensland Health**

**Raymer M,<sup>1</sup> Smith D<sup>2</sup> and Swanson C<sup>3</sup>**

<sup>1</sup>Royal Brisbane and Women's Hospital, Brisbane <sup>2</sup>Ipswich general Hospital, Ipswich <sup>3</sup>University of Queensland, Brisbane

Orthopaedic physiotherapy screening clinics were introduced into four major public orthopaedic outpatient services in Queensland from mid 2005, as part of the Fit for Surgery Project. Musculoskeletal physiotherapists are employed in a primary contact, diagnostic and case management role. They are supported by a multidisciplinary allied health professional team, providing comprehensive non-operative management for selected patients. To March 2007, 1201 patients had been managed through the service. The patients have reported high levels of satisfaction with the quality of the service and the outcomes of their management, including a significant improvement in quality of health (EuroQOL QOH,  $p < 0.001$ ) and quality of life (Spitzer QOL Uniscale,  $p < 0.001$ ). All orthopaedic consultants directly associated with the service ( $n = 19$ ) reported they were confident or very confident in the quality of patient assessment and management undertaken by the musculoskeletal physiotherapists. Satisfaction with the overall patient outcomes achieved and the value of the screening clinics as a component of the orthopaedic service was reported by 95% of orthopaedic consultants. Increased throughput of orthopaedic new cases attributable to the screening clinics ranged from 23–76% across the four sites. Implementation of the service also contributed to reductions in orthopaedic outpatient waiting lists and waiting times. These results indicate that the employment of musculoskeletal physiotherapists in an advanced practice role, supported by a multidisciplinary team, is a clinically effective strategy for helping to improve access to orthopaedic outpatient services that is supported by both patients and orthopaedic consultants.

### **Justifying the visit: patient problem presentations and physiotherapists' responses**

**Lamont-Mills A,<sup>1</sup> Schloss J<sup>2</sup> and Epsley S<sup>3</sup>**

<sup>1</sup>Centre for Rural and Remote Area Health, University of Southern Queensland, Toowoomba <sup>2</sup>University of Southern Queensland, Toowoomba <sup>3</sup>Peak Performance Sports Medicine, Toowoomba

In order to visit a physiotherapist, patients must first decide they have a problem that warrants physiotherapy attention. This decision making process often becomes evident during the consultation through the interaction between patient and physiotherapist. This presentation focuses on how patients present new health problems during real-life physiotherapy consultations. Digital audio-recordings of 98 real-life physiotherapy consultations between 94 patients and 3 physiotherapists comprised the data corpus. This data were analysed using conventions of conversation analysis and discursive psychology. Analysis revealed that a patient's problem presentation is primarily concerned with justifying the decision to seek help from the physiotherapist. These justifications include: how long the patient has endured the condition; how assistance has been sought from other health professionals before seeking physiotherapy help; and how the problem is unknown to the patient. Typically, a physiotherapist gives priority to determining the nature of a patient's problem and selecting appropriate management. However a patient typically gives priority to establishing the presenting problem as one amenable to physiotherapy. Legitimising the presenting problem is important to the patient. Thus from a servicing perspective, problem statements may be more than just reflections of potential tissue damage and injury severity.

### **Lessons learnt from a trial of motor control exercise versus placebo in patients with chronic low back pain**

**Costa LOP,<sup>1</sup> Maher CG,<sup>1</sup> Latimer J,<sup>1</sup> Hodges PW,<sup>2</sup> Refshauge KM,<sup>1</sup> Moseley GM,<sup>3</sup> Herbert RD,<sup>1</sup> McAuley J<sup>1</sup> and Shirley D<sup>1</sup>**

<sup>1</sup>Back Pain Research Group, School of Physiotherapy, The University of Sydney, Sydney <sup>2</sup>Division of Physiotherapy, The University of Queensland, Brisbane <sup>3</sup>Department of Human Anatomy & Genetics, Oxford University, Oxford, UK

The presentation will describe the lessons learnt in the conduct of a randomised placebo-controlled trial evaluating motor control exercises for chronic low back pain. A prime concern in a trial is that treatment is delivered according to protocol and is of high quality. To accomplish this we have 1) recruited physiotherapists with expertise in motor control exercise, 2) developed a treatment manual, 3) provided physiotherapists with an ultrasound for use in training, 4) held regular staff training sessions supplemented by audit by the chief investigators of sample treatment sessions. Because the trial included a placebo arm we have had to develop a placebo treatment that was both inert and credible. To gain further understanding of the mechanism of action of motor control exercise we have supplemented the clinical outcome measures with measurements of the deep abdominal muscles taken with real time ultrasound at baseline and after intervention. This secondary analysis will be performed in order to establish whether the ability



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to activate the deep abdominal muscles can predict response to motor control treatment. Slow recruitment has been a particular problem and we have developed a number of strategies to manage this.

### **Non-uniform motor control changes with manual pelvic compression during an active straight leg raise in pelvic girdle pain patients**

**Beales DJ, O'Sullivan PB and Briffa NK**

*Curtin University of Technology, Perth*

A subgroup of pelvic girdle pain patients with a positive active straight leg raise respond positively to external pelvic compression during this test. This study investigated the effect of this phenomenon on intra-abdominal and intra-thoracic pressures and electromyographic activity of the trunk muscles in subjects with pelvic girdle pain ( $n = 12$ ). Paired t-tests were used to analyse pressure variables and repeated measure analysis of variance for the electromyographic data. All subjects reported reduced difficulty ratings lifting their leg with pelvic compression (paired t-test:  $p < 0.001$ ), yet no statistically significant changes in the pressure variables or muscle activation were found. However visual inspection of the data revealed two divergent motor control strategies with the addition of compression. Seven subjects displayed characteristics of decreased motor activation. This included a reduction in the baseline shift of intra-abdominal pressure ( $p = 0.028$ ) and reduced activation of the internal oblique on the contralateral side to the leg lift ( $p = 0.031$ ). A trend also existed for reduced external oblique activity bilaterally ( $p = 0.09$ ,  $p = 0.062$ ). With the other five subjects motor activation appeared to increase on visual inspection, however there were no statistically significant changes, possibly due to the small sample. This study provides preliminary evidence of two disparate patterns of motor control in response to the addition of pelvic compression to an active straight leg raise. This may reflect different mechanism, not only in the response to compression, but in the nature of the underlying pelvic pain disorder

### **No rest for the wounded: early ambulation after hip surgery accelerated recovery**

**Oldmeadow LB,<sup>1</sup> Edwards E,<sup>2</sup> Kimmel L,<sup>1</sup> Kippen E,<sup>3</sup> Robertson VJ<sup>4</sup> and Bailey M<sup>5</sup>**

<sup>1</sup>Department of Physiotherapy, Alfred Hospital <sup>2</sup>Department of Trauma Surgery, Alfred Hospital <sup>3</sup>Acute Aged Care Service <sup>4</sup>University of Newcastle & Central Coast Health <sup>5</sup>Epidemiology Alfred Hospital

Evidence-based guidelines published in the Medical Journal of Australia, recommend early assisted ambulation within 48 hours post hip fracture surgery. However, early ambulation in the elderly patient with a fractured hip is resource intensive. To investigate the effect of early ambulation after hip fracture surgery on patients and hospital outcomes, we undertook a randomised controlled trial involving 60 patients (41 women and 19 men: mean

age 79.4 years) admitted with a fractured hip to The Alfred hospital, Melbourne, March 2004 through December 2004. Patients were randomised into either an early ambulation group (first walk post operative day 1 or 2, or a standard ambulation group (first walk postoperative day 3 or 4). Outcomes measured were functional levels on day 7 after surgery, acute hospital length of stay and destination at discharge. Our results showed that at one week post surgery, patients in the early ambulation group walked further than those in the standard ambulation group ( $p = 0.03$ ), and required less assistance to transfer ( $p = 0.009$ ) and negotiate a step ( $p = 0.23$ ). More patients in the early ambulation group were discharged directly home from the acute care (26.3% compared to 0%). The differences were more marked when data from patients randomised to walk early but who failed to do so were removed from the analysis. The true early walkers had a 2-day shorter length of stay. The failed early ambulation subgroup had significantly more post operative cardiovascular instability and worse results for all outcome measures.

### **Physiotherapy management incorporating direct acupuncture needling to a large intrasubstance supraspinatus tear: case report**

**McCutcheon LM<sup>1,2</sup>**

<sup>1</sup>Elanora and Robina Physiotherapy Clinics <sup>2</sup>Combined Health Acupuncture and Dry Needling Education

A 64-year old woman presented with a 2-month old traumatic intrasubstance supraspinatus tear measuring  $1.8 \times 1.2$  cm. Four treatments consisting of taping, rotator cuff and scapular stabilising exercises, ultrasound and laser were implemented over a 5-week period with minimal effect on range and no effect on supraspinatus power or pain reduction. The therapy regime was supplemented with acupuncture consisting of threading the supraspinatus tendon from both an anterior (LI 15) and posterior (LI 16) approach with 40 mm and 50 mm needles respectively. The aim of acupuncture tendon threading is to produce a local healing response due to the various chemicals and neuropeptides that are activated when a needle is inserted into damaged tissue. Disability of the Arm, Shoulder and Hand (DASH) questionnaire performed prior to the commencement of acupuncture depicted a 71.7 score. Eight acupuncture treatments were performed over a 3-month period with a reduction to 27.5 on the DASH scale. An additional three treatments were performed over a 2-month period with a further reduction on the DASH scale to 5. Another diagnostic ultrasound was performed following treatment depicting a small 3 mm region of heterogeneity in the supraspinatus tendon which is a common phenomenon in asymptomatic individuals within this age group. This study raises the possibility of an alternative to surgery in the case of a torn supraspinatus tendon. Results of this single case report support the need for randomised controlled trials to further investigate the effect of deep acupuncture needling on rotator cuff tears.



## 5 × 5 PRESENTATIONS – *continued*

### Predicting long term disability in primary care whiplash patients: a simple approach

Gabel CP,<sup>1,2</sup> Neller A,<sup>1</sup> Burkett B<sup>1</sup> and Yelland M<sup>2</sup>

<sup>1</sup>University of the Sunshine Coast, Sunshine Coast  
<sup>2</sup>Griffith University Brisbane

This pilot study of primary care whiplash associated disorder (WAD) patients investigated the predictive capacity of screening questionnaires and patient reported outcomes (PROs) in determining recovery status at six months. Thirty participants, age  $37 \pm 14$ , 77% female, were recruited from eight primary care sources. Recovery status at six months was determined by impairment classification scores from six PROs using common 100% scales. Data were analysed at two separate cutoff levels:  $\geq 8\%$  (non-recovered) and  $\geq 28\%$  (severe) with participants dichotomised at each level. Baseline data included demographics, cervical rotation at impact, psycho-social screening using the Generic Screening Tool (GST) and impairment status using six standardized PROs. Repeated PRO measures were made at one, three and six months. Sensitivity, specificity and subsequent likelihood ratios (LR) were used for data analysis. At six months 30% of patients were non-recovered and 17% remained severe. These outcomes were best predicted by two separate baseline measures: non-recovered—by screening alone (GST cut-off 109 points) was 78% sensitive and 86% specific (LR = 5.4); severe—by the same screening cut-off score and the presence of Cervical Rotation at Impact was 100% sensitive and 87% specific (LR of 7.7). Neither demographic data nor baseline individual PROs provided prediction. This study found recovery status at six months following a WAD in primary care patients can be predicted using a screening cut-off score of 109 GST-points, whilst severe impairment is predicted from the screening score in the presence of cervical rotation at impact. A larger population study investigating these protocols is warranted.

### Proposed classification system for peripheral nerve disorders with a musculoskeletal underlying mechanism

Moulaert P<sup>1</sup> and Dankaerts W<sup>2</sup>

<sup>1</sup>Private practitioner, Belgium; [www.capeducation.be](http://www.capeducation.be)  
<sup>2</sup>Department of Health Care Sciences, AUHL-PHL,  
REVAL Research Group, Hasselt, Belgium

Pain originating from peripheral neural tissue has different clinical presentations. In order to guide targeted interventions and effective management a clinical useful sub-classification system is required. This classification system for peripheral nerve disorders should be based on identifying the underlying mechanism(s) driving the disorder. Within a broader biopsychosocial construct, classification of the clinical findings must be correlated with medical imaging and possible co-existing patho-anatomical findings. It is proposed that there are three subgroups. Subgroup 1 is associated with high levels of pain and disability, due to an underlying pathology and secondary adaptive movement and/or control impairments. Manual therapy treatment if appropriate should be based on the 2 subdivisions described in the third subgroup. In

Subgroup 2 the pain disorder is forebrain driven, secondary to a dominance of psycho-social factors. In Subgroup 3 the adaptive movement impairment and control impairments results in abnormal nerve tissue loading and chronic pain. In both, movement and control impairment the subdivision into a mechanosensitive and/or a stenotic (compression) group based on clinical findings and medical imaging is essential for management. Further sub-classifying into three subtypes is based on the extend of possible nerve conduction loss. The movement impairment is characterised by pain avoidance behaviour and is mostly adaptive due to higher neural tissue mechanosensitivity. Treatment techniques are predominantly passive. Control impairment are associated with faulty postures and/or repetitive movements that result in abnormal strain on the peripheral nerves. The control deficit is maladaptive. Treatment aims to restore the control impairment.

### Scales to assess the methodological quality of randomised controlled trials: a systematic review

Armijo-Olivo SA,<sup>1</sup> Macedo LG,<sup>1,2</sup> Gadotti IC,<sup>1</sup> Fuentes J,<sup>1</sup> Liddle N<sup>1</sup> and Magee DJ<sup>1</sup>

<sup>1</sup>University of Alberta, Edmonton, Canada  
<sup>2</sup>The University of Sydney, Sydney

The assessment of methodological quality of randomised controlled trials is important in order to assess the risk of biased results and thus accurately identify treatments effects. The purpose of this systematic review was to summarise the content, construction, development, and psychometric properties of scales used to evaluate the quality of RCTs in health research. Extensive electronic databases searches along with a manual search were performed. Five independent reviewers screened the publications and extracted data. Seventy-one relevant studies were identified. They accounted for 18 scales and their modifications. Most of the analysed scales have not been rigorously developed following the methodological standards and have not been tested for validity, responsiveness, and reliability in the areas to which they have been applied. The most used scales in the physiotherapy area are Jadad and PEDro. However, these scales have not been validated for assessing physical therapy trials. Based on the findings of this systematic review, there are many scales used to evaluate the methodological quality of RCTs in health research. However, there are few original scales that have been systematically developed or had their measurement properties tested.

### Stabilising function of trunk muscles can be modified by training

Druitt TRJ, Tsao H and Hodges PW

NHMRC Centre of Clinical Research Excellence in Spinal Pain, Injury and Health, The University of Queensland, Brisbane

Changes in the control of the trunk muscles have been observed in people with low back pain (LBP). Increased activity of superficial trunk muscles and reduced activity of the deep extensors has been frequently reported. It remains unclear whether control of the trunk muscles can

## 5 × 5 PRESENTATIONS – *continued*

be altered by motor training. Twenty volunteers with LBP were randomly assigned to perform either isolated deep multifidus (DM) training, or extension training to activate DM at the same intensity but in association with other trunk muscles. Electromyographic activity (EMG) was recorded from trunk muscles with fine-wire and surface electrodes during slow movements of the trunk between ~15 degrees extension and ~15 degrees flexion. In the mid-position, minimal muscle activity is required to maintain equilibrium and this can be considered to be associated with the maintenance of stability. Minimum EMG was recorded as a reflection of this point. Following isolated training, superficial abdominal and paraspinal muscle coactivation around the neutral spine posture was reduced and activation of DM on the painful side was increased. These changes were not observed after non-isolated training. The findings suggest training of isolated voluntary contractions of DM may result in increased activity of the trained muscle. We argue that the reduction in activation of superficial trunk muscles observed following this type of training may result in a reduction in the stability of the spine. However this is likely to be beneficial as people with LBP often excessively stabilise the spine, with a resultant increase in spinal load.

### The analysis of standing posture using 3D imaging

**Shaw LG and Tomkinson GR**

*University of South Australia*

Posture is frequently observed by clinicians to determine whether any faults could be contributing to patient symptoms. Recent advances in three-dimensional (3D) technology provide exciting opportunities for standing postural assessment. The aim of this study was to quantify the intra-rater reliability of measuring standing posture using 3D technology. Using a systematic strategy which identified, defined, described and operationalised 13 standing postural measurements, 52 subjects (18–62 years) were landmarked and scanned using the Vitus Smart 3D whole body scanner at the same time on two consecutive days. Cartesian coordinates of 29 landmarks were digitally located on each 3D image using Digisize measurement extraction software. These landmarks were used as inputs into calculations to quantify the postural measurements. All postural measurements were calculated in angular degrees (°). Systematic error (bias) was calculated as the mean difference between duplicate measurements and random error as the 95% Limits of Agreement (LoA). Positive values indicate that second measurements were smaller, and negative values indicate that second measurements were larger. Reliability was considered acceptable if the within-subjects standard deviation was less than the between-subjects standard deviation. The mean bias was  $-0.2^\circ$  (range  $-3.4^\circ$ – $2.2^\circ$ ) and the mean LoA was  $8.3^\circ$  (range  $2.2^\circ$ – $24.6^\circ$ ). Head and neck postures exhibited the largest systematic and random errors. The within-subjects standard deviation was less than the between-subjects standard deviation for all postural measurements except those of the head and neck. These results demonstrate that this 3D method of measuring standing posture is acceptable for the majority of postural measurements.

### The effect of a one-month program of generalised and individualised physiotherapy on patellofemoral pain and function

**Mason M,<sup>1</sup> Keays SL<sup>1</sup> and Newcombe PA<sup>2</sup>**

<sup>1</sup>Private practice, Nambour <sup>2</sup>The University of Queensland, Brisbane

Generalised treatment combining standard patellar taping, quadriceps strengthening and stretching have been shown to improve patellofemoral pain. However standard patellar tape fixation is poor during quadriceps stretching in contrast to infrapatellar tape fixation. This study assesses the effect of infrapatellar taping combined with quadriceps strengthening and stretching in addition to individualised treatment targeting specific causative deficits, for example iliotibial band tightness and poor lower limb alignment. Twenty-one patients (34 knees) with patellofemoral pain completed a 4–5 week program of generalised and individualised physiotherapy. Patients were assessed before and after treatment on eight measures: pain recorded on a visual analog scale during stair ascent, stair descent, a controlled step down test and a self-selected activity; quadriceps and hamstrings isokinetic strength using a Cybex 11 dynamometer; heel to buttock distance to assess quadriceps tightness; and the eccentric knee flexion control angle. One assessing and one treating physiotherapist were involved in this study. Results showed that pain decreased respectively by 1.3, 1.8, 1.5, and 3.2 on the visual analogue scale, quadriceps strength increased 19 ft lbs and hamstring strength 11 ft lbs, heel to buttock distance improved 11 cm and the eccentric knee flexion control angle increased 24 degrees. The improvement for each measure was significant ( $p < 0.001$ ). This study has shown that a comprehensive program comprising a generalised program of infrapatellar taping, quadriceps exercises, and quadriceps stretches complemented by individualised program improves patellofemoral pain significantly. Further study investigating the effectiveness of targeting specific treatments to specific causative deficits for patellofemoral pain is continuing.

### The effect of two commonly prescribed stabilisation exercises on spinal stiffness

**Stanton TR and Kawchuk GN**

*The University of Alberta, Edmonton, Canada*

The aim of this study was to determine the spinal stiffening effect of two different exercises frequently prescribed for low back pain. Using a subject as own control study design, each subject was randomly assigned to the order in which the exercises would be performed. Twenty-eight asymptomatic subjects were taught abdominal hollow and abdominal brace stability exercises. During periods of rest and contraction, stiffness of the lumbar spine was quantified in each subject using an assisted indentation technique. Additionally, electromyography and B-mode ultrasound were used to characterise trunk muscle activity. Outcomes were global stiffness (slope of the force-displacement curve from 30 N to maximal force) and mean maximal stiffness (average of the force-displacement data at maximal displacement). It was found that spine stiffness was significantly greater for each contraction compared to rest ( $p < 0.001$ ) while

## 5 × 5 PRESENTATIONS – *continued*

the abdominal brace generated significantly greater global and mean maximal stiffness compared to the abdominal hollow ( $p = 0.022$ ,  $p = 0.013$ ; respectively). No gender difference was noted. The abdominal brace provided a greater stiffening effect to the spine. Therefore, this finding may provide knowledge to better match exercises to specific patient needs.

### **The relation between passive intervertebral accessory movements of the cervical spine and movement at the target intervertebral motion segment**

Tuttle N, Laakso L and Barrett R

*Griffith University, School of Physiotherapy and Exercise Science*

A therapist's thumb can move more than 25 mm during cervical passive accessory intervertebral movements (PAIVMs), but no more than a few millimetres of this movement occurs at the motion segment targeted by the technique. Forces of up to 147 N have reportedly been applied during cervical PAIVMs and the endfeel or stiffness of the latter portion of PAIVMs is often considered to be indicative of the segmental mobility. Our research using a combination of computer based simulations and *in vivo* measurements suggests that significant movement at the target motion segment would not occur at forces of over 20 N. Larger forces may still be useful for treatment but when used for assessment, the direct information about the mobility of the target motion segment is likely to be found in the characteristics of the movement at forces less than 20 N. The results suggest that neither endfeel, as is often described by clinicians, or end of range stiffness, as reported in previous studies of spinal PAIVMs, are likely to be the characteristics of interest when assessing the mobility of a target intervertebral motion segment.

### **The relationship between head posture and severity and disability of patients with neck pain**

Chiu TTC,<sup>1</sup> Yip CHT,<sup>2</sup> and Poon ATK<sup>3</sup>

<sup>1</sup>Department of Rehab. Sciences, The Hong Kong Polytechnic University, Hong Kong China <sup>2</sup>Physiotherapy Department, Queen Mary Hospital, Hong Kong China <sup>3</sup>A&J Physiotherapy clinic (Acupuncture and Manipulation), Hong Kong China

The aim of this study was to investigate the relationship between head posture with pain and disability in neck pain patients. A cross-sectional correlational study was carried out in the physiotherapy outpatient department. Sixty-two subjects with neck pain and fifty-two normal subjects were recruited by convenience sampling. The forward head posture was measured via the craniovertebral (CV) angle by using the Head Posture Spinal Curvature Instrument (HPSCI). The Chinese version of Northwick Park Neck Pain Questionnaire (NPQ) and Numeric Pain Rating Scale (NPRS) were used to assess neck pain disability and severity. The difference in CV angles between the two groups and the Pearson's correlation coefficient between the CV angle, NPQ and NPRS were determined. Results demonstrated that there was a significant difference in the CV angle between subjects with and without neck pain. CV angle

was negatively correlated with NPQ ( $r_p = -0.3101$ ,  $p = 0.02$ ) and NPRS ( $r_p = -0.329$ ,  $p = 0.009$ ). It was also negatively correlated with age ( $r_p = -0.380$ ,  $p = 0.002$ ). When age was taken into account, the CV angle was negatively correlated with NPQ ( $r_p = -0.3101$ ,  $p = 0.02$ ) but showed no significant correlation with NPRS ( $r_p = -0.1848$ ,  $p = 0.15$ ). The CV angle in subjects with neck pain is significantly smaller than that in normal subjects. There is moderate negative correlation between CV angle and neck disability. Patients with small CV angle have a greater forward head posture and the greater the forward head posture, the greater the disability.

### **The role of experienced physiotherapists as gatekeepers to hospital orthopaedic outpatient care**

Oldmeadow L,<sup>1</sup> Bedi H,<sup>2</sup> Burch H,<sup>1</sup> Smith J,<sup>1</sup> Leahy E<sup>1</sup> and Goldwasser M<sup>2</sup>

<sup>1</sup> Department of Physiotherapy, The Northern Hospital <sup>2</sup> Orthopaedics, The Northern Hospital

The aim of this study was to investigate the impact, quality and acceptability of a musculoskeletal screening clinic, provided by physiotherapists, for patients referred to the outpatient orthopaedic department at a major metropolitan hospital. Fifty-two patients with non-urgent musculoskeletal conditions, referred to The Northern hospital, Melbourne, were selected to be assessed first by one of two physiotherapists with post-graduate qualifications and subsequently by an orthopaedic surgeon. Outcomes were the proportion of new referrals managed without needing to see a surgeon, levels of agreement between the physiotherapist and orthopaedic surgeon on diagnoses and management decisions, and patient, GP and surgeon's level of satisfaction with the physiotherapist-led screening initiative. Forty-five of 52 selected patients (31 women and 21 men; mean age 53.3 years) attended their appointment with the physiotherapist and of these, 38 also attended a later appointment with the orthopaedic surgeon. Seven of the 38 patients were listed for surgery, and 7 others needed management from the surgeon (injection for 3, imaging for 4). Twenty-four were appropriate for non-surgical management. The physiotherapists identified the same patient management plans as the surgeon for 74% of the group. Patients and doctors reported high levels of satisfaction with the physiotherapist-led service. Two-thirds of patients with non-urgent musculoskeletal conditions, referred by their GPs to one public outpatient orthopaedic department, did not need to see a surgeon at the time of referral and were appropriately assessed and managed by experienced, qualified physiotherapists.



## 5 × 5 PRESENTATIONS – *continued*

### **The impact of hand disorders associated with diabetes: relationships between self-reported disability levels and physiological impairments**

**Redmond CL,<sup>1</sup> McNeil JD,<sup>1</sup> Bain GI<sup>2</sup> and Laslett LL<sup>1</sup>**

<sup>1</sup>The University of Adelaide, Adelaide <sup>2</sup>Modbury Public Hospital, Modbury

The aim of this study was to investigate the relationships between self-reported disability levels and physiological impairments, in adults with the hand disorders associated with diabetes mellitus (DM). The hypothesis was that the self-reported measure of upper extremity symptoms and function (the DASH questionnaire) would correlate moderately well with measures of hand strength, sensation and dexterity. Hand assessments were performed on 33 adults with diabetes type 1 or type 2 and carpal tunnel syndrome, trigger finger, Dupuytren's disease or the syndrome of limited joint mobility. The examination included measurement of grip strength, light touch perception and dexterity, as well as self-reported upper extremity function using the DASH questionnaire. The relationships between DASH scores and impairments were analysed using correlation and regression. The most frequent diagnosis was carpal tunnel syndrome (58%), disorders usually affected both hands (83%) and it was common to present with more than one hand or shoulder disorder associated with diabetes (48%). The cohort presented with a range of disability levels of the upper extremity, as measured by the DASH questionnaire. The DASH questionnaire correlated moderately well to grip strength, right hand sensation and dexterity (range 0.40–0.49,  $p < 0.05$ ). Impaired peripheral nerve function and weaker grip strength were related to increased difficulties with activities of daily living. This study suggests that both self-reported outcomes and physiological measurements have value in assessing hand function in adults with diabetes.

### **Trunk and limb muscle activity during the application of a mobilisation type force to the vertebral column**

**Blaich RH,<sup>1,2</sup> Ginn K,<sup>2</sup> Cathers P<sup>2</sup> and Lee M<sup>2</sup>**

<sup>1</sup>The University of Western Sydney, Sydney <sup>2</sup>The University of Sydney, Sydney

The aim of this study was to determine whether the application of mobilisation forces to the vertebral column induce activity in back muscles. Manual postero-anterior mobilisation forces were applied to asymptomatic ( $n = 18$ ) as well as a pilot group of symptomatic subjects having chronic, low-level lower back pain ( $n = 3$ ). The forces were applied to the asymptomatic subjects at three vertebral levels (T6, T12 and L3) with three magnitudes (70, 140 and 210 N) and two frequencies of application (1.4 and 2.3 Hz). The mobilisation forces and frequencies used for the symptomatic subjects was a subset which did not exceed the appropriate therapeutic dose for each subject. Muscular

activity was measured at seven different muscle areas using surface electromyography. The time series signals and their frequency spectra were visually inspected and the mean signal levels before and during the mobilisation calculated. In the asymptomatic group there was no evidence of electromyographic activity before or during the application of the mobilisations at any of the muscle areas under any of the conditions. There was little evidence to suggest an effect of mobilisation on muscle activity in the subjects with chronic, low grade low back pain.

### **Ultrasound imaging assessment of abdominal muscle function during drawing-in of the abdominal wall: an intra-rater reliability study**

**Miokovic T,<sup>1,2</sup> Hides JA,<sup>1,2</sup> Stanton W,<sup>1,2</sup> Belavy DL<sup>1,3</sup> and Richardson CA<sup>2</sup>**

<sup>1</sup>Mater Misericordiae Hospital, Brisbane <sup>2</sup>University of Queensland, Brisbane <sup>3</sup>School of IT and Electrical Engineering, University of Queensland, Brisbane

Ultrasound imaging (USI) has previously been used to assess abdominal muscle function during a drawing-in manoeuvre of the anterior abdominal wall, and measurements conducted by an experienced assessor have been validated by comparison with magnetic resonance imaging. Few studies have examined the reliability of less experienced operators, and only in isolated measurement conditions. This study aimed to examine parameters of ultrasound measurement reliability across a broad range of conditions for a physical therapist newly trained in assessment by ultrasound imaging. USI was used to bilaterally assess the thickness of internal oblique (IO) and transversus abdominus (TrAb) as well as the changes in length of the TrAb muscle (indicated by slide of the anterior abdominal fascia) during an abdominal drawing-in manoeuvre in 19 subjects (11 female, 8 male) without a history of low back pain. The reliability of a novice operator who received 8 hours of training was examined (a) across 3 measurements of the same ultrasound image, (b) across 3 ultrasound images (averaged for day and side of abdomen), and (c) across 2 days (averaged for images and side). The reliability of assessing muscle thickness was very high across 3 measurements of the same image (ICC = > 0.97), fair to high across 3 images (ICC = 0.62–0.82) and fair to high across 2 days (ICC = 0.63–0.85). Reliability of measuring the slide of the anterior abdominal fascia was very high across measurements from the same image (ICC = 0.98) but low across images (ICC = 0.44) and across two days (ICC = 0.36). High reliability of a novice operator was demonstrated for some measurement conditions. Measures of reliability for recapturing the image and repetition across days ranged from low to high. Inconsistencies in the pattern of the results for this study suggest that a broad range of conditions need to be tested before concluding that a novice operator is reliable.



# ABSTRACTS

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## FREE PAPERS

### **An evaluation of client satisfaction with different methods of physiotherapy delivery after stroke**

**Harling RF,<sup>1</sup> Lynch E,<sup>1</sup> Stiller K<sup>2</sup> and English C<sup>3</sup>**

<sup>1</sup>Hampstead Rehabilitation Centre, Adelaide <sup>2</sup>Royal Adelaide Hospital, Adelaide <sup>3</sup>The University of South Australia, Adelaide

The aim of this study was to compare levels of patient satisfaction with circuit class therapy and individual one-to-one therapy sessions amongst a sample of stroke survivors. Fifty subjects, receiving inpatient rehabilitation following a diagnosis of stroke, who had received both circuit class therapy and one-to-one physiotherapy sessions, completed a custom-designed questionnaire one week prior to discharge. The questionnaire was administered by a physiotherapist who was unknown to the subjects and was not involved in any aspect of their rehabilitation. Results of the questionnaire were analysed descriptively. Responses in support of circuit classes included that 26 (52%) subjects felt that circuit classes helped to build their confidence more than individual sessions. Additionally, 24 (48%) subjects preferred exercising in a group environment than on their own. In support of individual therapy sessions, 26 (52%) subjects agreed that they could concentrate more on their performance during their individual sessions rather than in the circuit class environment. Similarly, 29 (58%) subjects agreed that their individual therapy sessions gave them a greater sense of independence as compared to circuit class sessions. Thirty-five (70%) subjects felt that individual therapy sessions were more tailored to their goals than the circuit class sessions. The results of this study suggest that both circuit class therapy and one-to-one physiotherapy sessions are associated with high patient satisfaction and that patients see merits in both types of therapy delivery.

### **An update on the outcomes of a vestibular rehabilitation service in the public health system: 3 years on**

**McGann A,<sup>1</sup> Hill K,<sup>2</sup> Louie J<sup>1</sup> and Macdonell G<sup>1</sup>**

<sup>1</sup>Royal Melbourne Hospital-Royal Park Campus, Melbourne <sup>2</sup>National Ageing Research Institute, Melbourne

Dizziness is a frequently reported symptom across all ages and is a common symptom of vestibular pathology. The multidisciplinary Vestibular Rehabilitation Service at the Royal Melbourne Hospital Royal Park Campus was established in May 2004. Early outcomes from this service have previously been presented at the APA National Neurology & Gerontology Groups Joint Conference 2005. This paper will provide an update on the outcomes and ongoing evaluation of this service. To date, 45 clients have completed the program with 25 returning for 3-month review. Sixty-one percent of clients were female with an average age of 60 (SD = 17). The most common diagnosis was unilateral peripheral vestibular dysfunction with 91% of clients suffering symptoms for more than 6 months. At the end of a 9-session physiotherapy based program, clients had significantly improved on the Dizziness Handicap Inventory ( $p < 0.001$ ) and achieved clinically and statistically significant improvement in a number of balance measures including Foam Feet Together Eyes Closed, Sharpened Romberg Eyes

Closed, Step Test and Functional Reach ( $p < 0.001$ ). The improvements in handicap ( $p < 0.001$ ) and balance ( $p < 0.01$ ) were maintained at 3 months. We expect to have completed analysis of a further 25–30 clients by October 2007. We will continue to explore factors contributing to our outcomes (e.g. age, anxiety, chronicity, diagnosis) and will report on recent expansions to the service. These findings continue to support the multidisciplinary model of care provided and highlights the need to improve access to skilled clinicians working in the field of vestibular rehabilitation.

### **A prospective study examining the benefits of different levels of group physiotherapy intervention in subacute neurological rehabilitation**

**Mathieson S,<sup>1</sup> Connors K,<sup>2</sup> Bahr F,<sup>1</sup> Winter A<sup>1</sup> and Holland A<sup>3</sup>**

<sup>1</sup>Caulfield General Medical Centre, Melbourne <sup>2</sup>Calvary Health Care Bethlehem, Melbourne <sup>3</sup>The Alfred, Melbourne

The aim of this study was to examine the characteristics and outcomes of participants attending high or low level group therapy in subacute neurological rehabilitation. One hundred and twenty-three subjects admitted to our subacute neurological rehabilitation unit participated in physiotherapy groups. Two higher level groups addressed cardiovascular fitness and high-level balance. The lower level group focused on basic functional activities. Allocation to groups was made by treating therapists according to clinical criteria based on functional abilities. On admission and discharge, results of the Timed Up and Go, 10 m walk, 6-minute walk and FIM scores for transfers, walking and stairs were collected. One-third of patients ( $n = 34$ ) attended only the low level group. There was no difference in diagnoses between the groups; however those who attended the low level group were older ( $p = 0.003$ ) and had lower admission scores for all physical FIMS and all physical measures ( $p < 0.001$ ). The lower level group improved more over the course of admission than the higher level group on 10 m walk ( $p = 0.02$ ), FIM transfer ( $p = 0.001$ ) and walking ( $p = 0.002$ ) scores. However at discharge the lower level group still had poorer physical outcomes ( $p < 0.001$ ) and physical FIMS ( $p < 0.001$ ) than the higher level group despite a longer length of stay ( $p < 0.001$ ). This study supports the contention that different levels of physiotherapy group intervention may be of benefit for these differing patient populations in subacute neurological rehabilitation.

### **A randomised controlled trial of the effects of stretching on contracture of the wrist and finger flexor muscles following stroke**

**Horsley SA,<sup>1</sup> Herbert RD<sup>2</sup> and Ada LA<sup>2</sup>**

<sup>1</sup>The Townsville Hospital, Townsville <sup>2</sup>The University of Sydney, Sydney

The purpose of this study was to evaluate the effects of four weeks of 30 minutes daily stretching of the wrist and finger flexors on contracture, upper-limb function and pain in adults following stroke. An assessor-blinded randomised controlled trial, with concealed randomisation,



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was conducted in a rehabilitation unit in Queensland. Forty adults undergoing rehabilitation after stroke, who were unable to actively extend the affected wrist, were included. Both control ( $n = 20$ ) and experimental ( $n = 20$ ) groups received routine upper-limb retraining. The experimental group received 30 minutes daily stretch of the wrist and finger flexor muscles, five days a week for four weeks. The primary outcome measure was torque-controlled passive wrist extension. Secondary outcome measures were upper-limb function using the Motor Assessment Scale and pain at rest. Outcome measures were obtained at baseline, post-intervention (at 4 weeks), and at follow-ups (at 5 and 9 weeks). Compliance with the intervention was 96% and the primary outcome measure was obtained from 100% of participants at four weeks. At 4 weeks, the mean treatment effect on passive range of wrist extension was 5.1 degrees,  $p = 0.09$ , (95% CI  $-0.9^\circ$  to  $11.1^\circ$ ), and there was no significant difference between groups for pain (mean 0.2 cm,  $p = 0.76$ , 95% CI  $-1.0$  to 1.3) or upper-limb function (mean 1.7,  $p = 0.1$ , 95% CI  $-0.37$  to 3.82). Four weeks of daily stretch of the wrist and finger flexors appears to have a small effect on prevention of contracture of these muscles in adults undergoing rehabilitation following stroke.

### Baseline profile of stroke survivors recruited for a randomised controlled trial investigating falls prevention

Hill K,<sup>1</sup> Said C,<sup>2,3</sup> Mackintosh S,<sup>4</sup> Whitehead C,<sup>5</sup> Batchelor F,<sup>1</sup> Pinfold M,<sup>1</sup> Fryer C,<sup>4</sup> Keller B<sup>4</sup> and Hunt, S<sup>1</sup>

<sup>1</sup>National Ageing Research Institute, Melbourne <sup>2</sup>Austin Health, Melbourne <sup>3</sup>University of Melbourne, Melbourne <sup>4</sup>University of South Australia, Adelaide <sup>5</sup>Flinders University, Adelaide

Previous research highlights the high risk of falling for people returning home after stroke, however, there has been little focus on prevention of falls. We are conducting a randomised controlled trial to evaluate a multi-factorial falls prevention program for stroke survivors who are at high risk of falling. Participants are recruited from five sites in Melbourne and Adelaide and included if they are over 50 years, and have had a fall in hospital or poor balance score. Baseline assessments are conducted shortly after discharge from rehabilitation, participants are then randomised to control or intervention group and followed up for 12 months. The first 56 participants have a mean age of 73 years. Five percent (3/56) of participants were unable to complete the Timed Up and Go (TUG) or 5 metre walk test (5mwt); one-third were unable to complete the Sit-to-Stand Test (STS) or the Step Test. Mean, standard deviation and range for the completed tests were TUG (single task)  $27.9 \pm 17.2$  seconds (6.7–81.0), 5mwt (comfortable pace)  $33.9 \pm 16.5$  m/min (7.1–85.7), STS  $22.2 \pm 7.9$  seconds (8.5–40.0). The median score for the Step Test was 3. Twenty-nine percent reported at least one fall between discharge and baseline assessment, 40% at least one fall during rehabilitation and one-third at least one fall in the 12 months prior to stroke. As expected, these participants had poorer performance on gait and balance tasks compared with similarly aged individuals. Falls are still a major problem for this group.

### Comparisons between treadmill and overground walking in stroke patients able to walk

Kuys S,<sup>1,2,3</sup> Brauer S<sup>1</sup> and Ada L<sup>4</sup>

<sup>1</sup>University of Queensland, Brisbane <sup>2</sup>Griffith University, Gold Coast <sup>3</sup>Princess Alexandra Hospital, Brisbane <sup>4</sup>University of Sydney, Sydney

Physiotherapists are concerned that the differences between treadmill and overground walking may harm walking quality, therefore we looked at whether one session of treadmill walking produced harmful effects on overground walking in people undergoing rehabilitation following stroke. A within-subject observational study involving two modes of walking was conducted. Twenty-one subjects with first stroke able to walk underwent ten minutes overground walking followed by ten minutes treadmill walking in a different session. Heart rates were matched. Subjects were grouped into better and poorer walkers based on Motor Assessment Scale Item 5 score. Measures of walking quality, spatial-temporal and kinematic gait variables, were taken pre and post each walking mode over an 8 m Gaitrite mat. Hip, knee and ankle joint measures were taken at stance and swing phases of gait via 2D posterior and lateral webcam system. The only significant differences between the two modes of walking were an increase in paretic limb step length (0.03 m) following overground walking, and an increase in knee extension ( $4^\circ$ ) at heel strike and ankle plantar flexion at toe-off ( $6^\circ$ ) following treadmill walking. Repeated measure analyses found increased paretic limb step length following overground walking ( $p = 0.004$ ) and increased nonparetic limb step length (0.02 m) following treadmill walking ( $p = 0.043$ ) for both better and poorer walkers. It appears that treadmill walking does not harm walking quality, gait spatial-temporal parameters, or joint kinematics compared to overground walking. It is feasible to use treadmill walking during inpatient rehabilitation to retrain walking in stroke patients able to walk.

### Comparison of neurological rehabilitation inpatients who attended or did not attend physiotherapy groups as part of their therapeutic intervention

Bahr F,<sup>1</sup> Connors K,<sup>2</sup> Holland A,<sup>3</sup> Mathieson S<sup>1</sup> and Winter A<sup>1</sup>

<sup>1</sup>Caulfield General Medical Centre (CGMC), Melbourne <sup>2</sup>Calvary Healthcare Bethlehem, Melbourne <sup>3</sup>La Trobe University, Melbourne

The aim of this study was to determine differences between neurological patients who participated in group therapy and those who did not; identify barriers to group participation, and to discover differences in outcomes. Prospective data collection was undertaken on all inpatient admissions (excluding spinal patients) into the neurological rehabilitation unit ( $n = 164$ ). Admission and discharge cognitive FIMs and weekly measures of mobility (Timed up and go, 10 m walk, 6-minute walk, mobility FIMs) were recorded. Patients had a mean age of 64.0 years (SD 17.1) and median length of stay 25.5 days (range 1–155 days). Seventy-five percent of patients attended groups ( $n = 123$ ), with no significant difference in diagnosis ( $p = 0.08$ ), age ( $p = 0.949$ ), physical measures at admission, nor in admission cognitive and mobility FIM scores between groups/no groups. However

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patients attending groups at week 1 (45%) had greater mobility FIMs ( $p < 0.001$ ), better physical measures ( $p < 0.05$ ) and a trend towards higher comprehension FIM scores ( $p = 0.08$ ) at admission. Greater improvement in walk/wheelchair FIMs ( $p = 0.027$ ) was demonstrated in those who attended groups, but length of stay was longer (median 27 days vs 17 days,  $p = 0.001$ ). Both groups demonstrated significant improvement in physical measures during their admission, but there was no difference in the magnitude of change. In the inpatient rehabilitation setting, these results show that lower level patients commence groups later than higher level patients, supporting the need for both individual and group treatment in neurological rehabilitation.

### Cardiorespiratory fitness assessment in people who have sustained a traumatic brain injury: a validation study

Hassett LM,<sup>1,2</sup> Harmer AR,<sup>2</sup> Moseley AM<sup>2</sup> and Mackey MG<sup>2</sup>

<sup>1</sup>Brain Injury Rehabilitation Unit, Liverpool Health Service, Sydney <sup>2</sup>The University of Sydney, Sydney

The primary aim of this study was to validate the modified 20-metre shuttle test against a symptom-limited treadmill test in adults who have sustained a traumatic brain injury. The secondary aim was to determine the applicability of these two fitness tests in the clinical setting. A single-sample validity study was carried out in a brain injury rehabilitation unit. Twenty-four community-dwelling adults with severe traumatic brain injuries; attended the unit for a familiarisation session, followed by a symptom-limited treadmill test and a modified shuttle test, on two separate days in random order. The treadmill test utilised an individualised protocol with a therapist-selected speed and increments in gradient every minute until volitional fatigue. The modified shuttle test commenced with a speed of 2.4 km/h, which increased progressively every minute until volitional fatigue. Four primary measures were assessed from both tests: peak oxygen uptake, peak heart rate, maximal velocity, and rating of perceived exertion. All participants completed the study. There were no adverse events. A high correlation was observed between the modified shuttle test and the treadmill test for the first three primary measures ( $r = 0.96$ ,  $r = 0.80$ ,  $r = 0.82$  respectively;  $p < 0.001$ ), but not for the fourth ( $r = 0.013$ ,  $p = 0.95$ ). Measurement of maximal velocity in each test allowed valid prediction of peak oxygen uptake. The modified shuttle test is a valid test of cardiorespiratory fitness in adults with a severe traumatic brain injury; and both the shuttle and treadmill tests have clinical relevance and utility.

### Does three months of intensive stretch reduce thumb web-space contractures in people with a neurological condition: a randomised controlled trial

Harvey L, De Jong I, Goehl G, Marwedel S

Rehabilitation Studies Unit, Northern Clinical School, Faculty of Medicine, University of Sydney, Sydney

The purpose of this single-blind randomised controlled trial

was to determine whether an intensive stretch program is effective for the reduction of thumb web-space contractures in people with neurological conditions. The thumb was chosen for pragmatic reasons as a model to explore the responsiveness of soft tissues to stretch administered regularly for three months. Forty-four patients (60 hands) with uni- or bilateral thumb web-space contractures and a neurological condition participated in the study. The median (quartile range) age and time since injury were 54 years (43–65) and four years (2–10), respectively. The thumbs of experimental hands were stretched into an abducted position with a splint for eight hours a day. The splint was regularly remoulded to ensure it maintained a stretch. The primary outcome measure was palmar abduction of the thumb carpometacarpal joint measured at the beginning and end of the study. This was measured by blinded assessors with a device which standardised torque. The mean treatment effect was  $1^\circ$  (95% CI  $-1^\circ$  to  $2^\circ$ ) indicating that regular and intensive stretch administered over three months does not reduce thumb web-space contractures in patients with neurological conditions. Interestingly, at the end of the study, 20 patients believed that the splint had increased the extensibility of their thumb web-space and 22 patients wanted to continue to wear the splint. This study adds to the growing number of clinical trials questioning the effectiveness of stretch for the treatment of contractures.

### Effect of mirror therapy on early post-stroke upper limb sensorimotor recovery: a randomised-controlled trial

Acerra NE,<sup>1,2</sup> Souvlis T,<sup>1</sup> S Brauer S<sup>1</sup> and Moseley GL<sup>3</sup>

<sup>1</sup>Division of Physiotherapy, The University of Queensland, Brisbane, Australia <sup>2</sup>Physiotherapy Department, Royal Brisbane and Women's Hospital, Brisbane, Australia <sup>3</sup>Department of Physiology, Anatomy & Genetics, Oxford University, Oxford, UK

The current study assessed the effectiveness of mirror-therapy versus sham-therapy on early post-stroke upper limb sensory and motor recovery in a randomised clinical trial. Forty acute stroke patients (< 14 days) were recruited from an acute hospital and randomly assigned into either mirror-therapy or sham (non-reflective surface) groups. Blinded assessments were performed at baseline, post-treatment and one-month post-intervention and included a quantitative sensory assessment (sensory detection, pressure-pain threshold, hot/cold sensation and pain) and motor assessment (grip strength and Motor Assessment Scale (MAS) items). During the intervention, both groups performed simple motor tasks and sensory stimulation progressed by complexity with both the affected and unaffected limbs. Participants in the mirror-therapy group watched the mirror image of the unaffected upper limb during intervention, with the affected limb hidden from view. Participants in the sham group were not able to view affected limb or a reflection of the unaffected limb. Results were analysed on an intention to treat basis. There was no difference in measures at baseline. Subjects who underwent mirror-therapy demonstrated an improvement in sensorimotor measures ( $p < 0.005$ ) that was maintained at the one-month follow-up. This included improved sensory detection, pressure-pain threshold, hot/cold sensation, grip

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strength, MAS scores and decreased resting pain intensity compared with the sham group. This is the first known RCT of mirror-therapy in a post-stroke population. The results of this study support the use of mirror-therapy in an acute stroke unit. Further research is needed to determine the optimum parameters of mirror-therapy and if it is equally effective when it is unsupervised.

### **Falls, fear of falling and balance and mobility impairment in chronic fatigue syndrome**

**Clarke J,<sup>1,2</sup> Lowchoy N<sup>2</sup> and Lynch M<sup>2</sup>**

<sup>1</sup>Physiotherapy Department, St Andrew's War Memorial Hospital, Brisbane. <sup>2</sup>Physiotherapy Department, School of Rehabilitation and Health Sciences, University of Queensland, Brisbane

Chronic fatigue syndrome (CFS) is classified as a neurological disorder and therefore warrants investigation from a motor control perspective. The aims of this two-part study were to investigate the incidence of falls and fear of falling and the balance and mobility function of people with CFS. A series of surveys were completed by 89 people with CFS. Fifty-one percent of the cohort reported a history of a fall occurring in the past six months, while thirty-nine percent were identified as recurrent fallers. A fear of falling was reported by 55% of CFS subjects. The mean Modified Falls Efficacy scale score for the cohort was 7.7. Dynamic Visual Acuity, postural stability, limits of stability, and gait of 14 CFS subjects and 20 healthy controls was assessed. Dynamic Visual Acuity was significantly reduced in CFS subjects ( $p = 0.003$ ). There were no significant differences between the groups for postural stability measures of bilateral stance, although there was a strong trending increase in sway velocity when CFS subjects stood on a firm surface with eyes closed ( $p = 0.018$ ). Slower reaction times when weight shifting in a mediolateral direction were demonstrated by CFS subjects ((R)  $p = 0.004$ , (L)  $p = 0.007$ ). CFS subjects walked significantly slower on the Timed Up and Go ( $p = 0.001$ ) and 10 m walk tests ( $p < 0.01$ ). Falls in CFS may be related to reduced mediolateral stability and vestibular dysfunction. These findings may have implications for physiotherapy intervention for sufferers of CFS.

### **Feldenkrais method balance retraining classes: a qualitative analysis of class content**

**Connors KC,<sup>1,2</sup> Said CM<sup>1</sup> and Galea MP<sup>1</sup>**

<sup>1</sup>Rehabilitation Sciences Research Centre, University of Melbourne, Melbourne <sup>2</sup>Calvary Health Care Bethlehem, Melbourne

Feldenkrais method balance classes have been found to be effective in improving balance, but there has been little research into the content of these classes. This study used qualitative research methodology to investigate 16 Feldenkrais method balance training classes which have been recorded to CD (the 'Getting Grounded Gracefully' series). An enumerative qualitative methodological approach was used, as a sample of data that had already been produced was being analysed. The lessons were transcribed, summarised as movement tasks and coded according to a set of themes. The themes were developed

from an analysis of the data, in conjunction with findings from the literature in the fields of motor skill acquisition and postural control. A selection of the lessons was coded independently by two researchers. The same themes were identified by both researchers. The analysis revealed that the classes used motor skill acquisition elements of internal feedback, repetition and variability of practice using an exploratory learning approach. Postural control skills of intersegmental coordination of ankle/hip/trunk synergies were practised in anterior/posterior, mediolateral, diagonal, rotational and circular directions. Additional themes of body awareness and balance confidence also emerged from examination of the data. In conclusion, the classes contained many elements consistent with current theories of motor skill acquisition and postural control.

### **How active are stroke patients during physiotherapy sessions? A comparison of circuit class therapy and individual therapy sessions**

**Elson T, English C and Hillier S**

University of South Australia, Adelaide

The time spent practising a motor task is a major determinant of the level of skill achieved, and increased levels of physical activity have been shown to facilitate recovery post stroke. If circuit class therapy is to be an effective alternative model of physiotherapy service delivery, it must involve a high level of patient activity. This study compared patient activity levels during circuit class therapy and individual physiotherapy sessions during inpatient stroke rehabilitation. Twenty subjects receiving inpatient stroke rehabilitation at Hampstead Rehabilitation Centre were videotaped during one circuit class and one individual physiotherapy session. The videotapes were analysed to determine the time patients spent active using the videotape time-clock and strict definitions of active and inactive. Preliminary results from 3 subjects show that in individual physiotherapy sessions, patients spent a mean of 24.5 minutes active (93.9% of the total session time). In circuit classes, patients spent a mean of 41.6 minutes active (83.5% of the total session time). Preliminary results from this study suggest that patients spent a greater percentage of individual sessions, as compared with circuit class therapy sessions, engaged in physical activity. However, circuit class therapy sessions ran for a longer time each day, resulting in a greater total time spent active in these sessions. If circuit class therapy is to be taken up as an alternative model of physiotherapy service delivery, it is important that effective strategies are implemented to maximise the time that patients spend actively engaged in task practice.

### **Increasing the cardiovascular demand of treadmill walking for stroke patients: the impact on gait parameters and walking quality**

**Kuys S,<sup>1,2,3</sup> Brauer S<sup>1</sup> and Ada L<sup>4</sup>**

<sup>1</sup>University of Queensland, Brisbane <sup>2</sup>Griffith University, Gold Coast <sup>3</sup>Princess Alexandra Hospital, Brisbane <sup>4</sup>University of Sydney, Sydney



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The aim of this study was to investigate if increasing cardiovascular demand during treadmill walking adversely affected gait in stroke patients able to walk. Eighteen subjects undergoing rehabilitation walked at predetermined heart rates equivalent to 30%, 40%, 50% and 60% heart rate reserve, the minimum intensity capable of improving cardiorespiratory fitness. Main outcomes were kinematic gait variables and visual analysis of walking quality. A 2D posterior and lateral webcam system was used to record 10 gait cycles at each cardiovascular demand during treadmill walking. Spatial-temporal and kinematic measures were taken at stance and swing phases of gait, and visual gait analysis used the Wisconsin Gait Scale and a visual analogue scale. Additional spatial-temporal measures were taken pre and post treadmill walking over an 8m Gaitrite mat. An increased step length was found for both paretic (0.06m) and nonparetic (0.09m) limbs walking on the treadmill at 60% compared to 30% demand ( $p < 0.01$ ). Greater hip ( $3^\circ$ ) and knee ( $4^\circ$ ) flexion during mid-stance ( $p < 0.01$ ) and increased knee flexion ( $4^\circ$ ) at toe-off ( $p = 0.02$ ) was also found at 60% compared to 30% demand. No differences were found for other variables. Visual gait analyses showed no difference across the demand levels. Treadmill walking at increasing cardiovascular demands results in some favourable and unfavourable differences in gait spatial-temporal and kinematic variables although these differences were not detectable using visual scales. It is feasible to use treadmill walking during inpatient rehabilitation to retrain walking capacity in stroke patients able to walk without compromising gait quality.

### Is amount of physical activity undertaken in the community after stroke dependent on walking ability?

Alzahrani M, Ada L and Dean C

*University of Sydney*

The aim of this study was to examine whether the amount of physical activity undertaken by people living with stroke is determined by their walking ability. A prospective descriptive study was carried out on community-dwelling people who were over 50 years old, between 1–5 years of first ever stroke, and who were able to walk 10 m in bare feet independently. Walking ability was measured as velocity during 10 m walk test in minutes and distance during the 6-minute walk test in metres. Physical activity was measured using an activity monitor (the Intelligent Device for Energy Expenditure and Activity) as number of steps taken, distance covered, and calories expended. Physical activity was measured over 2 days that were randomly allocated. Participants were instructed to follow their normal daily routine. Data were analysed using simple linear regression to examine the relationship between walking ability and physical activity. The relation between walking ability and physical activity ranged from  $r = -0.51$  to  $0.10$ ,  $p = 0.30$ – $0.95$ . In other words, the amount of physical activity undertaken may be determined by factors other than walking ability. These factors will be explored in a subsequent study.

### Keeping patients in clinical trials: how was it done?

Quah D,<sup>1</sup> Collier JC,<sup>1</sup> Purvis T<sup>2</sup> and Bernhardt J<sup>1,3</sup>

<sup>1</sup>National Stroke Research Institute, Melbourne <sup>2</sup>Austin Health, Melbourne <sup>3</sup>School of Physiotherapy, La Trobe University, Melbourne

All high quality clinical trials aim to retain at least 85% of recruited patients through to follow-up. This was a key objective when conducting A Very Early Rehabilitation Trial (AVERT) for stroke patients, a pilot multi-centre, randomised controlled trial. Between March 2004 and Feb 2006, 71 patients admitted within 24 hours of confirmed stroke presenting to two metropolitan stroke units were recruited. Subjects were randomised into either very early rehabilitation ( $n = 38$ ) or routine care ( $n = 33$ ). Forty-six percent required third-party consent. Early rehabilitation provided by a physiotherapist/nurse team, commenced day zero and continued for up to 14 days. Assessments were conducted by a blinded assessor at days 7, 14 and 3, 6 and 12 months. Assessments were completed at face-to-face interviews in 95% of cases. Although 17 patients died by 12 months follow-up (a trial outcome), only 2 patients were lost to follow-up at 12 months post stroke, resulting in a 97% retention rate. In addition to the use of face-to-face assessments, strategies that we believe contributed to these excellent retention rates include: recording of subjects' contact details, contact details of their GP, and those of a friend/relative not living with them. Dedicated trial staff ensured that consenting patients and their families had a clear understanding of trial commitments; helped optimise research-patient rapport; maintained flexible assessment times and organised follow-ups at locations to best suit the patients and their families. Unlike many clinical trials, these results indicate that high retention rates can be achieved.

### Measuring the normal balance responses to galvanic vestibular stimulation in standing postures that involve the upper limb

McLoughlin JV,<sup>1</sup> Mochova M<sup>2</sup> and Day BL<sup>2</sup>

<sup>1</sup>Department of Rehabilitation and Aged Care, Flinders University, Adelaide <sup>2</sup>Sobell Department of Motor Neuroscience and Movement Disorders, Institute of Neurology (Queen Square), University College London, London, United Kingdom

Galvanic vestibular stimulation (GVS) is a technique of applying a small percutaneous electrical stimulus behind the ears to modulate firing of vestibular afferents. In normal subjects, the standing postural response to this stimulus is a compensatory body sway in the direction of the anodal ear. The aim of this study is to measure the whole-body motor behaviour to GVS in standing positions that involve the upper limb. We investigated 15 normal subjects in 5 different standing conditions, analysing body sway distance and velocity via infrared markers. Feet and hand forces were also measured via force plates and force handles. In all 5 standing positions there was a GVS-evoked lateral postural response. Results reveal significant changes in the whole body response when comparing positions. We can confirm that the upper limb can be included as part of the functional



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GVS-evoked whole body response. Corresponding changes in forces at the hand and feet illustrate how the balance system is able to redistribute the force response between the upper and lower limbs. We were also able to demonstrate how sensory information via fingertip touch can drastically alter the GVS response even though the hand in this position was unable to generate significant lateral forces. This study reveals the way in which the upper limb can play an important part in the vestibular control of balance, by providing useful sensory information, as well as producing forces that may be needed to maintain balance.

### Methods used by physiotherapists to assess knee proprioception in stroke

Piriyaprasarth P,<sup>1</sup> Morris ME,<sup>1</sup> Winter A<sup>2</sup> and Paratz J<sup>3</sup>

<sup>1</sup>The University of Melbourne, Melbourne <sup>2</sup>Caulfield General Medical Centre, Melbourne <sup>3</sup>Burns, Trauma & Critical Care Research Centre, The University of Queensland

Proprioception assessment is an integral part of neurological assessment in stroke. The purpose of this study was to examine the procedures used by physiotherapists to assess proprioception of the knee joint in stroke. A postal survey was conducted in 2005 with the members of the National Neurology Group of the Australian Physiotherapy Association. A 63% response rate was achieved from the 517 participants. Their work experience ranged from new graduates (less than two years) to over 20 years. Most physiotherapists assessed both joint position sense and joint movement sense. Proprioception assessment of the knee joint was usually performed in the supine position (43%), followed by sitting (26%) and standing (17%). Most respondents assessed proprioception of the knee joint (38.2%) with fewer examining proprioception of the hip (11.9%), ankle (26%) or toe (22.8%). Proprioception assessment of the knee joint was completed with the patients' eyes closed. The protocol adopted by physiotherapists included moving the affected limb and asking the stroke patients to verbally respond to the direction of movement. Another strategy was to ask patients to replicate the movement or position of the affected limb with their unaffected limb. Joints were usually moved three to 10 times with five repetitions most often chosen. One strategy to reduce error in assessment was handling the affected limb with minimal contact at the bony prominences. This minimises cutaneous feedback that could have confounded the results. Using a standardised protocol may enhance the consistency of the assessment.

### Outcome measures for community rehabilitation teams

Comans TA,<sup>1,2</sup> Hillier S<sup>3</sup> and Sutton M<sup>3</sup>

<sup>1</sup>The University of Queensland <sup>2</sup>Community Rehabilitation Service, Southside HSD, QHealth <sup>3</sup>The Centre for Allied Health Evidence, University of South Australia

Outcome measures are necessary to measure the outputs of community rehabilitation services, however problems with efficiency and effectiveness of outcome measures occur when: outcome measures are chosen ad hoc, not according to the best available evidence, teams use many different measures to measure the same outcome and

training in application of measures is not standardised. This project's aim was to increase the knowledge base of health professionals in the use and application of outcome measures for community rehabilitation. In particular, it aimed to review appropriate outcome measures as they relate to the activities of six community rehabilitation services across Queensland. The project specifically investigated measures used by physiotherapists, speech pathologists and occupational therapists within community rehabilitation teams with a stroke focus. However a variety of non-discipline specific measures, which gauge patient outcomes such as quality of life were also investigated. These measures have application across a wide range of multidisciplinary community teams. Measures were chosen from a systematic literature review conducted by the Centre for Allied Health Evidence (CAHE), University of South Australia. The measures were further refined by review of psychometric properties and usefulness by the CAHE with a reference committee of clinicians drawn from the community rehabilitation teams. After identification of the measures, a compendium and training package in the measures was developed. This project has standardised outcome measures used across community rehabilitation teams in a variety of geographical settings.

### Plasticity of peripheral nerve function following spinal injury

Boland RA,<sup>1,4</sup> Lin CS-Y,<sup>1</sup> Krishnan AV,<sup>1</sup> Engel S<sup>3</sup> and Kiernan MC<sup>1,2</sup>

<sup>1</sup>Spinal Injuries Research Centre-Prince of Wales Medical Research Institute, Sydney <sup>2</sup>Prince of Wales Clinical School-University of New South Wales, Sydney <sup>3</sup>Spinal Injuries Unit-Prince of Wales Hospital, Sydney <sup>4</sup>Faculty of Health Sciences, Discipline of Physiotherapy, University of Sydney

There is emerging evidence that functional changes occur in peripheral motor axons following spinal cord injury (SCI). This is contrary to the prevailing model for SCI. Changes that have been recently observed include increases in threshold, and reduction in amplitudes of compound motor action potentials. It remains unclear however, whether these changes occurred in the acute or subsequent stages after injury. To investigate the timing of changes, prospective studies are being undertaken in patients within 14 days of acute SCI. Motor nerve excitability is formally assessed using threshold tracking techniques to measure axonal excitability parameters (stimulus-response curves, strength-duration properties, threshold electrotonus, a current-threshold relationship and the recovery cycle) of motor axons in the common peroneal nerve to tibialis anterior. Seven patients with SCI at T8 or above have been studied, and compared with 25 control subjects. Relative to control data, responses were suggestive of depolarisation, particularly threshold electrotonus, which was significantly 'fanned in'. During the recovery cycle, superexcitability was reduced (SCI  $-11.23\% \pm 2.15\%$ , controls  $-19.31\% \pm 1.31\%$ ) and refractoriness was increased (SCI  $79.61\% \pm 21.6\%$ , controls  $37.13\% \pm 3.83\%$ ). In two patients with T8 lesions, lower limb axons were completely inexcitable. These data demonstrate that changes in excitability of peripheral motor axons occur early after SCI while patients are still

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in intensive care, and have implications for the validity of current models of nerve function after SCI. Whether these changes are reversible is the focus of follow-up studies.

### Progressive decline in the gait and balance performance of non-disabled multiple sclerosis patients in the absence of clinical relapse

Martin CL,<sup>1</sup> Phillips BA,<sup>2</sup> Galea MG,<sup>1</sup> Kilpatrick TJ<sup>3</sup> and Butzkueven H<sup>3</sup>

<sup>1</sup>The University of Melbourne, Melbourne <sup>2</sup>La Trobe University, Melbourne <sup>3</sup>Royal Melbourne Hospital, Melbourne

This study investigated changes in the gait and balance performance of newly diagnosed, non-disabled multiple sclerosis patients over a 12-month period. Thirty-eight subjects with multiple sclerosis participated in laboratory-based gait and balance assessments, and clinical neurological examinations at baseline and one year. During the follow-up period three subjects experienced a clinical relapse, while 35 subjects remained clinically stable, as judged by an experienced neurologist. At the one-year assessment, each of the relapsing subjects demonstrated a reduction in self-selected speed and stride length and increased double limb support time during gait, and a decreased Functional Reach Test score, compared to baseline. Comparison of the baseline and one-year gait and balance measures for the non-relapsing subjects indicated that these subjects also experienced a deterioration in performance, represented by a significant decrease in self-selected speed ( $p < 0.001$ ) and stride length ( $p < 0.001$ ) and increased double limb support time during gait ( $p = 0.01$ ), and a decreased Functional Reach Test score ( $p < 0.001$ ). The non-relapsing subjects also demonstrated reduced ankle motion throughout the gait cycle which corresponded to a decrease in the amplitude of gastrocnemius activity recorded during the stance phase of gait. These results provide evidence of disease progression in newly diagnosed multiple sclerosis subjects, even in the absence of acute clinical relapse and change in clinical status as evaluated during a standard neurological examination. The outcomes of this study may have implications for the clinical management of newly diagnosed multiple sclerosis patients, particularly in relation to physiotherapy.

### Relationship of clinical measures of walking to step activity monitoring

Mudge S and Stott NS

The University of Auckland, Auckland, New Zealand

The aim of this study was to examine the relationship of the output of the StepWatch Activity Monitor (SAM) with common clinical measures of walking. Sixteen subjects more than six months post stroke were recruited. Subjects attended one clinic session where the following tests were administered: Rivermead Mobility Index, 6-minute walk test (6MWT), self-selected gait speed and the Rivermead

Motor Assessment. Subjects then wore a SAM for a total of six days over a 10-day period. The subjects took an average of 3369 strides a day with a wide range (772–10068) and a large standard deviation (2195) of strides across the group. There were significant correlations between SAM outputs and self selected gait speed ( $r = 0.559$ – $0.705$ ) and between SAM outputs and the 6MWT ( $r = 0.501$ – $0.814$ ). In particular, both self-selected gait speed and the 6MWT were most strongly correlated with the highest activity in one minute, the total number of steps, the number of steps at a high rate and the peak activity index (highest step rate over 30 non-continuous minutes). There were no significant correlations between SAM outputs and the Rivermead Mobility Index and only one significant correlation between SAM outputs (highest activity in one minute) and the Rivermead Motor Assessment ( $r = 0.563$ ). Both self selected gait speed and the 6MWT were significantly correlated with usual walking performance as measured by the SAM, although the 6MWT had a greater number of significant correlations than self selected gait speed tested over a shorter distance.

### Reliability and normative values for the AsTex™ in healthy subjects

Miller KJ,<sup>1</sup> Wheat HE,<sup>2</sup> Phillips BA,<sup>3</sup> Martin CL,<sup>1</sup> Goodwin AW<sup>2</sup> and Galea MP<sup>1</sup>

<sup>1</sup>School of Physiotherapy and the Rehabilitation Sciences Research Centre, University of Melbourne, Melbourne <sup>2</sup>Department of Anatomy and Cell Biology, University of Melbourne, Melbourne <sup>3</sup>Faculty of Health Sciences, La Trobe University, Melbourne

Appreciation of the surface texture of objects has been shown to be an important factor in hand function. The AsTex™ is a new instrument that was developed to assess hand texture discrimination capabilities and requires less than 5 minutes to administer. The aims of this series of studies were to investigate the test-retest and inter-rater reliability in neurologically normal subjects, and to establish normative ranges for texture discrimination values using the AsTex™. Test-retest reliability of the AsTex™ was found to be excellent (ICC = 0.98 (95% CI 0.97–0.99)) when the same examiner assessed 31 subjects on 2 occasions separated by a week. The standard error of measurement was 0.03 mm, representing less than 5% of the mean texture discrimination value. Inter-rater reliability of the AsTex™ was also found to be excellent (ICC = 0.81 (95% CI 0.73–0.87)) when 3 examiners assessed 31 subjects on a single testing occasion; however standard error of measurement rose to 0.13 mm, representing 20% of the mean texture discrimination value. Normative data, stratified by gender and age, were collected in 90 subjects aged 18–80 years. There was a trend for texture discrimination values to rise (indicating poorer sensory discrimination) after the 4<sup>th</sup> decade. Subjects aged 70 years or older had significantly higher texture discrimination values than younger subjects ( $p < 0.001$ ). The AsTex™ is a reliable instrument for quantifying hand sensation capabilities. The age-stratified normative data will facilitate the interpretation of AsTex™ assessment findings in clinical populations.

## FREE PAPERS – continued

### Reliability and responsiveness of a new tool, the pre-functional upper limb test, for upper limb recovery following stroke

Luke C,<sup>1</sup> Brock K<sup>1</sup> and Cotton S<sup>2</sup>

<sup>1</sup>St Vincent's Health, Melbourne <sup>2</sup>Melbourne University, Melbourne

This preliminary investigation aims to determine if a new measurement tool, the Pre-functional Upper Limb Test (PreFULT), is a reliable and responsive measure of upper limb recovery following stroke in patients with very poor arm function. In addition this study aims to acquire the necessary data (effect size) to develop a protocol for a randomised control trial. Ten participants from an in-patient and out-patient rehabilitation centre were recruited to the study. The primary outcome measure was the PreFULT and the secondary outcome measure was the Motor Assessment Scale upper limb section. A repeated measure within subject design was utilised consisting of three pre-intervention measurements during a 10-day baseline period and a post intervention measurement following a 10-day intervention period. Intervention consisted of six additional one hour physiotherapy sessions based on the Bobath concept. A one-way repeated measures analysis of variance was conducted to determine whether there was a difference in Pre FULT scores over the four time points. The PreFULT was found to have high test-retest reliability (Pearsons  $r$ , 0.96) and stability (paired  $t$  test,  $p = 0.4$ ). Results found the difference was significant, ( $F(3,27) = 11.74$ ,  $p < 0.001$ ), with post hoc analysis indicating that the mean score at time 4 was significantly higher than that at all other time points, all  $p < 0.01$ . These preliminary results suggest that the Pre-Functional Upper Limb Test may be a useful measure for testing the efficacy of interventions to improve upper limb recovery in patients following stroke.

### Serial casting for the treatment of elbow contractures in adults with traumatic brain injury: a randomised controlled trial

Moseley AM,<sup>1</sup> Hassett LM,<sup>1,2</sup> Leung J,<sup>3</sup> Clare JS,<sup>4</sup> Herbert RD<sup>1</sup> and Harvey LA<sup>5</sup>

<sup>1</sup>Discipline of Physiotherapy, University of Sydney, Sydney <sup>2</sup>Brain Injury Rehabilitation Unit, Liverpool Health Service, Sydney <sup>3</sup>Brain Injury Rehabilitation Unit, Royal Rehabilitation Centre Sydney, Sydney <sup>4</sup>Brain Injury Rehabilitation Unit, Westmead Hospital, Sydney <sup>5</sup>Rehabilitation Studies Unit (Medicine), University of Sydney, Sydney

The aim of this randomised controlled trial was to compare serial casting with one hour of daily stretch for the treatment of elbow flexion contracture after traumatic brain injury. Twenty-six adults with elbow flexion contracture after traumatic brain injury participating in multidisciplinary inpatient rehabilitation were recruited, and all subjects completed the study. Subjects were randomised to receive either serial casting or a program of one hour of daily stretch for two weeks. During the four-week follow-up period all subjects received one hour of daily stretch. Outcomes were measured at baseline, after two weeks, then one day and four weeks later. The primary outcome was passive elbow extension using a torque-controlled procedure. At two weeks, serial casting reduced contracture by an average of 22° (95% CI 13–31) compared to the stretch group. One day later this

effect had decreased to 11° (95% CI 0–21). The effect had almost completely disappeared at the four-week follow-up (mean 2°, 95% CI –13 to 17). Serial casting produces greater short-term reductions in elbow flexion contracture than a program of one hour of stretch per day in adults with traumatic brain injury, but these effects are not sustained. Future research could determine if administration of a more aggressive stretching protocol in the period following cast removal could maintain the increase in joint range.

### The effect of Achilles tendon vibration on gait performance in ambulatory stroke patients

Hsu LJ, Lin SI and Wang HC

Department of Physical Therapy, College of Medicine, National Cheng Kung University, Tainan, Taiwan

Gait asymmetry is often seen in stroke patients even after intensive rehabilitation. Thus, developing new effective intervention is necessary. Somatosensory inputs have been shown to regulate locomotion and thus could potentially enhance gait performance post stroke. Muscle or tendon vibration can selectively activate muscle spindles and induce changes in joint movement and muscle activation during gait in healthy adults. The purpose of this study was to investigate if and how Achilles tendon vibration would alter the gait performance of stroke patients. Eight stroke patients participated and walked on a pressure sensor walkway at their comfortable speeds normally (NORM), and then with the affected Achilles tendon vibrated (VIB). Stride characteristics of the affected side and asymmetry ratio (affected side/unaffected side) were compared with paired  $t$  tests to determine the effect of vibration. It was found that patients were characterised by prolonged affected swing time, with the swing time asymmetry ratios being  $1.16 \pm 0.24$  and  $1.14 \pm 0.22$  in NORM and VIB, respectively. The step and swing time ( $0.76 \pm 0.17$  sec and  $0.50 \pm 0.09$  sec) in VIB was significantly shorter than in NORM (step time:  $0.79 \pm 0.16$  sec; swing time:  $0.53 \pm 0.10$  sec). Between-condition differences in other variables were non-significant. These findings show that additional proprioceptive stimulations during walking significantly shortened the affected swing time and thus yielded a more symmetrical gait pattern. These findings indicate that Achilles tendon vibration had immediate beneficial effect for locomotion control for stroke patients. Thus, tendon vibration could potentially be an effective intervention and deserves further investigations to determine its long term effect.

### The effects of progressive resistance training on strength in people with spinal cord injuries: a randomised controlled trial

Glinsky J,<sup>1</sup> Harvey L,<sup>1</sup> Korten M,<sup>2</sup> Drury C<sup>3</sup> and Gandevia S<sup>4</sup>

<sup>1</sup>Rehabilitation Studies Unit, Faculty of Medicine, University of Sydney, Sydney <sup>2</sup>School of Physiotherapy, Faculty of Health Science, Maastricht University, Netherlands <sup>3</sup>Department of Physiotherapy, Hampstead Rehabilitation Centre, Adelaide <sup>4</sup>Prince of Wales Medical Research Institute, Sydney

Whilst the optimal strengthening protocols for the fully



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innervated muscles of able-bodied individuals are well understood, little is known about the most effective way to increase the strength of the partially paralysed muscles in people with spinal cord injuries. The aim of this single blind randomised controlled trial was to determine the effectiveness of an 8-week program of progressive resistance training. Thirty-two spinal cord injured patients with between grade 1/5 and grade 4/5 muscle strength in the wrist extensor or flexor muscles were recruited. Participants were randomly allocated to the experimental (strength training) or control (no training) group. The wrist muscles of one hand of experimental subjects were trained three times a week for 8 weeks. The control group received no intervention. The primary outcome was maximal voluntary strength. The secondary outcomes were endurance and the Canadian Occupational Performance Measure. Measurements were taken at the commencement and end of the eight-week treatment period by a blinded assessor. The mean treatment effect (95% confidence interval) of progressive resistance training was 0.2 Nm (95% CI -0.4 to 0.8). Eight weeks of progressive resistance training does not increase strength in the partially-paralysed wrist muscles of people with spinal cord injuries.

### **The effectiveness of electrical stimulation for increasing muscle strength in people with neurological conditions: a systematic review**

**Glinsky J,<sup>1</sup> Harvey L<sup>1</sup>  
and Van Es P<sup>2</sup>**

<sup>1</sup>Rehabilitation Studies Unit, Faculty of Medicine,  
University of Sydney, Sydney <sup>2</sup>School of Physiotherapy,  
Faculty of Health Science, Maastricht University,  
Netherlands

Weakness in partially paralysed muscles is a disabling impairment for people with neurological conditions. Strength-training programs are widely administered to address this impairment. There is a common belief that the effectiveness of strength-training programs can be enhanced by the addition of electrical stimulation. The purpose of this systematic review was to assess the efficacy of electrical stimulation for increasing voluntary strength in people with neurological conditions. Eligible randomised trials of electrical stimulation were identified by searches of computerised databases. The search yielded 11267 abstracts of which 63 were retrieved. Two assessors independently reviewed full text versions of these articles. Eighteen studies satisfied the inclusion criteria. These studies involved participants with spina bifida (n = 1), cerebral palsy (n = 1), peripheral nerve lesion (n = 1), multiple sclerosis (n = 1), spinal cord injury (n = 3) and stroke (n = 11). The mean (SD) PEDro score for trial quality was 5 (1) out of 10. Meta-analyses of studies involving similar patients were not done because of insufficient data or lack of homogeneity. The results of all studies were analysed individually. Several studies suggest a modest beneficial effect of electrical stimulation in patients who had had a stroke. It is not clear whether patients with other types of neurological disabilities benefit from electrical stimulation in the same way.

### **The relationship between quality of life and ICF components of function and disability for people with spinal cord injury**

**Barker R,<sup>1,2</sup> Pershouse K,<sup>1</sup> Kendall M<sup>1</sup> and Amsters D<sup>1</sup>**

<sup>1</sup>Spinal Outreach Team, Queensland Spinal Cord Injuries Service,  
Brisbane <sup>2</sup>James Cook University, Townsville

The purpose of this study was to investigate the relationship between quality of life and ICF components of function and disability across the lifespan, for people with spinal cord injury in Queensland, Australia. A cross-sectional analysis of the first year of data in a longitudinal study on spinal cord injury was undertaken. A random sample of 270 individuals who sustained spinal cord injury during the last 60 years was surveyed using a guided telephone interview format. The sample was drawn from the Princess Alexandra Hospital Spinal Injuries Unit archival records. Quality of life was measured using the WHO Qol-8. Impairment was measured according to the ASIA classification and the Secondary Condition Surveillance Instrument. Activity limitations were measured using the Clinical Outcome Variables Scale. Participation restrictions were measured using the Community Integration Measure. Lifespan was considered in terms of age and time since injury. Regression analyses were employed to determine the relationship between quality of life and components of disability across the lifespan. The results revealed that perceived quality of life was not significantly different according to age or time since injury. The single most important predictor of quality of life was the presence of secondary conditions while the second most important predictor was the extent of participation. These findings suggest that rehabilitation services must focus on minimising secondary conditions and enhancing societal participation in order to optimise quality of life across the lifespan for people with SCI in Queensland.

### **The relationship between clinical measures of handgrip limitation and impaired pinch grip force control following stroke**

**Blennerhassett JM,<sup>1,2,3</sup> Carey LM<sup>2,3</sup> and Matyas TA<sup>2</sup>**

<sup>1</sup>Austin Health: Royal Talbot Rehabilitation Centre, Melbourne <sup>2</sup>  
La Trobe University, Melbourne <sup>3</sup>National Stroke Research Institute,  
Melbourne

This study aimed to explore whether handgrip limitation measured by clinical tests related to impaired pinch grip force control measured by laboratory tests post-stroke. Handgrip ability for 45 people with stroke who had residual grip ability was contrasted to that of 45 healthy adults matched for age, gender and hand dominance. Handgrip ability was measured using items from the Jebsen Hand Function Test, Motor Assessment Scale, Functional Independence Measure (FIM) and a custom-designed self-report of hand use during daily tasks. The laboratory-based investigation of pinch grip, lift and hold revealed that impaired pinch grip force control following stroke could be represented by two principal components: Pre-



## FREE PAPERS – continued

Lift Delay, and Grip Force Dyscontrol. The relationships between performance for the clinical tests and pinch grip force control were analysed using Spearman Rho. With the exception of the FIM item, performance during the clinical tests identified handgrip limitation in 40–91% of the stroke participants. Pre-Lift Delay was moderately to strongly related to handgrip limitation recorded on each clinical test ( $r_s = 0.70$ – $0.85$ ) except for the FIM item ( $r_s = 0.38$ – $0.49$ ). In contrast, Grip Force Dyscontrol was not associated with performance during any of the clinical tests ( $r_s = -0.08$  to  $0.18$ ). Impaired ability to apply and adapt pinch grip force to achieve the initial grip-lift phase contributes to handgrip limitation following stroke. Use of clinical tests that specifically measure grip-related ability, and training of grip force control during grip-lift are recommended during stroke rehabilitation.

### The stride length sequence effect interaction: a determinant of freezing during walking in Parkinson's disease

Danoudis M,<sup>1</sup> Ianse R,<sup>1</sup> Murphy A,<sup>1</sup> Chee R,<sup>2</sup> and Georgiou-Karistianis N<sup>2</sup>

<sup>1</sup>Geriatric Research Unit, Kingston Centre Southern Health, Melbourne, Australia <sup>2</sup>School of Psychology, Psychiatry and Psychological Medicine, Monash University, Clayton, Victoria, Australia.

Freezing of gait in Parkinson's disease results in decreased mobility, increased risk of falls, increased mortality and a loss of independence. The pathophysiology of freezing of gait in Parkinson's disease remains unclear however a reduction in the background step length and the presence of the sequence effect (step-to-step reduction in amplitude) have been reported to be associated with freezing of gait episodes. It was hypothesised that participants with Parkinson's disease who had a significant sequence effect (measured as a regression slope) would experience freezing of gait more frequently at reduced step lengths. Twenty participants with Parkinson's disease were separated clinically into a freezing group ( $n = 10$ ) and non-freezing ( $n = 10$ ) group, with ten age-matched control participants. All participants were tested walking at their preferred step length, then at step lengths that were set at 100%, 75%, 50% and 25% of their normalised step length. Participants with Parkinson's disease who had a large average regression slope in the 75%, 50% and 25% conditions experienced more freezing episodes in the 50% and 25% conditions. There was no significant difference between the regression slopes for the participants with Parkinson's disease who did not freeze and those in the control group, indicating the reduced step length and the sequence effect may have led to the occurrence of freezing of gait. These findings support the possible dual requirement of a reduced step length and a successive step-to-step amplitude reduction to lead to freezing of gait.

### The physiotherapy pill: can clinicians provide a specified dose in a clinical trial?

Collier JC,<sup>1</sup> and Bernhardt J<sup>1,2</sup>

<sup>1</sup>National Stroke Research Institute, Melbourne <sup>2</sup>La Trobe University, Melbourne

Rehabilitation clinical trial quality is frequently affected by inadequately defined and recorded therapy dose. During a pilot multi-centre, randomised controlled trial of very early rehabilitation (AVERT) for stroke patients, subjects were randomised to receive either very early rehabilitation or standard care. An important aim of the trial was to evaluate whether the specified therapy dose was achieved. From March 2004 to February 2006, 71 patients admitted within 24 hours of confirmed stroke presenting to Austin and St. Vincent's Hospitals were recruited. Very early rehabilitation commenced at day zero and included an additional, specified dose of physiotherapy. Intervention was delivered daily from Monday to Friday for up to 2 weeks or until discharge (whichever was sooner). Standard care was usual physiotherapy stroke unit care. Physiotherapy dose data were collected on personal digital assistants (PAs). We recorded the number of minutes per session and the number of sessions per day over the intervention period. Therapist data were examined after 7 months, with dose data fed back to intervention therapists. After feedback, the intervention was consistently delivered more frequently, resulting in a higher total dose. This new level of therapy complied with the specified therapy dose outlined in our protocol. Our results indicate that monitoring and feedback to physiotherapists is critical to achieve high quality trial interventions.

### Timed up and go, 10-metre walk and the 6-minute walk tests: walking ability at discharge in a non-traumatic spinal cord injured population

Sturt R, New P and Holland A

Caulfield General Medical Centre, Bayside Health, Melbourne

The walking ability of patients with spinal cord injury has a significant impact on their functional status at discharge from inpatient rehabilitation. Walking tests such as the Timed Up and Go, the 10-metre walk test and the 6-minute walk test help physiotherapists to evaluate patients' walking abilities throughout their rehabilitation. The purpose of this study was to utilise these tests to evaluate and describe the walking abilities of non-traumatic spinal cord injured patients during inpatient rehabilitation. A database was established to document demographic information, admission American Spinal Injury Association scores; the patient's capacity to walk; and initial and discharge Timed Up and Go, 10-metre walk and 6-minute walk scores. Functional Independence Measure scores (physical domain subscale scores) were also recorded at both admission and discharge. Data from sixteen subjects who completed

their inpatient rehabilitation demonstrated that ten (62%) regained some ability to walk. Subjects able to walk also improved from their initial Timed Up and Go, 10-metre walk and 6-minute walk scores resulting in discharge scores of 26.1 sec (range 12.3–39.7 sec), 25.4 sec (range 10.2–53.0 sec) and 227 m (range 146–350 m) respectively. These results compare favourably with a study by van Hedel (2005) of 22 traumatic and ischaemic SCI inpatients. This information may prove valuable not only to physiotherapists in evaluating individual patient's walking performance but to the rest of the multidisciplinary team in assessing overall burden of care and discharge planning. It may also be useful in determining resource allocation and costs such as gait aids, orthoses and wheelchairs.

**Gaze instability, dizziness handicap, and reduced community ambulation require physiotherapy preventive interventions during conservative management of people with vestibular Schwannoma**

Low Choy N,<sup>1</sup> Conaghan C,<sup>1</sup> Panizza B<sup>2</sup>  
and Rothwell-Brown D<sup>2</sup>

<sup>1</sup>The University of Queensland, <sup>2</sup>Princes Alexandra Hospital

This pilot study compared dizziness handicap, gaze stability, balance and mobility of people being conservatively managed with a diagnosed vestibular Schwannoma and aged-matched controls to establish falls risk of the clinical group and need for education and preventive intervention. An initial 24 participants (9 clinical, 15 controls) aged between 40 and 60 years had completed the Dizziness Handicap Inventory, the dynamic visual acuity test, measures of postural stability (bilateral stance on firm/foam, eyes open/closed; and one-legged stance), step test, lateral reach, 10 tandem steps, TUG test, 10 m walk with/without head turns, the Dynamic Gait Index and the 6-minute walk test (6MWT). Compared to the controls, the clinical group presented with higher dizziness handicap ( $p = 0.026$ ); reduced gaze stability ( $p = 0.007$ ); lower DGI Scores ( $p = 0.002$ ) with stepping over/around obstacles and stairs without a rail more difficult for this group. Shorter distances were walked during the 6MWT ( $p = 0.012$ ). A trend for reduced reach (non-dominant upper limb) was identified ( $p = 0.093$ ) but no significant differences between the groups for postural stability and other clinical balance measures were revealed. These preliminary data revealed that people with small tumours presented with increased dizziness handicap and gaze instability. Although the clinical group walked independently, negotiation of obstacles, narrow spaces and stairs without a rail was more difficult. Deconditioning was evident with reduced capacity to walk fast. Thus, physiotherapy education and preventive intervention is indicated for this clinical group during conservative management with educational strategies and management directed at gaze instability, reported dizziness, safe community ambulation and improving functional fitness.

## 5 × 5 PRESENTATIONS

**A novel application of ankle CPM for calf stiffness: reliability and proof of concept in normal volunteers**

Singer B,<sup>1</sup> Cawley DM,<sup>1,2</sup> Dunne JW<sup>3</sup> and Singer KP<sup>1</sup>

<sup>1</sup>Centre for Musculoskeletal Studies, The University of Western Australia, Perth <sup>2</sup>Neurosurgical Rehabilitation, Royal Perth Hospital, Perth <sup>3</sup>Department of Neurology, Royal Perth Hospital, Perth

Increased calf muscle stiffness is a common consequence of acquired brain injury that can interfere with functional mobility. Repeated cyclic stretching, or continuous passive motion (CPM), of the ankle may reduce muscle stiffness. This investigation examines reliability of a novel application for a commercial ankle CPM device (Breva, KINETIC, Surgical Synergies), which may have therapeutic application to symptomatic neurological cohorts. The device was instrumented to evaluate load and angular displacement. Paired strain gauges were bonded to the articulated ankle plate arm, with displacement acquired from a high resolution optical encoder attached to the CPM drive shaft. Load and position data were acquired in Labview software direct to a PC from which cyclic hysteresis curves were derived. Mechanical trials were undertaken over two 24 hour periods using static then dynamic standard loads. Four normal volunteers underwent a standardised test protocol on four different occasions to examine the repeatability of all derived variables. Torque at 20° dorsiflexion, plus stiffness gradient between 10–20° were assessed, with data from the eighth cycle used for analysis. Torque and stiffness variables from mechanical trials were all highly reliable with coefficients of variation (CV) < 0.1%. Subject trials demonstrated mean CVs for torque at 20° of dorsiflexion < 5.0% and for stiffness gradient 3.7%. Instrumentation of an ankle CPM device has resulted in a highly reliable system with acceptable inter-trial subject reliability. A prospective evaluation of the efficacy of ankle CPM to reduce calf muscle stiffness is underway in a range of clinical sub-groups.

**Association between different somatosensory functions and gait characteristics of stroke patients**

Wang HC, Lin SI, Hsu LJ

Department of Physical Therapy, College of Medicine,  
National Cheng Kung University

Impaired somatosensation can often be seen in stroke patients. Specifically, impaired joint position sense (JPS) has been shown to be related to gait performance in stroke patients. However, little is known about the effect of cutaneous sense impairments. This study sought to determine the contribution of JPS and cutaneous sensation on gait performance in stroke patients. Fifteen stroke patients participated in this study and walked at their natural speeds on a pressure-sensor walkway to record

## 5 × 5 PRESENTATIONS – *continued*

stride characteristics. Electrogoniometers were used to measure the variability in the joint repositioning test in the ankle and knee to reflect JPS, while monofilaments were used to determine the plantar cutaneous sensation. Fugl-Meyer Lower Extremity Motor Assessment (FM) was used to measure the motor function. The results of correlation analysis showed that stride characteristics of the affected leg were significantly correlated with the FM scores, but not with the JPS or cutaneous sense. Stepwise regression (FM and age as control variables) showed that the knee JPS significantly contributed to step time ( $r^2$  change = 0.354), double support time ( $r^2$  change = 0.387), and step length ( $r^2$  change = 0.144), while the ankle JPS significantly contributes to step length ( $r^2$  change = 0.329), and velocity ( $r^2$  change = 0.237). Cutaneous sensation also had significant contribution to step length ( $r^2$  change = 0.085) and double support time ( $r^2$  change = 0.088). These findings showed that for stroke patients somatosensation was associated with gait performance, and that JPS appeared to have a larger contribution than the cutaneous sense.

### **Does comprehensive stroke unit care prevent shoulder pain following acute stroke?**

Ancliffe J

*Royal Perth Hospital, Perth*

Aims of study were to determine prevalence of shoulder pain, identify patients most likely to develop shoulder pain and review the effectiveness of current strategies to prevent shoulder pain in patients admitted to a comprehensive stroke unit at Royal Perth. A prospective audit was conducted over a six-month period and of 121 patients admitted, 81 met the criteria for inclusion. Demographic data was obtained with motor recovery (Chedocke-McMaster) for arm and hand and daily evaluation for shoulder pain (Ritchie articular Index). Physiotherapy interventions were documented. The prevalence of shoulder pain for all subjects 30.9% (25), with a mean length of stay 21.6 days (SD  $\pm$  14.57) and mean time to onset of pain 10.98 days (SD  $\pm$  12.04). Eleven patients experienced shoulder pain prior to admission and eight (72%) developed shoulder pain post stroke. Patients who had motor scores 1 or 2 at admission (n = 35) were the group where 20 (57%) developed pain within 12.9 days (SD  $\pm$  12.8) from admission. They also experienced longer periods with pain 18.1 days (SD  $\pm$  13.4) compared to patients with score 3 or 4, mean = 5 days and score 5, 6 or 7 mean = 2.7 days. Three patients achieved max pain score of 3, while 20 scored 1. While current strategies (education and handling all staff, daily evaluation of pain, early detection and prompt intervention, medical and physiotherapy mobilisation, facilitation techniques, strapping, shoulder support, lap trays etc) appear to be working, a further investigation into which factors influence shoulder pain is planned.

### **Feldenkrais method balance classes improve balance confidence and mobility in older adults: a pilot study**

Connors KC,<sup>1,2</sup> Galea M,<sup>1</sup> and Said CM<sup>1</sup>

<sup>1</sup>*Rehabilitation Sciences Research Centre, University of Melbourne*

<sup>2</sup>*Calvary Healthcare Bethlehem, Melbourne*

Falls in older adults commonly result in injuries. Various interventions have attempted to prevent falls by improving balance. Preliminary studies show the Feldenkrais method, which uses an exploratory learning approach to improve functional movement, may be a useful intervention. The purpose of this pilot study was to investigate the effects of Feldenkrais method balance classes on balance and mobility in community-dwelling older adults. Twenty six older adults (mean age 75 years) were measured before and after a series of Feldenkrais method balance classes. The classes were specifically designed for balance retraining and addressed sit-to-stand, standing balance, walking, body awareness and inter-segmental control of the ankle, knees, hips and trunk. A control group (n = 37) received no intervention. Measurements were made of balance (Four Square Step Test), balance confidence (Activities-related Balance Confidence Questionnaire) and gait parameters (GaitRITE instrumented gait analyser). There was significant improvement on all measures in the experimental group between initial and retesting. There was significant difference between groups in the change scores for the Activities-specific Balance Confidence questionnaire (mean treatment effect = 11.3 points, 95% CI 4.5–18.1,  $p$  = 0.002) and gait speed (mean treatment effect = 0.11m/sec, 95% CI 0.03–0.18,  $p$  = 0.006). Differences between change scores in the Four Square Step Test were not significant (Mean treatment effect equals –1.18 sec, 95% CI 0.15 to –2.5,  $p$  = 0.08). Feldenkrais method balance classes appear to have a positive effect on gait and balance confidence in older adults.

### **Reliability in the measurement of passive and dynamic range of motion in adults with hemiplegia due to stroke**

Cameron D, Danoudis M, Kravtsov S and Murphy A

*Kingston Centre, Melbourne*

Measures of passive and dynamic range of motion of lower limbs are part of the clinical assessment for patients having 3 dimensional gait analysis. Results of both are important in interpreting gait data, therefore reliability and repeatability are essential. The project aimed to determine the intra-rater and inter-rater reliability of three physiotherapists in measuring passive and dynamic range at the ankle and knee of three adults with stroke. Participants were included if they: 1) were living in the community, 2) were able to walk independently, 3) walked faster than 40 cm/sec. The



## 5 × 5 PRESENTATIONS – *continued*

physiotherapists were randomised to work in pairs, one taking the limb through range, the other measuring the joint angle using a hand held goniometer. Participants were assessed by each therapist on two separate days and by all therapists on the same day. Outcomes were the passive and dynamic range of motion for bilateral popliteal and dorsiflexion joint angles (knee straight and at 90°). The intra-rater ICC was 0.83 (95% CI 0.72–0.90) for passive range, 0.97 (95% CI 0.95–0.98) for dynamic range; the inter-rater ICC was 0.80 (95% CI 0.69–0.89) for passive range, 0.95 (95% CI 0.90–0.98) for dynamic range. Consistency was greatest at the ankle with more variability at the knee. This study found that the three therapists had moderate to high consistency in measuring passive and dynamic ranges at knee and ankle in people with stroke.

### Test-retest reliability and clinical utility of the AsTex™ for the assessment of hand sensation following stroke

Miller KJ,<sup>1</sup> Wheat HE,<sup>2</sup> Phillips BA,<sup>3</sup> Goodwin AW<sup>2</sup> and Galea MP<sup>1</sup>

<sup>1</sup>School of Physiotherapy and the Rehabilitation Sciences Research Centre, University of Melbourne <sup>2</sup>Department of Anatomy and Cell Biology, University of Melbourne <sup>3</sup>Faculty of Health Sciences, La Trobe University, Melbourne

Assessment of sensory capabilities beyond simple detection of pain or light touch is difficult in stroke survivors. Sensory discrimination is an important factor in hand function. The AsTex™ was developed to assess texture discrimination. As it requires less than 5 minutes to administer, the AsTex™ is potentially a clinically feasible method for assessing functional hand sensation following stroke. The aims of this series of studies were to investigate the test-retest reliability and the clinical utility of the AsTex™ in stroke subjects. Test-retest reliability of the AsTex™ was found to be excellent (ICC = 0.86 (95% CI 0.68–0.94)) when the same examiner assessed the affected hands of 22 chronic stroke subjects on 2 occasions separated by a week. The standard error of measurement was 0.14 mm, representing 21% of the mean texture discrimination value. Floor effects were observed in 3 (12.5%) of 24 subacute stroke subjects measured 14–42 days post-stroke, floor effects of less than 15% being indicative of an appropriate measurement model. In the remaining 21 subjects, sensory discrimination of the affected hand was found to be significantly poorer than the unaffected hand ( $p = 0.002$ ). The sensation of the affected hands of 9 subjects and the unaffected hand of 1 subject was classified as impaired (above the 90<sup>th</sup> percentile for age-stratified normative values for the AsTex™). The AsTex™ was found to be simple and easy to administer in stroke subjects. The AsTex™ is a reliable, useful and clinically feasible method for quantifying hand sensation following stroke.

### Test-retest reliability of the StepWatch activity monitor

Mudge S and Stott NS

*The University of Auckland, Auckland, New Zealand*

The aim of this study was to examine the test-retest reliability of the StepWatch Activity Monitor (SAM). Sixteen subjects more than six months post stroke and with a mean gait speed of 0.70 m/s (range 0.17–1.42) were recruited. The SAM was calibrated for each subject, who then wore the device on the non-paretic limb for three consecutive days one week and the same three consecutive days the following week. The subjects took an average of 3369 strides a day with a wide range (772–10068) and a large standard deviation (2195) of strides across the group. The within-subject variation for SAM outputs between individual days was higher (12.13–52.19%) than the within-subject variation between the means of the two three day periods (5.03–23.28%). The intraclass correlation coefficients between the means of the two 3-day periods were high for all SAM outputs (ICC = 0.931 –0.989). 95% limits of agreement showed that total steps, peak activity index (highest step rate over 30 non-continuous minutes) and the highest activity in one minute were 9.7%, 17% and 22% of the mean respectively, showing acceptable test-retest reliability. However six other SAM outputs were more than 25% of the mean (28–105%). Step activity monitoring is not recommended for only one day due to the high daily variation; however the means derived from a three-day period shows acceptable test-retest reliability for some key outputs in subjects with stroke.

### The predictive value of the motor assessment scale (MAS) on discharge outcomes in older stroke patients in a rehabilitation setting

Tucak C,<sup>2</sup> Scott J,<sup>1</sup> Kirkman A, and Singer B<sup>1</sup>

<sup>1</sup>School of Health Sciences, University of Notre Dame, Perth <sup>2</sup>Stroke Rehabilitation Unit, Osborne Park Hospital, Perth

This retrospective study explored the predictive value of the motor assessment scale (MAS) to determine patient outcomes including length of stay (LOS), mobility at discharge and discharge destination. The dataset included 239 patients admitted to a stroke rehabilitation unit (SRU) between 5/6/2001 and 10/1/2007. MAS scores were measured on admission to, and discharge from, the SRU by four different treating clinicians. Associations between variables (admission and discharge MAS scores, discharge destination and LOS) were analysed using Spearman's rank correlation coefficient. The ability of the MAS to predict the discharge variables and the influence of other factors such as age, stroke classification and gender was analysed by multiple linear regression. Results indicated that a low MAS score on admission was significantly associated with



## 5 × 5 PRESENTATIONS – *continued*

a more dependent discharge destination, ( $r = -.512$   $p < 0.001$  for total MAS score,  $r = -.496$   $p < 0.001$  for MAS items 2, 4 and 5). Poor mobility on admission was significantly associated with longer LOS ( $r = -.716$   $p < 0.001$  for MAS items 1–5 combined). The MAS admission score ( $p < 0.001$ ) and POCI stroke classification ( $p = 0.003$ ) were significantly predictive of LOS at the SRU. The only factor of significance in relation to the MAS discharge score was the MAS score on admission ( $p < 0.001$ ). The likelihood of discharge to an institution increased with age ( $p = 0.009$ ) and with lower MAS on admission ( $p < 0.001$ ). This study has provided further evidence for the potential utility of MAS admission scores in predicting stroke outcomes in the older stroke patient, with significant influence from age and some stroke classifications.

### Three blinded physiotherapists visually assess head alignment

Gesch J,<sup>1</sup> Nascimento P,<sup>1</sup> Passier L<sup>1</sup> and Haines T<sup>1,2</sup>

<sup>1</sup>Department of Physiotherapy, Princess Alexandra Hospital, Brisbane

<sup>2</sup>Division of Physiotherapy, School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane

This study tested the hypothesis that physiotherapists could visually assess if a patient's head is in a neutral position or malaligned in any plane of movement. This was necessary to establish the validity and reliability of the alignment subscale of the Acute Brain Injury Physiotherapy Assessment (ABIPA), a quantitative assessment tool for patients with severe brain injury. Previous studies have investigated the accuracy and validity of tools for measuring cervical ROM. In the acute severe brain injured population, however overall head alignment is more clinically relevant than an exact measure of malalignment. Following calibration to a neutral cervical spine position, the Intersense InteriaCUBE (a computer generated program with integrated sensors) was used to position a healthy subject's head into randomly chosen positions, which were in neutral or malaligned in combinations of sagittal, coronal and transverse plane movements of 5–10° from neutral. Three experienced physiotherapists independently observed each of the 53 head positions and recorded the magnitude and direction of alignment in each plane of movement. Of the 53 test positions 10 were recorded accurately across all components by all three physiotherapists. All therapists successfully identified the neutral position. Malalignments most difficult to assess were those in the transverse plane and those of 5° from neutral. Malalignment in the coronal plane was most accurately detected however, malalignment in this plane made accurate assessment of the other planes more difficult. Overall there was moderate inter-tester reliability using the ABIPA alignment subscale, which improved with 10° of malalignment.

### Using volunteers to enhance activity levels and care of patients in a rehabilitation hospital

Coppi G, Baker G, Said C,<sup>1,2,3</sup> Smith P and Braemer K

<sup>1</sup>Austin Health, Melbourne <sup>2</sup>Rehabilitation Sciences Research Centre, Melbourne <sup>3</sup>University of Melbourne, Melbourne

In 2003, in the context of its consumer engagement strategy, the Austin Health Aged Care Service initiated an innovative program to utilise volunteers. This included recruiting volunteers to work within the physiotherapy department to enhance patient care. The use of volunteers was not designed to substitute physiotherapy or allied health assistant treatments, but to add to the patients' program with volunteers overseeing ward walking programs or exercise programs that had been prescribed by the treating physiotherapist and were deemed appropriate to be performed with a volunteer. The physiotherapy department currently has five volunteers who each work for two hours per week. On average they would see seven to eight patients for individual exercise and then assist physiotherapy staff to implement an exercise group. Time is also spent talking with patients who are socially isolated, confused and at risk of falling. As a department we feel the volunteer program provides benefits to our service on many levels. The volunteers offer an improved interaction between patients and the community; patients received a better quality program especially by increasing patient activity levels. The Aged Care Services volunteer coordinator recruits and orientates volunteers and refers those interested and suitable to the physiotherapy program. The physiotherapy department provides individual training for the specific tasks. A physiotherapist and allied health assistant are responsible for the program and use the department's daily planning meeting to organise the volunteers work load. The volunteers have annual reviews that judge level of satisfaction and, to date, feedback has been positive.

### Visual and cutaneous regulation of postural stability

Li SW,<sup>1</sup> Lin S,<sup>1</sup> Hsu LJ<sup>1</sup> and Liao CF<sup>2</sup>

<sup>1</sup>Department of Physical Therapy, College of Medicine, National Cheng Kung University, Tainan, Taiwan <sup>2</sup>Institute of Allied Health Sciences, College of Medicine, National Cheng Kung University

Different types of sensory inputs can be used simultaneously to regulate postural stability. However, how different inputs that convey similar information for postural control such as visual and cutaneous, would affect each other is unknown. This study sought to determine how visual inputs and cutaneous inputs from fingertip contact would affect postural stability. Twenty healthy young adults participated in the study and stood with the feet together on a force platform with eyes open in a lighted room (normal, NORM), in darkness (deprived, DPRV), and in darkness with a light fixated onto the head (fixed, FIXD), first without and then with fingertip contact (FC). The variables of interest were COP in the anterior-posterior (AP) and medial-lateral (ML) directions. Vision and FC each was found to have significant main effect, but not interaction. Significantly smaller postural sway was found in FC than without FC. NORM and FIXD had significantly smaller sway trajectory, velocity, and range in the ML but not the AP direction, than DPRV. These findings confirmed the effect of FC in stabilising standing posture, and demonstrated that this effect was not affected by visual inputs. The effect of visual inputs however, was direction-specific having a greater effect on the direction that was more challenged, i.e. ML in feet-together standing. What is more, fixed visual inputs

## 5 × 5 PRESENTATIONS – *continued*

although inaccurate in reflecting postural sway, helped to improve postural stability, suggesting that the role of visual inputs may not necessarily be confined to providing information regarding the relationships between the body and the environment.

### Which muscles have the greatest impact on gait velocity?

**Dorsch S, Ada L, Canning C, Dean C and Alzahrani M**

*The University of Sydney, Sydney*

The aim of this study is to describe the contribution of muscles of the lower limb to gait velocity in people who can walk independently following a stroke. This will provide information on which muscles make important individual contributions to gait velocity. A prospective descriptive study was carried out on people over 50 years of age who were more than one year post stroke and were able to walk

10 metres independently. Strength was measured as peak isometric force in N in the following muscles; hip abductors, hip adductors, hip flexors, hip extensors, hip internal rotators, hip external rotators, knee extensors, knee flexors, ankle plantarflexors, ankle dorsiflexors, ankle invertors and ankle evertors. Gait velocity was measured using the 10 metre walk test in m/s. Linear regression between the strength of each muscle group and gait velocity was calculated. The muscle groups with the most significant correlations were then put into a multiple regression model to look at the relative contribution of each muscle group to gait velocity. At this stage\*, the results from 9 participants suggest that the muscles that make an independent contribution to gait velocity are the knee flexors, ankle evertors and ankle dorsiflexors. In other words, once independent walking has been achieved, the muscles that have the largest impact on velocity may be different muscles to those that impact on the ability to walk or not walk. This information will assist in the tailoring of rehabilitation programs aimed at increasing walking velocity and therefore community ambulation after a stroke. \*The results from 30 participants will be reported.

## Join an APA National Group

The Australian Physiotherapy Association has 14 National Groups. Each group represents a discrete area of physiotherapy and provides members with access to a wide range of educational and research materials. If you have an interest, or work, in a particular field of physiotherapy, membership of the relevant group will provide you with an opportunity to develop and maintain high-level knowledge and skills, and remain abreast of key issues in that area of physiotherapy. Membership automatically adds your name to a network of your professional peers – providing opportunities to discuss issues or seek advice from other members of the group.

### Key Benefits of Membership

- Access to quality professional development courses, symposia, and conferences, at discounted prices, enhancing your knowledge of your chosen physiotherapy speciality area
- Group newsletters at least twice a year, plus regular email news and notices
- Access to evening lectures and social functions, providing you with the chance to touch base with other physiotherapists, discuss ideas, and develop a peer support network

### APA National Groups

Acupuncture and Dry Needling  
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Aquatic Physiotherapy  
Cardiorespiratory Physiotherapy Australia  
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To apply for membership of a group go to:  
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For more details email: [ng@physiotherapy.asn.au](mailto:ng@physiotherapy.asn.au) or  
call: **1300 666 772**



AUSTRALIAN PHYSIOTHERAPY ASSOCIATION

# ABSTRACTS

Occupational Health Physiotherapy Group  
Conference

## Strength in Diversity



APA Conference Week  
4–8 October 2007  
Cairns, Australia



AUSTRALIAN PHYSIOTHERAPY ASSOCIATION

## INTRODUCTION

The inaugural Occupational Health Physiotherapy conference was held in Cairns, 7–8 October, 2007. This conference was especially exciting as, for the first time, all physiotherapists with an interest in occupational health gathered for the opportunity to hear from experts in their field, receive updates on the latest research projects, and enjoy networking with colleagues from interstate and overseas.

The chosen theme *Strength in Diversity* was accurately reflected in the many presentations during the conference. *Strength* represents the strong focus we all share in ensuring the health of our working population and *Diversity* acknowledges the broad range of roles occupied by physiotherapists in this speciality area.

The conference attracted delegates from around Australia and overseas. There were presentations on the prevention of musculoskeletal injury by Dr Straker and Dr Neumann. Delegates were challenged to consider their approach to rehabilitation and return to work by the presentations of

David Butler, Dr Moseley and Dr Schonstein. For those seeking more practical skills, there was a workshop by Dr McAtamney on how and when to use her musculoskeletal assessment tool, and a workshop on solving worksite injuries from beginning to end by Dr Mackey. Barbara McPhee, who has mentored many physiotherapists seeking to enter this field, discussed the challenges facing occupational health physiotherapy in Australia in the next decade. Legislation relevant to the workplace was presented by industrial relations and employment lawyer, Robert King. Finally, the conference concluded with an informative session in compiling a portfolio for those seeking titled membership.

In addition to the invited speakers, there were 13 free papers on the latest research conducted in the field of occupational health physiotherapy demonstrating that research is alive and well in this speciality area.

**Venerina Johnston, Rose Boucaut, Susie Riddoch and Yvonne Hinch**

Occupational Health Physiotherapy Scientific Committee

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### A longitudinal study investigating the validity of pre-employment functional testing

Legge JB<sup>1,2</sup> and Burgess-Limerick R<sup>2,3</sup>

<sup>1</sup>JobFit Systems International, Mackay <sup>2</sup>School of Human Movement Studies, University of Queensland, Brisbane <sup>3</sup>Burgess-Limerick & Associates, Brisbane

The aim of this study was to determine if a predictive relationship exists between performance in a job-specific Pre-employment Functional Assessment (PEFA) and subsequent workplace musculoskeletal injuries. The assessment determines whether a prospective employee has demonstrated the functional capacity to perform the position with no restrictions (PEFA = 1) or with minimal (PEFA = 2) or moderate (PEFA = 3) restrictions. A prospective study was undertaken of 336 workers at a Queensland coal mine employed for an average of 2.25 years between December 2002 and January 2007. Ninety-one injuries were reported by 62 workers during the period. The overall injury rate was 0.12 injuries per person per year. A statistically significant relationship was found between the overall PEFA score and the risk of reporting a shoulder, back or trunk injury. Twenty-four of 254 PEFA = 1 employees reported at least one shoulder, back or trunk injury (9.4% or 4.2% per year) vs 15 of 82 PEFA > 1 employees (18% or 8.4% per year), a relative risk of 1.94 (95% CI 1.07–3.51). The relationship between PEFA and the risk of a back, shoulder or trunk injury associated with a manual handling task was stronger. Nine of 254 PEFA = 1 employees reported at least one such injury (1.6% per year), compared with 10 of 82 PEFA > 1 employees (5.6% per year), a relative risk of 3.56 (95% CI 1.5–8.47). Pre-employment functional assessments are a valid component of pre-employment testing.

### A randomised controlled trial of the effects of work-site exercise on the physical fitness and work-ability of older workers

Mackey MG,<sup>1</sup> Maher CM,<sup>1</sup> Collins K<sup>2</sup> and Wong T

<sup>1</sup>Back Pain Research Group, University of Sydney, Sydney <sup>2</sup>University of Sydney, Sydney

Older workers have a lower level of physical fitness but a higher rate and cost of injury than younger workers performing comparable jobs. With a rapidly ageing workforce this study aimed to examine the feasibility of implementing work-site based exercise training as a means of improving physical fitness and workability of older workers. A randomised controlled pilot study was carried out in a large distribution warehouse. Twenty healthy employees aged over 45 years volunteered to participate and were randomised into an experimental group (n = 10) and a control group (n = 10). The experimental group exercised in pairs for 40 minutes, three times per week for the 12-week intervention. Exercise was undertaken during work time and under the supervision of an experienced exercise physiologist. The control group was asked to continue with their customary physical activity only. Physical capacity outcomes were predicted: maximal oxygen consumption (L.min<sup>-1</sup>) on YMCA cycle ergometry test; maximal arm and leg strength (kg) on standardised bench and leg press

tests respectively, and functional lifting capacity (kg) on the Progressive Isoinertial Lifting Evaluation test. Perceived workability was evaluated by the Work Ability Index (WAI) questionnaire. Pre- and post-training measurements were made. Exercise training resulted in greater improvements in all physical capacity measures for the experimental group compared to the control group ( $p < 0.001$ , for all). There was no significant difference between groups for change in WAI score. Workplace based exercise improves fitness in employees over 45 years, and is safe, desirable and feasible to implement.

### Assessment of dentist posture in two seating conditions

Gandavadi A,<sup>1</sup> Ramsay JRE<sup>1</sup> and Burke FJT<sup>2</sup>

The University of Birmingham, Birmingham, U.K <sup>1</sup>School of Health Sciences-Physiotherapy <sup>2</sup>School of Dentistry

The aim of this study is to determine whether the type of seat influences working posture of dentists. A conventional flat seat and Bambach saddle seat were used in the study. The posture of dentists was assessed using RULA (Rapid Upper Limb Assessment). The dentists from the West Midlands, U.K. were randomly selected from electronic yellow pages for the conventional seat (n = 10) and from the manufacturer's list for the Bambach seat (n = 12); all had been using their seats for at least one year. Observation was undertaken in the dental clinics and photographs were taken by the researcher and then assessed using RULA. Risk scores for the right and left sides were calculated for each participant. Mann-Whitney test was used for statistical analysis. The results indicate that the dentists using the conventional seat recorded significantly higher risk scores when compared with the dentists using Bambach saddle seat ( $p = 0.005$  for the right side;  $p = 0.016$  for the left side). The results suggest that the dentists using the Bambach saddle seat adopted an acceptable working posture and were at a lower risk of developing musculoskeletal disorders.

### Assessment of muscle activity of dental students using surface electromyography and changes in muscle activity over a 6-month period

Gandavadi A,<sup>1</sup> Ramsay JRE<sup>1</sup> and Burke FJT<sup>2</sup>

The University of Birmingham, Birmingham, U.K <sup>1</sup>School of Health Sciences-Physiotherapy <sup>2</sup>School of Dentistry

The aim of this study is to assess the changes in muscle activity over a 6-month period in dental students who have been using a saddle seat for practical skills sessions in a phantom head laboratory. Thirty second year dental students at the University of Birmingham, UK who were attending their first classes in the phantom head laboratory were randomly selected and allocated the Bambach saddle seat. Students were trained in the use of the seats. The spinal extensor muscle activity of the longissimus thoracis and multifidus lumborum was measured using surface electromyography. Three measurements of muscle activity were taken, Baseline (0 months), after 3 months, after 6 months of the use of seat. A mixed design ANOVA was used for Statistical Analysis. The results indicated that the

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back muscle activity when using the saddle seat increased from 0–3 months and decreased significantly from 3–6 months ( $p < 0.05$ ). The results suggest that use of saddle seat over time may reduce the back muscle activity in dental students.

### Functional capacity evaluation: what is it good for?

Davidson M

*La Trobe University*

The large number of tests and test batteries that are available for Functional Capacity Evaluation (FCE) pose a challenge to the clinician to select tests and measures that are appropriate to a particular purpose. A common criticism of the field has been the proliferation of tests without rigorous testing of the measurement properties of the tests. This paper applies an approach to critically evaluating the measurement properties of three widely used FCE systems and examines their utility for evaluative, predictive and diagnostic purposes. For even long-established and widely used FCE protocols gaps in the evidence relating to reliability and validity persist. There is limited evidence that accurate predictions about future events can be made on the basis of FCE test results. It is also doubtful whether judgements made about a person's sincerity of effort during testing can be made with acceptable accuracy. The consequences of testing should be kept in mind when making inferences from FCE test results. Where the consequences of decisions made on the basis of test results are 'high stakes' then test accuracy is paramount. Testing of ability to perform work-related activities should be seen only as part of a comprehensive evaluation of the range of biopsychosocial variables that are relevant for the specific purpose for which the FCE is being conducted.

### I can't reach my keyboard: the challenges of office ergonomics for pregnant and bariatric clients

Conroy AV

*Calvary Health Care, Canberra*

Three groups of desk-based workers who are particularly difficult to make comfortable and safe are pregnant women, tall heavy clients and very heavy (bariatric) clients. The unique problems of providing a safe comfortable work station for each group will be explored using relevant case studies. Opportunity will be provided to contribute solutions from delegates' experiences. A chair choice checklist is a tool to assist the novice occupational health physiotherapists to consult the client regarding their chair prescription.

### Individual, psychosocial and ergonomic risk factors for neck pain in female office workers

Johnston V,<sup>1</sup> Jimmieson NL,<sup>2</sup> Souvlis T<sup>1</sup> and Jull G<sup>1</sup>

<sup>1</sup>*Division of Physiotherapy, The University of Queensland, Brisbane*

<sup>2</sup>*School of Psychology, The University of Queensland, Brisbane*

The aim of this study was to investigate the relationship between neck pain as measured by the Neck Disability Index (NDI) and workplace ergonomic, psychosocial and individual risk factors in female office workers. A comprehensive survey was distributed to various organisations with questions on age, leisure time activity, typing style and body mass index to assess the individual risk factors. The psychosocial risk factors evaluated were: job demands, job control and support from supervisors and colleagues. Ergonomic risk factors in the workplace assessed features of the workstation design and task demands such as duration of mouse use. Results indicate that 61% of respondents experienced neck pain for greater than seven days in the last 12 months. The risk factors for greater score on the neck disability index (sample mean = 15) after controlling for covariates were spending more than two hours at a time on computer based tasks, using the mouse for greater than six hours per day, use of vision correction, touch typing with greater force, rarely exercising, increasing age and an uncomfortable workstation. Most ergonomic features of the workstation were not significantly related to the score on the NDI. Low supervisor support and the interaction of high job demands, high decision authority and low supervisor support were significantly associated with the NDI score. This research clearly demonstrates the importance of acknowledging individual, workplace and psychological factors and that any education campaigns need to consider these variations in any attempt to control the risk factors for neck pain.

### Levator scapulae muscle activity in repetitive workers using minimal gleno-humeral excursion

Riddoch SG,<sup>1</sup> Summers JJ<sup>1</sup> and Taylor B<sup>2</sup>

<sup>1</sup>*University of Tasmania, Hobart* <sup>2</sup>*Royal Hobart Hospital, Hobart*

Clinical evidence of persistent overactivity in the levator scapulae muscle in patients with neck/shoulder pain, who performed repetitive work involving minimal gleno-humeral excursion, was noted. As little research has been done to discover the activity of levator scapulae under 30° gleno-humeral excursion, this situation motivated the present research. To ensure accurate replication when measuring possible levator scapulae activity in all studies, a functional arm task was chosen that involved elbow flexion but minimal gleno-humeral excursion; this was touching the nose without bending the head. A clinical study ( $n = 12$ ) using deep wire electromyography confirmed that levator scapulae is active where arm movements require minimal gleno-humeral excursion ( $p = 0.001$ ). Another study ( $n = 7$ ) using both deep wire and surface electromyography demonstrated that it is possible to measure levator scapulae using surface electromyography. Studies in the field using surface electromyography compared levator scapulae activity in repetitive workers (fish processors,  $n = 17$ ) and

## FREE PAPERS – continued

non-repetitive workers (child-carers,  $n = 20$ ). Results showed that both activate levator scapulae during the task phase ( $p = 0.001$ ) and that the repetitive workers' levator scapulae activity had a higher mean percentage change score ( $p = 0.06$ ). The final field study in a call centre compared those with ( $n = 20$ ), and without ( $n = 20$ ), work-related neck/shoulder pain showed that both groups activated levator scapulae during the task phase ( $p = 0.001$ ). The biomechanical consequences of levator scapulae overactivity to the upper limb in such repetitive workers requires further investigation.

### **Occupational health physiotherapy Australia: recognising the expertise of members and providing them with a progressive career path**

**Boucaut RA,<sup>1</sup> McPhee B,<sup>2</sup> Morgan A<sup>3</sup> and Worth D<sup>4</sup>**

<sup>1</sup>School of Health Sciences (Physiotherapy) University of South Australia, Adelaide <sup>2</sup>Jim Knowles Group, Kurri Kurri <sup>3</sup>Jardine Lloyd Thompson, Brisbane <sup>4</sup>Rankin Occupational Safety and Health, Adelaide

This paper describes establishing a process of recognising expertise within one subset of the Australian Physiotherapy Association (APA), the Occupational Health Physiotherapy Australia (OHPA) group. The challenge to gain recognition from the APA of OHPA member expertise has been prolonged. Perhaps in part this is due to a lack of understanding within the broader physiotherapy profession of the work done by OHPA members. Further, it may also be due to their work often falling outside the traditional physiotherapy and medical model of service delivery. In 2003, an APA facilitator worked with the professional development panel (PDP) of OHPA to start the process of establishing a two-staged recognition model. The initial step involved defining the professional practice standards (PPS) expected of an OHPA member. Subsequently, three progressively experienced levels were defined: novice, titled and specialist. Benchmarks and examination criteria were set by the PDP for Titled Membership. A portfolio submission was chosen as the means for candidates to present their work to examiners. Candidates were required to link their portfolio work to the seven PPS to demonstrate that they met each of them at an advanced level. To date five OHPA physiotherapists have become Titled Members. An evaluation of the examination process has led to proposed amendments being suggested by the PDP to bring Titled OHPA members into line with other APA groups who have as their benchmark Masters level qualifications. A specialist pathway is currently being established to recognise members working at a highly advanced or specialist level within the field.

### **Positive performance indicators in the management of work injuries: the challenge to show positive physiotherapy impact**

**Boucaut RA<sup>1</sup> and Morgan A<sup>2</sup>**

<sup>1</sup>School of Health Sciences (Physiotherapy) University of South Australia, Adelaide <sup>2</sup>Jardine Lloyd Thompson, Brisbane

In Australia, occupational health (OH) physiotherapy work falls into two broad categories aligned with workplace legislation: injury prevention and injury management. The focus of this paper is injury management. Measuring the efficacy of interventions is in the minds of physiotherapists as they rehabilitate injured clients. OH physiotherapists face the challenge of third party evaluation by paying stakeholders (including insurers, employers and workers compensation authorities) as they rehabilitate work-injured employees. This paper first briefly describes the legislated injury management hierarchy and then describes measures organisations currently utilise as part of their evaluation, including lost time, treatment costs and whether the return to work is feasible. Additional measures of physiotherapy performance that could be used with a focus on the rehabilitation and return to work process and outcomes are presented. The injury management performance measures described constitute a large shift from pain and range of motion measures. They include service delivery and functional measures incorporating the workplace context. They require the physiotherapist to have an understanding of the job the injured worker performs, and the functional requirements of tasks within that job. This means physiotherapists need to adjust their subjective and objective assessments and treatment goals to make them relevant to the workplace tasks of the injured worker. This then positions the physiotherapist to discuss rehabilitation and return to work with the external providers on their terms and to measure performance from both the perspective of these external stakeholders and the more traditional physiotherapy perspective.

### **Positive performance indicators to measure injury prevention activities: what are they and how might they be utilised?**

**Boucaut RA<sup>1</sup> and McPhee B<sup>2</sup>**

<sup>1</sup>University of South Australia, Adelaide, SA <sup>2</sup>Jim Knowles Group, Kurri Kurri, NSW

The prevention of work-related injury and illness is complex, requiring a range of advanced skills that physiotherapists usually do not acquire in their undergraduate training. Further, measuring the success of these interventions is challenging as, in many cases, practitioners are trying to measure something that has not happened (that is, the injury or illness). Currently, outcome measures and evidence are integral to general physiotherapy professional practice. However, while physiotherapists' judgement of the outcome of interventions may be clear to them they may not be compatible with the systems and outcome measures used in the workplace. To ensure that their contributions are recognised occupational health physiotherapists, like other managers,



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need to devise valid and useable performance measures for their work that fit within the general management system. In the past, many organisations appraised injury/illness prevention success with traditional lost time injury (LTI) measures. These are lag indicators (Negative Performance Indicators). While they may be useful, they can indicate only what has failed in the past; they do not show positive steps being taken to improve future outcomes. The use of positive performance indicators (PPIs or lead indicators) allows physiotherapists conducting prevention programs to demonstrate progress incrementally or, in other words, to measure work in progress. Measurements need to be valid, sensitive, specific and repeatable with both qualitative as well as quantitative aspects. Devising these measures is a challenge for occupational health physiotherapists, and this paper aims to stimulate discussion on future ways of measuring success.

### **The preferred outcome tool for measurement of upper limb impairment: an investigation of psychometric and practical characteristics of six questionnaires**

Gabel CP,<sup>1,2</sup> Neller A,<sup>1</sup> Burkett B<sup>1</sup> and Yelland M<sup>2</sup>

<sup>1</sup> University of the Sunshine Coast, Sunshine Coast <sup>2</sup> Griffith University, Brisbane

This study determined which upper limb regional patient report outcome questionnaire was optimal for clinical and research settings. Six tools were prospectively investigated: 1) the Disabilities Arm Shoulder and Hand (DASH), 2) Quick (Q)-DASH, 3) Q-DASH-10, 4) Upper Extremity Functional Scale (UEFS), 5) Upper Extremity Functional Index (UEFI) and 6) Upper Limb Functional Index (ULFI). Final comparisons between questionnaires were made using the Measurement of Outcome Measures (MOM). Two hundred and twenty-nine subjects completed the ULFI whilst two subgroups concurrently completed: a) the Q-DASH, Q-DASH-10 and UEFI and b) the DASH and UEFS. Psychometric properties analysed included reliability, validity, responsiveness, internal consistency, error scores, impairment distribution range and factor analysis. Practical characteristics included completion and scoring time, errors and missing responses. Each tool demonstrated the required psychometric properties and a single or two factor structure. Validity and responsiveness were similar and satisfactory as was reliability (ICC, 2:1 > 0.92) whilst subsequent error scores ranged from 5%–10%. Item redundancy was present in the DASH and UEFI. Missing responses ranged from 0% (ULFI) to 34% (DASH). Combined patient and therapist

scoring time ranged from 45 seconds (UEFS) to 300 seconds (DASH). The MOM methodology demonstrated questionnaire efficacy for the ULFI at 96%, Q-DASH-10 at 90%, Q-DASH at 88%, UEFI at 84% with the DASH and UEFS at 68%. The ULFI was the preferred tool, the Quick-DASH-10 sacrificed sensitivity, construct diversity and error range for completion efficiency. The UEFI and DASH had item redundancy, the Quick-DASH poor practicality and the UEFS poor psychometrics.

## 5 × 5 PRESENTATION

### **A pilot project evaluating a workplace supported exercise program on the incidence of upper limb injuries in the red meat industry**

Valiant D<sup>1</sup> and Davitt C<sup>2</sup>

<sup>1</sup>Catalyst Injury Management <sup>2</sup> Australian Country Choice

Work related injury in the meat industry is a significant issue, with the meat industry having an incidence rate over five times that of other industries. The majority of injuries are in the upper limb. The aim of this pilot project to evaluate the effect of a three-month gym-based supervised exercise program on cardiovascular fitness, upper limb flexibility, perceived health benefit using the SF36, absenteeism and compensable injury. Sixty employees volunteered for the program, with forty being allocated to the program based on selection criteria. Twenty employees were randomly allocated to the experimental group and the remaining twenty were allocated to the control group. The experimental group participated in a highly structured upper limb and cardiovascular exercise program three times weekly, monitored weekly by an exercise physiologist and upgraded as a group, out of work time. They also attended one session by a dietician and one session by a psychologist. The program and all of the time at the gym and at other sessions was funded by the employer. The results of the program were disappointing with no demonstrable difference in any of the outcome measures, other than a slight increase in perceived health benefit for the experimental group. There were a number of confounding factors that influenced attendance at the program and participation by the experimental group that would need to be considered in any further study of this kind.

# ABSTRACTS

Paediatric Group  
Conference

## Strength in Diversity



APA Conference Week  
4–8 October 2007  
Cairns, Australia



AUSTRALIAN PHYSIOTHERAPY ASSOCIATION

## INTRODUCTION

It was a pleasure to welcome delegates to the 7th Biennial paediatric conference as part of APA Conference Week 2007. As well as continuing our proud tradition of sharing our experience as a group, we started a new tradition of having all APA National Group conferences being staged at the same time, in the one venue. This was a ground-breaking, innovative event giving us the opportunity to meet with other APA physiotherapists, broaden our experiences, ideas, and knowledge, and catch up with old friends.

The theme *Strength in Diversity* was chosen to reflect the broadening role of paediatric physiotherapy. As a group we have reached that stage of development where differences and diversity are seen as sources of strength and inspiration.

Our program was designed to inspire delegates and refresh their passion for paediatric physiotherapy. It included all the usual attractions of dynamic keynote speakers, a stimulating scientific program, and interactive workshops.

Our invited speakers and workshop presenters were chosen for their influence on our profession, their creative

thinking, and their dynamic presentation skills. We were fortunate to have Dr Patricia Trott open our conference, and proud to have recognised Australian Keynote speakers Professor Mary Galea and Mr David Butler. Professor Galea is an internationally recognised leader in neurology, understanding voluntary movement, and recovery following neurological injury. In keeping with our diversity theme we also invited Mr David Butler, a recognised leader in the field of understanding pain. The variety of the program and post-conference workshops guaranteed multiple learning opportunities to suit everyone's interests and needs.

We are grateful for the support of our trade exhibitors and sponsors who were very generous in their contribution. I wish to thank the APA Conference Planning committee, in particular Stephanie Gershon, and our paediatric conference planning subcommittee Melissa Locke and Helen Burgan (co-convenors), Sue Charlton and Denise Luscombe, and the WA Chapter of the paediatric group for taking on the role of scientific committee.

**Noula Gibson**  
Chair, National Paediatric Group

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### Accuracy and reliability of a telerehabilitation system for administration of the Edinburgh Visual Gait Scale for children with cerebral palsy

Doyle KP,<sup>1</sup> Johnston LM,<sup>1 2</sup> Russell T,<sup>1</sup> Grote R<sup>3 1</sup> and Phillips T<sup>3</sup>

<sup>1</sup>Cerebral Palsy League of Queensland, Brisbane <sup>2</sup>Division of Physiotherapy, University of Queensland, Brisbane <sup>3</sup>Queensland Children's Gait Laboratory, Royal Children's Hospital, Brisbane

Observational gait analysis is essential for management of mobility concerns in children with cerebral palsy, however travel required to access to this typically metropolitan-based service is expensive and time consuming for children living in rural areas. This study aimed to investigate the suitability of new telerehabilitation technology as an alternative option. Participants included 26 children aged 4–17 years with cerebral palsy. Observational gait analysis was performed using the Edinburgh Visual Gait Score for cerebral palsy via traditional face-to-face split-screen methodology and a telerehabilitation system. Split-screen involved video recording and subsequent review of footage via a television monitor. The telerehabilitation system collected footage via web cameras, automatically saved this data at low (bitrate = 384 Kbit/s) and high (bitrate = 56 Kbit/s) compression and transferred it to an independent rater's computer via the internet. Measurement agreement was analysed between methods and intra-rater and inter-rater reliability was calculated for each method. Results showed good–excellent agreement between split-screen and telerehabilitation methods at low (%E  $\pm$  1: 96–100%; %EA: 67–96%; Kappa EVGS total 0.98) and high compression (%EA  $\pm$  1: 94–100%; %EA: 65–92%; Kappa EVGS total 0.95). Intra-rater reliability was excellent for all methods (Split-screen ICC = 0.97; telerehabilitation low compression ICC = 0.98; high compression ICC = 0.98). Inter-rater reliability was lower, but still very good for all methods (Split-screen ICC = 0.87; telerehabilitation low compression ICC = 0.90; high compression ICC = 0.90). Findings show that observational gait analysis via telerehabilitation technology, following high or low data compression is as reliable as traditional split-screen methodology. This supports telerehabilitation as a modern, cost-effective solution for providing greater equity in health service delivery for children with cerebral palsy living outside metropolitan areas.

### Altered muscle lengths in young people with cystic fibrosis

Giraud D,<sup>1,2</sup> Watter P,<sup>1</sup> MacDonald J-A<sup>1</sup> and Mandrusiak A,<sup>1,2</sup>

<sup>1</sup>The University of Queensland, Brisbane<sup>2</sup>  
Royal Children's Hospital, Brisbane

The aim of this study was to evaluate any differences between muscle lengths in a group of inpatient and outpatient young people with cystic fibrosis, and an age and gender matched group of typically developing children. Thirty-seven children with cystic fibrosis (17 inpatients, 20 outpatients) and 37 age and gender matched typically developing controls were included in the study. Ages ranged from 7–14 years. The following muscle lengths were measured using standard protocols: thoracic and lumbar flexors, extensors and lateral flexors; shoulder horizontal

adductors; pectoralis minor and major muscles, hip internal and external rotators, hamstrings and gastrocnemius. Young people with cystic fibrosis had significantly shorter pectoralis minor, pectoralis major and calf muscles, and significantly longer shoulder horizontal adductor and hip internal and external rotator muscles ( $p$  ranged 0.001–0.03) than matched typically developing young people. Height, weight and body mass index (BMI) were similar for both groups. No significant differences between inpatient and outpatients with cystic fibrosis were found for height, weight or BMI, and although those in the inpatient group were significantly older ( $m = 11.00$  years) than those in the outpatient group ( $m = 9.62$  years) ( $p = 0.029$ ), there were no significant differences in muscle length between these two groups. Young people with cystic fibrosis are likely to have some shortened muscles, which need to be considered by physiotherapists when planning and implementing their treatment programs.

### Are physiotherapists able to identify motoric markers that will predict infants at risk of adverse developmental outcomes who present with torticollis/plagiocephaly?

Beaton HE,<sup>1</sup> Hall A,<sup>2</sup> Munasignhe A,<sup>1</sup> Oliff C,<sup>1</sup> Parsons A,<sup>1</sup> Patel S,<sup>1</sup> Walker J,<sup>2</sup> Walters J<sup>1</sup> and Wray JA<sup>1</sup>

<sup>1</sup>The State Child Development Centre, Child & Adolescent Health Service, Perth <sup>2</sup>The Association for the Blind Western Australia, Perth

The aim of this study was to examine the ability of physiotherapists compared to paediatricians and visual orthoptists to categorise infants referred with torticollis into clinical sub-groups based on motor developmental assessment and for physiotherapists to identify infants at high risk of developmental delay. This multidisciplinary prospective longitudinal observational study based in a community child development service was completed in 2007. Fifty-nine infants who were referred to the service with torticollis were enrolled into the study (age range 1–6 months, mean age 3 months). All subjects received an initial physiotherapy assessment comprised of the Movement Assessment of Infants (MAI), the Alberta Infant Motor Scale (AIMS) and evaluation of cervical movements. Infants were assigned by the physiotherapist into one of six clinical sub groups. Group 1 torticollis only; Group 2 torticollis, plagiocephaly and normal muscle tone; Group 3 torticollis with or without plagiocephaly with tonal anomalies; Group 4 torticollis, with or without plagiocephaly, tonal and visual motor anomalies; Group 5 plagiocephaly only; and Group 6 none of the above. Infants were given therapeutic intervention based upon initial assessment outcomes and ongoing evaluation of intervention effectiveness. At 6 and 12 months, the infants received a standardised general developmental assessment (Griffiths Mental Developmental Scale) performed by a developmental paediatrician, and were also assigned into one of the six clinical sub groups. Thirty-nine infants also received a standardised visual motor assessment (TELER) performed by an orthoptist. The orthoptist assigned infants into one of two clinical groups: 1) visual problems, 2) normal vision. With regards to the initial aim of classification, results are still under analysis. Preliminary analysis has showed that initial physiotherapy assessment identified 25% of infants who

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had other developmental delays identified at 12 months. The presentation will focus on the important study outcomes, implications for physiotherapy practice.

### A retrospective and prospective review of clinical history and referral patterns for children presenting with slipped upper femoral epiphysis

Weigall PM, Vladusic SL and Torode IP

*Royal Children's Hospital, Melbourne*

Slipped upper femoral epiphysis (SUFE) is a condition which requires urgent admission to hospital for surgical management, but is often complicated by delayed diagnosis. This study investigates the incidence and factors contributing to missed or delayed diagnosis of SUFE, by a retrospective and prospective review of children ( $n = 120$ ) who presented to the Royal Children's Hospital with a diagnosis of SUFE from 2003–2007 (69 boys and 51 girls). The mean age at admission was 13.1 years for boys and 11.5 years for girls. There were 103 unilateral SUFE and 17 simultaneous bilateral SUFE. For children admitted prior to 2006, information was obtained retrospectively from the medical record and by telephone conversation with the child's parent. From 2006, information has been obtained prospectively at the time of admission or during the inpatient stay. Average time from onset of symptoms to initial presentation to a health professional was 65.5 days (range 1–540). Average time from initial presentation to a health professional to diagnosis was 60.0 days (range 0–730). Factors causing delay in diagnosis include failure to recognise the SUFE symptoms, delays in obtaining and reporting appropriate investigations, and failure to instigate direct referral following diagnosis. This study highlights the difficulties in diagnosis given the often vague and subtle symptoms in the presentation of children with SUFE, and emphasises the need for greater awareness of this condition in all paediatric primary health care providers.

### A retrospective audit of the impairment and functional ability in young people with lipomyelomeningocele

Mobbs C,<sup>1</sup> Moller M,<sup>2</sup> Watter P<sup>3</sup> and MacDonald J<sup>3</sup>

<sup>1</sup>Disability Services, Brisbane <sup>2</sup>Royal Children's Hospital, Brisbane

<sup>3</sup>University of Queensland, Brisbane

The aim of this study was to examine the idiosyncratic presentation of impairment and functional ability in young people with lipomyelomeningocele (LMM) who attend the Brisbane Royal Children's Hospital (RCH) spinal disabilities clinic (SDC) in order to evaluate current LMM clinical physiotherapy pathway. An audit of 26 charts was undertaken which represented the total cohort of young people with LMM within a total cohort of young people on RCH SDC database ( $n = 155$ ), with LMM representing 17%. Mean age of cohort with LMM was 9.7 years (22 months to 18 years). Mean age at diagnosis was 12.8 months (birth–8 years) and while 85% of cohort were diagnosed before 12 months of age, 15% were diagnosed between 1–10 years with the presenting symptom of failure to gain continence. All of the young people with LMM were functional community ambulators. Changes in motor function were experienced in

27% of this cohort since their last physiotherapy assessment at RCH SDC and changes in MMTs for any one muscle tested over time were observed in 40–80% of young people with LMM. Thirty-eight percent of the cohort with LMM reported experiencing back/head aches at their most recent physiotherapy assessment while 23% had altered skin sensation and 12% had bladder function changes at the time of their last physiotherapy assessment. A consistent, formalised approach to assessment of young people with LMM is necessary to monitor function and safeguard the health of this complex cohort of young people. This study will be helpful in reviewing clinical pathways for clients of the SDC.

### Body mass index and motor competence in young Perth children

Hewitt M,<sup>1</sup> Jensen L<sup>1</sup> and Briffa T<sup>2</sup>

<sup>1</sup>Curtin University of Technology, Perth <sup>2</sup>The University of Western Australia, Perth

Physical inactivity has been linked to the escalating prevalence of childhood overweight and obesity. Promoting physical activity to establish and maintain a healthy childhood weight assumes motor competence. This study examined whether body mass index was associated with gross motor competence in children aged 4–9 years. We recruited a convenience sample of 70 children (37 girls) with mean age 6.7 years (range 4.6–9.2) attending a non-government metropolitan primary school and its associated preschool. We measured participants' height (nearest 0.1 cm) and weight (0.1 kg) and their motor ability using the Test of Gross Motor Development (2nd ed). Fifty-four (77.1%) children were of healthy weight, while 16 (22.9%) were overweight or obese (defined by International Obesity Taskforce cut off points corrected for age and sex). There was no significant difference between gross motor quotient scores for healthy versus overweight and obese children (98.28 versus 97.00 points;  $p = 0.62$ ). Similarly, no statistically significant differences existed between groups for the locomotor (8.87 versus 7.81;  $p = 0.06$ ) and object control (10.52 versus 11.19;  $p = 0.30$ ) components. Further, there was no linear relationship between gross motor quotient and body mass index even with adjustment for age and sex ( $p = 0.13$ ). Thus, despite nearly a quarter of the children being overweight or obese, body mass index was not associated with motor ability in selected young Perth school children. The majority of children had sufficient motor ability to participate in standardised gross motor tasks regardless of body mass index status.

### Can foot and ankle muscle strength be reliably measured in very young children?

Rose K,<sup>1,2</sup> Burns J,<sup>1,2</sup> Ouvrier R,<sup>1,2</sup> Ryan, M<sup>3</sup> and North K<sup>1,2</sup>

<sup>1</sup>Institute for Neuromuscular Research, The Children's Hospital at Westmead, Sydney <sup>2</sup>Discipline of Paediatrics and Child Health, The University of Sydney, Sydney <sup>3</sup>The Department of Neurology, The Royal Children's Hospital, Melbourne

Reliable and objective outcome measures for clinical trials in very young children are lacking. In particular, clinical



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trials evaluating therapies to improve foot and ankle muscle weakness in children with neuromuscular disorders require reliable outcome measures to assess treatment success. The primary aim of this study was to evaluate the reliability and suitability of using handheld dynamometry to measure foot and ankle muscle strength in very young children. Secondary aims were to establish normal values for foot and ankle muscle strength and determine the relationship between strength and functional ability. A community sample of 60 healthy children aged two, three and four years (20 children in each age group consisting of 10 boys and 10 girls) were recruited for this cross-sectional reliability study. Strength of muscles responsible for foot inversion and eversion, as well as ankle plantarflexion and dorsiflexion were quantified using a handheld dynamometer. Participant behaviour during muscle testing was measured by each assessor using a 100 mm visual analogue scale. Three functional tests were assessed in order to validate the strength measures obtained from the dynamometer. These included time to run 9 metres, vertical jump height and horizontal jump length. Intra-rater and inter-rater reliability will be determined using the intraclass correlation coefficient and 95% confidence intervals. To determine the absolute between trial variability in scores, the standard error of measurement will be calculated. To date, 51 children have been recruited and the final results will be presented at the APA Paediatric Group Conference.

### Clinically relevant muscle strength and endurance values of Western Australian children aged 8–12 years

Rolfe K,<sup>1</sup> Laird K<sup>2</sup> and Hamer PW<sup>1</sup>

<sup>1</sup>The University of Notre Dame Australia, Fremantle <sup>2</sup> Princess Margaret Hospital for Children, Perth

There are many children who suffer debilitating stays in hospital who then need to return to school and play with their peers. To allow this return, clinicians must guide the child towards regaining adequate levels of muscle strength and endurance. However, relatively few studies provide normative or reference values for easily administered measures of physical capacity in the paediatric population. As a result, this study aimed to provide easily measured reference values for muscle strength and endurance of healthy children aged 8–12 years of age. Two hundred and thirty healthy children from primary schools in the Perth metropolitan area were tested for selected muscle strength and endurance values using a variety of tests including the use of the Jamar hand-held dynamometer, Lafayette Manual Muscle Test System, a modified Biering-Sorenson test, sustained squat and number of repeated heel-raises. Results indicated that strength increased as age and height increased; plantar-flexor and thigh muscle endurance increased with age; and trunk muscle endurance varied across the age and height ranges. This study presents reference values for muscle strength and endurance in healthy children aged 8–12 years. The data collected will allow clinicians and therapists to evaluate the progression of disease or recovery, evaluate the outcomes of intervention and importantly guide goal-setting for exercise prescription for previously unwell or injured children to attain the physical capacities allowing return to the social and physical settings of play, games and sport.

### Comparison of energy expenditure index of typical developing adolescents and adolescents with developmental disabilities

Rotor ER, Galero ML, Hebreo AR, and Tongo, MA

University of the Philippines-Manila, Philippines

The study aimed to compare the energy expenditure index of adolescents with developmental disabilities to those who are typically-developing. Twenty-four subjects participated in a descriptive study, 12 participants with developmental disabilities, mean age 14.5, and 12 age-matched typically-developing adolescents. The diagnoses of the group with developmental disabilities are Down syndrome ( $n = 2$ ), autism ( $n = 7$ ), and mental retardation ( $n = 3$ ). To determine the energy expenditure index, the resting heart rate was subtracted from ambulation heart rate and this was divided by the ambulation velocity. Mean findings show that resting heart rates and ambulation velocity among the typically-developing group is higher than the group with developmental disabilities. A comparison of findings between the two groups using the Mann-Whitney test shows significant differences between resting heart rate,  $p = 0.001$ , ambulation heart rate,  $p = 0.017$  and energy expenditure index,  $p = 0.008$ . This may be explained by the higher increase in ambulation heart rates among the group with developmental disabilities. Adolescents with developmental disabilities are predisposed to a sedentary lifestyle putting them at risk for medical conditions like diabetes, heart diseases and obesity. Currently, practice patterns of Filipino physical therapists in developmental disabilities are in early intervention and early childhood. This study emphasises the need to expand current practice to adolescents and early adulthood and stresses the role of physical therapists to promote wellness among this population.

### Correlations between respiratory status and functional measures in young people with cystic fibrosis

Mandrusiak A,<sup>1,2</sup> Watter P,<sup>1</sup> MacDonald J,<sup>1</sup> Moller M,<sup>2</sup> Wilson C<sup>2</sup> and Paratz J<sup>3</sup>

<sup>1</sup>The University of Queensland, Brisbane <sup>2</sup>The Royal Children's Hospital, Brisbane <sup>3</sup>The Royal Brisbane and Women's Hospital, Brisbane

Physiotherapists managing young people with cystic fibrosis would find it clinically useful if a relationship was demonstrated between respiratory function tests and physical measures and activities. This study explored the relationships between respiratory function and functional measures in this population. Activities were chosen to be readily transferable to any setting, including the school and home. Seventy-three participants with cystic fibrosis aged 7–17 years (mean = 11.94 years) were recruited as a consecutive series who satisfied selection criteria, either as inpatients ( $n = 37$ ) or outpatients ( $n = 36$ ). The International Classification of Functioning, Disability and Health provided a framework for grouping measures: body structure and function (musculoskeletal, respiratory, physiological), activity (six-minute walk test, jump tasks) and participation (Cystic Fibrosis Questionnaire, Fels Physical Activity Questionnaire). Pearson's correlation (two-tailed) was computed between measures, controlling



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for patient group (inpatient or outpatient), age and gender. Example correlations (mostly moderate,  $p$  ranged < 0.001–0.03) were found between respiratory function and: elbow flexion strength, vertical jump height, distance walked in six-minutes, number of jumps performed before fatigue and quality of life-physical domain for child, adolescent and parent-report. This study shows that impairment in respiratory function may be related to impairment in other parameters within the body structure and function domain, as well as activity limitations and participation restrictions. This strengthens the evidence base for physiotherapists to use simple field tests to assess strength, power, range of motion, endurance, activity and quality of life in young people with cystic fibrosis.

### Do environment and personnel affect the effectiveness of group motor coordination programs for children with developmental coordination disorder: a randomised controlled trial

Ward EJ,<sup>1,2</sup> Hillier S<sup>1</sup> and Raynor A<sup>1</sup>

<sup>1</sup>University of South Australia, Adelaide <sup>2</sup> Flinders Medical Centre, Adelaide

Despite the amount of literature regarding developmental coordination disorder (DCD) there is paucity of literature relating to service delivery. This study aims to identify the most appropriate personnel and setting to provide group motor coordination programs to children with DCD. A randomised controlled trial is currently being conducted to assess three modes of service delivery for children with DCD, comparing personnel and environment. Allied health professionals (AHP) will be compared to school assistants (SA), and the school environment will be compared to the health clinic environment. A prewritten 14-week motor coordination program is being delivered to 5 to 8-year old children with DCD in 13 South Australian public schools in one of the following modes: in school conducted by AHP, in school provided by SA or in clinic provided by AHP. The effectiveness of these groups will be assessed using the Movement-ABC (MABC), Test of Gross Motor Development (TGMD), Pictorial Scale of Perceived Self Competence and parent/child questionnaires specific to the study. These will be administered pre and post intervention and at 6 months follow-up. Ninety-seven participants have been recruited and stratified cluster randomisation was performed to randomise schools for an intervention mode. Preliminary results using mixed model statistics, following the first round of data collection revealed a significant improvement  $p < 0.001$ , for all modes of delivery using MABC data pre and post intervention (mean difference 6.88 MABC points). Final results will be available in September 2007. The findings will be used to inform recommendations for future services to children with DCD.

### Evaluating movement quality in children with developmental coordination disorder

Watter P,<sup>1</sup> MacDonald JA,<sup>1</sup> Yap K<sup>1,2</sup> and MacFadyen C<sup>1</sup>

<sup>1</sup>The University of Queensland, Brisbane <sup>2</sup> Singapore Hospital, Singapore

Children with developmental coordination disorder (DCD) demonstrate deficits in their ability to achieve age appropriate levels of movement quality, impacting on their participation and adversely affecting self esteem. This comparative study evaluated fine and gross motor movement quality, using clinical descriptors/ratings developed for a norm based project ( $n = 508$ ). Nineteen children (14 males) aged 69–137 months referred to a physiotherapy service performed 4 gross motor tasks (jump a line forward/back and side/side; astride jump; floor/stand manoeuvre), and 23 children (15 males) aged 69–146 months performed 3 fine motor tasks (finger tapping, drumming, opposition). Distribution of ratings was examined, and Z scores were calculated where numbers were sufficient, using age-matched typical data. No child with developmental coordination disorder received the best/normal rating of '1' on any gross motor task at any age, whereas 17% of 6-year olds increasing to 74% of 11-year olds did in the typical group. Fewer typical children scored the poorest quality rating of '3' than those with developmental coordination disorder, at every age for every task. At 6 years, the experimental group scored significantly worse than the typical group for all gross motor tasks ( $p$  ranged 0.01–0.001). Children with DCD at 6 and 7 years scored worse on most fine motor measures compared with typical children ( $p$  ranged 0.025–0.001). Importantly for clinicians, the ratings can be used to provide both descriptive and quantitative information for evaluating the performance of children with developmental coordination disorder. This strengthens the evidence base for physiotherapy practice.

### Implementation of family-centred practice in children with minor motor dysfunction

Klepper K,<sup>1,2</sup> Burns YR<sup>2</sup> and Watter P<sup>2</sup>

<sup>1</sup>Child Development Program, Royal Children's Hospital, Brisbane <sup>2</sup>The University of Queensland, Brisbane

This study investigated the efficacy of physiotherapy intervention for children with motor coordination problems that incorporated a child and family-centred therapy approach. A two group cross-over study was carried out in school-aged children (aged 7.5–10.5 years) with motor difficulties. The participants were 17 children who attended a community based child development unit and satisfied the inclusion criteria. They were randomised to one of two groups. Group 1 received intervention (10 weekly sessions) while group 2 received no intervention. After three months, the non-intervention group received intervention. Both groups were followed for a further three months after cessation of intervention and reassessed to evaluate maintenance of any gains made during the intervention period. To evaluate change in motor function and goal attainment, a number of assessments were used. Child and parent perception of competency and

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satisfaction were evaluated. Results on standardised motor assessment (M-ABC) showed significant improvement after intervention for one group ( $p = 0.02$ ) but not the other ( $p = 0.52$ ). Improvements on the Goal Attainment Scaling (GAS) after intervention were significant for both groups ( $p < 0.001$ ). Results of both groups on Likert scales, showed improvement for satisfaction and performance by both children and parents ( $p < 0.001$ ). All improvements were maintained over a period of three months of non-intervention. The results of this study suggest that GAS and Likert scales are useful measures of quantitative child and family specific goals demonstrating improvement with physiotherapy intervention, in children with minor motor difficulties.

### Measuring activity levels during typical activities of childhood

Rush R,<sup>1,2</sup> Brown C,<sup>2</sup> Collins A,<sup>2</sup> Hauschildt J<sup>2</sup> and Watter P<sup>2</sup>

<sup>1</sup> The Royal Children's Hospital, Brisbane

<sup>2</sup> The University of Queensland, Brisbane

This correlational study aimed to investigate the relationship between measures of activity using an electronic pedometer at hip and ankle, the ActivPAL™ at upper and lower thigh, and gold standard recording from video observation, when performing typical activities of childhood. Ten subjects undertook a walking task and activities typical of childhood (climbing stairs, running, jumping, crawling, dressing, handball, cycling). The data were collected by electronic pedometer, gold standard video observation and ActivPAL™. ActivPAL™ is a physical activity log which uses angulation of the thigh to record the time spent in sitting/lying, standing and stepping. Since the study simply examined the relationships between the equipment, we used adults to achieve the cycles of data collection necessary. Counts (number of steps or movements) from pedometers and ActivPALs™ correlated well with the gold standard across most activities ( $r$  ranged 0.64–0.98). There were some differences during specific activities based on hip/ankle placement of the pedometer or ActivPAL™. In stair climbing, ankle pedometer correlated better with gold standard ( $r = 0.92$ ) than did hip pedometer ( $r = 0.66$ ); in handball, the ankle pedometer correlated ( $r = 0.74$ ) better with gold standard than did hip pedometer ( $r = 0.38$ ); lower thigh placement of ActivPAL™ correlated better ( $r = 0.95$ ) with gold standard for cycling than did upper placed ActivPAL™ ( $r = 0.29$ ). Results indicate that the both pedometer and ActivPAL™ are effective measures of activities of childhood, although the pedometer is more cost effective. This study supports that diverse measures can be used to evaluate activity, strengthening the evidence base for physiotherapy practice.

### Mentoring in the physiotherapy department of a paediatric teaching hospital

West KD, Hancock J and Wicks S

*The Children's Hospital at Westmead, Sydney*

Mentoring is a professional development activity whereby a partnership is established so that the mentee can learn from their more experienced mentor. Importantly, mentoring relationships exist outside of organisational structures and are independent of existing line management and performance management arrangements. Mentoring is not a replacement for clinical supervision. The aim of The Children's Hospital at Westmead Physiotherapy Department Mentoring Program is to encourage and inspire staff to further their knowledge and skills beyond their current job descriptions, therefore improving the quality of the physiotherapy service provided and contributing to long-term professional development. The program commenced in March 2006 with 19 mentees receiving mentors via a facilitated matching process. A survey was conducted after six months. Five staff members had left. Of 14 remaining partnerships 10 mentees and 11 mentors replied to the survey. Most people had met at least twice and some at least five times in the first six months. Mentees set themselves three goals to achieve at the beginning of the program. At six months 16% had achieved their goals and 80% were working towards their goals. Participants reported the best aspects of the program being a chance to work together with someone to achieve goals and motivation to complete tasks both within current roles and beyond. Mentors reported satisfaction from having helped someone and having an opportunity to give something back to the profession. Eighteen people wanted to continue mentoring with their current partner. A 12-month evaluation of the program will be conducted in April 2007.

### Multidisciplinary physical activity and diet intervention for obese adolescents: a pilot study

Johnston KN and Laird K

*Department of Physiotherapy, Princess Margaret Hospital for Children, Perth*

Referrals to the physiotherapy department for management of obese patients increased nearly four-fold in 2006 compared with 2005. The aim of this pilot study was to determine the efficacy of a group program for obese adolescents. Thirteen obese adolescents (10 girls, aged 13.5 [2.1] years, BMI = 35.2 [8.7] kg/m<sup>2</sup>) participated in the study. The eight-week program 'FitMatters' involved supervised exercise sessions, behaviour change strategies to increase physical activity and reduce screen time, dietary education sessions, social work contact, and a parent information session from a clinical psychologist. All adolescents completed the intervention and the pre/post outcome measures. Participants demonstrated significant reductions in waist circumference (mean diff 6.2 [5.8] cm, 95% CI 2.6 to 9.8 cm,  $p = 0.003$ ) and hip circumference (mean diff 5.0 [3.9] cm, 95% CI 2.5 to 7.5 cm  $p = 0.001$ ) after completing the program. Adolescents also described more benefits and fewer barriers to exercise after completing FitMatters (mean improvement Exercise Benefits and Barriers Scale = 11.1 (12.2) points, 95% CI

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3.7–18.5 pts,  $p = 0.007$ ). Post intervention participants had more positive perceptions of their self worth (mean diff = 4.9 [4.2], 95% CI 2.3–7.6,  $p = 0.002$ ) and physical appearance (mean diff = 2.3 [2.0], 95% CI 1.3–3.8,  $p = 0.001$ ) in the Harter Self Perception Profile. Self reported daily sedentary time decreased (mean reduction = 1.5 [1.1] hours, 95% CI 0.8–2.2 hrs,  $p < 0.001$ ) and weekly exercise time increased (mean increase = 2.6 [2.5] hours, 95% CI 1.1–4.1 hrs,  $p = 0.003$ ). The results suggest FitMatters was an effective program to achieve short-term improvements in anthropometry, psychological measures and lifestyle change in obese adolescents.

### Musculoskeletal management of pelvic alignment issues in children improves co-morbid symptoms of bed wetting: a case study

Dikkenberg A

Camberwell Physiotherapy, Melbourne, Australia

This case study reports the apparent causal effect between pelvic alignment problems and bed wetting. Single case design is presented for two subjects treated in a private physiotherapy practice. Subject one presented with low back pain and co-morbid bed wetting. Subject two presented with pelvic alignment issues and co-morbid bed wetting but had no back pain. A detailed history of pain, bladder and bowel management was taken including bladder tests to rule out medical problems. A detailed physical examination of the lumbar spine, pelvis and sacrum was performed including muscle power assessment. Intervention involved muscle energy techniques, lumbar joint mobilisation, massage and basic core exercises. Outcomes were removal of pain in the pain symptomatic subject and improvement in pelvic alignment. Secondary outcome was found to be that bed wetting was alleviated for both subjects. Subject one was pain free, with improved pelvic alignment and dry following three treatments over three weeks. The subject remained pain free and dry at review three months post intervention. Subject two showed improved pelvic alignment and no bed wetting symptoms following just one treatment. Improvement was maintained for three months. Both subjects showed a recurrence of bed wetting symptoms at three months which was associated with pelvic malalignment. This relapse was treated successfully with one treatment for both subjects. These observations suggest that assessment and treatment of pelvic alignment and stability are useful adjuncts to treating bed wetting in children who present with this co-morbid state. Further research regarding the incidence of the association of pelvic alignment and continence issues in children is needed.

### Paediatric physical activity measurement using the new ActivPAL™

Johnston LM,<sup>1,2,3</sup> Howard A,<sup>2</sup> Jakab S,<sup>2</sup> Lloyd M,<sup>2</sup> Saw A<sup>2</sup> and Edgerton T<sup>2</sup>

<sup>1</sup>Cerebral Palsy League of Queensland, Brisbane, Australia <sup>2</sup>Division of Physiotherapy, University of Queensland, Brisbane, Australia <sup>3</sup>Mater Children's Hospital, Mater Health Services Brisbane, Australia

In childhood motor disorders, accurate physical activity measurement and physiotherapy intervention is required to

reduce negative outcomes of inactivity including impaired fitness, play, socialisation, self-care and quality of life. Measurement tools, originally designed for adults, lack reliability in children (activity diaries), adaptation for community settings (Cosmed) or range of information recorded (pedometers, up timers). This study investigated reliability and validity of the ActivPAL™, a new multi-modal activity log, for recording childhood activities. Ten students repeated two-minute trials of 11 childhood activities (sitting, crawling, standing, walking, running, jumping, stairs, cycling, handball, computer games, dressing). ActivPALs™ attached above and below mid-thigh recorded state duration and step count. Measurement agreement was determined between ActivPAL™ devices, repeated trials and with gold standard video observation. Good agreement was demonstrated for state duration between ActivPALs™, between trials and with video observation, especially for static (e.g. sitting) and repetitive tasks (e.g. crawling) with slightly lower agreement for non-repetitive tasks (e.g. dressing, computer games) and cycling. Step count agreement between trials and with video observation was equal or better for the uppermost ActivPAL™ for all tasks except the cycle task. Agreement for step count between ActivPALs™ was best for static (e.g. sitting  $r = 1$ ), followed by repetitive tasks (e.g. crawling  $r > 0.95$ ) and then cycling. Findings suggest that mid-thigh placement of the ActivPAL™ is critical for cycling and that accurate activity measurement in children would be best achieved using the ActivPAL™ to record state duration and step count alongside an activity diary to record nature of activity.

### Physical and sedentary activity in adolescents with cerebral palsy

Maher CA,<sup>1,2</sup> Williams MT,<sup>1</sup> Olds TS<sup>1</sup> and Lane AE<sup>1</sup>

<sup>1</sup>University of South Australia, Adelaide <sup>2</sup>Novita Children's Services, Adelaide

Australian guidelines recommend that young people should participate in at least 60 minutes of moderate-to-vigorous-intensity physical activity every day and restrict recreational use of electronic media to less than 2 hours per day. This study investigated current patterns of physical and sedentary activity in adolescents with cerebral palsy (CP). A cross-sectional, descriptive postal survey was used to survey young South Australians with a primary diagnosis of CP aged 11 to 17 ( $n = 229$ ). Two instruments were used; the Physical Activity Questionnaire for Adolescents (PAQ-A) and self-report for level of gross motor function (based upon the Gross Motor Function Classification System). Information was also sought regarding weekly screen time (time spent viewing television, playing on the computer and playing video games). Data were analysed descriptively and ANCOVA used to identify relationships between participants' characteristics and physical and sedentary activity patterns. Results were compared with recent normative age- and gender-matched datasets. One hundred and eighteen surveys were returned (mean age 13 yrs  $1m \pm 23m$ , males  $n = 76$ ). Adolescents with CP were less physically active than their able-bodied peers, and tended to participate in less structured and lower intensity physical activities. The sedentary activity patterns (screen time) of adolescents with and without CP were very similar. Within



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the CP respondents, physical activity level was related to level of gross motor function ( $p < 0.001$ ) and inversely related to age ( $p = 0.03$ ). Males accrued more sedentary time than females ( $p = 0.01$ ), however sedentary time was unrelated to other demographic characteristics.

### **Play and learn support for young children and their families: early intervention programs in remote Indigenous communities of Arnhem Land**

Dunkin HJ

*Batchelor Institute of Indigenous Tertiary Education, Yirrkala*

'Play and learn support for young children and their families' is an early intervention initiative of Anglicare-NT and Batchelor Institute of Indigenous Tertiary Education under the Australian Government's Communities for Children Strategy. It operates in remote Aboriginal communities of North-East Arnhem Land. Most of these communities are accessible only by air, have high numbers of children with failure to thrive issues and have limited service delivery. The aim is to give Indigenous community workers and local women an understanding of motor development from birth to three years, to equip them to provide stimulation through play and to enable them to recognise children showing signs of developmental delay and refer them to a health professional. It also provides support for families and children with special needs. The program is delivered in communities through the provision of training packages and mentoring of Indigenous trainees. Training developed by a paediatric physiotherapist is practical, interactive and culturally appropriate for learners with English as a second language. Teaching materials focus on observation using illustrations based on the Alberta Infant Motor Scale. A snapshot checklist has been adapted from an Early Detection Manual from Indonesia. A one-year review highlights the successes and challenges as the training has been piloted in workshops with five Indigenous women in Gapuwiyak and Yirrkala and will be extended to Mililingimbi, Numbulwar, Umbakumba and Angurugu later in 2007.

### **Physiotherapy management of Australian children with obstetric brachial plexus palsy**

Bialocerkowski A, Virtue D, and Galea M

*School of Physiotherapy,  
University of Melbourne, Melbourne*

This study documented the treatment provided by Australian physiotherapists for young children (0–6 years of age) with obstetric brachial plexus palsy. A cross-sectional postal survey was sent to 184 Australian paediatric sites (hospitals, community health centres, non-government services, paediatric physiotherapy private practices). Sites were invited to participate in the study by completing a questionnaire on the management of young children with obstetric brachial plexus palsy. Consent was implied by return of a completed questionnaire. One hundred and forty-one questionnaires were returned (response rate = 77%). Seventy-two physiotherapy sites (52%) reported that treated young children with obstetric brachial plexus palsy.

The selection of treatment techniques was most frequently based on therapist experience. The primary treatment aim was prevention of contractures and joint deformities. Sensory re-education and protection of the affected upper limb were not treatment priorities. The most frequently used treatment techniques included play, integration of the affected upper limb, active movement exercises and facilitation of gross motor development. Serial casts, passive accessory mobilisations and splints were infrequently used. Children were discharged from physiotherapy if they made a full recovery (which was variably defined), when a plateau in status was reached or on referral to another physiotherapy service. There is little information in the literature on what constitutes physiotherapy management for young children with obstetric brachial plexus palsy. The results of this study add to the body of knowledge in this area and will be used to develop a clinical guideline for physiotherapy management of children with obstetric brachial plexus palsy.

### **Physiotherapy service provision and assessment techniques used for Australian children with obstetric brachial plexus palsy**

Bialocerkowski A, Virtue D,  
and Galea M

*School of Physiotherapy,  
University of Melbourne, Melbourne*

This study documented the service provision and assessment techniques used by Australian physiotherapists who treat young children (0–6 years of age) with obstetric brachial plexus palsy. A cross-sectional postal survey was undertaken on 184 Australian paediatric sites (hospitals, community health centres, non-government services, paediatric physiotherapy private practices). Sites were invited to participate in the study by completing a questionnaire on the management of young children with obstetric brachial plexus palsy. Consent was implied by return of a completed questionnaire. One hundred and forty-one questionnaires were returned (response rate of 77%). Seventy-two physiotherapy sites (52%) provide outpatient treatment for young children with OBPP. These sites were located throughout Australia. Most frequently treatment was provided by a senior physiotherapist. Only three multidisciplinary clinics were reported in Australia (located in New South Wales, Western Australia and Victoria). All comprised a physiotherapist. The selection of assessment techniques was most frequently based on therapist experience. Range of movement, which was most frequently quantified visually, was used by the majority of physiotherapists. OBPP-specific assessments, such as the Active Movement Scale and Assisted Hand Assessment, were infrequently used. Developmental assessments were routinely performed by 48 physiotherapists (71%). The Alberta Infant Motor Scale was the most frequently used (48%). Twenty-six physiotherapists (41%) stated that they routinely referred infants to occupational therapists or paediatricians for developmental assessment. These results indicate that further physiotherapy education is needed on psychometrically sound assessment techniques for children with OBPP, including developmental assessments. This will increase the effectiveness of outcome measurement and selection of appropriate management strategies.



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### Positional plagiocephaly prevention campaign: 1-year and 3-year outcomes

Leung AY

*Therapy and Support Service for Children, Ipswich*

A positional plagiocephaly prevention campaign has been launched in the West Moreton South Burnett Health Service District. The prevention campaign included: development of educational materials; training delivered to child health nurses and midwives; implementation of prevention strategies in the maternity ward of a local government hospital; and the promotion of prevention strategies in new parents group meetings. The purpose of this study was to investigate the impact of this prevention campaign on the community after one year and three years post-implementation. Pre- (n = 86), 1-year (n = 99) and 3-year (n = 85) post-campaign questionnaires were completed by separate samples of mothers from the community with healthy babies who were under twelve month of age. While the 1-year survey did show an increase in awareness of positional plagiocephaly prevention compared to pre-campaign levels, this came at the cost of an increase in the number of mothers who reported putting their babies to sleep on their sides, which is not a prevention strategy. This was rectified in further health promotional activities. In the 3-year survey, the number of mothers reporting putting their babies to sleep on their sides had reverted to pre-campaign levels. There was no significant increase in mothers changing baby's head position during sleep and put baby on their tummy in the 1-year survey but a significant increase was reported in the 3-year survey. About 80% of the mothers reported that they would seek advice from their general practitioners and child health nurse if their babies showed signs of plagiocephaly in pre-and post-campaign study.

### Preliminary results from a study of extremely preterm birth on infant motor development using the Alberta Infant Motor Scale

Pin TW,<sup>1</sup> Eldridge B,<sup>2</sup> Darrer T<sup>3</sup> and Galea MP<sup>1</sup>

<sup>1</sup>University of Melbourne, Melbourne <sup>2</sup>Royal Children's Hospital, Melbourne <sup>3</sup>Mercy Hospital for Women, Melbourne

Infants who are born at or less than 29 weeks of gestation (extremely preterm born) are recognised as developing at a significantly slower rate than their full-term peers. In addition to a delay in the attainment of major developmental milestones, the quality of the movements in these preterm infants is different. One of the aims of this study is to describe the longitudinal developmental trajectories of these infants in the first 18 months (corrected) of life. Fifty-nine infants who were born at or less than 29 weeks of gestation have been recruited for this longitudinal study and will be assessed at 4, 8, 12 and 18 months of corrected age using the Alberta Infant Motor Scale (AIMS). The assessments will be video-recorded. Since commencement of the study, two infants died before the first assessment and another infant died after the 4-month assessment. Twenty-nine infants have been assessed and 14 infants have completed their first two assessments. Infants who continued to use oxygen due to chronic lung diseases scored consistently at or lower than 5<sup>th</sup> percentile. Some infants were found to have a

large decline in their percentile ranks from the 4-month to 8-month assessments because they did not show as much as progression in the sitting subscores at the level expected from typically developing infants at this age. One possible explanation may be that these infants have strong extensor strength but inadequate flexor strength to counterbalance this for trunk control in a sitting position. Data analysis is continuing.

### Quality of life in adolescents with cerebral palsy

Maher CA,<sup>1,2</sup> Williams MT,<sup>1</sup> Olds TS<sup>1</sup> and Lane AE<sup>1</sup>

<sup>1</sup>University of South Australia, Adelaide <sup>2</sup>Novita Children's Services, Adelaide

Previous studies of the health related quality of life (HRQOL) of young people with cerebral palsy (CP) have relied heavily, or solely, on proxy reports from their parents/guardians. This study aimed to investigate the self-reported HRQOL of South Australian adolescents with CP. A cross-sectional, descriptive postal survey collected information on HRQOL (Pediatric Quality of Life Inventory 4.0 (PedsQL)), self-reported level of gross motor function (using the Gross Motor Function Classification System), general health issues and sleep quality/quantity. The survey was mailed to 229 young South Australians with CP (11–17 years), with 118 surveys returned. Sixty-six percent provided self-reported HRQOL data (median age 14 years, males n = 49, females n = 25); with the remainder deemed by their parent/guardian as having insufficient cognitive ability to self-report. Categorical and ratio data were analysed descriptively, with ANCOVA undertaken to identify relationships between participants' characteristics and HRQOL. Results were compared with recent normative adolescent and disease-specific paediatric HRQOL datasets. Within the CP participants, HRQOL was significantly related to number of health issues ( $p = 0.01$ ) and level of gross motor function ( $p = 0.02$ ). Descriptive analysis suggested that the adolescents with CP had lower HRQOL than their able-bodied peers (in both physical and psychosocial dimensions of HRQOL) and paediatric cancer and rheumatology populations. Two-thirds of CP respondents fell below the PedsQL 'at risk of impaired HRQOL' cut-off compared with only 13% of able-bodied adolescents. Further investigation is needed to determine how supportive services can impact on the HRQOL of this population.

### Reduced peripheral muscle strength in young people with cystic fibrosis

Masters K,<sup>1</sup> Wilson C,<sup>2</sup> Watter P<sup>3</sup> and MacDonald J<sup>3</sup>

<sup>1</sup>Redcliffe Hospital, Brisbane <sup>2</sup>Royal Children's Hospital, Brisbane <sup>3</sup>University of Queensland, Brisbane

The aim of this pilot study was to determine test-retest reliability of isometric strength testing in young people with cystic fibrosis (CF), to investigate differences in muscle strength between outpatient and inpatient young people with CF and to examine the differences in peripheral muscle strength between young people with CF and the values reported for healthy age and gender matched young people. Using convenience sampling, 17 outpatients (8

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males) and 15 inpatients (7 males) aged  $12 \pm 3.3$  years were recruited from Royal Children's Hospital's population of young people with CF. Isometric peak force for ankle dorsiflexors, elbow flexors, knee extensors, shoulder abductors, hip abductors and hip extensors were measured. The outpatient and inpatient cohort of young people with CF were compared for the variables of age, gender, respiratory function testing, body mass index, number of admissions in past year, genotype and pancreatic status. No significant differences existed between the groups. Both outpatient and inpatient cohort of young people with CF demonstrated very high levels of within session test-retest reliability for isometric muscle strength of all muscle groups (intra-class correlation coefficients ranging from 0.89–0.99). There was no significant difference in the isometric strength of the six groups of muscles between the outpatient cohort and inpatient cohort with CF. This cohort of young people with CF however were significantly weaker than reported values of healthy age and gender matched young people with respect to ankle dorsiflexors, elbow flexors, shoulder abductors, and hip abductors ( $p$  values ranging from 0.000–0.006).

### Relationship between hamstring length and spasticity and knee extension during gait in children with cerebral palsy

Johnston LM,<sup>1,2,3</sup> Alanzi S,<sup>2</sup> Watter P,<sup>2</sup> Grote R,<sup>2,3</sup> and Phillips T<sup>3</sup>

<sup>1</sup>Cerebral Palsy League of Queensland <sup>2</sup>Division of Physiotherapy, University of Queensland <sup>3</sup>Queensland Children's Gait Laboratory, Royal Children's Hospital, Brisbane

Optimal management of gait dysfunction in children with cerebral palsy via orthopaedic (e.g. surgery) and/or neurological interventions (e.g. botulinum toxin) is dependent on an understanding of the proposed effect of interventions and also the relative contributions of target musculoskeletal (e.g. contracture) and neurological causes (e.g. spasticity) to the nature, severity and prognosis of the gait abnormality. This study aimed to determine the relationship between the most common gait abnormality in children with cerebral palsy, poor knee extension, and its likely contributors, hamstring range and spasticity, with reference to effects on each gait phase. Participants included 19 children (12 boys) with cerebral palsy (10 diplegia, nine hemiplegia) aged three years or older (mean 128.5 months), with three-dimensional gait analysis and musculoskeletal assessment data stored at the Queensland Children's Gait Laboratory, and parental consent for research audit. Exclusion criteria were any orthopaedic surgery, recent botulinum toxin injection, or poor performance reliability due to compliance/behaviour. Database variables sampled included sagittal knee kinematics and temporospatial parameters during independent bare-footed walking, hamstring length (popliteal angle and straight leg raise) and hamstring spasticity (modified Tardieu scale). Correlations were determined between variables. Results showed that increasing hamstring contracture and spasticity were correlated with decreasing knee extension during stance and swing phases of gait and decreasing step length. Lower correlation between hamstring spasticity and stance phase extension highlighted the importance of other contributors such as quadriceps strength. In children with cerebral palsy,

abnormal musculoskeletal and neurological findings for the hamstrings contribute differentially to knee joint gait abnormalities.

### The APA motor skills project: a best practice model for inclusive education for children with physical disabilities

McCoy A,<sup>1</sup> Vu M,<sup>1</sup> Galea MP,<sup>2</sup> and Clark K<sup>1</sup>

<sup>1</sup>Australian Physiotherapy Association, Melbourne <sup>2</sup>Rehabilitation Sciences Research Centre, University of Melbourne, Melbourne

Whilst embracing the concept of inclusive education for children with physical disabilities in mainstream schools, paediatric physiotherapists contended that there remained unmet needs with regard to the motor skills of children who are unable to keep up with their able-bodied peers in the school environment. A grant to the Australian Physiotherapy Association (APA) from the Victorian Department of Education and Training funded the delivery of a pilot motor skills training program for children with mild to moderate physical disabilities in mainstream schools. An expert reference group with representatives from the physiotherapy, occupational therapy and teaching professions monitored the program. The program was conducted in local primary schools during term time in two metropolitan regions, and involved weekly physiotherapy or occupational therapy sessions to achieve individualised functional goals. The program was evaluated within the framework of the Victorian Essential Learning Standards strand of physical, personal, and social learning. The training programs enhanced the children's performance in three domains within the school environment: health and physical education, interpersonal development and personal learning. Teachers reported improved physical skills, confidence, self-esteem and participation in school life. For some children there was also an improvement in academic performance. The results of the APA Motor Skills Project support a model of collaboration to enhance the health and well-being of children with physical disabilities in primary schools. This model involves a partnership with the parent, therapist and teacher to address a child's physical needs and in turn improve confidence and level of participation in the school environment.

### The children's activity scale: reliability and concurrent validity with the movement assessment battery for children in an Australian setting

Pridham L, Hillier S and Esterman A

The University of South Australia, Adelaide

This study investigated reliability and concurrent validity of the children's activity scale (ChAS) with 4-year old Australian children. The ChAS has both parent and teacher rating scales designed to identify motor skill difficulties in 4 to 8-year old children. Twenty-one 4-year old children with varying abilities but without a diagnosed motor disorder were recruited from five preschools. Parents and teachers completed the respective versions of the ChAS once and again two weeks later to determine reliability. Concurrent validity of the ChAS was established with the

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movement assessment battery for children (MABC) which a physiotherapist undertook with each child. A further 50 children were recruited to determine concurrent validity because the original sample had low numbers of children with motor skill difficulties. Reliability of the ChAS scores was higher for parents ( $r = 0.85$ ) than teachers ( $r = 0.62$ ). Sensitivity of the parent and teacher versions of ChAS to identify children that the MABC determined to have motor skill difficulties was 80% and 77% respectively while specificity to identify children that the MABC determined not to have motor skill difficulties was 34% and 64% respectively. Correlation of the MABC scores with the ChAS scores was poorer for parents (Kappa 0.125 CI 95% 0–0.4337) than teachers (Kappa 0.3826 CI 95% 0.1617–0.6035). The sensitivity results indicate that both parent and teacher versions can identify children with motor skill difficulties. However using the teacher version may be preferable due to the higher specificity and correlation results.

### The development of Pre-PAQ®: construction of a questionnaire to measure physical activity in preschool-age children

Dwyer GM,<sup>1,2</sup> Baur LA,<sup>1,3</sup> Hardy LL<sup>3</sup> and Higgs J<sup>4</sup>

<sup>1</sup>Discipline of Paediatrics and Child Health, University of Sydney, Sydney

<sup>2</sup>Discipline of Physiotherapy, University of Sydney, Sydney

<sup>3</sup>NSW Centre for Overweight and Obesity, University of Sydney, Sydney

<sup>4</sup>The Education for Practice Institute, Charles Sturt University, Sydney

One in five preschool-aged children in Australia is overweight or obese. Physical inactivity and sedentary behaviour contribute to this situation. We need tools that measure these behaviours and from which we can then identify health-enhancing or risk behaviours. The physical activity questionnaire for preschool-aged children (Pre-PAQ®) has been developed to address a major gap in measurement of physical activity in young children, aged 3–5 years, in population studies. It has been designed within a socio-ecological framework, embracing the parent-child dyad, home and family environment, and neighbourhood and organisational influences upon the child's physical activity and sedentary behaviour. To strengthen the psychometric properties of the tool, the development of Pre-PAQ® has involved an extensive literature review of paediatric obesity risk factors and influences upon children's physical activity. The construction of Pre-PAQ® has been guided by previously validated tools including the 'children's leisure activity study survey', the 'Nepean kids growing up questionnaire', the 'adolescent physical activity recall questionnaire' and the 'physical activity in localities and community environments study'. Three strategies were used to determine that the Pre-PAQ® has strong face and content validity and adequate utility. These were: input from experts in physical activity (Australian Child and Adolescent Obesity Research Network) and early childhood educators, including staff from the Kindergarten Union Children's Services (NSW) ( $n = 15$ ), focus groups with parents and carers of preschool-aged children via focus groups ( $n = 32$ ), and pilot trialling of the questionnaire ( $n = 20$ ). Evaluation of its concurrent validity against accelerometry is underway. Theoretically the Pre-PAQ® appears to be a promising means of measuring physical activity and sedentary behaviour in children young children.

### The effect of a group-based occupational therapy and physiotherapy program on bimanual upper limb use in young children with hemiplegia

Auld M,<sup>1</sup> Langtry K,<sup>1</sup> Johnston L<sup>1,2</sup> and Glare A<sup>1</sup>

<sup>1</sup>Cerebral Palsy League of Queensland <sup>2</sup>Division of Physiotherapy, University of Queensland

Children with cerebral palsy-spastic hemiplegia have difficulty with bimanual tasks that involve simultaneous upper limb use. Two possible reasons include sensory disturbances and reduced weight shift to the affected side. Although these disturbances are well documented and commonly treated by therapists, intervention effectiveness is not well understood. This study aimed to investigate the effectiveness of a group-based therapy program designed to improve tactile tolerance, weight shift and bimanual function. Participants included six children aged 2–4 years with spastic hemiplegia. Pre and post-intervention assessment included lateral weight shift, posture and balance, bimanual skills tests, completion of the tactile behaviour observation scale (TBOS) and parent questionnaires. Prior to group sessions, parents attended an information session about difficulties in spastic hemiplegia. Children and parents attended eight weekly group-based therapy sessions, promoting weight shift, tactile tolerance and forced use of the affected side. Following sessions, parents performed a structured home program. Comparison of pre and post-intervention assessment scores was conducted using paired t-tests. The relationship between variables at pre and post-intervention phases was evaluated using Pearson Correlations. Improvements were noted in sensory tolerance, weight shift to the affected side and self-initiated bimanual function. Group-based physiotherapy and occupational therapy intervention accompanied by a structured home program is effective for improving weight shift, tactile tolerance and use of the affected side in children aged 2–4 years with spastic hemiplegia.

### The international classification of functioning, disability and health characterises diversity in young people with cystic fibrosis

Mandrusiak A,<sup>1,2</sup> Watter P,<sup>1</sup> MacDonald J,<sup>1</sup> Moller M,<sup>2</sup> Wilson W<sup>2</sup> and Paratz J<sup>3</sup>

<sup>1</sup>The University of Queensland, Brisbane <sup>2</sup>The Royal Children's Hospital, Brisbane <sup>3</sup>The Royal Brisbane and Women's Hospital, Brisbane

The aim of this study was to demonstrate the usefulness of the International Classification of Functioning, Disability and Health for characterising young people with cystic fibrosis. Seventy-three participants with cystic fibrosis were recruited as a consecutive series who satisfied selection criteria, either as inpatients ( $n = 37$ ) or outpatients ( $n = 36$ ) to provide a cross-sectional view at younger (7–11 years,  $n = 37$ ) and older (12–17 years,  $n = 36$ ) ages. Musculoskeletal, respiratory and physiological measures represented the body structure and function domain, the six-minute walk test and jump tasks were included in the activity domain, and participation was described by the Cystic Fibrosis Questionnaire and Fels Physical Activity Questionnaire. Contextual factors were also considered. In this paper, some components of physiotherapy assessment from each



## FREE PAPERS – continued

domain are described. Between inpatients and outpatients in the specified age groups, there was a statistically significant difference in means for the following measures, with inpatients displaying consistently poorer mean scores in both age groups: respiratory function ( $p = 0.001$ ); quadriceps muscle strength ( $p < 0.001$ ); pectoralis muscle length ( $p = 0.02$ ); seated ball throw ( $p < 0.001$ ); number of astride jumps performed before fatigue ( $p = 0.004$ ) and six-minute walk distance ( $p = 0.05$ ). However, there was no significant difference in reported activity levels between inpatients and outpatients for the specified age groups. This classification model allows comprehensive assessment for this diverse population of young people with cystic fibrosis, so strengthening the evidence base for effective intervention.

### The use of bubble PEP in Australian hospitals: results from a national benchmarking project

McDonald RM, Hennessy PA, Daley DT and Doumit MA

*Sydney Children's Hospital, Sydney*

Devices designed to administer positive expiratory pressure (PEP) have been used worldwide as an adjunct to conventional physiotherapy for over twenty years. Bubble positive expiratory pressure (BPEP) has been used across Australia for at least ten years, combining therapy and play to aid in the removal of excessive mucus and improve ventilation in the management of children with acute and chronic lung disease. The use of BPEP at Sydney Children's Hospital (SCH) was suspended in 2005 after senior nursing staff raised possible infection control and safety issues. The initial step in addressing these concerns was to investigate the current use of BPEP by conducting a national physiotherapy benchmarking project. Forty hospitals (85%) returned the questionnaire. Four hospitals did not use BPEP and five hospitals reported using other forms of PEP instead. Results were therefore based on information from 31 hospitals. The majority of hospitals (50%) had more than five patients per week using BPEP, for various conditions and ages. Despite this being a popular adjunct to therapy, there is discrepancy in clinical practice. Hospitals reported using a variety of bottles, water and tubing. However the largest variation in practice revolves around the changing and cleaning of equipment. There are no clear recommendations for current best practice and only ten hospitals have a protocol for using BPEP. Further research is required to establish evidence based infection control guidelines to ensure the continued use of this invaluable technique.

### Uptime in boys with severe haemophilia

Eldridge B,<sup>1</sup> Egan B,<sup>1</sup> Barnes C,<sup>1</sup> Wolfe R<sup>2</sup>

<sup>1</sup>The Royal Children's Hospital, <sup>2</sup>Monash University

In the past boys with haemophilia were discouraged from participating in physical activity. The introduction of prophylaxis has allowed these boys to experience less bleeding episodes and to participate in a wide variety of sporting and leisure activities. Currently there are no quantitative measurements of physical activity in the haemophilia population. The PALI is a remote activity

monitor that records uptime (time spent in the upright position). Uptime is an indication of physical activity, and normative values for the general child population (age 8–15 years) are available. The aim of this research was to measure uptime in a group of boys with severe haemophilia. Total uptime for each 24-hour period of recording was used to calculate mean uptime. This was compared to the mean uptime in normal children in order to investigate whether boys with severe haemophilia were less active than their peers. Fourteen boys with severe haemophilia were recruited from the Haemophilia Treatment Centre to participate in the study. They wore the PALI for four consecutive days. The results showed that boys with severe haemophilia had a mean uptime of 4.9 hours per 24-hour period (SD 1.3, range: 2.0–8.2 hours) compared with 5.3 hours (SD 1.5, range: 1.5–10.3 hours) for boys in Victoria, Australia. There was no significant difference in within-and between-child variability in uptime compared to normative values. The conclusion was that boys with severe haemophilia are as active as their peers and that uptime is a useful outcome measure for this group of children.

### Using goal attainment scaling to evaluate motor skills in children with physical disabilities in mainstream schools

Vu M,<sup>1</sup> McCoy A,<sup>1</sup> Galea MP<sup>2</sup> and Clark K<sup>1</sup>

<sup>1</sup>Australian Physiotherapy Association, Melbourne <sup>2</sup>Rehabilitation Sciences Research Centre, University of Melbourne, Melbourne

A pilot motor skills training program was conducted for twelve children with mild to moderate physical disabilities in Victorian mainstream schools. The program consisted of six weeks of group physiotherapy in one school term and six weeks of group occupational therapy in another school term. Group A received physiotherapy first whilst Group B initially received occupational therapy. Four goals pertaining to mobility, fine motor skills and self-care were identified with each child and his/her parents. Goal attainment scaling was used to evaluate achievement of the functional goals at 6 weeks, 12 weeks and at 18 weeks post baseline and at 3 months post completion of both training programs. Upon completion of physiotherapy, 80% of the children in Group A successfully met or exceeded their mobility goals. At the three-month follow up, 80% of these children continued to meet or exceed their goals. At 6 weeks and 12 weeks post baseline, prior to receiving physiotherapy, children in Group B made no substantial improvements in mobility whereas all the children met or exceeded their goals upon conclusion of the physiotherapy program. At the three-month follow up, 67% of the children in Group B were able to perform their goals at the expected level. The results of this study suggest participants can benefit from a six-week goal oriented physiotherapy and occupational therapy group program. Further, the goal setting process supported a model of collaboration between teachers, parents, children and therapists.



### **Use of targeted training to improve sitting balance, posture and gross motor skills in children with cerebral palsy: five case studies**

Morris JB

*Senior Physiotherapist, Early Intervention Programme, The Centre for Cerebral Palsy, WA, Australia (formerly the Cerebral Palsy Association of Western Australia)*

Targeted training uses a sitting or standing frame mounted on a rocking base to give children practice at independent sitting and standing. Results of 10 weeks targeted training for five clients with cerebral palsy are reported. Five children aged 3–4 years, with spastic diplegia and GMFCS classifications II or III were given targeted training for 10 weeks. Assessments included the Gross Motor Function Measure (GMFM), range of movement, and Goal Attainment Scaling (GAS). Client one improved in the standing domain of the GMFM by 11% and achieved a GAS score of 0 (i.e. goal achieved to parent's satisfaction). Her popliteal angles improved in both dynamic and actual ranges. Client two made an 8% improvement in standing and a 19% improvement in the walking, running and jumping (W, R, J) domains. She achieved a +2 score for GAS (i.e. well above predicted levels). She achieved independent standing and began to take steps independently. Client three improved in the standing domain of the GMFM by 7%. He achieved a GAS score of 0 for independent standing. Knee angles improved from fixed flexion of 20° and 25° to 10° and 12°, causing a more upright posture in standing and walking. Client 4 made a 23% gain in the standing dimension of GMFM and client 5 made 5% gains in standing and 4% gains in (W, R, J) domains. These results suggest that targeted training can have a significant effect on gross motor function, range of movement, postural control and balance in sitting and standing.

## **5 × 5 PRESENTATIONS**

### **An enhanced physiotherapy service to paediatric orthopaedics**

Bradford KL

*Physiotherapy Department Royal Children's Hospital, Brisbane*

Prior to 2006, the orthopaedic physiotherapy service at Royal Children's Hospital, Brisbane, was fragmented and merely reactive to referral demand. Significant gaps existed in service provision. A four-month project to systematically investigate deficiencies and devise recommendations commenced in October 2005. Improvement strategies were formulated from stakeholder consultation, use of activity level data, and benchmarking with other tertiary paediatric hospitals across Australia and New Zealand. Implementation of enhancements coincided with the commencement of an orthopaedic staff specialist in January 2006 and a resultant large increase in demand for services. Outcomes of the project have included improvements to: staffing structure, continuity of care from the pre-admission to post-discharge stage, services to complex low-incidence groups (e.g. club-feet and limb reconstruction), links with health professionals outside the hospital environment, and professional

development to all members of the multidisciplinary team. An Australian-New Zealand paediatric orthopaedic physiotherapy network has also been established. Barriers to these changes were addressed with innovative problem-solving and commitment to quality practice. Ongoing improvements are planned and include increased attention to additional high-risk groups (e.g. scoliosis and oncology), extended scope roles (e.g. normal variance clinic, emergency department), and consideration of alternate modes of service delivery. This service improvement activity can act as a model to other centres wishing to optimise available resources to provide quality tertiary care. It is also hoped that the expanding image of paediatric orthopaedics in Queensland will encourage development of this as an area of interest for paediatric physiotherapists, and promote engagement amongst adult orthopaedic physiotherapists.

### **An investigation of the evidence for neurological paediatric physiotherapy practice: A review of the Physiotherapy Evidence Database (PEDro)**

Butler J, Higgs J, Herbert R and Moseley A

*The University of Sydney, Sydney*

In paediatric physiotherapy, as in other areas of physiotherapy, it is important to apply the best available evidence to clinical decision making. Randomised controlled trials and systematic reviews of randomised trials provide recognised evidence of the effectiveness of clinical interventions. The aim of this study was to identify the quantity and quality of evidence of the effects of neurological paediatric physiotherapy interventions from a search of the systematic reviews and randomised controlled trials located on the Physiotherapy Evidence Database (PEDro). A search of the PEDro database was conducted on 28 March 2007 and records pertaining to neurological paediatric physiotherapy were identified. The search revealed a total of 131 records relevant to neurological paediatric physiotherapy of which 106 were randomised controlled trials and 25 were systematic reviews. The first randomised controlled trial was published in 1975 and the first systematic review was published in 1993. The number of randomised controlled trials identified on the PEDro database doubled between 2000 and 2007. Although paediatrics is the area of physiotherapy practice that has the smallest number of randomised trials and systematic reviews, there has been a rapid increase in recent years. More recent studies are of higher quality and therefore provide stronger evidence of the effectiveness of intervention than earlier studies. Further clinical trials and systematic reviews of neurological paediatric physiotherapy are needed to support clinical decision making practice.

### **A review on the effects of sleep position, play position and equipment use on motor development in infants**

Pin TW,<sup>1</sup> Eldridge B<sup>2</sup> and Galea MP<sup>1</sup>

*<sup>1</sup>University of Melbourne, Melbourne <sup>2</sup>Royal Children's Hospital, Melbourne*

Since the observation that Sudden Infant Death Syndrome (SIDS) may be associated with infants sleeping in a prone position in 1992, parents have been urged to put infants on

## 5 × 5 PRESENTATIONS – *continued*

their back while sleeping. The resulting lack of experience in a prone position appears to cause developmental delay in infants. Use of various infant equipment, except baby walkers, has not been examined thoroughly for its influence in the motor development of infants. The aim of this systematic review was to evaluate the effects of sleep/play positions and use of infant equipment on motor development. Nineteen studies with evidence at level II were selected against the selection criteria and scored against the PEDro scale. Despite the generally poor methodological quality, the studies have consistently shown that there was transient delay in motor development for healthy full-term and low risk preterm infants who were not exposed to the prone position or who used infant equipment. However most of these infants walked unaided within a normal time frame. Limited evidence was found about the effect on more vulnerable infants. More rigorous longitudinal studies using outcome measures focussing on movement quality are recommended to understand any long-lasting influence on the development of motor skills in these infants.

### **Cough assist: who else can benefit?**

Ferguson AH and Pike SE

*Royal Children's Hospital, Brisbane*

Impaired cough can cause severe respiratory compromise, contributing to complications such as collapse or infection. In the 1950s mechanical cough assist devices (CA) were used primarily on patients with poliomyelitis; demonstrating clinical and radiological improvement. It was not until the 1990s when the role in neuromuscular patients was highlighted by its original advocate John Bach. It is now recognised by worldwide centres as an integral part of their management and those with spinal injuries. Currently there is only anecdotal evidence available for other conditions. The CA insufflation/exsufflation device aims to create a rapid change from positive (max + 60 cmH<sub>2</sub>O) to negative pressure (max -60cm H<sub>2</sub>O) to stimulate the airflow changes necessary for mucociliary clearance. The pressures required should be tailored to the patient but some recommend expiratory pressures greater than -40cm H<sub>2</sub>O. It is possible to incorporate the CA with other physiotherapy techniques to optimise sputum clearance, for example using a series of insufflations with manual techniques followed by insufflation/exsufflation with vibrations to augment a cough. CA has been used successfully in our paediatric setting on a variety of children who experienced difficulty with airway clearance. Three cases are presented on the effectiveness of CA based on clinical outcome including CXR and oxygen requirement. A 4-year old boy with burns (45% body surface area), 8-year old girl with cerebral palsy and 12-year old girl following spinal instrumentation. This report demonstrates effective utilisation of the CA in a non-traditional population, highlighting the need for further research to realise maximal clinical benefit.

### **Selection and trial of an instrument to determine physical activity levels in pre-schoolers in the City of Greater Dandenong**

Cran F

*Greater Dandenong Community Health Service, Springvale, Melbourne*

This investigation and trial of a tool to determine physical activity of preschool children in the City of Greater Dandenong was in consideration of allocation of finite health promotion resources. For a population-based investigation, criterion assessments such as accelerometers and direct observation are not cost or time effective. Unfortunately other measures have lower validity and reliability. Any tool used on a population basis should have both a low investigator and participant burden, but still provide useful information. Young children do not have the cognitive skills to self-report, so a proxy survey is completed by a parent or preschool teacher. After considering tools, the Modified Netherlands Physical Activity Questionnaire (NPAQ) for Young Children (as used in the Iowa Bone Development Study) was selected. The Iowa study investigated NPAQ reliability and validity with a criterion reference of accelerometers. That study and others found the NPAQ could crudely sort preschoolers into high and low physical activity and fitness categories. The NPAQ is a proxy report completed by parents, asking about personality traits instead of relying on complete and accurate recall of activity intensity, frequency and duration. Teachers in our municipality distributed the NPAQ to parents of all preschoolers. The relative simplicity of the survey helped achieve a return rate of 249 of 1114 (22.35%). From scores, the 'low' physical activity group contained 30 children (13.95%). This demonstrates local need for resource allocation since physical activity levels tend to decline as children grow older, so ideally they need to start from a high level.

### **Self directed learning package: using a mobile hoist**

Sheppard R

*Calvary Healthcare Tasmania Children's Therapy Services*

Therapists involved in the care of children with complex needs are required to provide education to parents/carers in the use of a hoist for safe transfers. Training as an undergraduate is minimal, with knowledge and skills being developed through practise. Consequently our service employs staff with various levels of experience in this field, resulting in inconsistent service provision to clients in an area where safety is critical. This project involved the use of a self directed learning package as an educational tool for therapists. Therapists were pre-tested against a developed set of competencies. A self directed learning package was completed addressing these competencies and therapists were retested. Less than half (42.3%) of therapists were rated as competent in pre-testing. Following the use of the self directed learning package 99.4% attained competencies. The use of a self directed learning package is therefore recommended as an efficient means of educating staff who use and/or train others to use mobile hoists to provide client transfers.

## 5 × 5 PRESENTATIONS – *continued*

### **Supporting young people with autistic spectrum disorders: a review of service demand and the role of physiotherapists working in Queensland State Schools**

Ogilvie K

*Education Queensland, Cairns*

The purpose of this review was to inform and update practice guidelines for physiotherapists working with children with autistic spectrum disorders (ASD) in Queensland state schools. Reasons for teachers requesting physiotherapy services were explored through a retrospective review of 46 student files of children, 3–15 years of age, identified as having ASD according to Education Queensland's verification process. The physiotherapy service request forms uses 44 validated indicators of need for assessment under 5 categories to identify functional difficulties for students. These were analysed to determine the percentage of students with ASD for whom teachers were reporting movement and postural control difficulties. Indicators of difficulty reported ranged from 32% for maintaining sitting posture to 63% for gross motor and ball skills and 78% for pencil use. Further information about the role of physiotherapists working with children with ASD in the school setting was collated from a survey of 25 physiotherapists. This data has informed current trends for practice and the development of practice guidelines for physiotherapists when supporting students with autistic disorders in Queensland state school settings.

### **Website of physiotherapy exercises for children with traumatic brain injury**

Mudge A,<sup>1</sup> Thomas B,<sup>2</sup> Hancock J,<sup>2</sup> Katalinic O,<sup>3</sup> and Harvey L<sup>3</sup>

<sup>1</sup>Brain Injury Rehabilitation Program, Sydney Children's Hospital, South Eastern Sydney and Illawarra Area Health Service, Sydney

<sup>2</sup>Brain Injury Unit, The Children's Hospital at Westmead, Sydney

<sup>3</sup>Rehabilitation Studies Unit, Northern Clinical School, Faculty of Medicine, University of Sydney, Sydney

The aim of this project was to add 150 exercises appropriate to children with traumatic brain injury (TBI) to an existing website for physiotherapists. The website was designed to collate the exercise ideas of experienced physiotherapists into one accessible site, and to provide a means by which physiotherapists can readily generate professional-looking exercise booklets for their patients. A committee of experienced clinicians working in the area of neurological paediatrics identified 150 appropriate exercises. Each exercise was illustrated with a sketch and photograph. Explanatory text was written to accompany each exercise. The existing search engine was modified to enable users to find exercises appropriate to the needs of their patients. The success of the website will be evaluated using an on-line questionnaire and site tracking. In addition, data about the number and type of exercises that physiotherapists select for exercise booklets will be monitored. Site tracking of the

existing website shows a rapidly increasing number of users from throughout the world, with an average of 10 000 hits per day from over 100 countries. The website also has an online questionnaire for feedback, indicating a very high level of satisfaction with the website. This website will be a valuable resource for physiotherapists working with children following TBI.

### **What is the most effective regime for serial casting for equinus in ambulant children with cerebral palsy?**

Arndell C and Morgan C

*The Spastic Centre, Sydney*

Serial casting is a treatment technique that is commonly used by physiotherapists to improve muscle length in children with cerebral palsy and other conditions where muscle contracture occurs. The efficacy and limitations of serial casting are well documented in terms of measurable outcomes. However within the literature a great deal of inconsistency exists in the choice of clinical indicators for casting and the length of time necessary to achieve results. This paper reviews current evidence around serial casting in ambulant children with cerebral palsy. It lists the key clinical findings from this evidence and makes recommendations as to best practice guidelines for the use of serial casting in the clinical setting. Recommendations for future research are put forward.

## POSTER PRESENTATION

### **Education Queensland physiotherapy services: celebrating strength in diversity**

Collins E and de Regt R

*Education Queensland*

This poster presentation describes the physiotherapy services of Education Queensland and demonstrates that paediatric physiotherapy services do have strength in diversity. The poster presentation looks at diversity in: values and vision underpinning the service, framework of the service, assessment of student needs, interventions for students with disabilities, and outcomes of physiotherapy interventions.

# ABSTRACTS

Sports Physiotherapy Australia  
Conference

## Exercise: the cornerstone of rehabilitation



APA Conference Week  
4–8 October 2007  
Cairns, Australia



AUSTRALIAN PHYSIOTHERAPY ASSOCIATION



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### Augmented low-Dye tape induced changes in muscle activation but not foot posture are maintained following removal of tape

Franettovich M,<sup>1,2</sup> Chapman AR,<sup>1,2,3</sup> Blanch P<sup>2</sup> and Vicenzino B<sup>1</sup>

<sup>1</sup>The University of Queensland, Brisbane<sup>2</sup> Australian Institute of Sport, Canberra<sup>3</sup> Simon Fraser University, Vancouver

The augmented low-Dye (ALD) taping technique has demonstrated improvements in pain and function, which have been shown to continue following tape removal. To date the literature has examined the initial mechanical and neurophysiologic effects of APT, yet there has been no study that has explored whether these initial effects are maintained following removal of the tape. Seven asymptomatic individuals walked barefoot for 10 min under three conditions: 1) prior to ALD tape, 2) with the ALD in situ, and 3) following removal of the ALD. Surface electromyographic (EMG) recordings from tibialis anterior, soleus, peroneus longus, medial and lateral gastrocnemius were performed to obtain peak muscle activation whilst walking under each condition. Arch height (AH) in standing was measured for each condition, before and after walking. The initial application of ALD tape produced mean (95% CI) reductions in peak activation of soleus by 25% (-31 to -19%) and tibialis anterior by 13% (-19 to -6%), with small insignificant changes in other muscles. Following removal of the tape, peak soleus activity remained reduced by 15% (-24 to -5%) whereas there was no reduction in tibialis anterior (-2% (-10 to 6%)). Although an initial 10% (4–15%) increase in AH was observed with application of ALD tape, this effect was reduced to 4% (0–8%) with walking and to 1% (-1 to 3%) following removal of the tape. This study provides preliminary evidence to suggest that specific ALD-induced neurophysiologic but not mechanical effects carry over following removal of the tape, and may contribute to maintenance of clinical efficacy observed following tape removal.

### Low back pain in adolescent female rowers: a multidisciplinary intervention study

Perich D,<sup>1</sup> Burnett A,<sup>1</sup> O'Sullivan P<sup>1,2</sup> and Perkin C<sup>2</sup>

<sup>1</sup>School of Physiotherapy, Curtin University of Technology, Perth <sup>2</sup>Body Logic Physiotherapy, Shenton Park

Previous research has demonstrated that 47.5% of female rowers (14–17 years) have low back pain, approximately three times the incidence found in a matched non-rowing control group. Rowers with back pain have poorer back and lower limb endurance and more passive sitting postures. The aim of this study was to examine the effectiveness of a multi-disciplinary intervention program to decrease the incidence of low back pain in female adolescent rowers. For this study an intervention group from one school (n = 95) and a control group from three other schools (n = 238) were examined during the 2006 rowing season. The intervention

group underwent: an education session regarding back pain and rowing; a musculoskeletal screening and two follow-ups by a physiotherapist, in which girls with and without low back pain, were prescribed individualised exercises designed to enhance lumbo-pelvic control during sitting, squatting and rowing. They were instructed to perform these exercises throughout the season. During the rowing season an off-water conditioning program was integrated into the training program where the exercise program was reinforced. Control group rowers underwent different interventions including, general conditioning, pilates and fit ball training. Low back pain incidence was collected four times throughout the rowing season. The intervention group had a significantly lower incidence of low back pain (26%) during the season when compared with the control group (48%). There was also significant improvement in back and lower limb endurance and spinal posture. The multi-disciplinary approach to reducing the incidence of low back pain in adolescent female rowers in this study was effective.

### Pain severity, function and the anterior knee pain scale predict three-month outcome following conservative treatment for anterior knee pain

Collins N,<sup>1</sup> Crossley K,<sup>2</sup> McPoil T<sup>3</sup> and Vicenzino B<sup>1</sup>

<sup>1</sup>The University of Queensland, Brisbane <sup>2</sup>The University of Melbourne, Melbourne <sup>3</sup>Northern Arizona University, Flagstaff, USA

Patient factors such as age, pain severity and symptom duration have been shown to predict outcome for some musculoskeletal conditions. The aim of this study was to identify prognostic indicators of pain and function in individuals with anterior knee pain three months after commencement of treatment. One hundred and seventy-nine participants who underwent one of four randomly-assigned interventions were followed up after three months of treatment. Multivariate analysis of variance was used to determine the effect of potential prognostic indicators on pain severity, the Functional Index Questionnaire and the Anterior Knee Pain Scale. Potential prognostic indicators were age, gender, duration of knee pain, baseline pain and function scores, step down repetitions, arch height, and physical activity level. Treatment group was included in all models as a covariate. Participants who had higher pain levels and poorer scores on the Functional Index Questionnaire and Anterior Knee Pain Scale at baseline showed greater improvements in the three measures after three months of treatment (B = -0.56, 95% CI -0.78 to -0.34,  $p < 0.001$ ; B = -0.66, 95% CI -1.28 to -0.03,  $p = 0.04$ ; B = -0.63, 95% CI -0.84 to -0.42,  $p < 0.001$ , respectively). There were no significant main effects for demographic variables or other outcome measures. These findings indicate that individuals with anterior knee pain who have more pain and poorer function prior to treatment will show better improvements with intervention than those with lower pain levels and better function, irrespective of their age, gender or duration of symptoms.

## FREE PAPERS – continued

### Predictors of lateral ankle sprain in adolescents

Hiller CE, Refshauge KM, Herbert RD and Kilbreath SL

*The University of Sydney, Sydney*

Ankle sprain is the most common injury in high-school sports. Despite the prevalence of the injury, there is little consensus on predictors for injury and therefore an effective prevention program is difficult. The aim of this paper is to discuss three recent prospective studies of predictors of lateral ankle sprain in adolescent athletes, American football players and dancers. Our recent study followed 114 dancers for 13 months. Both ankles of each dancer were randomly assigned to a test and a validation group. The test group was used to generate a prediction model (using backward stepwise Cox regression) and the predictive validity of that model was tested in the validation group. Significant predictors determined on the test group were younger age, previous sprain of the contralateral ankle, inability to balance on demi-pointe, and greater degree of inversion. When these predictors were tested on the validation group, only previous sprain of the contralateral ankle was significant (HR = 3.9, CI 1.49–10.2). This finding was in contrast to the other studies which also found previous sprain to be a predictor, but had a higher numbers of ipsilateral injuries. Additionally, an increased BMI in male football players increased the risk of sprain. None of the studies found generalised flexibility, increased anterior draw, decreased dorsiflexion range, increased 1<sup>st</sup> metatarsophalangeal extension range, decreased hip external rotation range or strength, or impaired balance to predict future lateral ankle sprain. The finding of a previous contralateral sprain predicting future sprain implies there may be bilateral changes following the initial sprain which might require bilateral interventions.

### The push-throw continuum and core stability: are physiotherapists training good motor patterns with bilateral pre-activation of the transversus abdominis?

Allison GT

*School of Surgery and Pathology, University of Western Australia*

There are biomechanical and motor control differences between a throw and a push. A throw in a sequential transfer of angular momentum from the ground up, a push in contrast has the peak accelerations synchronised. Core stability training, including the pre-setting of the transversus abdominis (TrAb) bilaterally, has increased popularity many different sports. Yet we do not know if the different push-throw motor control patterns are also reflected in the activation profiles of the deep abdominals. Using bilateral finewire insertions for TrAb and surface for other trunk muscles, EMG profiles were recorded at 2 kHz during different single arm and bilateral throw and push arm actions. The within session results were compared with matched data recorded on two independent testing sessions years apart and with unilateral arm raising tasks in six normal control subjects. Following over 80+ trials the laterality response of the abdominals was clearly evident during pure throw tasks ( $p < 0.01$ ) and this was modulated as the task moved towards a push pattern and

during bilateral arm movements. The laterality differences ( $p < 0.05$ ) show that the planning of the task (push/throw) alters the symmetry of the TrAb activation patterns in the feedforward window. These findings clearly show that the choice of task modifies the behaviour of the feedforward responses of the deep abdominals. The implication for sports is that bilateral pre-activation training of the deep abdominal muscles is not the normal functional approach for rapid arm raising or throwing and may be more specific for training in pushing tasks.

### Treatment tests in patients with adaptive and maladaptive movement patterns

Tuttle N

*Griffith University, School of Physiotherapy and Exercise Science*

Treatment tests, or treatment direction tests, have been advocated for predicting the usefulness of a technique or intervention prior to its therapeutic application. The application of treatment tests however varies for different approaches: McKenzie considers the response to repeated active movements; Maitland to passive movements during physical assessment; and Mulligan, McConnell & Vicenzino to passive inputs superimposed on an active movement. The response to repeated lumbar spine movements has been shown to predict effective treatment by the McKenzie method, but there is little evidence of validity for other treatment tests. This presentation will consider the content validity of treatment tests by discussing the assumptions and rationale underlying the tests. Examples of patients with adaptive or maladaptive movement patterns will be used to clarify the appropriateness of types of treatment tests when applied to different hypotheses and different patient presentations. For example, the response to passive movement directed to a local symptomatic structure may be more useful in a patient with an adaptive movement pattern, while the response to a remote application of a treatment direction test may be more relevant in the presence of a maladaptive pattern. Pending research on the ability of treatment tests to predict outcomes, it is hoped that an understanding of the assumptions and rationale underlying the tests will assist physiotherapists in their application in the clinical setting.

## 5 × 5 PRESENTATIONS

### A new model of chronic ankle instability

Hiller CE, Refshauge KM and Kilbreath SL

*The University of Sydney, Sydney*

Ankle sprain frequently results in chronic ankle instability but despite its prevalence there is no effective rehabilitation. Part of the difficulty in determining an effective intervention is the assumption that people with chronic ankle instability are a homogenous group with similar impairments. However, a number of recent studies suggest that this is untrue. Consequently, we have proposed a new model of chronic ankle instability that includes the components of

## 5 × 5 PRESENTATIONS – *continued*

functional and mechanical instability and recurrent sprain. It is possible that these components exist in isolation or in various combinations. To validate the model we examined the fit of data from two studies; an investigation of functional ankle instability, and a prospective study of risk factors for ankle sprain. The data fit all components of the model, except recurrent sprain alone. Additionally, the notion that different components or combination of components may have different impairments was explored in the same data set. Measures of balance, and recovery after an inversion perturbation, were analysed when participants were categorised by the new model. We found that balance was impaired in participants with functional ankle instability, either in isolation or any combination with the other components, but not in participants with mechanical instability alone. Recovery from an inversion perturbation was impaired in functional ankle instability in combination with mechanical instability or both mechanical instability and recurrent sprain, but not in either mechanical or functional instability alone. The new model of chronic ankle instability should change the way we consider investigating the characteristics and treatment of participants with chronic ankle instability.

### **Are strength and power measures related to maximal throwing velocity in elite female water polo players?**

**Woodhouse D, Hopper D and Briffa NK**

*Curtin University of Technology, Perth*

The purpose of the study was to determine if there was a correlation between strength and power measures and maximal throwing velocity in elite female water polo players. Fifty-two national level female water polo players participated in this cross sectional correlational study. All players performed five maximal throws shooting for goal. Three-dimensional cinematography captured these throws at 100 frames per second. A radar gun was used to determine the three fastest trials to establish the maximal velocity at ball release. Strength measures followed the Australian Women's Water Polo testing protocol of three maximal repetitions of bench press, bench pull and squats. Power measures included vertical jump height in water and on land and maximal head height at ball release. Furthermore, a full anthropometric analysis was implemented to ascertain the influences of a range of body measurements on throwing velocity. Power was strongly correlated with maximal throwing velocity. Body weight, bench press and bench pull were also correlated as were upper limb girths. Maximal head height was not correlated to maximal throw velocity. This study suggests that power and upper limb strength optimise maximal throwing velocity in elite female water polo players.

### **Autologous chondrocyte implantation in an elite rugby league player: a case report**

**Sartori S and Maguire J**

*SportsMed Physiotherapy Kirwan/Mater, Townsville*

Articular cartilage lesions have a limited potential for self repair, and restoration of an adequate articular surface remains a challenge. Controversy exists as to whether microfracture, autologous osteochondral grafting, or cultured autologous chondrocyte implantation is the best repair technique and to which lesion each should be applied. Current autologous chondrocyte implantation involves biomaterials seeded with autologous chondrocytes as carriers and scaffolds for cell growth, and is the most widely researched articular cartilage repair technique today. Rehabilitation and return to sport parameters after autologous chondrocyte implantation are still evolving, with limited multi-centre research available. We report on the treatment, rehabilitation and return to sport of an Outerbridge classified grade four lateral femoral condyle lesion with concomitant revised anterior cruciate ligament reconstruction in an elite rugby league player. To our knowledge, this is the first described autologous chondrocyte implantation procedure in an elite rugby league player in Australia.

### **Can the standard postoperative rehabilitation protocol for single-bundle ACL reconstruction be safely applied to the anatomic double-bundle reconstruction procedure?**

**Tanabe Y,<sup>1,2</sup> Kondo E,<sup>2</sup> Shida M<sup>1</sup> and Yasuda K<sup>2</sup>**

*<sup>1</sup>Hokkaido Chitose Institute of Rehabilitation Technology, Chitose, Japan <sup>2</sup>Hokkaido University School of Medicine, Sapporo, Japan*

To clarify whether the standard postoperative rehabilitation protocol for single-bundle ACL reconstruction can be safely applied to the 'anatomic double-bundle' ACL reconstruction procedure developed by the co-authors to obtain a better clinical outcome. Forty-eight patients with unilateral ACL-deficient knees were divided into two groups (Groups S and D) of 24 patients each. Concerning all background factors, there were no significant differences between the two groups. In Groups S and D, single-bundle and anatomic double-bundle reconstruction procedures, respectively, were performed with the hamstring tendon grafts. The standard postoperative rehabilitation protocol for single-bundle ACL reconstruction was used for all patients. Weight-bearing was allowed with a brace at one day after surgery. Passive knee extension was encouraged on the first day, although passive knee flexion was allowed at one week. The closed kinetic chain exercises were started at one week. Each patient underwent the standard clinical examinations before surgery and at one year. There were



## 5 × 5 PRESENTATIONS – *continued*

no significant differences in the preoperative evaluation between the two groups. The postoperative side-to-side anterior laxity was significantly less ( $p = 0.002$ ) in Group D (1.1 mm) than Group S (2.8 mm). Concerning the pivot-shift test, Group D was significantly better than Group S ( $p = 0.025$ ). There were no significant differences in the range of motion, the muscle torque, and the IKDC evaluation. The standard postoperative rehabilitation protocol for single-bundle ACL reconstruction can be safely applied to the anatomic double-bundle ACL reconstruction procedure in order to obtain better results in the side-to-side anterior laxity and the pivot-shift test.

### **Humeral torsion and proprioception in high level adolescent baseball players**

**Whiteley R, Adams R, Ginn K and Nicholson L**

*The University of Sydney, Sydney*

The degree of twist about the long axis of the humerus influences the range of rotational shoulder motion such that an arm with greater humeral retrotorsion will display an apparent increase in external rotation, with a corresponding reduction in internal rotation range of motion. Previous work has shown reductions in proprioceptive acuity in the dominant arms of throwing athletes, but the relationship of humeral torsion (which will influence the rotational range of motion) has not been investigated in relation to proprioception. In this study, humeral torsion in 16 elite level adolescent baseball players was measured using diagnostic ultrasound to standardise arm position for the test. Subsequently, arm proprioception was measured by asking subjects to judge overhead points of contact with their shoulders abducted to 90° and then externally rotated to touch the adjustable contact plate with the back of the hand, out of line of sight. A relationship was found between humeral torsion and proprioception in both the dominant and non-dominant arms. The implications for sporting performance and therapy are discussed.

### **Management of an inferior calcaneal apophysis fracture in an elite gymnast: case report**

**Rath L,<sup>1,2</sup> Hamilton B<sup>1</sup> and Fricker P<sup>1</sup>**

<sup>1</sup>Physical Therapies Department and the Sports Medicine Department of the Australian Institute of Sport, Canberra, Australia <sup>2</sup>The Australian Ballet

This case report describes the mechanism of injury and management of an acute avulsion fracture of the medial plantar calcaneal apophysis in an elite female gymnast. This injury was sustained landing a vault performed during an international competition. Video footage of the vault will

be shown to demonstrate the incorrect landing technique used that resulted in the injury. Diagnosis of the acute avulsion fracture was made using a plain radiograph and was confirmed and further defined by MRI. A time course of progression through management and rehabilitation of the injury will be detailed covering the period leading back to full gymnastics training. A pain minimisation approach was used and load tolerance was monitored through recovery by tracking clinical signs and symptoms. These will be outlined. There will be some discussion about the cavus foot type and injury history of the athlete and their potential contribution to the occurrence of the injury. The injury history on the symptomatic side included recurrent medial ankle ligament sprains and a long history of Sever's disease (calcaneal apophysitis). Calcaneal apophyseal fractures are uncommon despite a high incidence of heel pain among physically active adolescents. This case study demonstrates that conservative management of a minimally displaced inferior calcaneal apophyseal fracture may allow for a rapid and uncomplicated return to full elite gymnastics training.

### **Predisposing factors for the development of shin pain in elite female hockey players with a view to prevention**

**Epsley SA,<sup>1</sup> Young J and Goodman, C**

<sup>1</sup>Peak Performance Sports Med

This study reviewed the current literature pertaining to the pathophysiology and aetiology of shin pain in athletes. A pilot study was performed to identify training and physical variables useful in predicting the onset of shin pain. Eleven national and state representative female hockey players who developed medial shin pain over a twelve-month period completed a questionnaire pertaining to training variables and a musculoskeletal screening. The results were compared to pre-existing data published on uninjured individuals, and correlations between screening variables were examined. A 121% increase in skills training, with 62% of total training being performed on synthetic turf was found in those developing shin pain. The navicular drop test revealed significantly higher values (mean = 14 mm, 95% CI 10–17 mm) than pre-published non-injured subjects whose 95% CI did not overlap our data. Hip internal rotation was also greater in our injured cohort (mean = 37.5°, 95% CI = 32–42°) with significance similarly inferred. A trend towards poor proprioception and decreased dorsiflexion was observed. Static foot posture appears poorly associated with shin pain. Soleus endurance was negatively correlated to navicular drop scores ( $CC = -0.46$ ,  $p = 0.03$ ) and positively correlated with a neutral lower limb alignment ( $CC = 0.45$ ,  $p = 0.03$ ) and sub-talar inversion range ( $CC = 0.44$ ,  $p = 0.03$ ). Training time on synthetic turf should be minimised and screening should evaluate the navicular drop, hip internal rotation range, knee to wall test and proprioception in attempting to predict female hockey players at risk of developing shin pain. Soleus endurance may be important in prevention and rehabilitation

## 5 × 5 PRESENTATIONS – *continued*

### **The activity and influence of an emergency department physiotherapy practitioner**

**Large J,<sup>1,3</sup> Holdgate A,<sup>1,2</sup> Axford K<sup>1,3</sup> and Jennings M<sup>1,3</sup>**

<sup>1</sup>Department of Emergency Medicine, Liverpool Hospital, Sydney

<sup>2</sup>University of NSW <sup>3</sup>Department of Physiotherapy, Liverpool Hospital, Sydney

This study examines the impact of an emergency department physiotherapy practitioner in a large tertiary trauma emergency department. The physiotherapist autonomously managed a subset of emergency department patients with acute musculoskeletal complaints and collaboratively managed others that required physiotherapy intervention as part of their multidisciplinary care. The aim of this study was to describe the overall activity of a single physiotherapy practitioner and compare waiting times for patients managed autonomously by the physiotherapist with a similar cohort managed by medical staff. Over six months the physiotherapy practitioner managed 348 patients autonomously and 532 patients collaboratively. Of those managed autonomously, 88% were discharged from the department after presenting with a wide range of conditions, most commonly lower back pain, upper and lower limb fractures, knee and ankle soft tissue injuries. Ninety patients with distal limb fractures seen by the physiotherapist were then compared with 480 patients managed by medical staff. Patients seen by the physiotherapist had shorter waiting times (29 vs 67 minutes,  $p < 0.001$ ), similar treatment times, and shorter total length of stay in the emergency department (145 vs 177 minutes,  $p < 0.001$ ). Physiotherapy interventions for the 532 patients managed collaboratively included plaster application, respiratory and mobility assessment and treatment, manual therapy and exercise prescription. This study demonstrates how a physiotherapist within a tertiary emergency department can assist to reduce waiting times and therefore emergency department length of stay in a select subgroup of patients whilst also providing collaborative care to the broader range of emergency patients.

### **Ultrasound measurement of humeral torsion: reliability and findings in throwing athletes, swimmers, and non-athletic adults**

**Whiteley R, Ginn K, Nicholson L and Adams R**

*The University of Sydney, Sydney*

Humeral torsion is a measure of the amount of twist about the long axis of the humerus, and can now be accounted for when measuring shoulder rotational range of motion. The importance of measuring retrotorsion is that a subject with greater retrotorsion will have apparently increased shoulder external rotation, and a corresponding reduction in internal rotation, compared to their non-retrotorted peers. Thus the influence of retrotorsion needs to be accounted for in setting therapeutic goals of subjects with reduced total rotational range of motion. This investigation was in two parts. The first was a reliability trial of measurement of humeral torsion using ultrasound (US). The method of measuring humeral torsion involves US visualisation of the bicipital groove in a standardised manner, then placing it uppermost with the supine subject's arm abducted to 90°. With the elbow flexed

to 90°, the inclination of the ulna describes a measure of humeral torsion. The inter-rater reliability of the ultrasound method was shown to be high ( $ICC_{2,1} > 0.93$ ). In the second part, by use of this method the side-to-side difference in torsion was determined in 217 subjects, comprising adult and adolescent throwing athletes, adolescent swimmers, and non-athletic adults. The throwing athletes demonstrated greater humeral retrotorsion in their dominant compared to their non-dominant arms. Swimmers also showed a handedness effect, but not to as great an extent as the throwing athletes, whereas the non-athletic subjects showed no handedness differences in measured retrotorsion.

### **When would you use a functional hop test during rehabilitation after an ACL reconstruction?**

**Hopper DM,<sup>1</sup> Strauss GR,<sup>1</sup> Boyle JJW,<sup>2</sup> Goh S,<sup>1</sup> Neo C<sup>1</sup> and Bell J<sup>1</sup>**

<sup>1</sup>School of Physiotherapy, Curtin University of Technology, Western Australia <sup>2</sup>Fremantle Football Club

The purpose of this study was to evaluate functional performance in subjects with an anterior cruciate ligament (ACL) reconstruction with a bone-patellar tendon-bone graft (PTG) during 12, 18, 26, 39 and 52 weeks. A longitudinal comparative study was conducted at Curtin University of Technology Research Laboratory. Nineteen subjects with an ACL (PTG) were recruited from Royal Perth Rehabilitation Hospital ACL rehabilitation program and were assessed in the Cincinnati and analogue scales, the 6-metre timed hop, crossover hop, stair hop and vertical hop on 5 different occasions. The uninjured and injured legs and test order were randomised. There was a significant test occasion main effect for both the Cincinnati and analogue scores ( $p = 0.0001$ ). Subjective rating scores improved over the five testing occasions. For all four hop tests, test occasion and limb main effects were significant ( $p = 0.0001$ ). Paired  $t$ -test comparisons at each testing occasion indicated a significant difference between the reconstructed and uninjured limb ( $p < 0.05$ ). Furthermore, significant test occasion main effects were noted for limb symmetry indices for the four hop tests ( $p = 0.0001$ ). Using a score of  $\geq 85\%$  as a criterion for normal limb symmetry, normal scores were recorded in the 6-metre timed hop at the week 18 test occasion, the stair hop and vertical hop at the week 26 test occasion, and the cross over hop at the week 39 test occasion. These four functional tests may be considered when monitoring the degree of difficulty during the rehabilitation cycle.

### **Which strain is that, calf or cancer?**

**Gabel CP**

*University of the Sunshine Coast*

This case study looks at the differential diagnosis and clinical reasoning on the management of a medial gastrocnemius strain in a 40-year old female runner three weeks before her major target competition. This is an acceptable presentation to a sports physiotherapist as a primary contact practitioner. With the history of symptom onset following a fartlek session with short hills plus clinical signs of tenderness to

touch, soreness on single leg calf raise, steps, running and stretch, the provisional diagnosis of a medial gastrocnemius strain was made. A previous history of a similar calf strain some 5 months before which settled with rest and local modalities was noted. Initial treatment involved modifications to training with no speed work, use of a high mileage shoe and thicker heel, gastrocnemius and soleus stretches, graded eccentric loading, soft tissue massage and modalities of laser and interferential. After two treatments symptoms were markedly improved but a deeper dull ache persisted more than presentation muscle pain symptoms. Initiation of accelerations had noted a calf pulling. A small freckle was situated near the head of medial gastrocnemius. Skin examination via the GP was made leading to a biopsy and diagnosis of a melanoma. This was removed under a general anesthetic, with a skin graft and graded closure of 3 weeks. At 6 months follow-up she was running, under GP three-monthly review for the local region, skin and lymph nodes. Sometimes the strain can be of an unexpected type.

## POSTER PRESENTATIONS

### Activation patterns of deep and superficial lumbar multifidus during forward bending in patients with non-specific chronic low back pain

Carroll S,<sup>1</sup> O'Sullivan P,<sup>1</sup> Burnett A,<sup>1</sup> Rodrigues J<sup>2</sup> and Dankaerts W<sup>1,3</sup>

<sup>1</sup>School of Physiotherapy, Curtin University of Technology <sup>2</sup>Australian Neuromuscular Research Institute, University of Western Australia, Perth <sup>3</sup>Department of Health Care Sciences, AUHL-PHL, REVAL Research Center, Hasselt, Belgium

The absence of flexion relaxation during forward bending in standing, in patients with non-specific chronic low back pain (NSCLBP) has been well documented for the superficial fibres of lumbar multifidus. There is a common belief that differential motor patterns exist between the deep and superficial aspects of the muscle. However, it is not known whether the same pattern exists in the deep fibres of lumbar multifidus. The purpose of this pilot study was to examine for differential activation of the DLM and SLM in patients with NSCLBP (active extension pattern), during forward bending. Three volunteers with at least a 2-year history of back pain were recruited. EMG was recorded bilaterally from SLM using surface electrodes over L4–5 and from DLM using fine wire electrodes (inserted at L4–5). Spinal kinematic data during the functional movements was recorded using the 3 Space Fastrak. An absence of the flexion relaxation response was observed bilaterally in both deep and superficial LM in two subjects; in the third subject the absence of this response was seen unilaterally. The results support the hypothesis that deep and superficial fibres of lumbar multifidus work in concert during forward flexion from standing and do not support the view that these muscles possess differential motor patterns.

### Augmented low-Dye tape produces reductions in muscle activity of the leg whilst increasing medial longitudinal arch height

Franettovich M,<sup>1,2</sup> Chapman AR,<sup>1,2,3</sup> Blanch P<sup>2</sup> and Vicenzino B<sup>1</sup>

<sup>1</sup>The University of Queensland, Brisbane <sup>2</sup>Australian Institute of Sport, Canberra <sup>3</sup>Simon Fraser University, Vancouver

Augmented low-Dye (ALD) tape is a technique commonly used by clinicians in the management of lower limb musculoskeletal pain and injury. In contrast to the mounting evidence of the mechanical effect induced by ALD tape, there is a lack of specific research into the neurophysiologic effects. Twelve asymptomatic participants walked barefoot for 10 minutes before and after the application of ALD tape. Electromyographic (EMG) activity of six leg muscles during walking, as well as arch height (AH) during standing were analysed for each condition. Intramuscular EMG recordings from tibialis posterior (TP) as well as surface EMG recordings from tibialis anterior (TA), peroneus longus (PL), soleus (SOL) and medial and lateral gastrocnemius (MG, LG) were performed. Application of ALD tape produced mean (95% CI) reductions in peak activity of TP, SOL and TA by 40% (–63 to –17%), 25% (–31 to –19%) and 18% (–24 to –12%) respectively (effect sizes 1.5, 3.0, 1.6). Smaller changes that were statistically non-significant were observed for PL, MG and LG (effect sizes 0.3, 0.6, 0.1). AH was increased by 12% (8–16%) immediately following the application of ALD tape, and by 6% (3–9) following 10 minutes of walking (effect sizes 1.7, 1.3). This study suggests that ALD tape reduces activity of TA, TP and SOL muscles during gait while increasing arch height, and provides preliminary evidence of the role of tape in reducing the load on these key extrinsic muscles of the ankle and foot, which may have important clinical implications.

### Does Mulligan ankle tape influence balance performance in athletes with unilateral chronic ankle instability?

Hopper DM,<sup>1</sup> Samsson K,<sup>1</sup> Hulenik T,<sup>1</sup> Ng C,<sup>1</sup> Hall T,<sup>1</sup> Robinson K<sup>1</sup> and Edwards D<sup>2</sup>

<sup>1</sup>Curtin University of Technology <sup>2</sup>Edith Cowan University

The purpose of the study was to determine if there were differences between uninjured and unilateral chronic ankle instability (CAI) during static, fatigue induced and dynamic balance tasks and to establish if Mulligan ankle taping influenced balance performance in subjects with CAI. In a cross-sectional within-subjects experimental study design, the independent variables were an uninjured ankle and CAI; taped or untaped ankle conditions. While the dependent variables were FADI (Foot and Ankle Disability Index) and FADI Sport scores, postural sway area (the 95<sup>th</sup> percentile ellipse), and wandering, reaction times and target overshoot.



## POSTER PRESENTATIONS – *continued*

Twenty volunteer recreational athletes with unilateral CAI (age =  $23.1 \pm 1.0$  years, height =  $173.1 \pm 2.45$ , weight =  $69.3 \pm 2.9$  kg) were recruited from Curtin University. The results showed that FADI Sport detected a larger score difference compared to FADI for CAI conditions. There was no significant difference between the four conditions during static balance ( $p = 0.792$ ). Significant change of postural sway over time for all four conditions post fatigue was found ( $p < 0.001$ ). Wandering was highly correlated with reaction-time and overshooting ( $p < 0.01$ ) but no significant changes were found between the four conditions for the dynamic tracking variables. A thirty-seconds single leg-hopping test was sufficient to induce muscle fatigue at the ankle which showed a significant recovery at sixty seconds post-fatigue phase regardless of conditions. Mulligan ankle taping did not influence balance performance in subjects with CAI, therefore can be used with confidence in sport.

### **Overuse injuries and patterns of stretching in Ironman triathletes**

Ansell WH, Rivett D1 and Callister R1

*Faculty of Health, The University of Newcastle*

Ironman triathlon is a sport consisting of three disciplines: swimming, cycling and running. This endurance sport has grown in popularity with over 22 races worldwide and 24 000 participants. Despite this participation, there have been few investigations of injuries or potential injury prevention behaviours such as stretching in these triathletes. The aim of this retrospective study was to investigate the incidence of chronic injuries according to anatomical site. Relationships to gender, age, training hours and stretching habits were analysed. Questionnaires were provided to the 1250 participants of the 2006 Australian Ironman Triathlon, and 296 questionnaires were completed giving a response rate of 24% (74% male). In this sample, 86% reported having experienced an overuse or chronic injury in the past 12 months. The most common site of injury was the knee (35% of respondents) followed by the lower back (34%) and the ankle/foot (31%). Among respondents, 41% stretched regularly before training and 67% stretched regularly after training. The most commonly stretched muscle groups were the hamstrings (89%), calves (89%) and quadriceps (86%), followed by the lower back (62%), upper back (32%) and shoulders (53%). Lower back injuries were attributed more to cycling ( $r = 0.256$ ,  $n = 101$ ,  $p = 0.01$ ) than swimming or running. Stretching after training was performed more in those reporting more total injuries ( $p = 0.059$ ). The health professional most sought for treatment by the respondents were physiotherapists. Injuries were reported to improve more with treatment than rest or changes to training. The overuse injuries in Ironman triathlon seem to be most common in the lower limb and lower back. More investigation is needed to determine strategies to reduce overuse injuries in these athletes.

### **Sports acrobatics injury: occurrence, site and training risk factors**

Purnell M, Shirley D, Adams R<sup>1</sup> and Nicholson L

*The University of Sydney, Sydney*

Sports acrobatic skills have long been a part of the theatrical arena as well as an international gymnastic discipline, which in Australia, is gaining popularity. Therefore the purpose of this study was to determine the occurrence, site and training factors associated with sports acrobatics injuries in order to allow specific injury prevention strategies to be developed. Seventy-three sports acrobats aged between 8–26 years were surveyed. A widely-used dance injury survey was modified for the purpose of this study. The majority of injuries were found to have occurred in subjects aged over 12 years. Most of these subjects (51%) reported sustaining an injury within the previous six months, and 39% of the sample reported being affected by chronic injury at the time of data collection. Ages of onset for acute and chronic acrobatics-related injury averaged 13.7 and 14.7 years respectively. Sites of injury were predominately the knee, ankle, wrist and lumbar spine. Those training for more than 8.5 hours per week when 13 years of age were significantly more likely to report sustaining acrobatic related injuries ( $p < 0.001$ ) making this training load a likely risk factor. The results of this retrospective study suggest that 13–14 years is a critical age for occurrence of injury in acrobats and that a specific training threshold may exist for adolescent sports acrobats, which if exceeded, increases the risk of injury. Further prospective research is warranted to determine optimal training regimes for adolescent sports acrobats in order to minimise the risk of injury.

### **The difference in shoulder strength and range of motion between elite female water polo players and controls**

De Burca N, Kristiansen S, Tung SPW, Briffa NK, Woodhouse D and Hopper D

*Curtin University of Technology, Perth*

This study aimed to evaluate range of motion and isokinetic strength in elite female water polo players and controls. Fourteen national level female water polo players and 14 matched controls participated in this cross-sectional observational comparative study. Active and passive shoulder range of motion was measured using a digital inclinometer. Isokinetic concentric and eccentric shoulder internal rotation and external rotation strength in sitting was tested using a KinCom dynamometer<sup>®</sup> at 30° and 150°. The water polo group exhibited a deficit in active and passive internal rotation range of motion in their throwing arm (group  $\times$  side:  $p = 0.02$ ) with range of motion in the non-throwing arm comparable to the control group (group:  $p = 0.42$ ) who had no difference between sides. There was a trend towards increased active external rotation range of motion in the throwing arm of the water polo group compared to control group (group  $\times$  side:  $p = 0.11$ ) and for controls to have more passive external rotation in their dominant arm ( $p = 0.001$ ). Water polo players were stronger than controls (group:  $p = 0.05$ ). Measured at 30°, water



## POSTER PRESENTATIONS– *continued*

polo players' throwing arm had a lower functional ratio than controls ( $p = 0.002$ ), without side-to-side differences in either group (sides:  $p = 0.02$ ). Elite female water polo players have a deficit in shoulder internal rotation range of motion and a trend to gain external rotation range of motion compared to a control group and exhibit a lower functional strength ratio bilaterally.

### **The effect of different combinations of Skins compression garments on post training fatigue**

Lambert SM and Andruska KA

*Skins Research Institute*

Long Skins has been shown to decrease fatigue and aid recovery during exercise. The extent to how different combinations of Skins achieve this is currently unknown. The aim of this study was to determine whether a combination of half tights and Powersox have the same effect as the long Skins in terms of 400 m fatigue run times. Thirteen subjects (male) were asked to complete a 400 m fatigue run after high intensity training on four occasions. The four conditions to which they were randomly assigned were: 1) not wearing any skins or compression product (control), 2) wearing Skins long tights (LS), 3) wearing Skins half tights (shorts, HT) 4) wearing Skins half tights (shorts) and Powersox (below knee sleeves, combo). They were asked to don garments (or not) prior to training and continue to wear them for 2 hours after training. Analysis was performed on the 400 m fatigue run times as a measure of fatigue after training. The average run times showed a control (NS) time of 77.51 seconds ( $\pm 7.31$  s) followed by half tights (HT) with a time of 76.27 seconds ( $\pm 5.30$  s) with the combination of Powersox and half tights (combo) giving a time of 75.85 seconds ( $\pm 8.22$  s) and the full Skins (FS) having the best time of 74.61 seconds ( $\pm 9.31$  s). The pilot data showed similar times performed for the different combination of Skins. Long Skins had the best fatigue run time followed by the combination then the half tights. All combinations were better than using no Skins.

### **The ilio-tibial band: implications of its complex anatomy**

Alexander M<sup>1 2 3</sup>

<sup>1</sup>La Trobe University, Melbourne <sup>2</sup>Lifecare Prahran Sports Medicine Centre, Melbourne <sup>3</sup>BakBalls Pty Ltd, Melbourne

The anatomy of the ilio-tibial band is not described and taught accurately in undergraduate anatomy education. Greater knowledge of the ilio-tibial band's complex anatomy is required for more accurate management of conditions such as patello-femoral pain syndrome, ilio-tibial band friction syndrome and hamstring strains. The ilio-tibial band is commonly described as a tight isolated band of fascia running down the lateral side of the thigh. This presentation will show photos from cadaveric dissection and highlight information from numerous studies that show the iliotibial band is not an isolated band, but instead is a thickened section of the fascia lata which is circumferential

around the entire thigh. Furthermore, the Gerdy's tubercle on the lateral tibia is the site of insertion specifically referred to in anatomy textbooks but studies and dissection reveal numerous distal attachment points such as the medial and lateral patella retinaculae, femoral condyles, fibula head, femur (via intermuscular septae) and the biceps femoris tendon. The complex anatomy of the ilio-tibial band has major implications for physiotherapeutic management of the conditions mentioned above. Most notably, the assessment and treatment of patello-femoral pain syndrome will be enhanced by incorporating techniques that reflect a greater recognition of the circumferential nature of the ilio-tibial band and its multiple distal insertions.

### **The relationship of Q-angle, local tenderness, and hopping strategies in young subjects with idiopathic anterior knee pain**

Chen WL,<sup>1</sup> Li JS,<sup>1</sup> Lee PY,<sup>1</sup> Huang TH<sup>2</sup> and Yang CY<sup>3</sup>

<sup>1</sup>School and Graduate Institute of Physical Therapy, National Cheng-Kung University, Tainan, Taiwan, <sup>2</sup>Institute of Physical Education, Health & Leisure studies, National Cheng-Kung University, Tainan, Taiwan, <sup>3</sup>Department of Orthopaedics, National Cheng Kung University, Tainan, Taiwan

Deficits in dynamic neuromuscular control of the knee such as greater dynamic knee valgus was reported to contribute to higher incidence of anterior cruciate ligament injury in female athletes. However, no study has provided direct evidence to link the deficits in dynamic knee control and the structure or painful status of the knee. The study aimed to investigate the relationship among knee pain, Q-angle, and the neuromuscular control during one-leg hopping tests. Fifty-one subjects with or without idiopathic anterior knee pain were recruited for the evaluation of pain pressure threshold at pes anserine and popliteus, Q-angle, and one-leg hopping tests. Electromyographic and kinematic measurements focused on the hopping knees were performed during hopping tests. Pearson Correlation Coefficients were conducted to analyse the relationship among different measurements. Subjects with larger Q-angle were found to present significantly lower pain pressure threshold at popliteus. ( $r = -0.47$ ,  $p = 0.000$ ) Significantly larger internal rotation of the knee at landing instant, significantly greater firing of gastrocnemius lateralis before taking off, and significantly increased hamstrings (medialis/lateralis:  $r = 0.33/0.35$ ,  $p = 0.024/0.016$ ) and gastrocnemius activities (medialis/lateralis:  $r = 0.43/0.34$ ,  $p = 0.004/0.025$ ) during landing were also noted in those with larger Q-angle. On the other hand, those with less tenderness at pes anserine hopped significantly further. ( $r = 0.42$ ,  $p = 0.002$ ) Those who hopped for further distances exhibited significantly larger knee valgus at landing instant ( $r = 0.53$ ,  $p = 0.006$ ) and showed significantly greater firing of gastrocnemius lateralis before taking off ( $r = 0.45$ ,  $p = 0.042$ ). In addition, subjects presenting more tender popliteus hopped with significantly greater activities of gastrocnemius lateralis during landing phase. ( $r = -0.37$ ,  $p = 0.014$ )