

Whole body vibration: the next frontier in exercise rehabilitation?

A review of therapeutic efficacy

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The objective of this study was to review and critically evaluate the past literature for physiotherapist delivered whole-body vibration training (WBVT). Randomised controlled trials were searched electronically and manually from 2002 to December 2009. Study quality was independently assessed by two reviewers using the Physiotherapy Evidence Database (PEDro) scale. Results were summarised in a best evidence synthesis. The search identified 20 studies which met the inclusion criteria. Three studies were conducted in an orthopaedic population, five in a neurological, five in the aged, three in post menopausal women and four in healthy young adults. Studies were of moderate methodological quality (median PEDro score=6, range:4-8). Collectively, there was evidence of improved strength, balance and bone mineral density and decreased pain with WBVT. Strength benefits were similar to those achieved with traditional resistance training. Studies that demonstrated no or little effect typically used frequencies lower than used clinically or recommended by the equipment provider. There is preliminary evidence that physiotherapist delivered WBVT can have therapeutic benefit for a variety of conditions. The comparable efficacy with traditional resistance training suggests WBVT could be a viable alternative for patients who are unable to participate in these programs such as people with osteoporosis. The paucity of studies indicates that further research is required to more accurately quantify the WBVT benefits in these and other clinical populations. In a culture of evidence based-practice this should be a priority for physiotherapy research as WBVT is already widely used and becoming an increasingly popular treatment modality for physiotherapists.

Are people with chronic low back pain less active than people with acute low back pain?

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Evidence-based guidelines advocate graduated return to activity for rehabilitation of people with acute (ALBP) and chronic low back pain (CLBP). However the affect of LBP on activity levels remains unclear. This three month non-experimental cohort study explored free living activity of people with ALBP and CLBP, receiving physiotherapy, at baseline, week six, and week twelve with the RT3 activity monitor. The minutes per day spent in Moderate and Vigorous Physical Activity (MVPA/day) and number of MVPA bouts lasting ten minutes in duration per day were evaluated. The mean (SD) minutes of MVPA/day increased from 55.7 (36.8) at baseline to 61.3 (38.2) at week twelve in the ALBP group (N = 67) and decreased from 52.1 (37.8) at baseline to 45.2 (31.0) at week twelve in the CLBP group. The mean (SD) number of ten minute bouts of MVPA/day peaked at 1.9 (1.8) in week six for the ALBP group. Repeated measures ANOVA found significant interaction between time and LBP group for minutes of MVPA/day, Wilks Lambda = 0.90, F(2, 92) = 5.2, p = 0.007 consistent with a different pattern of change in activity with time by back pain group. Both LBP groups met national activity recommendations for minutes of MVPA/day. However the daily number of 10 minute MVPA bouts did not meet the recommendations in either group during the study. Minutes of MVPA/day was consistently lower for the CLBP group compared to the ALBP group and the minutes of MVPA/day decreased over the twelve week period in the CLBP group despite physiotherapy intervention.

Responsiveness of the RT3 activity monitor to measure change in the free living activity of patients with low back pain.

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Low back pain (LBP) is a common musculoskeletal condition. There is strong evidence for the resumption of activity being an effective intervention in the rehabilitation of LBP. However, until recently the ability to measure a change in free living activity has been limited. This three month non-experimental cohort study investigated the responsiveness of the RT3 activity monitor to measure a change in activity from week one, to weeks six and twelve in patients with acute and chronic LBP. Activity was measured in Mean Vector Magnitude Units/minute (MVMU/min). Change in activity was assessed with a 15 point Global Rating of Change (GROC) scale which runs from -7 to +7. One hundred and eleven LBP patients receiving physiotherapy were recruited. Only between week one and week six was a small positive relationship found between the GROC and the RT3; R² 11.6%, F(1,96) 12.6, p < 0.0005. The GROC scale was then dichotomised into participants who perceived that their activity was better and into participants who thought their activity was no different or worse with two cut point values; +5 and +1. The area under the curve for the GROC cut point five was 0.6 and for the GROC cut point one was 0.73. The minimal clinically important difference for GROC cut point one was 40 MVMU/min with a sensitivity of 0.81 and specificity of 0.42. The RT3 activity monitor was responsive to change. However, the relationship between perceived activity change by participants and an objectively measured change in activity requires further investigation.

Does physiotherapy reduce the incidence of postoperative pulmonary complications in patients following pulmonary resection via thoracotomy? A randomised controlled trial.

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Postoperative pulmonary complications are an important cause of morbidity following thoracotomy and physiotherapy interventions are commonly provided with the aim of preventing and treating these. This study aimed to determine if prophylactic postoperative respiratory physiotherapy reduced the incidence of postoperative pulmonary complications and decreased length of stay in patients following pulmonary resection via thoracotomy. Seventy six patients undergoing elective thoracotomy were randomised to a treatment group (n = 42) receiving respiratory physiotherapy interventions on a daily basis until discharge or a control group (n = 34) who received standard care involving a clinical pathway but no postoperative physiotherapy intervention. Postoperative pulmonary complication data were recorded daily throughout hospitalisation by a physiotherapist blinded to group allocation using a diagnostic tool previously described. There was no significant difference between groups in baseline demographic data or in surgical interventions. Overall incidence of postoperative pulmonary complications was 3.9% (n = 3) and there was no significant difference between the incidence of postoperative pulmonary complications in the Treatment and Control Group (p = 1.00, absolute risk reduction -0.02, 95% CI -0.13 to 0.11). No significant difference was found between groups for LOS (p = 0.87), with the median (interquartile range) length of stay for the Treatment Group 6.0 (4.0) and the Control Group 6.0 (1.0) days. Given the low incidence of postoperative pulmonary complications, these results suggest that prophylactic

postoperative respiratory physiotherapy may not be required in addition to standard care involving a clinical pathway following open pulmonary resection.

Gamma-loop dysfunction contributes to quadriceps activation deficits in people with knee osteoarthritis.

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A consequence of knee osteoarthritis (OA) is an inability to fully activate the quadriceps muscles, a problem known as arthrogenic muscle inhibition (AMI). The purpose of this study was to determine whether quadriceps gamma-loop dysfunction contributes to AMI in people with knee OA. Fifteen subjects with knee OA and fifteen matched controls with no history of knee joint pathology participated in this study. Quadriceps and hamstring torque (Nm) and electromyography (EMG) were collected during maximum effort isometric contractions. Twenty minutes of 50Hz vibration was then applied to the infrapatellar tendon. After tendon vibration, maximum effort isometric contractions were repeated, with torque and EMG collected in an identical manner. One sample t-tests were undertaken to analyse whether percent changes in torque and EMG differed from zero after vibration in each group. Following tendon vibration, quadriceps torque decreased significantly in the control group ($p < 0.05$) but did not change in OA subjects ($p > 0.05$). Hamstrings torque was unchanged in both groups ($p > 0.05$). Similarly, after tendon vibration quadriceps EMG amplitude decreased ($p < 0.01$) in the control group, but was unchanged in the OA group ($p > 0.05$). EMG amplitude of the hamstrings remained unchanged in both groups ($p > 0.05$). The results demonstrate that gamma-loop dysfunction contributes to quadriceps AMI in patients with knee joint OA. This dysfunction may partially explain the marked quadriceps weakness and atrophy seen in these patients, increasing the risk of disease progression and impairing physical function and quality of life.

The recovery of muscle strength and function after anterior cruciate ligament (ACL) reconstruction: Implications for rehabilitation and return to sport.

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Rehabilitation after ACL reconstruction has progressively shifted from more conservative protocols to accelerated rehabilitation programmes that aim to return patients to sport within 6 months. Despite this, there is limited evidence that physical function and muscle strength recover fully in this time frame and ongoing controversy concerning the optimum clinical criteria for return to sport. Thirteen ACL reconstructed patients (10.4 ± 5 months post surgery) and 10 healthy controls participated in this cross-sectional study. Self reported lower limb function, dynamic balance (star balance test), hop test performance and normalised quadriceps and hamstrings muscle strength (Nm/kg*100) were assessed. Limb symmetry indices (LSI) were calculated for the star balance and hop tests by dividing the score on the injured/non-dominant leg by the score on the uninjured/dominant leg. Differences in LSI and muscle strength between the ACL and control groups were analysed using independent t-tests. All ACL reconstructed patients had been cleared to return to sport despite limited objective testing. None had been able to achieve their pre-injury level of sporting activity. The LSI achieved by the ACL group was significantly lower compared to the control group in the star balance ($p < 0.001$) and hop tests ($p < 0.001$). Compared to the control group, the ACL group were 25% and 37% weaker in their quadriceps ($p < 0.05$) and hamstrings ($p = 0.01$) respectively. These findings question the delivery of current rehabilitation protocols and highlight the importance of objective testing in deciding when an ACL reconstructed patient should return to sport.

The immediate effects of neuromuscular electrical stimulation on cortical excitability and grip control in people with chronic stroke

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Impaired grip control is common following stroke. While neuromuscular electrical stimulation is widely used in rehabilitation following neurological injury, its use as an adjunct to improve grip control has not been explored. This study aimed to identify whether a short intervention of neuromuscular electrical stimulation had immediate effects on cortical motor excitability and grip control in people with chronic stroke. Fifteen people with chronic stroke participated. Participants performed a simple grip force tracking task with or without neuromuscular electrical stimulation of the finger flexor muscles. Cortical motor excitability was measured using transcranial magnetic stimulation. Multi-digit grip control accuracy was measured during ramp and sine wave force tracking tasks, and maximal grip strength was measured before and after each intervention to monitor muscle fatigue. No significant differences in cortical motor excitability were found following either the neuromuscular electrical stimulation or voluntary activation intervention. Accuracy during one component of the force tracking tasks significantly improved ($F(1, 14) = 4.701, p = 0.048$) following both interventions. Maximal grip strength reduced significantly following both interventions; after the assessment of cortical excitability ($F(1, 8) = 9.197, p = 0.016$) and grip control ($F(1, 14) = 9.026, p = 0.009$). Short duration force tracking training, either with or without neuromuscular electrical stimulation, did not increase cortical motor excitability in participants with chronic stroke. Short duration force tracking training, both with and without neuromuscular electrical stimulation, did lead to improvements in training-specific aspects of grip control, reinforcing the importance of task-specificity in rehabilitating hand function.

Optimising rehabilitation for older adults with osteoarthritis - accuracy and timing of movement may be as important as muscle strength.

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The incidence of lower limb osteoarthritis increases sharply after the age of 60 often associated with reduced muscle strength. However there is a growing body of literature suggesting that muscle weakness and reduced neuromuscular control are primary impairments predisposing joints to damage, rather than secondary impairments caused by pain and immobility. Joints that are unprotected by accurate and timely muscle activity are vulnerable to cumulative damage during ambulation due to an increase in impact at initial contact. Descent from a step is a common task that produces a large impact and may highlight muscle activity and joint range changes that occur in older adults that help to explain the onset of joint damage. A systematic literature search was conducted using Ovid, Evidence Based Medicine Reviews, Allied and Complimentary Medicine, CINAHL, MEDLINE, PsychINFO and EBSCOhost electronic search engines. Key words used were (Step OR Stair) AND (Climb OR Descent), (Impact OR Ground reaction force OR shock absorption) and (Muscle active* OR muscle contract*) AND (lower limb OR leg). Eligible studies published from 1975 through to the present day were selected if they evaluated any kinematic or kinetic aspects of stair descent in the older or younger population. Results showed an increase in muscle pre-activity and co-activity and a decrease in joint range of motion in older compared with younger adults, leading to an increased rate of joint loading in the older adults. Physiotherapeutic interventions relating to timing and accuracy of movement can address these problems and will be presented.