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Mobilisation or immobilisation-based treatments for first carpometacarpal joint osteoarthritis: A systematic review and meta-analysis with subgroup analyses

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Abstract

Introduction: Both joint mobilisation and immobilisation are thought to be effective in the treatment of first carpometacarpal joint (CMCJ) osteoarthritis (OA). The objective of this review was to establish whether either intervention reduced pain and improved pinch strength in people with first CMCJ OA in the short term and assess whether one intervention is superior to the other.

Method: This was a systematic review and meta-analysis. Seven databases were searched until May 2021. Only RCTs were included. The Cochrane Risk of Bias Tool and the Grade of Recommendations Assessment, Development and Evaluation system were utilised to rate the evidence. Random-effects meta-analysis with subgroup analyses were used.

Results: Eight studies were included with a total of 417 participants. Mobilisation treatments included manual therapy with or without exercise while immobilisation interventions utilised thumb splinting with several different designs. Very low-quality and low-quality evidence showed that mobilisation led to statistically but not clinically significant improvements in pain (standardised mean difference (SMD) = 0.53; 95% confidence interval (CI) = 0.03 to 1; I^2 = 60%; p = 0.06) and pinch strength (SMD = 0.35; 95% CI = 0.03 to 0.7; I^2 = 12%; p = 0.3) compared to placebo. Very low-quality and low-quality evidence showed no effect on pain and pinch strength compared to a control or no intervention. Subgroup analyses revealed no difference between interventions.

Discussion: Neither mobilisation nor immobilisation alone led to clinically important improvements in pain or pinch strength in the short term in people with symptomatic first CMCJ OA. Neither therapeutic strategy appeared to be superior.

Keywords

Basal joint arthritis, pain, splints, exercise, orthotics

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Introduction

Symptomatic hand osteoarthritis (OA) affects millions of people worldwide. Different types of hand OA have been described in the scientific literature, with first carpometacarpal joint (CMCJ) OA being the most debilitating.[1] People with 1st CMCJ OA often present with pain and deficits in the pinch strength.[2] Amongst conservative, non-pharmacological interventions, both joint immobilisation strategies such as splinting and, paradoxically, joint mobilisation strategies such as manual therapy and exercise have been proposed as therapeutic modalities for the first CMCJ OA.[3]

The stated aim of splinting for symptomatic first CMCJ OA is to reduce movement and stabilise the joint as well as reduce load through the ligaments of the first CMCJ.[4] It is also possible that in the presence of inflammation, immobilisation could reduce the nociceptive discharge of peripherally sensitised joint nociceptors.[5] In turn, splinting

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has been suggested to reduce pain and improve function.[3] A recent systematic review and meta-analysis showed no effect of splinting in the short term (less than 3 months) compared to a combination of interventions or no splinting on pain.[6] Currently, it is unclear whether splinting in comparison to no intervention is effective at improving pinch strength.

In direct contrast to splinting, other conservative treatments for CMCJ OA aim to mobilise the affected joint, both to manage symptoms such as pain and stiffness and to improve muscle performance.[7–9] Mobilisation based treatments include exercises as well as passive mobilisations of the joint and surrounding tissues utilising manual therapy. A systematic review by Bertozzi et al.[10] showed that exercise alone was not effective in improving pain, function, range of movement, or stiffness, although it improved grip strength in people with first CMCJ OA. When exercises and manual therapy were combined, both pain and grip strength improved, however, no change in pinch strength was noted.[10]

No study has directly compared immobilisation versus mobilisation-based interventions in people with first CMCJ OA. Of note, the first CMCJ is the only joint of the body where immobilisation is considered as a treatment option in the presence of symptomatic OA.[11] For most other joints, OA guidelines routinely suggest movement-based interventions, which include exercise and manual therapy, to address pain and muscle atrophy.[11,12] In addition, there is evidence that prolonged wrist immobilisation in a healthy, pain-free population can lead to reorganisation of the somatosensory cortex and reduced tactile acuity,[13] as well as increased pain on movement and hyperalgesia to mechanical and thermal sensory inputs.[14] Considering that many of these changes are already present in people with first CMCJ OA,[15,16] it is of interest to question whether immobilisation is an efficacious therapeutic option. As no study directly compared mobilisation versus immobilisation-based interventions, clarification of this point may arise from a subgroup analysis of studies utilising splinting or joint movement interventions.

The aim of this systematic review and meta-analysis was therefore to assess the effectiveness of any form of mobilisation or immobilisation-based intervention on pain and pinch strength in people with symptomatic first CMCJ OA in the short term (2–6 weeks). It was also of interest to indirectly compare splinting and joint movement interventions through subgroup analysis. It was hypothesised that (1) splinting would not reduce pain compared to a control group, (2) joint movement interventions would reduce pain compared to a control group, (3) joint movement interventions would provide a significantly greater improvement in pain compared to splinting, (4) neither splinting nor joint movement interventions would improve pinch strength compared to a control group and (5) no difference would be found in pinch strength between participants treated with splinting or joint movement interventions.

Methods

Design and search strategy

This systematic review was completed following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[17] and registered on PROSPERO (CRD42021247520). The search strategy was conducted according to the Population, Intervention, Comparison and Outcome (PICO) format. The electronic databases EBSCO host (CINAHL, MEDLINE, SPORTDiscus), Cochrane Central Register of Controlled Trials via Wiley, Allied and Complementary Medicine Database (AMED) via OVID, Scopus and Web of Science were searched between 1975 and May 2021. Study selection was limited to participants older than 18 years and published in English. Table 1 explains the search strategy in more detail. The search was performed independently by two authors (NM and DR). No ethical approval was required for this study as data were pooled from existing studies.

Eligibility criteria

To be eligible for inclusion, studies had to investigate the effect of either immobilisation (e.g. splinting) or mobilisation-based (e.g. manual therapy, exercise) treatment strategies in participants with symptomatic first CMCJ OA. Only randomised controlled trials (RCTs) were included in the present review. Papers were included if they compared the effectiveness of immobilisation or mobilisation-based interventions to a control group undergoing no treatment or a sham intervention. Studies comparing a combination of both immobilisation and mobilisation-based interventions to a control group were excluded. Variables of interest were pain and pinch strength. Reference and forward search of included studies were completed.

Study inclusion

All the papers were downloaded to Endnote X9 (Thomson Reuters). Duplicates were removed before title and abstract screening. The full text of potentially suitable studies was downloaded and assessed for inclusion independently by two people. Disagreement on study inclusion was discussed between the two reviewers (NM and DR). If these authors did not achieve a consensus upon discussion, the third author was involved in a final decision.

Table 1. Search strategy across databases.

Search 1	Thumb* OR carpometacarpal* OR trapeziometacarpal* OR CMCJ*
	AND
Search 2	osteoarthr* OR OA
	AND
Search 3	mobili* OR train* OR strength* OR exercis* OR brace* OR splint* OR cast* OR orthosis OR orthoses
	AND
Search 4	RCT* OR random* OR trial* OR experiment*

Risk of bias and overall quality of evidence

The risk of bias table was used to assess the quality of the RCTs included. This tool has been recommended by the Cochrane Bias Methods Group and the Cochrane Statistical Methods Group.[18] In this critiquing tool, there are seven items that assess the internal validity of each RCT. Items are scored as high, low, or unclear risk.

The Grade of Recommendations Assessment, Development and Evaluation (GRADE) system was utilised to assess the overall quality of the evidence.[19] Downgrading by one point from high quality occurred if any of the following were encountered: inconsistency of results (wide variance of effect sizes or significant or large heterogeneity between trials: $p < 0.05$, $I^2 > 50\%$), imprecision (optimal information size not met), risk of bias (if it was deemed that the bias may affect trial outcomes) and/or indirectness (intervention or outcomes are different from what indicated in the PICO research question). For each pooled outcome, a GRADE profile was provided. Quality of evidence was defined as: very low (the true effect is most likely different from the estimated); low (the true effect may be significantly different from the estimated); moderate (the authors are moderately confident in the effect estimate); high (the authors are confident that the true effect is close to the one estimated).[20]

Data extraction

Study characteristics and descriptive statistics (means, standard deviations) for demographic and pre-post outcome dependent variables were extracted by the first author and verified by an additional reviewer (DR). Where possible, the post-intervention values for the intervention and control groups were used to calculate the standardised mean difference (SMD). The SMD is the difference between groups, outcome results, divided by the pooled SD from the studies. This was adjusted for the small sample sizes of the studies included (Hedges g: SMD). If the standard errors of the mean were provided (e.g. Rannou et al.,[21] the formula $SD = SE \times \sqrt{N}$ was utilised as suggested by the Cochrane group.[22]

Data synthesis and analysis

Review Manager (RevMan) software (version 5.3; Cochrane Collaboration) was utilised for the meta-analysis. The inverse variance method was adopted. It was assumed that studies' heterogeneity was random and a random effect model was therefore adopted.[17,23] Effect sizes of 0.2, 0.5 and 0.8 were considered small, medium and large, respectively.[24] Publication bias was assessed by visually inspecting funnel plots.[20] Statistical heterogeneity was assessed using chi-square tests and the I^2 statistic. This test provides an assessment of the heterogeneity remaining if the sampling error was eliminated.[25] Treatment subgroup analyses (splinting vs movement) were interpreted according to the principles described by Richardson et al.[26]

Results

The initial search identified 842 papers. Duplicates were removed and 430 underwent title and abstract screening. After title and abstract screening, 28 papers were deemed suitable for full-text review. The full-text review identified eight papers suitable for inclusion in the present review. An outline of the selection process is provided in Figure 1. A reference search and forward search of included papers identified one additional research paper,[27] which was excluded as it appeared to have similar participants as another RCT included in the present review.[28] Details regarding study characteristics and interventions are reported in Table 2. Summary of findings and GRADE quality assessment for the splinting and joint movement interventions are reported in Table 3 and 4, respectively.

Study characteristics

A total of 417 participants were included, comprising of 372 female participants (89%) and 45 male participants (11%). The average age ranged between 51 to 83 years old. The primary outcomes of interest were pain and pinch strength. Pain was assessed through the Visual Analogue Scale (VAS)[21,29–31] or pain pressure thresholds (PPT) at the first CMCJ of the affected hand.[28,32–34] The study by

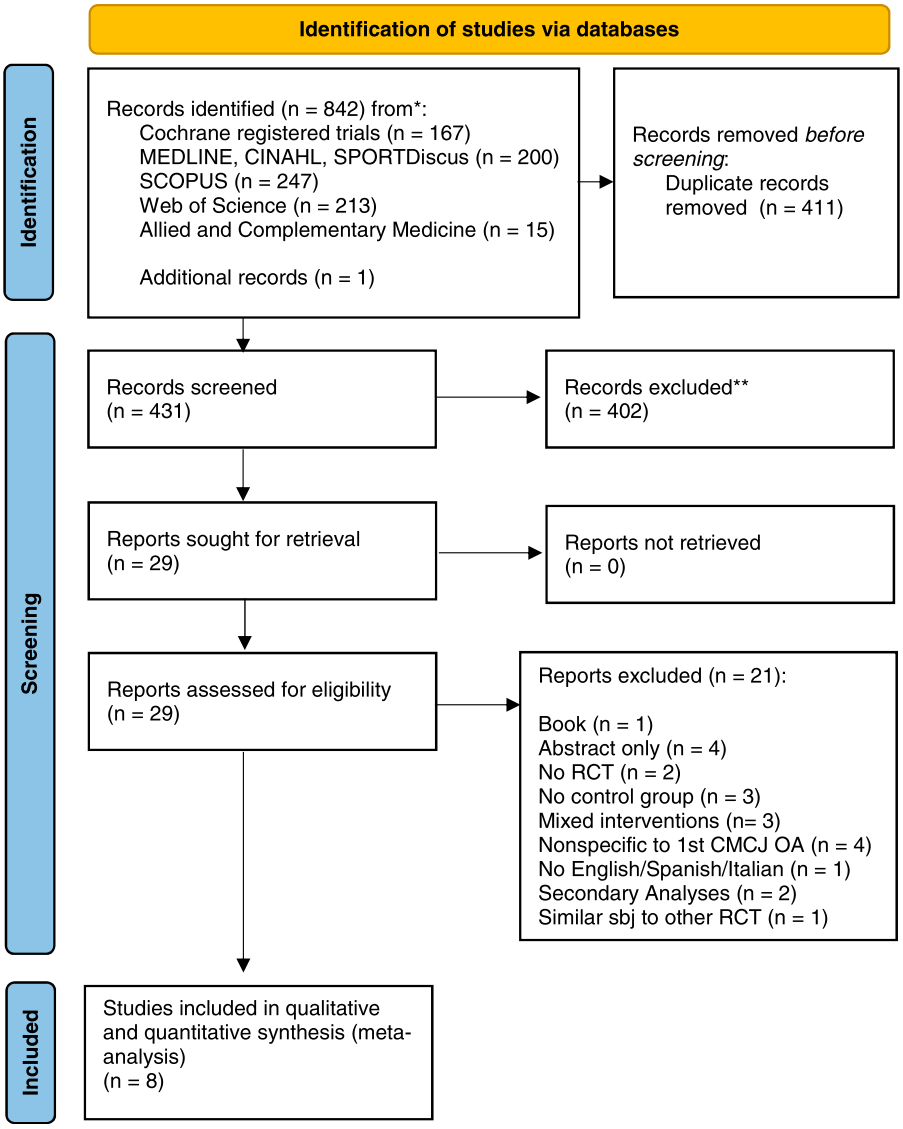

Figure 1. Flow chart of study selection, exclusion and inclusion.

Villafañe et al.[32] was the only one presenting a VAS outcome amongst the papers investigating movement interventions (to reduce meta-analysis heterogeneity, only the PPT measure was pooled from this study). Pinch strength was assessed through a pinch meter. Tip to tip pinch was assessed in all studies except for Rannou et al.,[21] where no specific information was provided in terms of pinch testing.

Symptomatic first carpometacarpal OA diagnosis

Symptomatic first CMCJ OA was diagnosed through X-ray and subjective reports of pain at the base of the thumb.[21,28–30,32–34] In addition, the study by Villafañe et al. and Can and Tezel,[30,32] confirmed the clinical and radiological diagnosis through the opinion of a hand surgeon. The study by Carreira et al.[31] was the only study that utilised the American College of Rheumatology criteria to make a diagnosis of the first CMCJ OA.[35]

Experimental Intervention

Immobilisation-based treatment. Immobilisation-based treatment was utilised in four randomised controlled trials through the use of thumb splints,[21,29–31] (See Table 2). Although the splints provided differed among studies, they were all hand-based orthoses. Two studies involved custom made splints, which were prescribed for daily use only.[29,31] Another

Table 2. Characteristics of Included Studies and Interventions.

Study	Participants	Interventions	Outcome (follow-up time)
Arazpour et al. (2017)	*Exp* = 16 *Con* = 9 *N* = 25 88% F 51 (6) years old	*EXP*: treatment = custom made thumb splint prescription = use during ADLs, removed at night *CG*: treatment = no intervention	Pain – VAS (4 wks): Statistically but not clinically significant difference between groups in favour of EXP.
Can and Tezel (2020)	*Exp* = 35 *Con* = 28 *N* = 63 91% F 56(8) years old	*EXP:* treatment = joint protection advice + off the shelf thumb splint Prescription = use day and night for first 3 weeks, use for painful tasks only in the following 3 weeks *CG:* treatment = joint protection advice only	Pain – AUSCAN pain (6 wks): Statistically but not clinically significant difference between groups in favour of EXP. Pinch strength (6 weeks): Statistically and clinically significant difference between groups in favour of EXP.
Carreira et al. (2010)	*Exp* = 20 *Con* = 20 *N* = 40 95% F 63 (10) years old	*EXP*: treatment = custom made thumb splint prescription = use during ADLs, removed at night *CG*: treatment = custom made splint used during assessment only	Pain – VAS (6 wks): Statistically and clinically significant difference between groups in favour of EXP. Pinch strength (6 wks): No statistically significant difference between groups.
Rannou et al. (2009)	*Exp* = 57 *Con* = 55 *N* = 112 90% F 63 (8) years old	*EXP*: treatment = customised neoprene splint prescription = use at night only *CG*: treatment = no intervention	Pain – VAS (4 wks): No statistically significant difference between groups. Pinch strength (4 wks): No statistical significant difference between groups.
Villafañe et al. (2011)	*Exp* = 14 *Con* = 15 *N* = 29 100% F 80 (2) years old	*EXP*: treatment = first CMCJ distraction plus Kalterborn mobilisation frequency = three times per week duration = three sets of 3 minutes mobilisation with one-minute rest each session *CG*: treatment = sham ultrasound frequency = same as experimental group duration = same as experimental group	Pain – PPT (2 wks): No statistically significant difference between groups Pinch strength (2 wks): No statistically significant difference between groups.
Villafañe et al. (2012a)a	*Exp* = 30 *Con* = 30 *N* = 60 90% F 81 (3) years old	*EXP*: treatment = radial nerve glider in supine frequency = once to twice a week, total of six sessions duration = four minutes of glider exercise (2 seconds per glider) *CG*: supervision = sham ultrasound frequency = same as experimental group duration = same as experimental group	Pain – PPT (4 wks): No statistically significant difference between groups. Pinch strength (4 wks): Statistically but not clinically significant difference between groups.
Villafañe et al. (2012b)b	*Exp* = 14 *Con* = 14 *N* = 28 71% F 83 (6) years old	*EXP*: treatment = first CMCJ posterior-anterior mobilisation according to Maitland frequency = two times per week duration = three sets of 3 minutes mobilisation with one-minute rest each session (60 mobilisations per minute) *CG*: treatment = sham ultrasound frequency = same as experimental group duration = same as experimental group	Pain – PPT (2 wks): No statistically significant difference between groups. Pinch strength (2 wks): No statistically significant difference between groups.

(continued)

Table 2. (continued)

Study	Participants	Interventions	Outcome (follow-up time)
Villafañe et al. (2013b)	*Exp* = 30 *Con* = 30 *N* = 60 85% F 82 (1) years old	*EXP*: treatment = first CMCJ distraction plus Kalterborn mobilisation, radial nerve, and median nerve gliders, range of movement and strengthening exercises. frequency = three times per week duration = Kalterborn mobilisation – three sets of 3 minutes with one-minute rest after each set (60 mobilisations per minute) Nerve gliders – two sets of 5 minutes with one-minute inter-set rest Exercises – 10 to 20 repetitions. Resistance exercises were progressed through Thera-Band Hand Exercisers. *CG*: treatment = sham ultrasound frequency = same as experimental group duration = same as experimental group	Pain – VAS (4 wks): Statistically and clinically significant difference between groups in favour of EXP. Pain – PPT (4 wks): No statistically significant difference between groups. Tip pinch strength (4 wks): No statistically significant difference between groups.

exp: experimental; con: control; N: total sample size; F: female; ADL: activity of daily living; CG: control group; VAS: visual analogue scale; wks: weeks; PPT: pain pressure thresholds; CMCJ: carpometacarpal.

study provided a prefabricated thumb splint to be worn full time for the first three weeks, followed by use of the splint for the most painful tasks only for the following three weeks.[30] One study customised an off the shelf neoprene splint for night use only.[21] Most of the studies provided a splint which included both the first CMCJ as well as the MCPJ of the thumb.[21,30,31] In the study by Arazpour et al.[29] only the first CMCJ was immobilised while the MCPJ of the thumb was free to move. Splinting was applied for a period of four,[21,29] or six weeks.[30,31]

Mobilisation based treatment. The studies providing mobilisation-based treatment for the first CMCJ, utilised several different interventions[28,32–34] (See Table 2). These included first CMCJ mobilisation as described by Kaltenborn[33] and Maitland,[34] radial nerve mobilisation,[28] or a combination of these and resistance exercises for gripping and pinching.[32] The treatment was delivered for a period of two,[33,34] or four weeks.[28,32]

Control group

For the immobilisation-based treatment studies, three experiments presented a control group receiving no intervention[21,29,30] and one study provided a custom made splint to be worn during the assessment only (i.e. pinch testing).[31] For the mobilisation-based treatment, all studies had a placebo/sham treatment group that received an equal number of treatments as the experimental group. The placebo consisted of a non-active dose of ultrasound therapy, which was delivered by the same treatment provider with the machine turned off (See Table 2).

Risk of bias

There was significant variability in terms of risk of bias across the studies included (See Figure 2(a) and (b)). All included studies did not blind the treatment provider. This was due to the nature of the intervention. In addition, the mobilisation studies did not present with allocation concealment. Carreira et al.[31] presented the lowest risk of bias while Arazpour et al.,[29] and Can and Tezel[30] presented the highest risk of bias.

Overall quality of evidence and meta-analyses

The forest plots for pain and pinch strength are reported in Figure 2(a) and (b). Visual inspection of funnel plots revealed no publication bias. Due to the limited number of studies, it was not possible to measure the likelihood of publication bias statistically.

Pain

Four studies assessed the effect of splinting on pain[21,29–31] (See Table 4). Three of these identified a statistically significant change at follow up with splinting.[29–31] However, only the results from Carreira et al.[31] can be considered clinically relevant (2.7 points out of 10 difference between groups on the VAS favouring splinting). Four studies assessed the effect of joint movement interventions versus placebo/sham treatment on pain pressure thresholds at the first CMCJ and none identified a significant between-groups difference.[28,32–34] However, the study Villafañe et al,[32] which also reported changes in pain on VAS, found a statistically and

Table 3. Summary of Findings (GRADE of Evidence): Immobilisation (Thumb Splinting) Compared to no Intervention for First Carpometacarpal Joint Osteoarthritis.

Outcomes	Anticipated absolute effects* (95% CI)	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
Pain assessed with: VAS follow up: range 4 weeks to 6 weeks	The pain score in the splinting group was on average 0.35 SDs (−0.28 lower to 0.98 higher) higher than in the control group	240 (4 RCTs)	⊕◯◯◯VERY LOW[a,b,c]	The results can be interpreted as an average improvement of 0.6 (95% CI = −0.45 to 1.6) points on a 0–10 cm VAS scale.[d] This is unlikely to be of clinical relevance[f]
Tip to tip pinch and other pinch strength follow up: range 4 weeks to 6 weeks	Tip to tip pinch strength was 0.39 SDs (−0.02 higher to 0.8 higher) higher than in the control group	215 (3 RCTs)	⊕⊕◯◯LOW[a,c]	The results can be interpreted as an average improvement of 0.4 kg (95% CI = −0.02 to 0.8) in tip to tip pinch.[e] This finding may have some clinical relevance[g]

Note. * = The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI); CI = confidence intervals; SMD = standardised mean difference.
[a]Downgraded because of lack of outcome assessor blinding and sham intervention.
[b]Downgraded because of large heterogeneity.
[c]Downgraded because sample size less than 400 participants.
[d]The control group pain mean (SD) 2.6 (1.6) was calculated by averaging the 10-point VAS scores of[21,29,31].
[e]The control group pinch strength mean (SD) 1.7 (0.97) was calculated by averaging the pinch strength values.[21,31].
[f]The minimal clinically important difference for pain is 2 points out of 10.[38].
[g]The minimal clinically important difference for pinch strength is 0.3 kg for tip to tip pinch strength in females with thumb CMCJ OA.[36].

Table 4. Summary of findings (GRADE of evidence): Joint movement compared to sham intervention for first carpometacarpal joint osteoarthritis.

Outcomes	Anticipated absolute effects* (95% CI)	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
Pain assessed with: VAS, Pressure pain thresholds follow up: range 2 weeks to 4 weeks	The pain score in the joint movement group was on average 0.53 SDs< (0.03 higher to 1.03 higher) higher than in the sham group	177 (4 RCTs)	⊕◯◯◯VERY LOW[a,b,c]	The only paper assessing pain on a 0–10 cm VAS scale Villafañe et al. (2013b) reported a between groups difference of 2.9 points out of 10 in favour of the joint movement group. This could be considered a clinically relevant finding[e]
Tip to tip pinch strength follow up: range 2 weeks to 4 weeks	The pain score in the joint movement group was on average 0.35 SDs (0.03 higher to 0.67 higher) higher than in the sham group	177 (4 RCTs)	⊕⊕◯◯LOW[a,c]	The results can be interpreted as an average improvement of 0.4 kg (95% CI = 0.03 to 0.76) in tip to tip pinch.[d] This finding may have some clinical relevance[f]

Note. * = The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI); CI = confidence intervals; SMD = standardised mean difference.
[a]Downgraded because of lack of allocation concealment.
[b]Downgraded because of large heterogeneity.
[c]Downgraded because sample size less than 400 participants.
[d]The control group pinch strength mean (SD) 2.1 (1.13) was calculated by averaging the pinch strength values of.[28,32–34].
[e]The minimal clinically important difference for pain is 2 points out of 10.[38].
[f]The minimal clinically important difference for pinch strength is 0.3 kg for tip to tip pinch strength in females with thumb CMCJ OA.[36]

clinically significant difference (2.9 points out of 10 difference between groups) in favour of combined manual therapy and exercise-based intervention compared to placebo.[32]

Eight studies were included in the meta-analysis for the pain outcome. The pooled results (concerned with ppt measures) provide very low-quality evidence supporting the

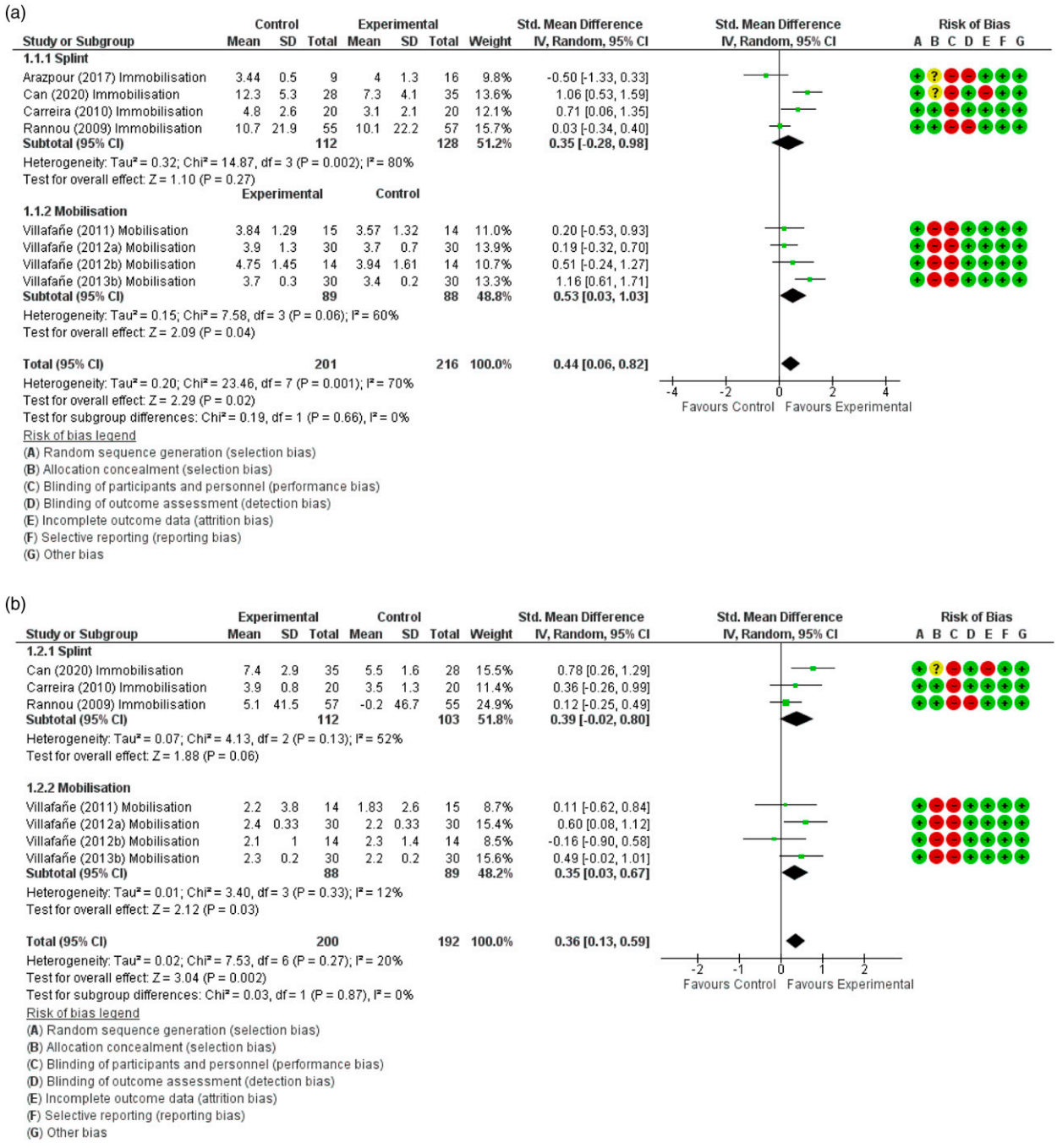

Figure 2. (a). Meta-analysis with subgroup comparison for Pain Outcomes. Note. SD = standard deviation; Std. = Standardised; CI = confidence intervals and (b) Meta-analysis and subgroup comparison for Tip to Tip Pinch Strength Outcome. Note. SD = standard deviation; Std. = Standardised; CI = confidence intervals.

use of mobilisation-based treatment (SMD: 0.53; 95%CI: 0.03 to 1; $p = 0.04$) but not splinting (SMD: 0.35; 95%CI: −0.2 to 1; $p = 0.27$) to improve pain. The I^2 value was 80% ($X^2 = 14.9$; $p = 0.002$) and 60% ($X^2 = 7.6$; $p = 0.06$) for immobilisation and mobilisation-based interventions, respectively (See Figure 2(a)).

The test for subgroup differences indicated that there is not a statistically significant subgroup effect ($p = 0.66$),

suggesting that the type of treatment provided (immobilisation or mobilisation) does not modify pain outcomes (See Figure 2(a)).

Pinch strength

Three studies assessed the effect of splinting on tip to tip pinch strength[21,30,31] (See Table 2). One study identified a statistically and clinically significant difference[36] (1.9 kg difference between groups) between splinting and control at follow up.[30] Out of four studies assessing pinch strength following mobilisation-based treatment[28,32–34] one study identified a statistically significant but not clinically important improvement (0.23 kg difference between groups) at follow up with mobilisation-based treatment.[28]

Seven studies were included in the meta-analysis for the pinch strength outcome. The pooled results provide low-quality evidence supporting the use of mobilisation-based treatment (SMD: 0.35; 95%CI: 0.03 to 0.7; $p = 0.03$) but not splinting (SMD: 0.4; 95%CI: −0.02 to 0.8) to improve pinch strength. The I^2 value was 52% ($X^2 = 4.1$; $p = 0.13$) and 12% ($X^2 = 3.4$; $p = 0.3$) for immobilisation and mobilisation-based interventions, respectively (See Figure 2(b)).

The test for subgroup differences indicated that there is not a statistically significant subgroup effect ($p = 0.9$), suggesting that the type of treatment (immobilisation or mobilisation) does not modify pinch strength outcomes (See Figure 2(b)).

Discussion

This systematic review and meta-analysis assessed the short-term effect of immobilisation and mobilisation-based treatment for symptomatic first CMCJ OA. There was very low and low-quality evidence suggesting that mobilisation-based treatment may provide some benefit (statistically significant but clinically irrelevant) in respect to pain and pinch strength, respectively. Very low and low-quality evidence also suggests that splinting is ineffective in improving pain or pinch strength, respectively. Overall, there were no subgroup differences when splinting was compared to joint movement interventions, with respect to pain and pinch strength.

Mobilisation based treatments improved CMCJ joint pain to a statistically significant level. However, the clinical relevance of these findings is uncertain. Our findings are in line with a recent systematic and meta-analysis assessing the effectiveness of manual therapy alone versus placebo in people with first CMCJ OA. The results showed statistically significant but not clinically significant improvements in grip, pinch strength and pain pressure threshold at the affected first CMCJ.[37] Out of four studies exploring the effectiveness of joint movement interventions, only one assessed pain through the VAS, making the results more easily interpretable.[32] This paper compared a combination of first CMCJ mobilisations, neurodynamic gliders and resistance exercises to a sham ultrasound intervention. The results showed that the experimental group reported an average improvement in pain of 2.9 (95% Confidence Intervals: 2.2 to 3.7) points out of 10. This can be interpreted as a clinically important change in pain[38]; however, the other three papers utilised only pressure pain thresholds to assess treatment effectiveness, making the interpretation of results more difficult. Although pressure pain thresholds and measures of clinical pain intensity are often correlated, they are functionally distinct constructs.[39] Additionally, pressure pain thresholds are not routinely assessed in clinical practice and the minimal clinical important difference (MCID) for this measure is unknown. Overall, these papers reported no statistically significant increase in pressure pain thresholds after mobilisation-based interventions, although there was a trend for improvement in the experimental group compared to the sham intervention.

Immobilisation-based interventions provided no overall significant short-term improvements in pain. Three studies showed statistically significant improvements in pain following splinting compared to no intervention. However, only one study,[31] identified improvements in pain which were clinically relevant[38] with a between-group (splint vs control) difference of 2.7 points out of 10 on VAS. Hence, the pooled results across all the included splint studies could be interpreted as a between-group (splint vs control) difference in pain of 0.6 points out of 10, which is unlikely to be of clinical relevance. This is in line with a recent RCT by Adams et al.[40] which compared sham splinting to real splinting whilst providing advice and self-management strategies (including exercises) to both groups. These researchers showed that both groups improved over time by a clinically significant amount (20% change in AUSCAN pain at two months[41]) without differences between groups.[40]

Both splinting and joint movement interventions improved pinch strength to a similar extent. Pinch strength increased by an average of 0.4 kg following both splinting and joint movement interventions (See Table 3 and 4). These findings are in line with a previous review by Bertozzi et al., and can possibly be considered of some clinical relevance if the MCID is based upon the study by Villafañe et al.[32] Villafañe et al.[32] suggested that a difference of 0.3 kg in pinch strength could be deemed clinically relevant in people with first CMCJ OA. However, they only utilised a distribution method to calculate this MCID, and the smallest measurable change in pinch strength in clinical settings is 0.5 kg (the dial of analogue pinch meters presents 0.5 kg increments). It is therefore unlikely that the pinch strength changes identified in this review are indicative of strong clinical relevance. The lack of pinch strength improvements with joint movement interventions may be due to the low-intensity level of the exercises.[42] Longer term, progressive resistance training interventions of appropriate intensity/volume,[43] may improve pinch strength weakness, often identified in people with symptomatic first CMCJ OA.[1]

Overall, there was no difference between mobilisation or immobilisation-based interventions in respect to pain or pinch strength in the short term. This, in combination with the lack of consistently clinically relevant findings, suggests that these interventions may need to be improved, or that alternative forms of treatment may be required for people with symptomatic first CMCJ OA. In clinical practice, it may be useful to assess other contributing factors to pain including biological and psychosocial aspects. For example, psychological factors such as beliefs about causality between pain and joint damage, catastrophising thoughts and depression can worsen the pain experience.[44,45] More specifically, illness perception, distress, and pain catastrophising have been shown to predict 47% of the pain reported by hand OA patients.[45] In contrast, radiographic findings explain only 6% of the variance in symptoms reported.[45] In addition, poor sleep quality and elevated stress levels have repercussions on the neuroimmune system and may lead to increased pain sensitivity.[46,47] It also appears that a lower educational status may contribute to worse outcomes in people with hand OA.[48] The use of principles which move away from the association between pain and tissue damage (biomedical approach) and more towards a person-centred, biopsychosocial approach may be useful in treating clients with symptomatic first CMCJ OA.[49] In this context, the use of splinting, joint mobilisation, or any other treatment may need to be discussed as a pain-relieving approach mediated by changes in tissue sensitivity, rather than changes in biomechanics or stability of the joint.[50] In fact, there is some evidence that the importance of joint instability in the first CMCJ OA can be questioned.[51] In addition, neither joint size nor joint congruence appear to be risk factors for early first CMCJ OA.[52] Explanations promoting a stability concept may lead clients to think that movement of the joint may be harmful and cause further joint damage, which is in direct contrast with the current understanding of both the pathophysiology and treatment of chronic pain conditions, including OA.[47,49] Overall, improvements noted in clinical practice are likely mediated by positive treatment expectations rather than the type of intervention.[53] Therefore, providing patients with a positive outlook on their pathology, and avoiding inducing fear avoidance and catastrophising thoughts in our clients, is likely going to benefit them.

This review presents several limitations. Only short-term outcomes were considered. Although this could be viewed as a limitation, clients engage with health care providers for pain relief and it is useful to identify treatments which could help in the short term as well as in the long term. An additional limitation is that no functional outcomes were included. This is because the joint movement intervention studies included did not report on these outcomes. In addition, all the studies on CMCJ mobilisation were undertaken by the same author, which may increase bias. Another limitation is that only papers published in English were considered for inclusion in the present review. Finally, both the mobilisation and immobilisation-based interventions were heterogeneous in their results, making the interpretation of the findings challenging. However, this limitation was accounted for and the overall grade of evidence was downgraded.

Conclusion

In conclusion, there is very low- to low-quality evidence suggesting that mobilisation and immobilisation-based interventions do not provide clinically significant improvements in pain or pinch strength in the short term for people with symptomatic first CMCJ OA when compared to a control group or placebo intervention. A broader, person-centred approach that considers psychosocial and behavioural (e.g. sleep) factors in addition to biomedical factors may help in providing more effective interventions to people with symptomatic first CMCJ OA.

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