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Protocol

The effectiveness of exercises in patients with thumb carpometacarpal osteoarthritis: a study protocol for a systematic review and meta-analysis

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ABSTRACT

Background: The thumb carpometacarpal osteoarthritis (CMC-OA) is a common musculoskeletal condition of the hand causing increased pain and significant disability. Although different modes of exercises are usually prescribed during the management of the condition, the evidence for their effectiveness is sparse. The aim of this protocol is to investigate through a systematic review the effectiveness of exercises compared with other non-surgical interventions in reducing pain and improving function in the management of the thumb CMC-OA.
Methods: We will conduct this systematic review following the preferred reporting items for systematic reviews and meta-analysis (PRISMA) guidelines. PubMed, CINAHL, EMBASE, PEDro, ScienceDirect, Cochrane Library, Grey literature databases and clinical trial registries will be searched. Two reviewers will independently evaluate the retrieved results. Subsequently, data extraction of the eligible trials will be conducted by two independent researchers. We will use the grading of recommendations assessment, development, and evaluation (GRADE) approach to assess the certainty of evidence.
Conclusions: This systematic review will provide evidence for the clinical benefits of exercises compared with other conservative interventions in the management of patients with thumb CMC-OA.
Trial registration: PROSPERO registration number is CRD42023461505.

Keywords: Training, Exercises, Osteoarthritis, Trapeziometacarpal, Thumb, Base

INTRODUCTION

The thumb carpometacarpal (CMC) joint is a common location of osteoarthritis (OA) in the hand affecting approximately 15% of adults over the age of 40 years.[1] The prevalence of the condition increases with older age reaching up to 57% in individuals over the age of 60 years affecting mostly women in the postmenopausal period.[1,2] It is characterized by progressive degeneration of the trapeziometacarpal joint, deterioration of joint surfaces, bone remodeling and capsular/ligamentary laxity which in later stages results in subluxation of the trapezium and adduction contracture of the thumb.[3-5] Patients with thumb CMC joint OA present pain at rest or during activity in the radial side of the hand, decreased pinch strength, reduced thumb motion and significant disability during daily activities.[5,6]

Although surgical procedures are considered effective to provide pain relief in patients with thumb CMC OA, they remain the last treatment option due to the increased risk of complications.[7] Hence, a multifaceted conservative management is commonly used as first-line management including analgesics, education, injections (corticosteroid or hyaluronic), physical therapy modalities, exercises, manual therapy and orthotic devices.[8-10] Using different

modes of exercises with or without additive non-pharmacological interventions appear to be the most popular treatment approach among therapists.[8,11] Previous systematic reviews have advocated the use of therapeutic exercises and manual therapy as effective interventions in reducing pain and improving function at the short-term.[6,8,10] However, the superiority of exercises compared with other interventions remains unclear and an evidence-based exercise programme for the management of the condition is not available yet.[6,12]

The primary aim of the current review is to evaluate the effectiveness of exercise compared with other conservative interventions in the management of thumb CMC joint OA. The secondary purpose is to perform a meta-analysis synthesizing the evidence regarding exercise type, mode and dosage that could further inform clinical practice.

METHODS

The present intervention review will be conducted and reported according to the preferred reporting items for systematic reviews and meta-analyses guidelines. The study protocol has been prospectively registered in prospective register of systematic review (PROSPERO) with registration number: CRD42023461505.

Eligibility criteria

Study design

We will include only randomized controlled trials (RCTs) assessing the effectiveness of exercises used alone or as an additive intervention in reducing pain and improving function in patients with thumb CMC joint OA. Publications written only in the English language will be considered for inclusion.

Participants

Adults (>18 years) of both sexes diagnosed clinically, radiologically or both, with thumb CMC joint OA will be considered eligible for the present review. We will exclude patients with thumb CMC joint OA but without pain or disability. Similarly, patients that have been treated surgically, presented a systemic disease such as rheumatoid arthritis or other serious comorbid conditions of the hand (i.e., carpal tunnel syndrome, De Quervain's tendonitis, Dupuytren's contracture) will be excluded.

Interventions

We will include studies using any type of exercises (stretching, isometric, isotonic, concentric or eccentric contractions or a combination of them) used alone or as an additive intervention in adult diagnosed with thumb CMC joint OA. The equipment may include therabands, dumbbells squeeze balls etc., or even the gravity itself as a resistance tool.

Comparisons

Studies using comparisons of any type of conservative treatment (without exercise or using another type of exercise), placebo, sham exercises or no-treatment will be considered appropriate for inclusion.

Outcomes

The primary outcomes will include: pain intensity using the visual analogue scale (VAS) score or numeric pain rating scale (NPRS), disability using the disability of the arm, shoulder and hand (DASH) questionnaire, the Australian/Canadian osteoarthritis hand index (AUSCAN), the functional index of hand OA (FIHOA)/Dreiser index. The secondary outcome measures will include: the range of motion (º), grip strength (kg), pinch strength (kg), and quality of life (QoL). Follow-up was categorized into very short-term (≤2 months), short term (>2 months to ≤3 months), midterm (>3 to <12 months) and long term (≥12 months).[13]

Search strategy

We will search the following databases PubMed, CINAHL, EMBASE, PEDro, ScienceDirect, Cochrane Library, Grey literature databases and clinical trial registries from inception to December 2023. The full search strategy is presented on Table 1.

Data selection

Search results will be imported into EndNote version X9 and two authors (DM and FK) will thoroughly review the titles, abstracts and full-texts against the eligibility criteria in a two-stage process [14]. After independently selecting the eligible studies, the two authors will cross-check their findings. In case of any disagreement a third reviewer will be consulted (SK) and discrepancies ate going to be resolved through a consensus process.

Data extraction

Data extraction will be conducted by the same reviewers independently using a standardized data extraction form including details about the authors, publication year, sample size, interventions, comparative interventions, outcomes, follow-up and results. Any discrepancy will be resolved through a consensus process with a third reviewer (SK).

Risk of bias

The chosen papers will be assessed for risk of bias using the PEDro criteria by two independent reviewers (FK and DM). Each eligible trial will be rated based on the number of criteria satisfied with a score from 0 to 10.[15,16] Methodological quality of each study will be considered as 'poor' for a PEDro score ≤4, 'moderate' for scores of 5 or 6, and 'high' for scores ≥7.[15,17] Any difference will be

discussed during a consensus meeting and a third reviewer (GG) will be consulted if needed.

Data analysis, synthesis and summary of findings

Continuous data will be transformed to 100-point scales (i.e., pain, function) or ratios of symptomatic: non-symptomatic hand for pintch and grip strength (x100%) for analyses. Mean difference (MD) or standardised mean difference where applicable with 95% confidence intervals (Cis) will be used as measures of treatment effect. A random-effects model will be included to pool studies' outcomes due to clinical and methodological heterogeneity. The meta-analyses will be estimated using the Cochrane Review Manager Software V.5.3 (The Cochrane collaboration). To assess publication bias, we plan to generate funnel plots for meta-analyses including at least 10 trials.[18]

To evaluate the risk of heterogeneity I^2 statistic will be estimated with results ≥0.75 reflecting high heterogeneity.[18] Subgroup analyses will be performed between exercises with or without other treatment and other type of intervention (modalities, corticosteroid injections etc.) or without intervention (sham/placebo or control). We will conduct a sensitivity analysis to investigate the sources of heterogeneity examining studies with 'low' or 'moderate quality' (PEDro score <7), unexpectedly large treatment effect sizes, as well as studies presenting significant heterogeneity at baseline for participant characteristics. Statistical significance (p) will be set at <0.05.

We will use the grading of recommendations assessment, development and evaluation (GRADE) methodology to assess the certainty of evidence.[18] Initially, evidence will be evaluated as high certainty and shall downgrade it for each of the following reasons if will be present: high risk of bias (PEDro score <7) in most of the eligible studies (>75%), inconsistency (substantial heterogeneity on the point estimates, statistical heterogeneity and I^2 >50%), imprecision (sample does not reflect inclusion criteria of the review, CIs limit crosses the effect size of 0.5), indirectness (trials including indirect comparisons), and publication bias (asymmetry in funnel plots where a sufficient number of studies is available).[19] In case of one trial available, we will grade the evidence as low certainty, and if this study presents with low quality evidence, we will grade it with very low certainty.[17,20]

Minimal clinically important difference of the DASH was defined as a mean of 11-point change or 37% of the baseline score and for pain intensity as a 30% improvement from the pooled weighted mean of the baseline.[20,21] The minimal clinically important difference of grip strength, a minimal clinically important difference of 20% was considered appropriate for grip strength.

Table 1: Search strategy for MEDLINE, EMBASE, CINAHL, PEDro, Science Direct, Cohrane library.

No.	Search strategy
#1	(carpometacarpal OR carpo- metacarpal OR thumb OR base of thumb OR basal thumb OR basilar thumb OR thumb base OR trapeziometacarpal OR trapezometacarpal OR trapezialmetacarpal OR trapezio- metacarpal OR trapezo-metacarpal OR trapezial-metacarpal OR metacarpophalangeal joint OR hand OR wrist OR finger OR carpal bones OR pollex OR first carpometacarpal OR first carpo metacarpal OR metacarpus OR metacarpal OR carpal OR carpus OR carpo OR carpi OR trapezium OR trapezoid OR trapezial OR CMC)
#2	(degenerative arthritis OR degenerative arthritis OR degenerative arthrosis OR degenerative osteoarthritis OR degenerative osteoarthritis OR degenerative osteoarthrosis OR degenerative osteoarthritis OR arthritis OR arthritis OR arthrosis OR osteoarthritis OR osteoarthritis OR osteoarthrosis OR rhizoarthosis OR rhizarthosis OR osteoarthritis OR arthralgia OR hyperalgesia OR joint diseases OR pain OR acute pain OR chronic pain OR musculoskeletal pain OR breakthrough pain)
#3	(physiotherapy OR physical therapy OR rehabilitation exercise OR generic exercise OR specific exercise OR home exercise OR therapeutic exercise OR exercise program OR training OR training program OR proprioception OR neuromuscular re-education OR dynamic stabilization OR neural mobilization OR exercise therapy OR stretching cast OR splint OR casting OR orthotic devices OR orthosis OR conservative treatment OR conservative treatments OR conservative option OR conservative options OR manual therapy OR manipulation OR mobilization OR strengthening OR joint protection education OR tens OR ultrasound therapy OR electrotherapy OR magnetotherapy OR biofeedback OR massage OR paraffin OR cryotherapy OR hand therapy OR cognitive therapy OR counseling OR self-management OR occupational therapy).
#4	#1 AND #2 AND #3

DISCUSSION

Previous systematic reviews and meta-analysis have focused on the use of manual therapy, splints, injections and multimodal physiotherapy interventions in patients with CMC OA.[5,6,22-25] Based on authors' knowledge, this is the first study aiming to investigate the effectiveness of exercises compared with other non-surgical interventions in pain intensity and function in patients with the condition. Although a recent study suggested that both mobilization and immobilization of the first CMC joint are effective in the treatment of CMC OA, their results should

be interpreted with caution because functional outcomes were not included.[26] Another systematic review has advocated the superiority of unimodal or multimodal physiotherapy interventions including exercises in CMC OA; however, their literature search was conducted seven years ago and several recently published studies have not been considered.[6] Also, comparisons between physiotherapy with or without exercises against different types of injections remains inconclusive. Riley et al in their systematic review and meta-analysis compared different injection-based therapies with each other; nonetheless, there were no comparisons between injection-based therapy with a non-injection-based intervention.[24] Also, despite the fact that the use of exercises is common when treating patients with the current condition, the certainty of evidence for the effectiveness of this intervention has not been documented yet. Therefore, we aim to evaluate the certainty of evidence for the use of exercises against other interventions using the GRADE methodology.

Our protocol should be viewed in the light of some limitations. First, only papers published in English will be considered for inclusion in this systematic review. Second, the management of the current condition usually includes multimodal interventions such as exercises, splints, manual therapy, and electrophysical modalities.[27] Possibly, the inclusion of studies with increased heterogeneity regarding interventions might make the interpretation of the findings challenging. Similarly, the entry criteria of patients with thumb CMC OA are highly variable, reflecting the lack of specific classification criteria for the patients with the condition.[22] Consequently, there is a potential risk of heterogeneity in patients' characteristics (such as severity of symptoms or chronicity) which in turn might influence the analysis of the study results.

CONCLUSIONS

The present protocol for systematic review can provide clinical directions for the benefits of exercises compared with other conservative interventions in the management of patients with thumb CMC-OA. Also, our study aims to synthesize the evidence regarding the best available training programme including details such as the type, mode and dosage of exercises to inform clinical practice.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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