

ORIGINAL RESEARCH

Efficacy and safety of non-pharmacological, pharmacological and surgical treatments for hand osteoarthritis in 2024: a systematic review

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ABSTRACT

Background We aimed to update the 2018 systematic literature review on the efficacy and safety of treatments for hand osteoarthritis (OA), which was based on 126 studies.

Methods We performed a systematic literature search on randomised controlled trials from June 2017 up to 31 December 2023. Risk of bias was assessed using the RoB2 tool. Meta-analyses of previous and new studies regarding the efficacy for pain, function, grip strength and OMERACT/OARSI responders were performed. Certainty of evidence was judged using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) tool.

Results Sixty-five new studies were included. For non-pharmacological interventions, there was low-certainty evidence for a small long-term effect of hand exercises and a moderate long-term effect of thumb orthoses for pain, and moderate-certainty evidence that assistive devices had a moderate long-term effect on function. Concerning pharmacological interventions, there was low-certainty evidence for a moderate short-term effect of oral non-steroidal anti-inflammatory drugs (NSAIDs) on pain, high- and moderate-certainty evidence for a small short-term effect of topical NSAIDs and oral glucocorticoids on function, respectively, and low-certainty evidence that oral glucocorticoids had a small short-term effect on function. Further, there was low-certainty evidence that methotrexate had a small long-term effect on pain. The heterogeneity of studies did not allow for any meta-analyses on surgery.

Conclusion The results largely support current treatment recommendations. However, there is a lack of interventions that efficiently improve grip strength, and the evidence for most current treatments is still limited. To better understand action mechanism of different treatments, future trials should include hand OA subtyping and be powered for subgroup analyses.

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Hand osteoarthritis (OA) is a prevalent rheumatic joint disease, for which there is yet no cure or disease-modifying treatment.
- ⇒ There is a general consensus across international treatment recommendations that all patients with hand OA should receive patient education and exercises to improve hand function, that topical or oral non-steroidal anti-inflammatory medication may be considered for short time use, whereas surgery may be considered for patients with structural abnormalities when other treatment modalities have not been sufficiently effective in relieving pain.
- ⇒ The treatment recommendations vary with respect to other treatment modalities, and the evidence for most treatments is limited.

WHAT THIS STUDY ADDS

- ⇒ This systematic literature review includes 65 new randomised controlled trials published in the hand OA field since June 2017, thereby providing an updated overview of all current evidence on efficacy and safety of non-pharmacological, pharmacological and surgical treatment options for hand OA.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ This study confirms the need for high-quality randomised controlled trials including hand OA subtyping to better understand the action mechanisms and allow for separate analyses with regard to OA phenotype and trials with low risk of bias.
- ⇒ It further shows that there is a need for studies that help us understand factors that may influence grip strength as a basis for developing evidence-based interventions that efficiently improves grip strength.
- ⇒ The results also indicate that mobile applications may be used to deliver interventions designed to enhance self-management, but the efficacy and cost-effectiveness of this delivery mode should be evaluated in robust clinical trials.

INTRODUCTION

Hand osteoarthritis (OA) is a common rheumatic joint disease, leading to structural and functional impairment that may significantly impact body functions and structures, activity performance, work ability and health-related quality of life.^{1,2} Despite its high and increasing prevalence, research shows that the quality of care services in general is suboptimal for people with OA, and that especially those with hand OA have poor access to treatment in primary and specialist healthcare.^{3,4} To optimise the care for people with hand OA, treatment recommendations should be based on updated best evidence.

In a recent systematic review, Conley *et al* identified the following four high-quality clinical guidelines published since 2019, addressing different treatments for hand OA⁵: The Osteoarthritis Research Society International (OARSI) guidelines for the non-surgical management of knee, hip and polyarticular OA⁶; the 2019 American College of Rheumatology (ACR)/Arthritis Foundation Guideline for the Management of OA of the Hand, Hip, and Knee⁷; the Italian Society for Rheumatology clinical practice guidelines for the diagnosis and management of knee, hip and hand OA⁸; and the 2018 update of the European Alliance of Associations for Rheumatology (EULAR) recommendations for the management of hand OA.⁹ After the review by Conley *et al* was published,⁵ the National Institute for Health and Care Excellence (NICE) has also launched updated guidelines for diagnosis and management of OA, including hand OA.¹⁰ There is a general consensus across the five guidelines that patient education and exercises are essential components of hand OA treatment, that topical non-steroidal anti-inflammatory drug (NSAID) gel/cream should be the first pharmacological choice, and that oral NSAIDs may be considered alongside non-pharmacological treatment for short time use. Further, EULAR and ACR guidelines state that conventional or biological disease-modifying anti-rheumatic drugs (DMARDs) should not be used in hand OA. However, the treatment recommendations vary with respect to other treatment modalities, such as the use of orthoses, assistive devices, electrotherapy, thermal modalities, paracetamol and intra-articular injections. The aim of the current study was to update the 2018 systematic literature review (SLR) by Kroon *et al*¹¹ on the efficacy and safety of non-pharmacological, pharmacological and surgical treatments for hand OA.

METHODS

Search strategy

The study protocol for this review have been published in the International Prospective Register of Systematic Reviews, PROSPERO (#CRD42022288691). A systematic literature search was conducted by two of the authors (ATT and IK) in close collaboration with an experienced librarian. We used the same search strategy as Kroon *et al* (see online supplemental material) and searched the PubMed/MEDLINE, Embase and Cochrane CENTRAL

databases from 7 June 2017 (end date of search of original SLR) up to 31 December 2023. Additionally, conference abstracts of the EULAR, ACR and OARSI annual conferences of 2022 and 2023 and EULAR, and reference lists of included studies and other relevant SLRs were screened. Eligible study types were parallel randomised controlled trials (RCTs), cluster-randomised trials and cross-over randomised trials, published in English or Scandinavian. Cochrane systematic reviews were also included as a source of relevant RCTs.

We included all studies of non-pharmacological, pharmacological and surgical interventions for hand OA. Additionally, studies also involving participants with other diagnoses were included if the results were presented separately for participants with hand OA.

In line with the outcomes proposed by the OMERACT core set,¹² the main efficacy outcomes were as follows: (1) pain (measured on Visual Analogue Scale (VAS)), Numerical Rating Scale (NRS) or a validated questionnaire, for example, Australian/Canadian Hand OA Index (AUSCAN) or Michigan Hand Outcomes Questionnaire (MHQ); (2) hand function measured by a validated questionnaire, for example, Functional Index for Hand OA (FIHOA), AUSCAN or MHQ; (3) grip strength; and (4) number of participants fulfilling the OMERACT-OARSI responder criteria.¹³ Safety measures (adverse events (AEs)) were also analysed, if available.

Study selection, data extraction, risk of bias and GRADE assessment

Four reviewers (ATT/DHB/KAAF/IK, working in pairs) screened all titles and abstracts using the Rayyan tool.¹⁴ The following hierarchy was used for exclusion:

1. Wrong design.
2. Wrong population.
3. Wrong language.
4. Wrong intervention.
5. Wrong outcome.

In case of doubt, the third reviewer was consulted. Thereafter, potentially relevant studies were read and evaluated in full text. For each study, two authors (DHB/IS/IK) extracted data on study design, first author, publication year, patients (hand OA definition, location and subtype, proportion of women, mean age, disease duration, number of participants per study arm), intervention (including frequency, duration and dose), primary outcome, other outcomes and AEs. The data extraction sheets were subsequently compared to ensure accuracy.

Risk of bias (RoB) was assessed in pairs by three authors (DHB, IS and IK) using the RoB2 tool,¹⁵ including bias arising from the randomisation process, deviations from the intended interventions, missing outcome data, measurement of the outcome and selection of the reported results. Each item was judged as low (green colour), high (red) or some concerns (yellow). Finally, we did an 'overall assessment' for each study based on the judgements of all RoB2 items. Although not described in the protocol, we decided to also use the Grading of

Recommendations Assessment, Development and Evaluation (GRADE) tool to assess the certainty of the effect estimates of all interventions and outcomes for which we conducted a meta-analysis.¹⁶ One author (GS) performed a first assessment, which was thereafter checked by two other authors (DHB, IK). GRADE considers the risk of bias, consistency and directness of estimates, precision of results, risk of publication bias, size of effect, dose-response, and possible confounding to produce a grading into one of four categories: high-, moderate-, low- or very low-certainty of the estimates of the efficacy. In section 6 in the online supplemental material, we show GRADE summary of findings tables for each outcome. Whenever we have downgraded the certainty, the reasons for this downgrading are provided in the footnote.

Data analysis

We extracted outcome data from each study and, as in the original review,¹¹ categorised these by short-term (<3 months) and long-term (≥ 3 months) follow-up. Continuous outcomes were summarised as standardised mean differences (SMDs) with 95% CIs. We used random-effects models for conducting meta-analyses of studies assessing efficacy of the same intervention and pooled data if there was adequate clinical and methodological homogeneity. Heterogeneity was assessed with the I^2 statistic and tested with Cochran's Q test. However, we only pooled data from studies where the intervention of interest was compared with a control group receiving placebo or no intervention, or, if study groups received a combination of interventions, the only difference between groups in terms of treatment was the intervention of interest. We also included results from relevant studies in the SLR by Kroon *et al.*¹¹ in the meta-analyses (hereafter termed previous studies), but used data from full-text articles of conference abstracts included in this SLR, if available.^{17–23}

We applied the commonly used categorisation by Cohen, and regarded the effect as small, moderate or large if the SMD was 0.2–0.5, ≥ 0.5 –0.8 and ≥ 0.8 , respectively.²⁴ Finally, we conducted meta-analyses comparing the pooled effect of each non-pharmacological and pharmacological intervention on the four main efficacy outcomes. The Stata Statistical Software: Release V.18 was used for meta-analyses.

RESULTS

After removal of duplicates, the SLR yielded a total of 4162 records, of which 65 studies (hereafter termed new studies) reported in 66 publications were included (see flow chart in the online supplemental material, p 6). Thirty-three studies (reported in 34 articles) assessed benefits and harms of different non-pharmacological therapies, 17 investigated pharmacological interventions against each other or placebo, 4 studies compared pharmacological and non-pharmacological interventions, whereas different surgical interventions were compared

in 10 studies. Additionally, one study with three arms compared a non-pharmacological and a pharmacological intervention to a control group receiving no intervention²⁵ and is listed both as a non-pharmacological and a pharmacological intervention. We did not identify any new relevant Cochrane reviews. The characteristics and overall RoB of all new studies are presented in [tables 1–3](#). The detailed RoB of all new studies are provided in online supplemental material (pp 10–26), as are characteristics and overall RoB of previous studies included in our meta-analyses (pp 27–36), GRADE assessments of the meta-analyses with reasons for why an analysis was downgraded (pp 37–52) and the meta-analyses (pp 53–89). The main results of the GRADE assessments are also included in [figures 1–3](#). The reporting of results mainly focuses on findings new to this review, meta-analyses where results are graded with moderate or high-certainty, and on efficacy and safety of interventions recommended for or against in one or more of the five hand OA guidelines.^{6–9}

Non-pharmacological interventions

We identified 34 new studies assessing the efficacy of exercises (n=11), orthoses (n=6), assistive devices (n=1), kinesiology tape (n=2), thermal modalities (heat application) (n=7), ultrasound/laser therapy (n=1), low-dose radiation therapy (n=1, results reported in two articles), gloves (n=1), acupuncture (n=1) or programmes combining two or more non-pharmacological interventions (n=3) ([table 1](#)). The studies varied with regard to number of participants (11–347; 11 studies with ≥ 80 participants), type and duration of interventions (range 1–24 weeks, the majority ≤ 8 weeks), outcomes included and follow-up period (4–52 weeks). None of the studies specifically included participants with signs of inflammatory OA. All but two studies^{26 27} were parallel RCTs, and all but one study on low-dose radiation therapy²⁸ were judged to have high RoB or some concerns, most often related to lack of blinding of participants and therapists delivering the interventions (online supplemental material, pp 10–18). Whereas the studies on ultrasound/laser, radiation, acupuncture and one study of thumb orthoses²⁹ used placebo as comparator, the control group in the other studies either received no intervention, an information leaflet, the same intervention as the intervention group except for the intervention of interest, or another intervention (see also descriptions in [table 1](#)). All the results from our meta-analyses were graded with very low or low certainty, except for one on long-term effect of assistive devices on function and one on short-term effect of ultrasound/laser on grip strength, which both were graded as moderate certainty.

Hand exercises

Six of 11 new exercise studies evaluated the effect of hand exercises (see [table 1](#) for details on interventions).^{26 30–34} The exercise programmes varied in content, length and intensity and were often combined with other non-pharmacological interventions. Meta-analyses of

Table 1 Characteristics of 34 new studies of non-pharmacological interventions published between 7 June 2017 and 31 December 2023

RoB	Study	Design	Intervention	Duration, frequency, instructions	Measurement timepoints	N	OA location, definition	Women (%)	Age in years (SD)	Primary outcome (PO)
Hand exercises										
	Kang <i>et al</i> 2019 ³⁰	RCT parallel	A: Combination of conservative treatment (paraffin therapy+physio supervised exercise programme 5times/week) B: Paraffin bath therapy	A: 6 exercises, 10 to 15 reps, 30 min, 5times/week for 8weeks. A and B: Paraffin bath therapy: Once a day, 5times/week for 8 weeks	Short term	15 14	Hand, ACR	NR	46.7 (4.6) 47.9 (4.0)	Grip strength (dynamometer) at 8 weeks. Also measured pain and function (AUSCAN subscales)
	Leonard <i>et al</i> 2021 ³¹	RCT parallel Pilot study	A: Educational pamphlet about HOA+exercise—knitting programme B: Educational pamphlet about HOA	A: Knitting 20 min/day for 8 weeks	Short term Long term	19 8	Hand, ACR, pain >3 months	100 100	64.6 (6.4) 70.5 (7.0)	Morning stiffness (VAS) at 8 weeks. Also measured pain (VAS) and function (AUSCAN) and grip strength (JAMAR)
	Magni <i>et al</i> 2022 ³²	RCT parallel Feasibility study (three groups)	A: Advice and blood flow restriction training B: Advice and traditional high intensity training C: Advice only	A and B: Exercising 3times per week for 6 weeks	Short term	19 20 20	Hand, ACR, KL _{≥1} , NRS pain >3 months and pain ≥3last week	84 95 70	67.9 (8.6) 72.7 (9.0) 75.6 (12.0)	Exercise-induced pain (NRS) 1 week post-intervention. Also measured grip strength, function (FIHOA) and OMERACT-OARSI responders
	McVeigh <i>et al</i> 2021 ³³	RCT parallel	A: Standard conservative therapy (SCT); heat application, joint protection, assistive devices, ADL modifications, thumb orthosis, with the addition of 3 dynamic stabilisation exercises B: SCT	A: Exercises with 10 repetitions, 3times/day, 7 days/week for 6 weeks	Short term	42 42	CMC, clinical and Rx diagnosis	85 90	70.6 84.8	Pain (NRS) at 6 weeks. Also measured function (qDASH) and grip strength
	Pedersini <i>et al</i> 2021 ³⁴	RCT parallel	A: Neurodynamic mobilisation B: Robotic-assisted passive movement	A: Mobilisation in 3 minutes × 3/session, 3 sessions/week for 4 weeks B: Passive movement, 3 sessions/week for 4 weeks	Short term Long term	36 36	Hand, clinical diagnosis and KL 3 to 4 on Rx	71 69	58 52	NR. Measured pain (NRS) and grip strength (dynamometer) after 3 months
	Pisano <i>et al</i> 2022 ²⁶	RCT crossover	A: SCT: heat application, joint protection, assistive devices, ADL modifications, thumb orthosis. B: SCT+stabilisation and/or stretching and/or stabilising thumb exercises	B: Exercising 2 to 3times/day, 7 days/week for 6 months	Long term	96 94	CMC, clinical diagnosis by surgeons and/or physician assistant	80 78	60 (8.8) 61 (9.6)	NR. Measured pain at rest (NRS), grip strength (JAMAR) and function (DASH)
Proprioceptive exercises										
	Cantero-Téllez <i>et al</i> 2023 ³⁵	RCT parallel Pilot study	A: Standard treatment plus a proprioceptive training programme B: Standard treatment	A: Exercises 2 to 3x8–10 repetitions, 2times/day for 12 weeks	Long term	6 6	CMC, E-L stage I–II, NRS pain >4 in ADL	NR	67.2 65.3	NR. Measured pain intensity during activity (NRS)
	Cantero-Téllez <i>et al</i> 2022 ⁴⁰	RCT parallel	A: Standard treatment plus a proprioceptive training programme B: Standard treatment	A: Exercises 3x10 repetitions daily for 12 weeks	Short term Long term	26 26	CMC, E-L stage I–III, NRS pain >4 in ADL	100 100	63.5 (6.6) 62.7 (8.0)	Proprioception measured as joint position sense. Also measured pain (NRS) and hand function (qDASH)

Continued

Table 1 Continued

RoB	Study	Design	Intervention	Duration, frequency, instructions	Measurement timepoints	N	OA location, definition	Women (%)	Age in years (SD)	Primary outcome (PO)
	Cantero-Téllez <i>et al</i> 2022 ⁴¹	RCT parallel	A: A conservative exercise program+a proprioceptive training programme. B: A conservative exercise programme	A and B: Daily exercises with 3x10 repetitions for 4 weeks	Short-term Long-term	23 22	CMC, E-L stage I-III, NRS pain >4 in ADL	100 100	63 (7) 62 (7)	Proprioception measured as joint position sense. Also measured pain (NRS) and hand function (qDASH)
	Campos-Villegas <i>et al</i> 2022 ⁴²	RCT parallel	A: Strength exercising programme (SEP) B: SEP+proprioceptive neuromuscular facilitation programme	A and B: Both programmes with 3 sessions of 30 to 45 min/week. 3x10 repetitions of each exercise/session for 4 weeks	Short-term	21 21	CMC-OA, clinical diagnosis and E-L stage ≤3	100 100	59.1 (8.1) 61.0 (6.1)	Function measured with qDASH. Also measured pain (VAS) and grip strength
	Cruz-Gamero <i>et al</i> 2023 ⁴³	RCT parallel	A: Orthosis, exercises+a proprioceptive training programme for 4 weeks. B: Orthosis and exercises for 4 weeks.	NR	Long-term	29 28	CMC, E-L grade I-III	NR	58 (8) 62 (6)	NR. Measured pain (NRS) and Occupational performance (COPM)
Orthoses vs no orthoses or placebo										
	Adams <i>et al</i> 2021 ²⁹	RCT parallel (three groups)	A: Self-management programme: Booklet and exercise programme B: Self-management program+an orthosis for the CMC, MCP+ (for some) the IP joint C: Self-management programme+placebo orthosis for the CMC, MCP and the IP joint**	A and B: Exercises at least 3 days/week for at least 20 min/day for 12 weeks B: Orthosis should be used minimum 6 hours/day for 12 weeks	Short term Long term	116 116 117	CMC, pain >5 and function >9 on AUSCAN	64 (9.4) 62.1 (9.1) 61.7 (10.1)	78 78 79	Pain (AUSCAN) at week 8. Also measured function (AUSCAN) and OMERACT-OARSI responders
	Can <i>et al</i> 2020 ⁷	RCT parallel	A: Prefabricated orthosis immobilising the wrist and CMC and MCP joint of the thumb. B: Oral information only	A: Orthosis should be used as much as possible for the first 3 weeks and then only during painful activities for the next 3 weeks	Short term	40 40	Stage one or 2 CMC-OA	56.1 (7.5) 56.6 (9.2)	91.7 89.3	NR. Measured pain and function (AUSCAN and qDASH) and grip strength (JAMAR) at 6 weeks
	Silva <i>et al</i> 2020 ¹²⁸	RCT parallel	A: Custom-made nighttime neutral positioning orthosis in the DIP or PIP joint of the 2 or 3 finger (or both) of the dominant hand+patient education B: Patient education	A: Orthosis should be used every night for 6 months A and B: Patient education, three 40min sessions	Short term Long term	26 26	PIP and/or DIP ACR, pain 3 to 8 on NRS	64.1 (8.4) 63.5 (7.8)	100 100	Pain (NRS). Also measured function (AUSCAN) and grip strength
Thumb orthoses immobilising the CMC-joint only against thumb orthoses also immobilising the wrist and/or one or more additional thumb joints										
	Cantero-Téllez 2018 ⁵²	RCT parallel	A: Thumb orthosis (CMC and MCP joint immobilised) B: Thumb orthosis (only CMC joint immobilised)	A and B: Orthosis should be used at night and during daytime ADL for 3 to 4 hours/day in 1 week	Short term	33 33	CMC, E-L stage II-III and NRS pain >4 in ADL	63.8 (8.9) 63.7 (10.3)	84.8 81.8	NR. Measured pain (VAS) and function (qDASH) at 1 week

Continued

Table 1 Continued

RoB	Study	Design	Intervention	Duration, frequency, instructions	Measurement timepoints	N	OA location, definition	Women (%)	Age in years (SD)	Primary outcome (PO)
	Cantero-Téllez# 2018 ⁵¹	RCT parallel	A: Thumb orthosis (CMC and MCP joint immobilised) B: Thumb orthosis (only CMC joint immobilised)	A and B: Orthosis should be used at night and during daytime ADL for 3 to 4 hours/day in 3 months	Long term	44	CMC, Rx diagnosis and NRS pain >4 in ADL	59.7 (9.6) 60.5 (9.8)	93.2 90.0	NR. Measured pain (VAS) and function (DASH) at 3 months
	Eyilis <i>et al</i> # 2023 ²⁷	RCT crossover	A: 3-D customised thumb orthosis (only CMC immobilised) B: Plaster customised thumb orthosis (CMC and MCP immobilised)	A and B: Use of orthosis for 4 weeks	Short term	24 25	CMC, KL I-III, positive shear and grind tests	65 (11) 61 (11)	66.6 84.0	Patient satisfaction at 4 weeks. Also measured pain (VAS) and function (QuickDASH)
Assistive devices										
	Amaral <i>et al</i> # 2018 ⁵⁶	RCT parallel	A: Assistive devices+group education B: Information leaflet	A: 12 week treatment period in which use of devices should become part of each individual's routine	Short term Long term	19 20	Hand, ACR and ADL problems	59.0 (9.0) 60.2 (6.2)	100 100	Occupational performance (COPM) and hand function (SACRAH) at 30 days. Also measured pain (VAS)
Kinesiology tape										
	Farhadian <i>et al</i> 2019 ⁴²⁹	RCT parallel Pilot study	A: Kinesiology tape (wrist and thumb)+exercise B: Exercise	Kinesiotape was used for 2 months but changed after 3 days or when it was necessary, with a 1-day rest before applying new tape. Exercise dosage not described	Short term	19 19	Hand, NR	69.5 (4.0) 68.5 (3.9)	84 84	NR. Measured pain (VAS), grip strength (dynamometer) and function (DASH)
	Wade <i>et al</i> 2018 ¹³⁰	RCT parallel Pilot study	A: Supportive/analgesic kinesiology tape (PIP) B: Placebo kinesiology tape (PIP)	A and B: Used tape for 1 week	Short term	6 5	Hand, clinical and Rx diagnosis	62.4 (8.4) (sample)	83.3 40.0	Pain (VAS). Also measured function (qDASH)
Thermal modalities										
	Aksanyar <i>et al</i> 2022 ⁵⁸	RCT parallel	A: Hot paraffin+exercise B: Hot peloid mud+exercise	Paraffin or mud: One 20 min session 5 days/week for 3 weeks, 47°C Exercises: 2 daily sessions with 10 repeats of each exercise for 3 weeks	Short term	40 40	Hand, ACR, VAS-pain score ≥4	55.2 (8.3) 57.7 (7.0)	100 100	NR. Measured pain (NRS), grip strength (JAMAR) and function (AUSCAN)
	Benini <i>et al</i> 2021 ⁶¹	RCT parallel Pilot study	A: Hot mud+bath therapy (balneotherapy) B: Bath therapy (balneotherapy)	A and B: 15 min/day for 12 days intercepted by 2 rest days, 47 to 50°C	Short term Long term	26 26	Hand, ACR, KL II or III	67.3 (6.8) 64.3 (9.4)	92.3 90.5	Pain and/or function (AUSCAN) at 12 months
	Azevedo <i>et al</i> # 2023 Abstract ⁶²	RCT parallel	A: Paraffin baths B: Leaflet with information on joint protection (control)	A: 3 times/week for 4 weeks B: Delivered once	Short term	34 33	HOA acc. to ACR criteria	59 (10) 60 (9)	32 (94) 31 (94)	Pain (VAS) after 4 weeks

Continued

Table 1 Continued

RoB	Study	Design	Intervention	Duration, frequency, instructions	Measurement timepoints	N	OA location, definition	Women (%)	Age in years (SD)	Primary outcome (PO)
	Kasapoğlu Aksoy <i>et al</i> # 2018 ⁵⁹	RCT parallel	A: Hot paraffin therapy+home-based exercise programme B: Home-based exercise programme alone	A: Paraffin: 52°C, 20 min/5 days weekly for 2 weeks A and B: Exercises: 15 min x 2 per day, 5 days/week for 2 weeks	Short term	31 30	Hand, Rx-based (KL) diagnosis	57.2 (10.6) 61.3 (8.4)	90.3 89.3	NR. Measured pain (VAS) and grip strength (JAMAR)
	Savas <i>et al</i> # 2019 (NB also listed as a herbal intervention) ⁶⁵	RCT parallel (three groups)	A: Flaxseed poultice hot compress** B: Hot compress C: No intervention	A and B: The hot compress was applied for 20 min once a day for 7 days, 40 to 45°C	Short term	33 29 20	Primary IP, ACR	62 (6.8) 64.9 (8.3) 65.5 (9.2)	93.9 96.6 85	NR. Measured pain (VAS) and function (AUSCAN)
	Ustun and Çağlar 2023 ⁶¹	RCT parallel	A: Paraffin wax 52°C B: Prolotherapy injection 0.25 to 0.50mL 15% dextrose solution	A: Daily 20min 5 days/week for 2 weeks B: 1 injection into the peritarticular ligaments of the symptomatic PIP, DIP and CMC joints	Short term Long term	23 23	Hand OA	60.43 (7.36) 59.52 (6.92)	100 100	NR. Measured pain (NRS), function (DHI) and grip strength (JAMAR)
	Öncel <i>et al</i> 2021 ⁶⁰	RCT parallel	A: Hot paraffin therapy B: Fluid therapy (dry heat therapy)	A and B: Received 20min therapy daily 53°C for 14 days	Short term	41 41	Hand, ACR	61.9 (10.3) 64.2 (10.3)	80.6 97.6	NR. Measured pain (VAS) and function (DHI)
Laser therapy										
	Cantero-Téllez <i>et al</i> # 2020 ⁶⁷	RCT parallel	A: High-intensity laser therapy B: Laser placebo	A: 75 J/session, spot size 5cm ² , 3 days/week for 4 weeks B: 1 session, 3 days/week for 4 weeks	Short term Long term	22 21	CMC, Rx stage 1–2 and NRS pain >4in ADL	63.1 (7.5) 64.3 (8.6)	100 100	NR. Measured pain (VAS)
Low-dose radiation										
	Minten <i>et al</i> # 2018 ¹³²	RCT parallel	A: Low-dose radiation B: Sham radiation	A: 1 Grey x 3 per week for 2 weeks B: Sham therapy x 3 per week for 2 weeks	Long term	28 28	Hand, ACR, NRS pain ≥5for min 15 of last 30 days	67 (1.2) 63 (1.2)	86 71	OMERACT-OARSI responders at 3months. Also measured pain (NRS) and function (AUSCAN)
	Van den Ende <i>et al</i> 2020 (NB Report 6- and 12 months results from the study by Minten <i>et al</i>) ²⁸	RCT parallel	A: Low-dose radiation B: Sham radiation	A: 1 Grey x 3 per week for 2 weeks B: Sham therapy x 3 per week for 2 weeks	Long term	28 28	Hand, ACR, NRS pain ≥5for min 15 of last 30 days	67 (1.2) 63 (1.2)	86 71	OMERACT-OARSI responders at 3months. Also measured pain (NRS) and function (AUSCAN)
Gloves										
	Jamison <i>et al</i> 2018 ¹³³	RCT parallel	A: Vibrating gloves B: Treatment as usual	A: Gloves used minimum 20 min per day for 3 months	Short term Long term	34 35	Hand, OA-related pain	100 (sample)	63.0 (7.8) (sample)	NR. Measured pressure pain (Pain Disability Inventory)
Acupuncture										
	Barnard <i>et al</i> 2020 ¹³⁴	RCT parallel	A: Acupuncture B: Sham acupuncture	A and B: Both groups received two sessions/week for 3 weeks	Short term	36 37	CMC, Rx or clinical diagnosis	Not described	Not described	Pain (VAS) after 4weeks. Also measured grip strength (JAMAR) and hand function (Nelson score)
Combination programmes										

Continued

Table 1 Continued

RoB	Study	Design	Intervention	Duration, frequency, instructions	Measurement timepoints	N	OA location, definition	Women (%)	Age in years (SD)	Primary outcome (PO)
	Rodríguez Sanchez-Lauhié <i>et al</i> 2023 ⁶⁹	RCT parallel	A: Combination of conservative treatments delivered in mobile app B: Exercises only (description)	A: 12 weeks of self-management recommendations, joint protection material, general information about the disease, videos with demonstrations, and a 'follow-up diary' with graphical representations of the exercises performed every session. Exercises 4 times per week. Phone call once/month B: Phone call once/month, exercises 4 times per week, usual consultations	Long term	66 hands 78 hands	Symptoms. Hand OA, ACR	73 62	62.2 (8.8) 64.3 (7.7)	AUSCAN function at 3+6 months. Also measured pain (AUSCAN) and grip strength (Saehan SH5001)
	Stoffer-Marx <i>et al</i> 2018 ⁷⁰	RCT parallel	A: Combination of conservative treatments (information, assistive devices, instructions on pain management and exercises) B: Routine care+placebo (a massage ball)	A: One therapy session+one telephone-follow up after 4 weeks B: Use a massage ball on the hands	Short term	74 77	Hand, ACR or bony swelling of min 1 IP or CMC joint	60.1 (10.9) 59.6 (10.6)	79.7 88.3	Grip strength (Martin vigorimeter) at 8 weeks. Also measured pain (NRS) and function (AUSCAN)
	Tveter <i>et al</i> 2022 ⁷¹	RCT parallel	A: Patient education, assistive devices, hand exercises, thumb o B: Leaflet with written information	A: One session with education+followup session after 2 weeks. Told to do hand exercises three sessions/week for 3 weeks	Long term	90 90	Referred to surgical consultation due to CMC-OA	62.8 (7.5) 63.3 (7.8)	81 77	Number of patients receiving CMC surgery during the 2-year follow-up period. Also measured pain (NRS), grip strength (Gripit) an function (qDash).

Studies marked with # are included in meta-analyses, whereas intervention groups from these studies marked with ** are excluded from meta-analyses.

*Available as abstract only to the 2018 review of Kroon *et al* (paragraph)—full-text manuscript evaluated for the update. **Not included in meta-analyses. Colours denote RoB (green: low, yellow: some concern, red: high). (A) indicates conference abstract.

ACR, American College of Rheumatology; ADLs, activities of daily living; AUSCAN, Australian/Canadian Hand Osteoarthritis Index; CMC, first carpometacarpal joint; CO, cross-over trial; COPM, Canadian Occupational Performance Measure; OMERACT-OARSI criteria, Outcome Measures in Rheumatology-Osteoarthritis Research Society International responder criteria; DASH, Disabilities of the Arm, Shoulder and Hand; DHI, Duröz Hand Index; DIP, distal interphalangeal joint; E-L, Eaton-Litter; FHOA, Functional Index for Hand Osteoarthritis; IP, interphalangeal joint; MCP, metacarpophalangeal; MHQ, Michigan Hand Questionnaire; N, number; NR, not reported; NRS, Numerical Rating Scale; OA, osteoarthritis; PO, primary outcome; qDash, quick DASH; RCT, randomised controlled trial; RoB, risk of bias; Rx, radiography; SLR, systematic literature review; VAS, Visual Analogue Scale; WA, wash-out period.

Table 2 Characteristics of 22 new studies of pharmacological interventions published between 7 June 2017 and 31 December 2023

RoB	Study	Design	Intervention	Frequency, duration (instructions)	Measurement timepoints	N	OA location, definition	Age, years (SD)	Women (%)	Primary outcome
Herbal treatment										
	Kim <i>et al</i> 2021 ⁷⁷	RCT parallel	A: Red ginseng (RG) capsules B: Placebo capsules	A: 3g/day of RG for 12 weeks B: Daily placebo for 12 weeks	Long term	26 26	Hand, Rx diagnosis	60.2 (9.5) 60.6 (7.9)	100 100	NR. Measured pain (VAS) and function (DASH) at 12 weeks
	Liu <i>et al</i> 2021 ⁷⁸	RCT parallel	A: Combination of three herbs B: Placebo	A: Combination of Boswellin Super 250 mg/day, Fenoprolol 70 Organic 100mg/day and MSM 1500 mg/day (capsule 1) and curcumin (Flexofytol) 168 mg/day (capsule 2). 7 capsules/day for 12 weeks B: Placebo capsules, 7 capsules/day for 12 weeks	Long term	52 54	Hand, ACR, VAS pain 40–90, FIHOA ≥6 and KL ≥2 in ≥1 painful joint	65.1 (6.9) 66.2 (7.6)	85 78	Pain (VAS) at 12 weeks. Also measured function (FIHOA) and OMERACT-OARSI responders
	Savaş <i>et al</i> 2019 (NB also listed under non-pharmacological interventions) ²⁵	RCT parallel (three groups)	A: Flaxseed poultice hot compress B: Hot compress C: No intervention	A and B: The hot compress was applied for 20 min once a day for 7 days, 40–45°C	Short term	33 29 20	Primary IP, ACR	62 (6.8) 64.9 (8.3) 65.5 (9.2)	93.9 96.6 85	NR. Measured pain (VAS) and function (AUSCAN)
Topical corticosteroids										

Continued

Table 2 Continued

RoB	Study	Design	Intervention	Frequency, duration (instructions)	Measurement timepoints	N	OA location, definition	Age, years (SD)	Women (%)	Primary outcome
	Wang et al 2023 ⁷⁹	RCT parallel	A: Topical betamethasone dipropionate B: Placebo	A and B: Self-apply a thin layer ointment on painful hand joints three times per day for 6 weeks	Short term	54 52	Symptomatic HOA, VAS pain ≥ 40 , KL ≥ 2 in ≥ 1 joint	85.2 86.5	63.0 (6.8) 64.5 (7.9)	Pain VAS at 6 weeks. Also measured function (AUSCAN)
Oral glucocorticoids										
	Kroon et al 2019 ⁸⁰	RCT parallel	A: Prednisolone 10 mg (oral solution) B: Placebo	A and B: Daily for 8 weeks	Short term	46 46	Hand, ACR, signs of inflammation in DIP/PIP joints	62.2 (8.8) 65.6 (8.5)	83 76	Pain (VAS) at 6 weeks. Also measured pain and function (AUSCAN subscales), grip strength and OMERACT-OARSI responders
IA hyaluronic acid										
	Wang et al 2023 ⁷⁶	RCT parallel	A: IA hyaluronic acid (ArtiAid-Mini) B: IA hyaluronic acid (Ostenil-Mini) A and B: A second injection given after 1 week	A: 1 mL of AAM (10 mg/mL) B: 1 mL or OM (10 mg/mL) A and B: A second injection given after 1 week	Long term	8 8	CMC OA, symptomatic and radiological	75 37.5	59.5 (10.5) 59.9 (9.0)	Pain (VAS) at 12 weeks. Also measured grip strength.
Biological disease-modifying anti-rheumatic drugs (bDMARDs)/TNF inhibitors										
	Kloppenburg et al 2019 ⁸¹	RCT parallel	A: Lutikizumab 200 mg subcutaneously B: Placebo injections	A and B: Injection every 2 weeks for 24 weeks	Short term Long term	64 67	Hand, ACR, ≥ 1 erosive and ≥ 3 tender and/or swollen joints	66 (8) 66 (7)	83 87	Pain (AUSCAN) after 16 weeks. Also measured function (AUSCAN)
	Richette et al 2021 ⁸²	RCT parallel	A: Intravenous infusions of tocilizumab 8 mg/kg B: Intravenous infusions of placebo	A and B: Intravenous infusion in weeks 0 and 4	Short term Long term	42 41	Hand, VAS pain ≥ 40 , ≥ 3 painful joints, KL ≥ 2	64.1 (8.9) 64.7 (8.6)	81 83	Pain (VAS) at 6 weeks. Also measured function (FIHOA)

Continued

Table 2 Continued

RoB	Study	Design	Intervention	Frequency, duration (instructions)	Measurement timepoints	N	OA location, definition	Age, years (SD)	Women (%)	Primary outcome
	Schett <i>et al</i> 2020 ⁸³	RCT parallel	A: Otilimab 180 mg subcutaneously B: Placebo subcutaneously	A and B: Weekly from week 0 to week 4, every other week from week 5 to week 10	Short term Long term	22 22	Inflammatory OA, ≥ 2 swollen and tender joints, inflammation on MR, pain NRS ≥ 5 past 7 days	60.9 (6.3) 56.7 (6.8)	91 91	Pain (NRS) at 6 weeks. Also measured function (AUSCAN)
	Synthetic DMARDs anti-rheumatic drugs (hydroxychloroquine)									
	Kedor <i>et al</i> # 2021 ⁸⁴	RCT parallel	A: Hydroxychloroquine oral 200–400 mg B: Placebo	A and B: Once per day for 1 year	Long term	75 78	Hand, inflammatory and erosive OA	52.4 (8.1) 50.2 (6.6)	90.7 76.9	Pain and function (AUSCAN) after 1 year
Synthetic DMARDs anti-rheumatic drugs (methotrexate)										
	Ferrero <i>et al</i> # 2021 ⁸⁵	RCT parallel	A: Methotrexate oral 10 mg B: Placebo oral	A and B: Once per week for 1 year	Long term	32 32	Hand, ACR, ≥ 1 joint with Rx erosion in both hands	64.9 (7.0) 67.5 (8.0)	97 91	Pain (VAS) at 3 months. Also measured function (FIHOA)
	Wang <i>et al</i> # 2023b ⁸⁶	RCT parallel	A: Methotrexate oral 20 mg B: Placebo oral	A and B: Once per week for 6 months	Long term	50 47	Hand OA and synovitis, ACR, VAS pain ≥ 40 past 7 days, KL ≥ 2 in min one joint, synovitis grade ≥ 1 on MRI in min one joint	61.4 (6.1) 61.5 (7.3)	68 72	Pain (VAS) at 6 months. Also measured function (AUSCAN and FIHOA) and grip strength.
Colchicine										
	Davis <i>et al</i> # 2021 ⁸⁸	RCT parallel	A: Colchicine oral 0.5 mg B: Placebo	A and B: 2x0.5 mg/day for 12 week	Short term Long term	32 32	Hand, ACR, pain for min 15 of last 30 days, VAS pain ≥ 40 past 48 hours	66.0 (8.0) 66.0 (7.0)	84 84	Pain (VAS) at 12 weeks. Also measured function (MHQ) and grip strength (JAMAR)

Continued

Table 2 Continued

RoB	Study	Design	Intervention	Frequency, duration (instructions)	Measurement timepoints	N	OA location, definition	Age, years (SD)	Women (%)	Primary outcome
	Døssing <i>et al</i> 2023 (abstract) ⁸⁹	RCT parallel	A: Colchicine oral 0.5 mg B: Placebo	A and B: 2x0.5 mg two times per day for 12 weeks	Long term	50 50	Symptomatic HOA and VAS pain ≥ 40	NA	NA	Hand/finger pain (VAS) at 12 weeks. Also measured function (AUSCAN), grip strength and OMERACT-OARSI responders
Platelet-rich plasma										
	Abdelfattah <i>et al</i> 2020 ¹³⁵	RCT parallel	A: Platelet-rich plasma IA injection 1 mL B: Hydraulic acid IA injection 1 mL C: Corticosteroid (betamethasone) IA injection 0.25 mL	A, B and C: One injection	Short term Long term	15 15 15	CMC, NR	52.5 (8.3) (total sample)	86.4 (total sample)	NR. Measured pain (VAS), function (AUSCAN) and grip strength
	Malahias 2021 ⁷⁵	RCT parallel	A: Platelet-rich plasma IA injection (dose NR) B: Corticosteroid (methylprednisolone) IA injection 125 mg/2 mL	A and B: First injection at day 1 and second at day 15	Long term	16 16	CMC, clinical and Rx, ACR diagnosis, E-L I-III	62.8 (10.6) 63.0 (11.8)	81 81	NR. Measured pain (VAS) and qDASH
	Winter <i>et al</i> 2023 ¹³⁶	RCT parallel	A: Platelet-rich plasma IA injection 1 mL B: Fat IA injection 1 mL C: Fat and Platelet-rich plasma IA injection 0.25 mL D: Placebo (saline 0.9%)	A, B, C and D: 1.5 mL was prepared in a 2 mL Luerlock syringe (one injection)	Short term Long term	24 25 25 21	CMC, E-L stage I-IV	NA	79 88 88 77	Pain (NRS). Also measured function (qDASH) and grip strength
Oestrogen										
	Williams <i>et al</i> 2022 ⁹⁰	RCT parallel feasibility	A: Oral conjugated oestrogens (dose not described) + bazedoxifene acetate (20 mg) B: Oral placebo	A and B: Once per day for 24 weeks	Short term Long term	14 14	Hand, ACR, NRS pain ≥ 4 in ≥ 2 hand joints	58.3 (3.4) 58.9 (3.4)	100 100	Feasibility outcomes. Also measured pain (NRS), function (FIHOA) and grip strength.
Studies comparing combinations of pharmacological and non-pharmacological interventions										

Continued

Table 2 Continued

RoB	Study	Design	Intervention	Frequency, duration (instructions)	Measurement timepoints	OA location, N	Age, years (SD)	Women (%)	Primary outcome
	Deveza <i>et al</i> 2021 ⁹¹	RCT parallel	A: Education, exercises, orthosis, Diclofenac gel 1% B: Education	A and B: 1 individual 30 min treatment session at baseline and 1 (15 min) in week 2, thereafter told to continue with treatment for 3 months	Short term Long term	102 CMC, Rx KL ≥ 2 , pain for min 15 of last 30 days, VAS pain ≥ 40 , FIHOA ≥ 6 , 102	66.0 (7.8) 65.2 (8.5)	85.3 66.7	Pain (VAS) and function (FIHOA) at 6 weeks. Also measured grip strength and OMERACT-OARSI responders
	Ioppolo <i>et al</i> 2018 ⁹²	RCT parallel	A: Extracorporeal shock wave therapy, 2400 consecutive pulses/session, frequency of 4 Hz energy flux density of 0.09 mJ/mm ² B: Hyaluronic acid IA 0.5 cm ³	A: One session per week for 3 weeks B: One IA per week for 3 weeks	Short term Long term	28 CMC, ACR 30	68.0 (9.0) 66.7 (8.1)	57 60	Pain (VAS) and function (DHI) at 6 months. Also measured grip strength
	Metin Ökmen <i>et al</i> 2018 ⁹³	RCT parallel	A: Nerve block injection (bupivacaine and 1 mL methyl-prednisolone acetate) subcutaneously around the superficial branch of the radial nerve+exercises B: Exercises	A: One injection A+B: 9 exercises with 10 repetitions, performed once a day for 4 weeks	Short term	25 Hand, ACR, KL ≥ 2 25	58.8 (5.5) 59.2 (4.8)	100 100	NR. Measured Pain (VAS), function (DASH) and grip strength (JAMAR)
	Nguyen <i>et al</i> 2022 ⁹⁴	RCT parallel	A: Botulinum toxin A IA injection, (50 Allergan units) + orthosis B: Placebo: Saline IA injection+orthosis	A and B: One single injection	Long term	30 CMC, ACR, CMC Rx OA evidence, CMC pain 30	65.2 (8.2) 64.6 (10.4)	83 73	Pain (NRS) at 3 months. Also measured function (Cochin and scale) and OMERACT-OARSI responders

Continued

Table 2 Continued

RoB	Study	Design	Intervention	Frequency, duration (instructions)	Measurement timepoints	N	OA location, definition	Age, years (SD)	Women (%)	Primary outcome
Studies marked with # are included in meta-analyses, whereas intervention groups from these studies marked with ** are excluded from meta-analyses. *Available as abstract only to the 2018 review of Kroon <i>et al</i> (paragraph) — full-text manuscript evaluated for the update. Colours denote RoB (green: low, yellow: some concern, red: high). (A) indicates conference abstract.										
ACR, American College of Rheumatology; ADLs, activities of daily living; AUSCAN, Australian/Canadian Hand Osteoarthritis Index; CMC, first carpometacarpal joint; CO, cross-over trial; DASH, Disabilities of the Arm, Shoulder and Hand; DHI, Duruöz Hand Index; DIP, distal interphalangeal joint; E-L, Eaton-Litter; FHOA, Functional Index for Hand Osteoarthritis; IA, intra-articular; IP, interphalangeal joint; KL, Kellgren-Lawrence; MCP, metacarpophalangeal; MHQ, Michigan Hand Questionnaire; N, number; NR, not reported; NRS, Numerical Rating Scale; OA, osteoarthritis; PO, primary outcome; qDASH, quick DASH; RCT, randomised controlled trial; RoB, risk of bias; Rx, radiography; TNF, Tumor Necrosis Factor; VAS, Visual Analogue Scale; WA, wash-out period.										

four new^{26 30–32} and five previous studies^{21 35–38} showed that, compared with no exercises, there is low-certainty evidence of a significant small long-term effect of exercises on pain (SMD=−0.34 (−0.58, −0.09)). For the other outcomes (function, grip strength and number of OMERACT/OARSI responders), the certainty of results from meta-analyses was very low (online supplemental material, pp 37, 53–56). New to this SLR, we also identified five studies assessing the effect of adding proprioceptive exercises to other hand exercise programmes.^{39–43} We pooled four of these studies,^{39–41 43} but again the certainty of results from meta-analyses was very low (online supplemental material, pp 38, 57–58). None of the new exercise studies reported on AEs, whereas Kroon *et al*¹¹ reported few and non-severe AEs in participants undergoing exercise therapy.

Orthoses

We identified six new studies on orthoses. One was a trial with high RoB showing that a custom-made night-time orthosis for the distal (DIP) and proximal interphalangeal (PIP) joint of the second or third finger of the dominant hand had no effect on pain or function compared with no orthosis.⁴⁴ Two studies investigated the effect of a thumb orthosis against a placebo orthosis²⁹ or information only.⁴⁵ When pooling these two with five previous studies,^{46–50} the results from meta-analyses showed that there is low-certainty evidence that, compared with no orthoses, thumb orthoses has a significant and moderate long-term effect on pain (SMD = −0.77 (−1.20, −0.34)) (online supplemental material, pp 39, 59–62). The last three new studies compared thumb orthoses immobilising the first carpometacarpal (CMC-1) joint against thumb orthoses additionally immobilising the wrist and/or one or more thumb joints.^{27 51 52} The certainty of results from meta-analyses of these and four previous studies^{22 53–55} was very low for all outcomes (pain and function) (online supplemental material, pp 40, 63–64). One new²⁹ and two previous^{22 50} studies reported on AEs, which were few and none serious.

Assistive devices

We identified one new study on the effect of assistive devices,⁵⁶ and pooled this with one previous study.⁵⁷ Compared with no assistive devices, the results showed evidence of moderate certainty for a moderate long-term effect of assistive devices on hand function (SMD −0.55, CI (−0.94 to −0.16)) (online supplemental material, pp 41, 65–66).

Thermal modalities

Five new studies evaluated the effect of heat application. The interventions comprised hot paraffin,^{58–60} hot mud,^{58 61} hot compress²⁵ and/or dry heat therapy⁶⁰ against each other or placebo. The results of meta-analyses of three new^{25 59 62} and five previous studies^{20 63–66} showed that, compared with no heat application, there is evidence for a large, significant short-term and long-term

Table 3 Characteristics of 10 new studies surgical interventions (published between 7 June 2017 and 31 December 2023)

RoB	Study	Design	Intervention	Postoperative (POM) management	Measurement timepoints analysed	N	OA location, definition	Age, years (SD)	Women (%)	Primary outcome (primary or NR)
Studies comparing surgical interventions including joint replacement										
	de Jong 2023 ^{et al/109}	RCT parallel	A: Total joint replacement (Maia prosthesis) B: Trapeziectomy	A and B: Patients immobilised in plaster bandage for 1 week and in a circular forearm and thumb plaster cast for another 3 weeks, thereafter supervised rehabilitation 1/week in weeks 5–8 and once every 2 weeks in 4 weeks.	Long term	31 31	CMC Eaton and Glickel grade II or III	59 (6.5) 61 (8.5)	100 100	MHQ total score at 12 months. Also measured pain (MHQ subscale) and grip strength
	Guzzini 2023 ^{et al/110}	RCT parallel	A: Touch TMC joint dual mobility press-fit prosthesis B: Trapeziectomy with tendon interposition (abductor pollicis longus) arthroplasty	A: Immobilised with cast or brace for 3 weeks, thereafter followed a rehabilitation protocol B: Immobilised with a spica splint for 1 week, followed by active thumb mobilisation with intermittent brace use for 1 week	Short term Long term	71 (75 hands) 65 (72 hands)	CMC Eaton and Glickel grade II or III Thumb base pain at rest or affecting ADL activities	66.8 (8.2) 68.2 (9.8)	81.7 79.4	NR. Measured pain (VAS), function (DASH) and grip strength after 1, 3, 6, 12 and 24 months
	Klim ^{et al 2023/111}	RCT parallel	A: The double mobility TCMC prosthesis B: Trapeziectomy with resection-interposition (flexor carpi radialis (FCR)) arthroplasty	A and B: The first ray immobilised with orthosis for 6 weeks, thereafter 8 weeks of physical therapy	Short term Long term	82 86	CMC Eaton and Glickel grade II or III	56 (53–62) 60 (55–68)	84 78	Pain (VAS) at 6 weeks. Also measured function (DASH)
	Thorkildsen ^{et al 2019/112}	RCT parallel	A: Hydroxyapatite-coated ElektraTM total joint replacement B: Trapeziectomy with LRTI (FCR)	A: Postoperative treatment NR B: Thumb immobilised for 6 weeks	Long term	20 20	Symptomatic idiopathic CMC-OA	64 (range 55–72) 61 (range 36–77)	70 70	Function (qDASH). Also measured grip strength
Studies comparing different surgical techniques										
	Brennan ^{et al 2021/118}	RCT parallel	A: Trapeziectomy alone B: Trapeziectomy+combinations (LRTI)	A and B: Patients immobilised in Bennett's type cast for 4 weeks, then mobilised for further 4 to 6 weeks	Long term (17 years)	28 (43%) of original 65	CMC Eaton and Glickel grade III or IV	76 (total sample)	79 (total sample)	NR. Measured pain (VAS), function (qDASH) and grip strength (JAMAR) after 17 years
	Marks ^{et al 2017/113}	RCT parallel	A: Trapeziectomy with suspension-interposition arthroplasty B: Trapeziectomy with a human dermal collagen template (allograft).	A and B: Patients wore a removable orthosis for 6 weeks. Active mobilisation started 3 weeks after surgery, strengthening exercises started 8 weeks after surgery	Short term Long term	29 31	CMC Eaton stage II or more	64 (8) 65 (8)	90 81	Function (MHQ) at 12 months. Also measured pain (MHQ subscale) and grip strength

Continued

Table 3 Continued

RoB	Study	Design	Intervention	Postoperative (POM) management	Measurement timepoints analysed	N	OA location, definition	Age, years (SD)	Women (%)	Primary outcome (primary or NR)
	Morais <i>et al</i> 2022 ¹¹⁴	RCT parallel	A: Trapeziectomy with LRTI B: Trapeziectomy with suture-button suspensionplasty	A: Thumb immobilised for 2 weeks, thereafter physiotherapy for 4 weeks B: Thumb immobilised for 6 weeks, physiotherapy from week 0	Long term	39 37	CMC Eaton classification	61.1 (7.4) 61.8 (7.8)	94.8 89.2	NR. Measured pain (VAS), function (qDASH) and grip strength (JAMAR) after 40 months
	Sánchez-Flo <i>et al</i> 2020 ¹¹⁵	RCT parallel	A: Partial trapeziectomy with suspension and interposition arthroplasty based on Weilby technique B: Total trapeziectomy with suspension and interposition arthroplasty based on Weilby technique	A and B: Thumb immobilised for 3 weeks with a thumb spica orthosis, followed by 3 months of physiotherapy until stabilisation.	Long term	17 17	Isolated CMC OA grade II to III (E-L) with pain and loss of function	60.5 (9.8) 61.0 (8.9)	76.5 88.2	Key-pinch strength (kg) at 12 months. Also measured pain (VAS), function (qDASH) and grip strength,
	van Laarhoven <i>et al</i> 2023 ¹¹⁶	RCT parallel	A: Arthroscopic distal hemitrapeziectomy B: Open trapeziectomy	A: Thumb immobilised for 4 weeks, thereafter hand therapy for up to 12 weeks	Long term	45 (45 hands) 40 (42 hands)	CMC OA grade II to III (E-L)	58.8 (9.6) 62.0 (7.8)	64.4 82.5	Pain and function (PRWHE). Also measured grip strength.
	Zarezaideh <i>et al</i> 2021 ¹¹⁷	RCT parallel	A: LRTI B: Haematoma distraction arthroplasty	A: Thumb immobilised with Spike orthosis for 6 weeks B: Thumb immobilised with orthosis for 4 weeks. ROM exercises from week 4, strengthening exercises from week 6	Long term	28 28	CMC-OA diagnosed by expert orthopaedic surgeons	54.6 (21.0) 54.3 (11.2)	64.3 71.5	NR. Measured pain (VAS), and function (DASH)

Colours denote RoB (green: low, yellow: some concern, red: high). (A) indicates conference abstract.

AUSCAN, Australian/Canadian Hand Osteoarthritis Index; CMC, first carpometacarpal joint; CO, cross-over trial; DASH, Disabilities of the Arm, Shoulder and Hand; E-L, Eaton-Littler; N, number; NR, not reported; NRS, Numerical Rating Scale; OA, osteoarthritis; PO, primary outcome; PRWHE, Patient-Rated Wrist and Hand Evaluation; qDASH, quick DASH; RCT, randomised controlled trial; RoB, risk of bias; ROM, range of motion; Rx, radiography; VAS, Visual Analogue Scale.

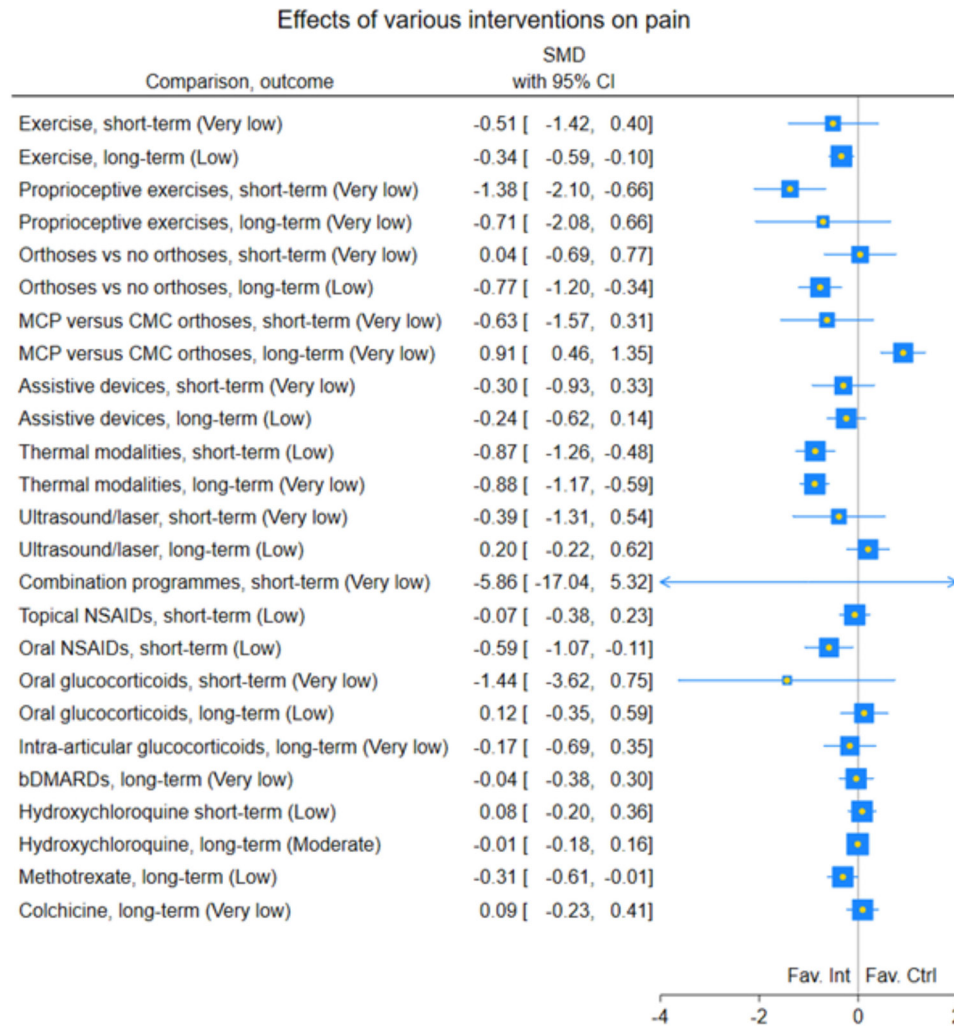


Figure 1 Effect of non-pharmacological and pharmacological interventions on pain. The GRADE assessment is provided in brackets after description of each intervention. CMC-orthoses immobilise the CMC-joint only, whereas MCP-orthoses additionally immobilises the MCP and/or wrist. bDMARDs, biological disease-modifying anti-rheumatic drugs; GRADE, Grading of Recommendations Assessment, Development and Evaluation; MCP,metacarpophalangeal; NSAID, non-steroidal anti-inflammatory drug; SMD, standardised mean difference.

effect on pain, and a moderate, significant long-term effect on function; however, these results were graded with very low certainty (online supplemental material, pp 42, 67–69).

Ultrasound/laser therapy

One new study evaluated the effect of high-intensity laser therapy⁶⁷ and were pooled with results from two previous studies.^{35 68} The results shows that, compared with a sham intervention, there is possibly small or no long-term effects on grip strength (SMD -0.13 (-0.50, 0.24) (low certainty)) (online supplemental material, pp 43, 70–71).

Combination programmes

We identified three new studies of combination programmes. One of these, and so far the first study of mobile health (mHealth) strategies, compared a mobile app-delivered multimodal programme with a control group receiving written exercises, and had a high RoB.⁶⁹ The results showed significant differences in short-term

and long-term pain and in long-term upper-limb function in favour of the mobile-app delivered programme. No serious AEs were registered.

The two other new studies compared a combination programme with routine care+placebo (a massage ball)⁷⁰ or information only.⁷¹ When pooling these with three previous studies,^{35 72 73} the certainty of the results was very low for all outcomes of pain, function or grip strength. Two previous studies reported on AEs,^{72 73} which were few, mild and with no significant between-group differences (pp 44, 72–74).

Pharmacological interventions

An overview of the characteristics and overall RoB of the 21 new studies including a pharmacological intervention is presented in table 2. All were parallel RCTs, of which 3 compared different pharmacological interventions against each other,^{74–76} 14 investigated pharmacological interventions against placebo,^{77–90} and 4 compared

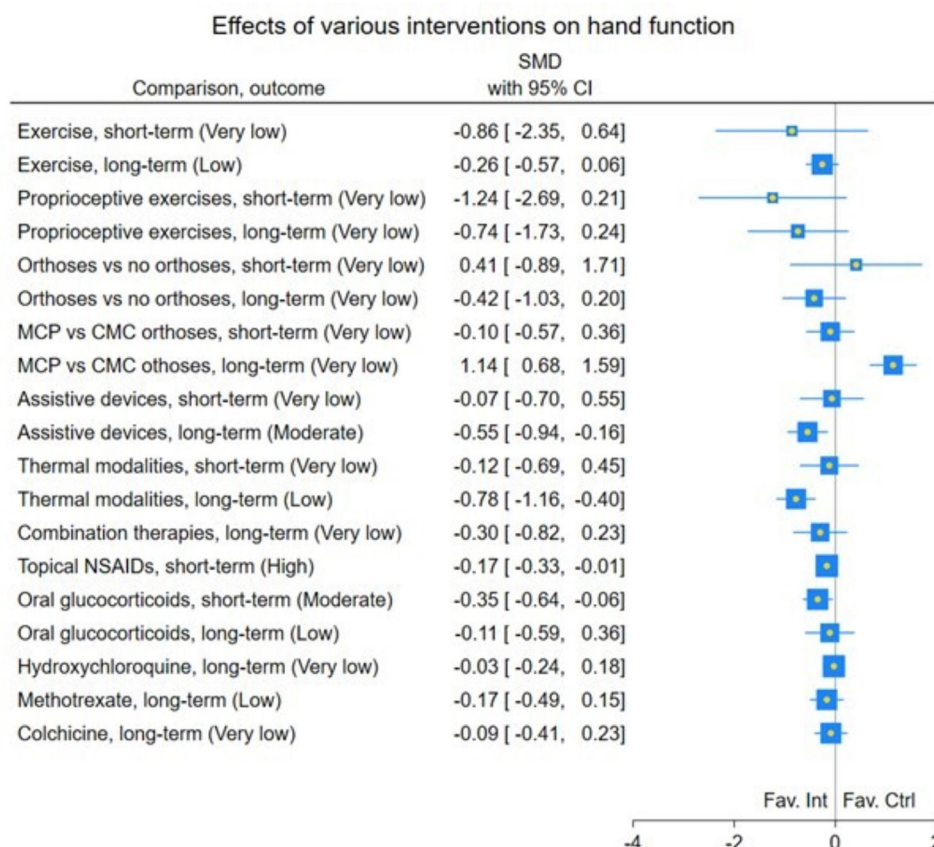


Figure 2 Effect of non-pharmacological and pharmacological interventions on function. The GRADE assessment is provided in brackets after description of each intervention. CMC-orthoses immobilise the CMC-joint only, whereas MCP-orthoses additionally immobilise the MCP and/or wrist. CMC, first carpometacarpal joint; GRADE, Grading of Recommendations Assessment, Development and Evaluation; MCP, metacarpophalangeal; NSAIDs, non-steroidal anti-inflammatory drugs; SMD, standardised mean difference.

combination programmes that also included a pharmacological intervention.^{91–94} The studies varied with regard to number of participants (16–204; 10 studies with ≥80

participants), 16 lasted ≥3 months, and 3 specifically included participants with signs of inflammatory OA (investigating oral glucocorticoids⁸⁰ or DMARDs).^{83 84}

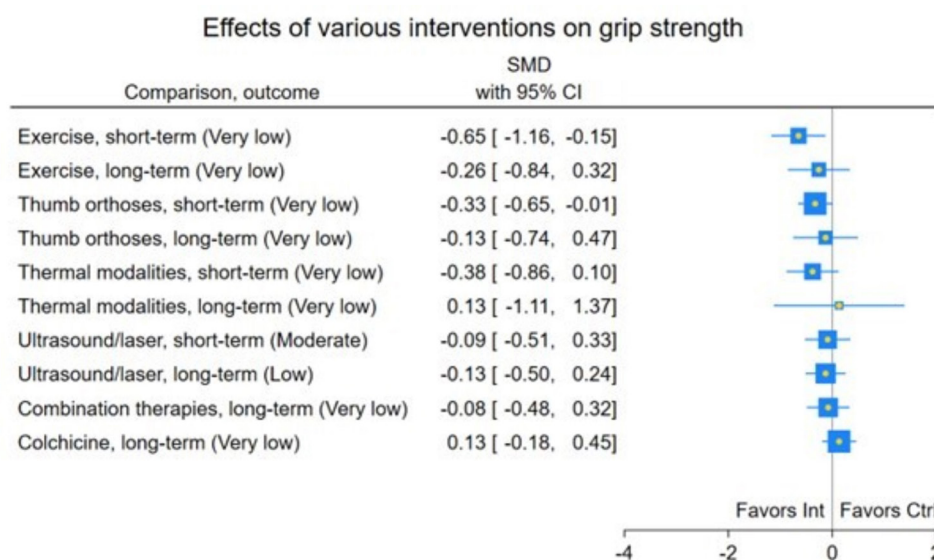


Figure 3 Effect of non-pharmacological and pharmacological interventions on grip strength. GRADE assessment is provided in brackets after description of each intervention. GRADE, Grading of Recommendations Assessment, Development and Evaluation; SMD, standardised mean difference.

Eight studies had low RoB. Reasons to judge studies to be at high (n=9) or unclear RoB (n=5) were most often related to the randomisation process, outcome measurement and/or selective reporting. Two meta-analyses were graded with high certainty, two with moderate and the rest with low or very low certainty. The detailed RoB and GRADE assessment are presented in online supplemental material (pp. 19–24, 45–52).

Topical pharmacological interventions

We identified one new study with 106 participants and low RoB comparing a topical corticosteroid ointment to placebo.⁷⁹ The results showed no significant between-group differences in any measure of pain or function after 6 weeks of treatment, and comparable rates of AEs between groups.

No new studies assessed the effect of topical NSAIDs. Meta-analyses of three previous studies comparing diclofenac^{95 96} or ibuprofen cream⁹⁷ to placebo showed a very small significant between-group difference in short-term function in favour of topical NSAIDs (SMD -0.17 (-0.33, -0.01), high certainty), and possibly a small or no short-term effect on pain (SMD -0.07 (-0.37, 0.24), low certainty) (online supplemental material, pp 45, 75).

Oral NSAIDs

No new studies of oral NSAIDs were detected. A meta-analysis of three previous studies comparing ibuprofen,⁹⁸ lumiracoxib⁹⁹ or meclofenamate¹⁰⁰ to placebo showed that there were possibly a moderate effect on short-term pain (SMD -0.59 (-1.07, -0.11), low certainty), and no significant between-group differences in any measure of adverse events (low, moderate or high certainty) (online supplemental material, pp 46, 76–78).

Oral glucocorticoids

We identified one new study of oral glucocorticoids,⁸⁰ which we pooled with two previous studies.^{101 102} The results showed that, compared with placebo, oral glucocorticoids likely had a small significant effect on short-term function (SMD -0.35 (-0.64, -0.07), moderate certainty), and possible a small or no effect on long-term function (SMD -0.11 (-0.58, 0.37), low certainty). Further, there is possibly a large to no effect on short-term pain (SMD -1.44 (-3.63, 0.74), very low certainty) and a small to no effect on long-term pain (SMD 0.12 (-0.36, 0.59), low certainty) (online supplemental material, pp 47, 79–80).

Intra-articular injections

We did not detect any new studies assessing the effect of intra-articular (IA) glucocorticoids or hyaluronic acid injections against placebo. We performed meta-analyses of three previous studies assessing glucocorticoid injections,^{103–105} showing no between-group differences in long-term pain (SMD -0.17 (-0.69, 0.35) or all AEs. However, the results were of very low certainty (online supplemental material, pp 48 and 81).

bDMARDs/TNF inhibitors

We identified three new studies comparing the effect of subcutaneous lutikizumab injections (anti-IL-1 α / β)⁹; intravenous tocilizumab infusions (anti-IL-6)⁸²; or subcutaneous otilimab injections (anti-GM-CSF)⁸³ to placebo. There were no significant between-group differences in any clinical outcome in any of the three studies, whereas AEs were more frequent in the intervention groups compared with placebo groups. We pooled results from four previous studies on adalimumab^{18 106 107} or etanercept (anti-TNF).¹⁷ The results showed that, compared with placebo, there is evidence of very low certainty for no effect on long-term pain (-0.04 (-0.38, 0.30)) and of moderate certainty for no between-group differences in all AEs (RR 0.95 (0.79, 1.15)) (online supplemental material, pp 49, 82–83).

Synthetic DMARDs

One new study on the effect of oral hydroxychloroquine⁸⁴ was detected and pooled with two previous studies.^{19 23} The results from meta-analyses showed that, compared with placebo, there is low and moderate certainty for no effect on short-term or long-term pain ((0.08 (-0.2, 0.36)) and (0.01 (-0.18, 0.16))), respectively, and of very low certainty for any effect on long-term function (SMD -0.03 (-0.24, 0.18)) or all AEs (online supplemental material, pp. 50, 84–85). New to this SLR, we also detected and pooled results from two studies on the effect of methotrexate against placebo.^{85 86} There is possibly a small effect on long-term pain (SMD -0.31 (-0.61, 0.00), low certainty) and long-term function (SMD -0.17 (-0.49, 0.15), low certainty), and very low certainty evidence for an effect on all adverse events (RR 0.80 (0.37, 1.73)) (online supplemental material, pp 51, 86–87).

Colchicine

New to this review, we detected and pooled two studies comparing colchicine to placebo.^{88 108} The results show that colchicine is not superior to placebo in terms of efficacy, while there is likely a higher risk of adverse events (RR 1.70 (1.27, 2.28), moderate certainty). The certainty for the results regarding pain, function and grip strength was very low (online supplemental material, pp 52, 87–89).

Surgical interventions

We identified nine new studies of surgical interventions^{109–117} and one¹¹⁸ reporting the 17-year follow-up results of a trial also included in the review by Kroon *et al* (see table 3). All studies were parallel RCTs. No trials compared surgery to no surgery, sham surgery or non-surgical interventions. All but one study¹⁰⁹ were judged to have high RoB or some concerns (online supplemental material, pp 25–26). Due to the heterogeneity of new and previous studies, we did not perform any meta-analyses of efficacy. New to this SLR, four studies compared joint replacement to trapeziectomy with or without ligament reconstruction and tendon interposition.^{109–112} In three

of the studies,^{110–112} the participants treated with prosthesis improved faster; however, after 6–12 months, there were no significant differences between the two groups. In the fourth study,¹⁰⁹ which was the only study with low RoB, those receiving prosthesis had significantly better grip strength and range of motion after 12 months compared with those treated with trapeziectomy.

The other six trials compared trapeziectomy performed with different or additional surgical techniques or interventions. In general, there were no significant between-group differences in any measure of pain, function or grip strength in any of the studies.

The efficacy of various treatments with regard to outcome

In a final step, we combined the results from the meta-analyses described above to visualise the efficacy of the different non-pharmacological and pharmacological treatments on pain, function and grip strength. As visualised in [figure 1](#), there is evidence of moderate certainty that hydroxychloroquine has no long-term effect on pain, and evidence of low certainty that hand exercises may have a small long-term effect, hand orthoses a moderate long-term effect, oral NSAIDs a moderate short-time effect, and methotrexate a small long-term effect on pain.

With regard to function ([figure 2](#)), there is high-certainty evidence for a very small short-term effect of topical NSAIDs, moderate-certainty evidence for a moderate long-term effect of assistive devices and a small short-term effect of oral glucocorticoids, and low-certainty evidence for a small long-term effect of exercises and a moderate effect of thermal modalities. Lastly, there is moderate-certainty evidence that hand ultrasound/laser has no effect on grip strength.

DISCUSSION

The aim of this SLR was to summarise the evidence for efficacy and safety of non-pharmacological, pharmacological, and surgical treatments for hand OA. In line with the current guidelines,^{6–10} recommending non-pharmacological interventions as the first choice of intervention, we found moderate-certainty or low-certainty evidence of the efficacy of hand exercises, thumb orthoses and use of assistive devices for pain and/or function. In the few studies which collected data on AEs, the reported AEs were infrequent and mild, indicating that these interventions are safe.

Research has demonstrated that the reduced grip strength of people with hand OA negatively impacts their function.^{119 120} Even if the exercise programmes varied in the type and number of exercises, as well as in the intensity, duration and frequency of sessions per day and week, most programmes included strengthening exercises. The meta-analyses showed a moderate estimated effect on grip strength; however, this evidence was of very low certainty. To improve the quality of these programmes, a key next step is to design an exercise programme based on current evidence and recommendations, and evaluate

its effect in studies with a sufficient number of participants. Future studies should also monitor adherence, as it is crucial for achieving any meaningful effect. Moreover, to develop more effective interventions, it is essential to conduct research that deepens our understanding of the factors influencing grip strength.

The development of mobile health devices (mHealth) represents a paradigm shift in healthcare, enhancing the delivery of evidence-based and sustainable care. However, to date, there are few mobile applications with programmes specifically developed for people with hand OA.¹²¹ Interestingly, results from the study comparing home exercise therapy delivered via a mobile application or on paper suggest that the app-based approach has at least the same efficacy as the traditional paper method. This indicates that mobile applications can serve as a viable and feasible mode of treatment delivery.⁶⁹ However, further research is warranted to understand the full impact of mHealth for people with hand OA, including high-quality trials evaluating the efficacy and cost-effectiveness of this delivery mode.

We found that thumb orthoses possibly had a moderate long-term effect on pain. Thumb orthoses are, however, not included in the updated NICE guidelines,¹⁰ most likely due to a recent large placebo-controlled RCT showing no additional benefit after 8 and 12 weeks of adding a thumb orthosis to a self-management programme for CMC-OA.²⁹ However, among the RCTs on thumb orthoses included in our SLR, only the two studies with follow-up ≥ 6 months^{48 50} suggested a notable decrease in pain within the intervention group, thereby supporting the EULAR recommendation advocating long-term use when CMC-orthoses are indicated.⁹ Also, to better decipher which thumb orthoses works best for whom, studies linking design to hypothesised working mechanisms and evaluating long-term effects of such orthoses are needed.

Although the results from meta-analyses were graded with very low certainty, we found that thermal interventions in general was beneficial. This is a low-cost and probably safe intervention which often is included at the beginning of exercise programmes to warm up the hands.¹²² Also, in line with results from a study on patients with rheumatoid arthritis,¹²³ one of the new RCTs showed that hot wax bath followed by hand exercises resulted in significant short term improvements in pain, function and grip strength compared with hand exercises only.⁵⁹ However, high-quality studies are needed to decide if a warm-up exercise should be included in future exercise programmes.

Looking at pharmacological interventions, there was high-certainty evidence for a small short-term effect of topical NSAIDs on function, low-certainty evidence for a moderate short-term effect of oral NSAIDs on pain, moderate-certainty evidence for a small short-term effect of oral glucocorticoids on function and low-certainty evidence for a small long-term effect of methotrexate on pain. Considering the lack of any convincing pain-relieving effects of topical NSAIDs, one might question

the consensus across several guidelines that this should be the first choice when it comes to medication. However, as stated in the EULAR recommendations,⁹ the recommendation also takes into consideration the beneficial effect on function and the favourable safety profile compared with oral analgesics, making it a safe choice. Further, the lack of evidence on any effect of IA corticoid injections, biological DMARDs and hydroxychloroquine strengthens the recommendations against the use of such medication.

New to this SLR, we identified two studies evaluating the effect of methotrexate in patients with symptomatic hand OA.^{85 86} The meta-analyses showed that there is low-certainty evidence for a small long term-effect on pain and no effect on function, indicating that further research is needed to clarify the role methotrexate may have in the treatment of hand OA. Interestingly, the most recent of the two studies⁸⁶ is the only study in this SLR applying synovitis detected by MRI as an inclusion criterion. Research has shown that the presence of synovitis is consistently associated with joint pain and structural progression.¹²⁴ Hand OA subtyping should therefore be included in all future studies to better understand the mechanism of action.

As in the review by Kroon *et al*,¹¹ the large heterogeneity and lack of control groups prevented us from doing any meta-analyses of surgical studies, and thus, no conclusions regarding which interventions may be effective can be drawn. Nevertheless, in an RCT investigating whether occupational therapy in the waiting period before surgical consultation for CMC-OA could reduce the likelihood of surgery, there were no significant differences after 2 years in pain or hand function between those opting for surgery and those who did not.¹²⁵ Interestingly, surgery did not result in additional improvements in pain and hand function within the group that received occupational therapy. To establish an evidence-based practice, it is now time for surgery to be compared with non-surgical treatments or placebo in robust RCTs, instead of comparing a variety of surgical interventions to each other.

A positive finding in this SLR is a significant increase in RCTs investigating the efficacy of treatments for hand OA. The first EULAR recommendations, published in 2007, were based on 48 RCTs or CTs.¹²⁶ Seventy-five studies were added to the evidence-base for the updated recommendations in 2018,¹¹ whereas we detected 65 new RCTs published up to 2024, suggesting a growing interest in hand OA research. On the negative side is the fact that the majority of studies included rather few participants. Additionally, in most of the non-pharmacological studies, the context varies, seemingly identical treatments often differ in design and content, and blinding of participants and therapists is usually not possible. Overall, this means that the studies have a high risk of systematic biases, indicating that the evidence base for hand OA treatments still is rather weak.

A limitation of the current SLR is that we have pooled results from studies comparing programmes

with different content, and studies with different medication dosage. The large number of meta-analyses also required numerous decisions, which can lead to either overestimation or underestimation of the true effects of interventions. Moreover, combining pilot or feasibility studies with full-scale studies in these meta-analyses may have inflated the observed effects.¹²⁷ Additionally, restricting the review to RCTs may limit the generalisability of the findings, as the effects observed under controlled conditions may differ from those in real-world clinical settings, where there is greater variability among patients and clinicians. Still, we probably have included a mixture of studies examining efficacy (referring to studies performed under ideal or controlled conditions) and effectiveness (studies assessing the effect under more 'real world' clinical settings). However, even if these two concepts may be easy to distinguish between in theory, in practice, they represent a continuum. As a result, we did not attempt to differentiate between them in this SLR. Readers should also be aware that effect estimates of results from the studies (as visualised in figures 1–3) are not directly comparable due to clinical heterogeneity of the study populations and differences in risk of bias. Further, as we included studies with high RoB in meta-analyses and conducted GRADE assessments, our results sometimes differ from those in Kroon's review. Also, defining a timeframe of 3 months or more as 'long-term' may limit the relevance of these results for informing clinical practice and policy. Lastly, the possibility of missing relevant publications cannot be entirely excluded. However, the strengths include an extensive literature search, independent study and data extraction by two authors, and thorough RoB and GRADE assessments to evaluate the certainty of the evidence.

CONCLUSIONS

The results from this SLR largely support current treatment recommendations. However, the evidence for most current treatments is still limited, particularly a lack of interventions that efficiently improve grip strength and of studies comparing non-pharmacological or surgical interventions to placebo or no intervention. To better understand the action mechanisms, future trials should include hand OA subtyping and be powered for subgroup analyses.

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