The effects of compression gloves on hand symptoms and hand function in rheumatoid arthritis and hand osteoarthritis : a systematic review

Hammond, A, Jones, V and Prior, Y

http://dx.doi.org/10.1177/0269215515578296

The effects of compression gloves on hand symptoms and hand function in rheumatoid arthritis and hand osteoarthritis: a systematic review.

Alison Hammond, Vivienne Jones, Yeliz Prior

Centre for Health Sciences Research, University of Salford, Salford, UK.

Address for Correspondence:

Professor Alison Hammond,

Centre for Health Sciences Research,

L701 Allerton (OT),

University of Salford,

Frederick Road,

Salford M6 6PU.

Tel: 0044 -161 295 0038

e-mail: a.hammond@salford.ac.uk and hammond116@btinternet.com

Fax: 0044)-161 295 2432

Main text: 2324 words

Abstract

Objective: to evaluate the effects of compression gloves in adults with rheumatoid arthritis and hand osteoarthritis.

Data sources: Systematic review of randomized controlled trials identified from MEDLINE, CINAHL, AMED, PEDro, OT Seeker, The Cochrane Library, ISI Web of Knowledge, Science Direct and PubMed from their inceptions to January 2015.

Review methods: Methodological quality of identified trials was evaluated using the PEDro scale by three independent assessors. Effects were summarized descriptively.

Results: Four trials (n=8-24; total n=74), comparing night wear of full-length finger compression gloves with placebo gloves, were assessed. Three were of moderate (PEDro score 4-5) and one low (score 3) methodological quality. Effect sizes or standardized mean differences could not be calculated to compare trials due to poor data reporting. In rheumatoid arthritis, finger joint swelling was significantly reduced, but results for pain and stiffness were inconclusive and no differences in grip strength and dexterity were identified. One study reported similar effects in pain, stiffness and finger joint swelling from both compression and thermal placebo gloves. Only one study evaluated gloves in hand osteoarthritis (n=5) with no differences.

Conclusions: All the trials identified were small with a high risk of Type I and II errors. Evidence for the effectiveness of compression gloves worn at night is inconclusive in rheumatoid arthritis and hand osteoarthritis.

Clinical Message:

- Evidence for compression gloves' effects on hand symptoms and function in rheumatoid arthritis and hand osteoarthritis is inconclusive.
- Trials to date are small and of moderate or low methodological quality.

Keywords: compression gloves, rheumatoid arthritis, osteoarthritis, hand, rehabilitation, occupational therapy

Introduction

About a third of patients with rheumatoid or hand osteoarthritis, referred to Rheumatology occupational therapists, are provided with compression gloves [1] and these are frequently bought by people with arthritis. Gloves are worn day and/or night to relieve hand symptoms and improve hand function [2-4]. Rheumatoid arthritis and hand osteoarthritis cause hand pain, muscle weakness, joint swelling, stiffness and deformity and reduce grip strength, range of motion and hand function. These effects reduce ability to perform daily activities, work and leisure, causing frustration and distress [5-10]. Reducing hand symptoms and maintaining hand function are important rehabilitation aims. Compression gloves are thought to remove extracellular fluid (articular and peri-articular swelling), possibly via the lymphatic system, thus reducing pain, stiffness and improving finger motion; and increase blood flow which increases warmth, and reduces pain and stiffness [2,11]. For day wear, they provide light support to joints, which helps improve grip and therefore hand function [3, 4]. Potentially, the pressure also acts as a biofeedback mechanism reminding users to take care of joints during hand use. Few manufacturers of compression gloves provide information on how much pressure their gloves apply. Isotoner® gloves (80% nylon, 20% elastane) apply 23 to 32mm Hg of pressure at the metacarpophalangeal joints [12,13] and Norco^{TM} gloves (89% nylon; 11% elastane) apply 15mmHg [13]. The optimal pressure compression gloves should apply is unknown, glove manufacturers do not report how pressures were evaluated and no independent research has been published investigating pressure applied by different glove models. The effectiveness of compression gloves in arthritis has not previously been systematically reviewed. The aim of this systematic review is to evaluate the evidence for whether compression gloves reduce hand symptoms and improve hand function in people with either rheumatoid or hand osteoarthritis.

Methods

Eligibility criteria

Randomized controlled trials, quasi-randomised controlled trials or randomised crossover controlled trials published in English were selected for evaluation. Studies were selected which

described the use of gloves to apply pressure to the hands of adults with rheumatoid or hand osteoarthritis as part of conservative management. Studies involving both conditions were included if data could be extracted for each condition separately. Rheumatoid or hand osteoarthritis should have been diagnosed by a physician and people recruited from either an in- or out-patient or community setting. Gloves should have been provided by health professionals for either day and/or night use. The control could be no treatment, usual care or a placebo glove. Studies needed to have evaluated at least one of the following hand outcomes: pain, stiffness, joint swelling, grip strength, range of movement or hand function. Studies were excluded if they: evaluated two types of compression glove without a control group or phase as a comparison; were case studies; observational studies; or reported only in abstracts, poster presentations or conference proceedings.

Search strategy

The following electronic databases were searched from inception until end of January 2015: MEDLINE; Cumulative Index to Nursing and Allied Health Literature; Allied and Complementary Medicine; Physiotherapy Evidence database (PEDro), OT Seeker; Cochrane Library; ISI Web of Knowledge; Science Direct; and PubMed (see Appendix 1 for search strategy). Reference lists of systematic and narrative reviews identified, related to orthoses and hand therapy in rheumatoid and hand osteoarthritis were also searched [14-28].

Study selection and assessment of study quality

Two authors (AH, VJ) independently screened titles and abstracts identified from literature and hand searches for potentially relevant studies using the eligibility criteria. For the identified studies, two reviewers (AH, VJ) evaluated the full text articles to identify if they met eligibility criteria. Three reviewers (AH,VJ,YP) then assessed the methodological quality of included trials using the PEDro scale, resolving disagreements when necessary [29]. The PEDro scale is a reliable and valid scale assessing 11 criteria [30,31] (see Table 1). The first (participant eligibility criteria) assesses external validity and is not included in the total score, which is thus a maximum of 10 if all criteria are met. It is difficult to blind therapists and participants in most

rehabilitation trials, meaning many cannot obtain the maximum score. Trials of high quality and low risk of bias are considered to be those scoring 7 or more. Those of low quality with a high risk of bias score 3 or less [32].

Data extraction and analysis

A predefined data extraction form was devised with the following headings: study design, participant characteristics, diagnosis, interventions, duration of interventions, outcomes, measurement points and key findings. Effects were summarized descriptively. It was not possible to compare outcomes between studies using standardised mean differences over time or effect sizes; or to conduct meta-analysis because no studies reported both mean (standard deviation) or median (interquartile range) of measurements at baseline and end of compression and placebo glove wear, meaning data could not be pooled.

Results

Study selection

The search results are shown in Figure 1. Ten articles were selected for full text review. Two case studies [3,4] and two observational studies were excluded [33,34]. A further trial, described as a randomised controlled trial in the title, was methodologically reviewed but excluded as no control group or phase was identified, rather two different makes of glove were compared [2]. A review of compression gloves in rheumatoid arthritis was excluded as this reviewed, and based conclusions on, all studies, irrespective of design or methodological quality [35]. Accordingly, four trials were reviewed, all published up to 1990 [11, 36-38].

Study characteristics

Details of the four eligible studies are presented in Table 2. All were randomised controlled crossover trials with people with definite or classical rheumatoid arthritis (n = 8 to 24), three specified participants should also have active synovitis [11, 36, 37]. Two studies also recruited

people with hand osteoarthritis but only one reported results (n=5; 37). Only two studies reported participants' ages [11, 36], with the former having a higher age range than is typical in many rheumatoid arthritis studies. Broadly, two types of compression glove were tested: nylon/ elastane [36, 38] and thermal compression gloves [11, 37], three of which are no longer manufactured [11,36,37].

Methodological quality

Three trials were moderate quality (PEDro scores of 4 to 5, with moderate risk of bias) [11,36,37] and one low quality (PEDro score = 3, high risk of bias) [38]. This latter study recoded pre-post-test results for each participant's measures as +1 (improved), 0 (no change) and -1 (deterioration), without stating criteria for categories, and total recoded scores were tested, meaning it was not possible to determine true effects of gloves (see Table 1) [38]. Concealed allocation and blinding of participants, therapists and assessors were not described in any trials.

Effects of compression gloves

All four studies evaluated the short-term effects (1 to 4 weeks) of full finger compression gloves worn at night. Results are summarised in Table 3.

In rheumatoid arthritis, compression gloves led to significant reductions in proximal interphalangeal joint circumference (0.7mm-1.15mm on average) [11, 36, 37]. Results were inconclusive for pain and stiffness, with one study reporting no improvements [37], one slightly better [36] and a third that both compression and placebo thermal gloves led to similar improvements [11]. Results were also inconclusive for swelling, numbness, night throbbing and health status. No significant differences were identified between compression and placebo gloves for grip strength, pinch strength, range of motion, dexterity, hand volume, number of tender joints, or metacarpophalangeal joint stiffness. Both compression and placebo gloves raised skin temperature by 1°C.

Only one study reported results (n=5) in hand osteoarthritis, finding no significant differences in any measures, apart from both compression and placebo gloves raising palmar skin temperature [37].

Side effects and precautions

No side effects from compression glove wear were identified. A quarter of participants in one study reported glove seams on the fingers caused discomfort, which was resolved by wearing gloves inside out [36]. Two had exclusion criteria of carpal tunnel syndrome and Raynaud's phenomenon, due to concerns about compression exacerbating symptoms [11,37]. Contraindications and precautions to be considered are: Raynaud's phenomenon because gloves might restrict blood flow; psoriasis and skin lesions as the gloves could be irritating and using dressings over affected areas could unduly increase local pressure; and those with carpal tunnel syndrome should be carefully monitored as this might be exacerbated by glove tightness at the wrist [36].

Attitudes to glove wear

For the nylon/elastane gloves, acceptance was good amongst women, but less so amongst men, mainly because available gloves were either too short or small [36,38]. Participants reported hand activity was easier during the day (e.g. writing, buttoning) but that hand swelling returned again by the evening [38]. In both thermal compression glove studies, participants were asked if they wanted to continue wearing gloves. In one trial 11/15 chose to do so [37] but in the other, only 2/8 did, with reasons for not continuing glovewear including being too warm or slipping off in bed [11].

Discussion

The evidence base for the effectiveness of compression gloves is weak, with insufficient evidence for any effects on hand symptoms or hand function, apart from possibly small reductions in proximal joint swelling in rheumatoid arthritis. No studies examined whether this was a clinically meaningful reduction. We identified only four randomised crossover trials, all with immediate follow-up assessments and none were high quality. All four had inadequate reporting of results and small sample sizes; none included sample size calculations or indicated if they were powered to detect statistical differences, meaning there is a high risk of Type I and Type II errors. Results should be interpreted with caution.

Only one small study in hand osteoarthritis, with negative findings, was identified [37], meaning no conclusions can be drawn as to effectiveness of gloves in this condition. All four studies evaluated the effects of full-length compression gloves versus placebo gloves worn at night by people with rheumatoid arthritis. Four different makes of compression glove were evaluated. Only one evaluated Isotoner® gloves, which is the commonest used [1] but this study had a high risk of bias [38]. Future studies should evaluate gloves most commonly provided in clinical practice.

Overall, considering outcomes measured in more than one study, the effects of compression gloves in rheumatoid arthritis on pain and stiffness were inconclusive and no effects were identified for grip strength and dexterity. Three studies identified significant reductions in proximal interphalangeal joint swelling, although this was small [11,36, 37] and may not be clinically important as this reduction was not accompanied by reduced finger stiffness, improved flexion or dexterity. The mechanism by which gloves affect joint swelling was unclear. The gloves evaluated exerted differing amounts of pressure (12 to 25mmHg at the fingers, where reported [36, 37], and two additionally had thermal properties [11,37]. One small study (n=8) identified similar improvements in pain, stiffness and proximal interphalangeal joint swelling from wearing both thermal compression and thermal placebo gloves, suggesting warmth could be the mechanism [11]. Future studies of compression gloves should evaluate the pressure exerted and temperature changes found during compression and placebo glove wear to identify the mechanisms through which compression gloves may have an effect. Future trials should also consider including placebo gloves to evaluate the impact of warmth and comfort.

The findings contrast markedly with those of a recent review which concluded compression gloves in rheumatoid arthritis lead to substantial improvements in pain, stiffness and swelling although not hand function (with the exception of grip strength) [35]. However, that review included studies of any design without consideration of their methodological quality.

Some outcome measures included are now infrequently used. For example, pain was evaluated on a 4, 6 or 7 point scale and grip strength with adapted sphygmomanometers. Future research should use measures considered as standards for arthritis clinical trials, such as pain visual analogue or numeric rating scales (0-10; no pain to severe pain) and the Jamar dynamometer.

Baseline and follow-up data were poorly reported, making comparison of results between trials difficult. Future research should follow CONSORT [39] and TIDIER [40] reporting guidelines. Systematic reviews normally focus on topics where there are sufficient reasonably rigorous studies, with larger samples, to identify the true effects of interventions. However, only four small studies were identified. All were published from 1979 to 1990, when trial reporting and analysis were generally of poorer quality than today. Medical management of rheumatoid arthritis has changed considerably since then and compression glove manufacture may also have changed. The results may not be relevant to modern practice. Nonetheless, it is still important to review what evidence is available, in order to inform clinical practice of the limited evidence base and identify the focus for future research. Limitations of the study were that we searched only for those published in English and did not search grey literature.

In conclusion, this review identified that the evidence for effectiveness of compression gloves on pain, stiffness, grip strength and dexterity is poor and inconclusive. Gloves may have a small effect on proximal interphalangeal joint swelling when worn at night. Rheumatology and rehabilitation teams should be aware that, given the moderate to low quality and small size of the trials, it is not possible to draw firm conclusions about the effects of compression gloves in rheumatoid arthritis or hand osteoarthritis. Future studies should evaluate the effects; of makes and designs commonly provided (e.g. three-quarter finger length Isotoner gloves); of gloves worn during the day (as well as at night); and on pain, stiffness and activity ability, which are now the common design, regimen and reasons for providing gloves. Compression gloves should be compared to placebo gloves to control for effects of warmth. The longer-term effects of compression glove wear (i.e. over 4 weeks) should be evaluated. Clinically, compression gloves are commonly provided to people with rheumatoid arthritis or hand osteoarthritis and people with these conditions purchase them privately. This systematic review highlights the need for adequately powered trials in rheumatoid arthritis and hand osteoarthritis to evaluate whether any clinically meaningful differences occur both immediately, and in the longer-term, during the day or night, in hand symptoms and hand function from wearing compression gloves.

Author contributions:

All authors were involved in drafting the article and revising it critically for important intellectual content, and all authors approved the final version to be published. All authors had full access to the data in the study, approved this version and take responsibility for the accuracy of the review.

Study conception and design: Hammond, Jones, Prior

Acquisition of data: Hammond, Jones

Analysis and interpretation of data: Hammond, Jones, Prior

Conflict of Interest Statement

The authors declare no conflict of interest

References

1. Prior Y, Hammond A, Jones V. A survey of Rheumatology occupational therapists' compression glove provision to people with rheumatoid arthritis or hand osteoarthritis in the United Kingdom (2013: unpublished report).

2. McKnight PT, Kwoh CK. Randomised controlled trial of pressure gloves in rheumatoid arthritis. Arthritis Care Res 1992;5:223-227

3. Murphy D. Lycra working splint for the rheumatoid arthritic hand with MCP ulnar deviation. Aust J Rural Health 1996;4:217-220.

4. Barbarioli M. A lycra glove working splint for rheumatoid arthritis: a case study. Br J Occup Ther 2001; 64:364-366

5 National Collaborating Centre for Chronic Conditions, Rheumatoid Arthritis: National Clinical Guidelines for Management and Treatment in Adults. London: Royal College of Physicians, 2009.

6. Kwok W, Kloppenburg M, Marshall M et al . Comparison of clinical burden between erosive hand osteoarthritis and inflammatory arthritis in symptomatic community dwelling adults: the Keele Clinical assessment studies. Rheumatology 2013;52: 2260-2267

7. Horsten NCA, Ursum J, Roorda LD, van Schaardenburg D, Dekker J, Hoeksma AF. Prevalence of hand symptoms, impairments and activity limitations in rheumatoid arthritis in relation to disease duration. J Rehabil Med 2010;42:916-921

8. Marshall M, van der Windt D, Nicholls E, Myers H, Hay E, Dziedzic K. Radiographic hand osteoarthritis: patterns and associations with hand pain and function in a community dwelling sample. Osteoarthr Cartil 2009; 17:1440-1447.

9. Leeb BF, Sautrner J, Andel I, Rintelen B. SACRAH: a score for assessment and quantification of chronic rheumatic affections of the hands. Rheumatology 2003; 22:1173-1178.

10. Michon M, Maheu E, Berenbaum F. Assessing health-related quality of life in hand osteoarthritis: a literature review. Ann Rheum Dis 2011;70:921-928

11. Oosterveld FJG, Rasker JJ. The effect of pressure gradient and thermolactyl control gloves in arthritis patients with swollen hands. Br J Rheumatol 1990;29:197-200

12. Isotoner Glove information:www.isotonertherapy.com. Downloaded 8.12.13

13. Janeczko J. Personal e-mail communication with Jobskin Ltd representative. (5.12.13)

14. Egan M, Brosseau L, Farmer M et al. Splints and Orthosis for treating rheumatoid arthritis. Cochrane Database of Systematic Reviews (2001). Issue 4. Art. No.: CD004018. DOI: 10.1002/14651858.CD004018

15. Mahendira D, Towheed TE. Systematic review of non-surgical therapies for osteoarthritis of the hand: an update. Osteoarthr Cartil 2009;17:1263-1268

16. Kjeken I, Smedslund G, Moe RH, Slatkowsky-Christensen B, Uhlig T, Hagen KB. Systematic review of design and effects of splints and exercise programs in hand osteoarthritis. Arthritis Care Res 2011;63:834-848

17. Steultjens EEMJ, Dekker JJ, Bouter LM, Schaardenburg DD, Kuyk MAMAH, Van den Ende ECHM. Occupational therapy for rheumatoid arthritis. Cochrane Database of Systematic Reviews (2004), Issue 1. Art. No.: CD003114. DOI: 10.1002/14651858.CD003114.pub2.

18. Towheed TE. Systematic review of therapies for osteoarthritis of the hand. Osteoarthr Cartil 2005;13:455-462

19. Valdes K, Marik T. A systematic review of conservative interventions for osteoarthritis of the hand. J Hand Ther 2010;23:334-351

20. Ye L, Kalichman L. Spittle A. Dobson F. Bennell K. Effects of rehabilitative interventions on pain, function and physical impairments on people with hand osteoarthritis: a systematic review. Arthritis Res Ther 2011;13:R28

21. Beasley J. Osteoarthritis and rheumatoid arthritis: conservative therapeutic management. J Hand Ther 2012;25:163-172

22. Christie A, Jamtvedt G, Dahm KT, Moe R, Haavardsholm EA, Hagen KB. Effectiveness of nonpharmacological and nonsurgical interventions for patients with rheumatoid arthritis: an overview of systematic reviews. Phys Ther 2007;87:1697-1715

23. Ehrlich GE. Future directions in therapy of pain in osteoarthritis. Semin Arthritis Rheum 1989;18 Supplement 2:100-104.

24. Estes JP, Bochenek C, Fasler P. Osteoarthritis of the fingers. J Hand Ther 2000;13:108-123

25. Minor M, Sanford MK. The role of physical therapy and physical modalities in pain management. Rheum Dis Clin North Am 1999;25:233-248

26. Moe RH, Kjeken I, Uhlig T, Hagen KB. There is inadequate evidence to determine the effectiveness of nonpharmacological and nonsurgical interventions for hand osteoarthritis: an overview of high quality systematic reviews. Phys Ther 2009;89:1363:1370.

27. Nicholas JJ. Physical modalities in rheumatological rehabilitation. Arch Phys Med Rehabil 1994;75:994-1001.

28. Ouellette EA. The rheumatoid hand: Orthotics as preventative. Semin Arthr Rheum 1991;21:5-72

29. Physiotherapy Evidence database. PEDro scale 1999; http://www.pedro.org.au/english/downloads/pedro-scale/ downloaded 6.11.13

30. Maher CG, Sherrington C, Mosely AM, Elkins M. Reliability of the PEDro scale for rating quality of randomised controlled trials. Phys Ther 2003;83: 713-721

31. Macedo LG, Elkins M, Maher CG, Moseley AM, Herbert RD, Sherrington C. There was evidence of convergent and construct validity of Physiotherapy Evidence Database quality scale for physiotherapy trials. J Clin Epidemiol 2010;63: 920-925

32. Elkins MR, Herbert RD, Moseley AM, Sherrington C, Maher C. Rating the quality of trials in systematic reviews of physical therapy interventions. Cardiopulm Phys Ther J 2010; 21:20-26.

33. Ehrlich GE, DiPiero AM. Stretch gloves: nocturnal use to ameliorate morning stiffness in the hands. Arch Phys Med Rehabil 1971; 52:479-480.

34. Askari A, Moskowitz RW, Ryan C. Stretch gloves: a study of objective and subjective effectiveness in arthritis of the hands. Arthr Rheum 1974;17: 263-265

35. Nasir SH, Troynikov O, Massy-Westropp N. Therapy gloves for patients with rheumatoid arthritis: a review. Ther Adv Musculoskel Dis 2014;6:226-237

36. Culic DD, Battaglia MC, Wichman C, Schmid FR. Efficacy of compression gloves in rheumatoid arthritis. Am J Phys Med 1979;58: 278-84

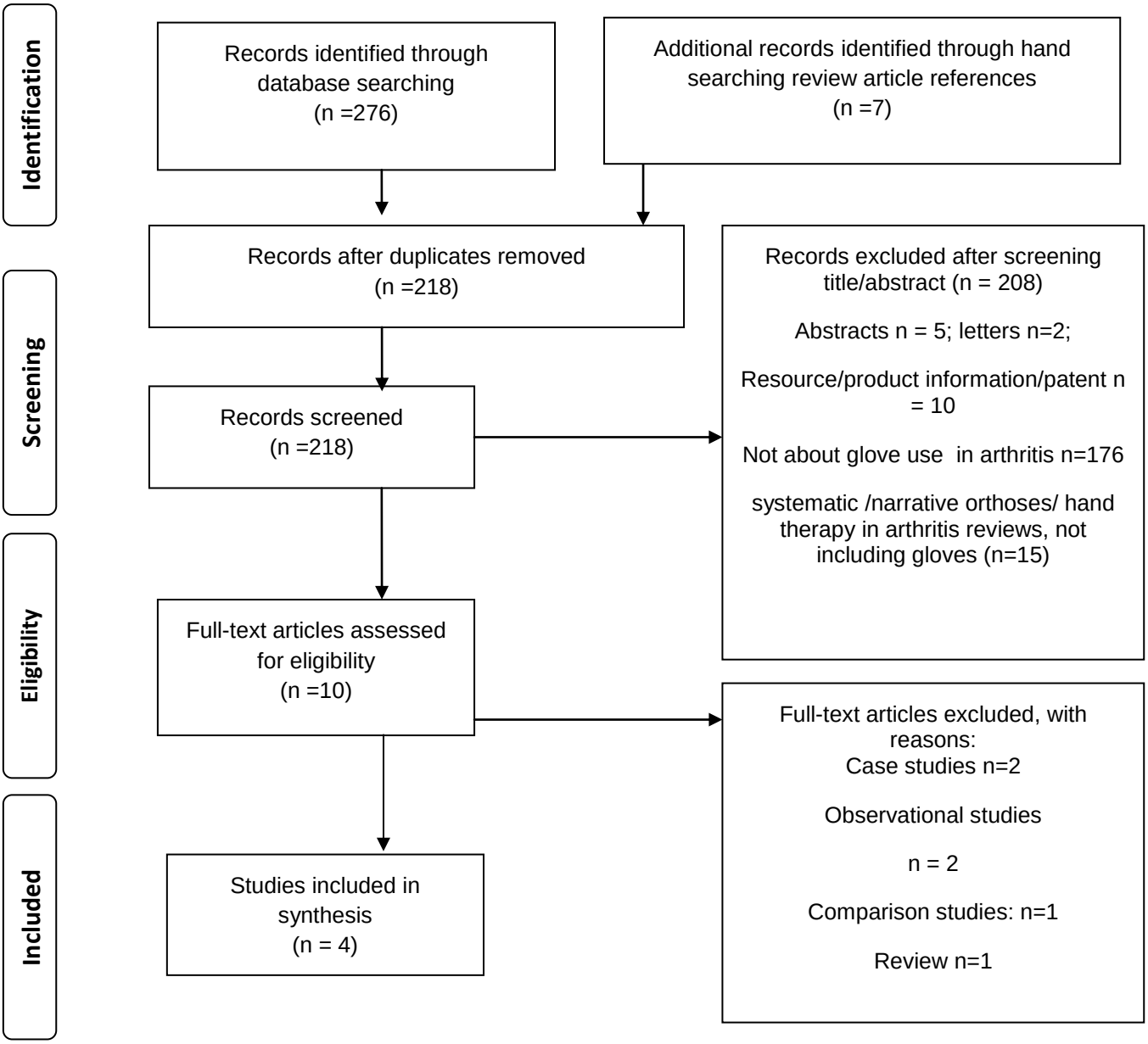
37. Swezey RL, Spiegel TM, Cretin S, Clements P. Arthritic hand response to pressure gradient gloves. Arch Phys Med Rehabil 1979;60: 375-377

38. Dixon A St.J, Harrison RA, Pocock P. Trial of Isotoner gloves for morning stiffness and pain in rheumatoid arthritis. Br J Clin Pract 1986;40: 271-272

39. Moher D, Hopewell S, Schulz KF et al. CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised controlled trials. Br Med J 2010;340:c869 doi: 10.1136/bmj.c869

40. Hoffmann TC, Glasziou PP, Boutron I et al; Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. Br Med J 2014;348:g1687. doi: 10.1136/bmj.g1687.

Figure 1: Flow diagram of the results of the study selection procedure, in accordance with Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines.



Appendix 1: Search terms used (title and abstract)

Compression OR arthritis relief OR therapy OR therapeutic OR stretch OR pressure OR pressure gradient OR oedema OR edema OR Isotoner OR IMAK OR Lycra OR Thermoskin AND glove$ AND arthr* OR osteoarthr* OR rheumatoid arthr*.

Table 1: Quality ratings of included studies according to the PEDro methodology scoring system.

	1*	2	3	4	5	6	7	8	9	10	11	Total PEDro score	Risk of bias
Culic et al (1979) [36]	✓	✓	x	✓	x	x	x	✓	✓	✓	x	5	Moderate
Swezey et al (1979) [37]	✓	✓	x	x	x	x	x	✓	✓	✓	✓	5	Moderate
Dixon et al (1986) [38]	x	✓	x	x	x	x	x	x	✓	✓	x	3	High
Oosterveld & Rasker (1990) [11]	✓	✓	x	x	x	x	x	✓	✓	x	✓	4	Moderate

Key: 1 = PEDro Scale criteria; 1 = eligibility criteria were specified*; 2 = random allocation; 3= concealed allocation; 4 = similarity at baseline; 5 = blinding of participants; 6 = blinding of therapists; 7 = blinding of assessors; 8 = measures of at least one key outcome from at least 85% of participants initially allocated to groups;9 = intention to treat principle; 10= results of between group comparisons; 11 = point measures and measures of variability reported.

Criteria 1 = external validity*; criteria 2-11 = internal validity. Maximum score = 10 (as criterion 1 is not included in scoring).

Table 2: Description of study designs, participants, interventions, outcome measures and analysis methods.

Study Title	**Culic et al (1979) [36]**	**Swezey et al (1979) [37]**	**Dixon et al (1986) [38]**	**Oosterveld and Rasker (1990) [11]**
Study Design	Randomised crossover trial	Randomised crossover trial	Randomised crossover trial	Randomised crossover trial
Setting	Out-patients	Out-patient arthritis clinic	In- and out-patients	In- and out-patients.
Hand condition	Definite or classical RA; pattern of active disease stabilized as receiving non-steroidal anti-inflammatory drugs/ or gold salt injections.	RA with active synovitis of MCP and PIP joints; or HOA	Classical RA; or HOA.	Patients with definite or classical RA with symmetrically and diffusely swollen and painful hands
Exclusion criteria	Marked hand deformity or inactive disease	Carpal tunnel syndrome, tenosynovitis, Raynaud's Phenomenon or other arthritic disorders	Unspecified	Carpal tunnel syndrome and Raynaud's Phenomenon
Sample Size	N=24	N=15 (RA n= 10; HOA n= 5)	N=27 (RA n= 24; HOA n=3). Analyses reported only for 18	N=8

Study Title	**Culic et al (1979) [36]**	**Swezey et al (1979) [37]**	**Dixon et al (1986) [38]**	**Oosterveld and Rasker (1990) [11]**
			women with RA completing trial.	
Mean age (years)	Not reported Range: 28-74, only 5 < 50 years	Not reported	Not reported	65.3 (SD 10.9)
Female	74%	100%	100%	87%
Treatment	Nylon and spandex full finger Aris Stretch glove (% spandex not stated). Men's = 8.75 or 9.5 inches long; women's=10.5 inches long. Pressure = 12mmHg at fingers.	Pressure gradient full finger thermal glove (acrylic/wool/ 5% spandex; Jung International Co). Pressure = 28mmHg (fingers); 20mmHg (MCPs); 15mmHg (hands); 10mmHg.	Isotoner ® full finger compression glove ("polyester stretch fabric"; % spandex not stated). Pressure not stated.	Futuro ® full finger pressure gradient thermal glove (thermo yarn/ spandex; % spandex not stated). Pressure not stated.
Control	Loose fitting full finger CG: 8.5 inches long.	Non-stretch cotton full finger gloves: "more bulky, less tight fitting".	Close-fitting warpknit nylon full finger gloves.	Thermolactyl full finger gloves "promoting warmth without compression" (made by Damart).
Study duration	8 weeks	6 weeks	2 weeks	3 weeks

Study Title	**Culic et al (1979) [36]**	**Swezey et al (1979) [37]**	**Dixon et al (1986) [38]**	**Oosterveld and Rasker (1990) [11]**
Treatment schedule	• Gloves worn at night • One pair for 4 weeks and alternate pair for the second 4 weeks (order of CG and PG randomised). • No washout period. • Drug therapy constant	• Gloves worn at night • One pair for 1 week; washout period 1 week between gloves; alternate pair 1 week (order of CG and PG randomised). Schedule repeated twice. • Drug therapy constant	• Gloves worn at night • One pair 1 week, alternate pair 1 week (order of CG and PG randomised). • No washout period. • Drug therapy constant	• Not stated, presume gloves worn at night (as nocturnal pain measured) • CG on one hand and control glove on other hand for 1 week; washout period 1 week between gloves; hand glove wear reversed (order of CG and PG hand allocation randomised). • Drug therapy constant
Response rate	96% (n=23)	100% (n=15)	67% (n=18; all RA)	100% (n=8)
Measurement points	Baseline and weekly	Baseline and weekly	Baseline and daily (except Sundays)	Baseline and weekly.

Study Title	**Culic et al (1979) [36]**	**Swezey et al (1979) [37]**	**Dixon et al (1986) [38]**	**Oosterveld and Rasker (1990) [11]**
Subjective Outcome Measures:	Pain Night throbbing Morning stiffness, Swelling, Numbness/ heaviness Feeling better/ worse (All measures evaluated on a 7 point scale:+ 3 = much better to -3 = much worse)	General pain Individual hand pain General Stiffness Individual hand stiffness General health assessment, Overall arthritis assessment (All measures evaluated on a 6 point scale: 0=none; 1= mild; 2- = less than usual; 2 = usual; 2+ = more than usual; 3 = severe).	Pain (4 point scale: end points not specified) Duration of morning stiffness (minutes)	Nocturnal hand pain (0=no pain to 4=worse possible pain) Duration of morning stiffness (minutes)
Objective Outcome measures:	PIP joint circumference: jeweller's rings, mm) Hand volume (volumeter,cm), Grip strength (sphygmom-anometer,mmHg) Thumb-index finger pinch	PIP joint circumference: ring size (flexible plastic ruler, mm) Tender joint count (number) Grip strength (sphygmom-anometer, mmHg), Range of motion (fingertip to	PIP joint size (Geigy spring loaded loop, mm), Grip strength (sphygmom-anometer, mmHg) Dexterity (large and small solitaire boards)	PIP and thumb IP joint circumference: plus proximal phalangeal circumferences (Ciba Geigy gauge,mm) Grip strength (sphygmom-anometer, mmHg).

	(spring device, lbs) Finger dexterity (Purdue Pegboard)	palm, mm) MCP joint stiffness (no. repetitions can flex/ extend in 10 secs.) Palmar skin temperature (skin thermistor) Hand "function" (Purdue Pegboard – a measure of dexterity)		
Analysis	Analysis of variance: three factors = glove variable, patient, hand; plus 4th factor (finger) for finger measurements.	Two-way analysis of variance, controlling for individual hand differences	All measures re-scored as: +1 improved; 0 = no change; -1 deterioration for analysis. • Criteria for re-scoring not specified. Unpaired t-test	Unpaired t-test or Wilcoxon test as relevant

Key: CG = compression gloves; PG = placebo gloves; RA = rheumatoid arthritis; HOA = hand osteoarthritis; MCP = metacarpophalangeal; PIP = proximal interphalangeal. Note: spandex is termed elastane or Lycra in UK and Europe.

Table 3: A summary of the results of the treatment effects of compression gloves compared to placebo gloves in the reviewed studies.

Study Title	**Culic et al (1979): RA (n=23) [36]**	**Swezey et al (1979) RA (n = 10) [37]**	**Swezey et al (1979) HOA (n = 5) [37]**	**Dixon et al (1986) [high risk of bias] RA (n=18) [38]**	**Oosterveld and Rasker (1990). RA n=8 [11]**
Subjective measures:					
Nocturnal pain	CG significantly improved (0.75-0.89; "slightly better") vs. PG (0.26 – 0.40) ($p<0.01$).	**NS**	**NS**	**Pain and stiffness scores combined**: CG significantly more recorded as "improved" ($p<0.001$)	**NS:** CG and PG both similarly significantly improved
Stiffness	CG significantly improved (0.75 – 0.78: slightly better) vs PG (0.33-0.40) ($p<0.01$)	**NS**	**NS**	(see above)	CG and PG both similarly significantly improved
Morning stiffness (minutes)	na	na	na	na	CG and PG both similarly significantly reduced (CG 30 mins. vs PG 26 mins.)
Night throbbing	CG significantly	na	na	na	na

Study Title	**Culic et al (1979): RA (n=23) [36]**	**Swezey et al (1979) RA (n = 10) [37]**	**Swezey et al (1979) HOA (n = 5) [37]**	**Dixon et al (1986) [high risk of bias] RA (n=18) [38]**	**Oosterveld and Rasker (1990). RA n=8 [11]**
	improved (0.58-0.64: slightly better) vs PG 0.24-0.36) (p <0.01)				
Swelling	CG significantly improved (0.71-0.97, slightly better) vs PG (0.31-0.41) (p<0.01).	na	na	na	na
Numbness	CG significantly improved (0.61-0.63, slightly better) vs PG (0.33-0.37) (p<0.01).	na	na	na	na
Better/worse; or Overall arthritis/ health assessment	CG significantly more reporting slightly better/ better than PG (p<0.01)	**NS**	**NS**	na	na

Study Title	**Culic et al (1979): RA (n=23) [36]**	**Swezey et al (1979) RA (n = 10) [37]**	**Swezey et al (1979) HOA (n = 5) [37]**	**Dixon et al (1986) [high risk of bias] RA (n=18) [38]**	**Oosterveld and Rasker (1990). RA n=8 [11]**
Objective measures:					
PIP joint circumference (mm)	CG significantly reduced by average 0.7mm vs PG 0.2mm (p<0.05)	CG significantly reduced by average 1.15mm (p=0.04).	**NS**	**NS**	CG significantly reduced (CG: average 0.9mm vs PG 0.5mm) (p<0.001)
Hand volume	**NS**	na	na	na	na
No. tender joints	na	**NS**	**NS**	na	na
Grip strength (mmHg)	**NS**	**NS**	**NS**	CG significantly more recorded as “improved” (p<0.05)	**NS**
Pinch strength	**NS**	na	na	na	na
Range of motion	na	**NS**	**NS**	na	na

Study Title	**Culic et al (1979): RA (n=23) [36]**	**Swezey et al (1979) RA (n = 10) [37]**	**Swezey et al (1979) HOA (n = 5) [37]**	**Dixon et al (1986) [high risk of bias] RA (n=18) [38]**	**Oosterveld and Rasker (1990). RA n=8 [11]**
Finger dexterity	**NS**: Improved equally in CG and PG	**NS**	**NS**	**NS**	na
MCP stiffness	na	**NS**	**NS**	na	na
Palmar skin temperature	na	CG and PG both significantly increased temperature (approx. 1°C) compared to control (p<0.001)	CG and PG both significantly increased temperature (approx. 1°C) compared to control (p<0.001)	na	na

Key: CG = compression gloves; PG = placebo gloves; na = not assessed; NS = non- significant result.