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The effectiveness of joint-protection programs on pain, hand function, and grip strength levels in patients with hand arthritis: A systematic review and meta-analysis

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ABSTRACT

Study Design: Systematic review with meta-analysis.
Introduction: Joint protection (JP) has been developed as a self-management intervention to assist people with hand arthritis to improve occupational performance and minimize joint deterioration over time.
Purpose of the Study: We examined the effectiveness between JP and usual care/control on pain, hand function, and grip strength levels for people with hand osteoarthritis and rheumatoid arthritis.
Methods: A search was performed in 5 databases from January 1990 to February 2017. Two independent assessors applied Cochrane's risk of bias tool, and a Grading of Recommendations Assessement, Development and Evaluation (GRADE) approach was adopted.
Results: For pain levels at short term, we found similar effects between JP and control standardized mean difference (SMD; −0.00, 95% confidence interval [CI]: −0.42 to 0.42, $I^2 = 49\%$), and at midterm and long-term follow-up, JP was favored over usual care SMD (−0.32, 95% CI: −0.53 to −0.11, $I^2 = 0$) and SMD (−0.27, 95% CI: −0.41 to −0.12, $I^2 = 9\%$), respectively. For function levels at midterm and long-term follow-up, JP was favored over usual care SMD (−0.49, 95% CI: −0.75 to −0.22, $I^2 = 34\%$) and SMD (−0.31, 95% CI: −0.50 to −0.11, $I^2 = 56\%$), respectively. For grip strength levels, at long term, JP was inferior over usual care mean difference (0.93, 95% CI: −0.74 to 2.61, $I^2 = 0\%$).
Conclusions: Evidence of very low to low quality indicates that the effects of JP programs compared with usual care/control on pain and hand function are too small to be clinically important at short-, intermediate-, and long-term follow-ups for people with hand arthritis.

Introduction

Osteoarthritis (OA) is a degenerative joint disease that affects approximately 27 million adults and is ranked in the top three causes of disability in the United States.[1] The economic burden for OA, rheumatoid arthritis (RA), and other rheumatoid conditions in the United States were estimated to be approximately 128 billion dollars, which represent 1.2% of the 2003 US gross domestic product.[2] The Arthritis Alliance of Canada estimated that 1 million Canadians currently live with inflammatory arthritis.[3] In Canada, between 2008 and 2009, the socioeconomic cost of arthritis was over 4.4 billion dollars. About 80% of these costs were attributed to the unemployment and underemployment.[4] Pain from OA has a significant impact on the quality of life, work productivity, and

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in the usage of health-care resources among workers.[1] Recent evidence from a systematic review (SR) suggests that the reduction in health-care costs for services to manage arthritis is as necessary as the improvement of the quality of life of this patient population.[5]

The most common site of OA is the hand, and the most commonly described symptoms are pain, joint deformity, loss of grip strength, and loss of hand function.[6] RA can also affect small joints in the hands and may cause painful swelling, joint deformity, loss of joint function, and increased disability.[4] Conservative management of hand arthritis includes both pharmacological (eg, non-steroidal anti-inflammatory drugs) and nonpharmacological interventions, such as joint-protection (JP) programs, assistive devices, and exercises.[7,8] Currently, there is no cure for hand arthritis, but many rehabilitation interventions are targeting toward helping individuals to maintain functional performance with activities of daily living, mediate symptoms, and prevent deformities.

JP programs were initially developed for people with RA and had been expanded to treat patients with hand OA.[9] JP intervention includes education in altering working habits, use of proper joint and body mechanics by applying ergonomic principles, use of assistive devices and orthotics, and modifying functional performance and environments. It is often integrated with fatigue management and hand flexibility and strength exercises.[10] It has been suggested that JP for people with RA may reduce load and effort during activities of daily living. Therefore, it theoretically results in strain reduction on joint structures which have been weakened by the disease, pain mediation, irritation prevention of the synovial membrane, and reduction of local inflammation and fatigue. Also, it has been suggested that JP for people with hand OA is aiming to reduce loading on articular cartilage, strengthen muscle support, and improve shock-absorbing capabilities of joints.[10,11]

Two recent SRs[7,12] examined the effectiveness of JP on people with RA. Each study examined JP and provided recommendations from 5 randomized controlled trials (RCTs) and 3 RCTs, respectively.[7,12] Those 2 SRs reported strong evidence that JP may improve function[7] and reduce pain.[7,12] For people with hand OA, an SR found that programs of JP, advice, and home exercises are effective in improving grip strength and hand function.[13] Although those reviews provided valuable insights, they have important limitations. Both studies reported effects mostly as statistical differences and not as magnitude of the effects. Also, both reviews did not interpret and discuss the potential impact of risk of bias when they provided recommendations. Given the limited number of RCTs that were included for JP for people with hand OA and RA, an appraisal of the most recent evidence is needed. Therefore, the objective of this SR is to evaluate the effectiveness of JP programs compared with usual care/no JP/advice on pain reduction and improvement of hand function for individuals with hand arthritis.

Methods

Search strategy

An electronic search was performed to identify RCTs in PubMed, Google Scholar, CINAHL, PEDro, and EMBASE from January 1990 to February 2017. Several different combinations of keywords were used, such as “rheumatoid arthritis” or “osteoarthritis” or “joint protection” or “hand osteoarthritis” or “self-management and osteoarthritis”. The complete search strategy is summarized in Appendix 1. The references of SRs and overviews found in the electronic search were then hand-searched to retrieve further RCTs.

Inclusion/exclusion criteria

RCTs were eligible for inclusion if they fulfilled the following criteria: (1) RCTs that included people with RA or hand OA, (2) those that included patients who received JP,[10,11] (3) those in which outcome measures were adequately reported. Studies were excluded if they were not written in English and they only examined a specific component of JP such as an assistive device or orthosis or just hand exercises without JP advice.

Study selection

Two independent reviewers (P.B. and M.S.) performed the electronic search to screen relevant articles based on title and abstract. After duplications were removed, inclusion criteria were applied to retrieve the articles for a full-text review. Disagreements were resolved using a consensus method via a third reviewer (J.C.M.).

Data extraction

Two independent researchers (P.B. and M.S.) extracted the data from the included RCTs. A third person checked the data extraction (J.C.M.). Data extraction included the following information: (1) author, (2) year, (3) study population, (4) sample size, (5) intervention method, (6) primary outcome measures, (7) secondary outcome measures, (8) results, and (9) recommendations made by authors (if any). We categorized the follow-up periods as short term (3-4 months or less), midterm (6-8 months), and long term (12 months or more).

Missing data from included studies

When values (mean and standard deviation [SD]) were not available, an attempt was made to contact the corresponding authors to request for the data. In addition, we searched other tables from previous SRs to identify means, and SDs of the included RCTs to facilitate our data analysis.

Risk of bias assessment

Two reviewers (P.B. and M.S.) independently assessed the risk of bias of each RCT. If there was a disagreement, consensus came from a third reviewer (J.C.M.). The risk of bias assessment was performed with Cochrane Collaboration’s tool[14] that contains seven domains (random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other bias) to score sources of bias. Each domain can be rated as “low risk of bias,” “unclear risk of bias,” or “high risk of bias.” The interpretation of this tool is as follows: (1) low risk indicates that if bias is present, results will be unlikely to be altered; (2) unclear risk of bias induces some doubts surrounding the results of the study; and (3) high risk of bias indicates that bias may change the results seriously.[14] Publication bias was planned to be assessed with funnel plots if more than ten studies were pooled.[15]

Assessing the quality of individual RCTs

The GRADE guidelines for SRs were used to evaluate the quality of individual RCTs related to five outcomes: hand function/functional ability, grip strength, and pain/hand pain levels.[16-21] GRADE approach includes the rating of the quality of evidence such as study limitations, risk of bias, publication bias, imprecision, and indirectness.[16-20] The rating of the quality of individual RCTs per outcome across trials was carried out to summarize the extent of our

confidence that the estimates of the effect were correct. This GRADE approach resulted in an assessment of the quality of each RCT for each outcome across trials as high, moderate, low, or very low.[16-20] The domains of GRADE approach that may decrease the quality of evidence are as follows: (1) imprecision, (2) indirectness, (3) limitations in study design, (4) inconsistency, and (5) reporting bias. An optimal information size (OIS) was calculated to define the minimum amount of sample size needed for precision in the meta-analysis.

Summary measures

To interpret our data, a standard deviation of 0.5 points for pain and function was used to indicate clinical importance.[22] We analyzed outcomes at short-term (3-4 months), midterm (6-8 months), and long-term (12 months) follow-ups.

Subgroup analysis and exploring heterogeneity

In the presence of clinical or statistical heterogeneity (ie, χ^2 with $P < .05$ and $I^2 > 50\%$),[14] we planned to perform the following subgroup analyses (a priori): trials at low risk of bias (low risk of bias in allocation concealment and blinding of outcome assessor if objective outcomes were used) and type/duration of the JP program received.

Synthesis of results

We performed six meta-analyses of trials comparing JP programs vs. usual care/control in patients with RA using the outcomes function, pain, and grip strength at short-term, midterm, and long-term follow-ups. When necessary, data direction was adjusted appropriately to reflect improvements in pain reduction and functional ability. We used the Review Manager 5.3 (RevMan 5.3) software to conduct our review and a random-effects model to pool outcomes. For outcomes of the same construct that were measured using a different metric, we used the standardized mean difference (SMD). If all eligible trials measured an outcome using the same metric, we used a weighted mean difference.

Results

Characteristics of included studies

Initially, 8837 articles were identified (Pubmed: 4161; EMBASE: 1403; Google Scholar: 3016; CINAHL: 104; PEDro: 49). After removal of duplicates, 6027 articles were then excluded (4420 nonhand wrist population, 1376 not talking about JP). Of the 29 studies that were deemed relevant from the abstract, 17 met our inclusion criteria and were included in the analysis (Fig. 1). JP programs were examined in 3 RCTs for hand OA and in 14 RCTs for patients with RA. The characteristics of the included RCTs are summarized in Table 1.

Excluded studies

Of the 29 studies that were deemed relevant for a full-text review, 12 articles were excluded for the following reasons:

1 Ineligible study design—nonrandomized studies ($n = 1$; Boustedt et al, 2009[23])
2 Used same data/participants with included RCT ($n = 1$; Oppong et al, 2015[24])
3 Ineligible population—RCT ($n = 1$; Maggs et al, 1996[25])
4 Ineligible intervention—RCT ($n = 7$; Grønning et al, 2014;[26] Grønning et al, 2012;[27] Lorig et al, 2009;[28] Barlow et al, 2008;[29] Brus et al, 1998;[30] Taal et al, 1997;[31] Fries et al, 1997[32])

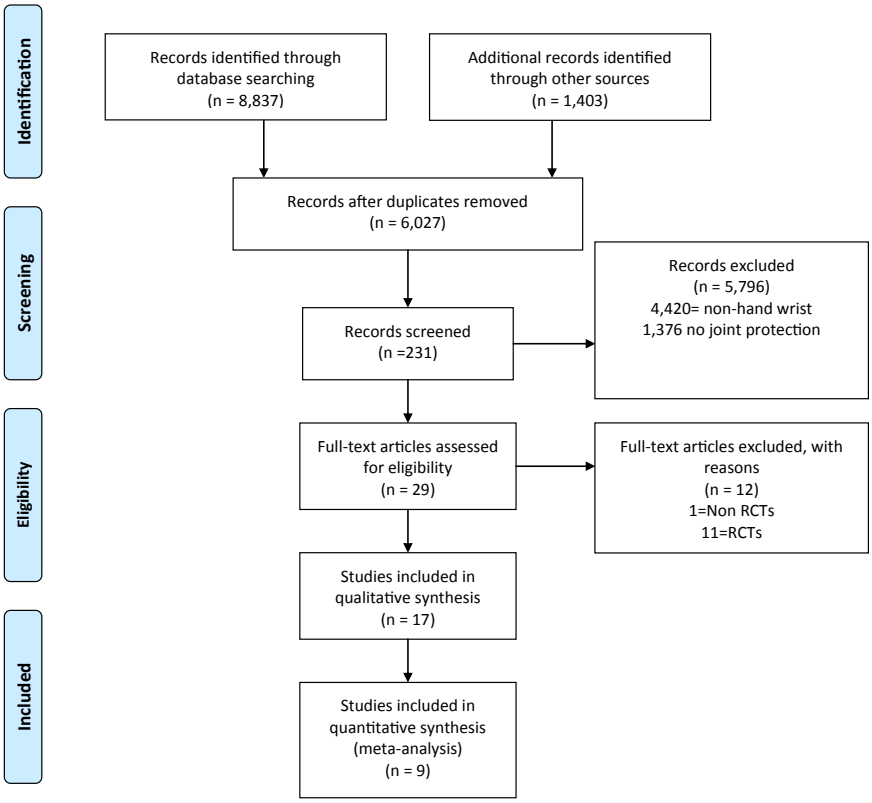

Fig. 1. Flow diagram. RCT = randomized controlled trail.

Table 1
Summary of the included studies

Study	Population	Groups	Outcomes	Follow-ups	Experimental group	Comparison group
Williams, 2015	$n = 490$ (374 women) Rheumatoid arthritis Age (y) = experimental: 61.3 (standard deviation [SD]: 12); control: 63.5 (SD: 11)	Hand exercise plus usual care vs. usual care	-Overall hand function subscale of the Michigan hand outcome questionnaire (MHQ), (0-100) higher indicating better performance -Pain subscale of MHQ (0-100; a high score is worse) -Grip strength (Newton)	4 and 12 months	-Assessment and advice session plus five 30- to 45-minute exercise sessions spread over 12 weeks l content of usual care arm treatment. -An exercise program aiming to improve strength, mobility, and dexterity (including four strength -Exercises for the hand and seven mobility exercises for all the upper limb joints -A home exercise plan with exercises performed daily -A standardized protocol for progression or regression -Strategies to improve program adherence including exercise diaries -No resting orthotic devices; no manual therapy or electrotherapy; assessment and treatment documented using a standardized log.	-Individual appointment(s) with a therapist (number of sessions dependents on clinical need, up to a maximum of three sessions or 1.5 h in total) -Joint-protection (JP) advice -Provision of arthritis research Campaign (ARC) booklets containing further advice and exercise information -Functional splinting as deemed necessary by the therapist -Assistive devices as required -No resting orthotic devices provided, no explicit exercise prescription, no manual therapy (ie, joint mobilizations) or electrotherapy assessment and treatment documented using a standardized log
Dziedzic, 2013	$n = 257$ (women 66%) Hand osteoarthritis (OA) Age (y) = leaflet and advice: 67.2 (SD: 9.5), JP: 65.5 (SD: 8.6), hand exercises (Hex): 64.5 (SD: 9), JP and Hex: 66 (SD: 9.3)	(1) JP vs no JP (2) Hand exercises vs JP and hand exercises combined	-Average pain severity over the past 3 days (0-10 numerical rating scale) -Australian/Canadian (AUSCAN) Osteoarthritis Hand Index function (0-36) -Grip strength (kg)	3, 6, and 12 months	For the remaining 75% of participants, in addition to receiving the leaflet, they received one of three interventions: JP, hand exercises, or a combination of the two. The interventions were all delivered over four group sessions (held once a week) by nine occupational therapists (OTs) in two hospital centers. OTs were rotated every 3 months to minimize the potential for bias. The rotation order was determined by the OT's availability to deliver the specific intervention. Groups included up to six participants and lasted for a maximum of 1 h (1.5 h for the combined intervention). Treatment session duration and participant attendances were recorded by the OTs on case report forms (CRFs). Attendance adherence was audited by the study coordinator (SH), and was defined (a priori) to be per protocol if participants attended: Session 1, 2, 3, and 4; sessions 1, 2, and 4; sessions 1, 3, and 4; or sessions 1 and 4. Any participant unable to attend week 1 was booked on to the following course.	All participants were given standardized written information on self-management approaches for hand OA, including general information on looking after hand joints and using analgesia (reproduced with permission from the arthritis research UK leaflets 'Looking after your joints when you have arthritis and osteoarthritis,' respectively, (http://www.arthritisresearchuk.org/) and the National Institute of health and care Excellence (NICE) good practice guidelines. Participants were advised to continue with any self-management approaches they were currently using and were given advice to consult their general practitioner if symptoms continued to be troublesome. For 25% of participants, this was the sole intervention.
Dilek, 2013	$N = 46$ (40 women) Hand OA Age (y) = experimental: 58.87 (SD: 9.47), control: 59.95 (SD: 8.71)	Paraffin bath therapy plus JP vs JP	-Pain (visual analog scale) (0-100; a high score is worse) -AUSCAN function -Grip strength (Jamar) (kg)	3 weeks and 3 months	Experimental group treated with dip-wrap paraffin bath therapy and JP. The temperature of the paraffin bath was 50°C. Patients dipped both hands into the paraffin, removed them, and waited for the layer of paraffin to harden and become opaque. Then they redipped both the hands. These steps were repeated 10 times. When the last layer hardened, their hands were wrapped within a plastic bag and covered with a towel. They then waited for 15 min until the paraffin cooled. A physiotherapist (PT) in the Department of Physical Medicine and Rehabilitation in the university hospital conducted these treatments 5 days per week for a period of 3 weeks.	Control group received JP techniques

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Table 1 (*continued*)

Study	Population	Groups	Outcomes	Follow-ups	Experimental group	Comparison group
Hammond, 2008	$n = 218$ (108 women) Rheumatoid arthritis Age (y) = experimental: 55.56 (SD: 13.10); control: 55.29 (SD: 11.84)	Standard program vs modular cognitive −behavioral approach program (the LMAP)	-Pain (visual analog scale) (0-100; high score is worse) -HAQ assessing functional ability (0-3 scale)	6 and 12 months	The LMAP included two modules, each with four 2.5-h meetings and one 2-h review meeting. To standardize program delivery, a two-day training course for each module (led by A.H.) was completed by therapists. This explained: evidence for program interventions; patient education and behavioral change methods; tips for good teaching practice (eg, voice modulation, eye contact, open questions, reflecting back, positive feedback); program structure; and role-play of sessions emphasizing group processes, teaching techniques, and skills teaching. A.H. delivered a program observed by the therapists. The therapists were then observed delivering a program and given feedback on performance. Module manuals enabled adherence to program content. Participants could attend the two LMAP modules and review meeting over a 3- to 9-month period, as convenient to them. Six people could attend module 1 ('Looking after your joints'), 7−10 could attend module 2 ('keeping Mobile and managing pain and Mood'), and up to 12 could attend the review meeting. Each meeting included self-monitoring, skills training with individualized feedback and advice, goal-setting and action-planning to follow individually determined home activity and exercise programmes working toward recommended frequency targets.	A standard program consisted of five 2-h meetings including talks each week from a different member of the team and group discussion. Meeting 1 included: What is arthritis, how it affects joints and other parts of the body, drug treatments and tests, and managing arthritis (rheumatology nurse and consultant rheumatologist); Meeting 2: exercise (including stretch program with 30-min demonstration and practice), rest, posture and pain management (using heat and cold, transcutaneous electrical stimulation [TENS], massage) (PT); Meetings 3 and 4: JP (including 45-min demonstration and practice), managing fatigue, aims of splinting, managing stress and relaxation (45-min practice), foot care (OT); Meeting 5: healthy diet, complementary therapies, social security benefits, and open discussion (nurse, OT, PT, social worker). Usually the same OT attended each week to facilitate discussion and program management. Relevant arthritis research campaign and arthritis care booklets were provided. Eight to 12 people were invited to attend each program.
Quintrec, 2007	$n = 208$ (177 women) Rheumatoid arthritis Age (y) = experimental: 55.32 (SD: 11.80); control: 54.31 (SD: 14.37)	Educational intervention program vs. usual care	Functional status, health assessment questionnaire (HAQ) (0-3), 0 (no functional limitation) to 3 (serious functional limitation	12 months	An intensive education program was proposed to deliver a large quantity of information about the disease and the treatment but also to point the possibilities to reduce pain and stress at home, to understand how to use nonchemical treatment (eg, physical activities or sports, social and professional behaviors, and nutritional advice). The interactive multidisciplinary education program consisted of passive information on the disease, on medical treatment, and on lifestyle advice concerning diet, but also included information on active coping strategies, JP, relaxation, and physical exercise, with the teaching of an exercise program to be followed at home. Sessions were conducted on Thursdays for 6 h for 8 consecutive weeks.	Usual care
Masiero, 2007	$n = 85$ (57 women) Rheumatoid arthritis Age (y) = experimental: 54.2 (SD: 9.8); control: 52.2 (SD: 11.9)	Drug treatment (with infliximab) with educational-behavioral JP training vs drug treatment (with infliximab) only	-Pain (visual analog scale) (0-100; a high score is worse) -Functional status was evaluated using the HAQ, which is an ordinal score measure (range: 0-3)	8 months	The experimental group continued with their usual drug treatment (with infliximab) in the follow-up months, but additional educational-behavioral JP training was provided. This training consisted of four meetings based on approximately 3-h sessions, every 3 weeks, for groups of 4-6 patients at a time, with one or more family member (the patients were encouraged to bring a partner). The education methods used were group discussion, problem-solving, guided practice, and lectures designed to facilitate understanding of the program. At the beginning of each session, feedback was provided, and the results of and problems with home practice were discussed. At the end of each meeting, patients received an illustrated brochure on the program meeting with a home guide.	The control group patients received only anti−TNF-α drugs (infliximab) and continued with their usual drug monitoring and medical management regimen in the follow-up months, but no physiotherapy, occupational therapy, or other additional treatments were performed or permitted

O'Brien, 2006	$n = 67$ (46 females) Rheumatoid arthritis Age (y) = group 1: 62.3 (SD: 9.95); group 2: 57.3 (SD: 8.24); group 3: 59.5 (SD: 12.92)	JP leaflet with hand-strengthening and hand-mobilizing exercises vs JP leaflet with hand-mobilizing exercises vs JP leaflet	-Arthritis impact measurement Scales II (AIMS II; upper limb, and hand and finger function subscales) subscales score range 5–25 (25 indicating severe functional difficulties). This score was then normalized so that the potential range of scores was 0–10, where higher scores indicate more problems. -Grip strength (Jamar) lbs	1, 3, and 6 months	Group 1 received JP and additional instruction on how to perform a total of eight simple strengthening and mobilizing (stretching) 'tendon gliding' exercises. These encouraged a maximum range of movement of all small joints of the fingers, thumb, and wrist, as well as radial finger walking (fingers moving toward the radius only, thus avoiding exacerbating ulnar deviation), pinch grip exercises, strengthening the intrinsic and thenar eminence muscles (using a towel) and wrist extensor muscle groups with a 'Theratubes' resistive band (Promedics, UK). Group 2 participants received the JP leaflet together with a set of eight stretching exercises, without any specific strengthening exercises. Exercises included wrist flexion, extension and circumduction, pronation and supination, radial deviation, as well as global flexion and abduction of all finger joints, thumb opposition, and interphalangeal flexion to the end of the possible range.	JP leaflet which covered the basic principles of JP, energy conservation, 'top tips' relating to personal and household activities, postural advice, types of splinting, and issues related to sexuality
Hammond, 2004	$n = 127$ (46 women) Rheumatoid arthritis Age (y) = experimental: 51 and control: 52	Standard program vs educational-behavioral JP program	-Pain (visual analog scale) (0-100; a high score is worse) -The AIMS II was used to assess activities of daily living (ADLs) (0-10, where 0 indicates good function) -Grip strength (kg)	24 months	The educational-behavioral JP consisted of four 2-hour weekly meetings. The educational-behavioral JP program applied educational, behavioral, motor learning, and self-efficacy–enhancing strategies to increase adherence.	The education consisted of four 2-hour weekly meetings. The standard program included talks from the rheumatology teams on: rheumatoid arthritis (RA), drug treatments, diet, exercise, pain management, relaxation, and JP.
Hammond, 2002	$n = 30$ (27 women) Rheumatoid arthritis Age (y) = 52.3 (SD: 12.08)	Group 1: Education first vs Group 2: Education second	-Pain (visual analog scale) (0-100; a high score is worse) -HAQ (0-3), with higher scores indicating poorer functional ability. -Grip strength (Jamar)	3 and 6 months	The 'Looking after your joints' program included information about RA and disease management, JP, and energy conservation education. About 5 h of JP practice was included, using motor learning, mental rehearsal, problem-solving, and behavioral methods, with the setting of weekly goals to practice JP methods at home. It also included self-efficacy and adherence-enhancing strategies. Structured teaching methods were used to enhance recall, such as explicit categorization, repetition, checking understanding by asking regular questions and structured visual aids. An information pack and a workbook were provided, containing summaries of the four sessions and a home program, as well as other information about the disease, its management (including drug therapy), exercise, rest, energy conservation, and splinting; these were also briefly discussed in the program.	Same as experimental group

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Table 1 (*continued*)

Study	Population	Groups	Outcomes	Follow-ups	Experimental group	Comparison group
Stamm, 2002	$N = 40$ (40 women) Hand OA Age (y) = experimental: 58.87 (SD: 9.47); control: 59.95 (SD: 8.71)	JP and home hand exercises (JPE group) vs information session about hand OA	-Pain (visual analog scale) (0-100; a high score is worse) -HAQ -Grip strength (Martin vigorimeter)	3 months	The JPE group received oral and written instruction for JP and a home hand exercise program, which was to be performed daily throughout a study period of 3 months. The following principles were explained during the JP instruction: the need for balance between movement and resting a joint; dividing stress between as many joints as possible; using larger and stronger joints; using each joint in its most stable plane to reduce pressure on the joint; avoiding staying in one position; and avoiding vibrations for the finger joints. In addition, patients were trained to protect their joints, using assistive devices, if necessary, to perform activities of daily living (ADLs). Patients were trained to do the following activities in a protective way: (1) wringing a cloth; (2) using enlarged grips for writing; (3) opening jars, cans, or boxes with Dycem; (4) using a book holder for reading; and (5) using a rocker or angled knife for cutting food. Patients were encouraged to find examples for application of these principles in their own daily activities, which were discussed. Oral and written information was provided. The JP instruction and ADL training took 30 min for each patient. The exercise program consisted of 7 exercises: (1) making a fist, (2) making a small fist (flexing the PIP and DIP joints only), (3) flexing the MCP joints while keeping the PIP and DIP joints stretched, (4) touching the tip of each finger with the tip of the thumb while keeping each finger flexed, (5) spreading the fingers as far as possible with the hand lying flat on a table, (6) pushing each finger in the direction of the thumb with the hand lying flat on a table, and (7) touching the MCP V joint with the tip of the thumb.	The control group was given oral and written information about hand OA to ensure that these persons also received proper attention. The information about hand OA included information on joint anatomy and pathogenesis of OA. During this session, each control person also received a piece of Dycem (nonslip matting), which they were told to use for opening jars throughout the period of 3 months. Duration of this session was 20 min.
Hammond, 2001	$n = 127$ (46 women) Rheumatoid arthritis Age (y) = experimental: 51.56 (SD: 9.73); control: 49.49 (SD: 11.49)	Standard program vs educational-behavioral JP program	-Pain (visual analog scale) (0-100; a high score is worse) -Function the AIMS II scales 0 to 10, with 0 representing good function -Grip strength (Jamar)	6 and 12 mont1hs	The JP program was based on the health belief model and the theories of social learning and self-management and was conducted by an experienced rheumatology OT. Between three and six participants usually attended, and with partners included, the numbers were between four and eight. Participants were provided with an information pack and workbook detailing the principles of JP, with photographs of a range of JP methods. The program applied educational, behavioral, motor learning and self-efficacy−enhancing strategies to increase adherence to the JP program, as well as a range of educational methods to match different group members' learning styles. Two-thirds of the program was spent practising hand-JP methods in small groups with feedback on performance from each other and the group leader. People were shown a range of options for task performance, so that they could select which methods worked best for them. Education programmes were of 8 h of duration over four afternoon or evening sessions of 2 h each	The standard program included short talks from nursing, medical, occupational therapy, and physiotherapy staff on the following: (1) RA; (2) drug treatments; (3) alternative therapies and diet; (4) exercise, rest, and positioning; (5) energy conservation; (6) JP; (7) assistive devices; (8) splinting; (9) pain and relaxation; and (10) other methods of controlling pain (eg, heat and ice). Some demonstrations and practise of exercise, JP, and relaxation were included (15-45 min for each). Meetings allowed time for discussion, and information leaflets were provided. Education programmes were of 8-h duration over four afternoon or evening sessions of 2 h each

Helliwell, 1999	$n = 77$ (51 women) Rheumatoid arthritis Age (y) = experimental: 55 and control: 56.5	Educational program vs control	-HAQ (0-3)	1 and 12 months	The education classes took place over 4 weeks in four afternoon sessions lasting 2 h. Subjects were encouraged to bring a partner, although this happened infrequently. For people who were still working or who preferred to come with a partner, evening sessions were arranged. The format of the sessions was a talk from a nonmedical health professional using overhead projection, a discussion period, and the distribution of supporting literature. The content of the sessions included the pathophysiology of rheumatoid arthritis, drug treatments, local treatments, mechanisms and control of pain, stress, exercise and rest, JP, task allocation, splinting and assistive equipment.	Not reported/no details
Scholten, 1999	$n = 68$ (53 women) Rheumatoid arthritis Age (y) = 48.3 (SD: 5.6)	Arthritis training program vs control	HAQ (0-5), 0 represents good function	12 months	The following fields were covered: (1) pathogenesis and mechanisms of RA; (2) benefits and limitations of drug therapy; (3) the impact of physiotherapy; (4) practical exercise in remedial gymnastics aimed at relieving pain and muscle tension; (5) the use of JP devices; (6) orthopedic perspectives including methods and indications of JP; (7) psychological counseling including coping strategies, Jacobson stress management, and relaxation exercise; (8) 20 dietetics, (9) information about unproven cures, and (10) social assistance to improve the patients' utilization of public social resources. Psychological counseling emphasized a general sense of control or efficacy, and skill in coping with variability of the disease and its sequelae. Training in the proper execution of remedial gymnastics was offered, and advice on JP was included in the program. The aim of the exercise practice sessions was to keep the patients mobile by feasible therapeutic exercises, preserving the axis of the joints destroyed by RA and by reinforcing the weakened muscles. Within a daily l0-minute training program, nearly every joint had to be moved in the right position and direction. The patients were taught performance of everyday activities and how to use auxiliary devices such as special scissors or knives. The importance of wearing orthotic devices at night or during manual activities was emphasized.	Control/no additional details
Hammond, 1999	$n = 35$ (29 women) Rheumatoid arthritis Age (y) = 55.17 (SD: 9.39)		-Pain (visual analog scale) (0-100; a high score is worse) -HAQ (0-3) -Grip strength (Smith and Nephew Rolyan Digital dynamometer)	3 and 6 months	The JP group education program consisted of four weekly 2-h sessions plus an optional home visit within 2 weeks of the end of the program. It was led by an experienced rheumatology OT. Partners or significant others were invited to attend. Between four and eight people attended each program. A teaching manual was followed throughout to standardize the program content and delivery. Patients were provided with a workbook 'managing your arthritis: Joint care Workbook', 'Coping with rheumatoid arthritis' and patient education leaflets produced by the Arthritis and Rheumatism Council (ARC) such as 'rheumatoid arthritis', 'your home and your Rheumatism', 'exercise and arthritis', 'Drug therapy', 'Gardening and arthritis', and 'Diet and arthritis'. The ARC videotape 'Help is at hand—getting the better of your arthritis' is shown at the first meeting to promote discussion of members' own alternate methods and gadgets they found useful, as well as on the impact of living with arthritis.	Control/no further details

(*continued on next page*)

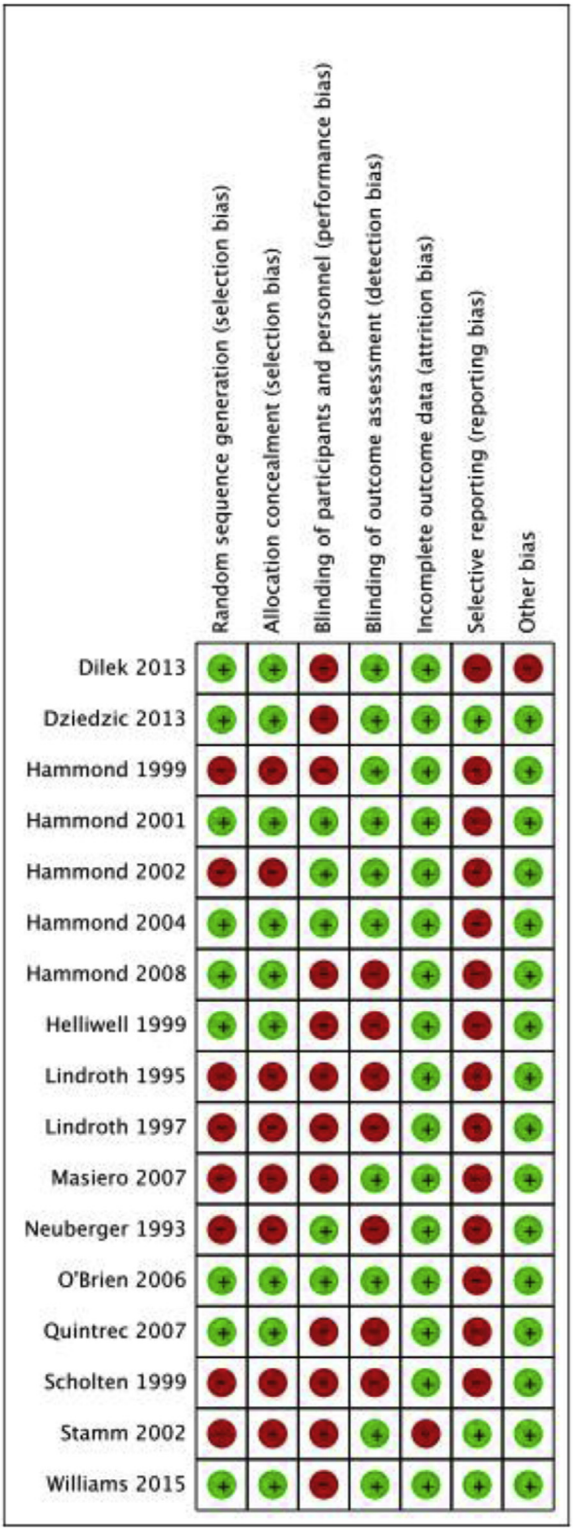
Table 1 (*continued*)

Study	Population	Groups	Outcomes	Follow-ups	Experimental group	Comparison group
Lindroth, 1997	$n = 100$ (84 women) Rheumatoid arthritis Age (y) = 55.17 (SD: 9.39)	Education program vs control	-Pain (visual analog scale) (0-100; a high score is worse)	3 and 12 months	A handbook for patients presented facts about each session. During 8 sessions, 2.5 h once a week, group discussions were led by a team of health-care professionals. The group members were encouraged to understand the terms of the disease process, such as inflammation, seropositive, erosion, and anemia. In the session on therapy, a nurse led discussions about medication, surgery, and alternative treatments. Diet, fasting, and basic nutrition were discussed with a dietitian. The session led by a PT concentrated on pain management by rest, exercise, and relaxation. Acupuncture and other forms of nonpharmaceutical pain relief procedures were discussed. Home exercise was explained by addressing the topics of why, how, when, and how much. The OT discussed problems related to hand function, hand program, and technical aids used to alleviate hand problems.	Control/no further details
Lindroth, 1995	$n = 92$ (84 women) Rheumatoid arthritis Age (y) = experimental: 64.8 (SD: 13.6); control: 63.5 (SD: 14.5)	Education program vs control	-Pain (visual analog scale) (0-100; a high score is worse) -HAQ (0-12)	12 months and 5 years	Six sessions, 2 h each, focused on medical aspects, pain management, available treatments, stress management, self-awareness and communication skills, exercise, JP, and work-simplification practices	Control
Neuberger, 1993	$n = 53$ (35 women) Rheumatoid arthritis Age (y) = 52.56 (SD: 14.32)	Group 1 (experimental)—LARA (self-instructional program) Group 2 (experimental) LARA and range of motion (ROM) exercises and JP practices (JPPs) Group 3 (experimental) LARA, ROM exercises, and JPP Group 4 (control)	-Pain analog scale) (0-10; a high score is worse)	4 months	The self-instructional program LARA was used in this study. Practice time consisted of 10- to 20-min time periods, in which a subject gave a return demonstration of ROM exercises to the investigator. Another 10- to 20-min time period, on a different clinic visit, was provided for the subject to give 3 return demonstration of tasks using JPPs. The effectiveness of the unit on JP was further tested by asking subjects to perform four tasks: (1) drinking from a coffee mug, (2) carrying a handbag, (3) moving a pot with a handle from one flat surface to another 2 feet away, and (4) transferring a book from one flat surface to another 2 feet away. One point was assigned to each task performed satisfactorily, with a possible sum total of four points. These tasks were performed by the experimental group and after reading the third unit of the instructional program on rest, pacing, and JP.	Did not read the instructional program but received the same attention time from the investigators.

LMAP = modular cognitive–behavioural approach programme; TNF = tumor necrosis factor; LARA = Learning about Rheumatoid Arthritis; PIP = proximal interphalangeal joints; DIP = distal interphalangeal joints; MCP = metacarpophalangeal joints.

5 Both the groups examined the same JP intervention with a different approach—RCT ($n = 2$; Niedermann et al, 2012;[33] Niedermann et al, 2011[34])

Table 2
Risk of bias summary: review authors' judgments about each risk of bias item for each included study



Key: Low risk of bias (green plus mark), High risk of bias (red plus mark).

Risk of bias and quality assessment

Overall, all the 17 studies were judged to be at high risk of bias (Table 2) (Fig. 2). Selection bias, performance bias, and reporting bias were the main contributors that influence our results (Fig. 2). Funding sources were reported in the majority of the included RCTs. Quality assessment ranged from very low to low, and most of the studies were downgraded for imprecision and high risk of bias. The summary of the findings is presented in Table 3.

Selection bias

Randomization and allocation concealment were not reported appropriately in many of the studies and were the main reason that studies were rated as high risk. More specifically, randomization sequence generation and allocation concealment were rated as high risk in 8 studies, whereas nine studies rated them as low risk (Table 2).

Performance bias

Blinding of participants and personnel was rated as high risk in 12 studies because the blinding procedure was not performed adequately. Only five studies were rated as low risk, and they managed to blind the participants and providers effectively (Table 2).

Detection bias

The majority of the studies (10 RCTs) were rated as low risk, and they managed to blind the outcome assessor effectively. Seven studies were rated as high risk because the blinding of the outcome assessor could not be achieved (Table 2).

Attrition bias

Sixteen studies were rated as low risk for attrition bias, and only one was rated as high risk. The RCT that was rated as high risk did not report any dropouts and did not report if all the participants were analyzed after randomization (Table 2).

Reporting and other bias

Most of the studies (16 RCTs) reported the timing of outcome assessment. The description of cointerventions was unclear in 16 studies because of poor reporting, and only 2 RCTs[9,35] performed trial registration and published their protocol. Seven studies[36-42] did not report their sources of funding, and only 2 studies[9,35] reported adverse effects (Table 2).

Publication bias

We assessed publication bias for the meta-analysis of pain and function outcomes (Figs. 3 and 4). The asymmetrical funnel plot (Fig. 4) demonstrates that the smaller RCTs produced exaggerated treatment effects.

Participants

Data from a total of 1847 participants with hand arthritis were included in this SR. The majority of them ($n = 1504$) have been clinically diagnosed with RA, and only 343 participants were diagnosed with hand OA. The average age of the participants with hand OA was 61 years, and 70% or more were women. The average age of the participants with RA was 62.8 years, and more than 70% of the sample comprised women.

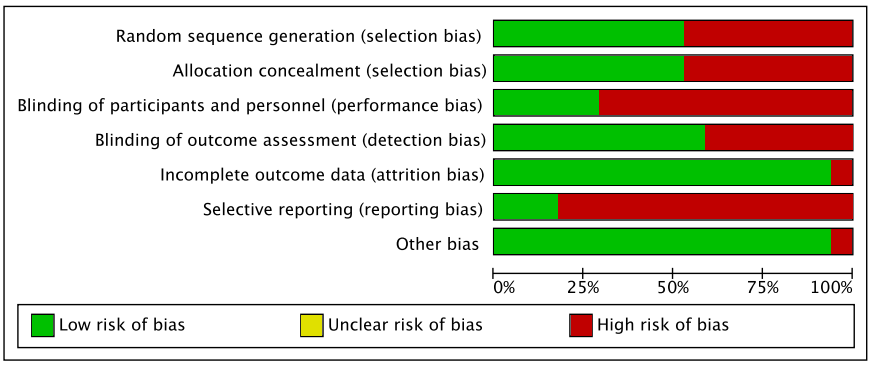


Fig. 2. Risk of bias graph.

Interventions

Studies included in this SR compared JP programs that had an exercise component or the participants received instruction on exercise or JP education, and either was administered individually or to a group and was mostly delivered by an occupational therapist. Comparisons consisted of no treatment, advice, usual care, and patient education. Treatment dose and frequency varied a lot across the studies, but typically it was on average 3 to 5 times per week from 45 min to 1.5 h. A summary of the interventions and comparators is presented in Table 1.

Outcomes

Outcomes of interest that were extracted from the included studies were pain levels[9,35-37,39,40,43-49] and were examined with the following outcome measures: (1) Michigan Hand Outcome Questionnaire pain subscale (0-100), with lower scores indicating better pain scores; (2) Numerical Rating Scale (0-10), in which a higher score is worse; and (3) Visual Analog Scale (VAS) (0-100 mm), in which a higher score is worse. Self-report hand function[9,35-43,45,47,48,50] was assessed with the following outcome measures: (1) Michigan Hand Questionnaire (0-100), with higher scores indicating better performance; (2) Australian/Canadian (AUSCAN) Osteoarthritis Hand Index (0-36); (3) Health Assessment Questionnaire (range from 0 to 3), a higher score is worse; and (4) Arthritis Impact Measurement Scales II (AIMS II; upper limb and hand and finger function subscales), subscale scores range from 5 to 25 (25 indicating severe functional difficulties). Grip strength[9,35,36,44-48] levels were assessed using a Jamar hand-held dynamometer and a Smith and Nephew Rolyan Digital Dynamometer.

Effects of interventions on RA

Short-term effects of interventions on pain levels

Three studies were pooled to examine the short-term effect of a JP program vs. usual care on pain levels. We found similar effects between JP programs and usual care/control (very low quality, 3 RCTs, 548 participants with RA, SMD: −0.00, 95% confidence interval [CI]: −0.42 to 0.42, $I^2 = 49\%$). The analysis is illustrated in Figure 5.

Midterm effects of interventions on pain levels

Three studies were pooled to investigate the midterm effects of a JP programs vs. usual care/control on pain levels. We determined that JP was favored over control (very low quality, 3 RCTs, 358 participants with RA, SMD: −0.32, 95% CI: −0.53 to −0.11, $I^2 = 0$). The analysis is summarized in Figure 5.

Long-term effects of interventions on pain levels

Four studies were pooled to examine the long-term effects of JP programs vs. usual care/control on pain levels. We determined that JP was superior when compared with control (low quality, 4 RCTs, 857 participants with RA, SMD: −0.27, 95% CI: −0.41 to −0.12, $I^2 = 9\%$). The analysis is presented in Figure 5.

Short-term effects of interventions on function levels

Only one study reported values of the function that we could calculate the SMD. We found that the JP intervention was superior when compared with usual care (very low quality, 1 RCT, 451 Participants with RA, SMD: 0.18, 95% CI: −0.01 to 0.36).

Midterm effects of interventions on function levels

Three studies were pooled to investigate the midterm effects of JP vs. control on function levels. We determined that intervention groups were superior over control (very low quality, 3 RCTs, 358 participants with RA, SMD: −0.49, 95% CI: −0.75 to −0.22, $I^2 = 34\%$). The forest plot is illustrated in Figure 6.

Long-term effects of interventions on function levels

Six studies were pooled to investigate the long-term effects of JP vs. control on function levels. We determined that intervention groups were superior over control (very low quality, 6 RCTs, 1077 participants with RA, SMD: −0.34, 95% CI: −0.50 to −0.11, $I^2 = 56\%$). The forest plot is illustrated in Figure 6.

Short-term effects of interventions on grip strength levels

One study reported the short-term effects of JP vs. control/usual care on grip strength levels. We determined that JP programs were inferior when compared with usual care/control (very low quality, 1 RCTs, 400 participants with RA, mean difference (MD): 1.38, 95% CI: −0.29 to 3.05). The analysis is presented in Figure 7.

Midterm effects of interventions on grip strength levels

One study investigated the midterm effects of JP programs vs. usual care/control on grip strength levels. We found that JP programs were superior over usual care/control (very low quality, 1 RCTs, 121 participants with RA, MD: −1.39, 95% CI: −5.02 to 2.24). Analysis and the strength of evidence are presented in Figure 7.

Long-term effects of interventions on grip strength levels

Two studies were pooled to examine the long-term effects of JP programs vs. usual care/control on grip strength levels. We determined that JP programs were inferior when compared with control (very low quality, 2 RCTs, 478 participants with RA, MD: 0.93, 95% CI: −0.74 to 2.61, $I^2 = 0$). Analysis and the strength of evidence are presented in Figure 8.

Table 3
Joint protection programs vs usual care/control in patients with rheumatoid arthritis (short term).

Summary of findings
Population: patients with rheumatoid arthritis
Settings: inpatient clinics.
Intervention: joint-protection programs
Comparison: usual care/control
Follow-up: short term (3-4 months).

Outcomes	SMD/MD (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)
Pain: -MHQ (0-100)	SMD, −0.00 (−0.42 to 0.42)	548 (3 studies)	⊕⊖⊖⊖ (very low)[1,2]
Lower scores indicating better pain scores. -NRS (0-10)			
Higher scores are worse -VAS (0-100)			
Higher scores are worse **Function:** -MHQ (0-100)	SMD, 0.18 (−0.01 to 0.36)	451 (1 study)	⊕⊖⊖⊖ (very low)[1,2]
Higher scores indicating better performance. **Grip strength:** -HHD (kg)	MD, 1.38 (−0.29 to 3.05)	400 (1 study)	⊕⊖⊖⊖ (very low)[1,2,3]
Higher values indicate better strength			

Joint Protection Programs vs Usual care/control in Patients with Rheumatoid Arthritis (midterm).
Summary of findings
Population: patients with rheumatoid arthritis
Settings: inpatient clinics.
Intervention: joint protection programs
Comparison: usual care/control
Follow-up: mid term (5-8 months).

Outcomes	SMD/MD (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)
Pain: -MHQ (0-100)	SMD, −0.32 (−0.53 to −0.11)	358 (3 studies)	⊕⊕⊖⊖ (very low)[1,2]
Lower scores indicating better pain scores. -NRS (0-10)			
Higher scores are worse -VAS (0-100)			
Higher scores are worse. **Function:** -HAQ (0-3)	SMD, −0.49 (−0.75 to −0.22)	358 (3 studies)	⊕⊖⊖⊖ (very low)[1,2]
Higher scores are worse. -AIMS II (0-10)			
Lower scores represent better function **Grip strength:** -HHD (kg)	MD, −1.39 (−5.02 to 2.24)	121 (1 study)	⊕⊖⊖⊖ (very low)[1,2,3]
Higher values indicate better strength			

Joint Protection Programs vs Usual care/control in Patients with Rheumatoid Arthritis (long term).

(*continued on next column*)

Table 3 (*continued*)

Summary of findings
Population: patients with rheumatoid arthritis
Settings: inpatient clinics.
Intervention: joint protection programs
Comparison: usual care/control
Follow-up: long term (12 months).

Outcomes	SMD/MD (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)
Pain: -MHQ (0-100)	SMD, −0.27 (−0.41 to −0.12)	857 (4 studies)	⊕⊕⊖⊖ (low)[1]
Lower scores indicate better pain scores. -NRS (0-10)			
Higher scores are worse -VAS (0-100)			
Higher scores are worse. **Function:** -MHQ (0-100)	SMD, −0.34 (−0.48 to −0.20)	1077 (6 studies)	⊕⊖⊖⊖ (very low)[1,5]
Higher scores indicate better performance. -HAQ (0-3)			
Higher scores are worse. -AIMS2 (0-10)			
Lower scores represent better function **Grip strength:** -HHD (kg)	MD, 0.93 (−0.74 to 2.61)	478 (2 studies)	⊕⊖⊖⊖ (very low)[1,2,3,4]
Higher values indicate better strength			

VAS = visual analog scale; NRS = numerical rating scale; MHQ = Michigan Hand Outcome Questionnaire; HHD = hand-held dynamometer; SMD = standardized mean difference; MD = mean difference; CI = confidence interval.
GRADE quality of evidence:
High quality: We are very confident that the true effect lies close to that of the estimate of the effect.
Moderate quality: We are moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low quality: Our confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.
Very low quality: We have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect.
[1] We downgraded by two levels due to high risk of bias.
[2] We downgraded by one level due to a relatively small sample size.
[3] We downgraded by one level due to indirectness (surrogate outcomes).
[4] We downgraded by one level due to publication bias.
[5] We downgraded by one level due to inconsistency.

Effects of interventions on hand OA

From the three studies that included participants with hand OA, only 1 RCT[9] reported clear means and SD. For short-term effects on pain levels, we found similar effects with JP compared with no JP (high risk of bias, relatively small sample size; 257 participants with hand OA, MD: −0.10, 95% CI: −0.60 to 0.40). For function levels, we found that JP was no better than no JP (high risk of bias, relatively small sample size; MD: −0.20, 95% CI: −1.59 to 1.99). For midterm effects on pain and function levels, we found similar effects with JP compared with no JP (high risk of bias, relatively small sample size; MD: −0.30, 95% CI: −0.23 to 0.83; and high risk of bias, relatively small sample size; MD: 0.50, 95% CI: −1.38 to 2.38, respectively). For midterm effects on grip strength levels, we determined that JP was superior when compared with no JP (high risk of bias,

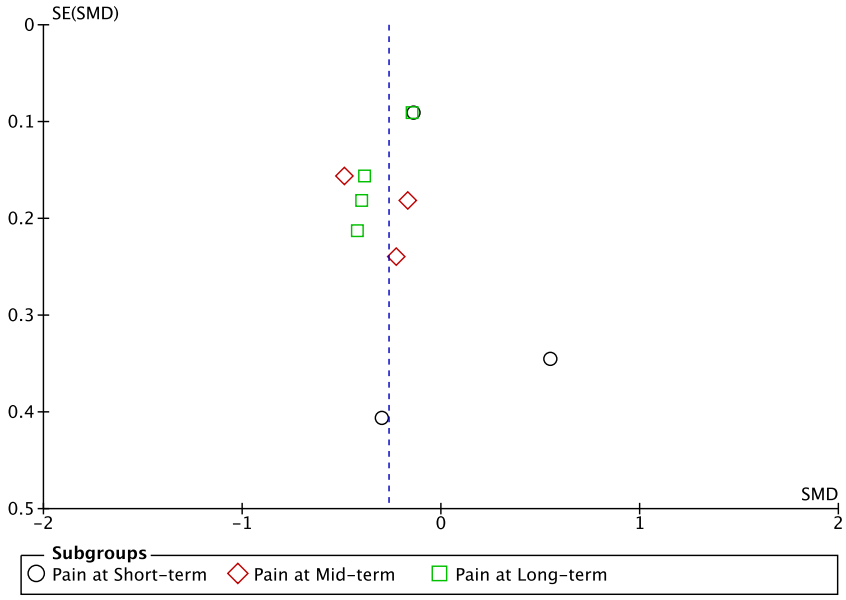


Fig. 3. Funnel plot for pain levels. SE = standard error; SMD = standardized mean difference.

relatively small sample size; MD: −2.20, 95% CI: −7.53 to 3.13). For long-term effects on pain and function levels, there was no difference between JP and no JP intervention (high risk of bias, relatively small sample size; MD: 0.10, 95% CI: −0.45 to 0.65; and high risk of bias, relatively small sample size; MD: 1.20, 95% CI: −0.68 to 3.08, respectively).

Unknown treatment effects on extracted outcomes

There were five studies for participants with RA and two studies for people with hand OA which were unable to calculate SMDs or effect sizes due to lack of reporting and are summarized below.

Hand RA

O'Brien et al, 2006,[50] ($n = 67$) investigated the effectiveness of 3 different JP groups on function and pain at 1, 3, and 6 months of follow-up (high risk of bias, relatively small sample size, low quality). Hammond and Freeman, 2004,[44] ($n = 127$) examined the effectiveness of educational-behavioral JP program vs. a standard program on pain, functional ability, and grip strength at 24 months of follow-up (high risk of bias, relatively small sample size, low quality). Hammond et al, 2002,[45] ($n = 30$) examined the effectiveness of JP first vs. JP second on pain functional ability and grip strength at 3 and 6 months of follow-up (high risk of bias, relatively small sample size, very low quality). Helliwell et al, 1999,[38] ($n = 77$)

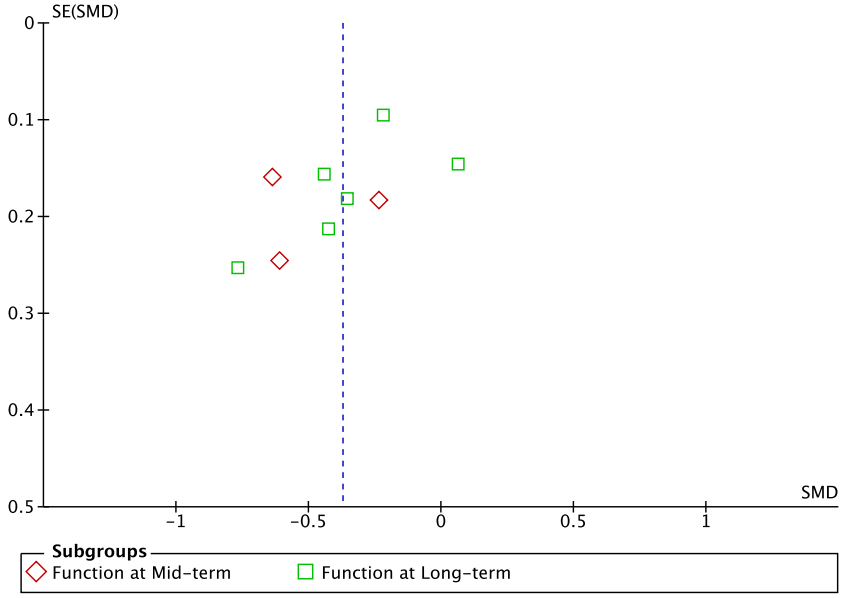


Fig. 4. Funnel plot for function levels. SE = standard error; SMD = standardized mean difference.

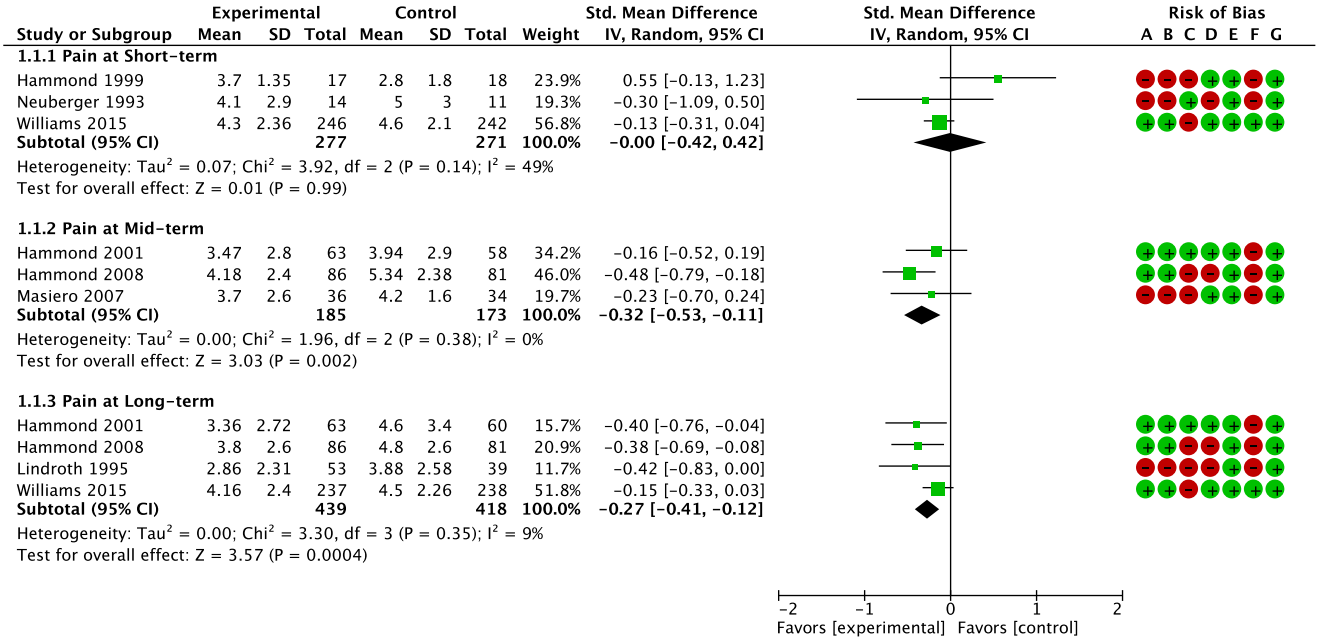


Fig. 5. Short-term, midterm, and long-term effects of interventions on pain levels. CI = confidence interval; SD = standard deviation.

examined the effectiveness of a JP program vs. control on functional ability at 1 and 12 months of follow-up (high risk of bias, relatively small sample size, very low quality). Lindroth et al, 1997,[39] ($n = 100$) examined the effectiveness of a JP program vs. control at 3 and 12 months of follow-up (high risk of bias, relatively small sample size, very low quality).

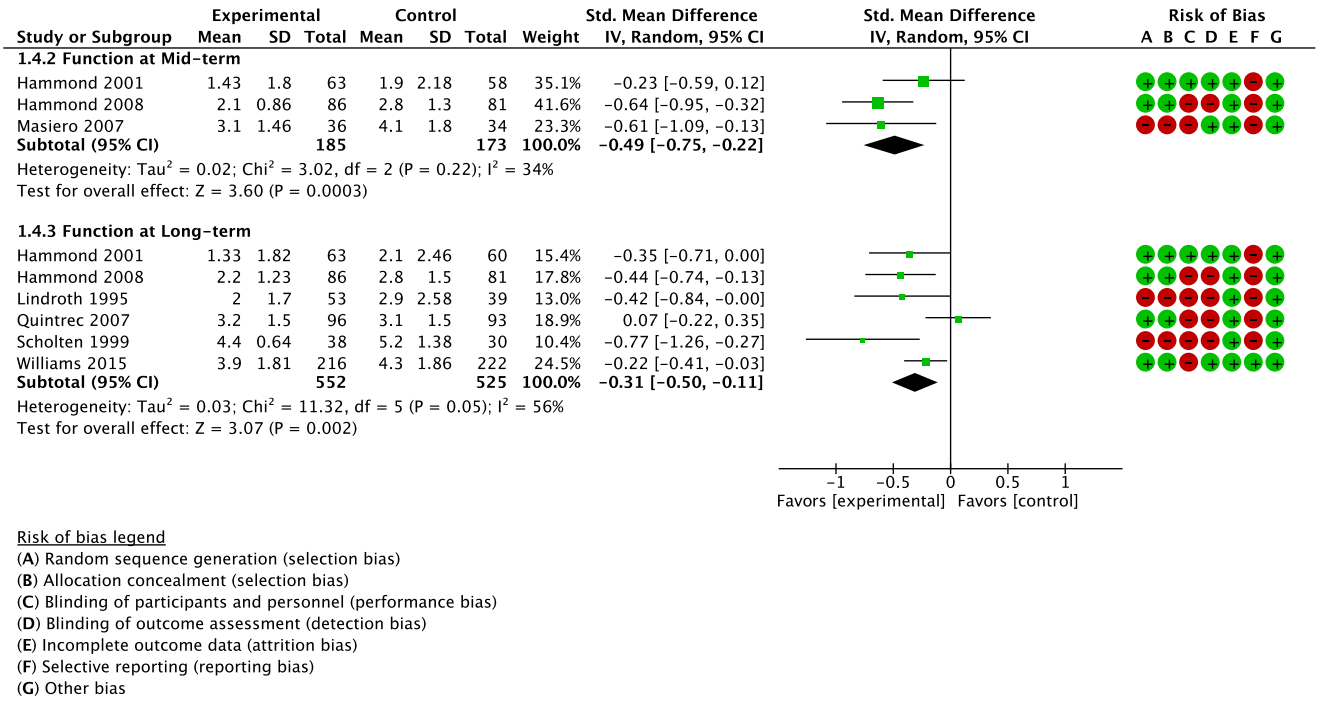


Fig. 6. Midterm and long-term effects of interventions on function levels. CI = confidence interval; SD = standard deviation.

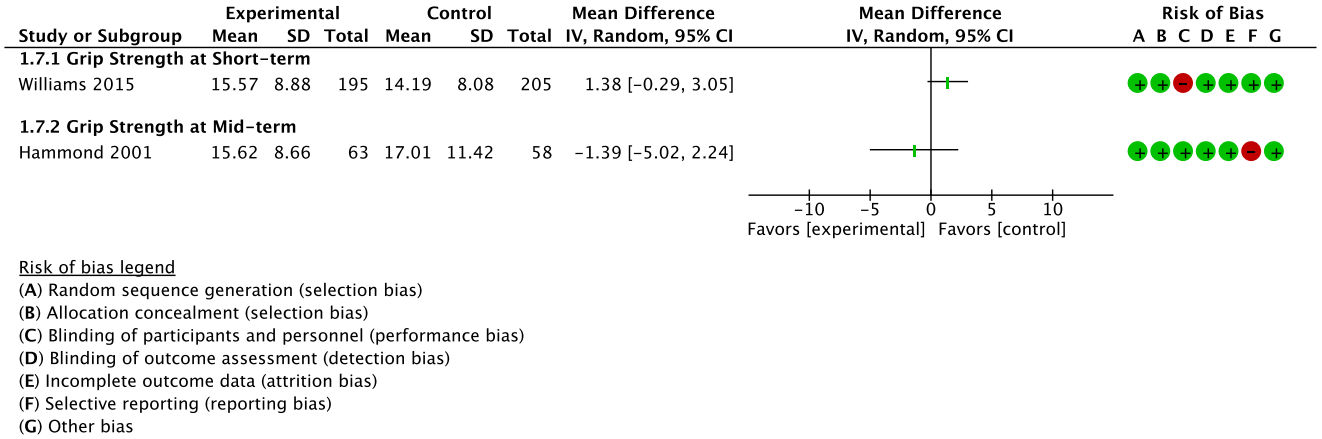


Fig. 7. Short-term and midterm effects of interventions on grip strength levels. CI = confidence interval; SD = standard deviation.

Hand OA

Dilek et al, 2013,[36] (n = 46) examined the effectiveness of paraffin bath therapy and JP vs. JP alone on pain, self-report function, and grip strength levels in patients with hand OA at 3 weeks and 3 months of follow-up (high risk of bias, relatively small sample size, very low quality). Stamm et al, 2002,[47] (n = 40) assessed the effectiveness of a JP program plus hand exercises vs. a control group (information only) on grip strength levels, pain, and functional ability in patients with OA at 3 months of follow-up (high risk of bias, relatively small sample size, very low quality).[47] We were unable to calculate effect sizes or report between-group (mean/median difference) improvements for pain and functional levels due to lack of reporting of group means, standard deviations, standard errors of means, CIs, or P values. Only grip strength values were reported, and we found similar effects between JP intervention and control with an MD of −0.01 (95% CI: 0.12 to 0.10 [Units: bar]) between the JP intervention and control at 3 months of follow-up.

Discussion

We aimed to summarize the current evidence of the effects of JP programs vs. usual care/control in patients with RA and hand OA on clinical outcomes of pain, functional ability, and grip strength. Based on the results of this study, we found no clinically important differences in function, grip strength, or pain levels at short-term, midterm, and long-term follow-ups. Our study provides more definitive estimates of JP treatment effects for people with RA based on our meta-analysis. Imprecision and high risk of bias were the main reasons that the quality of evidence was downgraded.

Nine different studies reported comparable outcomes and had multimodal JP interventions that enabled the statistical pooling. For pain levels at short term, we found similar effects between treatment groups and usual care/control. The wide CIs that crossed the vertical line imply that the studies' results did not find a statistically significant difference between the tested groups and also that the sample size was low. Although JP as a multimodal intervention reduced pain for people with RA at midterm and long-term follow-ups, the magnitude of the pooled estimates was smaller than the predefined clinically important difference (SMD > 0.5). At long-term follow-up, the number of pooled participants (n = 857) exceeded the estimated OIS (n = 685), which indicates that we had adequate sample size to be precise in our pain-level estimates. The effect sizes of the pooled estimates regarding function levels were improved from short-term to midterm follow-up (SMD: −0.49, 95% CI: −0.75 to −0.22) and slightly declined at long-term follow-up (SMD: −0.34, 95% CI: −0.50 to −0.11). Although these estimates are lower than the predefined clinically important difference, it is evident that the hand function at midterm was improved (SMD: −0.49) and very close to the clinically important margin. The upper bound of the 95% CI indicates an SMD of −0.70; however, owing to imprecision issues (n = 358 < OIS), we cannot be confident if the treatment effect can be clinically worthwhile or not. Regarding the grip strength, our short- and long-term effect

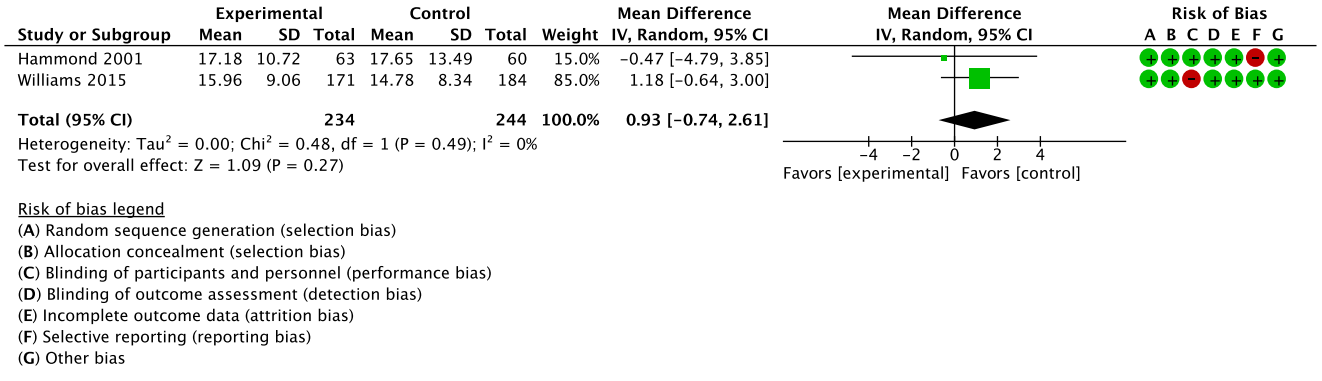


Fig. 8. Long-term effects of interventions on grip strength levels. CI = confidence interval; SD = standard deviation.

estimates indicated that JP programs were inferior to usual care/control. At midterm, JP programs were superior to usual care/control in terms of grip strength levels. However, the tested power was very low because of the wide CIs and also that the studies' results did not observe a statistically significant difference. Generally, the measurement of grip strength as a performance-based test provides very useful information in clinical practice because it is an indication of hand function. Previous studies have indicated a negative correlation between grip strength and disease activity for people with RA and showed that the grip strength becomes worse when the disease is more active.[51,52] Although JP principles indicate to maintain your muscle strength and range of movement, it is unclear if the instructed exercises are optimal to improve hand grip strength. Given the disease activity and the lack of clarity of JP programs, the results of grip strength are even more ambiguous. For patients with hand OA, only one study reported means and SDs for pain, function, and grip strength and compared a JP program with no JP. However, this study was rated as high risk of bias with a relatively small sample, and therefore, we have very little confidence about the treatment effects.

Previous recent SRs reported strong evidence that JP may improve function[7] and pain.[7,12] Our findings are not in concordance with those 2 SRs, and this can be attributed to the following main reasons. First, we included more studies (14 RCTs and 3 RCTs) in our analysis for people with RA and hand OA, respectively. We reported treatment effects of MD, SMD, and 95% CIs to indicate the magnitude of the effects. Second, we took a more conservative approach while synthesizing the evidence by using the Cochrane risk of bias tool and using GRADE approach to rate the quality of the evidence.

Publication bias was assessed with two different funnel plots (Figs. 3 and 4). Although an asymmetry was detected in both the figures, we deem that they do not indicate publication bias. In our meta-analysis, we pooled less than ten studies to examine the effects of interventions. However, the tested power was low, and it was very difficult to distinguish from the real asymmetry.[15] A statistical heterogeneity was detected at long-term function levels ($P = .05$, $I^2 = 56\%$). For that reason, we downgraded the quality of the evidence by 1 level for long-term function levels. A potential explanation for the causes of statistical heterogeneity may be variations in the treatment effects of a particular study from the pooled studies. This study[41] favors control over the experimental group when examining the function levels at long-term follow-up, which was not consistent with the other studies. The contributing percentage in the I^2 value when this trial was added in the analysis was an additional 36%, which may be attributed to a false variation from the real treatment effect.

Strengths of this SR are that we used the most conservative approach to assess risk of bias with Cochrane risk of bias tool. We interpreted our results by summarizing the results by providing GRADE rating. We calculated effect sizes, and we presented CIs to indicate the magnitude of the effects and whether the effects were meaningful or not. We estimated the OIS to demonstrate whether our results had precision or not.

Future implications

Although this is beyond the scope of this SR, the current state of the literature is not clear about the dosage, intensity, and frequency of JP programs and when other aspects are incorporated (eg, assistive devices, orthotic devices, exercises) when this therapeutic approach is delivered to people with hand arthritis. We were unable to extract instructions on JP in a specific and measurable way because of lack of reporting. Future research should aim to be more specific for all the components of JP programs for better head-to-head comparisons.

Limitations

Our study has some limitations that need to be addressed. Although a thorough literature review was conducted, trials that were under development may have been missed. Also, we were unable to calculate the effect sizes from some of the included studies, and therefore, we are uncertain of their effects. We extracted outcome measures for pain, hand function, and grip/pinch strength, and we did not analyze further outcomes for the effectiveness of JP.

Conclusions

This SR provides the most updated evidence on the effectiveness of JP programs vs. usual care/control in patients with RA and hand OA on clinical outcomes. Evidence of very low to low quality indicates that the effects of JP programs compared with those of usual care/control on pain and hand function are too small to be clinically important at short-, intermediate-, and long-term follow-ups for patients with hand arthritis.

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#1. The study design is
   a. a micro analysis
   b. a case series
   c. a systematic review
   d. RCTs
#2. The history of JP shows that JP techniques were originally
   a. developed to be used with RA patients
   b. developed to be used with OA patients
   c. rejected by PTs
   d. rejected by OTs
#3. The authors were interested in the effect of JP on
   a. grip strength
   b. pain control
   c. hand function
   d. all of the above
#4. Literature searches included
   a. only qualitative studies
   b. only retrospective cohorts
   c. only RCTs
   d. RCTs and case series
#5. The authors found sufficient evidence to conclude that JP was significantly more effective than other “usual care” of hand OA and RA
   a. true
   b. false

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