



JHT READ FOR CREDIT ARTICLE #603.

Scientific/Clinical Article

## Conservative therapeutic interventions for osteoarthritic finger joints: A systematic review



Jeanine Beasley EdD, OTR, CHT, FAOTA<sup>a,\*</sup>, LeeAnn Ward BBA<sup>b</sup>, Katie Knipper-Fisher MAEd<sup>b</sup>,  
Katia Hughes LAT, ATC<sup>b</sup>, Dianna Lunsford OTD, MEd, OTR/L, CHT<sup>c</sup>, Claudia Leiras PhD, MS<sup>d</sup>

<sup>a</sup> Occupational Science and Therapy Grand Valley State University, Grand Rapids, MI, USA<sup>b</sup> Grand Valley State University, Grand Rapids, MI, USA<sup>c</sup> Occupational Therapy Department, Gannon University, Ruskin, FL, USA<sup>d</sup> Allied Health Sciences, Grand Valley State University, Grand Rapids, MI, USA

### ARTICLE INFO

#### Article history:

Received 12 September 2017

Received in revised form

27 December 2017

Accepted 2 January 2018

Available online 14 July 2018

#### Keywords:

Osteoarthritis

Distal interphalangeal joint

Proximal interphalangeal joint

Joint protection

Hand exercises

Orthoses

### ABSTRACT

*Study Design:* Systematic review.

*Introduction:* Hand osteoarthritis (OA) is a chronic and disabling disease causing pain and functional limitations in approximately 54%–67% of the adult population aged 55 years and older.

*Purpose of the Study:* The objective of the study is to evaluate the evidence supporting conservative therapeutic interventions for the treatment of OA finger joints.

*Methods:* Eighteen studies dated between 1979 and 2016 were identified meeting the inclusion criteria. They were analyzed based on Structured Effectiveness for Quality Evaluation of a Study, level of evidence, and effect size.

*Results and Conclusions:* The current evidence varies in quality and effect sizes but generally supports the use of active range of motion and resistive exercises, joint protection, electromagnetic therapy, paraffin wax, and balneotherapy (combined and/or not combined with mud packs and magnetotherapy), and distal interphalangeal orthoses as effective treatment interventions for individuals with OA finger joints.

© 2018 Hanley &amp; Belfus, an imprint of Elsevier Inc. All rights reserved.

### Introduction

Hand osteoarthritis (OA) is a chronic and disabling disease which can cause pain and functional limitations.<sup>1</sup> Hand OA has an estimated radiologic prevalence of approximately 54%–67% in the adult population aged 55 years and older.<sup>2</sup> In this group, 47% will develop OA of the distal interphalangeal (DIP) joints and roughly 50% will also have OA of the proximal interphalangeal (PIP) joints.<sup>2,3</sup> This prevalence is expected to rise as the number of older adults increases.<sup>4</sup> Additionally, hand OA is the most common type of OA, affecting women 3 times more than men.<sup>5,6</sup>

Individuals with finger OA may experience metabolic derangement and degeneration of articular cartilage, subchondral bone thickening, narrowing of the joint spaces, and changes in the

periarticular structures.<sup>7–11</sup> Articular osteophytes, or bone spurs, can develop with OA at the PIP, DIP, and thumb interphalangeal (IP) joints.<sup>12,13</sup> Osteophytes of the PIP joints are called Bouchard's nodes, whereas osteophytes of the DIP joints are called Heberden's nodes.<sup>14</sup> Progression of the disease can produce joint pain, swelling, soreness, and stiffness due to joint cartilage deterioration leading to bone-on-bone contact within the joint and deformity.<sup>12,15</sup> Deterioration of motion, strength, and function of the finger joints also becomes evident with progression of the disease.<sup>16,17</sup> As a result of this condition, individuals may experience limitations performing self-care tasks, leisure activities, housework, and vocational tasks.<sup>15,18</sup> Additionally, psychosocial factors such as frustration, depression, and anxiety can impact participation in meaningful life activities.<sup>19,20</sup>

Hand therapists have been involved in the treatment of finger OA through a variety of interventions. Instruction in joint protection principles has demonstrated positive outcomes for increased grip strength and hand function.<sup>21</sup> Educational programs and self-management strategies have also demonstrated decreased pain with range of motion (ROM) and improvement in daily activities.<sup>22,23</sup> While there is moderate to high evidence to support conservative interventions for the carpometacarpal joints, few studies have addressed the effectiveness of hand therapy interventions for

Conflict of interests: The authors declare that there is no conflict of interest to disclose.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

\* Corresponding author. Occupational Science and Therapy Grand Valley State University, 301 Michigan NE, Room 256, Grand Rapids, MI, USA. Tel.: (616) 331-3117.

E-mail address: [beasleyj@gvsu.edu](mailto:beasleyj@gvsu.edu) (J. Beasley).

conservative management of OA of the finger joints.<sup>24,25</sup> The purpose of this systematic review is to determine effective conservative therapeutic interventions for the OA finger joints.

## Methods

### Data identification and study characteristics

A systematic review of the literature was performed searching PubMed, CINAHL, Web of Science, PEDro, and OTseeker from their inception to January 2017. These databases were chosen due to the vast array of health care literature indexed. The key search terms included: osteoarthritis, finger joint, digit, thumb, hand, proximal interphalangeal, distal interphalangeal, interphalangeal, hand therapy, occupational therapy, physical therapy, intervention, rehabilitation, and therapy. The key search terms were entered into each database in a precise sequential order in various combinations to maximize optimal results. The search strategy for each database is outlined in [Appendix A](#). As an example, the search in the CINAHL database included articles from inception to January 28, 2017. This advanced search was performed by clicking on Advanced Search and entering the key terms into the search boxes as follows: osteoarthritis (Select a Field (optional)) AND finger joint OR digit OR thumb OR hand OR proximal interphalangeal OR distal interphalangeal OR interphalangeal (Select a Field (optional)) AND hand therapy OR occupational therapy OR physical therapy OR intervention OR rehabilitation OR therapy (Select a Field (optional)). The search options were kept at default settings. This resulted in 451 files for the CINAHL database alone. See [Appendix A](#) for the results from each of the other databases.

The initial citation, title, and abstract search yielded 5592 articles referencing OA which were imported into Zotero, a bibliographic manager. Three of the authors utilized Zotero to remove articles based on duplication, non-English language, and the inclusion and exclusion criteria. The inclusion criteria included articles dated between 1979 and 2016, PIP and DIP joints, IP joints of the thumb, adults 18 and older, and the English language. Exclusion criteria included nonhuman subjects, not applicable to the DIP, PIP, or IP joints of the hand, surgical cases, pharmaceutical studies, lack of conservative hand therapy interventions, study registered/developed but not yet conducted, reviews, case reports, patents, abstracts, conference proceedings, editorials, commentaries, expert opinions, thesis or dissertations, and meta-analysis. After the citation, title, and abstract review, 5462 articles were removed leaving 130 articles for full-text review. The process was then repeated removing full-text articles based on the inclusion and exclusion criteria resulting in 18 articles to be included in this systematic review. [Figure 1](#) depicts a summary of the flow of all records through the review process.

### Critical appraisal and quality assessment

Data were extracted from the remaining 18 articles that met the inclusion and exclusion criteria (see [Table 1](#)). The level of evidence (LOE) was identified according to Sackett et al.<sup>42</sup> The quality of each research article was evaluated using the Structured Effectiveness for Quality Evaluation of a Study (SEQES).<sup>42</sup> The SEQES, developed by Joy MacDermid, is a 24-question evaluation that helps determine the quality of each research article.<sup>43</sup> This evaluation is a standardized tool that gives each item a score of 0, 1, or 2 for each question asked. These scores are then totaled for a maximum score of 48 points. An item score of 0 indicates poor quality or not meeting criterion, a score of 1 represents a fair quality, and a score of 2 is the highest score for that aspect of the study design.<sup>43</sup> Blind scoring of the articles was conducted by each of the authors

independently. Discrepancies were discussed until consensus was reached for each category (see [Table 1](#)).

### Effect size

Effect size was calculated (if not provided by the authors) for the primary outcomes according to Cohen's *d* with 0.2 denoting a small effect size, 0.5 representing a medium effect size, and 0.8 representing a large effect size.<sup>44</sup>

### Level of evidence

The articles' LOE ranges between level 1b—individual randomized controlled trial (RCT) with narrow confidence intervals, 2b—individual cohort study (including low-quality RCT, eg, <80% follow-up), level 3b—individual case-control study, and level 4—case series/case reports (and poor-quality cohort and case-control studies). Each article was also appraised for its quality and given an LOE rating using the Sackett scale.<sup>42</sup>

## Results

The analysis included a review of the articles based on statistical and clinical significance as well as effect size while considering the LOE and the SEQES score to determine effective interventions. The final 18 studies were analyzed using the SEQES to rate the quality of the research (see [Table 1](#)). The range for SEQES scores were 18/48 to 46/48. More recent studies met a greater number of criteria on the SEQES quality of research rating scale than did older studies. The effect size was calculated (if not provided by the authors) for the primary outcomes and is included in [Table 2](#).

### Exercise

Several subgroups were identified for this intervention: resistive hand exercise alone,<sup>29</sup> resistive hand exercises with general body strengthening,<sup>35</sup> resistive hand exercises including active range of motion (AROM) and joint protection,<sup>21,26,27</sup> and hand exercises with electromagnetic therapy.<sup>28</sup> The study by Paolillo et al<sup>37</sup> also included hand exercises but is included below with the low-level laser therapy (LLLT)/ultrasound studies. Although many authors used exercises, the results could not be pooled due to the lack of homogeneity of the studies. A table describing the specific hand exercises that were used in each of the studies is included (see [Table 3](#)). The quality of SEQES scores for these 6 studies ranged from 29 to 46.<sup>21,26-30</sup>

The cohort study by Lefler and Armstrong had a total of 19 participants.<sup>29</sup> This article with an SEQES score of 29 demonstrated significantly improved grip strength and finger range of motion with resistive hand exercises. There is some evidence of moderate quality to support resistive hand exercises to improve grip strength and finger ROM.

The Rogers and Wilder case-control study was completed with a total of 55 participants.<sup>30</sup> With an SEQES score of 29, it provided moderate support for resistive hand exercises and overall body strength training to significantly improve grip strength and decrease hand pain. It is difficult to determine if the gains made in these areas were due to the hand exercises or the secondary intervention of general exercise or a combination. There is some evidence of moderate quality to support resistive hand exercises combined with overall body strength training to improve grip strength and decrease hand pain.

For the hand exercises (AROM and resistive) combined with joint protection subgroup, 3 RCTs, totaling 377 subjects, examined these combined interventions.<sup>21,26,27</sup> These studies were of

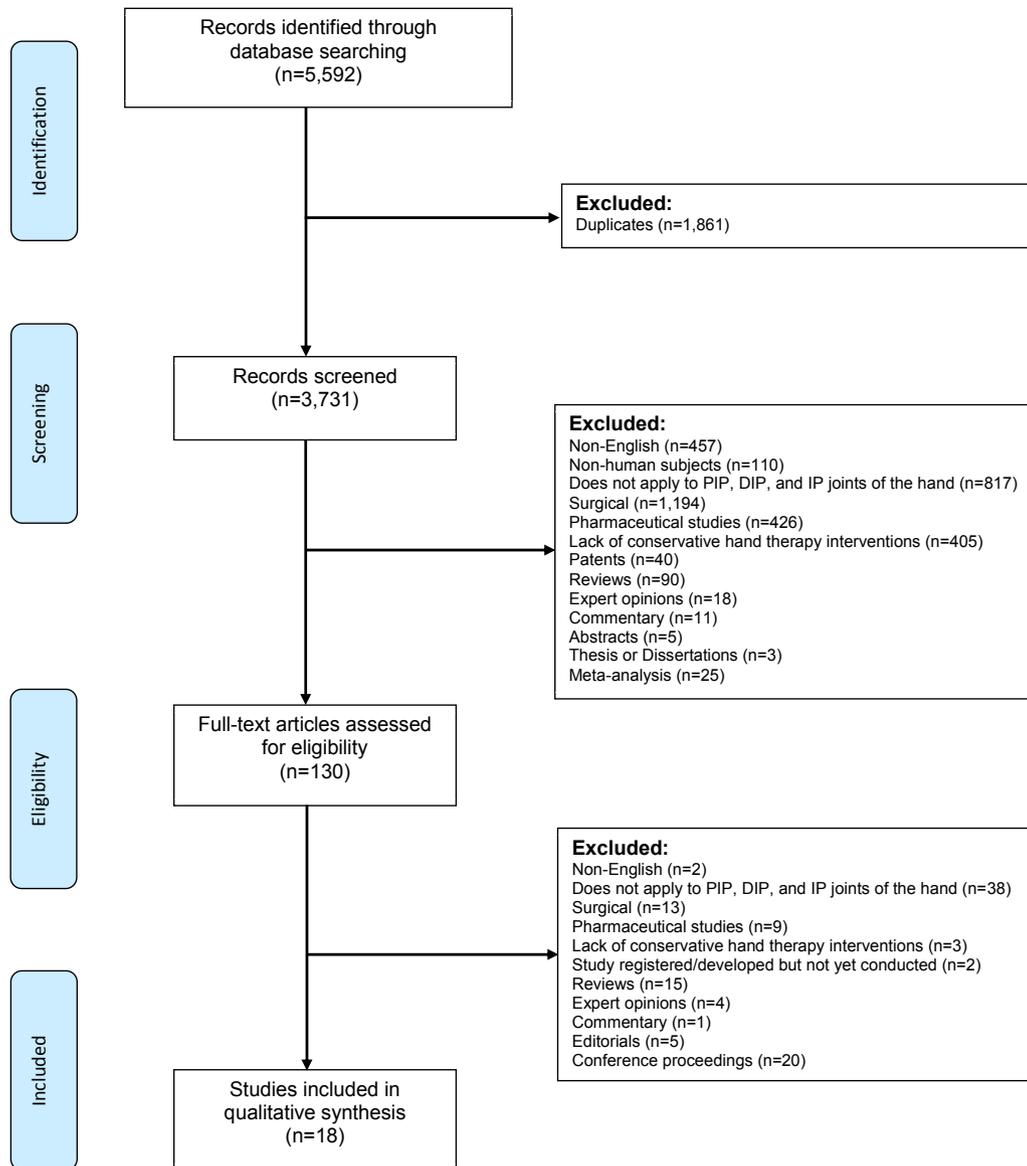


Fig. 1. A summary of the flow of all records through the review process.

high-quality receiving scores on the SEQES scale of 43/48,<sup>26</sup> and 46/48,<sup>21,27</sup> and provided support for the combined intervention of joint protection education and hand exercises (AROM and resistive) to decrease pain, increase grip strength, and improve hand function. A large effect size was calculated for pain reduction (Numeric Pain Rating Scale) in the study by Dziejczak et al.<sup>26</sup> In the Henning et al study, a large effect size was found on the Patient-Specific Functional Scale outcome measure.<sup>27</sup> There is sufficient evidence of high quality to support hand exercises (AROM and resistive) combined with joint protection to decrease pain and improve activity performance.

Electromagnetic therapy was combined with hand exercises (including AROM and resistive) in the RCT study by Kanat et al with a total of 50 subjects.<sup>28</sup> Electromagnetic therapy is defined as the application of a pulsed magnetic field. The mechanism of action is based on the flow of electrical charges and the movement of the ions within the cell.<sup>28</sup> The quality of SEQES score was 35/48. While this high-quality study demonstrated significant improvements in pain, function, joint stiffness, and quality of life scores, a limitation included lack of information on the specific hand exercises. This study provides high-quality evidence to support the use of

electromagnetic therapy combined with hand exercises (AROM and resistive) to decrease pain and increase function.

#### Thermal modalities

Four RCTs with a total of 224 subjects examined different thermal modalities and assessed the effect on pain in the treatment of OA finger joints.<sup>31–34</sup> The thermal modalities used included paraffin wax,<sup>31</sup> balneotherapy<sup>33</sup> with and without magnetotherapy,<sup>34</sup> and mud packs combined with balneotherapy.<sup>32</sup> Balneotherapy is defined as a natural mineral water bath.<sup>31</sup> The SEQES scores of these studies ranged from 41 to 44, all high-quality studies. Paraffin wax was demonstrated in the study by Dilek et al to significantly decrease pain at rest at 3 and 12 weeks, decrease joint pain and tenderness, and improve bilateral hand grip strength.<sup>31</sup> Horvath et al found that balneotherapy at 38° was more effective than at 36°, demonstrating significant improvements in pinch strength of the right hand and improved hand function when combined with magnetotherapy.<sup>33</sup> There is some evidence of high quality to support the thermal modalities of paraffin wax, and balneotherapy at 38°C combined and/or not combined with mud packs and

**Table 1**  
Summary of evidence for conservative therapeutic interventions for osteoarthritic finger joints

Authors and level of evidence	Number of subjects	Interventions	Primary outcome measure	Protocol	Results	Total SEQES quality score
Exercise Dziedzic et al 1b <sup>26</sup>	257	1 of 4 combinations—joint protection, hand exercises, joint protection and hand exercises combined, or advice on self-management approaches only	Pain and function subscales of the AUSCAN and global assessment of change as well as the Arthritis Self-efficacy Pain subscale	Interventions were delivered over 4 group sessions by 9 OTs in 2 hospital centers. OTs were rotated every 3 months to minimize potential bias. Sessions lasted for a maximum of 1 h. Study outcomes were collected at baseline, 3, 6, and 12 months.	Improvement in Arthritis Self-efficacy Pain subscale (0–10 with 10 = greater self-efficacy <sup>a</sup> ) with joint protection vs no joint protection at 3 mo (5.5 ± 1.9 vs 6.3 ± 1.8, <i>P</i> = .002), 6 mo (5.7 ± 1.9 vs 6.5 ± 1.7, <i>P</i> = .001), and 12 mo (5.4 ± 2.0 vs 6.0 ± 1.8, <i>P</i> = .03). Statistically significant improvements in the global assessment of change with hand exercises vs no hand exercises at 3 mo (OR = 2.48, 95% CI: 1.33–4.60), 6 mo (OR = 2.79, 95% CI: 1.44–5.40), and 12 mo (OR = 2.22, 95% CI: 1.20–4.11); improvement in the global assessment of change with joint protection vs no joint protection at 6 mo (OR = 2.71, 95% CI: 1.39–5.25)	43
Hennig et al 1b <sup>27</sup>	80	All received a leaflet about hand OA and ergonomic principles. Intervention group received home-based hand exercise program	Activity performance measured by the PSFS	3 exercise sessions a week (each exercise to be performed 10 reps the first 2 weeks, increasing to 12 reps the next 2 weeks, and 15 reps for the remainder 3-mo period) with 8 follow-up calls over the 3-mo study. Recorded adherence, pain after exercises, and adverse events in a diary.	Significant mean adjusted difference in the PSFS score (0–10 with 10 indicating no activity limitations) of 1.4 (95% CI: 0.6–2.2, <i>P</i> < .001) in favor of the exercise group. Mean adjusted difference in joint pain (–1.1, 95% CI: –2.0 to –0.2, <i>P</i> = .02), fatigue (0–10, 0 = no fatigue, –1.1, 95% CI: –2.3 to 0.00, <i>P</i> = .05), right hand maximum grip strength in Newtons (53.5, 95% CI: 27.8 to 79.1, <i>P</i> < .001), left hand maximum grip strength in Newtons (44.6, 95% CI: 23.4 to 65.8, <i>P</i> < .001)	46
Kanat et al 1b <sup>28</sup>	50	Electromagnetic therapy combined with active ROM and resistive exercises of the hand	Pain and joint stiffness, pinch and grip strength	Group 1 received 25 Hz, 450 pulse/s, 5–80 G, electromagnetic therapy for 10 days at 20 min/day combined with AROM and resistive exercises for the hand. Group 2 received sham magnetotherapy for 10 days at 20 min/day combined with same exercises as group 1.	Improvement for pain (0–10 <sup>a</sup> ) at rest from 4 ± 2 to 0 ± 0 ( <i>P</i> < .001), pain at motion from 7 ± 2 to 0 ± 0 ( <i>P</i> < .001), and joint stiffness from 5 ± 3.5 to 0 ± 0 ( <i>P</i> < .001) for group 1. Also SF-36 for pain improved from 43.20 ± 3.09 to 77.60 ± 5.08 ( <i>P</i> < .001), SF-36 social function improved from 67.80 ± 2.96 to 76.20 ± 3.87 ( <i>P</i> = .03), SF-36 general health	35

(continued on next page)

Table 1 (continued)

Authors and level of evidence	Number of subjects	Interventions	Primary outcome measure	Protocol	Results	Total SEQES quality score
Lefler and Armstrong 2b <sup>29</sup>	19	Strength training (isometric and isotonic) exercises	Pain level, ROM, grip and pinch strength	Treatment group performed strength training exercises 3 times per week for 6 weeks. The amount of weight lifted and number of reps for each subject was recorded each session. The comparison group did not receive treatment.	improved from 54.52 ± 3.16 to 62.92 ± 2.79 ( $P = .001$ ), and DAOI from 34.92 ± 1.83 to 22.04 ± 0.92 ( $P < .001$ ) for group 1. Significant improvement <sup>a</sup> in grip strength (baseline of 27.1 ± 15.0 vs posttreatment of 35.3 ± 8.4, $P < .05$ ) for the treatment group.	29
Rodgers and Wilder 3b <sup>30</sup>	55	Whole body strength training exercise program	Isometric grip strength	25-30 min exercise routine consisting of aerobic warmup, strength training, and cool down performed 3 times a week for 2 years. Two age groups (55-70 and 71-85) were compared.	Isotonic grip strength increased 1.94 kg ( $P < .0003$ ). Right and left isometric grip increased 3.62 kg ( $P < .002$ ) and 2.95 kg ( $P < .0005$ ), respectively. Hand pain decreased from 4.77 to 2.62 ( $P < .006$ ) among those with a baseline hand pain score of 3 or higher.	29
Stamm et al 1b <sup>21</sup>	40	All received oral and written information on joint protection. Intervention group received joint protection and home hand exercises	Grip strength	Joint protection exercise (JPE) performed a home exercise program on both hands, 10 times daily, recording the date, time, and duration of exercise in an exercise diary. Control group was given a Dycem gripper and was instructed to use it when opening jars throughout the 3 month period. Assessment at baseline and 3 months.	Grip strength <sup>a</sup> (Martin Vigorimeter) improved in the JPE group from 0.43 ± 0.21 to 0.55 ± 0.12 ( $P < .0001$ ) for the right hand and from 0.44 ± 0.19 to 0.55 ± 0.27 ( $P = .0005$ ) for the left hand. Grip strength between baseline and 3 months was significantly higher ( $P < .0005$ ) in the JPE group.	46
Thermal modalities Dilek et al 1b <sup>31</sup>	56	Paraffin bath therapy	Pain at rest and pain during ADL	Dip-wrap paraffin bath therapy for both hands for 15 min until paraffin cooled 5 days a week for 3 weeks vs no paraffin bath therapy (drug diary only)	Pain at rest decreased at 3 weeks (5-2, $P < .001$ ) and 12 weeks (5-0, $P < .001$ ) for paraffin group. Pain with ADL decreased at 3 weeks (7-5, $P < .001$ ) and 12 weeks (7-5, $P < .001$ ) for the paraffin group. Number of painful joints at 12 weeks decreased from 8 to 3 ( $P = .04$ ) for the paraffin group.	42
Fioravanti et al 1b <sup>32</sup>	60	Spa therapy consisting of mud packs and generalized thermal baths of sulfate-calcium-magnesium-fluorides mineral water	Global spontaneous hand pain on a 0-100 mm VAS and the FIHOA score	Spa therapy applied on both hands for 20 min at an initial temp of 43°C and with a sulfate-calcium-magnesium-fluoride water at 38°C for 15 min in a bathtub for	Improvement in spontaneous pain after treatment ( $P < .005$ ) and after 3 months ( $P < .01$ ) in the spa group. The FIHOA score decreased significantly ( $P < .001$ ) after 2 weeks	44

(continued on next page)

Table 1 (continued)

Authors and level of evidence	Number of subjects	Interventions	Primary outcome measure	Protocol	Results	Total SEQES quality score
Horvath et al 1b <sup>33</sup>	63	All received magnetotherapy. Intervention group received balneotherapy at either 36°C or 38°C	VAS for pain in small joints of the hand, grip and pinch strength, the number of swollen and tender joints of the hand, the duration of morning joint stiffness, HAQ, and SF-36	a total of 12 applications carried out over a period of 2 weeks vs no spa therapy.  All received standard pulsed magnetic field therapy (60 Hz, 20 J, 15 min) applied on the hands 3 times weekly for 3 weeks. Intervention group was bathed by immersion of the body (head-out immersion in 36°C or 38°C thermal mineral water, group 1 and group 2, respectively) for 20 min, 5 times a week for 3 weeks.	and continued at the 6-month follow-up ( $P < .001$ ) in the spa group. The HAQ improved at end of treatment ( $P < .0005$ ), after 3 months ( $P < .005$ ) and after 6 months ( $P < .005$ ) for the spa group. The 36°C thermal water treatment significantly improved pain at rest at 3 weeks (mean decrease of $-28.9$ , 95% CI: $-38.2$ to $-19.5$ , $P < .05$ ) and at 13 weeks (mean decrease of $-20.3$ , 95% CI: $-28.9$ to $-11.6$ , $P < .05$ ), pain at exertion at 3 weeks (mean decrease of $-28.2$ , 95% CI $-36.5$ to $-19.9$ , $P < .05$ ), and grip strength of the right hand at 3 weeks (mean increase of $3.8$ , 95% CI: $0.8$ to $6.8$ , $P < .05$ ). The 38°C thermal water treatment significantly improved pinch strength of the right hand at 13 weeks (mean increase of $0.6$ , 95% CI: $0.2$ to $1.1$ , $P < .05$ ), and HAQ parameters at 13 weeks (mean decrease of $-0.4$ , 95% CI $-0.6$ to $-0.2$ , $P < .01$ ).	44
Kovacs et al 1b <sup>34</sup>	45	Balneotherapy in sulfurous water or tap water at 37°C	Hand pain measured by VAS, morning stiffness based on self-report of patients, and grip strength	Patients sat in a bath with only their heads out of the water. They spent 20 min in the tub per occasion, 15 times in a 3 week period. The balneotherapy group sat in a tub of 37°C sulfurous water and the control group sat in 37°C tap water.	After 6-month pain improvement <sup>a</sup> in VAS from $59.96 \pm 16.64$ to $42.75 \pm 17.86$ ( $P < .001$ ), HAQ $1.56 \pm 0.54$ to $1.34 \pm 0.47$ ( $P = .034$ ), AUSCAN $36.75 \pm 9.34$ to $33.00 \pm 10.10$ ( $P = .049$ ) for the balneotherapy sulfurous water group.	41
Low-level Laser therapy (LLLT) Baltzer et al 4 <sup>35</sup>	34	Patients were administered 5-10 LLLT/ photobiomodulation therapy sessions to the leading joint(s)	Pain, ring size, and ROM	Therapy took place twice a week for 5, 7, or 10 treatments.	LLLT reduced pain (0-10; mean $\pm$ SD) from $4.72 \pm 0.52$ to $3.90 \pm 0.49$ after 5 sessions and $2.86 \pm 0.49$ after 7 sessions ( $P = .004$ ). ROM <sup>a</sup> increased from $54.48 \pm 4.97$ to $62.93 \pm 4.67$ after 5 sessions and $70.17 \pm 4.07$ after 7 sessions ( $P = .001$ ).	32
Basford et al 1b <sup>36</sup>	81	0.9 mw continuous wave Helium–Neon (HeNe) laser, via a fiberoptic delivery system with 15 sec irradiation at 4 points at approximately 90°	Grip and pinch strength, and joint tenderness	Subjects were randomized. Group A was irradiated with a 0.9 mw continuous wave HeNe (632.8 nm) laser, via a fiberoptic delivery system. Group	Significant improvement <sup>a</sup> in 3-finger chuck pinch increased ( $0.9 \pm 2.9$ , $P < .04$ ), decreased joint tenderness of MCP ( $0.3 \pm 0.7$ , $P < .1$ ) and IP	38

(continued on next page)

Table 1 (continued)

Authors and level of evidence	Number of subjects	Interventions	Primary outcome measure	Protocol	Results	Total SEQES quality score
Paolillo et al 2b <sup>37</sup>	43 (Note: <i>n</i> values only add to 37)	intervals around the CMC, MCP, and IP joints of the most symptomatic thumb.  3 groups: Placebo group—no therapeutic exercises (TEs) but used prototype without emitting electromagnetic or mechanical waves applied; ultrasound (US) + LLLT group—carried out only the prototype; TE + US + LLLT group performed TE before the prototype was applied. The parameters of the US were frequency of 1 MHz; 1.0 W/cm <sup>2</sup> intensity, pulsed mode 1:1 (dual cycle 50%). For the laser, the output power was fixed at 100 mW leading to an energy value of 18 J per laser.	PPT levels were measured at 30 locations 3 times to obtain an average	B received a sham treatment. Nine treatment sessions were completed on all subjects. The placebo group ( <i>n</i> = 11) did not perform TE, and the prototype set to null dose; US + LLLT group was prototype only; TE + US + LLLT performed TE before prototype applied; both hands were treated by prototype in circular, continuous, slow, and smooth motions. The treatments were done once a week for 3 months.	(0.2 ± 0.6, <i>P</i> < .1) for the laser-treated group.  The average PPT between baseline and 3 months showed significant decrease of the pain sensitivity for both the US + LLLT group ( $\Delta = 30 \pm 19$ N, <i>P</i> < .001) and the TE + US + LLLT group ( $\Delta = 32 \pm 13$ N, <i>P</i> < .001)	36
DIP orthosis Ikeda et al 4 <sup>38</sup>	25	Participants were to wear customized DIP orthoses that were molded tubular inserts made of elastic polypropylene. It was worn all day but participants were allowed to remove if they had discomfort.	Pain was measured by the 100-mm VAS	Affected DIP and thumb IP joints that rated between grade 0 and 3 on the Kellgren–Lawrence radiographic grading system received customized orthoses. Patients were instructed to wear the orthoses all day but were allowed to remove them whenever they felt discomfort. Patients were permitted to stop wearing the orthoses once the symptom subsided. Even if the pain decreased but persisted, the patient continued to wear the orthoses for up to 10 months.	Average VAS pain (0–100 mm scale) improvement from 56 mm (range, 24–75 mm) at pretreatment to 17 mm (range, 0–50 mm) at follow-up ( <i>P</i> < .001)	23
Watt et al 2b <sup>25</sup>	26 started; primary outcome data available for 23; 22 subjects completed all study visits	Participants were to wear the custom thermoplastic DIP orthoses for at least 6 h and no more than 12 h at night for 3 months.	Average pain in the nominated joints at 3 months (primary outcome recorded at baseline, 3 and 6 months)	Patients instructed to wear the orthoses every night no less than 6 h and no more than 12 h for 3 months with a follow-up appointment at 6 months. Anteroposterior radiographs of each of the nominated study digits were acquired prior to initiation of the orthotic intervention, at baseline, and at 3 and 6 months.	Significantly lower average pain (0–10) at 3 months (change from baseline of –1.5, range –6 to 2, <i>P</i> = .002) and at 6 months (change from baseline of –2.0, range –8 to 4.5, <i>P</i> = .001). Worst pain was significantly reduced at 3 months (change from baseline of –1.0, range –9.5 to 4, <i>P</i> = .02) and at 6 months (change from baseline of –2.5, range –9.5 to 1, <i>P</i> = .003).	39

(continued on next page)

Table 1 (continued)

Authors and level of evidence	Number of subjects	Interventions	Primary outcome measure	Protocol	Results	Total SEQES quality score
Other (keyboarding, yoga, gloves) Garfinkel et al 2b <sup>39</sup>	25	10-week supervised yoga and relaxation techniques (1 h session once a week for 8 weeks) and Patient education (weekly written instructions of clearly printed educational materials) session 1 and 10 were reserved for pretesting/posttesting.	ROM, grip strength, tenderness of the finger joints, hand pain	Treatment group received 8 60-min yoga sessions once a week that emphasized stretching and alignment. They performed classic yoga poses under supervision.	Significant improvements <sup>a</sup> in right hand ROM (16.93 ± 7.78 vs. 6.91 ± 6.67, <i>P</i> < .01), right and left hand tenderness (2.20 ± 1.32 vs. 0.40 ± 0.94, <i>P</i> < .01 and 2.14 ± 1.55 vs. 0.41 ± 1.43, <i>P</i> < .01, respectively), and pain during activity (−4.29 ± 2.09 vs. −1.00 ± 3.00, <i>P</i> < .01) in the yoga vs the control group after 8 weeks.	27
Swezey et al 4 <sup>40</sup>	15	Subjects wore a pressure gradient glove, a control glove, or no glove at all nightly for 1 week.	Pain, stiffness	Both groups were to perform the same procedure of wearing the gloves for 7 nights and then be assessed.	No significant differences in pain or stiffness in the OA group. Individual data not reported.	18
Zelazny 4 <sup>41</sup>	4	Playing folk and big band melodies on a Yamaha PSR-510 touch-sensitive electronic keyboard for 20 min each session.	Pinch meter measurements	Participants met the investigator 4 days a week for approximately 30 min for 4 weeks to play folk and big band melodies on a keyboard for 20-min each session.	2 participants had significant decreases ( <i>P</i> < .001) in arthritic discomfort after playing, whereas 3 participants showed significant improvement in finger velocity ( <i>P</i> < .001, <i>P</i> = .001, and <i>P</i> < .001, respectively). Participant data were not combined.	24

SEQES = Structured Effectiveness for Quality Evaluation of a Study; C = degrees Celsius; ADLs = activities of daily living; AROM = active range of motion; AUSCAN = Australian Canadian Osteoarthritis Hand Index; CI = confidence interval; CMC = carpometacarpal; DAOI = Duruöz and Auscan Hand Osteoarthritis Indexes; DIP = distal interphalangeal joints; FIHOA = Functional Index of Hand Osteoarthritis; G = Gauss; HAQ = Health Assessment Questionnaire; HeNe = Helium–Neon; Hz = Hertz; IP = interphalangeal; J = Joules; LLLT = low-level laser therapy; JPE = joint protection exercise; MCP = metacarpophalangeal; MHz = Megahertz; mW = milliWatts; N = Newtons; OA = osteoarthritis; OR = odds ratio; OTs = Occupational Therapists; PPT = pressure pain threshold; PSFS = Patient-Specific Functional Scale; ROM = range of motion; SD = standard deviation; SF-36 = 36-Item Short-Form Survey; TE = therapeutic exercise; VAS = Visual Analog Scale.

<sup>a</sup> Data reported as mean ± SD.

magnetotherapy to decrease pain and tenderness, and improve grip strength, pinch strength, and hand function.

#### Low-level laser therapy

The results of LLLT appear to be mixed. One RCT<sup>36</sup> 1 cohort study,<sup>37</sup> and 1 case series,<sup>35</sup> with a total of 158 subjects, examined the use of LLLT in individuals with OA of the finger joints. The SEQES scores of these studies ranged from 32 to 38. The case series by Baltzer et al found that LLLT was effective in reducing pain and swelling while improving joint mobility.<sup>35</sup> Similarly, Paolillo et al in a cohort study found that LLLT combined with ultrasound was statistically significant in reducing pain for women with hand OA.<sup>37</sup> Contradicting these results, Basford et al found that LLLT was not effective in improving ROM and joint tenderness.<sup>36</sup> These mixed results make it difficult to determine a conclusion in this area.

#### DIP orthosis

One RCT study<sup>25</sup> and 1 case series<sup>38</sup> with a total of 51 subjects examined the use of wearing a customized DIP orthosis and the effect on pain. The SEQES scores of these studies were 23/48<sup>38</sup> and 39/48.<sup>25</sup> In the case series, a night-time volar DIP custom thromboplastic gutter orthosis was fabricated by a senior hand therapist

and adjusted at 6 weeks (if necessary) to ensure comfort and fit.<sup>38</sup> In the RCT study, the orthosis is a premanufactured 1.0- to 1.2-mm-thick elastic polypropylene.<sup>25</sup> This orthosis is a molded tubular insert that partially immobilizes the DIP joint allowing slight active DIP joint flexion.<sup>25</sup> In the study, it was worn all day until symptoms subsided. The studies demonstrated wearing a customized DIP orthosis significantly reduces pain. There is some evidence of moderate to high quality to support DIP orthoses to decrease pain.

#### Other (keyboarding, yoga, gloves)

With an SEQES score of 27, 1 moderate quality cohort study with 25 subjects with hand OA found statistically significant evidence to support the use of yoga to decrease pain, tenderness, and increase hand AROM.<sup>39</sup> Two case series with a total of 19 participants found that gloves and keyboarding helped to decrease pain in individuals with finger OA, but this was not statistically significant.<sup>40,41</sup> These studies had SEQES scores of 24<sup>41</sup> and 18.<sup>40</sup> In addition to decreasing pain, Swezey et al<sup>40</sup> also found that wearing gloves increased the palmar skin temperature of the glove wearing hand, whereas Zelazny<sup>41</sup> found that active keyboard playing improved finger strength and dexterity. Although these studies are unique in their intervention methods, the research is dated, with the articles

**Table 2**  
Effect sizes

	Intervention	Author	Outcomes	Statistical significance and effect size*	P values
Exercise	Values exercise and strengthening	Hennig et al <sup>27</sup>	PSFS	1*	<.001
	Exercise and strengthening	Lefler and Armstrong <sup>29</sup>	Pain-level (6-point scale)	-0.7	<.05
			ROM	-0.5	
			Grip strength	0.7*	
			Palmar pinch	0.9	
			Fifth digit pinch	0.8	
	Exercise and joint protection	Rogers and Wilder <sup>30</sup> Stamm et al <sup>21</sup>	Third digit pinch	0.7	<.0001
			Grip strength, NPRS, AIMS2	N/C	
			Grip strength, JPE right hand	0.04*	
	Exercise and joint protection	Dziedzic et al <sup>26</sup>	Grip strength, JPE left hand	1.35*	.0005
NPRS pain—at 3 months			2.1*	.002	
NPRS pain—at 6 months			1.57*	.001	
Exercise and electromagnetic	Kanat et al <sup>28</sup>	NPRS pain—at 12 months	1.57*	.03	
		Pain and Joint Stiffness Likert Scale, SF-36, AUSCAN, grip and pinch strength			
Sizes thermal modalities	Mineral bath (H <sub>2</sub> O)	Fioravanti et al <sup>32</sup>	MJS, VAS, FIHOA, HAQ, SF-36, Meds	N/C	
	Balneotherapy (H <sub>2</sub> O) and magnetotherapy	Horvath et al <sup>33</sup>	HAQ, SF-36, PCS, MCS	N/C	
	Parrifin bath	Dilek et al <sup>31</sup>	VAS	N/C	
	Balneotherapy (H <sub>2</sub> O)	Kovacs et al <sup>34</sup>	VAS pain	0.358*	<.001
			MJS	0.099	
Grip strength, R hand			0.052		
Grip strength, L hand			0.087		
Low-level laser therapy	LLLT	Basford et al <sup>36</sup>	HAQ	0.192*	.034
			AUSCAN	0.176*	.049
			EQ5D	0.068	
			EQVAS	0.234*	.013
			Grasp	0.01	
			Lateral pinch	0.11	
			Three-finger chuck pinch	0.07*	<.04
			CMC—palmar abduction	0.02	
			CMC—planar (radial) abduction	0	
			MCP—extension	0.3	
			MCP—flexion	0.03	
			IP—extension	0.12	
			IP—flexion	0.11	
	Joint tenderness—thumb CMC	0			
Joint tenderness—thumb MCP	0.12				
Joint tenderness—thumb IP	0.17				
LLLT	Paolillo et al <sup>40</sup> Baltzer et al <sup>35</sup>	Grip strength, PPT	N/C		
		VAS—pain	0.13*	<.001	
Orthoses	DIP orthoses DIP orthoses	Watt et al <sup>25</sup> Ikeda et al <sup>38</sup>	ROM	0.15*	<.001
			Ring size	0.03*	<.001
			NPRS—pain	N/C	
Other Interventions	Yoga	Garfinkel et al <sup>39</sup>	VAS—pain	2.59*	<.001
			Circumference—R hand	0.61	
			Circumference—L hand	0.27	
			ROM—R hand	1.38*	.002
			ROM—L hand	0.7	
			Grip strength—R hand	0.16	
			Grip strength—L hand	0.67	
			Joint tenderness—R hand	1.57*	.001
			Joint tenderness—L hand	1.16*	.009
			VAS pain at rest—combined hands	0.39	
			VAS pain during activity—combined hands	1.27*	.004
			Hand function	0.59	
			Keyboarding	Zelazny <sup>41</sup>	Pinch strength, ROM, pain
Likert scale, MIDI					
Gloves	Swezey et al <sup>40</sup>	3-point pain and stiffness scale, ROM, number of tender joints, ROM, grip strength, ring size, PPB, skin temperature	N/C		

AIMS2 = Arthritis Impact Measurement Scale; MCP = metacarpophalangeal; ROM = range of motion; AROM = active range of motion; MCS = mental component summary; SF-36 = Short Form-36 Health Questionnaire; AUSCAN = Australian/Canadian Hand Osteoarthritis Index; Meds = number of tablets taken weekly; VAS = Visual Analog Scale; CMC = carpometacarpal; MIDI = computer program Master Tracks Pro, measured keynote finger velocity; Duruöz = Duruöz Hand OA Index; MJS = morning joint symptoms; EQ5D = EuroQol Group Generic Health Status; N/C = effect size could not be calculated based on the data provided; EQVAS = EuroQol Visual Analog Scale; NPRS = Numeric Pain Rating Scale; FIHOA = Functional Index for Hand Osteoarthritis; PCS = physical component summary; HAQ = Health Assessment Questionnaire; PPB = Purdue Peg Board; IP = interphalangeal; PPT = algometer used to measure the force or pressure intensity at which pain was evoked; L = left; PSFS = Patient-Specific Functional Scale; LLLT = low-level laser therapy; R = right; JPE = joint protection exercise.

\*Statistically significant.

**Table 3**  
Specific hand exercises completed in each study

Study	Hand exercises	Secondary intervention	Sets of exercises
Dziedzic et al (2015) <sup>26</sup>	AROM: wrist flexion/extension pronation/supination, tendon gliding, radial finger walking, opposition, thumb, and “stretching exercises.” strengthening: Rubber band to digital extensors and abductors, play-dough rolling, pinching, and gripping.	Joint protection education	3 reps. each exercise and building up to 10 reps within the limits of discomfort
Henning et al (2015) <sup>27</sup>	Rubber ball (7 cm in diameter) for grip strengthening and rubber bands for the thumb abductors and extensors	Education provided on OA and ergonomic principles (joint protection)	First 2 weeks: 10 reps, 12 reps. For the second 2 weeks, and then 15 reps. For the remaining 3 months
Paolillo et al (2015) <sup>37</sup>	Rolling a tennis ball between the palmar surface of both hands and on the table for sensorimotor input, passive wrist flexion, active wrist extension, and DigiFlex	Ultrasound and low-level Laser therapy	DigiFlex resistance increased gradually from 5,10, 16, and 23 lbs. over 2 months
Kanat et al (2013) <sup>28</sup> Rogers and Wilder (2007) <sup>30</sup>	AROM and resistive exercises Hammer strength gripper at less than near-maximum weight	Electromagnetic therapy Treadmill walking, stationary cycling, cabled weight stack machine (latissimus, seated row, shoulder press, biceps curl, triceps, seated chest press, and lower extremity exercises) at less than near-maximum weight	Specifics not provided First week: 2 sets × 10 reps. Second week: 2 sets × 15 reps. Third week: 3 sets × 15 reps.
Lefler and Armstrong (2004) <sup>29</sup>	Bucket of rice grasp and release, pinch grip lifting (gradually increasing a bag of sand not more than 250 g), wrist rolls for flexion/extension (1.75 diameter PVC pipe with weight adjustable sand bags on a rope), keeping below a 1.5 pain level above baseline	None	Exercises initiated at 40% maximal effort. The repetitions increased by 15 when achieved minimal effort
Stamm et al (2002) <sup>21</sup>	AROM: making a hook and full fist, intrinsic plus position, opposition, abduction, and full-thumb flexion to base of fifth digit. PROM of MP joint lying flat on a table towards radial abduction	Joint protection education and a Dycem gripper for bottle and jar opening	10 repetitions daily of AROM

AROM = active range of motion; PROM = passive range of motion; OA = osteoarthritis; MP = metacarpophalangeal; PVC = polyvinyl chloride.

written in 1979,<sup>40</sup> 1994,<sup>39</sup> and 2001,<sup>41</sup> and all had small sample sizes.

## Discussion

### Summary of evidence for the OA finger joints

There is some evidence of moderate quality to support resistive hand exercises to improve grip strength and finger ROM, and when combined with overall body strength, training may improve grip strength and decrease hand pain. There is sufficient evidence of high quality to support hand exercises (AROM and resistive) combined with instruction in joint protection to decrease pain and improve activity performance. There is some evidence of high quality to support the use of electromagnetic therapy combined with hand exercises (AROM and resistive) to decrease pain and increase function. There is some evidence of high quality to support the thermal modalities of paraffin wax, and balneotherapy at 38°C combined and/or not combined with mud packs and magnetotherapy to decrease pain and tenderness, and improve grip strength, pinch strength, and hand function. Finally, there is some evidence of moderate to high quality to support DIP orthoses to decrease pain.

This is the first systematic review to evaluate the evidence supporting conservative therapeutic interventions for osteoarthritic finger (PIP, DIP, and IP) joints. Previous studies have included the thumb carpometacarpal joint in their reviews<sup>24</sup> where this current review focused on finger joint interventions. The lack of parameters for some of the interventions, small sample sizes, and

studies that combined interventions limits the conclusions of this systematic review.

### Clinical implications

Watt et al identified reducing pain as a primary goal of therapeutic interventions for individuals with finger OA.<sup>25</sup> Manifestations of pain can generate functional deficits which include decreased grip and pinch strength, decreased ROM, and decreased performance during activities.<sup>27,35,36</sup> The clinician can utilize the interventions described in these studies in an attempt to decrease pain as a treatment goal. These interventions included AROM and resistive exercises, joint protection, electromagnetic therapy, paraffin wax, and balneotherapy (combined or not combined with mud packs and magnetotherapy), and DIP orthoses as effective treatment interventions for individuals with OA finger joints. Although resistive hand exercises have good support in the literature, it is important to note that many of the resistive exercises, when specified, focused on avoiding discomfort with a respect for pain. This respect for pain is a principle of joint protection education commonly discussed in treatment. The hand exercises outlined in Table 3 provide more detailed information to the clinician as to the specific parameters provided in most of the hand exercise studies. The clinician should take into consideration that some studies utilized combined interventions as opposed to a single intervention and results may vary. The clinician should rely not only on the highest LOE available but also sound clinical judgment when choosing appropriate client-centered interventions.

## Conclusion

This systematic review provides a synthesis of the research evidence for the conservative therapeutic interventions for osteoarthritic finger joints. The evidence varies in quality and effect sizes but in general supports the use of AROM and resistive exercises, joint protection, magnetotherapy, thermal modalities, and DIP orthoses as effective treatment interventions for individuals with OA of the finger joints. Unfortunately, limited research on these interventions, specific to the DIP, PIP, and IP joints, limits the ability to provide strong conclusions. Additional research is needed on the efficacy of therapeutic interventions for the OA finger joints.

## Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jht.2018.01.001>.

## References

- Kloppenborg M. Hand osteoarthritis—nonpharmacological and pharmacological treatments. *Nat Rev Rheumatol*. 2014;10(4):242–251.
- Dahaghin S. Prevalence and pattern of radiographic hand osteoarthritis and association with pain and disability (the Rotterdam study). *Ann Rheum Dis*. 2005;64(5):682–687.
- Kaufmann R, Lögters T, Verbruggen G, Windolf J, Goitz R. Osteoarthritis of the distal interphalangeal joint. *J Hand Surg*. 2010;35(A):2117–2125.
- Zhang Y, Jordan JM. Epidemiology of osteoarthritis. *Clin Geriatr Med*. 2010;26:355–369.
- Lawrence RC, Felson DT, Helmick CG, et al. Estimates of the prevalence of arthritis and other rheumatic conditions in the United States. Part II. *Arthritis Rheum*. 2008;58:26–35.
- Zhang Y, Niu J, Kelly-Hayes M, Chaisson C, Aliabadi P, Felson D. Prevalence of symptomatic hand osteoarthritis and its impact on functional status among the elderly: the Framingham study. *Am J Epidemiol*. 2002;156(11):1021–1027.
- Altman R, Alarcon G, Appelrouth D, et al. The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hand. *Arthritis Rheum*. 1990;33(11):1601–1610.
- Schiller A. Bones and Joints. In: Rubin E, Faber J, eds. *Essential Pathology*. 2nd ed. Philadelphia, PA: Lippincott; 1995:667–710.
- Gleason C, Crump G, Schneider P. Arthritis of the Hand and Upper Extremity in the Workplace. In: Kasden M, ed. *Occupational Hand and Upper Extrem Inj and Diseases*. Philadelphia, PA: Hanley & Belfus; 1998:233–245.
- Stern P, Ho S. Osteoarthritis of the proximal interphalangeal joint. *Hand Clin*. 1987;3(3):405–413.
- Stabler A, Heuck A, Reiser M. Imaging of the hand: degeneration, impingement, and overuse. *Eur J Radiol*. 1997;25(2):118–128.
- Strickland J, Idler R, Creighton Jr J. Osteoarthritis of the proximal interphalangeal joint. *Indiana Med*. 1990;83(12):908–910.
- Tiger L. Diagnosis and management of osteoarthritis. *Compr Ther*. 1986;12(9):30–35.
- Jacobs M, Chinchalkar S, Picicelli J. Arthritis. In: Jacobs M, Austin N, eds. *Orthotic Intervention for the Hand and Upper Extremity Splinting Principles and Process*. 2nd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2014:444–479.
- Estes J, Bochenek C, Fasler P. Osteoarthritis of the fingers. *J Hand Ther*. 2000;13(2):108–123.
- Fife R. Osteoarthritis Epidemiology, Pathology, and pathogenesis. In: Klippel J, Weyland C, Wortman R, eds. *Primer on Rheumatic Diseases*. 11th ed. Atlanta, GA: Arthritis Foundation; 1997:216–217.
- Scott D. Arthritis in the Elderly. In: Tallis R, Fillit H, Brochlehursts JC, eds. *Brocklehurst's Textbook of Geriatric Medicine and Gerontology*. 5th ed. New York, NY: Churchill Livingstone; 1998:1155–1178.
- Bukhave E, la Cour K, Huniche L. The meaning of activity and participation in everyday life when living with hand osteoarthritis. *Scand J Occup Ther*. 2014;21(1):24–30.
- Hill S, Dziedzic K, Ong B. The functional and psychological impact of hand osteoarthritis. *Chron Illn*. 2010;6(2):101–110.
- Stamm T, van der Giesen F, Thorstensson C, et al. Patient perspective of hand osteoarthritis in relations to concepts covered by instruments measuring functioning: a qualitative European multicenter study. *Ann Rheum Dis*. 2009;68(9):1453–1460.
- Stamm T, Machold K, Smolen J, et al. Joint protection and home hand exercises improve hand function in patients with hand osteoarthritis: a randomized controlled trial. *Arthritis Rheum*. 2002;47(1):44–49.
- Boustedt C, Nordenskiöld U, Lundgren N. Effects of a hand-joint protection programme with an addition of splinting and exercise: one year follow-up. *Clin Rheumatol*. 2009;28(7):793–799.
- Kjeken I, Darre S, Slatkowsky-Cristensen B, et al. Self-management strategies to support performance of daily activities in hand osteoarthritis. *Scand J Occup Ther*. 2013;20(1):29–36.
- Valdes K, Marik T. A systematic review of conservative interventions for osteoarthritis of the hand. *J Hand Ther*. 2010;23(4):334–351.
- Watt F, Kennedy D, Carlisle K, et al. Night-time immobilization of the distal interphalangeal joint reduces pain and extension deformity in hand osteoarthritis. *Rheumatology*. 2014;53(6):1142–1149.
- Dziedzic K, Nicholls E, Hill S, et al. Self-management approaches for osteoarthritis in the hand: a 2x2 factorial randomized trial. *Ann Rheum Dis*. 2015;74(1):108–118.
- Hennig T, Hæhre L, Hornburg V, Mowinkel P, Norli E, Kjeken I. Effect of home-based hand exercises in women with hand osteoarthritis: a randomized controlled trial. *Ann Rheum Dis*. 2015;74(8):1501–1508.
- Kanat E, Alp A, Yurtkuran M. Magnetotherapy in hand osteoarthritis: a pilot trial. *Complement Ther Med*. 2013;21(6):603–608.
- Lefler C, Armstrong W. Exercise in the treatment of osteoarthritis in the hands of the elderly. *Clin Kinesiol J Am Kinesiotherapy Assoc*. 2004;58(2):13–17.
- Rogers M, Wilder F. The effects of strength training among persons with hand osteoarthritis: a two-year follow-up study. *J Hand Ther*. 2007;20(3):244–250.
- Dilek B, Gözümlü M, Şahin E, et al. Efficacy of paraffin bath therapy in hand osteoarthritis: a single-blinded randomized controlled trial. *Arch Phys Med Rehabil*. 2013;94(4):642–649.
- Fioravanti A, Tenti S, Giannitti C, Fortunati N, Galeazzi M. Short- and long-term effects of mud-bath treatment on hand osteoarthritis: a randomized clinical trial. *Int J Biometeorol*. 2014;58(1):79–86.
- Horváth K, Kulisch Á, Németh A, Bender T. Evaluation of the effect of balneotherapy in patients with osteoarthritis of the hands: a randomized controlled single-blind follow-up study. *Clin Rehabil*. 2011;26(5):431–441.
- Kovács C, Pecze M, Tihanyi Á, Kovács L, Balogh S, Bender T. The effect of sulphurous water in patients with osteoarthritis of hand. Double-blind, randomized, controlled follow-up study. *Clin Rheumatol*. 2012;31(10):1437–1442.
- Baltzer A, Ostapczuk M, Stosch D. Positive effects of low level laser therapy (LLLT) on Bouchard's and Heberden's osteoarthritis. *Lasers Surg Med*. 2016;48(5):498–504.
- Basford J, Sheffield C, Mair S, Ilstrup D. Low-energy helium neon laser treatment of thumb osteoarthritis. *Arch Phys Med Rehabil*. 1987;68(11):794–797.
- Paolillo A, Paolillo F, João J, João H, Bagnato V. Synergic effects of ultrasound and laser on the pain relief in women with hand osteoarthritis. *Lasers Med Sci*. 2015;30(1):279–286.
- Ikeda M, Ishii T, Kobayashi Y, Mochida J, Saito I, Oka Y. Custom-made splint treatment for osteoarthritis of the distal interphalangeal joints. *J Hand Surg*. 2010;35(4):589–593.
- Garfinkel M, Schumacher Jr H, Husain A, Levy M, Reshetar R. Evaluation of a Yoga based regimen for treatment of osteoarthritis of the hands. *J Rheumatol*. 1994;21(12):2341–2343.
- Swezey R, Spiegel T, Cretin S, Clements P. Arthritic hand response to pressure gradient gloves. *Arch Phys Med Rehabil*. 1979;60(8):375–377.
- Zelazny C. Therapeutic instrumental music playing in hand rehabilitation for older adults with osteoarthritis: four case studies. *J Music Ther*. 2001;38(2):97–113.
- Sackett DL, Strauss SE, Richardson WS, Rosenberg W, Hayes RB. *Evidence-based Medicine. How to Practice and Teach EBM*. 2nd ed. Toronto, ON: Churchill Livingstone; 2000.
- MacDermid J. An introduction to evidence based practice for hand therapists. *J Hand Ther*. 2004;17(2):105–117.
- Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum; 1988.

# JHT Read for Credit

## Quiz: # 603

**Record your answers on the Return Answer Form found on the tear-out coupon at the back of this issue or to complete online and use a credit card, go to [JHTReadforCredit.com](http://JHTReadforCredit.com). There is only one best answer for each question.**

- #1. The study design is
- RCTs
  - qualitative
  - a case series
  - a systematic review of existing literature on the topic
- #2. Using X-ray verification techniques it has been shown that in adults over 55 years of age there is an approximately \_\_\_\_\_ % likelihood of having OA of the small joints of the hand
- 25
  - 35-40
  - 45-55
  - 75-85
- #3. The distribution of OA is
- approximately the same in the DIPs and PIPs
  - significantly greater in the PIPs than the DIPs
  - significantly greater in the DIPs than the PIPs
  - most pronounced in the MPJs
- #4. In addition to statistical and clinical significance, the authors looked at the
- degree of difficulty in applying the techniques described
  - effect size of each study
  - popularity of the concepts described
  - availability of the journals containing each study
- #5. Modest evidence was found to support resistive exercise to improve ROM and grip strength
- false
  - true

When submitting to the HTCC for re-certification, please batch your JHT RFC certificates in groups of 3 or more to get full credit.

## Appendix A. Detailed search strategy for each database

### CINAHL

Database search from inception to January 28, 2017: resulting in 451 files.

An advanced search was performed by clicking on Advanced Search and entering the key terms into the search boxes as follows: osteoarthritis (**Select a Field (optional)**)

AND finger joint OR digit OR thumb OR hand OR proximal interphalangeal OR distal interphalangeal OR interphalangeal (**Select a Field (optional)**)

AND hand therapy OR occupational therapy OR physical therapy OR intervention OR rehabilitation OR therapy (**Select a Field (optional)**)

Leave **Search Options** at default settings, click green **Search** button.

### PubMed

Database search from inception to January 28, 2017: Resulting in 2633 files.

An advanced search was performed by selecting (**PubMed**) and clicking on **Advanced** to take one to the *PubMed Advanced Search Builder* and entering the key terms into the **Builder** boxes as follows: (**All Fields**) osteoarthritis.

AND (**All Fields**) finger joint OR digit OR thumb OR hand OR proximal interphalangeal OR distal interphalangeal OR interphalangeal (click the + to add another box)

AND (**All Fields**) hand therapy OR occupational therapy OR physical therapy OR intervention OR rehabilitation OR therapy.

Click brown **Search** button.

### Web of Science

Database search from inception to January 28, 2017: Resulting in 2126 files.

A basic search was performed by selecting (**All Databases**) and (**Basic Search**) and entering the key terms into the search boxes as follows:

osteoarthritis (**Topic**) (click the + **Add Another Field** to add another box)

AND finger joint OR digit OR thumb OR hand OR proximal interphalangeal OR distal interphalangeal OR interphalangeal (click the + **Add Another Field** to add another box)

AND hand therapy OR occupational therapy OR physical therapy OR intervention OR rehabilitation OR therapy.

Leave **TIMESPAN** at (**All years**), click blue **Search** button.

### PEDro

Database search from inception to January 28, 2017: Resulting in 356 files.

A simple search was performed by clicking on **Begin a simple search** and entering the key term combinations into the **Search term (or terms)** box one combination at a time. After each search was performed, one needed to click **New Search (Simple)** to refresh the database for the next key term combination.

#### 2-word combination of key terms

osteoarthritis AND finger joint – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND digit – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND thumb – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND hand – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND proximal interphalangeal – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND distal interphalangeal – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND interphalangeal – click brown **Search** button, obtain results, click **New Search (Simple)**

#### 3-word combination of key terms

osteoarthritis AND finger joint AND hand therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND finger joint AND occupational therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND finger joint AND physical therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND finger joint AND intervention – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND finger joint AND rehabilitation – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND finger joint AND therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND digit AND hand therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND digit AND occupational therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND digit AND physical therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND digit AND intervention – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND digit AND rehabilitation – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND digit AND therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND thumb AND hand therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND thumb AND occupational therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND thumb AND physical therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND thumb AND intervention – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND thumb AND rehabilitation – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND thumb AND therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND hand AND hand therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND hand AND occupational therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND hand AND physical therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND hand AND intervention – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND hand AND rehabilitation – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND hand AND therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND proximal interphalangeal AND hand therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND proximal interphalangeal AND occupational therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND proximal interphalangeal AND physical therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND proximal interphalangeal AND intervention – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND proximal interphalangeal AND rehabilitation – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND proximal interphalangeal AND therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND distal interphalangeal AND hand therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND distal interphalangeal AND occupational therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND distal interphalangeal AND physical therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND distal interphalangeal AND intervention – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND distal interphalangeal AND rehabilitation – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND distal interphalangeal AND therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND interphalangeal AND hand therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND interphalangeal AND occupational therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND interphalangeal AND physical therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND interphalangeal AND intervention – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND interphalangeal AND rehabilitation – click brown **Search** button, obtain results, click **New Search (Simple)**

osteoarthritis AND interphalangeal AND therapy – click brown **Search** button, obtain results, click **New Search (Simple)**

#### OTSeeker

Database search from inception to January 28, 2017: Resulted in 26 files.

An advanced search was performed by clicking on **Advanced Search** and entering the key terms into the search boxes as follows: **(Any Field)** osteoarthritis.

**AND (Any Field)** finger joint OR digit OR thumb OR hand OR proximal interphalangeal OR distal interphalangeal OR interphalangeal (click the + to add another box)

**AND (Any Field)** hand therapy OR occupational therapy OR physical therapy OR intervention OR rehabilitation OR therapy.

Click orange **Search** button.

Uploading Files to Zotero

All databases were then uploaded into Zotero. Due to importing limitations within each database, the files were uploaded as follows:

- CINAHL and Web of Science were imported 50 files at a time.
- PubMed was fully imported with one file.
- OTSeeker was imported 20 files at a time.
- PEDro was imported after each key term combination.