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Exercise and Hand Osteoarthritis Symptomatology: A Controlled Crossover Trial

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ABSTRACT

Study Design: Randomized Clinical Trial.

Introduction: Hand exercises have been recommended as treatment for hand osteoarthritis (OA) but research evidence is sparse.

Purpose of the Study: To investigate effects of daily 16-week home-based hand exercise among persons with hand OA.

Methods: Forty-six older adults completed a crossover trial with washout between exercise and sham treatments. The AUSCAN physical function sub-scale served as the primary outcome measure. Other outcomes included pain and stiffness sub-scales, dexterity, and grip & pinch strengths.

Results: Changes in AUSCAN sub-scales did not differ between exercise and sham treatments. No changes in dexterity were seen. Grip and pinch measures modestly improved after exercise but not sham.

Conclusions: It is possible that our exercise protocol may have been too ambitious for this age group. Future research will further the understanding of the role of hand exercise in hand OA symptomatology.

Level of Evidence: 2b.

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Hand osteoarthritis (OA) is characterized by a progressive loss of articular cartilage with associated deterioration of subchondral bone, joint margins, and periarticular structures in the proximal interphalangeal joints (PIPs), distal interphalangeal joints (DIPs), or carpometacarpal joints (CMCs).[1] Among the rheumatic diseases, OA is the most common and frequently affects hand joints.[2–5] Most people older than 55 years have radiographic OA in at least one hand joint,[6] and 60–70% of those aged 65 years and older seek medical attention for hand OA symptoms.[7] Hand OA signs and symptoms may include pain, joint deformity, reduced hand strength, and decreased function in hand-related activities of daily living (ADLs).[8–11] Given the number of people affected, the growing number of older adults, the lack of curative treatment, and the side effects of many pharmacological pain treatments,[12] it is imperative to investigate simple, low-cost, noninvasive interventions for potential symptom relief and functional restoration.

Recommended by a recent European League Against Rheumatism (EULAR) task force[13] for the management of hand OA symptoms, hand exercises are commonly used.[14–17] Despite this emphasis on exercise treatment, there is a paucity of research into the efficacy of exercise for the management of hand OA symptoms and dysfunction. Only three randomized controlled trials specifically addressing hand exercise among persons with hand OA[17–19] could be located, in addition to one general strength training study.[20] In one of these studies, a facility-based yoga regimen decreased pain and tenderness and improved finger range of motion.[18] Although these results are promising, the control group received no treatment, thus limiting the assessment of placebo or social interaction effects. Another study determined that a combination of joint protection education and seven hand exercises were effective in improving isometric grip strength and global hand function.[17] The respective control group received

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verbal OA education and a piece of non-slip material for opening jars. Although clearly an important contribution, the recent EULAR task force charged with making recommendations for managing hand OA noted that "*we do not know whether the benefit derived from the range of motion exercise, the joint protection program or both…because the two elements of treatment were not directly compared*."[13]

A third trial compared a combination of two types of thumb splints and two types of thumb home exercise programs among persons with CMC OA.[19] Both of the splint and exercise combinations reduced pain and increased hand strength and function. Although these findings are encouraging, the trial has similar limitations to the aforementioned study[17] in that it used a combination of treatments. It is unclear if the exercises alone, or splints alone, would have been as beneficial as the combination.

A two-year study on the effects of a general strength−training program among persons with radiographic hand OA was recently published.[20] The upper extremity exercises included a plate-loaded dynamic gripper, lat pull downs, rows, chest press, and shoulder press. These subjects demonstrated a significant increase in grip strength and, among the symptomatic subjects, a reduction in hand pain. Although the study was limited in the ability to control for placebo, time, or socialization effects, it did suggest that older persons with hand OA can tolerate upper extremity exercises over an extended period.

Although the above exercise studies[17−20] provide some guidance, to date there are no published studies of the independent effects of hand exercise among persons with hand OA. Such research has been recommended by a recent task force following a systematic literature search and Delphi consensus.[13] The present investigation was designed to address this need. We conducted a randomized, placebo controlled crossover trial comparing the effects of a daily home-based hand exercise program to those of a daily sham hand cream application among persons with radiographic and symptomatic hand OA.

MATERIALS AND METHODS

Subjects

Seventy-six subjects were recruited from the greater Clearwater, Florida community through newspaper announcements, presentations at senior centers, and word of mouth. Participants enrolled in a locally based ongoing epidemiological OA study who met the present study's criteria were included in our recruitment efforts. Qualified subjects were 50 years or older with radiographic OA in at least one hand joint. Subjects were also required to present with symptomatic hand OA as determined by a minimum physical function subscale score on the Australian Canadian (AUSCAN) Osteoarthritis Hand Index VA3.1.[21]

Study exclusion factors were based primarily on recommendations from a task force of the Osteoarthritis Research Society International[22] and included: participation in hand exercise or hand therapy within prior six months; hand joint injection within prior three months; prior hand surgery requiring joint replacement or other instrumentation in the hands; planned hand surgery during the time course of the trial; participation in another interventional trial; regular use of a cane, walker, or assistive crutch; current use of a therapeutic hand cream; rheumatic disease other than OA; presence of other hand or wrist conditions such as a tunnel syndrome or tendonitis; and history of major hand trauma. Persons with altered endocrine function (e.g., diabetes mellitus, thyroid disorders) were not excluded.

At baseline, subjects reported their usage status of pain relief/anti-inflammatory medications and glucosamine/chondroitin. Subjects were instructed to continue regulating use of these substances in consultation with their own physicians. The risks and benefits of the study were explained to all subjects and written informed consent was obtained before enrollment. The study was approved by the Institutional Review Board of The Arthritis Research Institute and registered at ClinicalTrials.gov (NCT00375947).

Radiographs

All posteroanterior view radiographs of the hands were interpreted by the same board certified radiologist using the criteria of Kellgren and Lawrence.[23] The DIP, PIP, and CMC joints of each hand were read. Joints scored as grade 2, 3, or 4 were considered positive for radiographic OA.

Instruments

For both the exercise and sham treatments, all measures were taken at baseline and postintervention. The primary outcome factor was baseline to posttreatment hand function change as measured by the physical function subscale of the AUSCAN VA3.1 Osteoarthritis Index.[24] Ancillary outcome factors were changes in AUSCAN hand pain and hand stiffness; hand dexterity; and hand strength as measured by maximal and average isometric grip, key pinch, and three-point pinch. The 15-item AUSCAN VA3.1 instructs subjects to rate specific factors related to subscales of pain, stiffness, and physical function over the previous 48 hours on a 0−100-mm visual analog scale (VAS). Validity and reliability of the AUSCAN index for community-dwelling older adults have been demonstrated.[21,25,26] The potential span of scores with the AUSCAN physical function

subscale in this study was 225–900. A minimum entry score of 225 (25% of scale maximum) was imposed to identify subjects with symptomatic hand OA and to avoid a floor effect. There have been no published studies to determine the minimum clinically important difference (MCID) for the AUSCAN. Therefore, MCID was set conservatively at 100 mm of change on the physical function subscale.

All testing was conducted by the primary investigator (MWR). Hand strength was assessed using Jamar® grip and pinch dynamometers (Sammons Preston Rolyan, Bolingbrook, IL) newly purchased for this study. For all grip and pinch tests, subjects were seated with elbow flexed to approximately 90 degrees, hand in front of body, and forearm parallel to floor. Three trials of approximately 3–4 seconds duration were completed, with the highest trial recorded as the maximum. The mean of the three trials was also calculated. Subjects were instructed to squeeze the dynamometers as hard as possible. Hand grip was measured with the dynamometer in position 2; it was held by the subject with the instrument and arm unsupported. Pinches were assessed with the subject's arm unsupported and the evaluator lightly holding the dynamometer.

Dexterity was measured using right, left, and both hand pin placement tests of the Purdue Pegboard Model 32020 (Lafayette Instruments, Lafayette, IN) as described in the user's manual. The assembly tasks were not used. The Purdue Pegboard has been widely used because it was developed and validated in 1948.[27] Subjects were read the standardized instructions, which directed them to pick up one pin at a time (or one with each hand for the both hands condition) and place it in the top most hole of the peg board, working down the vertical rows. Each trial was 30 seconds duration and three trials were given. The trial with the highest number of pins completed was recorded as the maximum. A right + left + both hands score was calculated posttest for each of the three sets with the best set recorded.

Design

A crossover design was used with each subject receiving both of the 16-week interventions in randomly assigned order: the hand exercise program (investigational) and the sham hand cream application (placebo). A 16-week inactive washout period was included between the interventions. The trial was 48 weeks in duration (i.e., three 16-week periods). Testing took place at baseline, week 16, week 32, and week 48. A crossover design was chosen to allow a more precise comparison of treatments with a smaller number of subjects while maintaining appropriate statistical power. A clerical assistant not directly involved in the research used a random number table algorithm to assign intervention order for each subject. As various pain creams are purported to relieve hand OA symptoms, it is suggested that subjects believed they were comparing two equally effective interventions. Before poststudy debriefing, subjects were not aware of which intervention was under investigation. It was not possible to blind the primary investigator to treatment order. A dynamic entry cohort was used, with data collection taking place over an 18-month period from November 2005 to April 2007. Subjects were asked to immediately report any adverse reactions to either treatment to the principal investigator. As an additional safety precaution, subjects were asked to complete the AUSCAN Index midway during each intervention. This allowed study investigators to timely identify and address any significant responses to the treatments. Protocol adherence was determined via participants' daily log books for the exercise and sham treatments.

Sham Protocol

A 16-week sham intervention of an over-the-counter nonmedicated hand moisturizing lotion (hand cream) was used. The hand cream was provided in a plain white plastic jar. The jar was affixed with a bar code to increase the perception that the hand cream may have therapeutic benefits. As per the original label, the jar was affixed with a warning to keep the product out of the reach of children. During the sham intervention period, subjects were instructed to apply the hand cream once per day using a gentle, nonvigorous technique. This technique was used to prevent any effects that massaging the hands might have. The first application of the cream was completed in the laboratory as instructed by the principal investigator to ensure proper technique was used. Written and pictorial instructions were provided for home use. Each subject kept a daily log book noting if the cream was used or not used. The principal investigator attempted to contact each subject once per month by phone, e-mail, or postal letter in an effort to increase compliance with the protocol, ensure there were no adverse reactions to the cream, and answer subjects' questions. Subjects were free to contact the lead investigator at any time if they had questions or concerns.

Exercise Protocol

The 16-week daily hand exercise intervention was standardized and included nine exercises as described in Table 1. Given the paucity of guidance on hand OA exercise prescription in the literature, the protocol was developed based on the work of Stamm et al.[17] and in consultation with an Occupational Therapist/Certified Hand Therapist. The first six exercises consisted of active range of

TABLE 1. **Hand Exercises**

Exercise	*Description*
Tabletop	The hand and wrist are held in a neutral position; subject flexes at the second to fifth metacarpophalangeal (MCP) joints only, and then returns to neutral.
Small fist	From neutral position; subject flexes at the second to fifth proximal interphalangeal joint and distal interphalangeal joint only, and then returns to neutral.
Large fist	From neutral position; subject flexes all joints to form a fist and then returns to neutral.
Okay signs	From neutral position; subject flexes to form an ''O'' with the tip of the thumb to the tip of each finger, in turn, returning to neutral after each.
Finger spread	From neutral position; hand is placed on flat table top and fingers are spread apart as wide as possible before returning to neutral.
Thumb reach	From neutral position, subject reaches across the palm of the hand and touches tip of thumb to fifth MCP and then returns to neutral.
Gripping	Subject holds the Thera-Band® Hand Exerciser ball in palm of hand and squeezes until ball is about 50% depressed.
Key pinch	Subject holds the Thera-Band® Hand Exerciser ball between the side of the thumb and side of the index finger and squeezes until ball is about 50% depressed.
Fingertip pinch	Subject holds the Thera-Band® Hand Exerciser ball between the tip of the thumb and the tip of the index finger and squeezes until the ball is about 50% depressed; this is repeated for digits three to five.

motion movements designed to improve joint flexibility. The last three exercises were designed to strengthen grip and pinch and used a non-latex polymer ball, the Thera-Band® Hand Exerciser (The Hygenic Corporation, Akron, OH). The Hand Exerciser is color coded by approximate resistance level at 50% compression, with yellow at 1.5 lb (0.68 kg), red at 3.0 lb (1.36 kg), green at 5.0 lb (2.27 kg), and blue at 8.0 lb (3.64 kg). It was available in two sizes; ''regular'' size was used for small-to-average-sized hands and ''extra large'' was used for larger hands or for those with difficulty grasping the smaller ball. The starting resistance for each subject was determined by the baseline grip and pinch static strength testing result, per guidelines presented in Table 2. Depending on clinical presentation, subjects could be assigned to use more than one color ball. For example, greater pain and dysfunction in first CMC required a softer ball for pinching exercises, whereas a firmer ball was appropriate for gripping.

TABLE 2. **Starting Exercise Program Resistance Level Guidelines for Thera-Band® Hand Exerciser**

Grip (lb)	*Key Pinch (lb)*	*Resistance (lb)/Color*
≤15	≤5	1.5/yellow
16–30	6–10	3.0/red
31–50	11–15	5.0/green
≥51	≥16	8.0/blue

After baseline testing, the first exercise session was conducted in the laboratory and was taught by the principal investigator. Thereafter subjects independently completed the home-based exercises. As with the sham treatment, written and pictorial instructions were provided for home use. The daily hand exercises were conducted in approximately ten to 15 minutes. Subjects kept a daily log book noting if each exercise was completed or not completed. The 16-week exercise program was designed to be progressive, with an increase in repetitions occurring after every fourth week. Subjects began with 10 repetitions the first four weeks, progressed to 12, then 15, and finally 20, if able, during the last four weeks. An exception was made for fingertip pinch (exercise number 9) where the repetitions were halved so as not to over stress the thumb. The exercise protocol was designed to take advantage of the progressive overload principle.[28] A longer training period compared to previous studies[17–19] was prescribed to ensure adequate time for adaptation. The principal investigator attempted to contact subjects once per month by telephone, e-mail, or postal letter to encourage adherence to the protocol and to help subjects adjust the exercises if needed (e.g., increase or decrease repetitions).

Washout

During the 16-week washout period between interventions, subjects were instructed to not use therapeutic hand cream or to do hand exercises. The materials used for the first intervention were collected before the washout period.

STATISTICAL METHODS

Data analyses included a descriptive summary of the study sample, as well as frequency percentages of the OA hand joints. Changes in hand function between baseline and week 16 of each intervention were compared. Values and scores were tested for Gaussian distribution (normality test). Both parametric and nonparametric versions of the paired t-test were used to test if the AUSCAN changes were statistically different from zero. Statistical analysis was performed using SAS statistical software version 9.12.[29] An a priori power calculation[30] indicated that 44 subjects were required to test our primary hypothesis of no difference in physical functioning between the exercise and the sham treatments. This reflects an anticipated MCID of 100 points on the AUSCAN index and a standard deviation of 170 (two-tailed alpha = 0.05; 80% power). When considering our total sample size goal, anticipated losses to follow-up were difficult to

determine as this type of hand OA trial had no published studies available for reference. Considering this uncertainty and the trial's lengthy 48-week duration, we set our recruitment goal at 75 subjects.

RESULTS

Subjects ($N = 76$) were 55–93 years of age. At baseline, 44 subjects (58%) reported the use of analgesic medications; these subjects reported using the medications 4.7 days per week. Thirty subjects (39%) reported the use of glucosamine and/or chondroitin. Subject demographics, by retention status, are presented in Table 3. Of the 76 subjects enrolled, 46 (60%) were retained the full 48 weeks (i.e., completed both the exercise and placebo treatments). The number of retained subjects exceeded the minimum estimated by our a priori statistical power calculation. Losses to follow-up analyses revealed no significant baseline differences between retained and not retained subjects in relation to AUSCAN scores, age, gender, intervention order, body mass index, use of analgesics or glucosamine/chondroitin, smoking status, handedness, family history of hand OA, or location of OA by hand joint. Of the 30 subjects that withdrew, 18 did so during their first intervention phase, five during the washout phase, and seven during their second intervention.

Regardless of intervention order, more subjects withdrew during the exercise phase ($n = 18$) than the placebo phase ($n = 7$). Among those who withdrew during the exercise phase, the reasons reported were increased hand symptoms (four subjects); medical issues unrelated to study (four subjects); nonmedical factors unrelated to study (three subjects); lost interest or could not remember to do intervention (three subjects); and lost contact/unknown (four subjects). Among those who withdrew during the placebo phase, the reasons reported were medical issues unrelated to study (three subjects); nonmedical factors unrelated to study (one subject); lost interest (one subject); and lost contact/unknown (two subjects). Among those who withdrew during the washout phase, three subjects reported unrelated medical issues and two could not be contacted to begin the second intervention phase.

TABLE 3. **Study Subjects' Baseline Characteristics, by Retention Status**

Variable	*Retained (n = 46)*	*Not Retained (n = 30)*
Age mean (SD), years	75 (6.7)	74 (8.5)
Female (%)	87	83
Body Mass Index mean (SD) kg/m^2	27.3	27.4
AUSCAN PF score, mean	490 (165.9)	469 (178.6)
AUSCAN PF score, min/max	233/784	241/828
Analgesics use (%)	63	50
Glucosamine/chondroitin use (%)	41	37
Current smoker (%)	11	7
Right handed (%)	91	90
Family history of hand OA (%)	54	43
(%) Radiographic CMC OA* (%)	94	93
(%) Radiographic DIP OA* (%)	94	93
(%) Radiographic PIP OA* (%)	83	73

AUSCAN = Australian Canadian; OA = osteoarthritis; CMC = carpometacarpal joint; PF = Physical function; DIP = distal interphalangeal joint; PIP = proximal interphalangeal joint.
Note: Retained = completed both interventions.
*CMC, DIP, and PIP OA (not calculated as mutually exclusive of OA at other hand sites).

TABLE 4. **AUSCAN Scores, by Treatment Status**

Variable	*Baseline*	*Follow-up*	*Difference*
Exercise treatment			
AUSCAN Physical Function score	476	460	−16
AUSCAN Pain score	225	190	−35*
AUSCAN Stiffness score	47	38	−9*
Sham treatment			
AUSCAN Physical Function score	473	433	−40
AUSCAN Pain score	230	190	−40*
AUSCAN Stiffness score	47	41	−6*

AUSCAN = Australian Canadian.
Note: Subscale maximums are Physical Function = 900; Pain = 500; Stiffness = 100.
*$p < 0.05$.

To compare the effects of exercise versus placebo, prepost data were analyzed only for the retained subjects. Retained subjects completed 93% of the daily sham hand cream applications and 87% of the daily hand exercise sessions. Major study findings are presented in Tables 4–6.

Although both the exercise and placebo treatments led to changes in the AUSCAN Physical Function subscale scores in the direction of improved functioning (pre- to posttest), neither met our MCID threshold of 100 mm. Furthermore, the difference between the exercise and placebo change scores on this scale was not statistically significant (see Table 5). Therefore, we cannot reject the null hypothesis of equality of change in self-reported hand function between the two treatments. No difference between

TABLE 5. **AUSCAN Score Changes, by Treatment Status**

Variable	*Exercise tx*	*Sham tx*	*Difference*	*p-Value*
AUSCAN Physical Function score	−16	−40	24	0.41
AUSCAN Pain score	−35	−40	5	0.84
AUSCAN Stiffness score	−9	−6	−3	0.66

AUSCAN = Australian Canadian.
Note: Subscale maximums are Physical Function = 900; Pain = 500; Stiffness = 100.

TABLE 6. **Grip (kg), Pinch (kg), and Purdue Pegboard* Scores, by Treatment**

Variable	*Baseline*	*Follow-up*	*Difference*
Exercise treatment			
R. maximum grip	42.53	44.50	1.98†
R. average grip	39.22	42.14	2.92†
L. maximum grip	38.35	40.88	2.53†
L. average grip	36.03	38.85	2.83†
R. maximum key pinch	10.88	11.78	0.90†
R. average key pinch	10.11	10.99	0.88†
L. maximum key pinch	9.44	10.68	1.24†
L. average key pinch	9.00	10.19	1.19†
R. maximum three-point pinch	10.04	10.60	0.56
R. average three-point pinch	8.96	9.60	0.64
L. maximum three-point pinch	9.28	10.47	1.19†
L. average three-point pinch	8.65	9.72	1.07†
R. peg board	12.88	13.40	0.53†
L. peg board	12.40	12.35	0.05
Both hands peg board	9.86	9.96	0.10
R + L + B peg board (best set)	34.36	34.99	0.63
Sham treatment			
R. maximum grip	43.28	43.78	0.50
R. average grip	40.61	40.69	0.09
L. maximum grip	39.70	39.40	0.30
L. average grip	37.49	37.67	0.18
R. maximum key pinch	11.05	11.01	0.04
R. average key pinch	10.31	10.25	0.05
L. maximum key pinch	9.49	9.51	0.03
L. average key pinch	9.00	9.22	0.21
R. maximum three-point pinch	9.56	9.85	0.29
R. average three-point pinch	8.72	8.89	0.18
L. maximum three-point pinch	9.39	9.45	0.06
L. average three-point pinch	8.70	8.70	0.00
R. peg board	13.18	13.83	0.65
L. peg board	11.98	12.08	0.10
Both hands peg board	9.61	12.33	2.71
R + L + B peg board (best set)	33.96	34.25	0.29

Note: Values are rounded.
†$p < 0.05$.
*Number of pins completed in 30 seconds.

exercise and placebo AUSCAN Pain and Stiffness subscale change scores was found (see Table 5).

All Purdue Pegboard dexterity scores were virtually unchanged with either treatment (see Table 6). Nine of 12 grip and pinch test strengths increased significantly after the exercise treatment. Exceptions to this were the right maximum grip and right maximum and average three-point pinch. There were no significant changes in hand strength with the placebo treatment (see Table 6).

DISCUSSION

Results of this investigation demonstrate that a series of nine easily self-administered daily hand exercises modestly improved the hand strength of older persons with hand OA. However, this increased strength did not translate into a perception of improved physical functioning, pain, or stiffness of the hands that was significantly different from a placebo treatment. As our final group size ($N = 46$) met the a priori power calculation minimum sample size requirement ($N = 44$), our data indicate that, in the population from which we drew our sample, there is no difference in AUSCAN Physical Function score changes between the exercise and sham interventions. In addition, although the study's sample power calculation was specific to our primary hypothesis, ancillary hypotheses were evaluated using trial data. Given that our ancillary findings were generated under this constraint, it is prudent to interpret them with appropriate caution.

The intervention had no effect on hand and finger dexterity as measured by the Purdue Pegboard. The peg board outcome suggests either that this exercise intervention was not effective in improving dexterity, or the testing method was not sensitive enough to detect the change. The Purdue Pegboard was developed as an aid for the selection of industrial employees, although norms have also been developed for brain damage, learning disabilities, vocational rehabilitation, and reading disorders. Although the Purdue Pegboard was chosen because it is inexpensive and widely available, the tests were not specifically developed for older adults. A dexterity test specifically developed to test ADLs skills or for older adults (e.g., Jebsen Hand Function Test; TEMPA Upper Extremity Performance Test for the Elderly[31]) should be considered for future studies.

Our hand strength and function results are more difficult to interpret. Although there are few studies of the effects of exercise among persons with hand OA, there are many studies indicating the benefits of exercise for persons with knee OA.[32–35] It has been assumed that the benefits of exercise at the knee joint would be similar for exercise at other joints, but this assumption is only now being tested.

Our results are also in contrast with those of the only similar study in the literature. Stamm et al.[17] found a moderate (20%) improvement in maximum hand grip strength using a similar active range of motion hand exercise routine, but without specific strengthening exercises. They also found significantly more subjects improved on a VAS of "global hand function" in comparison to controls. By contrast, our investigation demonstrated a mean increase of about 5% in right and left hand grip maximum strength after the exercise treatment. Additionally, the improvement in AUSCAN hand function did not meet the predetermined MCID nor was it significantly different from the placebo treatment outcome.

The role and extent to which instrumentation may have influenced these differences in findings between the two studies remains unclear. Stamm et al.[17] used a pressure bulb vigorimeter for grip strength measurement, whereas we used an isometric grip dynamometer. However, a published study

indicates very high correlations between these two types of instruments in the elderly population.[36] Another possible explanation for the difference in findings between these two studies may be related to the approaches for measuring hand physical functioning. Stamm et al.[17] used the Human Activity Questionnaire plus two questions of their own to assess global hand function, with a 10% increase considered improvement, whereas we used the hand arthritis−specific AUSCAN with a MCID of 100. The Stamm et al.'s study provides an important contribution to the paucity of literature in this area. In conjunction with our present study, it also affords the comparison of findings between studies that use different parameters such as self-assessment measurements and MCID levels.

The small change in hand strength, resulting from our protocol was unexpected. Given that the previous study using only active range of motion exercises[17] experienced the aforementioned 20% increase in hand strength, we expected that a regimen which 1) was one month longer, 2) used similar active range of motion exercises, 3) was progressive in repetitions, and 4) included strengthening exercises should have seen similar, if not more substantial, effects. However, it may be that the exercise prescription of the present study was overly ambitious for elderly subjects with hand impairments. A general principle of resistance training is to allow at least one day of rest between strength training workouts to allow adaptations to occur.[37,38] However, it was not known how applicable this principle was to therapeutic hand exercises. In designing this investigation, it was assumed that due to the relatively low resistance of the hand exerciser balls and a protocol more conducive to improving muscular endurance than strength, a rest day would not be required. A recently published study[20] found that older adults with radiographic hand OA tolerated a fairly rigorous general strength training regimen that included a plate-loaded hand gripper exercise and other exercises requiring gripping. The older age group in that study (71−85 years) experienced an increase in grip strength of about 13%. However, only 24% of these subjects were classified as having symptomatic hand OA, whereas by design, all of the present subjects were symptomatic (in terms of hand function). In addition, although the former exercise program was much more demanding, the subjects trained only three days per week.

Another factor for consideration was our use of a progressive repetition protocol. Although progression is an accepted exercise training principle, it is possible that these older symptomatic subjects were not able to fully adapt to the increased repetitions in the course of each four-week period. Given the results of this and other investigations, future researchers should consider a day of rest between strength exercises, even if daily active range of motion exercises are prescribed, and carefully consider a slower progression of repetitions. Another consideration is that our study design tested the independent effects of hand exercise. In contrast, previous clinical trials tested hand exercise in combination with other interventions such as splinting and joint protection programs. We speculate that the practice of using a comprehensive intervention program that includes exercise may be superior to exercise alone. A final consideration is the age of our subjects. However, a previous study with a similar age group[20] demonstrated that older adults can increase grip strength by strength training. Numerous studies have found that older adults are able to improve muscle strength and muscle mass[39−41] with exercise training.

CONCLUSIONS

As the baby boomer population ages, many more adults are becoming at risk for hand OA. The results of this investigation found that while a home-based daily 16-week regimen of hand strength and range of motion exercises modestly improved grip and pinch strength, this benefit was not sufficient to see an improvement in self-reported hand physical function or pain. It is suggested that a hand strengthening program designed with a day of rest between strength sessions, and a slower progression of repetitions, may produce a greater improvement in hand strength and therefore improve self-reported hand function. Further research is needed to investigate this possibility. A shorter study period than that used here (48 weeks) might improve retention rates in future investigations. Further research of comprehensive intervention programs, which combine factors such as education and ergonomics with exercise may also be warranted.

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JHT Read for Credit
Quiz: Article # 119

Record your answers on the Return Answer Form found on the tear-out coupon at the back of this issue. There is only one best answer for each question.

#1. The AUSCAN measure has been
   a. previously shown to be valid but not reliable
   b. shown by this study to be reliable but not valid
   c. shown by this study to be reliable and valid
   d. previously demonstrated to be reliable and valid

#2. The design called for
   a. half the subjects to receive the exercise protocol
   b. half the subjects to receive the sham cream treatment
   c. all subjects to receive a course of the exercise protocol and a course of the sham cream treatment
   d. all the subjects to receive the exercise protocol first and the sham cream treatment second

#3. The instructions to the subjects purposely lead them to believe that
   a. each protocol was equally effective
   b. one protocol was more effective than the other, but they were not told which
   c. nothing was known about the effectiveness of either protocol, and therefore both were being tested for effectiveness
   d. the reliability and validity of the outcome measures were the focus of the study, not the effectiveness of the protocols

#4. The exercise protocol consisted of 9
   a. individualized exercises (on a subject-to-subject basis)
   b. standardized exercises
   c. exercises demonstrated to the subjects in a group setting
   d. standardized exercises presented to the subjects individually by handing them an instruction sheet with pictures and written instructions. There were no verbal instructions given, only the sheet.

#5. The study showed
   a. conclusive evidence of significant improvement in the AUSCAN measures
   b. no conclusive evidence of any significant improvement in the AUSCAN measures
   c. conclusive evidence that home exercises are not beneficial in the subject population
   d. conclusive evidence that home exercises are beneficial in the subject population

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