Journal of Hand Therapy xxx (2017) 1–11

Contents lists available at ScienceDirect

Journal of Hand Therapy

journal homepage: www.jhandtherapy.org

Scientific/Clinical Article

Effectiveness of a fine motor skills rehabilitation program on upper limb disability, manual dexterity, pinch strength, range of fingers motion, performance in activities of daily living, functional independency, and general self-efficacy in hand osteoarthritis: A randomized clinical trial

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ARTICLE INFO

Article history:
Received 11 May 2016
Received in revised form
22 November 2016
Accepted 9 December 2016
Available online xxx

Keywords:
Hand osteoarthritis
Occupational therapy
Rehabilitation
Activities of daily living

ABSTRACT

Study Design: A randomized clinical trial.
Introduction: Rehabilitation treatments for improving fine motor skills (FMS) in hand osteoarthritis (HOA) have not been well explored yet.
Purpose of the Study: To assess the effectiveness of a rehabilitation program on upper limb disability, independence of activities of daily living (ADLs), fine motor abilities, functional independency, and general self-efficacy in older adults with HOA.
Methods: About 45 adults (74-86 years) with HOA were assigned to an experimental group for completing an FMS intervention or a control group receiving conventional occupational therapy. Both interventions were performed 3 times/wk, 45 minutes each session, during 8 weeks. Upper limb disability, performance in ADLs, pinch strength, manual dexterity, range of fingers motion, functional independency, and general self-efficacy were assessed at baseline, immediately after treatment, and after 2 months of follow-up.
Results: FMS group showed significant improvements with a small effect size on manual dexterity ($P \leq .034$; $d \geq 0.48$) and a moderate-high effect on range of index ($P \leq .018$; $d \geq 0.58$) and thumb ($P \leq .027$; $d \geq 0.39$) motion. The control group showed a significant worse range of motion over time in some joints at the index ($P \leq .037$; $d \geq 0.36$) finger and thumb ($P \leq .017$; $d \geq 0.55$).
Conclusions: A rehabilitation intervention for FMS may improve manual dexterity and range of fingers motion in HOA, but its effects on upper limb disability, performance in ADLs, pinch strength, functionality, and self-efficacy remain uncertain. Specific interventions of the hand are needed to prevent a worsening in range of finger motion.
Level of Evidence: 1b.

Conflict of interest: All named authors hereby declare that they have no conflicts of interest to disclose.

Role of funding: This study was partially supported by CTS-526 grant from the Junta de Andalucía (Regional Government of Andalusia, Spain). JMP-M is PhD student of the Biomedicina program of the University of Granada and was supported by becas del Plan Propio of University of Granada, Spain.

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0894-1130/$ – see front matter
http://dx.doi.org/10.1016/j.jht.2016.12.001

Introduction

Osteoarthritis (OA) is a group of characteristics related to impairment on the integrity of the articular cartilage and variations in the underlying bone.[1,2] Hand osteoarthritis (HOA) is described by a gradual damage of articular cartilage linked to degradation of subchondral bone, joint borders, and periarticular structures. The joints of the hand most frequently altered are the 4 proximal and distal interphalangeal joints and the carpometacarpal joints.[1,3-5] However, the prevalence of affected joints in OA of the hand can vary widely. A prospective cohort study performed in the Netherlands and based on radiographic information showed that the most frequently affected locations were the distal interphalangeal joint with 47.3%, trapeziometacarpal joint with 35.8%, proximal interphalangeal joints with 18.2% and metacarpophalangeal joints with 8.2%.[6,7] Half of the patients with distal interphalangeal joint impairment also have deterioration of proximal interphalangeal joints.[1] These altered joints can directly cause disability,[1] and they may lead to functional limitation.[8]

OA is quite frequent after 40 years.[8] Patients older than 55 years usually present radiographic OA in one or more hand joints.[4,7] This pathology is also generalized in people older than 60 years,[7] and 60%-70% of patients being 65 years and older search for medical services for HOA symptoms.[4,9]

The main symptoms of this disease are pain, stiffness, inflammation, and deformities of several joints that cause restrictions in usual manual activities.[3,4,8] Function in hand-related activities of daily living (ADLs) declines[4] because patient with OA can encounter problems to handle heavy objects or manipulate small items.[10] The impaired ADLs are usually self-care activities, such as buttoning, using a toothbrush, or cutting foods with a knife, using hand tools[10] or writing tasks.[5] HOA patients can also suffer from reduced muscle strength including grip and pinch strength, decreased range of motion (ROM) in noninvolved and involved joints, increased fatigue, and decreased resistance.[1] In turn, the focal hand lesions provoked by OA process can cause upper limb disability.[1,10]

In the context of rehabilitation, the evaluation of patients with OA frequently includes performance in ADLs, upper limb coordination, manual dexterity, strength, ROM, and functional independency assessment. Furthermore, when therapists aim to optimize the practical skills of patients with OA, they should solely understand not only the biomechanical aspects but also the psychosocial aspects of the disease.[11] Hence, although patient's perceptions are not usually taken into account as possible outcomes after rehabilitation interventions, some motivational constructs such as general perception of self-efficacy are shown to be important to evaluate in that area,[12,13] especially in patients with OA.[14] Self-efficacy is defined as someone's belief in his or her own capacity to complete tasks and/or reach goals.[15] Self-efficacy beliefs have been shown to influence the sort of actions people select and someone's grade of effort and level of persistence to cope with obstacles and aversive experiences.[16,17] Self-efficacy has been shown to be associated with pinch strength, upper limb dexterity, involving upper limb coordination and manual dexterity, and upper limb disability.[14] This construct has been also suggested to be related to health behaviors and health status.[15] Greater self-efficacy predicts higher levels of functional performance in people with OA.[18,19] Furthermore, participation in physical activities may even increase self-efficacy perception.[16] In fact, Rejeski et al[18] reported higher self-efficacy scores 1 year and a half after an exercise intervention.

Traditional rehabilitation principles on OA patients have been aiming to maximize joint ROM and muscle strength, performing movement of both involved and noninvolved joints by therapeutic exercises, incorporating the joint protection principles, control of edema[8] using physical agent as cold or heat, and physical activity as yoga.[10,20]

Rehabilitation research for HOA has been focusing on general hand and upper limb exercises that however do not involve specific fine motor skills (FMS) of the hand.[1,8] Systematic reviews have reported that this approach has shown only moderate-level evidence for improving components, such as ROM, strength, or function.[1,3] According to Stamm et al,[21] patients with OA would appreciate more specific procedures directed to improve their individual everyday activities. For these reasons, several studies have suggested that suitably selected activities can lead to higher benefits in OA patients than simply hand exercise programs.[11,14] Selected activities could reach the desired aims for fine motor abilities on upper limb disability, without a negative effect on joints or tissues.[8] Hence, it would be necessary to study structured rehabilitation programs, including therapeutic principles in ADLs for developing fine motor abilities, directed to improve HOA symptoms and restore functional impairments.[4]

The purpose of this study was to assess the effectiveness of a specific FMS rehabilitation program on upper limb disability, performance in basic and instrumental ADLs, pinch strength, manual dexterity, range of finger motion, functional independency, and general self-efficacy in older adults with HOA. The hypothesis is that a specific intervention including FMS could improve upper limb disability, independence of ADLs, FMS, functional independency, and general self-efficacy in comparison to a conventional occupational therapy program for upper limb mobility based on technical aids and body exercises involving general and broad exercises of hands and upper limbs.

Methods

Participants

Study participants were older adults with OA from 6 health community centers in the province of Granada (Spain) who participated in a previous cross-sectional study.[14] Inclusion criteria were being older than or equal to 65 years; having a diagnosis of HOA; being stable at least 4 weeks before and during the period of the study; currently not receiving another specific rehabilitation therapy for upper limbs; and being institutionalized either on a full-time or part-time basis. Exclusion criteria were suffering from cognitive impairment (to obtain $<$23 points in educated people [with a school diploma] or $<$20 points in not educated or illiteracy [without a school diploma], in the Spanish validation of Mini-Mental State Examination test)[22] suffering from a severe visual or sensory deficit, suffering from problems of postural control, experiencing balance disorders while being seated; or suffering from severe motor impairment of the upper limbs obstructing the appropriate evaluation or participation in this study. Of 257 participants recruited from the accessible population, 48 met the study selection criteria. To control the participants' treatment adherence, the therapists registered each intervention daily, collecting the date, time, duration of the activity, and observations for each participant.

Design

A randomized clinical trial was performed between May 2014 and January 2015. Enrolled participants (enrolled by MEA-F and JMP-M) were randomly assigned to the control group ($n = 23$) for receiving a conventional occupational therapy intervention for upper limbs or to the experimental group ($n = 25$) for the application of a treatment for improving FMS (randomized by MIP-R). Both interventions were applied 3 times a week during 45