

# Comparison between Care Strategies for Patients with Osteoarthritis of the Hands Based on the Use of Joint Protection, Assistive Technology and Exercises

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## Abstract

**Background:** Osteoarthritis (OA) is a disabling disease that can affect 6% to 12% of the adult population and more than a third of people over 65 years of age. **Purpose:** To assess whether a group of people with hand osteoarthritis (hOA) who received different types of treatment improved their function after two years of follow-up. **Method:** The entire sample (n = 97) underwent three follow-up assessments regarding anthropometric parameters of the upper limbs and ability to perform functional activities. Subsequently, the sample was divided into two groups for the intervention periods, called the First Period (n = 73) and the Second Period (n = 24); the First Period kept the same protocol with orientations, and the Second Period went to an intervention with orientation strength exercises and use of orthosis. **Findings:** In the separate analysis of the three questions of the DASH pain module, no differences were found between the assessment moments for groups of guidelines, treatment, or symptoms. Significant effects were observed for  $F(2, 162) = 3.5$ ,  $p = 0.033$ ,  $\eta^2 = 0.04$ , and interaction for moments and intervention  $F(2, 162) = 4.3$ ,  $p = 0.016$ ,  $\eta^2 = 0.05$ . **Implications:** It can be concluded that only guidance treatment does not benefit patients with hand osteoarthritis. In contrast, guidance, exercise, and orthosis treatment can significantly improve the disease.

## Keywords

Hand Osteoarthritis, Hand Deformities, Occupational Therapy

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### 1. Introduction

Hand osteoarthritis (hOA) is characterized by the progressive loss of articular cartilage, accompanied by the deterioration of subchondral bone, particularly in the articular margins and periarticular structures of the proximal interphalangeal joints (PIPJ), distal interphalangeal joints (DIP), or carpometacarpal (CMC) joints [1]. The signs and symptoms of hOA can include pain, joint deformities, reduced hand strength, and decreased function in activities of daily living [2].

Due to the functional difficulties in daily activities, various studies have assessed hOA and functionality through non-drug treatments [3]-[11]. Nonpharmacological treatments for hOA primarily aim to relieve pain, maintain a functional range of motion, increase functional strength, preserve joint stability, and prevent fixed deformities [9].

Two essential rehabilitation treatments for hOA are exercise and assistive technology. Exercise is necessary for maintaining range of motion and muscle strength [8] [9] [12]-[14]. Proprioception, closely related to exercise, and the neuromuscular control of the thumb and fingers are essential for maintaining normal joint stabilization to avoid joint deformity or injury. Altered proprioception can be associated with pain, fatigue, localized nerve or tissue damage, desensitization of the nervous system, and changes in the cortical representation of the thumb or fingers involved in grip [15].

Assistive technology, such as orthoses and splints, provides joint support and allows functional hand movement [16] [17]. Despite the benefits of exercise and assistive technology, these interventions require time for monitoring support from healthcare professionals and can be costly [18] [19].

Therefore, patient education is another viable intervention, which can yield good results through joint protection (respecting pain, balancing activities and rest, providing regular rest for the joints, and maintaining or using other joints with good alignment) and fatigue management (energy conservation by modifying activities and adopting rest periods to avoid fatigue) [20]. This practice is currently recognized in the literature as “ergonomic principles” [21].

hOA is often associated with a high clinical burden, causing persistent pain, increased stiffness, and reduced grip strength, which can significantly limit daily activities related to self-care, work, and leisure, thus reducing the quality of life. The thumb carpometacarpal joint (CMCJ) is among the most commonly affected hand joints [22]. The 2018 EULAR recommendations for hOA management highlight that all patients with hOA should be offered patient education, hand exercises, and assistive devices, with orthoses considered for symptom relief [23].

To verify improvement, we analyzed assessments of the anthropometric parameters of the upper limbs and the ability to perform functional activities in all participants at three points (before starting the protocol, one year after orientation, and at the end of treatment). This study aimed to assess whether a group of hOA patients receiving different kinds of treatment showed functional improvement after two two-year follow-ups. The initial hypothesis was that all participants would improve initially with education treatment. In the second phase, both groups would continue to improve, with better outcomes for those who used exercise and assistive technology with guidance classes. The results of this study are essential for guiding therapists on the effectiveness of different treatment options for patients with hOA.

## 2. Materials and Methods

Considering the possibility of educational intervention for the treatment of hOA, including education on specific movements to avoid reducing joint pain and inflammation worsening [20] [24], we built a study to identify benefits from the patient education intervention organized in two intervention periods. In the First Period (during four repeated classes for one year), all participants underwent a treatment only using orientations to provide better function. At the same time, in the Second Period, the group was divided into two subgroups that underwent treatment for another year of therapy (*i.e.* the first subgroup maintained the same protocol with orientations, and the second subgroup practiced an intervention with strength exercises and the use of assistive technology—orthosis), considering the first group asymptomatic and the second referring to the most significant pain complaint in the pain assessment in the DASH questionnaire, and greater degrees of deformity according to the Kelgren and Lawrence (KL) classification. To verify improvement, we analyzed assessments regarding anthropometric parameters of the upper limbs and the ability to perform functional activities in all participants considering three evaluation moments (before stating the protocol, one year after orientation, and at the end of treatment).

Participants were evaluated for their upper limb abilities. At baseline in February 2012, the Stanford Health Assessment Questionnaire (HAQ) instruments and the Disabilities of the Arm, Shoulder, and Hand (DASH) were utilized. The patients were evaluated for grip strength with a Jamar dynamometer. Key pinch strength, tripod, and pulp-pulp pinch were evaluated using a B & L Gauge. The force was established by averaging three attempts. The tests were performed bilaterally. The presence of deviations or deformities of the hands was evaluated. Those patients with indications for hand, wrist, and/or finger orthotics received prescriptions for the devices.

Between March and May (2012), the patients received educational material (booklet and DVD) and attended classes with occupational therapy workers regarding OA, its causes, and treatment modalities. The patients were instructed on joint protection methods during activities of daily living and the importance

of alternating activities with different levels of energy expenditure. On the first lecture day, this was performed in a 50-minute class and a one-hour workshop with a simulated house (kitchen, living room, bathroom, bedroom, and tools room). On the second day of the lecture, patients were enrolled in a one-hour workshop to alternate activities of different levels of energy expenditure in their weekly routine. This education routine was repeated four times a year. After 12 months, the patients were again subjected to the HAQ and DASH questionnaires, and the handgrip and pinch strength measurements were repeated.

### **2.1. Ethical Approval and Informed Consent**

This study is a retrospective and experimental study of a non-randomized control case.

The research was submitted and approved by the Medicine College, São Paulo University ethics committee, with the approval protocol number 1,816,207. It was submitted to Clinical Trials with the identification number NTC03173989. This study was financed in part by the Coordination for the Improvement of Higher Education Personnel, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, Brasil (CAPES), Finance Code 001.

### **2.2. Participants and Location**

Ninety-seven patients from the group of Bone Metabolic Diseases of the Institute of Orthopedics and Traumatology of the Medicine College of the University of São Paulo (FMUSP) were included between 2012 and 2014. This research was used in the first author's master's thesis from 2016 to 2018.

The inclusion criteria were patients aged between 40 and 80 years, with involvement of the first carpometacarpal, metacarpophalangeal, or interphalangeal joint of the thumb and the proximal or distal interphalangeal joint of fingers with I to III degrees, considering Kelgreen and Lawrence (KL) classification.

This classification graduates hand osteoarthritis as grades 0 (none—no features); grade I (doubtful OA—osteophyte with doubtful significance); grade II (minimal OA—definite osteophyte, unpaired joint space); grade III (moderate OA—moderate diminution of joint space) and grade IV (severe OA—joint space significantly impaired with sclerosis of subchondral bone) [25]-[27].

As an exclusion criterion, we considered patients who had undergone previous non-medical treatment for hOA, had undergone some surgical procedure in the region, or were involved in another clinical trial and also excluded patients with rheumatoid arthritis or other rheumatologic disease, patients who had any neurological problems, and/or who were unable to understand and agree to the consent form and questionnaires and evaluations regardless of their level of education. Considering the Kelgreen and Lawrence (KL) classification, we also excluded patients in grade IV. Immobilization from degrees I to III, exercise, and analgesia are recommended. Exercises aren't recommended in grade

IV or when the patient does not present remission of symptoms with other treatments [28] [29].

### 2.3. Data Collection

All participants (n = 97) underwent Two Periods of Intervention (two different protocols) with three follow-up (moments) assessments regarding anthropometric parameters of the upper limbs and ability to perform functional activities.

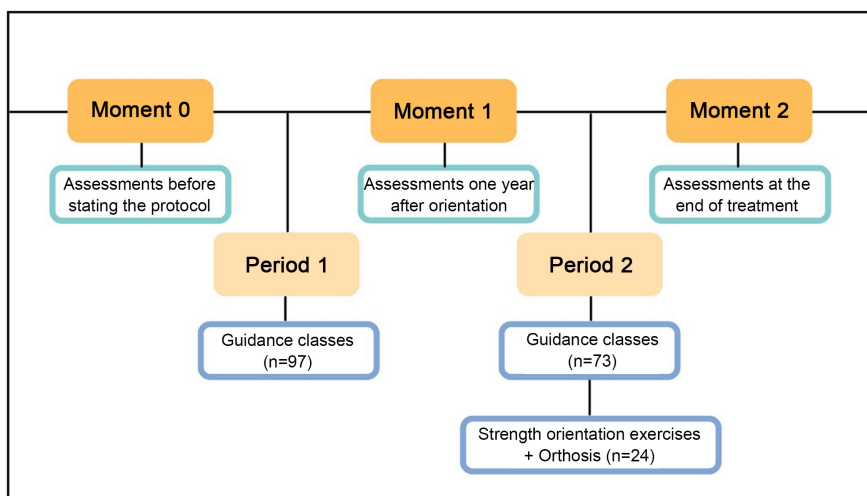
*Moment 0:* Assessments before starting the protocol.

*Moment 1:* Assessments one year after orientation.

*Moment 2:* Assessments at the end of treatment.

The assessments used in all three moments for hOA were the “Disability of the Arm, Shoulder and Hand—DASH” [30] and “Stanford Health Assessment Questionnaire—HAQ” [31] besides qualitative questionnaires to assess grip strength, with Jamar<sup>®</sup> Dynamometer and key pinch, palmar pinch, and thumb tip to index strength with B&L Pinch-gauge<sup>®</sup> Dynamometer [32]-[34]. The force measured with a dynamometer was established after the arithmetic average of three trials. The tests were performed bilaterally.

*Periods of Intervention (Figure 1):*



**Figure 1.** Study protocol design.

*First Period of Intervention:* The sample received four guidance classes on Joint Protection and Fatigue Management for one year. The guidelines included theoretical classes (slides, printed information material, and video) and practical classes at an adapted home. Theoretical classes were carried out through slide presentations with concepts of joint protection, fatigue management, time organization, home and work environment, and organization of the daily routine. The practical classes were held in a simulated house, set up in two infirmary rooms, suggesting all the environments of a conventional home. Adaptations made by therapists’ commercials and conventional objects used in activities of daily living were used for the guidelines described above. During the guidance

classes, we emphasized recommendations for joint protection and energy conservation, including osteoarthritis joints (hands, knees, hips, spine, shoulders, and others).

*Second Period of Intervention:* The entire sample was divided into two subgroups, receiving different interventions for another year. The first subgroup (n = 73) maintained the same orientation treatment with four orientation classes using the same protocol. In contrast, the second subgroup (n = 24) received the same number of orientations and started an intervention with strength orientation exercises and orthosis.

It is essential to emphasize that the second subgroup that participated in the second period was characterized by patients with radiographic signs and symptoms of hands that presented more significant functional limitations in the daily routine or that were eligible for rehabilitation treatment using orthoses models such as resting hand volar splints, thumb stabilization splints or finger volar splints with nocturnal support, aiming at the relief of the pain, stabilization of the affected joints and the prevention of the appearance/aggravation of deformities.

## 2.4. Data Analysis

The following variables were considered as dependent variables: HAQ, DASH (general questions, symptoms, and functions in athletes, performing artists, and workers), and dynamometry (hand grip, key pinch, palmar pinch, and thumb tip to index strength) for the right and left hands.

The dependent variables were submitted to ANOVA (variance analysis) with factor 2 (First Period and Second Period of Intervention) by 3 (Moment 0, Moment 1, and Moment 2) with repeated measures in the last factor. To compare the pain scores in the evaluation moments, the Friedman test was used in a separate moment for the three questions of the DASH's pain module. Post-hoc comparisons were conducted using the Tukey-HSD test ( $p < 0.05$ ). The effect size was calculated by *Partial eta squared*, with "0.01" indicating a small effect, "0.06" indicating a medium effect, and "0.14" or more indicating a large effect.

## 3. Results

Although there was no statistical significance for any of the tested variables, probably due to the number of subjects in each group, there was a tendency to have more women in the groups and more individuals using chondroprotective medications, according to (Table 1). Furthermore, most of the sample was not using an orthosis.

The results are also analyzed according to each test used.

### 3.1. Stanford Health Assessment Questionnaire—HAQ

There are no effects or interactions for intervention, groups of orientation, and evaluation moments.

**Table 1.** Characterization of the sample subjects, according to gender and variables such as medications and orthotic joints, in each group.

		Groups				
		1	2	3	4	Total
		Total n: 23	Total n: 24	Total n: 29	Total n: 21	Total n: 97
		n (%)	n (%)	n (%)	n (%)	n (%)
<b>Gender</b>	Woman	16 (70)	19 (79)	24 (83)	16 (76)	75 (77)
	Man	7 (30)	5 (21)	5 (17)	5 (24)	22 (23)
<b>Medication use</b>						
<b>Chondroprotectors</b>	Yes	18 (78)	19 (79)	23 (79)	12 (57)	72 (74)
	No	5 (22)	5 (21)	6 (21)	9 (43)	25 (26)
<b>Antirheumatics</b>	Yes	13 (57)	13 (54)	15 (52)	5 (24)	46 (47)
	No	10 (43)	11 (46)	14 (49)	16 (76)	51 (53)
<b>Calcium</b>	Yes	12 (55)	14 (58)	17 (59)	11 (52)	54 (56)
	No	10 (45)	10 (42)	12 (41)	10 (48)	42 (44)
<b>Vitamin D</b>	Yes	9 (39)	8 (33)	9 (31)	8 (38)	34 (35)
	No	14 (61)	16 (67)	20 (69)	13 (62)	63 (65)
<b>Vitamin B3</b>	Yes	3 (13)	6 (25)	6 (21)	2 (10)	17 (18)
	No	20 (87)	18 (75)	23 (79)	19 (90)	80 (82)
<b>Anti-inflammatories</b>	Yes	8 (35)	9 (37)	6 (21)	10 (48)	33 (34)
	No	15 (65)	15 (63)	23 (79)	11 (52)	64 (66)
<b>Painkillers</b>	Yes	11 (48)	11 (46)	16 (55)	9 (42)	47 (48)
	No	12 (52)	13 (54)	13 (45)	12 (57)	50 (52)
<b>Muscle Relaxants</b>	Yes	10 (43)	8 (33)	5 (17)	1 (5)	24 (25)
	No	13 (57)	16 (67)	24 (83)	20 (95)	73 (75)
<b>Orthoses (joints included)</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Total</b>
<b>Thumb</b>		4 (17)	0 (0)	1 (3)	0 (0)	5 (5)
<b>Fingers</b>		3 (13)	0 (0)	2 (7)	1 (5)	6 (6)
<b>Thumb and fingers</b>		0 (0)	2 (8)	0 (0)	1 (5)	3 (3)
<b>Fist and thumb</b>		1 (4)	0 (0)	0 (0)	0 (0)	1 (1)
<b>Fist</b>		0 (0)	1 (4)	0 (0)	0 (0)	1 (1)
<b>Thumb, fist, and fingers</b>		1 (4)	0 (0)	4 (14)	0 (0)	5 (5)
<b>None</b>		14 (61)	21 (88)	22 (76)	19 (90)	76 (78)

### 3.2. Disability of the Arm, Shoulder, and Hand—DASH (General)

There are no effects or interactions for intervention, groups of orientation, and evaluation moments.

### 3.3. DASH Symptoms and Functions in Athletes, Performing Artists

There are no effects or interactions for intervention, groups of orientation, and

evaluation moments.

### 3.4. DASH Work

No differences were found between evaluation moments for orientation, treatment, or symptom groups.

### 3.5. Hand Grip Dynamometry

#### 3.5.1. Right Hand

Significant effects for evaluation moments  $F(2, 162) = 3.5$ ,  $p = 0.033$ ,  $\eta^2 = 0.04$  and interaction for moments and intervention  $F(2, 162) = 4.3$ ,  $p = 0.016$ ,  $\eta^2 = 0.05$  were found. Post-hoc test showed that there was a difference between the first ( $M = 22.4$  g) and second evaluation moments ( $M = 20.4$  g;  $p = 0.018$ ), as well as between the second and third evaluation moments ( $M = 22.0$  g;  $p = 0.028$ ), but this difference was more predominant on the group that has intervened with exercises, orthoses and orientation (first—22.8 g *vs* second evaluation moment—18.6 g;  $p = 0.006$ /second *vs* third evaluation moment—21.4 g;  $p = 0.033$ ).

There are no effects or interactions for groups of orientation.

#### 3.5.2. Left Hand

Significant effects for evaluation moments  $F(2, 162) = 5.6$ ,  $p = 0.004$ ,  $\eta^2 = 0.04$  and interaction for evaluation moments and intervention  $F(2, 162) = 4.0$ ,  $p = 0.020$ ,  $\eta^2 = 0.05$  and were found. Post-hoc test showed that there was a difference between the first ( $M = 22.4$  g) and second evaluation moments ( $M = 21.5$  g;  $p = 0.002$ ), as well as between the second and third evaluation moments ( $M = 19.8$ ;  $p = 0.026$ ), but this difference was more predominant on the group that has intervened with exercises, orthoses and orientation (first—22.3 g *vs* second evaluation moments—17.7 g;  $p = 0.002$ /second *vs* third evaluation moments—20.6 g;  $p = 0.038$ ), while in the group with only orientation, there were no differences between moments of evaluation.

No effects or interactions for groups of orientation were found.

### 3.6. Tip Pinch Dynamometry

#### 3.6.1. Right Hand

A significant effect for evaluation moments  $F(2, 160) = 3.4$ ,  $p = 0.036$ ,  $\eta^2 = 0.04$  was found. Post-hoc test showed that the strength was higher in the third evaluation moment ( $M = 4.5$  g) compared to the second ( $M = 4.0$  g;  $p = 0.007$ ). There was no difference from the first evaluation ( $M = 4.2$  g).

No effects or interactions for groups of orientation and intervention were found.

#### 3.6.2. Left Hand

There was a significant effect for evaluation moments  $F(2, 162) = 5.2$ ,  $p = 0.007$ ,  $\eta^2 = 0.06$ . The post-hoc test showed a significant difference between the second ( $M = 3.6$  g) and third evaluation moments ( $M = 4.2$ ;  $p = 0.001$ ). There was no

difference comparing both to the first evaluation ( $M = 3.9$  g).

No effects or interactions for groups of orientation and intervention were found.

### 3.7. Key Pinch Dynamometry

#### 3.7.1. Right Hand

Significant effects for evaluation moments  $F(2, 160) = 5.5$ ,  $p = 0.005$ ,  $\eta^2 = 0.06$  and interaction for evaluation moments and intervention  $F(2, 160) = 3.1$ ,  $p = 0.046$ ,  $\eta^2 = 0.04$  were found. Post-hoc test showed that there was a marginal difference between the first ( $M = 6.5$  g) and second evaluation moments ( $M = 6.2$  g;  $p = 0.060$ ), and a significant difference between the second and third evaluation moments ( $M = 6.8$  g;  $p = 0.002$ ), but this difference was more predominant on the group that has intervened with exercises, orthoses, and orientation (first— $6.5$  g *vs* second evaluation moments— $5.7$  g;  $p = 0.013$ /second *vs* third evaluation moments— $6.5$  g;  $p = 0.034$ ).

No effects or interactions for groups of orientation and intervention were found.

#### 3.7.2. Left Hand

There was a significant effect for evaluation moments  $F(2, 162) = 5.9$ ,  $p = 0.004$ ,  $\eta^2 = 0.07$ . Post-hoc test demonstrated that there was a difference between the first ( $M = 6.0$  g) and second evaluation moments ( $M = 5.6$  g;  $p = 0.027$ ), as well as between the second and third evaluation moments ( $M = 6.4$  g;  $p = 0.001$ ).

No effects or interactions for groups of orientation and intervention were found.

### 3.8. Palmar Pinch Dynamometry

#### 3.8.1. Right Hand

Significant effects for evaluation moments  $F(2, 160) = 8.0$ ,  $p = 0.001$ ,  $\eta^2 = 0.09$  and interaction for evaluation moments and intervention  $F(2, 160) = 3.5$ ,  $p = 0.035$ ,  $\eta^2 = 0.04$  were found. Post-hoc test showed that there was a significant difference between the first ( $M = 5.5$  g) and second evaluation moments ( $M = 4.8$  g;  $p = 0.001$ ), and a significant difference between the second and third evaluation moments ( $M = 5.5$  g;  $p < 0.001$ ), but this difference was more predominant on the group that has intervened with exercises, orthoses, and orientation (first— $5.5$  g *vs* second evaluation moment— $4.2$  g;  $p = 0.001$ /second *vs* third evaluation moments— $5.1$  g;  $p = 0.014$ ).

No effects or interactions for groups of orientation and intervention were found.

#### 3.8.2. Left Hand

Significant effects for evaluation moments  $F(2, 160) = 12.2$ ,  $p < 0.001$ ,  $\eta^2 = 0.13$  and interaction for evaluation moments and intervention  $F(2, 160) = 6.2$ ,  $p = 0.003$ ,  $\eta^2 = 0.07$  were found. Post-hoc test showed that there was a significant difference between the first ( $M = 5.1$  g) and second evaluation moments ( $M =$

4.5 g;  $p = 0.001$ ), and between the second and third evaluation moments ( $M = 5.4$  g;  $p < 0.001$ ), but this difference was more predominant on the group that has intervened with exercises, orthoses and orientation (first—5.2 g *vs* second evaluation moments—3.9;  $p < 0.001$ /second *vs* third evaluation moments—5.0;  $p = 0.001$ ).

No effects or interactions for groups of orientation and intervention were found.

### 3.9. DASH Pain Module

In the separate analysis of the three DASH pain module questions, no differences were found between evaluation moments for groups of orientation, treatment, or symptoms.

## 4. Discussion

Considering the importance of rehabilitation to individuals with hOA, we built a study to identify benefits from the patient education intervention in a two-year follow-up comparing education intervention with strength exercises and Assistive Technology (Orthosis). Different from our hypothesis that all participants would improve in the first moment only using education treatment and in the second moment both groups would continue to strengthen (education group and education plus exercise/Assistive Technology intervention), our results showed only improvement for the group that went through exercise and assistive technology intervention. The effect size of the study results, as measured by partial eta squared ( $\eta^2$ ), offers insight into the practical significance of the interventions tested. In the context of the research on osteoarthritis of the hands, the effect sizes for various measurements range from small to medium. For instance, significant effects for evaluation moments were noted with  $\eta^2$  values of 0.04 to 0.07, indicating a moderate impact of the interventions. The combination of guidance, exercise, and orthosis demonstrated notable improvements in the hand grip, key pinch, palmar pinch, and thumb tip-to-index pinch dynamometry, with  $\eta^2$  values consistently showing moderate effects. These findings suggest that while education alone may not significantly benefit patients, adding exercises and assistive technology significantly improves hand function. Thus, the effect sizes reinforce the efficacy of combined treatment approaches over education-only interventions for managing hand osteoarthritis. Details of the results will be discussed in the following paragraphs.

#### *The Use of Only Education Intervention:*

In the first period, all participants underwent only an education intervention for one year, with assessments conducted before and after this period. The results did not show any benefit from using the education intervention alone. On the contrary, participants who received only the education intervention showed decreases in some variables, such as hand grip strength, key pinch strength, palmar pinch strength, and thumb tip to index pinch strength, as measured by dy-

namometry. Additionally, the group that continued with only the education intervention in the second period (another year of intervention) did not exhibit any benefits after this time.

Although numerous recommendations for the treatment of hOA are based on research evidence and expert opinion, as reflected in major international guidelines for nonpharmacological interventions [35]-[42], and despite the recommendation of education, advice, information, and self-management as nonpharmacological and nonsurgical treatments for osteoarthritis [43], our results did not find any benefits from using the education intervention alone. It is important to note that the education intervention alone should be used carefully and with an efficient protocol in hOA interventions.

The 2019 Arthritis Foundation Guideline for the Management of Osteoarthritis of the Hand, Hip, and Knee [44] recommends group sessions on education about the disease, the effects of medication and side effects, joint protection measures, physical conditioning, and exercise goals and approaches, to be conducted around 2 to 6 times a week. Perhaps the weakness of the present study lies in the frequency of orientation classes, which took place only four times over one year. This study observed that patients who received educational classes often reported forgetting to follow the recommendations, having doubts, not proceeding, and not adhering to the recommendations. The Guideline for the Management of Osteoarthritis of the Hand suggests that the best treatment approach includes exercises, orthoses, and educational classes rather than education alone. Moreover, some guidelines recommend that education interventions be delivered verbally and through digital sources, printed materials, and meetings [43]. Although this limitation exists in our study, our results underscore the importance of using education interventions carefully and with an efficient protocol in hOA interventions.

#### *The Use of Exercises and Assistive Technology:*

Unlike the education intervention, exercise and assistive technology showed significant benefits. Participants who switched to the exercise group demonstrated improved hand function, as analyzed through hand grip, key pinch, palmar pinch, and thumb tip to index pinch dynamometry. These results align with the literature, which supports using exercise and assistive technology as the best options for treating hand osteoarthritis (hOA) comorbidities. Exercises aimed at muscle strength, joint stability training, joint mobility, or a combination of these, are effective. A Cochrane systematic review highlights the benefits of an exercise-based intervention protocol for patients with hOA, including reduced hand pain, decreased finger joint stiffness, and improved hand functionality [23] [45].

In a randomized controlled trial with 125 participants with hOA, [8] [9] evaluated the effect of assistive technology (AT) in supporting daily living activities. The findings demonstrated that AT is a valuable resource for improving performance in daily activities. Another randomized controlled trial by Tveter [46] on occupational therapy intervention for patients with OA of CMC1, which in-

cluded guidance, exercises, and orthoses, showed significant improvements in reducing pain, increasing grip strength, and enhancing hand functionality in the short term. The methodology and results of Tveter *et al.*'s [46] study are similar to those in our study, where patients receiving treatment with orientation, exercise, and orthoses showed significant improvements in hand grip, pulp pinch, key pinch, and three-point pinch dynamometry.

Hand orthoses are strongly recommended for patients with first CMC joint OA according to the Guideline for the Management of Osteoarthritis of the Hand [47]. This finding aligns with the evidence from our study, supporting an adequate treatment protocol for patients with hOA that includes exercises and assistive technology.

A recent randomized controlled trial from 2021 compared two groups of patients with thumb osteoarthritis symptoms and radiographic evidence. The intervention group received education on self-management and ergonomic orientation, a base-of-thumb splint, exercises, and diclofenac gel, while the control group received only education on self-management and ergonomic orientation. The intervention group showed significantly improved hand function after 12 weeks of intervention ( $p < 0.001$ ) [21].

These results support our findings, where treatment with guidelines, exercises, and orthoses showed positive results in hand function, as analyzed through hand grip, key pinch, palmar pinch, and thumb tip to index dynamometry. Conversely, a decreased function was observed in interventions carried out only with orientation classes.

Based on this, our results strongly support evidence-based practices for professionals working with upper limbs and hand osteoarthritis, indicating effective treatments that are not likely to benefit the patient.

#### *Statistical Findings (Effect Sizes):*

It is possible to observe the following results found in the research in question regarding the Effect Size in each resource used:

#### **Hand Grip Dynamometry**

- Right Hand with size effect  $\eta^2 = 0.05$ , indicating small effect.
- Left Hand with size effect  $\eta^2 = 0.05$ , indicating small effect.

#### **Tip Pinch Dynamometry**

- Right Hand with size effect  $\eta^2 = 0.04$ , indicating small effect.
- Left Hand with size effect  $\eta^2 = 0.06$ , indicating medium effect.

#### **Key Pinch Dynamometry**

- Right Hand with size effect evaluation moments  $\eta^2 = 0.06$  and interaction for evaluation moments and intervention  $\eta^2 = 0.04$ , indicating medium and small effect, respectively.
- Left Hand with size effect  $\eta^2 = 0.07$ , indicating medium effect.

#### **Palmar Pinch Dynamometry**

- Right Hand with size effect evaluation moments  $\eta^2 = 0.09$  and interaction for evaluation moments and intervention  $\eta^2 = 0.04$ , indicating medium and small

effect, respectively.

- Left Hand with size effect evaluation moments  $\eta^2 = 0.13$  and interaction for evaluation moments and intervention  $\eta^2 = 0.07$ , indicating both medium effect.

Unfortunately, there is no literature that supports the results found in relation to the effect size for Hand Grip, Tip Pinch, Key Pinch and Palmar Pinch Dynamometry using the *Partial eta squared*.

## 5. Limitations

While providing valuable insights, the study on the effectiveness of different care strategies for patients with hand osteoarthritis has several limitations that should be considered. Firstly, the non-randomized control design may introduce selection bias, potentially affecting the generalizability of the results. The sample size, particularly the smaller subgroup that received exercise and orthosis interventions, limits the statistical power to detect more subtle effects. Additionally, the frequency of educational interventions, limited to four sessions over a year, may not have been sufficient to ensure consistent adherence to the recommended practices, as participants often reported forgetting or having doubts about the guidance provided. The reliance on self-reported adherence and outcomes also introduces a risk of reporting bias. Furthermore, the study did not account for potential confounding factors such as variations in the severity of osteoarthritis or differences in participants' baseline physical activity levels. Finally, the study's retrospective nature and the lack of long-term follow-up beyond two years limit the ability to assess the sustained impact of the interventions over a more extended period. These limitations suggest that future research should incorporate randomized controlled designs, larger sample sizes, more frequent and varied educational interventions, and long-term follow-up to validate and extend the findings of this study.

## 6. Conclusion

The findings from this study highlight the limited efficacy of education-only interventions for patients with hand osteoarthritis while underscoring the significant benefits of incorporating strength exercises and assistive technology. These results advocate for a more comprehensive treatment approach that combines patient education with practical interventions, such as exercise regimens and orthoses. By demonstrating improvements in hand function, grip strength, and overall joint stability, this combined approach can enhance the quality of life for patients with hOA. Healthcare professionals should consider integrating these modalities into standard care protocols to optimize patient outcomes, ensuring that treatment is theoretically sound and practically effective in managing hand osteoarthritis's symptoms and functional limitations. These findings provide a robust evidence base to support multifaceted rehabilitation strategies, guiding clinicians in delivering more effective and custom care to their patients.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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