Effectiveness of Triamcinolone Hexacetonide Intraarticular Injection in Interphalangeal Joints: A 12-week Randomized Controlled Trial in Patients with Hand Osteoarthritis

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ABSTRACT. ***Objective.*** To evaluate the effectiveness and tolerance of intraarticular injection (IAI) of triamcinolone hexacetonide (TH) for the treatment of osteoarthritis (OA) of hand interphalangeal (IP) joints.

Methods. Sixty patients who underwent IAI at the most symptomatic IP joint were randomly assigned to receive TH/lidocaine (LD; n = 30) with TH 20 mg/ml and LD 2%, or just LD (n = 30). The injected joint was immobilized with a splint for 48 h in both groups. Patients were assessed at baseline and at 1, 4, 8, and 12 weeks by a blinded observer. The following variables were assessed: pain at rest [visual analog scale (VAS)r], pain at movement (VASm), swelling (physician VASs), goniometry, grip and pinch strength, hand function, treatment improvement, daily requirement of paracetamol, and local adverse effects. The proposed treatment (IAI with TH/LD) was successful if statistical improvement ($p < 0.05$) was achieved in at least 2 of 3 VAS. Repeated-measures ANOVA test was used to analyze intervention response.

Results. Fifty-eight patients (96.67%) were women, and the mean age was 60.7 years (± 8.2). The TH/LD group showed greater improvement than the LD group for VASm ($p = 0.014$) and physician VASs ($p = 0.022$) from the first week until the end of the study. In other variables, there was no statistical difference between groups. No significant adverse effects were observed.

Conclusion. The IAI with TH/LD has been shown to be more effective than the IAI with LD for pain on movement and joint swelling in patients with OA of the IP joints. Regarding pain at rest, there was no difference between groups. Trial registration number: ClinicalTrials.gov (NCT02102620). (First Release August 1 2015; J Rheumatol 2015;42:1869–77; doi:10.3899/jrheum.140736)

Key Indexing Terms:
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Osteoarthritis (OA) is currently the most prevalent joint disease in the world, and it is also the main predictor of reduced independence of older people. The prevalence of OA increases sharply with age, particularly in patients older than 70 years[1], with pain being the main reason for seeking medical help[2].

Intraarticular injection (IAI) with steroids is recommended for the treatment of knee OA according to different guidelines, and this therapy is widely prescribed by rheumatologists. Several clinical trials and systematic reviews support the effectiveness and safety of such treatment. The onset of its effectiveness is fast, with peak action occurring in < 1 week and the response lasting at least 4 weeks[3,4,5,6].

Studies evaluating the effectiveness of intraarticular therapies in patients with hand OA are very heterogeneous in that they address different types of joints at the same time, use unusual drugs[7], do not include placebo groups[8], use soluble corticosteroids such as methylprednisolone[9], or do not use any corticosteroids[7,10,11].

To our knowledge, no studies in the literature have evaluated the effectiveness of IAI with the corticosteroid triamcinolone hexacetonide (TH) as a therapeutic option for patients with hand OA with involvement of the proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints. The aim of this study was to assess the effectiveness and tolerance of medium-term IAI of the corticosteroid TH for the treatment of OA of the PIP or DIP joints on clinical and functional variables.

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MATERIALS AND METHODS

Study design. We performed a randomized, prospective, controlled, double-blinded, intention-to-treat study.

Sample. Patients were recruited from the outpatient clinic of the Universidade Federal de São Paulo from August 2011 to August 2012. A total of 60 patients were randomly assigned to 1 of 2 groups (30 patients in each group).

The patients had to fulfill the following inclusion criteria: age older than 40 years, a diagnosis of hand OA involving the PIP or DIP joints according to the American College of Rheumatology (ACR) criteria[12], radiographs showing osteophytes in the studied joint, and pain between 3 cm and 8 cm on the visual analog scale (VAS) for pain (VAS pain at rest 0–10 cm) in at least 1 PIP or DIP hand joint.

Exclusion criteria were patients with change in the corticosteroids or nonsteroidal antiinflammatory drugs (NSAID) dosage in the last 30 days, change in drugs for the OA treatment (glucosamine, chondroitin, chloroquine, methotrexate) in the last 2 months, IAI with corticosteroids in the studied joint in the last 3 months, any change in nonpharmacological hand OA treatment in the last 2 months (rehabilitation, acupuncture, and others), suspicion of local or systemic infection, clinical or hand radiograph suggesting another cause of hand arthropathy (inflammatory arthritis, psoriatic arthritis, microcrystalline arthropathy, deposit disease), and severe coagulation disorder.

Our study was approved by the local ethics committee, and all recruited patients signed a consent form (written and informed consent).

Intervention. Patients were randomly assigned to 1 of 2 groups: a study group [TH/lidocaine (LD)] and a control group (LD only).

Patients in the TH/LD group underwent a treatment scheme for the most symptomatic interphalangeal (IP) joint; this treatment was composed of IAI with TH (20 mg/ml) and 2% LD without epinephrine. The IAI was administered in the 0.3 ml dose (6 mg) of TH for the PIP and 0.2 ml (4 mg) of TH for the DIP, always associated with 0.1 ml of 2% LD. Patients in the LD group underwent IAI with only 2% LD (0.1 ml) without epinephrine in its most symptomatic IP joint. Paracetamol (750 mg per tablet) was also used if required during the 12 weeks of followup (up to 3 tablets per day) for both groups. Both groups of patients underwent only 1 IAI in the most symptomatic joint and on a single occasion.

The procedures of the 2 groups were performed blindly by the same rheumatologist with 10 years of experience in interventional rheumatology after rigorous antisepsis with alcohol 0.5% chlorhexidine. A sterile insulin syringe (BD Ultra-Fine needle, 8 mm × 0.3 mm 30 G) covered with opaque adhesives was used on all patients. The anatomic place used for needle entry was located in the dorsolateral joint[13] (Figure 1). After the procedure, the injected joint was immobilized with a splint for 48 h in both groups.

Assessment. All patients had their data reported in an evaluation form. The data collected were age, sex, race, use of drugs, antiinflammatory drugs, and/or analgesic drugs. Radiographs of the hands were performed in the anteroposterior view and were rated by an observer using the Kellgren and Lawrence (KL) scale[14].

Five assessment evaluations were scheduled for a total of 12 weeks of followup. Patients were assessed at T0 (before the intervention) and at T1, T4, T8, and T12 weeks after the intervention. The assessment was carried out by a blinded assessor, trained in assessment instruments.

Clinical assessment. The following variables were assessed in both groups:

- VAS for pain at rest (VASr; 0–10 cm, self-reported);
- VAS for pain on movement (VASm; 0–10 cm, self-reported);
- VAS for joint swelling (physician VASs; 0–10 cm, physician assessed);
- joint goniometry in flexion (degrees of range of motion);
- analgesic consumption after the intervention (paracetamol daily average);
- grip strength using the Jamar dynamometer (kgf) by obtaining the average of 3 attempts[15];
- pinch strength using the pinch gauge dynamometer (kgf) by obtaining the average of 3 trials for the 3 types of pinches: tip, key, and tripod[15];
- hand function assessed by the Cochin Hand Functional Scale[16] and the AUStralian CANadian Osteoarthritis Hand Index (AUSCAN) using the subscales pain, stiffness, and hand function[17];
- treatment improvement scale varying by 5 points (much worse, worse, unchanged, little improvement, and much improved), assessed by the patient;
- adverse effects after the procedure (atrophy and/or subcutaneous atrophy and joint instability); and
- worsening of pain after IAI measured by VAS (post-IAI VAS 0–10 cm) at 48 h after the procedure (reported only at T1).

Sample size. Using the VASr as the primary study variable, we found a sample of 24 patients for each group. To arrive at our sample, we considered an SD equal to 1.5 points based on previous studies[7,8,9,10,11]. We also used ANOVA for repeated measures as the statistical method to calculate the sample. The statistical power was 90%, with 5% significance, and with a detectable difference of 2.0 points on the VAS pain scale when compared with the control group, measured 5 times across time into 2 independent groups. Anticipating a possible loss, we started the study with 30 patients in each group.

Random selection. Patients were randomly assigned using a randomization plan generated by the MINITAB 14.0 software without any stratification factors, with secret allocation guaranteed by opaque-sealed envelopes. In our current study, the randomization resulted, by chance, in 2 groups with the same number of patients (n). The rheumatologist responsible for the inclusion of these patients had no previous access to the randomization list. That rheumatologist was responsible for verifying that patients were within the inclusion and exclusion criteria of our study, and after the procedure, for referring patients to the evaluators in another room, where the study medication was prepared.

Sample blinding. Only the researcher responsible for patient inclusion and exclusion had access to which group the patients belonged after enrollment, and was responsible for preparing the syringes without the patients being able to see such preparation taking place. The observer responsible for the patient assessment was completely "blinded" to our study. The rheumatologist performing the procedure had no access to the recruitment, random allocation, inclusion, and assessment of patients, otherwise this blinding might be impaired because the amount used in the TH/LD group (study group) was greater than that used in the LD group (control group).

Statistical methods. SPSS software version 17.0 (IBM Corporation) was used to perform the statistical analysis. Descriptive statistics (mean, SD, 95% CI) were used to characterize the 2 groups of patients. Continuous variables of the 2 groups at baseline were compared using the Student t test (for normally distributed variables) and the Mann–Whitney U test (for variables with a distribution not considered normal). Categorical variables were evaluated using the chi-square test.

To assess response to the intervention, we used ANOVA with repeated measures to perform intragroup and intergroup analyses across 5 times (T0, T1, T4, T8, and T12 weeks) by repeated measures ANOVA for a treatment by time interaction. The p values described in the tables are the intergroup p; they show whether the groups behaved in the same way. The intragroup analysis assessed the evolution across time in relation to T0. This was an intent-to-treat study.

VASr, VASm, and physician VASs were considered the main outcomes of our study. The proposed treatment (IAI with TH/LD) was successful if statistical improvement ($p < 0.05$) was achieved in at least 2 of these 3 variables.

Differences were considered statistically significant when $p < 0.05$.

RESULTS

A total of 60 patients were randomly selected for our study, and no patients dropped out. Figure 2 shows a flowchart of our study.

No differences were found between the groups regarding

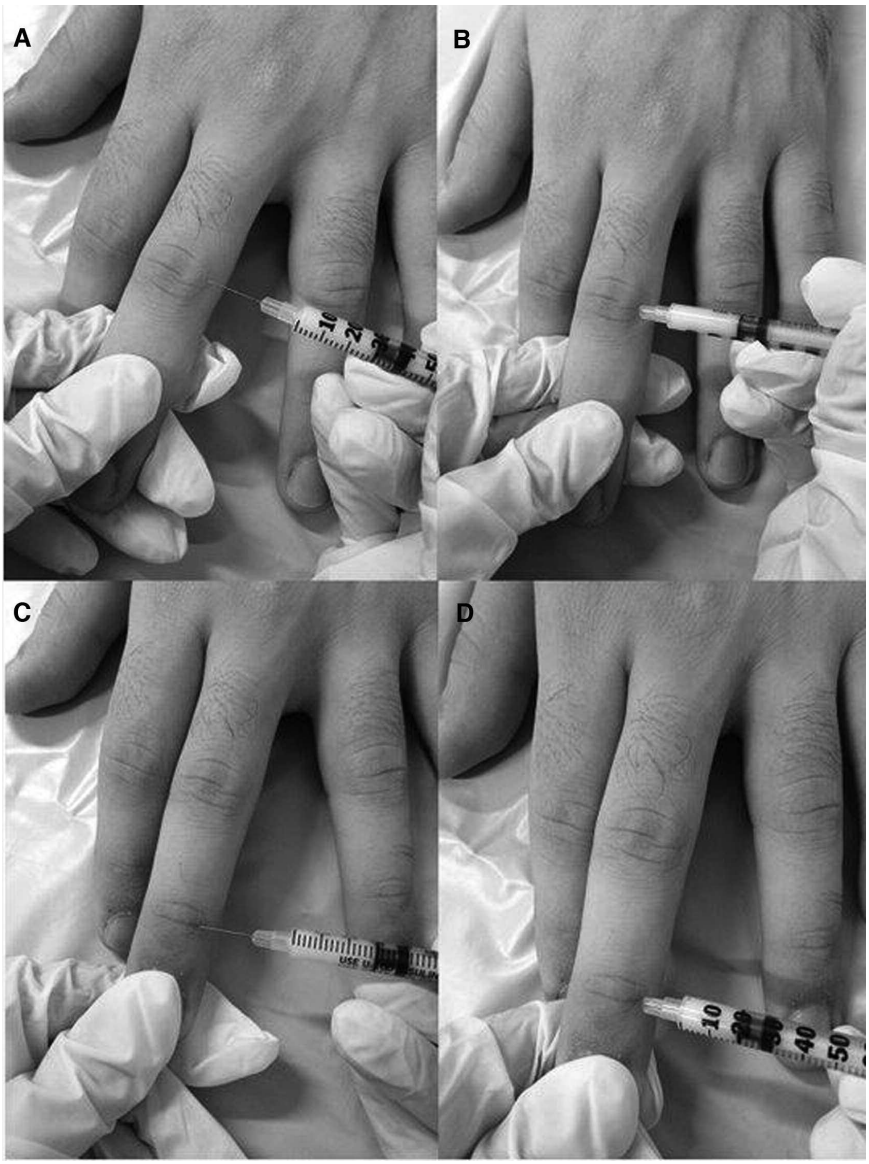

Figure 1. A and B: Intraarticular injection into the proximal interphalangeal joint. C and D: Intraarticular injection into the distal interphalangeal joint.

age, disease duration, sex, and other demographic variables (Table 1). In both groups, the patients had an average of 3 tender joints; only the most symptomatic joint was treated. Regarding the KL classification at baseline, the LD group appeared to have more joints that were graded KL IV, and the TH/LD group had more joints that were graded KL III. However, the statistical analysis showed no difference between the groups for this variable. Also, no difference was observed between the groups regarding the percentage of PIP and DIP joints studied or in relation to the use of NSAID and other drugs. None of the patients were taking oral corticosteroids. None of the patients had undergone IAI with corticosteroids in the last 3 months. The vast majority of patients did not use any continuous systemic treatment of OA.

The groups differed only in regard to self-reported skin color, with the LD group showing a higher percentage of patients who were white. We carried out the adjustment in relation to skin color for the main variables of our study (VASr, VASm, and physician VASs) among TH/LD patients.

On intragroup assessment, we observed a significant difference for most of the variables studied from baseline ($p < 0.001$ to $p < 0.05$). For the local variables (VASr, VASm, and physician VASs), the results are shown in Table 2. Our most important results were related to VASm and physician VASs, which differed significantly in the intergroup assessment. The TH/LD group showed better performance statistically than the LD group for VASm and physician VASs ($p = 0.014$ and 0.022, respectively) from the first week (T1)

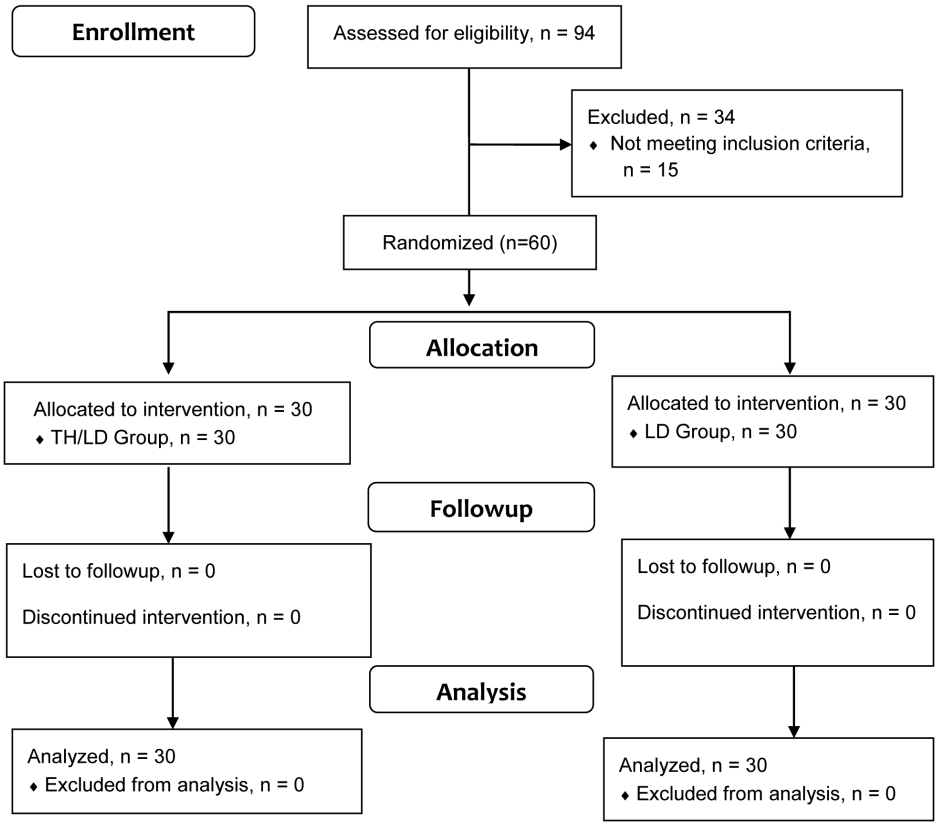

Figure 2. Study flowchart. TH: triamcinolone hexacetonide; LD: lidocaine.

Table 1. Sample characteristic at baseline. Values are n (%) unless otherwise specified.

Characteristics	TH/LD Group, n = 30	LD Group, n = 30	p
Age, yrs, mean (SD)	60.7 (9.1)	60.7 (7.3)	0.553*
Disease onset, yrs, mean (SD)	4.7 (4.2)	5.2 (3.0)	0.151*
Female/male	30 (100)/0	28 (93.3)/2 (6.7)	0.15**
White/non-white	17 (56.7)/13 (43.3)	25 (83.3)/5 (16.7)	0.034**
KL grade in the injected joint			0.180**
I	4 (13.3)	5 (16.7)	
II	7 (23.3)	4 (13.3)	
III	8 (26.7)	3 (10)	
IV	11 (36.7)	18 (60)	
Radiograph erosion, whole hand			0.297**
No erosion	19 (63.3)	15 (50)	
Erosion	11 (36.7)	15 (50)	
Drugs			0.423**
No drugs	23 (76.7)	18 (60)	
Hydroxychloroquine	1 (3.3)	2 (6.7)	
Glucosamine sulfate	5 (16.7)	5 (16.7)	
Glucosamine sulfate + chondroitin sulfate	0	3 (10)	
Methotrexate	1 (3.3)	1 (3.3)	
NSAID, sodium diclofenac, mg/day (SD)	3.3 (18.2)	1.7 (9.1)	0.981*
Paracetamol, 750 mg, tablets/day (SD)	0.6 (1.1)	0.2 (0.4)	0.127*
IP joint studied			
DIP	14 (46.7)	15 (50)	0.796**
PIP	16 (53.3)	15 (50)	0.423**

* Mann-Whitney statistical test. ** Chi-square statistical test. TH: triamcinolone hexacetonide; LD: lidocaine; KL: Kellgren-Lawrence classification scale; NSAID: nonsteroidal antiinflammatory drugs; IP: interphalangeal; DIP: distal interphalangeal joint; PIP: proximal interphalangeal joint.

Table 2. Comparison between groups for pain (VASr and VASm), swollen (VASs), joint goniometry, paracetamol use, scale of subjective improvement, and VAS for pain 48 hours after procedure. Values are mean (SD)/95% CI unless otherwise specified.

Time, Weeks	TH/LD Group, n = 30	LD Group, n = 30	p Intergroup
VASr			0.513*
T0	6.1 (1.7)/5.5–6.7	6.1 (1.6)/5.4–6.7	T0
T1	2.6 (2.9)/1.6–3.7	1.7 (2.7)/0.7–2.7	T1
T4	1.3 (2.1)/0.5–2.2	1.6 (2.6)/0.8–2.5	T4
T8	1.4 (2.6)/0.5–2.4	1.6 (2.6)/0.7–2.6	T8
T12	0.8 (1.7)/0.1–1.5	0.9 (2.2)/0.2–1.6	T12
VASm			0.014*
T0	6.5 (1.8)/5.9–7.1	6.6 (1.4)/6.0–7.2	T0
T1	3.9 (3.1)/2.8–5.0	4.1 (2.9)/3.0–5.2	T1
T4	2.8 (2.9)/1.7–3.8	3.0 (3.0)/1.9–4.1	T4
T8	1.8 (2.6)/0.7–2.8	4.0 (3.3)/2.9–5.0	T8
T12	2.2 (2.9)/1.1–3.3	4.0 (3.2)/2.8–5.1	T12
VASs			0.022*
T0	3.0 (1.5)/2.4–3.5	3.0 (1.7)/2.4–3.5	T0
T1	2.0 (1.5)/1.5–2.6	2.1 (1.4)/1.6–2.7	T1
T4	1.4 (1.4)/0.9–1.8	2.0 (1.2)/1.5–2.4	T4
T8	0.7 (0.8)/0.3–1.1	1.8 (1.3)/1.4–2.2	T8
T12	1.1 (1.2)/0.6–1.5	2.0 (1.3)/1.5–2.4	T12
Flexion, º			0.528*
T0	71.6 (20.4)/64.2–78.9	61.1 (19.8)/53.8–68.5	T0
T1	73.4 (22.8)/65.5–81.3	66.6 (20.6)/58.7–74.6	T1
T4	75.6 (22.3)/68.0–83.2	68.7 (19.1)/61.1–76.3	T4
T8	79.3 (21.1)/71.9–86.7	66.2 (19.4)/58.8–73.6	T8
T12	72.6 (25.1)/63.8–81.3	63.6 (22.6)/54.9–72.3	T12
Paracetamol use			0.784*
T0	0.65 (1.12)/0.34–0.96	0.17 (0.45)/–0.14–0.48	T0
T1	0.90 (1.22)/0.55–1.24	0.31 (0.58)/–0.04–0.66	T1
T4	0.71 (1.15)/0.39–1.03	0.26 (0.49) /–0.06–0.59	T4
T8	0.81 (1.19)/0.47–1.15	0.30 (0.58)/–0.04–0.64	T8
T12	0.74 (1.25)/0.38–1.10	0.33 (0.60)/–0.03–0.69	T12
Improvement scale, n (%)			0.236**

	Worse	Unchanged	Improved	Worse	Unchanged	Improved
T1	2 (6.9)	1 (3.4)	27 (90)	0	1 (3.3)	29 (96.7)
T4	0	1 (3.3)	29 (96.7)	0	4 (13.3)	26 (86.7)
T8	1 (3.3)	1 (3.3)	28 (93.3)	1 (3.3)	3 (10)	26 (86.7)
T12	2 (6.7)	1 (3.3)	27 (90)	1 (3.3)	5 (16.7)	24 (80)

VAS for pain 48 h after procedure, mean (SD)	3.5 (3.2)	3.8 (3.4)	0.825***

*ANOVA for repeated measures. ** ANOVA for repeated measures for categorical variables. *** Student t test. VAS: visual analog scale; VASr: VAS for rest pain; VASm: VAS for movement pain; VASs: VAS for joint swollen; TH: triamcinolone hexacetonide; LD: lidocaine.

until the end of our study (T12). Joint flexion showed improvement in both groups relative to T0; however, no intergroup difference was observed for this variable. The treatment improvement scale, which contained 5 intensities, was grouped into 3 variables: worse, unchanged, and improved. The groups behaved the same way across time with no differences seen between the groups at any time (intergroup p = 0.380, valid for all times), or between times for either group. Both groups reported "improvement" in most cases (Table 2).

For grip strength and pinch strength, no statistical improvement was observed in the intragroup evaluation relative to T0 for both groups ($p > 0.05$). For tip and tripod pinch strength, we observed a statistical improvement in the intragroup evaluation relative to T0 for both groups ($p < 0.05$). However, no statistical intergroup difference was observed for any of these variables (Table 3).

For the Cochin, AUSCAN global, and sub-global variables, there were a statistical improvement in the intragroup evaluation relative to T0 for both groups ($p < 0.05$). However, no statistical intergroup difference was observed for any of these variables (Table 4).

DISCUSSION

Our study was conducted in an attempt to test the effectiveness and tolerance of a local therapy (IAI with TH/LD)

Table 3. Comparison between groups for grip and pinch strength. ANOVA for repeated measures. Values are mean (SD)/95% CI unless otherwise specified.

Time, Weeks	TH/LD Group, n = 30	LD Group, n = 30	p Intergroup
Grip strength, kgf			0.832
T0	14.85 (6.71)/12.23–17.47	13.68 (7.59)/11.06–16.30	
T1	14.12 (6.56)/11.49–16.75	13.7 (7.79)/11.11–16.38	
T4	15.09 (6.57)/12.46–17.72	14.65 (7.78)/12.02–17.28	
T8	15.52 (7.33)/12.79–18.24	15.44 (7.58)/12.72–18.17	
T12	16.21 (6.24)/13.65–18.77	15.23 (7.70)/12.6–17.79	
Key pinch strength, kgf			0.236
T0	6.12 (1.82)/5.34–6.90	5.79 (2.40)/5.00–6.57	
T1	5.95 (1.84)/5.28–6.63	6.27 (1.86)/5.59–6.94	
T4	6.36 (1.61)/5.67–7.05	6.35 (2.11)/5.66–7.04	
T8	6.39 (1.98)/5.72–7.05	6.47 (1.64)/5.81–7.14	
T12	6.50 (1.88)/5.84–7.17	6.24 (1.75)/5.58–6.90	
Tip pinch strength, kgf			0.481
T0	2.78 (1.23)/2.31–3.25	2.63 (1.34)/2.16–3.10	
T1	2.85 (1.17)/2.39–3.32	2.99 (1.39)/2.52–3.46	
T4	3.28 (1.12)/2.81–3.74	3.03 (1.39)/2.57–3.49	
T8	3.30 (1.34)/2.76–3.86	3.31 (1.63)/2.76–3.86	
T12	3.44 (1.20)/2.90–3.99	3.38 (1.73)/2.84–3.93	
Tripod pinch strength, kgf			0.771
T0	4.08 (1.82)/3.38–4.79	3.81 (2.06)/3.09–4.49	
T1	4.10 (1.61)/3.44–4.77	4.18 (2.01)/3.47–4.79	
T4	4.51 (1.58)/3.87–5.15	4.24 (1.93)/3.52–4.80	
T8	4.81 (1.81)/4.11–5.52	4.60 (2.05)/3.79–5.20	
T12	4.82 (1.91)/4.10–5.54	4.63 (2.04)/3.81–5.25	

TH: triamcinolone hexacetonide; LD: lidocaine; kgf: kgforce.

in patients with hand OA. VAS pain at rest, pain on movement, and joint swelling were considered the most important variables of our study. Two of the 3 most important variables had better results in the TH/LD group, so we considered this trial as positive.

OA is the most prevalent joint disease in the world. In addition to advanced age, risk factors are female sex, especially when the knees and hands are affected; genetic predisposition; and obesity[1]. Hand OA is one of the most important forms of this disease. In an epidemiologic study conducted in Brazil, Rey, *et al* found a prevalence of 18.6% and 7.75% in women and men older than 50 years, respectively[18].

Many therapies have been proposed for the treatment of hand OA, but little scientific evidence is available about them. In 2012, the ACR recommended the following interventions: nonpharmacologic measures such as joint protection, use of bracing to the first carpometacarpal joint, and thermal therapy, and only oral antiinflammatory drugs, topical capsaicin, and oral tramadol. This is because few high-quality randomized clinical trials are available on this topic. Although hand OA is quite common, little scientific evidence currently exists for its therapeutic options[5].

The European League Against Rheumatism recommends the use of intraarticular corticosteroids for cases of painful OA joints, and also questions slow-acting drugs such as glucosamine, chondroitin, and diacerein, among others, stating that the pharmacoeconomic benefits are not yet well established[19].

In 2001, Ayral was already mindful of the lack of evidence for IAI with corticosteroids in hand OA. However, this procedure is common in clinical practice[20]. In reviewing the literature, we found that some studies reported using IAI for the treatment of hand OA; however, such studies involved mainly the first carpometacarpal joint and have had conflicting results[7,8,9,10,11,21].

In 2004, Meenagh, *et al*, in a randomized controlled trial of 40 patients with OA of the first carpometacarpal joint, divided the patients into 1 of 2 groups comparing IAI with TH versus placebo. They found no difference between the groups regarding moderate to severe disease relative to pain and joint stiffness[21]. Joshi conducted a prospective case series of 25 patients after IAI with methylprednisolone and also found no longterm improvement with injection in the same joint, with improvement in VAS pain only in the first month[9]. Fuchs, *et al* compared the efficacy and tolerability in 56 patients in a prospective, randomized controlled trial by dividing these patients into 1 of 2 groups. They found that IAI with sodium hyaluronate plus TH was effective in relieving pain and improving joint function in these patients[8].

To the best of our knowledge, our current study is the first to use IAI with corticosteroids only in the IP joints of the

Table 4. Comparison between groups regarding hand questionnaires. ANOVA for repeated measures. Values are mean (SD)/95% CI unless otherwise specified.

Time, Weeks	TH/LD Group, n = 30	LD Group, n = 30	p Intergroup
Cochin			0.668
T0	19.3 (17.3)/13.1–25.4	23.1 (16.3)/17.0–29.3	
T1	17.8 (19.5)/11.2–24.4	22.1 (16.7)/15.5–28.7	
T4	14.3 (16.4)/8.3–20.4	19.9 (16.7)/13.8–25.9	
T8	15.9 (18.1)/9.6–22.2	20.5 (16.3)/14.2–26.8	
T12	14.3 (15.3)/8.4–20.1	21.8 (16.7)/15.9–27.6	
AUSCAN global			0.501
T0	25.9 (15.1)/20.7–31.2	29.1 (13.4)/23.8–34.3	
T1	22.7 (13.8)/17.3–28.0	27.5 (15.2)/22.2–32.8	
T4	20.0 (13.9)/14.9–25.1	25.5 (14.0)/20.3–30.6	
T8	20.3 (14.6)/15.1–25.5	26.0 (14.0)/20.8–31.3	
T12	18.8 (14.1)/13.6–24.0	25.7 (14.4)/20.4–30.9	
AUSCAN subscale pain			0.421
T0	8.8 (4.8)/7.2–10.5	9.2 (4.3)/7.5–10.9	
T1	7.0 (4.6)/5.2–8.7	8.3 (5.1)/6.5–10.0	
T4	5.9 (4.9)/4.1–7.8	7.8 (5.4)/5.9–9.7	
T8	6.0 (4.9)/4.2–7.7	8.3 (4.5)/6.6–10.0	
T12	5.3 (4.7)/3.6–7.1	7.0 (4.8)/5.2–8.7	
AUSCAN subscale stiffness			0.487
T0	1.7 (1.4)/1.1–2.2	2.0 (1.5)/1.5–2.5	
T1	1.1 (1.3)/0.6–1.6	1.5 (1.5)/1.0–2.0	
T4	1.2 (1.5)/0.6–1.7	1.8 (1.5)/1.2–2.3	
T8	1.6 (1.4)/1.1–2.1	1.9 (1.2)/1.4–2.4	
T12	1.2 (1.4)/0.7–1.7	2.0 (1.4)/1.5–2.5	
AUSCAN subscale function			0.714
T0	15.4 (10.4)/11.9–19.0	17.9 (8.9)/14.3–21.4	
T1	14.6 (9.5)/11.0–18.1	17.8 (9.7)/14.2–21.3	
T4	12.9 (8.9)/9.7–16.2	15.9 (8.9)/12.6–19.1	
T8	12.7 (9.5)/9.2–16.2	15.8 (9.7)/12.3–19.3	
T12	12.3 (9.8)/8.7–15.9	16.7 (9.8)/13.1–20.3	

TH: triamcinolone hexacetonide; LD: lidocaine; Cochin: Cochin Hand Functional Scale; AUSCAN: AUStralian CANadian Osteoarthritis Hand Index.

hand (DIP and PIP) and the first to use TH as the corticosteroid of choice in these joints. Of the aforementioned studies, only Reeves and Hassanein[7] conducted studies of IAI use in the PIP joints, but unlike their study, we used corticosteroids. Only the studies by Fuchs, *et al* and Meenagh, *et al* previously used TH in their IAI[8,21]. In both studies, the carpometacarpal joints were injected, but the studies yielded opposite results.

We knew about the absence of controlled studies evaluating the effectiveness of corticosteroid IAI in the IP joints in patients with hand OA, and the greater effectiveness of TH in relation to other corticosteroids for this use in other joints. Therefore, our present study mainly aimed to evaluate the effectiveness and tolerance of a new therapeutic approach to OA of the IP joints with the most effective drugs known for this purpose.

Various assessment tools were used in our present study. We chose outcome measurements of local pain and inflammation — but also goniometry, hand function, and hand strength (grip and pinch) — in an attempt to assess the response to IAI with corticosteroids not only in regard to pain, but also to swelling, joint mobility, and function.

Intragroup improvements were observed for most of the outcomes assessed in both groups. Other authors also used the VAS for pain as the main method of assessment[7,9,21]. However, only Figen Ayhan and Ustün[10], Stahl, *et al*[22], and Heyworth, *et al*[23] used the grip strength and pinch strength as assessment tools.

The dose of TH used in our study was chosen empirically. Furtado, *et al*[24] and Lopes, *et al*[25] used 0.5–1 ml of TH in the metacarpophalangeal joints. We then chose to use the lowest dose in the IP joints studied. We used a syringe covered with opaque adhesives, but the complete blindness of the procedure was perhaps not achieved because of the difference in volume used in the groups.

Despite the improved intragroup outcomes in almost all of the variables in our study, we obtained intergroup statistical differences only for joint movement pain and joint swelling, with greater effectiveness found in the TH/LD group (corticosteroid group) since the first week (T1) until the last assessment (T12). Contrary to our results, Meenagh, *et al*[21], who used TH, and Joshi[9], who used methylprednisolone, did not find similar results. It would be expected that a short-term improvement in joint pain with corticosteroid injection would

occur, but with regard to VASr and VASs, this improvement continued until the end of the 12-week assessment.

Although we found superiority in the corticosteroid group for very important variables such as pain and joint swelling, we did not find statistical difference between the groups for most of the variables studied. Perhaps the absence of difference in rest pain between groups was because VAS at rest dropped to near 0 in both groups, and this prevented the detection of a difference. With a larger sample, we may have found greater differences between the groups, although our sample has been calculated before the study. Treatment of only 1 joint (the most painful) may have had a small effect on a patient's global assessment. The TH dose used may have been small; however, no studies have determined the optimal dose for the IP joints. Finally, the use of LD as a control drug may have had an effect on pain nociceptors. We believe that LD as a control drug was most important for the similar evaluations noted between the groups in our study.

The effect of LD on cartilage has been widely questioned. In a review of the deleterious effects of LD, Piper, *et al*[26] suggested that precautions be taken regarding continuous injections of anesthetics in high concentrations, although they said that the consequences of using single doses require further investigation. Some *in vitro* studies have warned of the deleterious effect of the use of LD on cartilage[27,28,29,30,31,32], even at a single dose[33]. Moreover, Piat, *et al*[34] suggested that there is an anabolic effect on cartilage metabolism through the increased synthesis of cartilage markers following administration of anesthetics.

These aforementioned authors believe that LD may have a toxic effect on articular cartilage. However, a possible antiinflammatory effect has been attributed to this anesthetic, according to some authors. Olsen, *et al* demonstrated an antiinflammatory effect of an analog of inhaled LD[35]; this matter has also been discussed in regard to local anesthetics[36].

Therefore, if we had used saline in our control group, perhaps the between-group differences would have been more pronounced. LD may have had some effect on the inflammatory synovia, and it may have been responsible for the good results also found in our control group (LD group).

We found that both groups tolerated the procedure, with no differences observed in discomfort and worsening of pain immediately after the procedure, and no major adverse effects. These findings suggest that blind IAI of the IP joints is a viable procedure to perform in a rheumatology practice. However, studies are needed to compare IAI blindly, to test this hypothesis.

Our present study had some limitations. The choice of a single finger to be submitted to the intervention and the use of LD as a control group were the main factors that may have affected our results. The difference in the volume injected in the 2 groups may also have impaired the results found in the TH/LD group. The imbalance in the groups at baseline — particularly in skin color — may have influenced our results, despite being the only difference between the groups at baseline. The 2 VAS for pain (VASr and VASm) behaved differently in our sample. The VAS at rest did not differ between groups, while the VAS on movement did. This may be because of the fact that OA classically is a disease that causes pain at the start of motion[2]. However, this may have occurred simply by chance. The high rate of erosive arthropathy may have negatively influenced some of the results.

As a practical application, our study adds a simple and inexpensive procedure that is well tolerated and effective for relieving pain and joint swelling in the treatment of patients with OA of the IP joints. No major adverse effects that would have contraindicated IAI of those joints were observed in our study.

We found that IAI with the corticosteroid TH exhibited safety and superiority for movement joint pain and joint swelling, which may justify its use in the treatment of OA of the IP joints. Regarding pain at rest, there was no difference between groups. We believe that further studies, with a larger sample, are needed to confirm the findings and to assess the longterm effectiveness of this procedure.

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