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Comparative Study of the Effectiveness of Ultrasound-Guided Intra-Articular Injection of Dextrose Prolotherapy, Hyaluronic Acid and Corticosteroid in Thumb-Base Osteoarthritis Patients

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ABSTRACT

Background: Hand osteoarthritis (OA) is a highly prevalent musculoskeletal disease, especially in older age groups.

Objective: To compare the efficacy of ultrasound (US)-guided intra-articular injection of dextrose (DX), hyaluronic acid (HA) and corticosteroids in patients with OA of the carpometacarpal Joint of the thumb.

Patients and Methods: This prospective cohort observational study was carried out on 45 patients fulfilled the American college of rheumatology criteria of OA in the hands, divided into three equal groups: Group I: treated by a single injection of 40 mg methylprednisolone mixed with 0.5 ml of local anesthetic, group II: treated with a single injection of 0.5 ml of sodium hyaluronate and group III: treated with three injections of 0.5 ml of 5% DX solution mixed with 0.5 ml of local anesthetic.

Results: Visual analogue scale (VAS) for pain measurement showed significant improvement after 1 and 3 months compared to pre-treatment ($P<0.05$). Tenderness in the corticosteroid group showed significant difference after 1 month and 3 months ($P<0.05$). Morning stiffness in corticosteroid and sodium hyaluronate groups showed significant difference after 1 month and 3 months compared to visit 1 ($P<0.05$). Range of motion using goniometer in corticosteroid group was significantly improved after 1 month compared to visit 1 ($P<0.05$). Hand disability evaluation by COCHIN scale in corticosteroid and sodium hyaluronate groups showed significant difference after 1 month compared to visit 1 ($P<0.05$).

Conclusions: Sodium hyaluronate showed significant improvement regarding VAS score, tenderness grades, morning stiffness, range of motion and hand disability from baseline to 3-month evaluation.

Keywords: Corticosteroid, Dextrose Prolotherapy, Hyaluronic Acid, Thumb-Base Osteoarthritis.

INTRODUCTION

One common musculoskeletal disorder, especially among the elderly, is osteoarthritis (OA) of the hand [1-3]. When it comes to OA, knees are the most prevalent site of impact, followed by the hands and hips. Erosive hand OA, nodal hand OA (also called non-erosive hand OA), and first carpometacarpal joint (CMCJ) OA are the three main kinds of osteoarthritis (OA) that have been identified [3].

The trapeziometacarpal joint (TMJ) is a primary site for thumb osteoarthritis, although it can also manifest at the trapezotrapezoidial and scaphotrapezial joints [4-7]. The TMJ is a saddle joint, which gives you a lot of mobility but less stability than the other joints in your fingers [8, 9]. In addition, biomechanical investigations have demonstrated that the CMC-1 joint is subjected to a disproportionately large stress when compared to joints farther away from the body, such as the fingers [10, 11]. Hand function is impaired due to TMJOA because it changes the thumb-index pinch [12]. Pain also makes functional impairment worse. Limitations in doing activities of daily living (ADLs) may provide a significant handicap, even though OA is commonly believed to contribute marginally to hand disability overall [5]. Utilizing the identical measurement instrument, it has been demonstrated that disability resulting from hand osteoarthritis may attain levels comparable to those induced by rheumatoid arthritis [7, 13, 14].

The structural deterioration in OA of the hand is most often evaluated with conventional radiography since these images are easily accessible and inexpensive [15].

In addition to bone, other structures like cartilage, synovium, and subchondral bone can be evaluated using ultrasonography (US). US investigations demonstrated that inflammatory indicators, including grey-scale synovitis and power Doppler signal, are commonly observed in the finger joints of individuals with hand osteoarthritis [16].

Treatment options that do not involve surgery include NSAIDs, splinting, thumb strengthening exercises, and injections into the joint [17]. For thumb base osteoarthritis (OA), the European Alliance of Associations for Rheumatology recommends corticosteroid injections and also believes that hyaluronic acid (HA) injections can be helpful [18].

Many different types of musculoskeletal pain have found relief by prolotherapy [19]. The most popular remedy is hyperosmolar dextrose (DX) [20]. It is thought that prolotherapy enhances endogenous healing by reducing inflammation and promoting the production of growth factors, among other things [21].

The purpose of this study was to evaluate the effectiveness of injecting DX, HA, or corticosteroid into the thumb joint using ultrasound guidance in individuals suffering from osteoarthritis of the CMCJ.

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PATIENTS AND METHODS

For this prospective cohort observational analysis, 45 patients were included who met the criteria for OA in the hands as set out by the American College of Rheumatology [(22)]. Radiological staging of OA severity was done using the Eaton and Littler categorization system [(23)]. All patients included have to be in stage II or III. This work was performed at Faculty of Medicine, Tanta University, Tanta, Egypt, from 2019 to 2023.

Participants were not allowed to participate if they had any of the following conditions: secondary OA (post-traumatic, inflammatory rheumatic, metabolic rheumatic), skin lesions, Dupuytren's contracture, collagen disease, neurological illnesses affecting the upper limbs, surgery on the hand or wrist, or had suffered trauma within the past 90 days.

There were three groups to which the patients were randomly assigned: Members of Group I were each given a single injection of 40 mg of methylprednisolone mixed with half a milliliter of local anesthetic. Sodium hyaluronate intragel 1.6% (32 mg / 2 ml HA * sodium salt) was injected once into each of patient in group II, which underwent continuous ultrasound guidance during the injection, and group III, which received three injections of 0.5 ml each of 5% DX solution and local anesthetic—instead of a single injection of the same medication. on a monthly basis while being monitored by a continuous ultrasound. At baseline (the first visit), one and three months, and all patients were assessed again.

Laboratory studies included measuring ESR, CRP, RF, serum uric acid, and radiographic examinations (X-ray and ultrasonographic evaluation) for all patients. The clinical examination also included the Cochin scale.

Classification of synovitis

According to grey scale mode [(24)] none is grade 0: SH grade 1 is characterized by no effusion but a connected bone surface; grade 2 is mild; grade 3 is severe; and grade 4 is characterized by effusion beyond the joint line and a flat upper surface.

Classification of effusion [(25)]:

Grade 1 effusion is characterized by a small enlargement of one or two joint recesses; grade 2 involves a partial enlargement of more than two recesses; and grade 3 is characterized by a complete enlargement of all joint recesses owing to a substantial quantity of fluid.

By power Doppler mode individually [(26)]:

The Doppler activity can be categorized into three grades: zero, which means no activity at all, one, which means a small number of spots (up to three single spots or one confluent spot), two, which means a moderate amount (greater than Grade 1) but less than 50% of the total GS background signals, and three, which means a severe amount (greater than Grade 2) with more than 50% of the background GS signals.

Injection technique

Using a linear probe operating at 3 to 12 MHz, the patient's wrist was positioned supine for a volar approach. They then the affected thumb's metacarpal was palpated along its volar-radial aspect, moving from distal to proximal. The transducer was gradually shifted proximally or distally while maintaining this orientation until a hypoechoic cleft defining the base of the thumb's metacarpal and the distal aspect of the trapezium was discovered. Alcohol was used to sanitize the area where the injection was going to be given. The US-guided injection was given using a simple free-hand technique after sterile gloves were put on. Following the establishment of access to the joint cavity, a 25-gauge, 3.8-cm needle was guided.

Ethical consideration:

The study was done after approval from the Ethical Committee Tanta University Hospitals, Tanta, Egypt (approval code: 33017/03/19). An informed written consent was obtained from the patients. The Helsinki Declaration was followed throughout the study's conduct.

Statistical analysis

Data were analyzed using SPSS version 28 (IBM Co., Armonk, NY, USA). The three groups were compared using one-way ANOVA (F) test, with a post hoc (Tukey) test applied to each pair of groups, for parametric variables, which were reported as means and SD. When two numerical variables were inside the same group, the paired Student t-test was used to compare them. (Paired t-test is not suitable to compare within group if you are comparing the same group at more than 2 times. Use repeated measures ANOVA test, and if P was significant, then you should also use another post hoc test so as to compare results within the same group). We used the Chi-square test to statistically assess categorical data that were expressed as percentages and frequencies. A two-tailed P value of 0.05 or less was used to determine statistical significance.

RESULTS

Demographic data, laboratory investigations and plain X-ray before treatment and after one and three months of treatment were insignificantly different between the three studied groups (**Table 1).**

Table 1: Comparison between the studied groups regarding demographic data, laboratory investigations and plain X-ray before treatment and after one and three months of treatment

		Corticosteroid (n=15)	Sodium hyaluronate (=15)	DX (n=15)	P
Age (years)		46.47±3.50	49.33±0 .08	46.73±3.61	0.217
Sex	**Female**	15(100.0%)	15(100.0%)	15(100.0%)	---
Marital status	**Married**	15(100.0%)	15(100.0%)	15(100.0%)	---
Occupation	**Housewife**	8(53.3%)	8(53.3%)	6(40.0%)	0.7
	Manual work	7(46.7%)	7(46.7%)	9 (60%)	
Laboratory investigations					
ESR (mm/h)	**Visit 1**	22.87±5.38	25.6±5.11	20.47±5.18	0.118
	1 month	22.93±5.76	25.33±5.85	20.33±5.43	0.163
	3 months	24.4±5.84	25.2±5.31	20.27±5.44	0.126
CRP (normal) mg/dL	**Visit 1**	1.73± 0.16	0.87±0.14	1.2±0.01	0.056
	1 month	1.33± 0.2	0.73±0.1	0.93±0.16	0.164
	3 months	1.13± 0.24	0.6±0.06	0.8±0.18	0.204
RF (negative)	**Visit 1**	15(100.0%)	15(100.0%)	15(100.0%)	--
	1 month	15(100.0%)	15(100.0%)	15(100.0%)	--
Serum uric acid (mg/dl) (normal)	**Visit 1**	5.18±1.01	5.4±1.24	5.19±1.05	0.148
	1 month	5.19±1.25	5.33±1.29	5.58±1.21	0.716
	3 months	5.20±1.30	4.8±0.26	5.67±0.34	0.152
Plain X-ray according to the Eaton and Littler Classification					
Plain X-ray	**Stage II**	9 60.0%)	11(73.3%)	9(60.0%)	0.678
	Stage III	6(40.0%)	4(26.7%)	6(40.0%)	

Data is presented as mean ± SD or frequency (%). ESR: erythrocyte sedimentation rate, CRP: C-reactive protein, RF: Rheumatoid factor, P1, P2, P3: Comparison between 3 groups, On using ANOVA, and P was not significant, then there is no need to use post hoc test (ANOVA test is not suitable to compare all the data of ESR and CRP in table 1 because samples are not normally distributed. Use another suitable test, e.g., Kruskal-Wallis test, and if P was significant, then you should use another post-hoc test so as to compare each group with each other group), DX: Dextrose.

VAS for pain measurement showed significant improvement within the three studied groups after 1 and 3 months compared to pre-treatment in all the studied groups. Tenderness in corticosteroid group showed significant difference after 1 month and 3 months. Also, hyaluronate group showed significant difference only after 3 months compared to visit 1, while patients treated with sodium hyaluronate, and DX showed no significant difference after 1 month and 3 months compared to visit 1 (**Table 2**).

Table 2: Comparison between the studied groups regarding pain measured by VAS and tenderness before treatment and after one and three months of treatment

		Visit 1	1 month	3 months
Pain measured by VAS				
Corticosteroid group (n=15)		67.3±14.9	41.33±4.48	38.07±1.44
		P1	**0.001***	**0.001***
Sodium hyaluronate group (n=15)		70±10.69	61.33±9.98	49±10.72
		P1	**0.029***	**<0.001***
DX group (n=15)		71.33±13.56	62±14.61	50±15.24
		P1	0.081	**<0.001***
P		0.70	0.205	0.920
Tenderness				
Corticosteroid group (n=15)	**Grade 0**	1(6.7%)	3(20.0%)	4(26.7%)
	Grade 1	5(33.3%)	12(80.0%)	11(73.3%)
	Grade 2	6(40.0%)	0(0.0%)	0(0.0%)
	Grade 3	3(20.0%)	0(0.0%)	0(0.0%)
	P1		**0.005***	**0.005***
Sodium hyaluronate group (n=15)	**Grade 0**	1(6.7%)	1(6.7%)	1(6.7%)
	Grade 1	7(46.7%)	9(60.0%)	14(93.3%)
	Grade 2	5(33.3%)	4(26.7%)	0(0.0%)
	Grade 3	2(13.3%)	1(6.7%)	0(0.0%)
	P1		0.875	**0.025***
DX group (n=15)	**Grade 0**	0(0.0%)	2(13.3%)	1(6.7%)
	Grade 1	7(46.7%)	11(73.3%)	10(66.7%)
	Grade 2	5(33.3%)	1(6.7%)	2(13.3%)
	Grade 3	3(20.0%)	1(6.7%)	2(13.3%)
	P1		0.087	0.389
P		0.937	0.266	0.068

Data are presented as mean ± SD. * Significant P value <0.05. P1: P compared to visit 1. VAS: visual analog scale, (Repeated measures ANOVA test is not suitable to compare Pain measured by VAS in Corticosteroid group and DX group in table 2 because samples are not normally distributed. Use another suitable test, e.g., Friedman test, and if P was significant, then you should use another post-hoc test so as to compare each group with each other group), DX: Dextrose.

Morning stiffness in corticosteroid and sodium hyaluronate groups showed significant difference after 1 month and 3 months compared to visit 1, while DX group showed no significant difference. Range of motion using goniometer in corticosteroid group, flexion and extension were significantly improved after 1 month compared to visit 1 and no improvement after 3 months, while in sodium hyaluronate and DX groups flexion and extension were significantly improved after 3 months, and no improvement occurred after 1 months (**Table 3).**

Table 3: Comparison between the studied groups regarding morning stiffness and range of motion using goniometer before treatment and one and three months after treatment

		Visit 1	1 month	3 months
Morning stiffness				
Corticosteroid group (n=15)	**Up to 5 min**	0(0.0%)	11(73.3%)	9(60.0%)
	Up to 10 min	3(20.0%)	4 (26.7%)	6(40.0%)
	Up to 15 min	12(80.0%)	0(0.0%)	0(0.0%)
	P1		**<0.001***	**<0.001***
Sodium hyaluronate group (n=15)	**Up to 5 min**	0(0.0%)	5(33.3%)	10(66.7%)
	Up to 10 min	6(40.0%)	9(60.0%)	5(33.3%)
	Up to 15 min	9(60.0%)	1(6.7%)	0(0.0%)
	P1		**0.003***	**<0.001***
DX group (n=15)	**Up to 5 min**	0(0.0%)	0(0.0%)	1(6.7%)
	Up to 10 min	6(40.0%)	8(53.3%)	8(53.3%)
	Up to 15 min	9(60.0%)	7(46.7%)	6(40.0%)
	P1		0.464	0.390
P		0.406	**<0.001***	**<0.001***
Range of motion using goniometer				
Corticosteroid group (n=15)	**Flexion**	113.47±8.21	119.27±7.04	114.13±11.81
	P1		**0.047***	0.859
	Extension	1.6±0.83	2.6±0.51	2.2±0.86
	P1		**<0.001***	0.062
Sodium hyaluronate group (n=15)	**Flexion**	135.93±16.76	133.93±13.76	123.4±16.68
	P1		0.724	**0.050***
	Extension	2.53±3.4	0.53±2.39	0.27±2.37
	P1		0.073	**0.043***
DX group (n=15)	**Flexion**	121.87±10.18	123.2±9.74	128.6±7.64
	P1		0.717	**0.050***
	Extension	3.93±5.42	2.8±3.32	0.73±2.49
	P1		0.495	**0.047***
P (Flexion)		0.13	**0.001***	**0.017***
P (Extension)		0.237	**0.022***	**0.034***

Data are presented as mean ± SD or frequency (%). * Significant P value <0.05. P1: P compared to visit 1, (ANOVA test is not suitable to compare extension in all the groups in table 3 because samples are not normally distributed. Use another suitable test, e.g., Kruskal-Wallis test, and if P was significant, then you should use another post-hoc test so as to compare each group with each other group) (Regrading flexion in table 3, by using ANOVA, P was NOT significant and you should NOT calculate P1), DX: Dextrose.

Hand disability evaluation by COCHIN scale in corticosteroid and sodium hyaluronate groups showed significant difference after 1 month compared to visit 1 and no significant difference after 3 months, while DX group showed no significant difference after 1 and 3 months. Joint effusion in corticosteroid group showed significant difference after 1 and 3 months, while sodium hyaluronate showed significant improvement only after 1 month. DX group showed no significant improvement (Table 4).

Table 4: Comparison between the studied groups regarding hand disability measured by COCHIN scale and joint effusion examined by ultrasound before treatment and one and three months after treatment

		Visit 1	1 month	3 months
Hand disability measured by COCHIN scale				
Corticosteroid group (n=15)	**0 – 20**	1(6.7%)	7(46.7%)	4(26.7%)
	21 – 50	7(46.7%)	3(20.0%)	6(40.0%)
	51 – 90	7(46.7%)	5(33.3%)	5(33.3%)
	P1		**0.040***	0.331
Sodium hyaluronate group (n=15)	**0 – 20**	1(6.7%)	1(6.7%)	1(6.7%)
	21 – 50	7(46.7%)	12(80.0%)	14(93.3%)
	51 – 90	7(46.7%)	2(13.3%)	0(0.0%)
	P1		0.129	**0.009***
DX group (n=15)	**0 – 20**	1(6.7%)	1(6.7%)	1 (6.7%)
	21 – 50	6(40.0%)	12(80.0%)	10 (66.7%)
	51 – 90	8(53.3%)	2(13.3%)	4(26.7%)
	P1		0.061	0.311
P		0.996	**0.003***	**0.028***
Joint effusion examined by ultrasound				
Corticosteroid group (n=15)	**Grade 0**	3(20.0%)	9(60.0%)	6 (40.0%)
	Grade 1	2(13.33%)	1(6.67%)	5 (33.3%)
	Grade 2	2(13.33%)	4(26.67%)	3 (20.0%)
	Grade 3	8(53.33%)	1(6.67%)	1 (6.7%)
	P1		**0.024***	**0.048***
Sodium hyaluronate group (n=15	**Grade 0**	1 (6.7%)	6 (40.0%)	3 (26.7%)
	Grade 1	2(13.3%)	2(13.3%)	5(33.3%)
	Grade 2	1(6.7%)	2(13.3%)	2(13.3%)
	Grade 3	11(73.3%)	5(33.3%)	5(33.3%)
	P1		0.104	0.182
DX group (n=15)	**Grade 0**	3(20.0%)	4(26.7%)	4(26.7%)
	Grade 1	3(20.0%)	3(26.7%)	4(26.7%)
	Grade 2	5(33.3%)	4(26.7%)	3(26.7%)
	Grade 3	4(26.7%)	4(26.7%)	4(26.7%)
	P1		0.968	0.853
P		0.246	0.380	0.667

Data is presented as frequency (%). * Significant P value <0.05. P1: P compared to visit 1, DX: Dextrose.

Synovial thickening and power Doppler signal in the three studied groups showed no significant improvement after 1 and 3 months (**Table 5).**

Table 5: Comparison between the studied groups regarding synovial thickening in ultrasound and power Doppler signal

		Visit 1	1 month	3 months
Synovial thickening in ultrasound				
Corticosteroid group (n=15)	**Grade 0**	5(33.3%)	9(60.0%)	5(33.3%)
	Grade1	2(13.3%)	4(26.7%)	6(40.0%)
	Grade2	3(20.0%)	1(6.7%)	2(13.3%)
	Grade3	5(33.3%)	1(6.7%)	2(13.3%)
	P1		0.140	0.323
Sodium hyaluronate group (n=15)	**Grade 0**	3(20.0%)	4(26.7%)	5(33.3%)
	Grade1	2(13.3%)	4(26.7%)	4(26.7%)
	Grade2	4 (26.7%)	2(13.3%)	3(33.3%)
	Grade3	6(40.0%)	5(33.3%)	3(33.3%)
	P1		0.667	0.511
DX group (n=15)	**Grade 0**	2(13.3%)	3(20.0%)	5(33.3%)
	Grade1	4(26.7%)	3(20.0%)	4(26.7%)
	Grade2	3(20.0%)	4(26.7%)	3(20.0%)
	Grade3	6(40.0%)	5(33.3%)	3(20.0%)
	P1		0.902	0.515
P		0.843	0.176	0.982
Power Doppler signal				
Corticosteroid group (n=15)	**Grade 0**	4(26.7%)	6(40.0%)	5(33.3%)
	Grade1	3(20.0%)	5(33.3%)	4(26.7%)
	Grade2	3(20.0%)	2(13.3%)	3(20.0%)
	Grade3	5(33.3%)	2(13.3%)	3(20.0%)
	P1		0.496	0.860
Sodium hyaluronate group (n=15)	**Grade 0**	3(20.0%)	4(26.7%)	5(33.3%)
	Grade1	2(13.3%)	4(26.7%)	5(33.3%)
	Grade2	4(26.7%)	5(33.3%)	3(20.0%)
	Grade3	6(40.0%)	2(13.3%)	2 (13.3%)
	P1		0.404	0.269
DX group (n=15)	**Grade 0**	1(6.7%)	5(33.3%)	6(40.0%)
	Grade1	4 (26.7%)	5 (33.3%)	5 (33.3%)
	Grade2	4 (26.7%)	2 (13.3%)	3 (20%)
	Grade3	6 (40%)	3 (20%)	1 (6.7%)
	P1		0.217	0.060
P		0.844	0.830	0.973

Data are presented as frequency (%). P1: P compared to visit 1, DX: Dextrose.

DISCUSSION

The debilitating effects of TBOA on both hand function and quality of life are well-documented, and the disorder primarily strikes women after menopause [27].

In the present study, sodium hyaluronate group had an average ESR of 25.6±5.11 mm/h at visit 1, 25.33±6.85 mm/h after 1 month, and 25.2±5.31 mm/h after 3 months, in contrast to the corticosteroid group which had an average ESR of 22.87±7.38 mm/h at visit 1, 22.93±7.76 mm/h after 1 month, and 24.4±7.84 mm/h after 3 months. Furthermore, the DX group recorded a rate of 20.47 ± 7.18 mm/h at the first visit, 20.33±6.43 mm/h after one month, and 20.27 ± 7.44 mm/h after three months.

In the group treated with corticosteroids, the mean ±SD of CRP was 1.73±1.16 at the first visit, 1.33±0.9 after one month, and 1.13±0.64 after three months. With relation to the average ± standard deviation of CRP, the group treated with corticosteroids had 1.73±1.16 at the first visit, 1.33±0.9 after one month, and 1.13±0.64 after three months. At the first visit, the sodium hyaluronate concentration was 0.87+0.64, 0.73±0.7 after one month, and 0.6±1.06 after three months. At visit 1, it was 1.2±1.01 in the DX group, 0.93±0.96 after one month, and 0.8±0.68 after three months. No patients in any of the three groups tested negative for RF in this investigation. The uric acid levels of all the patients were within the normal range.

In the current study, found that VAS scores for pain measurement varied significantly across the groups. In groups I and II, scores improved after 1 and 3 months compared to pre-treatment, while in group III, scores were insignificant between visit 1 and after 1 month, but after 3 months, scores decreased significantly compared to visit 1.

This confirms previous research showing a statistically significant reduction in average verbal numerical pain scores at 1,3, and 6-months following injection in both groups. Our results are in agreement with **Koh *et al.*** [28] who reported that there was a significant decrease in the mean verbal numeric scale for pain (VNS) score in both study groups at 1-, 3-, and 6-months post injection. At 1 month, the VNS score was significantly lower in the HA and ketorolac group than in the HA group, but there was no significant difference at 3 and 6 months.

Contrarily to our results, **Meenagh *et al.*** [29] investigated the efficacy of corticosteroid injections into the carpometacarpal joint of the thumb (CMCJ) in patients with osteoarthritis. There was no significant difference between the steroid and placebo groups in median values for joint stiffness, joint tenderness, or patient and physician global assessments. Insignificant difference regarding VAS score of pain between placebo and corticosteroid groups was observed at 8 and 12 weeks.

In this study, patients treated with corticosteroids showed a substantial decrease in discomfort after 1 month and 3 months compared to visit 1. Patients treated with sodium hyaluronate had significant progress between the initial and subsequent appointments. In terms of tenderness grade, none of the three groups that were considered showed any statistically significant difference. Contrary to what **Meenagh *et al.*** [29] found, we found a statistically significant difference in the grades of joint soreness at 8 and 12 weeks between the corticosteroid and placebo groups.

In the present study, there was a statistically significant difference between visit 1 and visits after 1 month and 3 months concerning morning stiffness in participants treated with corticosteroids. After 3 months of treatment with sodium hyaluronate, patients demonstrated a considerable improvement as compared to their first visit. There was no statistically significant difference in morning stiffness among the three groups **Frizziero *et al.*** [30] also demonstrated a considerable decrease in morning stiffness length and NSAID intake at any assessment point (3 and 6 months). Although **Tenti *et al.*** [31] demonstrated a statistically significant decrease in the length of morning stiffness from baseline to one and six months, our results contradicted theirs.

In the current study, Flexion and extension ranges measured by goniometer were substantially different after one month compared to visit one in the present investigation of patients treated with corticosteroids. After three months, there was a noticeable difference in flexion and extension in individuals treated with sodium hyaluronate. There was also a significant difference in flexion and extension at 3 months for those who received DX. Consistent with our findings, **Fuchs *et al.*** [32] showed that the groups did not vary significantly in terms of range of motion.

The current study found that the corticosteroid group showed a statistically significant change in the hand impairment evaluation using the COCHIN scale after one month compared to visit 1. The sodium hyaluronate group showed a considerable improvement between visits after 1 and 3 months as compared to visit 1. In the DX group, no discernible change was seen by **Jahangiri *et al.*** [33] who found improved outcomes with DX, but they were not statistically significant, which supports our findings. Using a local corticosteroid resulted in a much higher pain score in the second month.

In the present study, no statistically significant difference was seen between visit 1 and visits after 1 month and 3 months in terms of ultrasonographically observed joint effusion among patients treated with corticosteroid, sodium hyaluronate, or DX. When comparing the three groups, we could not find any

statistically significant difference in joint effusion. There was a marked improvement from baseline to endpoint in terms of effusion, functional ability, and physical activity, which is in agreement with what **Heidari *et al.*** [34] found.

In the current study, when comparing individuals treated with corticosteroids, sodium hyaluronate, or DX at visit 1 to those treated at 1 and 3 months, there was no statistically significant change in terms of synovial thickening. No statistically significant difference in synovial thickness was seen when comparing the three groups. Our results are consistent with those of **Tenti *et al.*** [31] who found that intraarticular corticosteroids improved synovial thinking six months after therapy for TMJ OA.

In the present study, after one and three months of treatment, patients treated with corticosteroid, sodium hyaluronate, and DX showed no statistically significant difference in power Doppler signal compared to visit 1 when compared across the three groups. Power Doppler signal was similar across all three groups. Our findings are corroborated by **Ingegnoli *et al.*** [35] who found a substantial reduction in power Doppler signal after 2 weeks of therapy. In the current study, the sample size was limited, which was one of its limitations. The research was performed in only one location. Inclusion of a placebo group was omitted.

CONCLUSIONS

Patients with thumb-base OA have demonstrated a favorable and very improved response to treatment with corticosteroid, HA, and DX. Corticosteroid showed only early improvement at 1 month compared to baseline, while sodium hyaluronate showed significant improvement regarding VAS score, tenderness grades, morning stiffness, range of motion and hand disability from base line to 3-month evaluation but DX showed significant improvement regarding VAS score and range of motion only.

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