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A Comparison between the Effects of Hyaluronic Acid and Platelet-Rich Plasma on Temporomandibular Joint Pain and Clicking

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ABSTRACT

Background and Objective: Patients with temporomandibular joint internal derangement (TMJ-ID) are presented with joint sounds, local or radiating pain and issues regarding the function of the mandible. The aim of this study is to investigate the therapeutic benefits of intra-articular injection of platelet-rich plasma (PRP) and hyaluronic acid (HA) on pain and clicking in TMJ-ID patients.

Methods: In this cross-sectional study, 52 patients with TMJ-ID were randomly selected and divided into two groups. Thirty patients were injected with HA for three sessions 10 days apart, and 22 patients were injected with PRP for three sessions 14 days apart. Joint pain and clicking was assessed through 5 follow-up sessions. Pain was assessed using a numeric pain rating scale ranging from 0 to 10. The clicking sound was assessed using a rating system of (0-3).

Findings: The mean age of the patients was 28.6±9.1 years. After treatment, significant improvement in pain and clicking was observed in both groups. HA (0.9±2.6, MR1=26.2) showed a lower mean value in pain and clicking compared to PRP (1.8±3.5, MR1=26.9), but did not reach a statistically significant level.

Conclusion: The results of the study showed positive therapeutic effects for both HA and PRP in terms of reducing joint pain and clicking sounds.

Keywords: *Temporomandibular Disorder, Minimally Invasive Procedure, Randomized Clinical Trial, Intraarticular Injection.*

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Introduction

Temporomandibular joint internal derangement (TMJ-ID) includes an abnormal relationship between the joint components (1). Jaw opening limitation, joint noises, discomfort and irregular jaw function are the most common findings associated with TMJ-ID (2). One of the approved minimally invasive measure for TMJ-ID treatment is intraarticular injections of HA and PRP which effectively improve function and relieve pain (1). Hyaluronic acid is a glycosaminoglycan polysaccharide detected in synovial fluid and cartilage spontaneously (3). HA effects are achieved through chondro-protective, analgesic and anti-inflammatory mechanisms (1). The high molecular weight form of HA has a stronger anti-inflammatory effect and can remain longer in the joint cavity than low molecular weight form (4). PRP usually contains 4-5 folds platelet concentration than in whole blood (3). Although the precise process by which PRP treats patients with TMDs is unknown, PRP may assist to reduce the inflammatory response through the anti-inflammatory cytokines that can release several growth factors, lead to chondrocyte proliferation and cartilage restoration and encourage endogenous HA synthesis (3). This study aims to explore the therapeutic benefits of HA and PRP on TMJ pain and clicking in individuals with TMJ-ID.

Methods

In accordance with TMDs diagnostic criteria (5), 52 patients attended the maxillofacial department of Al-Kadhemia teaching hospital during the period from May 2022 to October 2023. The inclusion criteria were: patients complaining about TMJ pain and clicking, with or without restricted mouth opening who don't respond to conservative therapy. The exclusion criteria were: pregnancy, anemia, bleeding disorder, being under anticoagulant or analgesic therapy as well as osteoarthritic patient. The comparative randomized study approval number was (Ref. 585 in 2022, College of Dentistry, Baghdad University). Each patient signed a written consent form after being informed about the treatment plan. The patients were then allocated into two groups according to the injected materials: HA group (30 patients) injected for three sessions with 10 days interval, and PRP group (22 patients) injected for three sessions with 14 days interval. There was also a post-treatment follow-up within 3 and 6 months and a total of 5 follow-up visits. For each patient, a case sheet was filled including demographic and pain estimation using NPRS range from 0 to 10 (0 indicated "No pain" and 10 indicated "Worst pain"). Clicking was evaluated using a grading system (0-3), with 0 indicating No clicking or noise and 3 Loud audible clicking (6). The injection point was detected by drawing a line from the center of the tragus of the ear to the lateral canthus of the eye, 10 mm forefront the tragus and 2 mm underneath the traced line. The patient was asked to open his/her mouth broadly; then, 0.7 ml of treatment materials was injected. HA was supplied as 2 ml pre-filled syringe, (Hyalgan®; Fidia Farmaceutici, Abano Terme, Italy). The PRP tube used was (Pro-PRP kit, Bio. Co., Ltd. Korea).

Statistical Package for Social Science (SPSS version -22, Chicago, Illionis, USA) was used. The descriptive data analysis included minimum, maximum, mean and standard deviation (SD) for quantitative variable, while percentage, median, and mean rank were used for qualitative variable. For inferential analysis, T test, Paired t test, and Friedman test were used. $P<0.05$ exhibited statistical significance.

Results

Fifty-two patients with unilateral TMJ-ID in the age range of 18-55 years and a mean age of 28.6±9.1 years were examined. Females were more predominant than males (Figure 1).

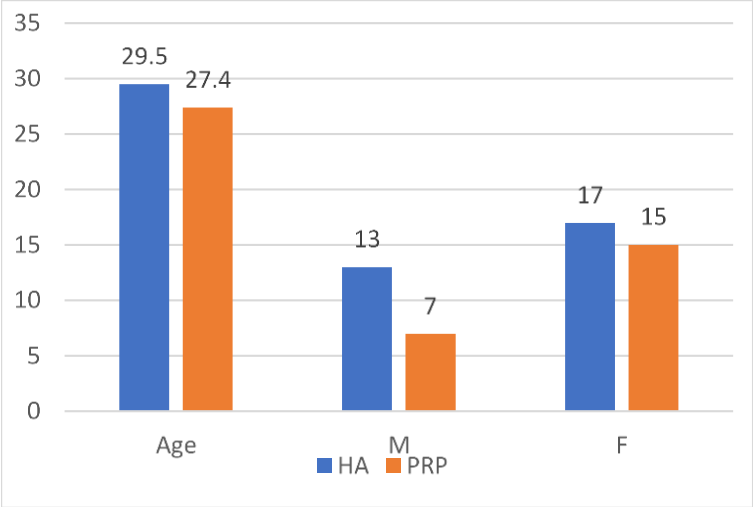

Figure 1. The study demography

Joint pain: At the 5th visit, the mean NPRS exhibited significant difference for each group (p=0.000). However, HA showed higher improvement in NPRS than PRP, but it was not statistically significant based on each visit (Table 1).

Table 1. Numerical pain rating scale for study groups

Numerical pain rating scale/ visit	HA (n=30)		PRP (n=22)		T-test	p-value
	Range	Mean±SD	Range	Mean±SD		
1st	4-10	7.9±1.7	4-10	7.8±2.2	0.2	0.82
2nd	0-10	3.4±3	0-9	4.3±2.9	1.1	0.3
3rd	0-10	2.3±2.4	0-10	2±2.7	0.5	0.6
4th	0-10	0.7±2.1	0-10	0.8±2.2	0.1	0.9
5th	0-10	0.9±2.6	0-10	1.8±3.5	1	0.3
F-test	68.646		32.505			
p-value	0.000		0.000			

F: Repeated Measure ANOVA

The HA group showed a significant difference between the 1st and the 5th visit, the 1st and the 2nd visit, the 3rd and the 4th visit. Also, PRP group exhibited a significant difference between the 1st and the 5th visit, the 1st and the 2nd visit, the 2nd and the 3rd visit (p=0.000). The HA group showed a significant difference between the 1st and the 5th visits, and the 1st and the 2nd visits (p=0.000). Similarly, PRP group exhibited a significant difference between the 1st and the 5th visits, the 1st and the 2nd visits, and the 2nd and the 3rd visits (p<0.05) (Table 2).

Joint clicking: A significant decrease in mean joint clicking at the 5th visit was found for each group (p=0.000). However, a higher improvement in HA was seen compared to PRP group, but it was not statistically significant based on each visit (Table 3).

Table 2. Numerical pain rating scale and Temporomandibular joint click improvement according to the visits

Groups	Visits	Mean difference pain	p-value	Mean difference Temporomandibular joint click	p-value
HA	1st vs 5th	6.967	0.000	6.124	0.000
	1st vs 2nd	4.500	0.000	3.511	0.000
	2nd vs 3rd	1.067	1.000	1.878	0.060
	3rd vs 4th	1.600	0.001	0.612	0.540
	4th vs 5th	-0.200	1.000	0.122	0.903
PRP	1st vs 5th	6.000	0.000	5.625	0.000
	1st vs 2nd	3.500	0.000	2.527	0.012
	2nd vs 3rd	2.273	0.012	2.813	0.005
	3rd vs 4th	1.182	0.080	0.477	0.634
	4th vs 5th	-0.955	1.000	0.191	0.849

Table 3. Temporomandibular joint clicks among groups and visits

Visits	Groups								Z	p-value
	HA (n=30)				PRP (n=22)					
	Range	Median	MR1	MR2	Range	Median	MR1	MR2		
1st	1-3	2.5	28.3	4.7	1-3	2	24.1	4.84	1.08	0.281
2nd	0-3	1	25.5	3.3	0-3	1	27.9	3.64	0.59	0.555
3rd	0-3	0	27.4	2.5	0-3	0	25.3	2.30	0.59	0.557
4th	0-3	0	26	2.3	0-3	0	26.9	2.07	0.26	0.797
5th	0-3	0	26.2	2.2	0-3	0	26.9	2.16	0.19	0.845
Friedman test	81.456				68.410					
p-value	0.000				0.000					

MR1: Mean Rank1, MR2: Mean Rank2, Z: Mann-Whitney U-test

Discussion

The present study demonstrated that both treatment modalities were effective in reducing signs associated with TMDs, but HA showed slightly higher and more rapid improvement than PRP. The results revealed that the majority of the TMDs patients were females, as females seek healthcare three times as males (7). A possible explanation was sex hormone levels; females with lower pain thresholds, joint laxity and TMJ hypermobility may influence TMDs physiopathology (8). Young people were affected more with TMDs in contrast to many other musculoskeletal disorders that appear in the elderly. This may be due to the impact of psychological stresses affecting TMJ (8).

Joint pain: The 5th visit showed significant improvement in NPRS in both groups. In HA group, it may be explained as HA can inhibit the release and propagation of inflammatory mediators and decrease pain receptors (3). This result agrees with a study which found that HA's analgesic impact was due to its high molecular weight and decreased stretch-activated channel sensitivity to mechanical forces, which inhibit pain response (9). In PRP group, an improvement in pain was owing to analgesic and anti-inflammatory properties (3). This finding was in line with a previous study which indicated the production of platelet growth factors that modulate inflammation and promote tissue repair (10). The non-significant difference

in NPRS scale between the two groups indicated that both materials were effective, but HA showed a slightly higher pain reduction than PRP. This finding is supported by some other studies which found that both medications were successful in decreasing TMJ pain (11, 12).

Joint clicking: Mean clicking decreased at the 5th visit in each group. Regarding HA, a possible explanation was that synovial fluid contains considerable amounts of HA, it acts as an elastic shock absorber during fast joint motions and as a viscous lubricant during slow joint motions (13). Furthermore, viscosupplements have disease-modifying features include lowering synovial inflammation, preventing cartilage erosion and stimulation of the synthesis of intra-articular HA (14). This finding agrees with a study which showed that improvement in clicking after HA injection may be related to the function of HA which hydrates, lubricates and stabilizes the joint (3, 15). In PRP, a potential explanation was the ability of growth factors to promote chondrocyte proliferation and encourage the regeneration as well as repair of cartilage (16). PRP therapy's fundamental idea was to heal injured areas by releasing a variety of bioactive factors and adhesion proteins (3). Comparing HA and PRP groups, a non-significant difference regarding clicking improvement was found, indicating that both administered substances had therapeutic effect but HA showed higher improvement in joint clicking than PRP. This was explained by exogenous HA's capacity to quickly replace endogenous HA, thereby improving joint function (14). This finding was consistent with a research which found that both HA and PRP showed a decrease in clicking (12).

Patients who received HA showed more rapid improvement in pain and clicking than those who received PRP, since HA's molecular weight is dropped in synovial fluid of TMDs patients (17). The exogenous HA can quickly substitute endogenous HA, replenish synovial fluid and enhance joint performance (18). Pain level decreased after each session of injections. Therefore, it is believed that HA administrations for three times were necessary to produce adequate results (19). The healing potential of PRP takes time due to molecular impacts on the joint structure (1). This finding agreed with a study which showed that HA exhibited improvements earlier than PRP (14). In conclusions, three sessions of intra-articular injections of HA and PRP in TMJ-ID patients showed a beneficial therapeutic effect on pain and clicking. Patients who received HA exhibited faster improvements than PRP.

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