AJDS LAZHAR Al-Azhar Journal of Dental Science
Vol. 22- No. 2- 137:144- April 2019
Record 1110-2624 | the ISSN Portal
portal.issn.org

EVALUATION THE ARTHROCENTESIS USING PLATELET-RICH PLASMA VERSUS HYALURONIC ACID IN TREATMENT OF INTERNAL DERANGEMENT OF TMJ

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ABSTRACT

The aim of the present study was to evaluate the arthrocentesis using platelet-rich plasma (PRP) versus hyaluronic acid (HA) in treatment of temporomandibular internal derangement. **Methods**: Patient of present study were carried out on adult patients with TMJ internal derangement. Seventeen cases 10 females (61%) and 7 males (39%). The patient obtained from Oral Maxillofacial Department at Faculty of Dental Medicine Al-Azhar University. All patients have arthrocentesis before injection with PRP or HA or Saline: Group (A): receives PRP injection, Group (B) receives HA injection, and Group (C) control group receives saline only. **Results:** The results of this study were to evaluate the effect of PRP and HA Injections after arthrocentesis in the patients with TMID in patients who didn't respond to conservative treatment. PRP administration showed a significantly high effect than (HA) on pain free mouth opening, clicking and masticatory efficiency. **Conclusion**: PRP and HA were safe material to be injected in TMJ cavity without any complications regarding to its administration.

INTRODUCTION

Temporomandibular joint (TMJ) performs most complicated movement in the human body. Internal derangement of the joint is a mechanical overload of the joint components, which eventually result in development of degenerative changes, which, characterized by abnormal positional relationship of the disc in relation to mandibular condyle as well as articular eminence and lead to degradation of the articular surfaces that become rough and eroded and dysfunction with exacerbation of the deterioration process sometimes occurs and progressing into osteoarthritis [(1)]. Although, displacement of the disc is common and asymptomatic in most patients, however the articular surfaces often deteriorate with age by internal derangement and arthritis [(2)]. The accurate etiology of Temporomandibular joint internal derangement TMID is multifactorial and the pathogenesis of the disease is incompletely understood [(3)] nevertheless, some factors of internal derangement are categorized as predisposing initiating[(4)], trauma[(5)], bruxism[(6)], and even psychological aspects [(7)].

Several treatment modalities have been recommended including home care practices, splint therapy, occlusal adjustment, medications as well as surgery. Splint therapy and occlusal adjustment have been extensively used, and there is no evidence to suggest that therapy can be completely cure. Surgical procedures considered alternative treatment to internal derangement but it is invasive except in rare cases. Arthrocentesis used to improve jaw function and reduce pain in the treatment of TMJ dysfunction [(8)].

Hyaluronic acid (glycosaminoglycan) produced by chondrocytes and synoviocytes within any joint. The concentration and molecular weight of HA gradually reduce to (35-50%) and this may result in osteoarthritic changes [(9)]. Different injectable forms of HA as Orthovisc. Hyaluronate has potential healing properties as triggering the cascade,

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enhancing proteoglycan synthesis, promoting chondrocyte proliferation and differentiate but still optimum outcome not occurs by using it [10].

Bertolami, et al in 1993[11] designed a multicenter study with a duration of 6 months. In his study examined the effects of the intraarticular injection of hyaluronate in patients complained of anterior disc displacement with reduction (ADDWR) and degenerative joint disease (DJD). The results showed significant improvement in the ADDWR patients treated with hyaluronate versus the placebo group regarding joint noise, mandibular deviation and visual analogue pain scores. The maximum difference in mouth opening between the hyaluronate and placebo group was 8 mm at fives week without statistically significant differences.

Orkun, et al in 2000 [12] have evaluated the efficiency of sodium hyaluronate in treating certain TMID. The result shows that HA highly recommended in treating TMID especially in anterior disc displacement with reduction. Oliveras, et al. in 2008 [13] injection of one intra-articular injection of HA was better in the test group, Also, the efficiency of two tablets of a combination of methocarbamol, and paracetamol to control group was given, the evaluation of efficiency by both the patients and investigators was better for the test group.

Platelet-rich plasma (PRP) is a product of autologous blood and contained concentrated platelets, obtained by centrifugation. The concentrated platelets contain growth factors that has potential healing properties on new bone and cartilage [14]. PRP have been used since 1970s by Machon, et al [15] whom injected into TMJ space. PRP has been used in maxillofacial and plastic surgery due to it is potential healing properties through proliferation, and differentiation of cells and tissue remodeling.

Based on the observations gained from several clinical studies that confirming the properties of Platelet-rich plasma and hyaluronic acid, this study was to evaluate arthrocentesis using platelet-rich plasma versus hyaluronic acid in treatment of internal derangement of TMJ.

SUBJECTS AND METHODS

Patient of present study were carried out on adult patients with TMJ internal derangement. seventeen cases 10 females (61%) and 7 males (39%). Their ages ranged from 16 to 40 years with mean (25.55±5.55). The patient obtained from Oral Maxillofacial Department at Faculty of Dental Medicine Al-Azhar University. All patients have arthrocentesis before injection with PRP or HA or Saline: Group (A) receives PRP injection, Group (B) receives HA injection, and Group (C) control group receives saline only. Inclusion criteria include: TMJ internal derangement disease diagnosed clinically and radiographically with panorama X-ray and magnetic resonance imaging (MRI) closed-and open-mouth position was performed for each patient to determine disc position and translation. Completion of one of the two treatment protocols for TMJ derangement. Patients above 16y.

Preoperative evaluation

Chief complaint and careful history were taken and recorded in questionnaire by the examiner. The history includes; demographic data, initial and duration of symptoms, history of noise or restricted mouth opening, bruxism or grinding habits and previous treatment. Pain level on forced mouth opening and its pain location were determined by the patient's self-assessments using visual analogue scale (VAS), ranging from 0 to 10 were used to assess joint pain and jaw dysfunction. [30] Clinical examination as maximum mouth opening (MMO), the range of lateral and protrusive movements of the mandible, measured and recorded. The character of the limitation in the jaw motion (mechanical origin, pain, persistence, intermittence, timing). The presence of joint noises judged clinically as none, early, or late click and crepitus.

Pre-surgical treatment:

All patients were subjected to conservative treatment as the first line of treatment in all TMID cases. The skin surface of the pre-auricular region disinfected with povidone iodine solution. Two points were marked, the first at 10 mm anterior and 2 mm inferior to the triages on the canthus-tragus line and the second at 20 mm anterior and 6 mm inferior to the tragus on the canthus-tragus line. Auriculo-temporal anesthesia with 2% Mepivacaine HCL with (levonordefrin 1:20000) injected into the joint cavity.

Arthrocentesis procedure:

Two 20-gauge needles were placed into upper joint space as entry and exit points for washing. The arthrocentesis will be performing with 100 ml of lactated Ringer's solution to eliminate the catabolites present in the synovial fluid started with 20 ml as pumping to stretch the capsule followed by 80 ml for washing. After the arthrocentesis, 1 ml of PRP injected into the degenerative joints in PRP group, 1 ml of HA (Orthovisc) injected into the degenerative joints in HA group, and 1 ml of saline injected into the degenerative joints in control group. Needles removed after the injection and covered its sites with gauze dressing.

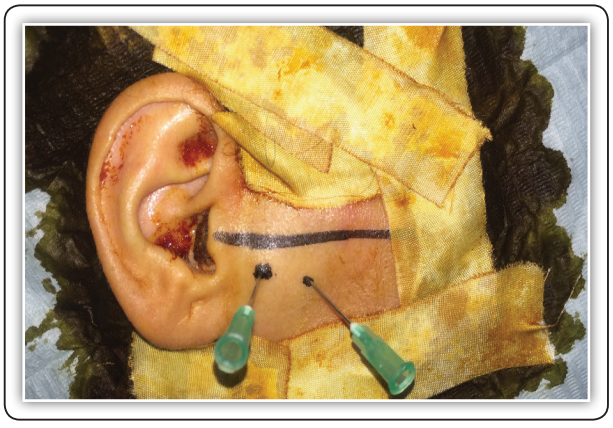

FIG (1) Showing tragus canthus line and position of two needles into joint space and lavage of the joint with 100 ml ringer solution.

Postoperative evaluations:

The patient recalled for examination after 1, 3 and 6 months to evaluate TMJ outcome after treatment, Patients evaluated clinically and radiographically as:

Clinical evaluation:

I. Self-pain and function of the jaw assessment, with Visual Analogue Scale (VAS), ranging from 0 to 10 scales. This scale used for self-evaluation of the patients, to evaluate pain level and jaw dysfunction and compared with preoperative degree. Patients were asked about the pain severity & dysfunction according to (VAS) as follow:

II. Maximum lateral excursion, the distance from midline of upper & lower jaw measured with a digital caliper in mm, summed and divided by 2 to give mean lateral movement.

III. Protrusive movement, the distance from labial surface of upper central incisor to lingual surface of lower central incisors during maximum forward movement.

IV. TMJ sound or clicking, measured by asking the patients to open and closed his mouth several, times and clicking was recorded as present (early clicking, late clicking) or absent. Assessment was performed on a scale of 0 at one end representing no noise, while number of 10 at the other end representing severe noise as it could be the worst.

V. Maximum mouth opening (MMO), between upper & lower incisors was measured during maximum opening with a digital caliber in mm.

VI. Masticatory efficiency, assessed on a scale ranged from 0 at one end representing good mastication, while, number of 10 indicated bad masticatory efficiency and the patient can be eating only liquid foods.

Radiographic evaluation:

As mentioned in preoperative evaluation panorama X-ray and (MRI) were performed at 6 months post injection for evaluation of TMJ outcome.

Statistical Analysis:

Data were collected, tabulated and analyzed, using SAS software (Statistical Analysis System version 9.1, SAS Institute Inc., Cary, NC, USA). Repeated measures analysis of variance was carried out including the effects and interactions of treatment, period, sex of patient and side affected. Age of patient and duration of illness before intervention were included. Tukey–Kramer test was used to compare the differences between means. The non-parametric Mann-Whitney test was performed to detect differences in pain score (ordinal data) between groups at each time point. Results are expressed as mean ± standard deviation. Differences were considered significant at probability $P \leq 0.05$.

RESULTS

This study was carried out on seventeen patients with no significant effects of (sex, age and affected joints) on the results in all groups, with the statistical analysis of the results. Patients with internal derangement of the TMJ based on clinical and radiographic evidence were included in the study. All of them suffered from pain on function associated with joint tenderness, pain in mouth opening and clicking sound on opening and closing of the mouth. All patients had arthrocentesis were divided to three groups 7 patients in 1st PRP group, 7 patients in 2nd HA group, 3 patients in 3rd saline group (control).

Clinical evaluations:

Clinical parameters of TMJ pain, clicking, MMO, lateral excursive movement, protrusive movement and masticatory efficiency were evaluated preoperatively and 1, 3, 6 months post-operatively as the following.

In the present study, all patients complained of severe pain, difficulty in chewing, limited mouth opening with significantly altered emotional states before treatment. After arthrocentesis with PRP injections, a significant improvement observed. The survey of patient satisfaction (questionnaire) ratified the treatment success, which was demonstrated after 6 months. In the present study, only two patients having OA. Positive response after injection with PRP. A dramatic decrease of pain and improvement in MMO were observed. The PRP effect extended to improve and sometimes eliminate TMJ clicking. In present study, once PRP injection was safe and gave a good result as reducing pain intensity, noisy TMJ clicking and increasing in MMO, mean lateral movements.

II. MRI and panoramic evaluations:

All patients in this study were examined with magnetic resonance imaging (MRI) and orthopantomogram (OPG) preoperatively and 6 months post-operatively. No changes were detected with MRI or OPG in between groups in whole time of evaluations**.**

TABLE (1): Showing comparison between groups according to different parameters

		Group: PRP (N=7)	Group: HA (N=7)	Saline group (N=3)	ANOVA	p-value$_1$
		TMJ pain				
Before	Mean ± SD. Range	8.3±1.0 7-10	8.0±0.6 7-9	9.0±1.0 8-10	1.560	0.245
After 1m	Mean ± SD. Range	7.3±1.3 5-9	7.1±0.7 6-8	8.3±0.6 8-9	1.711	0.216
After 3m	Mean ± SD. Range	5.9±0.9 5-7	6.6±0.5 6-7	8.0±1.0 7-9	7.892*	0.005*

		Group: PRP (N=7)	Group: HA (N=7)	Saline group (N=3)	ANOVA	p-value$_1$
After 6m	Mean ± SD.	4.4±1.1	5.9±0.7	8.3±0.6	20.114*	<0.001*
	Range	3-6	5-7	8-9		
	ANOVA test	11.342*	5.303*	2.000		
	p-value$_2$	<0.001*	0.002*	0.184		
		TMJ sound				
Before	Mean ± SD.	9.3±1.1	9.3±1.0	9.3±0.6	0.003	0.997
	Range	7-10	8-10	9-10		
After 1m	Mean ± SD.	8.4±1.0	8.9±1.1	9.3±0.6	0.963	0.406
	Range	7-10	7-10	9-10		
After 3m	Mean ± SD.	7.4±1.0	8.1±1.1	9.3±0.6	4.073*	0.040*
	Range	6-9	7-10	9-10		
After 6m	Mean ± SD.	6.6±1.5	7.9±0.9	8.7±0.6	4.001*	0.042*
	Range	5-9	7-9	8-9		
	ANOVA test	5.729*	4.804*	2.000		
	p-value$_2$	<0.001*	0.003*	0.184		
		MMO				
Before	Mean ± SD.	27.4±2.8	32.9±6.3	27.0±5.3	2.707	0.101
	Range	23-31	26-45	21-31		
After 1m	Mean ± SD.	31.6±4.3	38.2±8.0	31.7±7.5	2.085	0.161
	Range	26-40	30-47.5	24-39		
After 3m	Mean ± SD.	37.8±3.9	39.1±7.8	34.0±6.0	0.743	0.493
	Range	30-42	30-49	28-40		
After 6m	Mean ± SD.	43.4±3.7	40.6±8.0	35.7±6.1	1.631	0.231
	Range	39.5-48.5	32-50	29-41		
	ANOVA test	9.123*	5.599*	4.353		
	p-value$_2$	<0.001*	0.002*	0.235		
		Mean Lateral movement				
Before	Mean ± SD.	3.5±1.7	2.9±1.2	3.3±1.0	0.336	0.720
	Range	1.8-6.8	1.5-4.3	2.5-4.5		
After 1m	Mean ± SD.	5.0±1.8	4.1±0.9	4.5±0.5	0.796	0.471
	Range	3-8.5	2.5-5	4-5		
After 3m	Mean ± SD.	6.1±1.8	4.9±0.9	6.0±1.3	1.477	0.262
	Range	3.5-9.3	3.8-6.3	4.8-7.3		
After 6m	Mean ± SD.	7.3±2.2	6.0±0.8	7.7±0.8	1.652	0.227
	Range	5-11	5-7.5	6.8-8.3		
	ANOVA test	7.545*	6.497*	8.549*		
	p-value$_2$	<0.001*	<0.001*	0.013*		
		Protrusive movement				
Before	Mean ± SD.	1.5±1.6	2.4±1.4	2.0±1.0	0.627	0.549
	Range	0-4	1-5	1-3		
After 1m	Mean ± SD.	2.6±1.7	3.3±1.7	2.3±1.5	0.474	0.632
	Range	1-5	1.5-6	1-4		
After 3m	Mean ± SD.	3.9±1.2	4.0±1.4	3.0±2.0	0.525	0.603
	Range	2-5	2.5-6	1-5		
After 6m	Mean ± SD.	5.4±1.4	4.9±2.1	4.2±2.8	0.449	0.647
	Range	4-7	3-9	1.5-7		
	ANOVA test	17.110*	3.618*	2.137		
	p-value$_2$	<0.001*	0.011*	0.166		
		Masticatory efficiency				
Before	Mean ± SD.	6.7±1.3	8.3±1.0	9.3±0.6	2.642	0.056
	Range	5-9	7-9	9-10		
After 1m	Mean ± SD.	6.3±1.0	7.1±0.7	8.3±0.6	7.074*	0.008*
	Range	5-7	6-8	8-9		
After 3m	Mean ± SD.	5.4±0.8	6.7±1.0	7.3±0.6	6.936*	0.008*
	Range	4-6	5-8	7-8		
After 6m	Mean ± SD.	4.6±1.0	6.0±1.0	7.0±0.0	8.607*	0.004*
	Range	3-6	5-8	7-7		
	ANOVA test	8.216*	5.435*	7.000*		
	p-value$_2$	<0.001*	0.002*	0.020*		

p-value$_1$: p value for comparing between the **three groups**

p-value$_2$: p value for comparing between the **studied periods**

**: Statistically significant at p ≤ 0.05*

DISCUSSION

Non-invasive or conservative management such as hot fomentation, medication, physical therapy, splints and corrective dental problems either in diagnosis or treatment for internal derangement is the first and best choice treatment plan for the operators and the patients [16]. When this fails to give satisfactory results, especially related to pain reduction, joint clicking and inability to open the mouth [17], arthrocentesis can be used to alleviate pain and reduce TMID effects. [18]. Arthrocentesis is becoming minimally invasive surgical treatment for TMID either alone or with intra-articular administration of injectable material, some authors used anti-inflammatory & lubricant materials such as corticosteroids, Hyaluronic acid (HA) while others prefer to allow the body to heal itself using regenerative materials as PRP, PRF and other injectable materials [19-21].

Arthrocentesis was injected accurately with PRP or HA within joint space. In the present study, HA was the first line of treatment in the study design as evidence-based treatment option based on the previous study of Bjomland, et al [22], who found that HA patients had significantly better pain relief more than corticosteroids. Also, Manfredini, et al [23] compared arthrocentesis with different injection options and obtained better results with HA compared to corticosteroids. Noticeable improvement was achieved with repeated arthrocentesis combined with HA application. The principle of these previous studies was that the intra-articular administration of anti-inflammatory drugs into joints can improve lubrication and injectable material, reabsorbed within minutes [24, 25] In addition of arthrocentesis provides joint lavage, the irrigation of inflammatory mediators and loose particles of cartilage led to decrease of the adhesions [26,27]. Nevertheless, many physicians prefer to use HA at the end of arthrocentesis for its positive effect on inflammatory degenerative disorders [28].

Hepguler, et al [29] managed the patients with a conservative therapy treatment (hot-cold fomentation, medication, physical therapy, splints, corrective dental problems) for more than two months. Clicking and pain intensity improved in the patients using HA as compared to patients using saline solution. Orkun, et al in 2000 [30] evaluated the efficiency of sodium hyaluronate in treating certain TMID. Improvement in mouth opening was detected with decreasing of pain and noisy sounds during movement of lower jaw. The result of this research was in –agreement with the present study, which showed improvement of HA injection in treatment of TMID. Aforementioned research was in contrast, Kopp, et al in 1991[31] didn't find any statistical significance in MMO after two HA injections. Hegab, et al [17] showed that the effect of the application of sodium hyaluronate was significantly lower than PRP. In the present study the patients were injected with PRP. The effect of intra-articular administration of PRP was better than HA and saline injection was obtained in our study. This observed in reducing pain intensity, noisy TMJ clicking and increasing in MMO but no change occurs before or after in MRI for all cases.

A dramatic decrease of pain and improvement in MMO were observed in agreement with Machon, et al [32]. improvement may be attributed to the anti-inflammatory and anti-bacterial action of PRP plus its high contents of GF. PRP promotes healing through regeneration of degenerative changes in cartilage, bone, and synovial tissue [33, 34]. In the present study, all patients complained of severe pain, difficulty in chewing, limited mouth opening with significantly altered emotional states before treatment. After arthrocentesis with PRP injections, a significant improvement observed. The survey of patient satisfaction (questionnaire) ratified the treatment success, which was demonstrated after 6 months.

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