



FOLIA MEDICA CRACOVIENSIA  
Vol. LVII, 3, 2017: 57–65  
PL ISSN 0015-5616

## Evaluation of remission of temporomandibular joints pain as a result of treatment of dysfunction using intraarticular injection

MAŁGORZATA PIHUT<sup>1</sup>, MAŁGORZATA GÓRECKA<sup>2</sup>, PIOTR CERANOWICZ<sup>3</sup>

<sup>1</sup>Prosthodontics Department, Consulting Room of Temporomandibular Joint Dysfunction  
Jagiellonian University Medical College, Kraków, Poland

<sup>2</sup>University Dental Clinic, Jagiellonian University Medical College, Kraków, Poland

<sup>3</sup>Department of Physiology, Faculty of Clinical Physiology  
Jagiellonian University Medical College, Kraków, Poland

**Corresponding author:** Małgorzata Pihut, Prosthodontics Department,  
Consulting Room of Temporomandibular Joint Dysfunction, Jagiellonian University Medical College  
ul. Montelupich 4, 31-155 Kraków, Poland  
Phone: +48 12 424 55 55; E-mail: [m.pihut@op.pl](mailto:m.pihut@op.pl)

**Abstract:** The temporomandibular joint pain, which occurs in the course of temporomandibular joint dysfunction, is one of the main clinical problems in the treatment of joint disc displacement.

The aim of the study was to evaluate changes in temporomandibular joints pain in treatment supporting disc displacement without reduction using intra-articular injection of hyaluronic acid and platelet-rich plasma.

**Material and methods:** The study consisted of a group of 60 patients, aged 35–49, who reported for treatment, because of pain in the preauricular area. The functional examination stated disk displacement without reduction, along with the accompanying pain of temporomandibular joints. Patients were treated between January 2015 and February 2017. They were divided into two groups of 30 persons. The intraarticular injection of hyaluronic acid was administered in the I-test group, and the injection of platelet-rich plasma in the control group. This treatment was carried out parallel to the use of repositioning splints.

**The results:** Analysis of regression of symptoms other than intensity of pain during the treatment, evaluated in this study shows a decrease of individual symptoms, but the results of the regression of pain between two groups did not differ statistically significantly, because “p” is bigger than 0.05.

**Conclusion:** The results of the research show the clinical benefits of application of hyaluronic acid and plate rich plasma in the treatment of temporomandibular joint dysfunction.

**Key words:** temporomandibular joint dysfunction, intraarticular injection.

## Introduction

The temporomandibular joint pain, which occurs in the course of temporomandibular joint dysfunction, is one of the main clinical problems in the treatment of joint disc displacement. Both forms of dysfunction, i.e. the disc displacement with and without reduction, indicate the significant progression of pathological changes within the musculoskeletal system [1–5].

The main cause of this kind of pathological changes is the increase in masseter muscles tension, i.e. occlusion paralysis (grinding, clenching or rattling), especially the upper lateral pterygoid muscles, whose trailers — in about 30% — are located directly to the joint disc within temporomandibular joints. Excessive muscle tension, i.e. muscle activity that exceeds the required physiological activity, causes frequent and prolonged pulling of the disc towards the front, resulting in tearing and damage to the ligament structure of the disk. This in turn becomes the cause of the inability to lead the disc back to the correct position on the jaw joint head [1–5].

Chronic stress and the influence of the limbic system, involving the emotional zone, on the pathological increase of temporomandibular joint muscles in the stomatognathic system are mentioned as some causes responsible for the pathology of the temporomandibular joints. The configuration of the occlusion contacts of the individual teeth can be very detrimental to the lack of symmetry in the work of muscles located on both sides of the cranial face and thus uneven load on the TMJs. Craniofacial injuries are a rare cause of disk dislocation, but they should be considered in the subjective examination [6, 7].

Prosthetic treatment of disk displacement most often involves the use of occlusal splint (repositioning or relaxing in case of negative protrusion test) and supportive physiotherapeutic treatments such as manual therapy, laser biostimulation, or sonophoresis using analgesics [2, 5].

A recognized and frequently used method of orthopedic treatment of knee, jaw or elbow joints is intra-articular injection of hyaluronic acid and platelet-rich plasma (PRP). Exogenous visco-elastic acid is supplemented in the area of the compartment of superior joint (superior joint cavity), moisturizes the articular surfaces, improves the sliding of the joints, feeds them, as well as accelerates the healing process of damaged joints, especially the ligaments of the joint. Plate rich plasma is an autologous blood product that contains an increased platelet count in a small volume of plasma. The concentration is usually 1,000,000 platelets per  $\text{mm}^3$  at blood pH of 6.5–6.7. The essence of PRP is the release of growth factor from granules of proteins, which greatly assist the regeneration of damaged tissues. Growth factors stimulate cell migration to the site of damage, their multiplication and differentiation, as well as blood vessel proliferation. The following processes are particularly important for healing; platelet-derived growth factor, transforming, epithelial, insulin-like and vascular endothelial

growth factor. Adhesive molecules, polypeptides, enzymes, vitamins, oligoelements isolated from plasma play a key role in the activation and differentiation of stem cells. PRP is widely used in orthopedics, facial and maxillofacial surgery, periodontology, burn treatment, and more recently in sports and aesthetics medicine [8–16].

Consent of the Ethic Committee No KBET/125/L/2013 (1.07.2013).

### **The aim**

The aim of the study was to evaluate changes in temporomandibular joints pain in treatment supporting disc displacement without reduction using intra-articular injection of hyaluronic acid and platelet-rich plasma.

### **Material and methods**

The study material consisted of a group of 60 patients aged 35–49, who reported for treatment to the Consulting Room of temporomandibular joints dysfunction, Jagiellonian University Medical College in Krakow, because of pain in the preauricular area. The functional examination stated disk displacement without reduction, along with the accompanying pain of temporomandibular joints. Patients were treated between January 2015 and February 2017. They were divided into two groups of 30 persons. The intraarticular injection of hyaluronic acid was administered in the I-test group, and the injection of platelet-rich plasma in the control group. This treatment was carried out parallel to the use of repositioning splints. In all cases, contraindications for the use of evaluated methods such as intraarticular injection (inflammatory skin disease) or peripheral blood plasma disease (blood disorders, thrombocytopenia, platelet dysfunction, fibrinogen deficiency) were excluded.

The criterion of inclusion in the study were: generally healthy patients, with full arched teeth, diagnosis of disk displacement without reduction, positive protrusion test, qualifying patients for use of repositioning splint.

Exclusion criteria from the study; occurrence of general illness, occurrence of disk displacement with reduction, patient's will.

Patients who met the criteria for inclusion in the study were assigned alternately to the individual groups as soon as they applied for prosthetic treatment.

All patients were subjected to a subjective and objective examination as well as specialized functional examination of the chewing organs. An important element of the examination was to determine the pain intensity of one or both temporomandibular joints (VAS + WNRS) and its radiation, as well as the evaluation of clinical parameters related to: the range and symmetry of the mandible movements, evaluation of the mandibular abduction tract, the results of the palpation of the musculoskeletal system of chewing organs, as well as analysis of additional symptoms.

In selecting the type of occlusal device it was important to obtain the results of the protrusion test, i.e. the lowering of the mandible from the mandibular protuberance, and evaluation if at that moment the acoustic symptoms disappear. If the test was positive (disappearance of clicking), a repositioning splint was used; if the result was negative, then it was a relaxing splint. The recommended usage time of the splints in both groups was 21 hours per day.

The place of injection was determined in accordance with the rules for surgical treatment (Fig. 1) [10]. In group I, 1.5% hyaluronic acid was used for intra-articular injection in the amount of 0.4 ml for each joint, whereas in group II blood was collected from patients with ulnar vein, using a set of two tubes containing anticoagulant in the form of trisodium citrate (Fig. 2). Full blood was subjected to

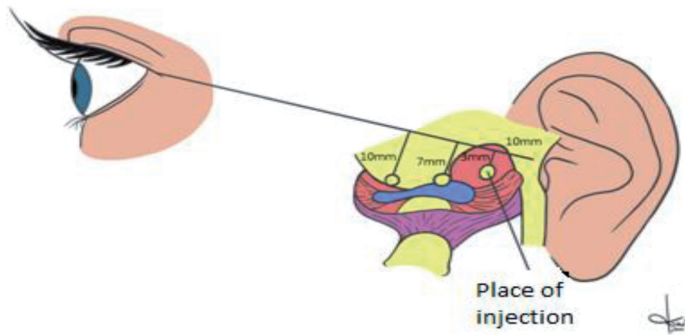


Fig. 1. The place of injection of hyaluronic acid and PRP in the area of temporomandibular joint dysfunction.



Fig. 2. "Closed" set for the patient's blood collection.

two spin cycles; in the first speed 2,400 rpm was used for 10 min, and the second spin was performed at 3,600 rpm for 10 min. Plate rich plasma was used directly after centrifugation. After the injection, patients were informed about the proper treatment.

Intraarticular infusions were made three times according to the rules of antiseptics, in both temporomandibular joints, at two-weeks intervals. Intraarticular injections were performed without local anesthesia. Immediately after injection, the patients were monitored for 20 minutes to control their comfort. Functional examination of the stomatognathic system was performed twice, i.e. before treatment and 2 weeks after the third injection. Postoperative recommendations did not limit chewing activity after intervention.

In case of the measure giving the constant results, statistical analysis was based on the traditional methods of calculation: mean values, standard deviation, minimal values, maximal values, standard error of the mean, variance analysis for dependent variables and post-hoc Tukey test for dependent variables being the statistical significance measure.

To compare the dependencies between the results obtained in consecutive clinical tests, the non-parametric Friedman test, Kendall's and Wilcoxon signed-rank test (comparing two related samples) were used. For statistical studies special computer software STATISTICA 2010 was used. A p value of less than 0.05 was accepted as statistically significant.

## The results

The study involved 60 patients (43 women and 17 men, mean age 29.2 years, The study group — I includes 21 women and 9 men, and the control group — II contains of 22 women and 8 men. The symptoms reported by patients in group I and group II obtained during the medical interview and evaluation of clinical parameters have been included in the Table 1. Table 2 contains mean value of punctuation of score VAS + WNRS (pain of the temporomandibular joints) in group I and II, collected during subsequent examinations.

The mean value of punctuation of score VAS + WNRS obtain in the first examination in group I was 5,766 points, and in group II 5,533. These results did not differ statistically, what proves the homogeneity of the examined groups. In the second examination — after treatment the mean values of punctuation were 1,433 in the group I and 1,466 in group II. Te result are presented in the Table 2.

Analysis of regression of symptoms other than intensity of pain during the treatment, evaluated in this study shows a decrease of individual symptoms, but the results of the regression of pain between two groups did not differ statistically significantly, because "p" is bigger than 0.05.

**Table 1.** The symptoms reported by patients in group I and group II obtained during the medical interview and evaluation of clinical parameters.

Symptoms of temporomandibular joint disorders			Group I		Group II	
			Ex I	Ex II	Ex I	Ex II
Spontaneous pain	single joint	acute	22	5	24	4
		dull	4	1	2	0
	bilaterally	acute	3	1	2	1
		dull	1	1	2	0
Pain presence during mastication			18	4	22	2
Pain of the TMJs triggered by palpation			22	5	24	4
Pain associated with lower jaw movements			16	7	18	4
Masticatory muscle pain			24	7	25	8
Radiation of pain			8	2	10	3
Sounds, click in TMJs		single TMJ	19	1	20	3
		bilaterally	11	2	9	1
Subjective feeling of increased tension in muscles			25	7	26	6
Constricted opening of the lower jaw			4	1	3	0
Constricted lateral mandibular movements			5	1	8	0
Mandibular deviation during opening			22	4	24	5
Difficulty on chewing			15	14	14	2
Occlusion parafunctions			30	5	30	8
„Closed ear” symptom on the affected TMJ side			2	0	4	2
Sudden hearing impairment			2	0	1	0
Tinnitus			1	0	2	0
Dizziness			2	1	2	1
Headaches			13	5	14	5
Pain in the neck			5	1	5	2

**Table 2.** The intensity of the pain in temporomandibular joint dysfunction in punctuation of VAS + WNRS score.

Examination Group	I examination	II examination
	$\bar{x} \pm s$ Min–Max Mediana	$\bar{x} \pm s$ Min–Max Mediana
I Group	5,766 ± 1,305 3–8 5.0	1,433 ± 1,04 0–4 1.5
II Group	5,533 ± 1,167 2–8 5.0	1,66 ± 1,188 0–3 2.0
p U Mann-Whitney	<b>p = 0.5015</b>	<b>p = 0.05048</b>

## Discussion

Temporomandibular joints dysfunction of the stomatognathic system have a compound etiology and it is difficult to clearly identify the leading cause of their occurrence. The complexity of the problem is due to the condition of the temporomandibular joints and stomatognathic muscles. That why, treatment of dysfunction is not so easy task. Therefore, the searching a new, supportive treatment methods is very valuable. Injections for orthopedic treatment have been rated for many years, and the healing and repairing properties of hyaluronic acid and platelet rich plasma are no longer of doubt. Injections of these preparations for temporomandibular joints are not commonly used, but few preliminary results in the available literature clearly raise hope for proven efficacy. Principles of treating dysfunctions of stomatognathic system include use; occlusal splints, botulinum toxin type A and physiotherapeutic procedures [9–17].

Comparative own studies show high efficacy of both formulations in joint pain remission and the results of VAS + WNRS scoring mean significant improvement in clinical parameters associated with functional assessment of stomatognathic system. These results are similar to those obtained by the Maheu *et al.*, who emphasize not only the effectiveness of hyaluronic acid but also the safety of this viscosupposition. They emphasize that hyaluronic acid may exhibit greater efficacy in: less advanced pathological changes in the joints and in younger patients [18].

The European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO) treatment algorithm recommends intra-articular hyaluronic acid for advanced pharmacological managements of knee osteoarthritis. These authors also emphasize the superiority of acid injection over steroids administered



this way. The results of two meta-analyses evaluating the efficacy of hyaluronic acid in intra-articular injection have revealed, beneficial effects on pain, function and patient global assesment at different postinjection time [18–22].

Cerza *et al.* [9] also compared the effectiveness of intra-articular injection of acid and plasma and their results indicate a high degree of efficacy of both test preparations. Also this therapeutic approach does not cause side effects such as inflammatory or pseudo septic reaction in the joints, what is very important. The precise mechanism of action of exogenous HA is unknown. However the proposed mechanism of the HA activity occurs in two stages; a mechanical and pharmacological stages.

Mechanical stage is concern with synovial fluid is replaced by higher concentration of the of HA thereby improving viscosity and lubricating abilities of deplaned synovial fluid and maintains a boundary layer around nociceptors, what is a course of reducing pain induction. The pharmacological stages induces the biosynthesis of endogenous HA and extracellular matrix components which reduces proteoglycan loss in cartilage and apoptosis of chondrocytes. The authors emphasized that HA demonstrates a greater effect beyond 12 weeks after injection with longer lasting benefits up to 6 month [9].

The clinical benefits of application of HA and PRP in the treatment of temporomandibular joint dysfunction are fact, but it is necessary to conduct further research in this area [16, 17, 19–23].

## Summary

Searching for a new diagnostic and supporting methods of treatment of temporomandibular joint dysfunction is still a current clinical problem. The complex etiology of the disease is determined by the need for individualized treatment, which is difficult for physicians. The current results of the research concern with hyaluronic acid and platelet-rich plasma in intra-articular injection in the region of temporomandibular joints are very important way of delivery of the such a convenient substance and soon will be a routine supporting method of prosthetic treatment of temporomandibular joints.

## References

1. Hughes J.: Pain Management. From basics to clinical practice. Elsevier, 2008, pp. 6–14, 65–78.
2. Okeson J.: Management of temporomandibular disorders and occlusion. (7e) Elsevier, 2013, pp. 26–45, 173–211.
3. Stępień A.: Neuralgias and facial pain. Polish Neurological Review. 2007; 3 (4): 262–266.
4. Madland G., Feinmann C.: Chronic facial pain: a multidisciplinary problem. J Neurol Neurosurg Psychiatry. 2001; 71: 6716–6719.
5. Grey R., Davies S., Quayle A.: The clinical guide to temporomandibular disorders. (The Clinical Guide Series). British Dental Journal. 2003; pp. 55–60, 23–30.
6. Pihut M., Gierowski J., Palusiński Ł.: Depression diagnosis in the group of patient treated prosthodontically due to temporomandibular joint dysfunction. E-Dentico. 2013; 5 (45): 70–75.



7. *Glaros A*: Temporomandibular disorders and facial pain: a psychological perspective. *Appl Psychophysiol Biofeedback*. 2008; 33 (3): 161–171. Epub 2008.
8. *Lewandowski L*: The management of some temporomandibular joints diseases with intra-articular administration of medicines. *Pol J Stomatol*. 2006; 59 (4): 266–271.
9. *Cerza F, Carni S, Carcangiu A, et al*: Comparison between hyaluronic acid and platelet-rich plasma, intra-articular infiltration in the treatment of gonarthrosis. *Am J Sports Med*. 2013,41(5), NP27. doi: 10.1177/0363546513485064.
10. *Stopa Z, Wanyura H, Pączek L, Samolczyk-Wanyura D*: The level of cytokines and proteolytic enzymes in the articular synovial fluid and blood serum of patients with temporomandibular joint disease. *Pol J Stomatol*. 2010; 67 (7): 429–443.
11. *Barbisan de Suosa A, Okawa R, Silva C, Araujo M*: Short-term changes on C-reactive protein (CRP) levels after non-surgical periodontal treatment in systemically healthy individuals. *Clin Oral Investig J*. 2017; 21 (1): 477–484.
12. *Podzimek S, Mysak J, Janatova T, Duskova J*: C-Reactive Protein in Peripheral Blood of Patients with Chronic and Aggressive Periodontitis, Gingivitis, and Gingival Recessions. *Mediators Inflamm*. 2015; 2015: 564858. doi: 10.1155/2015/564858. Epub 2015 Aug 4.
13. *Bansal T, Dhruvakumar D, Pandey A*: Comparative evaluation of C-reactive protein in peripheral blood of patients with healthy gingiva, gingivitis and chronic periodontitis: A clinical and particle-enhanced turbidimetric immuno-analysis. *J Indian Soc Periodontol*. 2014, 18 (6): 739–743.
14. *George A, Janam P*: The short-term effects of non-surgical periodontal therapy on the circulating levels of interleukin-6 and C-reactive protein in patients with chronic periodontitis. *J of Indian Soc Periodontol*. 2013; 17 (1): 36–41.
15. *Sargolzai N, et al*: Association of Periodontal Diseases with C- Reactive Protein. *J Med Sci*. 2008; 2: 191–195.
16. *Ugan Y, Yilmaz H, Yildirim Y, et al*: Clinical and magnetic resonance imaging findings of the temporomandibular joint and masticatory muscles in patients with rheumatoid arthritis. *Rheumatol Internat*. 2012; 32 (5): 1171–1175.
17. *Brown E.A., Schütz S.G., Simpson D.M*: Botulinum toxin for neuropathic pain and spasticity: an overview. *Pain Management*. 2014; 4 (2): 129–151.
18. *Maheu E, Rannou F, Reginster J.Y*: Efficacy and safety of hyaluronic acid in the management of osteoarthritis; Evidence from real-life setting trials and surveys. *Semin Arthritis Rheum*. 2016; 45: 28–33.
19. *Goncars V, Jakobsons E, Blums K, et al*: The comparison of knee osteoarthritis treatment with single dose bone marrow-derived mononuclear cells vs hyaluronic acid injection. *Medicina (Kaunas)*. 2017; 53 (2): 101–108. doi: 10.1016/j.medici.2017.02.002. Epub 2017 Mar 22.
20. *Van Rijswijk M.H., Van Leeuwen M.A., Sluiter W, et al*: Individual relationship between progression of radiological damage and the acute phase response in early rheumatoid arthritis. Towards development of a decision support system. *J Rheumatology*. 1997; 24 (1): 20–27.
21. *Tanaka N, Sakahashi H, Sato E, et al*: Intraarticular injection of high molecular weight hyaluronan after arthrocentesis as treatment for rheumatoid knees with joint effusion. *Rheumatol Int*. 2002; 22 (4): 151–154.
22. *Punzi L, Oliviero F, Ramonda R*: Laboratory investigations in osteoarthritis. *Aging Clin Exp Res*. 2003; 15 (5): 373–379.
23. *Skrzat J, Spulber A, Walocha J*: Three dimensional model of the skull and the cranial bones reconstructed from CT scan designed for rapid prototyping process. *Folia Med Cracov*. 2016; 56 (2): 45–52.