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Original Article

Comparison of the efficacy of dry needling and trigger point injections with exercise in temporomandibular myofascial pain treatment

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ABSTRACT

Objectives: We aimed to compare the efficacy of dry needling, trigger point injection, and protection methods through physical exercise on clinical symptoms and the pain threshold in patients with temporomandibular myofascial pain.

Patients and methods: Between March 2013 and September 2013, in a random consecutive manner, a total of 63 consecutive patients (10 males, 53 females; median age 39.4±14.9 years; range, 18 to 65 years) were randomly divided into three groups: Group 1 (only exercise and protection training), Group 2 (dry needling + exercise + protection training), and Group 3 (trigger point injection + exercise + protection training). Dry needling or trigger point injection was performed for three times to the patients in Group 2 and Group 3 on a weekly basis. All patients were followed on Day 10 and at one month.

Results: A statistically significant improvement in the assessment and response variables was found for all groups, particularly for pain and functional limitation status ($p<0.001$). All groups were similar in terms of the improvement degree ($p<0.001$). Although not statistically significant, the highest improvement in the facial pain was seen in Group 3 on Day 10 ($p=0.235$); however, on Day 30, no significant difference was observed.

Conclusion: Our study results showed that improvement in the subjective and objective symptoms in all treatment groups. Particularly, only exercise therapy was found to be beneficial as invasive methods. We suggest that all these methods should be applied together to achieve long-term efficacy.

Keywords: Dry needling, exercise, myofascial pain, temporomandibular joint, trigger point injection.

Temporomandibular joint (TMJ) is one of the most complex joints of human body, being the part of stomatognathic system composed of masseter muscles, head and neck muscles, ligaments, teeth, cheeks, lips, and salivary gland.[1] Diseases of the TMJ may result from pathologies of the joint itself or from diseases of the masseter muscles.

Myofascial pain syndrome (MPS) is one of these diseases. It is a chronic pain disorder characterized by pain or muscle spasm resulting from trigger points of the taut bands of muscles and/or fascia, tenderness, limited joint movement, dysfunction, fatigue, and sometimes autonomic dysfunctions.[2-4]

The etiology of MPS has long been under discussion and it has not been fully clarified, yet. Although there are numerous underlying reasons of MPS, acute trauma as a result of sudden pressure on muscles or chronic damages due to recurring micro-traumas and genetic factors, fatigue, and stress is one of the main causes of the disease.[2,3]

Dry needling is one of the most preferred methods for the treatment of MPS. Dry needling becomes effective by disrupting mechanically contractile elements that are abnormally functioning or sensorial or motor components of nerve terminations which contributes to the trigger point activity. It initiates

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trigger point damage and recovery process starts. Previous studies demonstrated that dry needling is a quite effective method in the myofascial trigger point inactivation.[5,6]

Stretching and posture exercises are suggested both as remedial and protective treatment modalities. In particular, passive stretching has of great importance within the treatment methods, as it is the only tolerable exercise for the excessively sensitive trigger point.[4]

In trigger point injection, when the local anesthetic injection is applied to the palped tense band, it is aimed to increase local circulation due to vasodilatation to eliminate muscle tension and excessive tenderness. In addition, the substances which increase the tenderness of the nerves are neutralized and also tissue injury due to focal necrosis which anesthetic agents cause is avoided by liquid injections.[4,7]

Temporomandibular disorders (TMD) is the main reason of orofacial pain which is not caused by teeth.[8] Approximately 50% of asymptomatic patients suffers from deviation while opening the jaw and TMJ sound.[9] These findings are accepted as normal symptoms and there is no need to any treatment. On the other hand, the frequency of TMD which requires treatment is thought to be less than 5% in the population.[10]

In the natural course of TMD, symptoms disappear without any treatment in 40% of the patients. Temporomandibular pain frequency within the society is higher in women than men. Up to 80 to 90% patients who are under medical treatment due to TMD are women.[9,11] The TMD frequency during adolescence period is equal in men and women and it is seen rarely during this period. The frequency increases considerably in women who are in the fertility period and, during postmenopausal period, it decreases again.[12] Differences observed in the temporomandibular pain during the menstrual cycle supports the idea that sex difference results from fertility hormones.[13]

In previous studies, dry needling and trigger point injections have been compared and both methods have been found to be beneficial with certain differences.[14,15] However, there is a limited number of studies on the efficacy of exercise methods. In the present study, therefore, we aimed to compare the clinical efficacy of dry needling, trigger point injection and protection through exercise therapy on the pain threshold of temporomandibular MPS patients.

PATIENTS AND METHODS

Patients with temporomandibular MPS, irrespective of reduction, who applied to Physical Medicine and Rehabilitation Clinic of Istanbul Training and Research Hospital between March 2013 and September 2013 were included in the study. A written informed consent was obtained from each patient. The study was approved by the local Ethics Committee of Istanbul Training and Research Hospital (No: 236, Date: 22/03/2013). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Inclusion criteria were as follows: patients between 18 and 65 ages, temporal, lateral pterygoid and/or masseter tenderness, and existing trigger points (MPS diagnosed according to the criteria defined by Travel and Simon), and symptoms for at least three months. Exclusion criteria were as follows: having active odontogenic disease, undergoing jaw joint operation, having a diagnosis of a systematic, metabolic, endocrine, tumoral, infectious, inflammatory, rheumatic, or neurological disease (trigeminal neuralgia, atypical fascial pain), having a psychiatric diagnosis, and any hemorrhagic disease.

Before starting the study, detailed history was obtained from each patient including demographic data, education level, career life, general health condition, oral health, depression, and somatization. All patients were informed about the treatment. A total of 63 patients (10 males, 53 females; median age 39.4±41.9 years; range, 18 to 65 years) who met the inclusion criteria were divided into three groups in a random consecutive manner. Randomization was performed according to the order of arrival of the patients.

Group 1 (16 females, 5 males): only the exercise and protection training

Group 2 (19 females, 1 male): dry needling + exercise + protection training

Group 3 (18 females, 4 males): trigger point injection + exercise + protection training

Our sample size is consistent with previous studies.[6,15] All patients were told about the suggestions such as hot and cold massage, soft nutrition, relaxation, lying, sitting and exercise positions. A print-out showing related exercises was delivered to all patients.

Exercise and protection training were given to all patient groups. Exercise therapy was given to bilateral temporal, masseter, and pterygoid muscles. It consists

of isometric, rotation, and coordination exercises for chewing muscles and isometric exercise for cervical muscles. In addition, stretching exercises were given, if there was limited mouth opening.

Dry needling or trigger point injection was performed for three times to the patients in Group 2 and Group 3 on a weekly basis by a single physiatrist.

Trigger point injection: The trigger point in the right or left or bilateral masseter and lateral pterygoid muscles was detected by palpation, and 1 mL of prilocaine was injected using a 22-Gauge 5 mL injector. After injection, the patient was observed for 10 min.

Dry needling: The trigger point in the right or left or bilateral masseter and lateral pterygoid muscles was detected by palpation. An acupuncture needle was applied to the point and the needle was turned around itself once in five min. The needle was kept in the muscle for 20 min until the muscle became relaxed.

Patients in Group 1 were called by phone weekly and they were checked and reminded about their exercises. All patients were examined physically on Day 10 and at one month from the beginning of treatment by the physiatrist. The examination included pain evaluation using the visual analog scale (VAS), changes in the mouth opening level, changes in the functional limitation level, and examination of the tender points of facial and neck muscles via palpation and using algometry method. The Pain Screener Form and Examination Form were taken from the Research Disease Criteria for Temporomandibular Disorders (RDC/TMD). The latter form also identifies the patient's quality of life and depression scores.

Statistical analysis

Statistical analysis was performed using the SPSS for Windows version 15.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were expressed in median (min-max) values for VASvariables and in number and percentage for categorical variables. The Kruskal-Wallis test was used for abnormally distributed data. The distributional assumption in groups was assessed by the Shapiro-Wilk normality tests. As dependent group comparison variables did not fulfill the parametric test condition, comparisons for the groups more than two were conducted using the Freidman test. Subgroup analyses in the dependent groups were performed using the Wilcoxon test. The Bonferroni correction was used. The percentage of categorical variables among the independent groups were evaluated using the chi-square test. The Monte Carlo simulation was applied for the chi-square test. The sample size was calculated using the G* Power Version 3.1.6 program (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). A p value of <0.05 was considered statistically significant.

RESULTS

There was no significant difference in the median age, education level, career life, general health condition, oral health, depression, and somatization among the groups. In addition, there was no statistically significant difference in the pain type, intensity, grade, the number of restricted days, and restriction scores among the study groups. The pain type was identified by the patients as recurrent at a rate of 40 to 60% and experienced from time to time.

Before the initiation of the treatment, there was a significant difference in the median VAS scores. The baseline VAS scores of the exercise groups were significantly lower than Group 2 and Group 3. However, there was no significant difference in the post-treatment VAS scores (at the final visit). All groups significantly responded to the treatments (all groups p<0.001). However, there was no statistically significant difference in the median VAS score variation of the groups (p=0.557) (Table 1).

Table 1. Visual analog scale scores of the groups

	Group 1 (n=21)		Group 2 (n=20)		Group 3 (n=22)		
	Median	Min-Max	Median	Min-Max	Median	Min-Max	p*
Starting point of the study	8	1-10	9	6-10	8	2-10	0.063
Median	6	1-10	7	3-10	6	2-10	0.205
After the treatment	1	0-4	2.5	0-3	0	0-6	0.087
p	<0.001		<0.001		<0.001		
Difference	4	1-9	6	0-7	5	0-10	0.557

Min: Minimum; Max: Maximum; * Kruskal Wallis Test (<0.05).

Table 2. Comparison of functional limitations of the groups

	Group 1 (n=21)		Group 2 (n=20)		Group 3 (n=22)		
	n	%	n	%	n	%	*p**
Not being able to eat							
Before treatment	18	85.7	15	75.0	18	81.8	0.670
After treatment	1	4.8	4	20.0	2	9.1	0.276
Sound from jaw							
Before treatment	17	81.0	14	70.0	18	81.8	0.653
After treatment	14	66.7	8	40.0	8	36.4	0.098
Facial pain in the morning							
Before treatment	12	57.1	12	60.0	14	63.6	0.909
After treatment	3	14.3	5	25.0	2	9.1	0.348
Tinnitus							
Before treatment	16	76.2	13	65.0	18	81.8	0.448
After treatment	0	0.0	1	5.0	5	22.7	0.033
Hardship in chewing							
Before treatment	17	81.0	19	95.0	17	77.3	0.314
After treatment	1	4.8	6	30.0	2	9.1	0.083
Hardship in drinking							
Before treatment	1	4.8	4	20.0	3	13.6	0.376
After treatment	0	0.0	1	5.0	0	0.0	0.318
Limitation in exercise							
Before treatment	10	47.6	12	60.0	11	50.0	0.702
After treatment	0	0.0	6	30.0	2	9.1	0.009
Not being able to eat hard food							
Before treatment	19	90.5	17	85.0	17	77.3	0.534
After treatment	4	19.0	10	50.0	3	13.6	0.018x
Limitation in laughing							
Before treatment	7	33.3	12	60.0	10	45.5	0.230
After treatment	0	0.0	1	5.0	2	9.1	0.647
Hardship in swallowing							
Before treatment	4	19.0	9	45.0	8	36.4	0.197
After treatment	0	0.0	1	5.0	1	4.5	0.770
Limitation in yawning							
Before treatment	18	85.7	19	95.0	18	81.8	0.501
After treatment	6	28.6	11	55.0	6	27.3	0.115
Limitation in tooth brushing							
Before treatment	7	33.3	6	30.0	9	40.9	0.747
After treatment	1	5.0	1	5.0	1	4.5	1.000

* Chi-square test (<0.05).

We found that tinnitus continued in Group 3, showing a significant difference. A significant limitation in exercise and not being able to eat hard food continued in Group 2. Limitation in eating due to the pain recovered in all groups at the end of the treatment without any significant difference among the groups (Table 2).

Limited yawning was seen in all groups even after the treatment. Among all functional limitations, yawning complaints were unable to be overcome. However, there was no significant difference among the groups (Table 2).

In the evaluation of facial pain, the most significant decrease in the pain level was observed in Group 3 at

Table 3. Comparison of facial pain levels

	Group 1 (n=21)		Group 2 (n=20)		Group 3 (n=22)		
	n	%	n	%	n	%	*p*
Facial pain							0.115
Right	5	23.8	4	20.0	10	45.5	
Left	10	47.6	5	25.0	5	22.7	
Both side	6	28.6	11	55.0	7	31.8	
Day 10							0.235
None	1	4.8	5	25.0	8	36.4	
Right	5	23.8	5	25.0	6	27.3	
Left	7	33.3	5	25.0	4	18.2	
Both side	8	38.1	5	25.0	4	18.2	
Month 1							0.021
None	12	57.1	7	35.0	15	68.2	
Right	0	0.0	4	20.0	3	13.6	
Left	7	33.3	3	15.0	1	4.5	
Both side	2	9.5	6	30.0	3	13.6	
Pain on right							0.332
None	10	47.6	5	25.0	5	22.7	
Jaw	1	4.8	0	0.0	0	0.0	
Muscle	4	19.0	4	20.0	5	22.7	
Both	6	28.6	11	55.0	12	54.5	
Day 10							0.614
None	13	61.9	10	50.0	11	50.0	
Jaw	0	0.0	1	5.0	0	0.0	
Muscle	2	9.5	5	25.0	6	27.3	
Both	6	28.6	4	20.0	5	22.7	
Month 1							0.274
None	17	81.0	10	50.0	16	72.7	
Jaw	1	4.8	1	5.0	0	0.0	
Muscle	1	4.8	5	25.0	2	9.1	
Both	2	9.5	4	20.0	4	18.2	
Pain on left							0.212
None	5	23.8	2	10.0	9	40.9	
Jaw	1	4.8	0	0.0	0	0.0	
Muscle	4	19.0	7	35.0	5	22.7	
Both	11	52.4	11	55.0	8	36.4	
Day 10							0.193
None	8	38.1	8	40.0	14	63.6	
Jaw	1	4.8	1	5.0	0	0.0	
Muscle	4	19.0	8	40.0	5	22.7	
Both	8	38.1	3	15.0	3	13.6	
Month 1							0.252
None	12	57.1	9	45.0	18	81.8	
Jaw	1	4.8	1	5.0	0	0.0	
Muscle	5	23.8	7	35.0	3	13.6	
Both	3	14.3	3	15.0	1	4.5	

* Chi square test (<0.05).

Table 4. Comparison of treatment efficacy of the groups in algometric measurement evaluation

	Group 1		Group 2		Group 3		
	Median	Min-Max	Median	Min-Max	Median	Min-Max	*p**
Right temporal algometry	3.5	1.5-4	3	1.25-4.5	2.75	1.75-4	0.637
Day 10	3.5	1-4	3.75	1.5-4.5	2.5	1-4	0.375
Month 1	3.5	1.75-4	3.75	1-4.5	3	1-4	0.460
*p***	0.006		0.005		0.125		
Left temporal algometry	3.5	1-4	2.8	1.5-4.5	3	2-4	0.619
Day 10	3.5	1.25-4	3.25	2-4.5	3.25	1.75-4.5	0.884
Month 1	3.5	1.5-4	3.25	1.25-4.5	3.25	2-4.5	0.814
*p***	<0.001		0.010		0.040		
Right masseter algometry	2	0.8-3	1.5	0.8-3	1.5	0.1-2.5	0.099
Day 10	2.25	1-3	2	1-3	2	1-3	0.185
Month 1	2.75	1.5-3.5	2	1-3	2	1-3	0.063
*p***	<0.001		<0.001		<0.001		
Left masseter algometry	1.75	1-3.5	1.5	0.75-2.5	1.5	1-3	0.206
Day 10	2	1-4	1.8	1-3	1.75	1-3	0.992
Month 1	2.5	1.5-4	2.1	1-3	2.5	1-3	0.516
*p***	<0.001		<0.001		<0.001		
Right lateral pterygoid algometry	2	0-3.5	2	1-3	2	0.25-3	0.804
Day 10	2	1-3.5	2	1.25-3	2	1-3	0.937
Month 1	2.5	1-3.5	2	1.25-3	2.25	1-3	0.287
*p***	<0.001		0.015		<0.001		
Left lateral pterygoid algometry	2	1-3	2	1-3	2	1.25-3	0.684
Day 10	2	1.25-4	2.3	1-3	2.5	1.5-3	0.207
Month 1	2.5	1.5-4	2	1-3	2.5	1.75-3	0.300
*p***	<0.001		0.070		0.002		

Min: Minimum; Max: Maximum; * Kruskal Wallis test; ** Friedman test (<0.05).

one month. Even if the efficacy of treatment on pain in Group 2 was more significant than Group 1 on Day 10, the results were found to be better in the long-term in Group 1 (Table 3).

The increase in the maximum mouth opening was not statistically significantly different among the groups. There was no significant difference in the muscle pain in maximum mouth opening on Day 10 among the groups; however, the results were significantly higher at one month in Group 1.

When the evaluation was considered; for the right temporal pain, Groups 1 and 2 were significantly benefitted from the treatment. For the left temporal pain, right masseter pain, left masseter pain, right lateral pterygoid pain, all treatment methods were significantly effective at the end of the treatment. In Groups 1 and 3, treatments applied were significantly effective for the left lateral pterygoid pain (Table 4).

DISCUSSION

In our study, we compared the efficacy of dry needling, trigger point injection, and protection through exercise therapy in temporomandibular MPS patients. Due to the limited number of studies on this subject in the literature, we aimed to find the most effective treatment method both by applying exercise and protection treatments alone and by combining these treatments with injection methods.

As TMJ diseases are frequently self-limiting by their nature, conservative treatment methods should be initially attempted. These methods include training of the patient, protective measurements, exercises, physiotherapy, and cognitive-behavioral approaches. It has been shown that success of this treatment is over 80%. About 50% of symptoms resolve within two to four weeks.[16] In our study, we also employed conservative treatment methods by suggesting

protection and exercise trainings to the patients and injection applications.

In our study, we first considered that invasive treatment methods could be more effective than exercise; however, we observed that protection and exercise therapy were also effective as invasive methods. Different from other studies showing that dry needling and local anesthetic injections have equal effects on MPS of the trapezius muscle, Guzel et al.[17] indicated in their study that the efficacy of the treatment started earlier with local anesthetic injection, and psychological component was also affected positively. The authors concluded that in MPS treatment, it was much more appropriate to prefer lidocaine injection rather than dry needling. On the other hand, in our study, both invasive methods were proved to be effective from the psychological point of view, and we observed that the patients attended to their controls, although in only exercise therapy group, the patients had some difficulty in attendance to their visits. This finding suggests that the Turkish patients do not conceive exercise as a treatment method with a low patient compliance rate.

In his study, Kraus and Fischer[14] showed that dry needling method caused pain after the injection. However, in our study, we observed that, in some of the local anesthetic injection patients, the VAS scores increased after the first injection. This was thought to be the side effect of local anesthetic injection; however we did not observe any side effects in the dry needling group. In another study, Kamanli et al.[18] applied dry needling, trigger point injection and botulinum toxin injection treatments to the cervical, dorsal, and shoulder muscles of 23 female patients, dividing them in three groups. They applied the injections to one side of the body to compare the results among the groups. Although all the treatment methods were successful, the authors found that the trigger point injection was more effective. Trigger point injection was suggested as the efficient treatment method, as it was more effective on disability, and it was cheaper than botulinum toxin. Fernández-Carnero et al.[19] found that the application of dry needling compared to the sham dry needling in patients with temporomandibular MPS into the masseter muscle significantly increased the pressure pain threshold levels and maximal jaw opening with deep dry needling. Blasco-Bonora et al.[20] investigated the effects of deep dry needling of myofascial trigger points of the masseter and temporalis on pain, pressure pain threshold, pain-free maximal jaw opening and temporomandibular disorder-related disability in patients with sleep bruxism and MPS. Each patient received a deep dry needling intervention in the masseter and temporalis trigger point. Short-term effects one week later showed a significant improvement in the jaw functioning.

In a systematic review on the myofascial trigger point needling treatment, Cummings and White[6] concluded that the differences between the substances injected did not pose a significant difference, and wet needling did not have a superiority over dry needling therapeutically. In our study, both methods were found to be effective at the end of the treatment and at one month of follow-up, consistent with the aforementioned findings.

In their study, Michelotti et al.[21] assigned protection training to one group, and protection + home-based exercise program to the other group. They measured headache, jaw pain during resting and activity position, mouth opening, and pain in the muscles doing palpation using the VAS. They concluded that the exercise was significantly effective. In the study of Carlson et al.,[22] after six-month monitoring, it was found that the exercise program including respiration, posture, and proprioceptive exercises was superior over conservative treatment (i.e., disc and protection training). All these studies, consistent with our study, suggest that exercise is an important and effective treatment method and that it should be combined with all other treatment methods. In the study of Bae and Park,[23] as with active exercises, relaxation exercises for the masticatory muscles were found to be effective for the range of motion and pain in TMD. In particular, masticatory muscle relaxation exercises were effective treatment methods for deviation, as in our study.

In the present study, the response to the treatment in all groups were statistically significant using the VAS. However, there was no statistically significant difference in the median VAS scores among the groups. A total of 20 to 30-mm decline in the VAS indicates the success of the treatment.[24] On the other hand, in our study, a decline between 4.4 to 5.1 mm was observed in all groups, indicating that combination of treatment methods should be adopted in myofascial pain treatment, rather than using monotherapy.

Limitation of our study, it was very difficult to keep the exercise group in the study, because of patients did not consider exercise as a treatment. Extra effort was shown to follow up during follow-up.

In conclusion, our study results showed that improvement in the subjective symptoms (limitation in

mandible's functioning, depression and somatization levels, functional pain levels) and objective symptoms (assisted and unassisted maximum mouth opening, TMJ sounds, muscle and joint pain during palpation) in all treatment groups. Particularly, only exercise therapy was found to be beneficial as invasive methods. We suggest that all these methods should be applied together to achieve long-term efficacy. Nevertheless, further large-scale and long-terms studies are needed to establish the most effective treatment method.

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REFERENCES

1. Hertling D, Dussault L. The temporomandibular joint. In: Biblis M, Di Palma D, Amico A, Scheinin SC, editors. Therapeutic Exercise. Philedelphia: Lippincott Williams & Wilkins Co; 1999. p. 499-524.
2. Aydın R, Şen N, Ellialtıoğlu A. Eklem dışı romatizmal hastalıklar. In: Diniz F, Ketenci A, editörler. Fiziksel Tıp ve Rehabilitasyon. İstanbul: Nobel Tıp Kitabevi; 2000. s. 299-320.
3. Tüzün F. Yumuşak doku romatizmaları. In: Tüzün F, Eryavuz M, Akarırırmak M, editörler. Hareket Sistemi Hastalıkları. İstanbul: Nobel Tıp Kitabevleri; 1997. s. 159-73.
4. Jaeger B, Simons DG, Simons L. Head and neck pain: In: Travell JG, Simons DG,Simons LS, editors. Myofascial Pain and Dysfunction: The Trigger Point Manual. Vol 1. Upper Half of Body Baltimore: Lippincott Williams & Wilkins; 1999. p. 238-74.
5. Borg-Stein J, Simons DG. Focused review: myofascial pain. Arch Phys Med Rehabil 2002;83:40-7.
6. Cummings TM, White AR. Needling therapies in the management of myofascial trigger point pain: a systematic review. Arch Phys Med Rehabil 2001;82:986-92.
7. Han SC, Harrison P. Myofascial pain syndrome and trigger-point management. Reg Anesth 1997;22:89-101.
8. Okeson JP. Temporomandibular disorders. In: Baragona PM, Bertrand PM, Black DF, editors. Orofacial Pain: Guidelines for Assessment, Diagnosis, and Management. Illinois: Quintessence; 1996. p. 129-84.
9. Dworkin SF, Huggins KH, LeResche L, Von Korff M, Howard J, Truelove E, et al. Epidemiology of signs and symptoms in temporomandibular disorders: clinical signs in cases and controls. J Am Dent Assoc 1990;120:273-81.
10. Scrivani SJ, Keith DA, Kaban LB. Temporomandibular disorders. N Engl J Med 2008;359:2693-705.
11. Wadhwa S, Kapila S. TMJ disorders: future innovations in diagnostics and therapeutics. J Dent Educ 2008;72:930-47.
12. Ingawalé S, Goswami T. Temporomandibular joint: disorders, treatments, and biomechanics. Ann Biomed Eng 2009;37:976-96.
13. LeResche L, Mancl L, Sherman JJ, Gandara B, Dworkin SF. Changes in temporomandibular pain and other symptoms across the menstrual cycle. Pain 2003;106:253-61.
14. Kraus H, Fischer AA. Diagnosis and treatment of myofascial pain. Mt Sinai J Med 1991;58:235-9.
15. Ozkan F, Cakır Özkan N, Erkorkmaz U. Trigger point injection therapy in the management of myofascial temporomandibular pain. Agri 2011;23:119-25.
16. Clark GT, Choi JK, Browne PA. The efficacy of physical medicine treatment, including occlusal appliances, for a population with temporomandibular disorders In: Sessle BJ, Bryant PS, Dionnee RA, editors. Temporomandibular disorders and related pain conditions. Seattle: IASP Press Co; 1995. p. 375-99.
17. Guzel R, Seydaoglu G, Kozanoglu E, Sarpel T. Efficacy of local anesthetic ınjection versus dry needling in myofascial pain syndrome treatment. Turk J Phys Med Rehab 2006;52:22-7.
18. Kamanli A, Kaya A, Ardicoglu O, Ozgocmen S, Zengin FO, Bayik Y. Comparison of lidocaine injection, botulinum toxin injection, and dry needling to trigger points in myofascial pain syndrome. Rheumatol Int 2005;25:604-11.
19. Fernández-Carnero J, La Touche R, Ortega-Santiago R, Galan-del-Rio F, Pesquera J, Ge HY, et al. Short-term effects of dry needling of active myofascial trigger points in the masseter muscle in patients with temporomandibular disorders. J Orofac Pain 2010;24:106-12.
20. Blasco-Bonora PM, Martín-Pintado-Zugasti A. Effects of myofascial trigger point dry needling in patients with sleep bruxism and temporomandibular disorders: a prospective case series. Acupunct Med 2017;35:69-74.
21. Michelotti A, Steenks MH, Farella M, Parisini F, Cimino R, Martina R. The additional value of a home physical therapy regimen versus patient education only for the treatment of myofascial pain of the jaw muscles: short-term results of a randomized clinical trial. J Orofac Pain 2004;18:114-25.
22. Carlson CR, Bertrand PM, Ehrlich AD, Maxwell AW, Burton RG. Physical self-regulation training for the management of temporomandibular disorders. J Orofac Pain 2001;15:47-55.
23. Bae Y, Park Y. The Effect of Relaxation Exercises for the Masticator Muscles on Temporomandibular Joint Dysfunction (TMD). J Phys Ther Sci 2013;25:583-6.
24. De Laat A, Stappaerts K, Papy S. Counseling and physical therapy as treatment for myofascial pain of the masticatory system. J Orofac Pain 2003;17:42-9.