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ORIGINAL RESEARCH

Medicine Science International Medical Journal

Medicine Science 2018;7(3):617-21

The effects of proprioceptive neuromuscular facilitation, myofascial releasing maneuvers and home exercises on pain and jaw function in patients with bruxism

Elisa Calisgan[1], Burcu Talu[2], Oguzhan Altun[3], Numan Dedeoglu[3], Burak Duman[3]

[1]Kahramanmaras Sutcu Imam University, Health School, Department of Physical Therapy and Rehabilitation, Kahramanmaras, Turkey
[2]Inonu University, Faculty of Health Science, Departmentof Physical Therapy and Rehabilitation, Malatya, Turkey
[3]Inonu University, Faculty of Dentistry, Department of Oral and Maxillofacial Radiology, Malatya, Turkey

Received 20 April 2018; Accepted 27 April 2018
Available online 24.07.2018 with doi: 10.5455/medscience.2018.07.8852

Abstract

To evaluate the effects of proprioceptive neuromuscular facilitation exercises, myofascial releasing techniques and home exercises on temporamandibular joint pain and jaw function in patients with bruxism. This randomized, controlled experimental trial included 52 patients (42 females, 10 males) aged 16 to 50 years (a mean age of 28.9 ± 11.05 years) with bruxism. The patients were separated into 3 groups, as Group 1 (n: 20) treated with proprioceptive neuromuscular facilitation exercises + myofascial release techniques + home exercise, Group 2 (n: 15) treated with myofascial release + home exercise and Group 3 (n: 17), as the control group, treated with the classical methods of occlusal splint, antidepressant drugs and botox. The Visual Analog Scale, Jaw Restriction Scale and Oral Habits Checklist were used to evaluate pain, restriction of jaw movements and bad habits, respectively. All groups were evaluated at the end of 2 weeks and 6 weeks. When the pre-treatment and post-treatment parameters were compared between the groups, a decrease was determined in the parameters of pain, limitation of jaw function, and restriction of oral behavioursin Group1 and Group2 ($p = 0.001$, $p = 0.05$, respectively). This decrease was statistically greater in Group 1. No statistically significant difference was determined in Group 3 in respect of resting, active and night pain, limitation of jaw function and restriction of oral behaviour ($p>0.05$). Proprioceptive Neuromuscular Facilitation Exercises + myofascial releasing techniques + home exercise were found to be effective in reducing pain, improving restriction of jaw movement and oral behaviors in patients with bruxism. As the first such study, the results of this study can be considered to provide important contributions to the understanding and treatment of patients with bruxism.

Keywords: Bruxism, pain, exercises, myofascial, releasing

Introduction

Bruxism is defined as nocturnal and diurnal parafunctional activity with unconscious grinding and clenching of the teeth. Bruxism constitutes one of the most significant parafunctional activities of the stomatognathic system [1,2].

Symptoms of bruxism are abnormal tooth wear, teeth grinding or clenching, sounds because of clenching and gliding, swallowing difficulties, frequent coughing, the feeling of obstruction in the throat, gingival inflamation, headache, ocular pain, limited mouth opening, a decrease in salivary flow, tinnitus, the sensation of blocked ear, temporomandibular pain (TMP), clicking sounds, hypertrophy and destruction of the masseter and temporal muscles. One of the general symptoms is jaw clicking when opening the mouth, with oral muscle deviation to one side, pain in the cheek muscles, and uncontrollable movement of the jaw. In addition, neck problems can also develop with pain in the shoulders and back, a lack of mobility, stiffness, and pain in the neck. Facial changes are seen patients with bruxism, as skin and facial muscles atrophy due to non-use, developing avermilion colour and drooping of the corners of the mouth [3-7].

Although bruxism is a very common disease and almost everyone experiences some period of clenching or grinding the teeth, there is very little knowledge available. Experts still do not know what causes the illness, how to diagnose it physically or treat it effectively [8-10].

The treatment of bruxism usually includes botulinum toxin, the use of an occlusal splint, perioral rejuvenation and antidepressant drugs but these methods do not have long-lasting effects. Although botox depresses the release of Ach hormone, the effect is transient and has to be repeated after 6 weeks. The use of an occlusal appliance is useful for the prevention of further tooth wear during sleep, but does not effectively eliminate the unconscious clenching/grinding activity nor the accompanying pain or discomfort [11-13].

Proprioceptive Neuromuscular Facilitation (PNF) therapy is administered bilaterally and symmetrically in patients with bruxism. All the muscle groups are stimulated with pivot points of the mouth, nose and eye. The objective is to release movement on the affected

Coresponding Author: Elisa Calisgan, Kahramanmaras Sutcu Imam University, Health School, Department of Physical Therapy and Rehabilitation, Kahramanmaras, Turkey **E-mail:** elisa.calisgan@inonu.edu.tr

side by providing resistance with strong movements. Therefore, the muscle strength is spread [3]. While facial movement in the direction of elevation is related to neck extension, inferior facial movement is related to neck flexion. Neck rotation can stimulate the facial muscles on the side it is turned proprioceptively. In order to stimulate facial muscles in PNF, hand contact and order should be harmonised. Bruxism affects specifically the buccinator muscle and movement of the tongue. In PNF, coordinated moves are applied to stimulate the buccinator, masseter muscle and tongue movements in particular. Resistance is given outwards with the use of a tongue depressor. The patient is asked to make a laughing or sucking move. It is also a type of exercise for mimicking [3,14].

Myofascial releasing techniques included massage therapy including sliding and kneading maneuvers on the masseter and temporal muscles in addition to the neck and upper trapezius muscles. Sliding and kneading are made with hand and finger maneuvers, which provide release of co-contraction muscles [15,16,29].

Home exercises are commonly prescribed to improve functional mobility for persons with bruxism and facial asymmetry. Many studies have been conducted on the effect of home exercises on functional mobility of jaw and tongue movements. Home exercises are made in front of a mirror (blowing up a balloon, sending kiss, raising eyebrows, closing eyes tightly) and they provide neural and muscle stimulation especially on the affected side [7,17,18].

Since rehabilitation provides facial muscle control and functionality, it has an important place in bruxism with time and cost advantages. The purpose of this study was to objectively evaluate the effects of proprioceptive neuromuscular facilitation exercises, myofascial releasing maneuvers and home exercises on temporomandibular joint pain and jaw function in patients with bruxism.

Material and Methods

This randomized, controlled, clinical trial was performed in compliance with the principles of the Declaration of Helsinki. Approval for the study was granted by the Malatya Clinical Research Ethics Committee (Approval number: 2017/98, dated: 06/09/2017). Informed consent was obtained from all the study participants.

The target population of the study consisted of patients who had been diagnosed with bruxism between July 2017 and February 2018 at the Department of Maxillofacial Radiology, Faculty of Dentistry, Inonu University. Individuals that met the inclusion criteria were selected from the target population using probable simple random sampling.

As part of the simple random sampling method, individuals were listed by number and thoseto be sampled were selected using a random number table.

The study included 52 patients diagnosed with bruxism (10 males, 42 females) aged 16-50 years with the aim of determining the effect of physical therapy on the TMJ function, pain control and mobilization of the jaw. Patients who agreed to participate in the study and met the inclusion criteria were selected by a randomizedsampling methodin the relevant phase. The inclusion criteriawere a diagnosis of bruxism, age 16-50 years, TMJ (temporo-mandibular joint) pain, and of a sufficient mental capability to be able to adapt to the training program.

Patients were excluded from the study if they were outside the age range of 16-50 years, had any existing health problem, did not allowmental evaluations, did not adapt to the training program, or were not willing to participate in the study. After the application of these criteria, a total of 20 patients were excluded.

The demographic information and clinical characteristics of the patients were recorded including age, gender, height, weight, and the presence or not of crepitation.

The severity of pain was evaluated using a Visual Analog Scale (VAS) ranging from 0 (no pain) to 10 (intolerable pain).The VAS scale is important and recommended for evaluation because of highly reliability [16].

The Jaw Functional Limitation Scale is a scale assessing the restriction of jaw movement. It consists of 8itemsrelated to normal daily functions of the mouth, such as chewing, yawning, swallowing and smiling, with each item scored on ascale of 0 (no restriction) to 10 (high restriction), thus total scores range from 0 -80 [4,17].

The Oral Behaviour Checklist consists of 21 questions about bad oral habits. All the issues questioned are those that lead to degeneration of the TMJ, hypertrophy of the masseter, pterygoid medialis and lateralis muscles, headache, loss of muscle strength in the buccinator and platysma muscles, pain in the upper trapezius and extensor muscles of the cervical vertebrae such as the longis colli, splenius and scalenius. This scale is answered as a 5-point Likert scale with the reponses of never, occasionally, sometimes, often, and always. The total points of the scale range from 0 to 84 [4,17].

Following the collection of data and individual pretesting, Proprioceptive Neuromuscular Facilitation exercises and post-myofascial relaxation exercises were administered for 2 weeks, followed by 3 sets of 10 repeat home exercisesand 6 weeks under physiotherapist control.

For Group 1 (n:20), the PNF, myofascial releasing and home exercises were used to decrease pain, jaw restriction and increase improve functional mobility on the masseter, lateral and medial pterygoid, buccinator, temporalis, orbicularis oris, orbicularis occuli, upper side of trapezius muscle, splenius, scaleneus, and cervical extensor muscle in 20 patients with bruxism, for 2 and 6 weeks after pre-evaluation.

In Group 2 (n: 15), final evaluation was made with 10 sets of myofascial releasing and home exercises for 2 and 6 weeks.

In Group 3 (n: 17), as the control group, no myofascial releasing or Proprioceptive Neuromuscular Facilitation exercises were applied.

Evaluation was made of all the patients before treatment, then at the end of 2 weeks and 6 weeks using VAS, the Jaw Functional Limitation Scale and the Oral Behaviours checklist.

Data Analyses

Data obtained in the study were analysed using IBM-SPSS Statistics 22.0 software. The level of pain was assessed pre and

post treatment using the Post-hoc test and between the groups with the Kruskal Wallis test. Results of the measured values were stated as mean ± standard deviation. In the power analysis performed, assuming that the differencebetween pre-treatment (7.00 + 1.32) and post-treatment (7.73 + 1.09) pain was 1 unit with α = 0.05 and 1-β (power) = 0.80, at least 50 patients were required for the sample. The Mann-Whitney U test was used for the comparison of the significance of data that did not meet parametric conditions. A value of p<0.05 was accepted as statistically significant.

Results

Evaluation was made of 52 patients with bruxism, comprising10 males and 42 females with a mean age of 28 years (range, 18-50 years) and mean body mass index (BMI) of 23 kg/m2 (range, 16-37). All patients with bruxism had temporomandibular crepitation.

In the intra-group analysis of statistically significant better results were observed at all time intervals in respect of pain, jaw movements hand oral habits in Group 1, where PNF, myofascial relaxation and home exercises were applied to the patients (Table 1). Statistically significant differences were determined in respect of resting, active and night pain in Group 1 and Group 2 at 0-2, 2-6 and 0-6 weeks (p<0.001, p= 0.001, respectively). No statistically significant difference was determined in Group 3 in terms of resting, active and night pain (p>0.05) (Table 1, Table 2 and Table 3).

According to the measurements (Table 4) taken at 0, 2, and 6 weeks, a statistically significant difference was determined in the restriction of jaw motions score (RJM) of Group 1 and Group 2, at 0-2, 2-6 and 0-6 weeks respectively (p<0.001). No statistically significant difference was observed in the restriction of jaw movement score of Group 3 (p= 0.084).

According to the OBC measurements taken at 0, 2, and 6 weeks, a statistically significant difference was observed during 2-6 weeks in Groups 1 and 2 (p<0.001, p=0.009, respectively). No statistically significant difference was determined in the OBC scale in Group 3 (p=0.135). The Group 1 were better than those of the other groups with significance of all the parameters of OBC at p<0.001 (Table 5).

Table 1. Resting Pain Scale

	First Week	2. Weeks	6. Weeks	P
	Mean ± Standard Deviation			
Group 1	4.55± 2.04	1.90 ± 1.45	0.15 ± 0.49	**<0.001**[a]
Group 2	5.20± 2.11	3.73± 1.71	1.80± 1.15	**0.001**[b]
Group 3	5.11± 2.13	5.11 ± 2.13	5.05± 2.01	0.332
P	0.123[c]	**<0.001**[c]	**<0.001**[c]	
	First Week	**2. Weeks**	**6. Weeks**	
Groups 1-2	0,314	**0.003**[g]	**<0.001**[g]	
Groups 1-3	0,752	**<0.001**[g]	**<0.001**[g]	
Groups 2-3	0,411	0.066[g]	**<0.001**[g]	

a: Friedmannb: Repeated Meausure c: Kruskall Wallis H test g:Mann-Whitney U Test

Table 2. Night Pain Scale

	First Week	2. Weeks	6. Weeks	P
	Mean ± Standard Deviation			
Group 1	7.35±2.11	2.85 ± 1.46	0.15 ± 0.49	**<0.001**[a]
Group 2	7.73 ± 2.12	6.47 ± 2.00	4.13 ± 1.81	**<0.001**[a]
Group 3	7.11±1.97	7.11±1.97	7.05±1.90	0.389[b]
P	0.175[c]	**<0.001**[d]	**<0.001**[c]	
	First Week	**2. Weeks**	**6. Weeks**	
Groups 1-2	0.086	**<0.001**[h]	**<0.001**[h]	
Groups 1-3	0.798	**<0.001**[h]	**<0.001**[g]	
Groups 2-3	0.082	0.758[h]	0.036[g]	

a: Friedmann b:Repeated Measure c: Kruskall Wallis H test d:ANOVA h: Independent sample t test g:Mann-Whitney U Test

Table 3. Active Pain Scale

	First Week	2. Weeks	6. Weeks	P
	Mean ± Standard Deviation			
Group 1	7.35 ± 2.11	2.85 ± 1.46	0.15 ± 0,49	**<0.001**[a]
Group 2	7.73 ± 2.12	6.47 ± 2.00	4.13 ± 1.81	**<0.001**[a]
Group 3	6.76 ± 1.78	6.76 ± 1.78	6.70 ± 1.68	0.332
P	0.542c	**<0.001**[c]	**<0.001**[c]	
	First Week	**2. Weeks**	**6. Weeks**	
Groups 1-2	0,479	**<0.001**[g]	**<0.001**[g]	
Groups 1-3	0,497	**<0.001**[g]	**<0.001**[g]	
Groups 2-3	0,097	0.422[g]	**<0.001**[g]	

a: Friedmann c: Kruskall Wallis H test g:Mann-Whitney U Test

Table 4. Restriction of Jaw Movements Measurements

	First Week	2. Weeks	6. Weeks	P
	Mean ± Standard Deviation			
Group 1	44.05 ±12.03	15.9 ± 6.53	2.20 ± 3.44	**<0.001**[a]
Group 2	47.40 ±12.82	38.47 ± 11.92	24.40 ± 9.97	**<0.001**[b]
Group 3	39.47 ± 8.43	39.58 ± 8.55	39.47 ± 8.45	0.084
P	0.123[d]	**<0.001**[d]	**<0.001**[c]	
	First Week	**2. Weeks**	**6. Weeks**	
Groups 1-2	0.655[h]	**<0.001**[h]	**<0.001**[g]	
Groups 1-3	0.412[h]	**<0.001**[h]	**<0.001**[g]	
Groups 2-3	0.108[h]	0.932[h]	**<0.001**[g]	

a: Friedmann b:Repeated Measure d:ANOVA h: Independent sample t test g: Mann-Whitney U test

Table 5. Oral Behaviour Checklist

	First Week	2. Weeks	6. Weeks	P
	Mean ± Standard Deviation			
Group 1	61.65 ± 6.26	23.55 ± 5.09	3.8 ± 5.06	**<0.001**[a]
Group 2	54.13±6.06	40.00±5.13	23.07±3.43	**0.009**[b]
Group 3	51.74 ± 10.77	51.74 ±10.77	51.63 ± 10.48	0.135[a]
P	**<0.001**[c]	**<0.001**[c]	**<0.001**[c]	
Chi square statistic	19.167	43.589	47.029	
	First Week	**2. Weeks**	**6. Weeks**	
Groups 1-2	**0.002**[g]	**<0.001**[g]	**<0.001**[g]	
Groups 1-3	**<0.001**[g]	**<0.001**[g]	**<0.001**[g]	
Groups 2-3	0.060[g]	**<0.001**[g]	**<0.001**[g]	

a: Friedmann b:Repeated Measure c: Kruskall Wallis H testi g: Mann-Whitney U Test

Discussion

This study investigated the effect on pain, jaw restriction and oral habits of PNF, myofascial releasing and home exercises in patients with bruxism. The results demonstrated that PNF, myofascial releasing and home exercises were more effective than classical treatment techniques. To the best of our knowledge, this is the first study to compare the effect on pain, jaw restriction and oral habits of the application of PNF, myofascial releasing and oral habits used in the rehabilitation of bruxism.

According to previous studies, bruxism is more frequently seen in females and in the 16-40 years age range [20,31-33]. In the current study, bruxism was seen more frequently in females in the age range of 18-50 years and with a high score on the oral behaviour checklist. The conclusion of this study is similar to those of previous studies.

After evaluation, the Group 3 patients with bruxism were treated with botulinium toxin, laser, radiofrequency, ultrasound, perioral rejuvenation, occlusal splint, dental restoration, plastic surgery, and self care. The botox, laser and fillers were observed to not be sufficient because of muscle volume loss, noimprovement in pain, and continued jaw restriction at the end of 2 and 6 weeks and the effect of botox only lasted six months.

The treatment methods applied in this study included relaxation techniques, facial muscle strengthening, facial mobility activities and home exercises including TMJ mobilization. There was no focus on the warm-up and cool down parts. Experts have stated that exercises should always have a warm-up and cool-down period but these can be minimized in bruxism. Exercise has been shown to create changes in the adrenocortical system, increase epinefrine transmission between neurons and thereby increase the amount of serotonin. Exercise is also regarded as a new biological pathway to decrease the adverse effects of bruxism [20-22].

Some researchers have advocated a multidiciplinary approach for bruxism which should include pharmacological and psychological methods and regular exercise. Moreover, exercise is known to be a non-pharmological cure that affects brain logic and safeguards against neurodegeneretive illness [4,5,9,23,24]. In the current study, it was observed that myofascial relaxation and home exercise improved pain, jaw restriction and facial flexibility.

In addition, many patients with bruxism suffer from back pain [6,18,22,25] so it was aimed in the current study to evaluate the benefits of physical therapy on patients with bruxism with back and shoulder pain. The results of the study showed that PNF, myofascial relaxation and home exercise statistically significantly improved the symptoms of bruxism patients with shoulder and low back pain.

The strength of weight-bearing bilateral face muscles, which consist of the temporalis, masseter, buccinator and lateral and medial pterygoid muscles, is improved with myofascial relaxation and PNF [5,26,27,30]. Therefore, this study focused on the importance of self-care, PNF, myofascial relaxation and home exercise in the treatment of pain, restriction of the jaw and oral bad habits. According to the results of this study, regular home exercise, myofascial relaxation, pulmonary and PNF exercises had many benefits on the physiological pain in the experimental group with bruxism compared to the control group.

Gomes et al. [13] compared the effects of massage therapy with occlusal splint use in patients with bruxism. The massage group of 17 patients were treated with massage therapy only, including sliding and kneading hand and finger maneuvers on the masseter and temporal muscles. The occlusal splint group (n: 19), combined group (n: 23) (massage+occlusal splint) and control group (n: 19) were compared with massage group. Combined treatments (occlusal splint usage and massage therapy on the masticatory muscles) were observed to provide the greatest reduction in pain. This conclusion was similar to the conclusion of the current study in terms of the effects of massage on pain.

Some authors have proposed myofunctional therapy (MFT) for the treatment of facial hypertonia, difficulties in biting, chewing, swallowing and pain of TMJ, but there has been no consistent scientific evidence showing the possibility of treating such a painful condition exclusively through myofunctional treatment rehabilitation. MFT is universally accepted for the treatment which consists of regular program of exercises and muscles of the face, tongue are activated with functional mobility, but not for the treatment of myofascial pain or for the reduction of the episodes of jaw clenching and bruxism [12,18,28,29]. The combination of PNF and myofascial relaxation can be highly recommended due to the lack of improvement in symptoms in the control group after 2 and 6 weeks. No significant differences were observed in the VAS, RMJ and BHS values of the control group at 2 and 6 weeks.

Messina et al. evaluated the effects of orofacial MFT on pain of TMJ and activation of facial muscles in 24 subjects with bruxism, comprising 15 females and 9 males in the age range of 25 - 45 years. Patients were evaluated with VAS and NIPS for numeric pain, bruxism episode/hour, electromyographic assessmet of masseter, temporalis and digastricus activation before (T0) and 15 days after (T1) the completion of the MFT. This therapy is based on re-education of the facial muscles, facial exercises, and modification of oral behaviour techniques and improvement of the pain of TMJ. The study concluded that MFT may be an effective therapeutic method for the treatment of muscle facial pain and hypertonia of the chewing and swallowing muscles. The treated patients were observed to have reduced facial pain, neck pain and a lower frequency of bruxism episodes per hour [18].

Previous studies have evaluated the correlation between the amount of myofascial exercise and home exercise with the bruxism threshold. Physical exercise was recommended as 3-4 exercise sessions per week of a moderate level with at least 30 minutes of classical exercise [16,18,26,28]. According to the results of the current study, the use of PNF, myofascial relaxation and home exercise provide a decrease in TMC (Temporomandibular Crepitation), pain, restriction of jaw movement and oral bad habits. However, the myofascial relaxation and home exercise applied in Group 2 were seen to be less effective after 4 weeks than after 2 weeks. As PNF and myofascial relaxation are employed to increase local blood flow and establish normal muscle conditions, there was seen to be a decrease in pain and in hypertrophy of the masseterica, lateral and medial pterygoid muscles.

Limitation

A limitation of the current study was that anthropometric measurements and jaw range of motion of the patients with bruxism were not evaluated.

Conclusion

In conclusion, this study demonstrated that combined therapy which includes PNF, myofascial relaxation and home exercise effectively decreased the pain of TMJ, restriction of jaw movement and oral bad habits. In addition, the results of this study provide further evidence of the effects of myofascial relaxation and home exercises on decreasing bruxism symptoms such as pain, restriction of jaw movement, muscle hypertrophy and increased well-being. Myofascial relaxation and home exercises decreased pain, RMJ and some subscales of the BHS. Morever, when PNF is combined with myofascial relaxation and home exercises, a greater reduction was observed in the VAS scale, RMJ scale, BHS and there was increased strength of the facial muscles, upper trapezius and extensor muscle of the neck. However, in the control group where no physical therapy was used, but only occlusal splint, botulinium toxin and antidepressant drugs, there was no significant change in pain, RMJ and BHS. Statistically significant differences were observed in the evaluation scales of Group 1 and Group 2 between 0- 2 and 2-6 weeks.

Competing interests
The authors declare that they have no competing interest.

Financial disclosure
The financial support for this study was provided by the investigators themselves.

Ethical approval
Declaration of Helsinki. Approval for the study was granted by the Malatya Clinical Research Ethics Committee (Approval number: 2017/98, dated: 06/09/2017).

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