Ann Med Res 2020;27(6):1756-60

Annals of Medical Research

DOI: 10.5455/annalsmedres.2020.01.016

Original Article

Effect of tooth loss on masticatory muscle pain of patients with bruxism

Bengisu Yildirim[1], Cansu Gul Koca[2]

[1]Department of Prosthodontics, Faculty of Dentistry, Usak University, Usak, Turkey
[2]Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Usak University, Usak, Turkey

Copyright © 2020 by authors and Annals of Medical Research Publishing Inc.

Abstract

Aim: It was aimed to compare the patients' masticatory muscle pain according to the gender, side of the face with pain, muscle tenderness, and tooth loss.

Material and Methods: The patients were selected randomly and the data were collected from 109 patients aged 18-50 years. Patients were examined by a maxillofacial surgeon and a prosthodontist blindly. During intraoral examination grinding, clenching confirmed by sleep partners or roommates, hyperkeratosis of cheek mucosa (linea alba), indented tongue, the unilateral masseter muscle hypertrophy, tooth wear, hypersensitivity, pain and fatigue in the chewing muscles in the daytime or in the morning were recorded. To classify tooth loss the Eichner index was used. It was asked to participants to score the masticatory muscle pain. Each participant scored the masticatory muscle pain on a visual analog scale (VAS/0-10). Data were analyzed with a non-parametric Mann-Whitney U test to compare the VAS results because the data were distributed non-normally. Chi-square test was used to compare categorical variables and Spearsman correlation test was performed to test the possible correlation between the masticatory muscle pain and age.

Results: The percentage of bruxism in female (52.3%) was higher than in male (47.7%). A total of 15 patients (13.7%) had tooth loss (premolar or molar). Pain score was higher in patients with tooth loss than without tooth loss (p=0.49).

Conclusion: The tooth loss may be increased the masticatory muscle pain. It should be considered both muscle pain and tooth loss together in clinical examination and perform the preventive treatment.

Keywords: Bruxism; pain; tooth loss

INTRODUCTION

"Bruxism is a parafunctional habit defined by rhythmic or irregular nonfunctional clenching, grinding and gnashing of the teeth" (1). Bruxism may be categorized as diurnal or nocturnal bruxism. The prevalence of the bruxism is 6-95% and the age have ranged from 20 to 50 years (2-4). It has been reported that the prevalence of bruxism is higher in female patients and decreases with age in both genders (4).

Polysomnography with audio-video recordings is used diagnosis of bruxism and it is considered as a definite and reliable method. However, polysomnography may not always be used because of the high cost, requiring the special devices and environment (5,6).

One alternative method for diagnosis of bruxism include story of the patient or roommate/bed partner as well as the clinical examination. In addition to that, pain and fatigue in the chewing muscles in the daytime or morning, masseter muscle hypertrophy, notch on the cheek mucosa, tooth wear and sensitivity should be also considered while diagnosing the bruxism.

It has been reported that bruxism may cause damage in the soft and hard tissues. Bruxism affects particularly tooth structure, periodontal ligament, alveolar bone, temporomandibular joint (TMJ), and masticatory muscles (7).

The correlation between bruxism and masticatory muscle pain (MMP) is still not clear. Although some studies have been resulted in a correlation between bruxism and MMP (8,9), some have been resulted in with no correlation (10,11). It is difficult to understand which one starts before. Whether bruxism causes MMP or vice versa is currently uncertain.

Occlusal alterations influence the masticatory muscles and their functions (12). In animal studies, it was shown that the loss of molar tooth cause fatigue and pain in the masticatory muscles (13,14).

Received: 05.01.2020 **Accepted:** 28.02.2020 **Available online:** 19.06.2020
Corresponding Author: Bengisu Yildirim, Department of Prosthodontics, Faculty of Dentistry, Usak University, Usak, Turkey
E-mail: yildirim_bengisu@hotmail.com

However, best to the authors' knowledge, there was not enough study that evaluated the MMP according to the gender, side of the face with pain, muscle tenderness, and tooth loss. Therefore, in this study, it was aimed to compare the patients' MMP according to these variables, evaluate the correlation among the gender, side of the face with pain, masticatory muscle tenderness, and tooth loss. In addition to that, to investigate whether there is a correlation between the MMP and age.

The null hypothesizes were that the MMP scores are similar according to the variables and there is no correlation between MMP and age.

MATERIAL and METHODS

The study was approved by the Non-Interventional Medicine Ethics Committee of Uşak University Faculty of Medicine with decision number 161-02.

The patients were selected randomly and the data were collected from 109 patients aged 18-50 years who applied to Uşak University Faculty of Dentistry Department of Prosthodontics participated in this study. 57 females and 52 males were included and the study was conducted between 2017 and 2018. The inclusion criteria were the presence of masseter muscle hypertrophy, tooth wear, tenderness and grinding. The exclusion criteria were a history of rheumatoid arthritis, myalgia, fibromyalgia TMJ surgery, TMJ local pathology, trauma or orthognathic surgery, head and neck radiotherapy, pregnancy, lactation, psychiatric problems, using narcotic muscle relaxant, using non-steroid anti-inflammatory drugs at least 3 days before, alcohol and drug dependence, TMJ disorders (DC/TMD), previous treatment with bruxism and daytime bruxism.

Examination

Data were collected with the examination and anamnesis. Then, all the information was recorded. Patients were examined by a maxillofacial surgeon and a prosthodontist blindly. During intraoral examination grinding, clenching confirmed by sleep partners or roommates, hyperkeratosis of cheek mucosa (linea alba), indented tongue, the unilateral masseter muscle hypertrophy, tooth wear, hypersensitivity, pain and fatigue in the chewing muscles in the daytime or in the morning were recorded. Moreover, overbite and overjet were noted as part of the RDC/TMD axis I. To classify tooth loss the Eichner index was used.

Tooth supports between the maxilla and the mandible in the bilateral premolar-molar regions represented Eichner A group. The tooth supports in one to three zones or in the anterior region were classified as the Eichner B group. Without any occlusal supports were classified as the Eichner C group (15). In the present study, all patients classified as the Eichner A group. Masseter and temporal chewing muscles were examined by palpation bilaterally according to Cranio Mandibular Index (16). The masseter muscle palpation was performed approximately 2 cm superior to the mandibular border and the temporal muscle palpation was performed 2.5 cm above the zygomatic arch and 2.5 cm lateral to the eyebrow (17). The muscles were palpated with small rotational movements using with second and third fingers with approximately 2-3 pounds of palpation pressure (18). Then it was asked to participants to score the MMP. Each participant scored the MMP on a visual analog scale (VAS/0-10) (19).

Statistical analysis

Statistical analyses were performed with IBM SPSS statistics (24.0 Version; SPSS Inc, Chicago, IL). The level of significance was set at $\alpha<0.05$. Descriptive data were calculated for all variables. Data were analyzed with a non-parametric Mann-Whitney U test to compare the VAS results because the data were distributed non-normally. Chi square test was used to compare categorical variables and Spearsman correlation test was performed to test the possible correlation between the MMP and age.

RESULTS

In this study, the mean age was 33.06 years, ranging from 18 to 50 years. The percentage of bruxism in female (52.3%) was higher than in male (47.7%). The MMP was higher right side of the face (52.3%) than left side (47.7%) (Table 1).

Table 1. Demographic data of the study

Gender	Number of the patients (n)	Percent (%)
Female	57	52.3
Male	52	47.7
Side of the face with muscle pain		
Right	57	52.30
Left	52	47.70
Age	**Mean±Std. deviation**	**Min-Max (median)**
	33.06±10.65	18-50 (32)

Although all the patients reported that they have tenderness in masseter muscle, only 63 (57.8%) of them reported that have tenderness in temporal muscle (Table 2).

Table 2. Distribution of patients according to muscle tenderness

Chewing muscles	Number of the patients have muscle tenderness (n)	Percent (%)
Mass	109	100
Temp	63 (25 male, 38 female)	57.8
Mass-Temp	63 (25 male, 38 female)	57.8

Mass: Masseter; Temp: Temporalis

A total of 15 patients (13.7%) had tooth loss (premolar or molar). The side of the face with pain and side of the muscle tenderness were same; each patient had muscle tenderness reported pain at the same side of the face. The muscle tenderness and the tooth loss according to side of the face are shown in Table 3.

Although the mean MMP score was higher in the female than the male, there was no statistically significance (p=0.618). There was a controversial result in temporal muscle tenderness and MMP however, it was not statistically significant (p=0.259). It was not possible to compare the VAS results of patients with masseter muscle tenderness because all of them had masseter tenderness. The mean MMP sores were higher in the right side than the left side nevertheless, it was not statistically significant (p=0.250). The mean MMP score was higher in patients with tooth loss than without tooth loss (p=0.49) (Table 4).

There was not a relation among the gender, side of the face with pain, masticatory muscle tenderness, and tooth loss. Besides, there was no correlation between the MMP scores and age (Table 5).

Table 3. Distribution of patients according to side of muscle tenderness, and tooth loss

Eishner Group A	Mass			Temp			Mass+Temp		
	R	L		R	L		R	L	
	n	n	Total	n	n	Total	n	n	Total
No tooth loss	50	44	94	28	26	54	28	26	54
Tooth loss (premolar or molar)	7	8	15	4	5	9	4	5	9
Total	57	52	109	32	31	63	32	31	63

Mass: Masseter; Temp: Temporalis; R: Right; L: Left; %: percent

Table 4. Mean, Std. deviation of MMP and P values

	N	Mean MMP score and Std. dev.	p-value
Female	57	8.26±1.53	0.618
Male	52	8.13±1.52	
Temporal muscle with tenderness	63	8.10±1.40	0.259
Temporal muscle without tenderness	46	8.35±1.60	
Right side of the face	57	8.33±1.56	0.25
Left side of the face	52	8.06±1.52	
No tooth loss	94	8.09±1.55	0.49
Tooth loss (premolar or molar)	15	8.93±1.03	

MMP: Masticatory Muscle Pain; Std. dev: Standard Deviation

Table 5. Chi-square and Spearsman Analyze Results

		p-value
Gender	Temporal muscle tenderness	0.50
Gender	Tooth loss	0.52
Gender	Side of the face with pain	0.40
Tooth loss	Temporal muscle tenderness	0.852
Tooth loss	Side of the face with pain	0.714
Age	Tooth loss	0.308

DISCUSSION

The null hypothesizes were accepted. Because there was not a significant difference between patients with tooth loss and patients without tooth loss in terms of MMP scores. Besides, there was not a significant difference in MMP scores according to the gender, temporal muscle tenderness, and side of the face with pain. Finally, there was no correlation between the MMP scores and age.

It has been reported that the definitive diagnostic test for bruxism is polysomnography. However, it may not be applicable to the clinic environment because it requires recording of the sound for many nights. Moreover, it is

time-consuming and not cost-effective (5). Therefore in this study, the story of patient and clinical examination in combination were used for diagnosis of the bruxism (6). It was asked to the patients to write a symptomatology diary including 2 weeks real-time assessment to increase the reliability of story of the patients (6).

In previous studies, it has been found that the prevalence of bruxism in the female patients is higher than in the male patients (20,21). Similarly, in the present study, the percentage of bruxism in female (52.30%) was higher than in male (47.70%).

Parafunctional activity occurs with bruxism that may damage the structures in the stomatognathic system. During the parafunctional activity, eccentric movements of the mandible start and force the tooth contacts increase (22). In the eccentric movements of the mandible, forces are applied to the teeth in the generally horizontal direction which is not well-tolerated (22,23). The eccentric movements of the mandible create more strain on the masticatory system, resulting in muscle pain. Another explanation for the muscle pain is vasoconstriction of the vessels causing ischemia. When ischemia occurs not only it is difficult to remove metabolic wastes from the muscle tissues but also algogenic substances are released (22).

In the present study, %57.80 of the patients had temporal muscle tenderness however; all of the patients had masseter muscle tenderness. One of the inclusion rule was masseter muscle hypertrophy that it may be explained the result. Because overworking muscles result in pain and this pain causes the muscles to work even more (24).

The impairment of occlusal harmony can lead to changes in the structures of the entire masticatory system (25). It has been reported that several types of occlusal changes have effects on masticatory muscles in animal studies. When occlusal changes and loss of posterior teeth causing fatigue, discomfort, and pain were observed in the masticatory muscles. In an animal study, Bani et al (26). reported that in the early stages of the experiments, constriction of muscle fibers reduces the blood flow by constricting the blood capillaries. Thus, the constriction of the masseter muscle of the molar-extracted side initiates ischemic injury of the muscle and releasing of the calcium ion. In the later stages, calcium ion releasing increases and results in more local ischemia, which may be caused the pain. Im et al (27) investigated the influence of unilateral tooth loss on the TMJ and masseter muscle of rabbits. They found that calcium concentration was higher on the extraction side than the non-extraction side after 6 weeks in the masseter muscle. However, after 12 weeks, calcium concentration was higher on the non-extraction side. Differences with earlier studies were attributed to different experimental conditions. Iyomasa et al (25). evaluated metabolic changes in the rats masseter muscle. Rats were submitted to acute stress associated with exodontia. They reported that the extraction was affected by the metabolic plasticity of the masseter muscle at the molecular level. In the literature, there are animal studies that evaluate the pain in molecular level. However, in the present study it was aimed to evaluate the pain in human being. According to the results of this study, there were only 15 patients who have tooth loss. The patients with tooth loss had higher MMP scores than the patients without tooth loss, but there was not a statistically difference. The muscles in the masticatory system, the related anatomic formations and occlusion have a close relationship. It should be remembered that muscle activity and the forces affecting the mandible are stimulated by dental contacts. In the absence of the first mandibular molar, muscles work in a way to adapt to this situation. We think that antagonist tooth contacts increase when first mandibular molar tooth extracted, which leads to an increase in masseter activity.

There are limitations associated with the present study. Pain is a subjective phenomenon and it is not possible to measure objectively. The study relies on only clinic information and not supported by histochemical indicators. In further studies, it should be investigated that the effects of tooth loss on TMJ.

CONCLUSION

The MMP was higher in female and right side of the face, however there was not a statistical significance. It should be considered both muscle pain and tooth loss together in clinical examination and perform the preventive treatment. The masseter muscle was one of the most vital muscles while diagnosing the bruxism.

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

Financial Disclosure: There are no financial supports.

Ethical approval: The study was approved by the Non-Interventional Medicine Ethics Committee of Usak University Faculty of Medicine with decision number 161-02.

REFERENCES

1. Mesko ME, Hutton B, Skupien JA, et al. Therapies for bruxism: a systematic review and network meta-analysis (protocol). Systematic Reviews 2017;6:4.
2. Koyano K, Tsukiyama Y, Ichiki R, et al. Assessment of bruxism in the clinic. J Oral Rehabil 2008;35:495-508.
3. Attanasio R. Nocturnal bruxism and its clinical management. Dent Clin North Am 1991;35:245-52.
4. Ahlberg J, Rantala M, Savolainen A, et al. Reported bruxism and stress experience. Community Dent Oral Epidemiol 2002;30:405-8.
5. Casett E, Réus J, Stuginski-Barbosa, et al. Validity of different tools to assess sleep bruxism: a meta-analysis. J Oral Rehabil 2017;44:722-34.
6. Pigozzi LB, Rehm DD, Fagondes SC, et al. Current Methods of Bruxism Diagnosis: A Short Communication. Int J Prosthodont 2019;32:263-264.
7. 7. Rawlinson A. Treatment of root and alveolar bone resorption associated with bruxism. Br Dent J 1991;170:445.
8. Egermark I, Carlsson GE, Magnusson T. A 20-year longitudinal study of subjective symptoms of temporomandibular disorders from childhood to adulthood. Acta Odontol Scand 2001;59:40-8.

9. Fernandes G, Franco A, Siqueira J, et al. Sleep bruxism increases the risk for painful temporomandibular disorder, depression and non-specific physical symptoms. J Oral Rehabil 2012;39:538-44.
10. John MT, Frank H, Lobbezoo F, et al. No association between incisal tooth wear and temporomandibular disorders. J Prosthet Dent 2002;87:197-203.
11. Raphael KG, Sirois DA, Janal MN, et al. Sleep bruxism and myofascial temporomandibular disorders: a laboratory-based polysomnographic investigation. J Am Dent Assoc 2012;143:1223-31.
12. Throckmorton GS, Ellis III E. The relationship between surgical changes in dentofacial morphology and changes in maximum bite force. J Maxillofac Oral Surg 2001;59:620-27.
13. Clark GT, Beemsterboer PL, Rugh JD. Nocturnal masseter muscle activity and the symptoms of masticatory dysfunction. J Oral Rehabil 1981;8:279-86.
14. Möller E, Sheikholeslam A, Lous I. Response of elevator activity during mastication to treatment of functional disorders. Eur J Oral Sci 1984;92:64-83.
15. Karl E. Uber eine Gruppeneinteilung des Luckengebisse fur die Prothetik. Dtsch Zahnarztl Z 1955;10:1831-4.
16. Fricton J, Schiffman EL. Reliability of a craniomandibular index. J Dent Res 1986;65:1359-64.
17. List T, Helkimo M, Falk G. Reliability and validity of a pressure threshold meter in recording tenderness in the masseter muscle and the anterior temporalis muscle. Cranio 1989;7:223-9.
18. Almoznino G, Zini A, Zakuto A, et al. Muscle tenderness score in temporomandibular disorders patients: A case-control study. J Oral Rehabil 2019;46:209-18.
19. Shimada A, Baad-Hansen L, Svensson P. Effect of experimental jaw muscle pain on dynamic bite force during mastication. Arch Oral Biol 2015;60:256-66.
20. Huhtela OS, Näpänkangas R, Joensuu T, et al. Self-Reported Bruxism and Symptoms of Temporomandibular Disorders in Finnish University Students. J Oral Facial Pain Headache 2016;30.
21. Manfredini D, Winocur E, Guarda-Nardini L, et al. Epidemiology of bruxism in adults: a systematic review of the literature. J Orofac Pain 2013;27:99-110.
22. Okeson JP. Management of temporomandibular disorders and occlusion. In: Reinhardt RW, Steube M eds. Third edition. St. Louis (MO): Mosby/Elsevier, 2012;178-83.
23. D'Amico A. Functional occlusion of the natural teeth of man. J Prosthet Dent 1961;11:899-15.
24. Travell J, Rinzler S, Herman M. Pain and disability of the shoulder and arm: treatment by intramuscular infiltration with procaine hydrochloride. JAMA 1942;120:417-22.
25. Iyomasa MM, Fernandes FS, Iyomasa DM, et al. Metabolic changes in masseter muscle of rats submitted to acute stress associated with exodontia. PloS one 2015;10:1-12.
26. Bani D, Bani T, Bergamini M. Morphologic and biochemical changes of the masseter muscles induced by occlusal wear: studies in a rat model. J Dent Res 1999;78:1735-44.
27. Im JH, Kim SG, Oh JS, et al. Influence of unilateral tooth loss in the temporomandibular joint and masseter muscle of rabbits. Oral Surg Oral Med Oral Pathol Oral Radiol 2012;114:9-16.