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ORIGINAL RESEARCH

Evaluation of the Relationship between Bruxism and Premature Occlusal Contacts

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ABSTRACT

Aim: This study evaluates the relationship between occlusal interferences and premature contacts and bruxism by determining the relationship between unassisted and assisted nonworking interferences.

Materials and methods: In this study, 60 subjects (14 males and 46 females) that consisted of 30 bruxers (7 males, 23 females) and 30 nonbruxers (7 males, 23 females) were selected after completion of a questionnaire based on the exclusion criteria. Occlusal interferences in the centric relation and eccentric movements in the two groups were evaluated and recorded. Data were analyzed by SPSS software (version 16) using the Chi-square and paired t-tests.

Results: The results showed a statistically significant relationship between bruxism and nonworking interferences ($p < 0.05$). There was no statistically significant relationship in the centric relation and other eccentric movements ($p > 0.05$). The number of assisted nonworking occlusal contacts was more than unassisted nonworking occlusal contacts.

Conclusion: According to the results of this study, there is a relationship between certain types of occlusal interferences (nonworking interferences) and bruxism. Hence, it would be useful to examine occlusal contacts in bruxing patients to eliminate probable causative or contributing occlusal factors. Both assisted and unassisted nonworking occlusal contacts should be evaluated.

Clinical implication: Bruxism is an oral habit that consists of involuntary rhythmic or spasmodic nonfunctional gnashing, grinding or teeth clenching, other than chewing movements by the mandible. Bruxism may lead to occlusal trauma, tooth wear, fracture of the teeth and fillings, and hypertrophy of the masticatory muscles. Treatment of bruxism needs a correct diagnosis. Therefore, it is useful to determine the relationship between occlusal interferences and bruxism in order to prevent its development by adjusting for these interferences.

Keywords: Bruxism, Occlusal interference, Balancing interference, a case-control study.

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INTRODUCTION

Bruxism is an oral habit that consists of involuntary rhythmic or spasmodic nonfunctional gnashing, grinding or teeth clenching, other than chewing movements of the mandible, which may lead to occlusal trauma.[1] This habit may occur either when awake or while asleep. Habitual tooth pressing or clenching is called diurnal bruxism, whereas tooth grinding which usually occurs during sleep is named nocturnal bruxism.[2] Centric bruxism is called clenching. Eccentric bruxism refers to nonfunctional grinding of the lower teeth against the upper teeth in excursive pathway.[1] The mean reported prevalence of bruxism in the general population is about 8 to 10% in adults, yet is more common in females.[3]

The etiology of bruxism is controversial. As there is no single factor responsible for all bruxisms,[1] thus many authors believe there are multifactorial causes.[4] Some morphologic factors such as dental occlusion and the anatomy of the bony structures of the orofacial origin may be associated with bruxism.[5] Other distinguishable etiologic factors of bruxism are: psychosocial factors such as stress and certain personality characteristics,[4,6] central factors and special neurotransmitters,[4] pathophysiological factors (i.e. smoking, diseases, trauma, genetics, alcohol and caffeine intake, illicit drugs and medications),[7] sleep disorders (sleep apnea and snoring),[8,9] and dopaminergic system involvement.[10]

Several studies have suggested different techniques to record bruxism such as the use of questionnaires or oral history taking, which includes their partner's report of grinding sounds.[11,12] Other methods to record bruxism are the evaluation of occlusal dental attrition either by direct visual observation in the mouth, a dental study cast or digital image analyzer,[13-16] an extraoral examination for clinical

signs of bruxism such as masticatory muscle hypertrophy,[11] setting a digital camera beside the bed in the home setting, and the use of a tooth contact sensor inserted in an oral appliance or mandibular movement sensor.[17] Another technique involves the recording of muscle activity with at least one EMG channel of masseter, preferably with full montage, that includes muscle activity from the EMGs of the jaws and legs, electrocardiogram (heart rate), encephalogram (brain activity), and eye movements for REM scoring from an electro-occulogram.[18-21]

Bruxism can cause the following clinical signs and symptoms: occlusal dental attrition, masticatory muscle hypertrophy, temporomandibular joint and muscle pain, temporal headaches, mechanical failure of dental implants and fillings,[22] abfraction in the cervical region of the teeth,[23] and occlusal pits.[24] It is necessary for the treating dentist to recognize the oromandibular manifestations and etiology of bruxism in order to plan the most appropriate treatment.

Few studies survey the relationship between bruxism and occlusal interferences. Since, occlusal interference is one of the probable causes of bruxism, determining this relationship for the prevention or treatment of bruxism would be useful.

According to a study by Ramfjord, some types of occlusal interferences are present in all patients with bruxism.[25] Meklas has believed that malocclusion and psychological factors are the most important factors in the etiology of bruxism.[26]

According to Jorgensen, occlusal interferences lead to bruxism,[27] which has been confirmed by Ramfjord and Ash who have shown that eliminating occlusal interferences causes a reduction in the level of muscle activity and a reduced tendency to clench.[2]

Williamson noted a significant relationship between posterior teeth contact in eccentric jaw movements and muscle hyperactivity.[28] Manfredini has studied the psychic and occlusal factors in bruxism, and concluded that there is an association between balancing side interferences and bruxism.[29]

In a study by Dawson, a precisely completed occlusal correction would allow many patients to see notable reductions in muscle activity. He also believed that even the most significant appearing premature occlusal contact can and often does activate high levels of muscle activity which normalizes when the occlusal interferences are eliminated.[1]

Kardachi has studied the role of occlusal adjustment in bruxism, but found no significant difference between electromyography of the masticatory muscle before, during, and after occlusal adjustment.[30] Also, Kato studied the relationship between nocturnal bruxism and peripheral sensory stimulus and found that local factors such as occlusal and anatomic factors were not as important in bruxism.[31]

The aim of this study, therefore, was to evaluate the relationship between different types of occlusal interferences (protrusive, centric relation, working and nonworking) and bruxism.We investigated the association between assisted and unassisted balancing interferences.

MATERIALS AND METHODS

This was a case-control, cross-sectional, retrospective study that enrolled a total of 60 people (14 males and 46 females). Participants were recruited from patients who referred to the Department of Prosthodontics, Shiraz Dental School, Shiraz, Iran and dental students over a period of 12 months. The method of sampling was convenience. Participants signed informed consents for the study protocol, which was approved by the Ethical Committee at Shiraz University of Medical Sciences. The mean age for the total group was 23.9 years (range: 17 to 32 years). Participants were required to have a history of good health, with no evidence of psychological or neurologic disorders. People who had any of the following conditions were excluded:

1. Loss of more than two anterior or posterior teeth (excluding third molars);
2. Four units and higher fixed prosthesis;
3. Gastroesophageal reflux disease;
4. Removable partial denture; and
5. Use of any medications with known sleep effects (i.e. antipsychotic drugs).

A special questionnaire designed for this study was completed for each participant. Subjects were divided into two groups, bruxers (7 males, 23 females) and nonbruxers (7 males, 23 females) based on the following criteria:

1. Self-reported history of nocturnal bruxism;
2. Reported bruxism by someone else;
3. Existence of wear facet on the teeth as seen by clinical examination;[24] and
4. Muscle fatigue upon awakening.

Those participants who met all of the above criteria were considered as having bruxism, whereas subjects who did not have any of the above criteria were classified as nonbruxers. Occlusal interferences of 60 participants for all jaw movements (centric relation, protrusion, laterotrusive, and nonworking) were recorded. All the examinations were performed by one operator.

Initially, the examiner recorded occlusal interferences in the centric relation by Dawson's bimanual manipulation technique.[32] In order to deprogram the masticatory muscle, a cotton roll was placed between the anterior teeth to separate them for 5 minutes; then the mandible was guided without the influence of tooth contacts.[32] The initial tooth contact in the centric relation may be assumed as a destructive factor for teeth by the neuromuscular system,

such that protective reflexes may activate and guide the mandible into the maximum intercuspation. In order to record centric relation interferences, the teeth were completely dried and 28 µm articulating paper (Artifol Bausch Dental KG, Koln, Germany) was placed between the posterior teeth to mark teeth contacts in the centric relation. Each subject was instructed to make eccentric mandibular movements. All eccentric interferences (protrusive, laterotrusive, and nonworking) were detected by asking the subject if any contact was felt in each position,[33] by observation,[33] and finally verification by the use of dental floss and articulating paper. Initially, protrusive interferences were recorded; the subject forwarded the mandible from the maximum intercuspation position until the end-to-end relationship of the anterior teeth. Any posterior contact in this position was assumed to be protrusive interference. The contacts were found initially by patient report, observation, and finally by the use of dental floss (Oral B essential floss; Braun and Oral B Ireland) which was placed between the teeth and pulled anteriorly from the most posterior teeth. Protrusive interferences stopped this movement. These interferences were verified by 28 µm articulating paper (Artifol Bausch Dental KG, Koln, Germany) in a different color from the maximum intercuspation contacts. Blue articulating paper was placed between the teeth; the subject was requested to perform a protrusive movement a few times to mark on the teeth. Then, red paper was used to mark the maximum intercuspation contacts by tapping the teeth in this position. Blue marks not covered by the red marks showed protrusive interferences.

Working (laterotrusive) interferences were recorded by asking the subject to move mandible laterally until the relationship of the canines became edge-to-edge. The normal working side occlusion may be group function, posterior disclusion, and partial group function.[1] In this study any occlusal relationship in the working side, with the exception of group function, was assumed as to be occlusal interference. Occlusal interferences of the working side were detected by observation, asking the subject about tooth contact on the working side, dental floss, and different colors of articulating paper.

Nonworking (mediotrusive) interferences were evaluated by two methods, assisted and unassisted nonworking contacts. In order to record unassisted nonworking contacts, the patient was asked to move the mandible laterally. Any posterior tooth contact on the balancing side was assumed to be unassisted nonworking interference. Then, the examiner applied a moderate superomedial force to the mandibular angle and guided the mandible to the opposite site. Any posterior tooth contact on the nonworking side was assumed to be assisted nonworking interference. The numbers of assisted and unassisted nonworking contacts were recorded separately by observation, asking the patient about having nonworking contact, dental floss and different colors of articulating paper.

Statistical analysis of the data was performed by SPSS version 17 software. The Chi-square and paired t-tests were used ($\alpha < 0.5$ was significant).

RESULTS

There were 60 participants as seen in Table 1, which included 30 bruxers (7 males and 23 females) and 30 nonbruxers (7 males and 23 females) (Table 1). The cross-tabulation between bruxism and three types of occlusal interferences and the average number of assisted and unassisted nonworking interferences are given in Tables 2 and 3, respectively. The average number of the assisted interferences in bruxers (1.867 ± 1.547) is more than nonbruxers (0.733 ± 1.048) (p-value = 0.002). In addition, the average number of the unassisted interferences in bruxers (1.033 ± 1.217) was more than nonbruxers (0.300 ± 0.702) (p-value = 0.006).

Data analysis showed statistical differences between bruxism and assisted (p = 0.002) and unassisted (p = 0.006) nonworking interferences. No significant association emerged between bruxism and other occlusal interferences (protrusive and working) and premature contacts (CR) (p > 0.05; Table 2).

Statistical analysis of the data also revealed an association between assisted and unassisted occlusal interferences (correlation = 0.89). The numbers of assisted nonworking contacts were more than unassisted nonworking contacts (Table 3).

DISCUSSION

There are different methods for diagnosing bruxism, which include the use of questionnaires[11,12] evaluation of dental attrition (observation, dental study cast or digital image analyzer),[13-16] extraoral examination for clinical signs of bruxism (i.e. masticatory muscle hypertrophy),[11] setting a digital camera beside the bed, use of a tooth contact sensor inserted in an oral appliance,[17] or the use of other special devices.[18-21]

Using only one method for the diagnosis of bruxism may be problematic. For example, questionnaires can be

Table 1: Frequency and percentages of bruxism according to gender

Variable		*Females*	*Males*	*Total*
Nonbruxers	Number	23	7	30
	Percent	76.7	23.3	100
Bruxers	Number	23	7	30
	Percent	76.7	23.3	100

useful when screening a large population, however questionnaires are subjective[12] or a person may not be aware of his or her bruxing habit. Several factors may lead to dental attrition[6] such as gastroesophageal reflux disease, saliva and special diet.[14] Additionally, the clinician must consider the role of timing of the attrition. If a patient has recently started bruxing, the dentist may not detect any attrition on the teeth or despite stopping bruxism, attrition is yet to be observed.[13]

A combination of methods should be used to diagnose bruxism. In this study, therefore, we have used three diagnostic tools:

1. Evaluation of dental attrition,
2. Muscle tenderness upon awakening, and
3. Completion of a yes or no questionnaire about bruxism awareness. Results of these diagnostic tools were used to divide 60 subjects into 2 groups of bruxers and nonbruxers.

The results of this study showed a statistically significant relationship between nonworking (assisted and unassisted) occlusal interferences and bruxism. However, we found no association between other occlusal interferences (centric, working and protrusive) and bruxism.

The results of this study agreed with some previous studies.[1,2,25-29] Manfredini's study revealed an association between nonworking interferences and bruxism. He recorded the laterotrusive and nonworking interferences within the first millimeters of the lateral excursions.[29] Studies by Ramfjord and Williamson revealed a relationship between eccentric occlusal interferences and muscle hyperactivity. These researchers have proposed that careful occlusal adjustment may lead to a reduction in muscle hyperactivity.[2,28] According to Dawson, the primary cause of eccentric bruxism is occlusal interferences. He has proposed that occlusal interferences, even the most insignificant prematurities, often lead to high levels of muscle activity which reduces after occlusal adjustment.[1] However, several studies have shown no relationship between occlusal interferences and bruxism.[30,31]

Table 2: Cross-tabulation between bruxism and three types of occlusal interferences

Variable	*Bruxers*	*Nonbruxers*	*p-value*
CR interference			0.105
Yes	86.7	70	
No	13.3	30	
Working interferences			0.058
Yes	53.3	30	
No	47.6	70	
Protrusive interferences			0.5
Yes	43.3	40	
No	56.7	60	

Table 3: Average number of assisted and unassisted nonworking interferences

Variable	*Bruxers*	*Nonbruxers*	*p-value*
Mean ± SD Assisted	1.867 ± 1.547	0.733 ± 1.048	0.002*
Mean ± SD Unassisted	1.033 ± 1.217	0.300 ± 0.702	0.006*

*Significant

The results of this study demonstrated a statistical association between assisted nonworking interferences and unassisted nonworking interferences in bruxers and nonbruxers. The number of nonworking occlusal interferences increased when forced was applied to the angle of the mandible. This result can be justified by three explanations. First, the forced applied to the mandibular angle may overcome the neuromuscular reflex of the masticatory system, which avoids damaging contact. Therefore, more nonworking interferences appear by the application of force.[33] Secondly, during mandibular movements the condyle may or may not show the full Bennett's shift. Bennett's shift increases by the application of force to the mandibular angle, with an increase in the number of interferences.[33] Third, during full mouth opening the arch distance of the mandible reduces due to mandible flexing. The same mandible flexing can occur when medial force is applied in the assisted method.[33]

Therefore, it seems necessary to record both assisted and unassisted nonworking interferences. Some postural positions such as resting the chin in the hand, sleeping on the stomach,[33] or putting the hand under the head during sleep[3] result in the application of medial forces to the mandibular angle. More occlusal interferences in the nonworking side would appear when compared to situations where no force is applied.

Some interferences are only detected by evaluation of assisted balancing side interferences, thus it is suggested that both assisted and unassisted balancing side interferences should be evaluated to find these prematurities.

Currently, the multifactorial nature of bruxism is proven. There is no single effective treatment that reduces all forms of bruxism. More studies in larger populations are necessary to investigate the relationship between bruxism and premature contacts as causative or contributing factors.

Limitations of this study were the use of a self-reported questionnaire, intraoral examination and use of cotton roll to disclude posterior teeth. In this study the absence of posterior teeth contact was verified visually once the cotton rolls were placed between anterior teeth. Making jig instead of using the cotton rolls in order to deprogram the masticatory muscle would have been more accurate. Although Dawson's bimanual manipulation technique presents some criticism, this technique is simple and can be

done clinically without use of any special complex equipment. Use of precision methods such as Gothic arch tracing and Lauritzen[34] designed instrument is recommended for recording true hinge axis.

CONCLUSION

The results of this study showed a statistically significant relationship between bruxism and nonworking occlusal interferences. We did not find any statistically significant relationship between bruxism and other occlusal interferences. Finally, the number of assisted nonworking occlusal contacts was more than the unassisted nonworking occlusal contacts. Treatment of bruxism needs a correct diagnosis. Occlusal interferences are one of the probable causes of bruxism. Some interferences are only detected by evaluation of assisted balancing side interferences, thus it is suggested that both assisted and unassisted balancing side interferences should be evaluated to find these interferences and in order to treat one of the probable causes of bruxism, both types of interferences should be treated.

CLINICAL SIGNIFICANCE

Bruxism is an oral habit that consists of involuntary rhythmic or spasmodic nonfunctional gnashing, grinding or teeth clenching, other than chewing movements by the mandible. Bruxism may lead to occlusal trauma, tooth wear, fracture of the teeth and fillings, and hypertrophy of the masticatory muscles. Treatment of bruxism needs a correct diagnosis. Occlusal interferences are one of the probable causes of bruxism. Some interferences are only detected by evaluation of assisted balancing side interferences, thus it is suggested that both assisted and unassisted balancing side interferences should be evaluated to find these interferences and in order to treat one of the probable causes of bruxism, both types of interferences should be treated.

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