Original Article

The Relationship Between Bruxism and Occlusal Factors Among Seven- to 19-Year-Old Turkish Children

Abdullah Demir, DDS, MS[a]; Tancan Uysal, DDS, PhD[b]; Enis Guray, DDS, PhD[c]; Faruk Ayhan Basciftci, DDS, MS[d]

Abstract: The aim of this study was (1) to investigate the relationship between occlusal factors and bruxism among 965 Turkish subjects (472 boys and 493 girls) with a mean age of 12.8 years (range, seven to 19 years); and (2) to identify possible sex differences between girls and boys. This sample was divided into two groups of bruxers or nonbruxers based on a clinical examination and self-reports. The examiner recorded the Angle molar classification bilaterally, severity of anterior crowding, existence of anterior and posterior crossbite, open and deep bite, functional shift, and excessive overjet. The relationships between occlusal factors and bruxism and sex differences between boys and girls were evaluated with chi-square analysis (χ^2) using the SPSS software package. The results showed that bruxism was diagnosed in 12.6% of all subjects. The evaluation of the findings indicated that no statistically significant relationships were determined between bruxism and occlusal factors. No sex differences were found between occlusal factors in relation to bruxism. The prevalence of bruxism in boys and girls was similar, and no statistically significant differences were found. It is concluded that none of the occlusal factors seem to play a role in the development of bruxism. However, additional longitudinal studies with larger samples need to be conducted to determine if there is any relationship between occlusal factors and bruxism. (*Angle Orthod* 2004;74:672–676.)

Key Words: Bruxism; Turkish; Occlusal factors

INTRODUCTION

Bruxism may be defined as purposeless rhythmic, habitual tooth clenching or grinding movements that may occur either when awake or during sleep.[1] Habitual tooth pressing or clenching has been termed diurnal bruxism, whereas tooth grinding, which usually occurs during sleep, has been called nocturnal bruxism.[1]

The etiology of bruxism has been attributed to systematic factors, such as intestinal parasites, subclinical nutritional deficiencies, allergies, and endocrine disorders[2,3] to local factors, especially malocclusion,[4,5] and to psychological factors.[6,7] Ramfjord and Ash[8] stated that there are three mechanisms that interact to trigger bruxism, ie, emotional tensions, pain or discomfort, and occlusal maladjustments. Nadler[2] emphasized the causes of bruxism as local, systemic, psychological, and occupational. Meklas[9] believed that psychogenic and local irritation factors such as orthodontic malocclusions outweighed other causes of bruxism.

The prevalence of signs and symptoms of temporomandibular disorders are described in the literature for various worldwide ethnic groups. However, few studies have attempted to survey the occlusal factors in relation to bruxism. It would be useful to know this relationship in order to prevent bruxism developed by occlusal disorders.

Nilner[10] studied the relationship between occlusal factors and parafunctional activities in 440 children aged seven to 14 years. Statistically significant relationships were found between Class II and Class III malocclusion and bruxism. Widgorowicz-Makowerowa et al[11] examined 2100 children (10 to 15 years old) and found statistically significant differences in the prevalence of bruxism between children with and without malocclusion, but the type of malocclusion was not defined in the study.

The aim of this study was (1) to investigate the relationship between occlusal factors (such as Angle classification of molars, anterior and posterior crossbites, excessive over-

[a] Research Assistant, Selcuk University, Faculty of Dentistry, Department of Orthodontics, Konya, Turkey.
[b] Research Assistant, Selcuk University, Faculty of Dentistry, Department of Orthodontics, Konya, Turkey.
[c] Associate Professor, Selcuk University, Faculty of Dentistry, Department of Orthodontics, Konya, Turkey.
[d] Assistant Professor, Selcuk University, Faculty of Dentistry, Department of Orthodontics, Konya, Turkey.
Corresponding author: Abdullah Demir, DDS, MS, Selcuk Universitesi, Dishekimligi Fak. Ortodonti AD, Kampüs, Konya 42079, Turkey
(e-mail: abd_demir@hotmail.com).

Accepted: October 2003. Submitted: September 2003.

TABLE 1. Number of Female and Male Subjects by Age Group

	Age Groups				
	7–9 yr	10–12 yr	13–15 yr	16–19 yr	Total
Female subjects	132	129	144	88	493
Male subjects	117	125	106	124	472
Total	249	254	250	212	965

TABLE 2. The Distribution of Bruxism in Seven- to 19-Year-Old Turkish Subjects

	Bruxism			
	Present	Absent	Total	%
Boys	61	411	472	12.92
Girls	61	432	493	12.37
Total	122	843	965	12.64

jet, open and deep bite, functional shift, and anterior crowding) and bruxism among seven- to 19-year-old Turkish subjects; and (2) to identify possible sex differences between male and female subjects.

MATERIALS AND METHODS

A total of 965 pupils (472 boys and 493 girls) were selected randomly from four different schools in Konya, Turkey. The mean age for the total sample group was 12.8 years (range, 7–19 years). The mean age was calculated as 12.9 $\pm$ 4.1 years for boys and 12.7 $\pm$ 3.9 years for girls.

The distribution of age for all participants is shown in Table 1. The following inclusion criteria were used for the selection of the sample.

- Seven years of age or older
- All permanent first molars erupted
- Caucasian

The examiner recorded the Angle classification for molars bilaterally, severity of anterior crowding, existence of anterior and posterior crossbite, open and deep bite, functional shift, and excessive overjet.

Four mutually exclusive anteroposterior (A-P) molar relationship groups were established: (1) Class I, (2) Class II division 1, (3) Class II division 2, and (4) Class III. Crossbites were designated as either present or absent. Anterior and posterior crossbite was recorded as a single tooth or multiple teeth. More than five mm of anterior crowding was designated as anterior crowding present. Overjet or the horizontal distance between the facial surface of the upper central incisors and the facial surface of the lower central incisors was recorded using a periodontal probe. Overjet exceeding six mm was recorded as extreme overjet.

The process of diagnosing a functional shift in occlusion consisted of deconditioning the subject's habitual biting pattern, thus making it possible to measure any functional shift of the mandible. In this way any functional shift caused by an occlusal interference resulting in a reflex alteration in the movement pattern at the occlusal interface was detected. Deconditioning was accomplished using cotton rolls to separate posterior teeth for three minutes before any measurement of a functional shift was attempted.

Similarly, three groups were derived from the overbite data:[12] (1) open bite (negative overbite), (2) deep bite (overbite greater than the lower incisor crown's height), and (3) overbite less than the total overlap of the lower incisor's crown.

The study was conducted using bruxing and nonbruxing subjects. Subjects were divided into two groups of bruxers or nonbruxers as determined by the clinical examination and self-report. The subjects were characterized based on answers to several questions related to them or their families and to their awareness of their teeth clenching or grinding. A clinical examination of signs and symptoms of bruxing was also important. The bruxing patients were required to meet all the following predetermined criteria in order to be selected for this study: (1) a self-reported history of nocturnal bruxism; (2) bruxing currently or heard to brux by parents or someone else; and (3) confirmation of bruxism by the principal investigator with an intraoral examination (presence of wear facets on teeth; grade 0, no wear facets; grade 1, enamel only; grade 2, enamel and dentin; grade 3, wear of the cusp). The nonbruxist sample was selected based on the subjects answering ''no'' to all inquiries regarding clenching or grinding their teeth, as well as an intraoral examination that ruled out obvious signs of bruxing (grade 2 or 3 of the presence of wear facets on at least four teeth).

All statistical analyses were performed using the SPSS software package (SPSS for Windows 98, version 10.0, SPSS Inc, Chicago, Ill). The relationship between bruxism and occlusal factors was evaluated with chi-square analysis (χ^2). Chi-square analysis was also performed to compare the changes observed in male and female samples.

RESULTS

The evaluation of the results showed that bruxism was registered in 12.6% of all subjects. It was determined that 12.4% of girls and 12.9% of boys have bruxism. The distribution of bruxism in seven- to 19-year-old Turkish subjects is presented in Table 2. The results indicate that the prevalence of bruxism in boys and girls is similar, and no statistically significant differences were found in this population ($P > .05$).

The distribution of different occlusal factors in seven- to 19-year-old Turkish subjects is presented in Table 3. The results showed that no statistically significant relationships existed between bruxism and occlusal factors, such as Angle classification for molars, severity of anterior crowding,

TABLE 3. Prevalence of Different Occlusal Factors Among Seven- to 19-Year-Old Turkish Subjects

Occlusal Factors	n	%
Angle Class I	737	76.40
Angle Class II division 1	153	15.90
Angle Class II division 2	41	4.20
Angle Class III	34	3.50
Anterior crossbite	52	5.40
Posterior crossbite	92	9.50
Excessive overjet	168	17.40
Open bite	79	8.20
Deep bite	211	21.90
Functional shift	11	1.10
Anterior crowding	179	18.50

existence of anterior and posterior crossbite, open and deep bite, functional shift, and excessive overjet (Table 4).

Sex differences between occlusal factors and bruxism are shown in Table 5. No sex differences were found between occlusal factors in relation to bruxism.

DISCUSSION

Different techniques are suggested to record bruxism in epidemiologic studies.[13] One technique is the evaluation of dental attrition, from direct visual observations in the mouth,[14] from dental study casts,[15] or from occlusal appliances. However, it is very difficult to be sure if the bruxing is a consequence of parafunctional or functional habits.[16] Because the occlusal surfaces are worn physiologically in

TABLE 4. The Relationship Between Different Occlusal Factors and Bruxism

	Bruxism[a]		
Occlusal Factors	n	χ^2	Significance
Angle Class I malocclusion	92	0.789	NS
Angle Class II, division 1 malocclusion	19	0.928	NS
Angle Class II, division 2 malocclusion	6	0.695	NS
Angle Class III malocclusion	5	0.712	NS
Anterior crossbite	7	0.855	NS
Posterior crossbite	8	0.231	NS
Exessive overjet	24	0.481	NS
Open bite	9	0.727	NS
Deep bite	22	0.273	NS
Anterior crowding	21	0.685	NS

[a]n, Sample size; χ^2, chi-square value; NS, not significant.

TABLE 5. Gender Differences Between Occlusal Factors in Relation to Bruxism

		Bruxism[a]		
Occlusal Factors	Sex	n	χ^2	Significance
Angle Class I malocclusion	Female	47	0.528	NS
	Male	45		
Angle Class II, division 1 malocclusion	Female	11	0.369	NS
	Male	8		
Angle Class II, division 2 malocclusion	Female	1	0.157	NS
	Male	5		
Angle Class III malocclusion	Female	2	0.274	NS
	Male	3		
Anterior crossbite	Female	3	0.368	NS
	Male	4		
Posterior crossbite	Female	5	0.539	NS
	Male	3		
Exessive overjet	Female	14	0.366	NS
	Male	10		
Open bite	Female	6	0.519	NS
	Male	3		
Deep bite	Female	10	0.533	NS
	Male	12		
Anterior crowding	Female	12	0.256	NS
	Male	9		

[a]n, Sample size; χ^2, chi-square value; NS, not significant.

the deciduous dentition, the reliability of using only the evaluation of dental attrition is controversial.[17] Another remarkable point is the timing of the attrition because there is a risk of recording no bruxism when the subjects have recently begun bruxism and may not show signs of attrition.[17] The same risk exists if bruxism has stopped, but attrition is observed.[18] Also, dental wear can be caused by many factors other than bruxism.[19] Therefore, in this study the bruxism history was obtained by a combination of methods. Interview of the children and clinical examination were carried out by the clinician.

The prevalence of bruxism is difficult to determine because the activity is performed subconsciously and questioning alone without a clinical examination is therefore unreliable. Studies by questionnaire, however, have reported that approximately 15–20% of people are aware of bruxing or habitually clenching their teeth.[1] Reports of the prevalence of bruxism vary, ranging from 5% to 96% of the population.[20,21]

Egermark-Erikson et al[22] reported a high prevalence of bruxism and of subjective symptoms and clinical signs of mandibular dysfunction in seven, 11, and 15-year-old children. In this study, the prevalence of bruxism was 13.27% among seven- to 19-year-old Turkish subjects. In addition, the results indicated that the prevalence of bruxism was similar in boys and girls.

In this study, bruxism was considerably less common than reported by Lindqvist.[23,24] She based her assessment on the presence of wear facets on the teeth and found an incidence of about 50% in 12-year-old children, although only 15% of the parents reported bruxism in their children. The findings of this study are more in agreement those studies of adults in which bruxism was recorded based on the subject's own appraisal.[25,26] However, people are often unconscious of their bruxism, and the occurrence is undoubtedly higher than that reported in the answers to questionnaires.

Henrikson et al[27] indicated that bruxism was higher in the Class II malocclusion group than in the normal group, which suggests a relationship between parafunctions and orthodontic malocclusion. Nilner[10] studied the relationship between occlusal factors and bruxism and found statistically significant correlations between Class II and Class III molar relationships and bruxism. Carlsson et al[28] indicated that Angle Class II malocclusion and tooth wear in childhood predicted increased tooth wear in adulthood. However, Clarke[29] asserted that occlusal factors are not involved in the etiology of bruxism. Gunn et al[30] found no statistically significant relationship between any type of morphologic malocclusion and tooth clenching and grinding. In this study we also found that the molar relationships were not related to bruxism in both the mixed and permanent dentitions. The current findings are in accordance with Clarke[29] and Gunn et al.[30]

In another study, Nilner[31] examined the relationship between occlusal factors and bruxism in 309 adolescents. A statistically significant correlation was reported between deep bites and clenching and dental wear. Nilner[31] also asserted the need for occlusal treatment in young people with occlusal interferences combined with oral parafunctions. Bailey and Rugh[32] showed that occlusal adjustments do not stop bruxism. Brandt[33] studied the associations between morphological malocclusion and bruxism in 1342 children and adolescents aged six to 17 years. Significant associations were found among molar relationship, excessive overjet, overbite, and bruxism. Sari et al[17] found statistically significant relationships among overjet $>$ 6 mm, negative overjet, overbite, open bite, and bruxism in the permanent dentition. The same investigators also found relationships among Angle Class I occlusion for the first molar teeth, overjet $>$ 6 mm, overbite $>$ 5 mm, scissor bite, crossbite for anterior-posterior multiple teeth, and bruxism in the mixed dentition. In contrast to Nilner,[31] Egermark-Eriksson[34] indicated that children with deep bite had less worn teeth than other children. In this study, no statistically significant relations were found between bruxism and severity of anterior crowding, existence of anterior and posterior crossbite, open and deep bite, functional shift, or excessive overjet.

Currently, it is widely accepted that temporomandibular disorders are multifactorial in nature and more prevalent in female subjects than in male subjects.[35–39] Therefore, to elucidate the causes or relationships of bruxism, it is of great importance to examine sex differences in bruxism in response to the occlusal factors. Egermark-Eriksson et al[22] stated that there were no significant differences between the sexes in the occurrence of bruxism. Similarly, in this study, no statistically significant sex differences were determined among the seven- to 19-year-old Turkish population.

CONCLUSIONS

Based on the results obtained, it can be concluded that

- The data obtained from the physical examination and questionnaire identified no statistically significant relations between bruxism and all occlusal factors investigated in seven- to 19-year-old Turkish subjects. No evidence that the occlusal factors studied play a role in the development of bruxism was found.
- No statistically significant sex differences were found between different occlusal factors and bruxism.
- There is a need for further longitudinal investigations with larger sample sizes to know if there is a relationship between occlusal factors and bruxism.

REFERENCES

1. Jagger RG, Bates JF, Kopp S. *Temporomandibular Joint Dysfunction.* Wright, Butterworth-Heinemann Medical. U.K.; 1994.
2. Nadler SC. Bruxism a classification: critical review. *J Am Dent Assoc.* 1957;54:615–622.

3. Nadler SC. Detection and recognition of bruxism. *J Am Dent Assoc.* 1960;61:472–479.
4. Ramfjord SP. Bruxism, a clinical and electromyographic study. *J Am Dent Assoc.* 1961;62:21–44.
5. Posselt U. The temporomandibular joint syndrome and occlusion. *J Prosthet Dent.* 1971;25:432–438.
6. Yemm R. Neurophysiologic studies of temporomandibular joint dysfunction. *Oral Sci Rev.* 1976;1:31–39.
7. Rugh JD. Electromyographic analysis of bruxism in the natural environment. In: Weinstein P, ed. *Advances in Behavioral Research in Dentistry.* Seattle, Wa: University of Washington Press; 1978:67–83.
8. Ramfjord SP, Ash MM Jr. *Occlusion.* 2nd ed. Philadelphia, Penn: WB Saunders Company; 1974.
9. Meklas JF. Bruxism—diagnosis and treatment. *J Acad Gen Dent.* 1971;19:31–36.
10. Nilner M. Relationship between oral parafunctions and functional disturbances in the stomatognathic system in 7 to 14 year olds. *Acta Odontol Scand.* 1983;41:167–172.
11. Widgorowicz-Makowerowa N, Grodzki C, Panek H, Maslanka T, Plonka K, Palacha A. Epidemiologic studies on prevalence and etiology of functional disturbances of the masticatory system. *J Prosthet Dent.* 1979;41:76–82.
12. Riolo ML, Brandt D, TenHave TR. Associations between occlusal characteristics and signs and symptoms of TMJ dysfunction in children and young adults. *Am J Orthod Dentofacial Orthop.* 1987;92:467–477.
13. Lobbezoo F, Montplaisir JY. Bruxism: a factor associated with temporomandibular disorders and orofacial pain. *J Back Musculoskeletal Rehabil.* 1996;6:165–176.
14. Clark GT, Beensterboer PL, Rugh J. Nocturnal masseter muscle activity and the symptoms of masticatory dysfunction. *J Oral Rehabil.* 1981;8:279–286.
15. Johansson A, Haraldson T, Omars R, Kiliaridis S. A system assessing the severity and progression of occlusal wear. *J Oral Rehabil.* 1993;20:125–131.
16. Lobbezoo F, Lavigne GJ. Do bruxism and temporomandibular disorders have a cause and effect relationship? *J Orofac Pain.* 1997;11:15–23.
17. Sari S, Sönmez H. The relationship between occlusal factors and bruxism in permanent and mixed dentition in Turkish children. *J Clin Pediatr Dent.* 2001;25:191–194.
18. Allen JD, Rivera-Morales WC, Zwemwe JD. The occurrence of temporomandibular disorder symptom in healthy young adults with and without evidence of bruxism. *J Craniomandib Pract.* 1990;8:312.
19. Carlsson GE, Johansson A, Lindqvist S. Occlusal wear: a follow up study of 18 subjects with extensively worn dentitions. *Acta Odontol Scand.* 1985;43:83–90.
20. Norheim PW, Dahl BL. Some self-reported symptoms of temporomandibular joint dysfunction in a population in northern Norway. *J Oral Rehabil.* 1978;5:63–68.
21. Pavone BW. Bruxism and its effect on the natural teeth. *J Prosthet Dent.* 1985;53:692–696.
22. Egermark-Eriksson I, Carlsson GE, Ingervall B. Prevalence of mandibular dysfunction and orofacial parafunction in 7-, 11-, and 15-year-old Swedish children. *Eur J Orthod.* 1981;2:163–172.
23. Lindqvist B. Bruxism in children. *Odontol Rev.* 1971;22:413–424.
24. Lindqvist B. Bruxism in twins. *Acta Odontol Scand.* 1974;32:177–187.
25. Molin C, Carlsson GE, Friling B, Hedegard B. Frequency of symptoms of mandibular dysfunction in young Swedish men. *J Oral Rehabil.* 1976;3:9–18.
26. Ingervall B, Molin B, Thilander B. Prevalence of symptoms of functional disturbances of the masticatory system in Swedish men. *J Oral Rehabil.* 1980;6:185–197.
27. Henrikson T, Ekberg EC, Nilner M. Symptoms and signs of temporomandibular disorders in girls with normal occlusion and Class II malocclusion. *Acta Odontol Scand.* 1997;55:229–235.
28. Carlsson GE, Egermark I, Magnusson T. Predictors of bruxism, other oral parafunctions, and tooth wear over a 20-year follow-up period. *J Orofac Pain.* 2003;17:50–57.
29. Clarke NG. Occlusion and myofacial pain dysfunction: is there a relationship? *J Am Dent Assoc.* 1982;104:443–446.
30. Gunn SM, Woolfolk MW, Faja BW. Malocclusion and TM symptoms in migrant children. *J Craniomandib Disord.* 1988;2:196–200.
31. Nilner M. Relationship between oral parafunctions and functional disturbances in the stomatognathic system in 15 to 18 year olds. *Acta Odontol Scand.* 1983;41:197–202.
32. Bailey JO, Rugh JD. Effect of occlusal adjustment on bruxism as monitored by nocturnal EMG recordings [abstract 199]. *J Dent Res.* 1980;59:317.
33. Brandth D. Temporomandibular disorders and their associations with morphologic malocclusion in children. In: Carlsson DS, McNamara JA, Ribbens KA, eds. *Developmental Aspect of Temporomandibular Joint Disorders.* Ann Arbor, Mich: University of Michigan Press; 1985:179–298.
34. Egermark-Eriksson I. Malocclusion and some functional recordings of the masticatory system in Swedish schoolchildren. *Swed Dent J.* 1982;6:9–20.
35. Wanman A. The relationship between muscle tenderness and craniomandibular disorders: a study of 35 year olds from the general population. *J Orofac Pain.* 1995;9:235–243.
36. Agerberg G, Inkapööl I. Craniomandibular disorders in an urban Swedish population. *J Craniomandib Disord: Facial Oral Pain.* 1990;4:154–164.
37. Dworkin SF, Huggins KH, LeResche L. Epidemiology of signs and symptoms in temporomandibular disorders: clinical signs in cases and controls. *J Am Dent Assoc.* 1990;120:273–281.
38. Krogstad BS, Dahl BL, Eckersberg T, Ogaard B. Sex differences in signs and symptoms from masticatory and other muscles in 19 year-old individuals. *J Oral Rehabil.* 1992;19:435–440.
39. Jensen R, Rasmussen BK, Pedersen B, Lous I, Olesen J. Cephalic muscle tenderness and pressure pain threshold in a general population. *Pain.* 1992;48:197–203.