A study to evaluate psychological and occlusal parameters in bruxism

Siddharth Bandodkar^a, Shuchi Tripathi^{b,*}, Pooran Chand^b, Saumyendra V. Singh^b,
Deeksha Arya^b, Lakshya Kumar^b, Mayank Singh^b, Rameshwari Singhal^c, Adarsh Tripathi^d

^a Private Practitioner, Goa, India

^b Department of Prosthodontics, King George's Medical University UP, Lucknow, India

^c Department of Periodontics, King George's Medical University UP, Lucknow, India

^d Department of Psychiatry, King George's Medical University UP, Lucknow, India

ARTICLE INFO

Keywords:

Anxiety

Bruxism

Depression

Digital occlusal analysis

Tooth wear

ABSTRACT

Purpose: To evaluate the role of anxiety/depression and occlusal factors in bruxism using Hospital Anxiety and Depression Scale and T-Scan III respectively.

Methods: The present case control study was comprising of a group of thirty patients with bruxism (Group Br) and 30 healthy individuals as control group (Group NBr). Subjects were selected from outdoor patients visiting the dental unit with the chief complaint of wearing off/sensitivity of all the teeth due to habitual grinding. The cases were selected by using the diagnostic criteria as given by the American Academy of Sleep Medicine (AASM). Further based on similarities of age and gender, controls were selected. Tooth wear index was recorded using an index given by Ekfeldt et al. Hospital Anxiety and Depression Scale (HADS) questionnaire was administered to both the groups to evaluate anxiety and depression. Recording of occlusal parameters in both the groups was done digitally by using T-Scan III. Statistical analysis was done by using student's *t*-test, chi square test and Mann Whitney *U* test.

Results: Group Br had significantly greater mean tooth wear index (22.24 ± 11.5) than group NBr (5.17 ± 3.30). Group Br had significantly higher anxiety ($9.03 \pm 1.87/7.17 \pm 1.82$) and depression scores ($8 \pm 1.93/6.17 \pm 1.23$) as compared to NBr. The discusion time of group Br was 0.652 ± 0.749 and that of group NBr was 0.247 ± 0.289 ($p = 0.008$).

Conclusions: Subjects with higher level of anxiety, depression and increased discusion time may have greater predilection towards suffering from bruxism ($p < 0.05$).

1. Introduction

The Glossary of Prosthodontic Terms-9 has defined 'bruxism' as 'parafunctional grinding of teeth or an oral habit consisting of involuntary, rhythmic or spasmodic nonfunctional gnashing, grinding, or clenching of teeth, in other than chewing movement of the mandible which may lead to occlusal trauma'.¹

Authors have reported prevalence of bruxism range widely from 4 to 96%.² Prevalence has been calculated to be present in 10% of the population during sleeping hours and the prevalence of bruxism during day hours has been calculated to be 20%.^{3,4} Prevalence of bruxism might be affected by variables such as age, gender and location demographics of the patient.⁵⁻⁸

Etiology of bruxism has been thought to be because of multitude of factors like central or pathophysiological factors involving brain

neurotransmitters or basal ganglia, psychosocial influences causing emotional stress or anxiety and peripheral factors such as tooth interference in dental occlusion.⁹⁻¹⁴ For evaluating the psychological status of the patient, various tests have been used such as Hospital Anxiety Depression Scale (HADS), Beck Depression Inventory (BDI) and Hamilton Anxiety Rating Scale (HAMA).¹² Traditionally, articulating paper has been used to discern points of contact between the maxillary and mandibular dentition during centric and eccentric movements of natural tooth and dental prosthesis. But using these papers have certain drawbacks like the size of the mark may not represent the amount of load¹⁵ and the paper markings gets smudged in saliva.¹⁶ Computerized occlusal analyzers have been used to overcome such shortcomings during evaluation of occlusion.¹⁷⁻¹⁹

Regrettably no clear data has been available on the cause and effect of bruxism.¹² Available studies have shown that possible relationship

* Corresponding author. Department of Prosthodontics, Faculty of Dental Sciences, King George's Medical University, Lucknow, Uttar Pradesh, India.

E-mail address: shuchitripathi@kgmcindia.edu (S. Tripathi).

<https://doi.org/10.1016/j.jobcr.2021.10.007>

Received 2 June 2021; Received in revised form 23 July 2021; Accepted 6 October 2021

Available online 14 October 2021

2212-4268/© 2021 Craniofacial Research Foundation. Published by Elsevier B.V. All rights reserved.

between bruxism and various psychosocial and occlusal factors is still in the progress but no conclusive report has yet been reported.^{9,21,22} Bruxism have severely influenced the quality of human life leading to depression and other oro-facial problems like damage to supporting structures of teeth, tooth wear, frequent fractures/wear of dental restorations/implants and temporomandibular and musculoskeletal disorders.^{23–29} The present study was conducted to find an association between anxiety/depression and occlusal parameters in bruxism as there is no clear direction in the existing literature in this regard.

In the present study, null hypothesis was that there is no significant correlation between anxiety/depression and occlusal parameters in patients with bruxism.

2. Material and methods

The present study was conducted from January 2017 to October 2018 in the 'Department of Prosthodontics and Crown & Bridge' of the institution. The study was a 'case control study' comprising of a group of patients with bruxism as cases (Group Br: Bruxers) and a group of age and sex matched control group (Group NBr: Non Bruxers). The sample size was calculated using the following formula:

$$n = 2X(Z_{\alpha/2} + Z_{\beta})^2 SD^2/d \quad 2$$

n: Sample size per group

SD: Pooled standard deviation being 3 in this.

d: Difference in the means (effect size)

$Z_{\alpha/2}$: Significance level (1.96), Z_{β} : Power of the study (0.84)

Assuming 80% power, 5% significance level with 95% confidence interval as well as assuming standard 4, the required sample size per group was 30. Ethical approval from the institutional ethics committee (1450/Ethics/R.cell-16) was obtained and the informed consent was taken from each subject included in the study. Thirty patients were selected in 'Group Br' as cases, using the diagnostic screening criteria of bruxism as given by the American Academy of Sleep Medicine (AASM).³⁰ Inclusion criteria for group Br were knowledge or awareness of bruxism either by the subject or by a bed partner (Clenching or grinding of the teeth during sleeping), healthy individuals with no systemic disorders, completely dentate subjects (Third molars were not evaluated) with absence of any restorations and prosthesis, no history of chronic diseases, migraine, neuralgia, trauma, tumours or temporomandibular joint disorders/surgeries in the head and neck region and no history of orthodontic treatment. Thirty healthy individuals were selected as 'Group NBr' based on similarities of age and gender with the 'Group Br'.

The demographic data was collected from both the groups regarding the age, sex and address. Clinically, the tooth wear was recorded using the Index given by Ekfeldt et al.³¹ for both the groups. The participants of both the groups were administered "Hospital Anxiety and Depression Scale" (HADS) to record anxiety and depression. HADS is a fourteen item scale that generates ordinal data.³² Seven items of which relate to anxiety and seven relate to depression. Each item on the questionnaire is scored from 0 to 3 meaning a person anxiety/depression score may vary between 0 and 21. A cut-off point of 8 was used to categorize anxiety or depression scale separately.

Occlusal contact data was evaluated digitally using T-Scan III for Windows (Tekscan Inc, Boston, MA, USA). Same examiner performed all routine clinical examinations and T-Scan measurements to reduce biasness. Appropriate sized T-scan sensor was fitted to a rigid, autoclavable, fork-shaped plastic holder and inserted into the oral cavity aligned with the midline of the participants. For each individual, a new T-scan III sensor was used and if the sensor got perforated while handling in the same individual, it was replaced with a new sensor to decrease chances of false readings caused by salivary leakage into the sensor. The individuals were instructed to bite down sensor stably and

the real-time force movie of occlusion generated was recorded on a computer monitor. Prior to measurement, T-scan sensor was recalibrated between participants to compensate individual variations in bite force. The same sensitivity value was maintained across all recordings for each participant. Based on individual recordings, following occlusal parameters were measured: a) occlusion time (time from the first contact of teeth to maximal intercuspation); b) disclusion time (time from maximal intercuspation to the last contact of teeth); c) left-right occlusal contact area distribution ratios and d) anterior-posterior occlusal contact area distribution ratios.

The data was summarized as mean $\pm$ SD (Standard deviation) and statistical analysis was done using the SPSS software 24.0 (Statistical Package for Social Sciences, Chicago, Illinois, USA). For parametric analysis, unpaired *t*-test and for non-parametric analysis, Mann Whitney *U* test were used.

3. Results

No significant difference in gender proportions between the groups Br (53.3% males, 46.7% females) and NBr (56.7% males and 43.3% females) [$p = 0.795$] was found (Table 1). Age group under 30 years (56.7%) had higher prevalence for bruxism than other age groups (Table 1). Bruxism was more common in patients belonging to urban areas (60%) as depicted in Table 1. Group Br had a significantly greater mean tooth wear index (mean = 22.24) as compared to the Group NBr (Table 2). A higher anxiety scores was found in Group Br (mean = 9.03) as compared to Group NBr (mean = 7.17) (Table 3). Similarly Group Br (mean = 8) had significantly higher depression scores than Group NBr (mean = 6.17) as shown in Table 4. When occlusal parameters were compared (Table 5), disclusion time of Group Br (0.652 ± 0.749) was more than Group NBr (0.247 ± 0.289).

4. Discussion

The diagnosis of bruxism whether subjective or objective have been found to be a challenging task.³³ No universally accepted criteria for diagnosis of awake bruxism have been reported in the literature yet. One of the best description for the diagnostic of sleep bruxism was proposed by American Academy of Sleep Medicine (AASM) for both research and clinical intentions.³⁰ Hence, in our study we have used the diagnostic criteria given by the AASM in the International Classification for Sleep disorders.

In the present study, 53.3% of the bruxers were males and 46.7% bruxers were females (Table 1) and it was found to be statistically not significant. Difference in level of anxiety, extent of statement of the problem in questionnaires in males and females,¹¹ variation in masticatory force and the time of detection of bruxism could account for the variation in prevalence of bruxism in males and females.⁵ Finding of this study corroborate with those conducted by Manfredini D et al.⁷ and Lavigne GJ et al.,⁸ who concluded that there was no gender based predilection for bruxism. However, findings opposed studies done by Al Zarea et al.⁵ and Hegde et al.⁶ who found higher predilection for bruxism in males. American Sleep Disorder Association though did find that there was a tendency for females to have a higher predilection for bruxism.³⁴

Table 1

Percentage distribution of subjects in Group Br and NBr according to Demographic profile.

Groups	According to Gender		According to age intervals			According to Location	
	Male	Female	24–30 years	31–35 years	36–41 years	Urban	Rural
Br	53.3	46.7	56.7	26.7	16.7	60.0	40.0
NBr	56.7	43.3	53.3	30.0	16.7	66.7	33.3
Total	55.0	45.0	55.0	28.3	16.7	66.7	33.3

Table 2

Comparison of mean Tooth wear index in groups Br and NBr.

Group	No of Subjects	Mean	Std Deviation	p-value
Br	30	22.2353	11.49874	<0.05 ^a
NBr	30	5.1663	3.30143	

^a Significant.**Table 3**

Mean anxiety scores for comparing groups Br and NBr using the HADS-A scale.

Group	No of subjects	Mean	Deviation	p-value
Br	30	9.03	1.866	<0.05 ^a
NBr	30	7.17	1.821	

^a Significant.**Table 4**

Mean depression scores for groups Br and NBr using the HADS-D scale.

Group	No of subjects	Mean	Deviation	p-value
Br	30	8.00	1.930	<0.05 ^a
NBr	30	6.17	1.234	

^a Significant.**Table 5**

Mean Occlusion time, disclusion time, anteroposterior and left right stress distribution of groups Br and NBr using the T scan occlusal analyzer.

	Group	No of subjects)	Mean	Deviation	p-value
Occlusion Time	Br	30	0.201	0.232	0.438
	NBr	30	0.344	0.591	
Disclusion Time	Br	30	0.652	0.749	0.008 ^a
	NBr	30	0.247	0.289	
Antero Posterior stress distribution	Br	30	0.236	0.199	0.431
	NBr	30	0.175	0.125	
Left Right Stress Distribution	Br	30	1.613	0.836	0.228
	NBr	30	1.450	0.604	

^a Significant.

A higher prevalence for bruxism in patients under the age of 30 (56.7%) than the patients in the age group of 31–35 years (26.7%) and patients above the age of 35 years (16.7%) was seen in the present study (Table 1). The prevalence of bruxism has usually been found to be higher in the younger generation due to higher amount of stress resulting from sedentary lifestyle, job constraints and inability to cope up with adverse circumstances.⁹ Manfredini D et al.⁷ concluded that bruxism tend to decrease with age.

Urban population (60%) were relatively more affected with bruxism than in rural population (40%) in the study (Table 1). This difference in prevalence rate could be because of variation in diet and lifestyle in the urban and rural places as well as unawareness leading to non-reporting of disease condition seen in rural population.^{5,6}

In the present study, tooth wear in Group Br was higher as compared to the Group NBr (Table 2). Seligman DA et al.²⁶ and Knight DJ et al.²⁷ found in their studies that tooth wear was increased in patients with bruxism. However, Pergamalian²⁸ and Baba K et al.²⁹ have not shown a positive correlation between tooth wear and bruxism in their study.

The relationship between anxiety/depression and bruxism has been studied in previous instances in the past. However, the jury is still out on this topic. Questionnaires like the Beck Depression Inventory (BDI), the Hospital Anxiety Depression Scale (HADS) and the Hamilton Anxiety Rating Scale (HAMA) have been used.¹² In the current study Hospital Anxiety and Depression Scale (HADS) was used, developed by Zigmond and Snaith in 1983.³² This test has previously been used by Gungormus and Erciyas¹² in their study and they found a positive correlation

between stress and bruxism.

The findings of our study showed a significantly higher level of anxiety (9.03 ± 1.87) and depression (8 ± 1.93) in the group of bruxers (Tables 3 and 4). The findings of this study were corroborated by Z Gungormus and Erciyas,¹² S. K. Rao et al.¹⁰ and Major et al.³⁵ who found that the subjects with higher level of anxiety and depression have higher tendencies for bruxism. While Pierce et al. found no relation between stress and bruxism.³⁶

Methods used for studying occlusion were evaluation of wear pattern of occlusal splints,³⁷ detection of force applied to the device and inter-arch contacts,³⁸ evaluation of occlusal marks using articulating papers and computerized occlusal analyzer.¹⁵ Saraçoğlu A and Ozpınar B¹⁶ found that the recording materials except the T-Scan were affected by the presence of saliva. Also, T scan considered the fourth dimension i.e. time while recording the patient's occlusion which helps to decipher the first point of contact.

In the current study T-Scan occlusal analyzer was used instead of a conventional articulating paper. While considering the occlusal factors in the subjects it was found that there was a significant increase in disclusion time (0.652 ± 0.749 s) in Group Br (Table 5). However no statistically significant difference was noted in occlusion time or disclusion time among the bruxism patients in previous study done by Gumus et al.¹⁸ A study done in military pilots affected with bruxism were characterized by a highly reduced occlusion time compared to healthy non-pilot subjects.³⁹ Further no significant difference were found in left-right and anterior-posterior occlusal contact areas while Gumus et al.¹⁸ have reported that in bruxism patients a larger areas of posterior contact is seen as compared to healthy individuals. Carlsson et al.⁴ and Kerstein and Radke¹⁹ found that occlusal prematurities and other malocclusions could play a role in increased bruxism in the subjects. However, Adisen et al.²⁰ and Manfredini et al.²¹ found that there was little correlation between occlusal factors and bruxism.

The purpose of this study was to evaluate the effects of occlusal and psychological factors in bruxism patients to decipher the possible causes of bruxism. This may help to formulate an effective treatment policy to prevent the harmful sequelae of bruxism like tooth wear and ensuing temporomandibular joint disorders. This study will help the dentist to formulate a clearer path to treat a patient with bruxism by treating not only the consequences but also the etiological factors. Limitation of this study was that the sample size was limited. Further long term longitudinal studies would be required to see the evolution pattern of bruxism and effect of long term treatment therapy on bruxism.

5. Conclusion

Within the limitations of the study, it was concluded that bruxism is related to multifactorial etiology with the presence of higher degree of tooth wear. Subjects with higher level of anxiety, depression and increased disclusion time have greater predilection towards suffering from bruxism ($p < 0.05$). Further long term studies are needed to formulate effective treatment planning of patients suffering with bruxism.

References

- 1 The glossary of prosthodontic terms: ninth edition. *J Prosthet Dent.* 2017;117(5S): e17.
- 2 Kataoka K, Ekuni D, Mizutani S, et al. Association between self-reported bruxism and malocclusion in university students: a cross-sectional study. *J Epidemiol.* 2015;25: 423–430.
- 3 Glaros AG. Incidence of diurnal and nocturnal bruxism. *J Prosthet Dent.* 1981;45: 545–549.
- 4 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.
- 5 Al-Zarea BK. Tooth surface loss and associated risk factors in Northern Saudi Arabia. *ISRN Dent.* 2012;2012:161565.

- 6 Hegde MN, Yelapure M, Honap MN, Devadiga D. The prevalence of tooth wear and its associated risk factors in Indian South West coastal population: an epidemiological study. *J Int Clin Dent Res Organ*. 2018;10:23–26.
- 7 Manfredini D, Winocur E, Guarda-Nardini L, Paesani D, Lobbezoo F. Epidemiology of bruxism in adults: a systematic review of the literature. *J Orofac Pain*. 2013;27(2): 99–110.
- 8 Lavigne GJ, Rompre PH, Montplaisir J. Sleep bruxism: validity of clinical research diagnostic criteria in a controlled polysomnographic study. *J Dent Res*. 1996;75: 546–552.
- 9 Shetty S, Pitti V, Satish Babu CL, Surendra Kumar GP, Deepthi BC. Bruxism: a literature review. *J Indian Prosthodont Soc*. 2010;10(3):141–148.
- 10 Rao SK, Bhat M, David J. Work, stress and diurnal bruxism: a pilot study among information technology professionals in Bangalore city, India. *Int J Dent*. 2011;1–5.
- 11 Sutin Angelina R, Terracciano A, Ferrucci L, Costa PT. Teeth grinding: is emotional stability related to bruxism. *J Res Pers*. 2010;44(3):402–405.
- 12 Gungormus Z, Erciyas K. Evaluation of the relationship between anxiety and depression and bruxism. *J Int Med Res*. 2009;37:547–550.
- 13 Ciancaglini R, Gherlone EF, Radaelli G. The relationship of bruxism with craniofacial pain and symptoms from the masticatory system in the adult population. *J Oral Rehabil*. 2001;28:842–848.
- 14 Dawson Peter E. *Evaluation, diagnosis and treatment of occlusal problems*. first ed. St Louis: Mosby; 1974.
- 15 Carey JP, Craig M, Kerstein RB, Radke J. Determining a relationship between applied occlusal load and articulating paper mark area. *Open Dent J*. 2007;1:1–7.
- 16 Saraçoğlu A, Ozpınar B. In vivo and in vitro evaluation of occlusal indicator sensitivity. *J Prosthet Dent*. 2002;88:522–526.
- 17 Koos B, Godt A, Schille C, Göz G. Precision of an instrumentation-based method of analyzing occlusion and its resulting distribution of forces in the dental arch. *J Orofac Orthop*. 2010;71:403–410.
- 18 Gümüş HO, Kılınç HI, Tuna SH, Özcan N. Computerized analysis of occlusal contacts in bruxism patients treated with occlusal splint therapy. *J Adv Prosthodont*. 2013;5 (3):256–261.
- 19 Kerstein RB, Radke J. Average chewing pattern improvements following disclusion time reduction. *Cranio*. 2017;35(3):135–151.
- 20 Adisen MZ, Okkesim A, Misirlioglu M, Yilmaz S. Does sleep bruxism affect masticatory muscles volume and occlusal force distribution in young subjects? A preliminary study. *Cranio*. 2018;20:1–7.
- 21 Manfredini D, Visscher CM, Guarda-Nardini L, Lobbezoo F. Occlusal factors are not related to self-reported bruxism. *J Orofac Pain*. 2012;26(3):163–167.
- 22 Manfredini D, Cantini E, Romagnoli M, Bosco M. Prevalence of bruxism in patients with different research diagnostic criteria for temporomandibular disorders (RDC/TMD) diagnoses. *Cranio*. 2003;21:279–285.
- 23 McArthur DR. Metal posterior teeth for chronic bruxing patients. *J Prosthet Dent*. 1978;39(5):578–581.
- 24 Ekfeldt A. Incisal and occlusal tooth wear and wear of some prosthodontic materials. An epidemiological and clinical study. *Swed Dent J Suppl*. 1989;65:1–62.
- 25 Salvi GE, Bragger U. Mechanical and technical risks in implant therapy. *Int J Oral Maxillofac Implants*. 2009;24:69–85.
- 26 Seligman DA, Pullinger AG. The degree to which dental attrition in modern society is a function of age and canine contact. *J Orofac Pain*. 1995;9:266–275.
- 27 Knight DJ, Leroux BG, Zhu C, Almond Ramsey DS. A longitudinal study of the tooth wear in orthodontically treated patients. *Am J Orthod Dentofacial Orthop*. 1997;112: 194–202.
- 28 Pergamalian A, Rudy TE, Zaki HS, Greco CM. The association between wear facets, bruxism and the severity of facial pain in patients with temporomandibular disorders. *J Prosthet Dent*. 2003;90:194–200.
- 29 Baba K, Haketa T, Clark GT, Ohya T. Does tooth wear status predict ongoing sleep bruxism in 30 year old Japanese subjects? *Int J Prosthodont (IJP)*. 2004;17:39–44.
- 30 American Academy of Sleep Medicine. *International classification of sleep disorders*. third ed. Darien, IL: American Academy of Sleep Medicine; 2014.
- 31 Ekfeldt A, Hugoson A, Bergendal T, Helkimo M. An individual tooth wear index and an analysis of factors correlated to incisal and occlusal wear in an adult Swedish population. *Acta Odontol Scand*. 1990;48(5):343–349.
- 32 Zigmund AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. 1983;67(6):361–370.
- 33 Palinkas M, De Luca Canto G, Rodrigues LAM, et al. Comparative capabilities of clinical assessment, diagnostic criteria, and polysomnography in detecting sleep bruxism. *J Clin Sleep Med*. 2015;11:1319–1325.
- 34 ICSD—International classification of sleep disorders: diagnostic and coding manual. In: *Diagnostic classification steering committee, thorpy, chairman*. Rochester, MN: American Sleep Disorders Association; 1990.
- 35 Major M, Rompre PH, Guitard F, et al. A controlled daytime challenge of motor performance and vigilance in sleep bruxers. *J Dent Res*. 1999;78:1754–1762.
- 36 Pierce CJ, Chrisman k, Bennett ME, Close JM. Stress, anticipatory stress and psychological measures related to sleep bruxism. *J Orofac Pain*. 1995;9:51–56.
- 37 Pierce CJ, Gale EN. Methodological considerations concerning the use of bruxcore plates to evaluate nocturnal bruxism. *J Dent Res*. 1989;68:1110–1114.
- 38 Nishigawa K, Bando E, Nakano M. Quantitative study of bite force during sleep associated bruxism. *J Oral Rehabil*. 2001;28:485–491.
- 39 Nota A, Tecco S, Cioffi C, Beraldi A, Padulo J, Baldini A. Occlusion time analysis in military pilots affected by bruxism. *Sci Rep*. 2019;9:1408.