The Prevalence of Bruxism and Associated Occupational Stress in Saudi Arabian Fighter Pilots

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ABSTRACT

Objective: To assess the prevalence of bruxism and occupational stress among Saudi Arabian fighter pilots.

Methods: This was an observational, cross-sectional study where 110 fighter pilots were compared with 110 control non-pilots. The data collection was carried out between February 2018 and May, 2019. Once subjects consented to the study, they completed a self-administered questionnaire and clinical data were collected from each subject. The short version of Karasek's Demand-Control questionnaire comprising of 11 questions (5 for demand and 6 for control) was used to measure occupational stress. The assessment of bruxism was confirmed using the non-instrumental approach of the International consensus on the assessment of bruxism that included both clinical examination and self-report of diurnal or nocturnal bruxism. A logistic regression test was performed with bruxism as the dependent variable controlling for occupational stress, type of occupation and smoking status. P value < 0.05 was considered statistically significant.

Results: The final sample had an overall bruxism prevalence of 41.8%, with pilots having higher percentage than non-pilots (52.7% and 30.9%, respectively). Pilots were more under occupational stress and exhibited more bruxism compared to non-pilots (OR = 2.2, 95% CI =1.3-

3.9 and OR = 2.5, 95% CI =1.4-4.3, respectively). **Conclusion:** Within the limitations of this study, pilots demonstrated significantly higher occupational stress and bruxism than non-pilots. Pilots were four times more likely to have stress and bruxism compared to non-pilots. Further investigations are necessary to examine a possible causal relationship between occupational stress and bruxism.

Keywords: Bruxism, Occupational stress, Military personnel, Prevalence, Saudi Arabia

INTRODUCTION

Repetitive masticatory muscle activity that is characterized by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible that happens during the day or sleeping, whether voluntary or involuntary, may be defined as bruxism (1). There are several consequences of bruxism such as temporomandibular joint (TMJ) disorders and periodontal deterioration due to occlusal trauma (2). The other reported signs and symptoms are tooth wear, chipping of teeth and prostheses, masticatory muscle pain, and sensitive teeth (3). The etiology is multifactorial and still an unsolved question (4). The most dominant sign related to bruxism is tooth wear (5). Tooth wear and bruxism are considered two sides of the same coin. A number of studies reported a positive association between tooth wear and bruxism (6-8).

Dental professionals are more worried about bruxism due to its side effects on the oral and maxillofacial area. According to several studies, there were deviant reports on the prevalence of bruxism (9-12). Bruxism can be initiated from multiple factors among which stress could be on the top, however, an explicit relationship remains unclear. Several studies reported an association between anxiety and depression with bruxism. (7-11) The stress experienced in the work environment has been shown to be related to perceived bruxism (12).

Military fighter pilots represent a unique working environment that exposes them to occupational stress that might give rise to a variety of health problems (13, 14). Our knowledge of the relationship between bruxism and occupational stress is largely based on very limited data. In a few investigations, it has been found that pilots have a moderate to high prevalence (30-70%) of parafunctional muscle activity represented as bruxism (13, 14). It essential to address any poor health side effects from occupational stress to this population. Thus, the aim of the research was to assess the prevalence of bruxism and occupational stress among Saudi Arabian fighter pilots.

METHODS

Study design:

This was a cross-sectional study designed to assess the prevalence of occupational stress and bruxism among a group of fighter pilots who were compared to a control group of non-pilot officers.

Setting and study subjects:

For convenience purposes, participants in this study were recruited from the Saudi Arabian Air Force officers who visited the aviation medical clinic in Dhahran, Saudi Arabia for routine medical and dental examination. The sample size of the original study was calculated using the following assumptions; alpha error = 5%, study power = 90%, estimated bruxism prevalence in fighter pilots = 65%, (13, 14) and null percent = 50%. The minimum required sample size to assess bruxism prevalence was calculated to be 110 (http://www.stat.ubc.ca/~rollin/tats/ssize/b1.html). The pilot (Jet and fighter) officers and non-pilot (Airfield operations, ground control, logistic, law and enforcement) officers of the Saudi Arabian Air Force who met the following inclusion and exclusion criteria were enrolled in the study. The inclusion criteria included that subjects have at least 21 teeth, are without any psychological or psychiatric issues, and are in good general health condition confirmed by the attending physician at the aeromedical center. Any subject with a history of chronic systemic diseases and/or did not sign the informed consent was excluded from the study. Furthermore, the study was approved by the Ethics and Research Committee at the College of Dentistry, Imam Abdulrahman Bin Faisal University. In addition, permission was sought and granted by the Aero Medical Center in King Abdul Aziz Air Base in Dhahran, Ministry of Defense, Saudi Arabia.

Examiner Calibration:

Two dentists were trained on clinical assessment using the tooth wear instrument (under clinical examination). The calibration session was conducted by an experienced dentist (the study PI) who was considered the gold standard. For training purposes, both dentists examined a group of 10 regular dental patients for tooth wear. A Kappa >0.75 of inter-examiner reliability was achieved before the launch of the study (The first dentist had an intra-examiner reliability of 77% while the second dentist was 82%).

Data Collection:

The data collection was carried out between February 2018 and May 2019. The data collection procedure was as follows: The general dentist recruited subjects who agreed to participate in the study based on the inclusion/exclusion criteria. Once subjects consented to the study, they completed the self-administered questionnaires and clinical data were collected from each subject. Since the study included both pilots and non-pilots, the subject recruitment phase depended on first recruiting the estimated sample size for pilots (n=110) which was followed by recruitment of the same number for non-pilots.

Questionnaire:

While waiting for the dental examination, subjects completed a short version of Karasek's questionnaire comprising of 11 questions (15). Karasek's questionnaire is well known tool to assess occupational stress as it has been validated and used in numerous studies (10, 11, 16). In this current study, two scales were used: namely, demand with 5 items and control with 6 items. The answers were in the form of a Likert scale where often "very high" = 4, sometimes " high"= 3, seldom " low"=2 and never \ almost never " very low'= 1. The score range for demand was 5–20 and for control was 6 –24, respectively. Higher scores indicated higher demand and control. Following the theory of the Job Demand–Control model (16), a median split of total sample or subsample job-specific scale values was used to construct four combinations of demand and control, the so-called quadrant approach, i.e., low strain (low demand + high control), active (high demand + high control), passive (low demand + low control), and high strain (high demand + low control) this is better illustrated in figure 1. Those subjects with high strain were considered under stress in this study. The questionnaire form also included demographic information as well as some basic health questions such as smoking and presence or absence of bruxism as observed by the study subject which can be either diurnal or nocturnal. Study participants were asked to monitor and record if they grind their teeth, keep their teeth together or brace their jaw during the day and at night whilst sleeping using a two weeks diary.

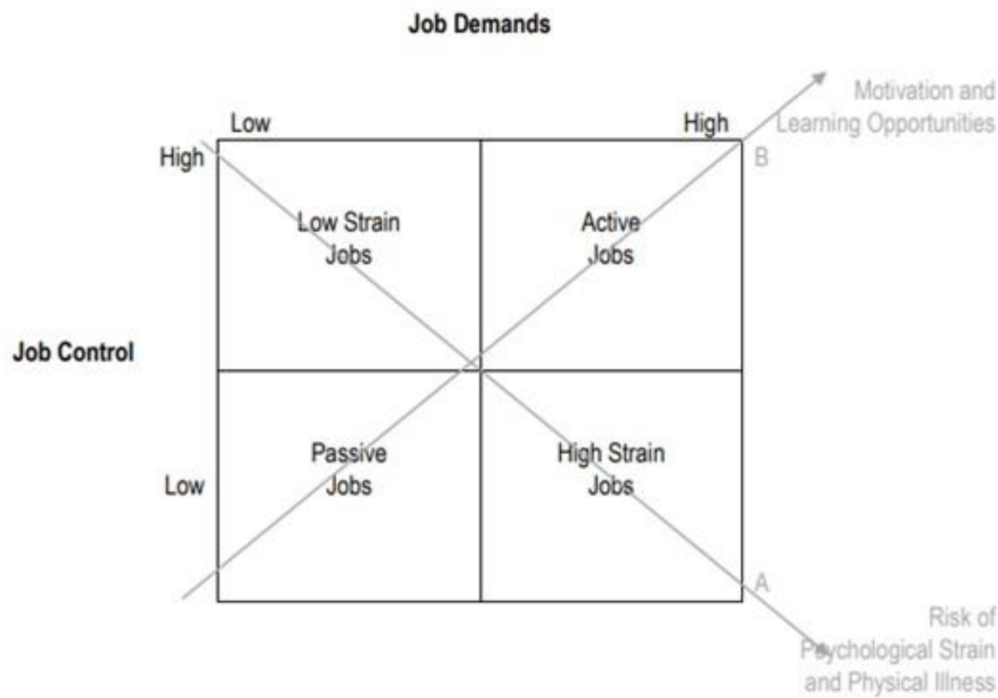

Figure 1: Job Demand / Control Model (based on: Karasek et al., 1998)

Clinical Examination:

The tooth wear severity index as described by Pullinger and Seligman was used in this study where for every tooth, the scores were as follows: 0 = no facet; 1 = slight facet; 2 = noticeable flattening with the normal planes of contour; 3 = flattening of cusps or grooves; 4 = total loss of contour and dentinal exposure when identifiable. Those who score from 0 to 2 were considered low tooth wear and those who score 3 or 4 were considered severe tooth wear (17).

Clinical features of both awake and sleep bruxism included the presence of masticatory muscle hypertrophy as well as indentations on the tongue or lip and/or a *linea alba* on the inner cheek. Other clinical features included damage to the dental hard tissues (i.e., cracked teeth), repetitive failures of restorative work/prosthodontic constructions, or mechanical wear of the teeth (i.e., attrition).

The assessment of bruxism was confirmed using the non-instrumental approach of the International consensus on the assessment of bruxism that included both clinical examination and self-report of diurnal or nocturnal bruxism (1, 4).

Statistical Analysis

The data were entered in Microsoft Excel (2010) and transferred to IBM SPSS Statistics for Windows, version 22 (IBM Corp., Armonk, NY, USA) for statistical analysis. The descriptive statistics included frequency distributions with percentages for categorical variables as well as means and standard deviations for continuous variables. For the bivariate analysis, variables with more than two levels, such as control and demand were dichotomized into two groups to develop the Job Demand–Control model. The differences between pilots and non-pilots for bruxism, occupational stress and combined bruxism and high stress were compared by using a chi square test. This was followed by a univariate and multivariate logistic regression test with bruxism as the dependent variable controlling for confounding factors such as occupational stress (Low vs. high), type of occupation (Pilot vs. non-pilot) and smoking status. Demographic variables such as age and work experience were not included in the logistic regression test to avoid any collinearity in the results. P value < 0.05 was considered statistically significant.

RESULTS

The final sample (N=220) consisted of equal numbers of participants for both pilots and nonpilots (n=110). The participation rate for pilots was 33% while it was 58% for non-pilots with an overall participation rate for both pilots and non-pilots of 45.5%. The average age for the sample was 29.8±6.3 years where pilots were slightly younger than non-pilots (28±5 yrs vs. 31.6±7 yrs). The working experience in years was dichotomized into two groups; those with 5 years or less (49.1%) and those with more than five years (50.9%). The working experience in pilots with 5 years or less was 52.7% and those with more than five years was 47.3%, while for non-pilots those with 5 years or less was 50.9% and those with more than five years was 49.1%. Smoking was distributed in a similar manner between the two groups where smokers counted for 40% of the pilots and 41.8% of the non-pilots. The mean (SD) tooth wear according to the index used was 2.2±0.9 (2.3±1.1 for pilots and 2.1±0.8 for non-pilots). As for the degree of tooth wear, the majority of pilots (40%) were recorded as grade 3, while 43.6% of non-pilots were recorded as grade 2. The 46.4% of the sample had history of bruxism with pilots having higher percentage than non-pilots (56.4% and 36.4%, respectively). (Table 1)

Table 1: Sociodemographic and health characteristics of the study subjects.

Continuous variables	Pilots Mean (SD)	Non-Pilots Mean (SD)	Total Mean (SD)
Age in years	28.0 (5.0)	31.6 (7.0)	29.8 (6.3)
Tooth wear	2.3 (1.1)	2.1 (0.8)	2.2 (0.9)
Categorical variables	**Pilots N (%)**	**Non-Pilots N (%)**	**Total N (%)**
Work experience in years			
≤5 years	54 (49.1)	58 (52.7)	112 (50.9)
>5 years	56 (50.9)	52 (47.3)	108 (49.1)
Smoking			
Yes	44 (40.0)	46 (41.8)	90 (40.9)
No	66 (60.0)	64 (58.2)	130 (59.1)
Degree of tooth wear			
Grade 1	36 (32.7)	28 (25.5)	64 (29.1)
Grade 2	16 (14.5)	48 (43.6)	64 (29.1)
Grade 3	44 (40.0)	32 (29.1)	76 (34.5)
Grade 4	14 (12.7)	2 (1.8)	16 (7.3)

History of Bruxism Bruxer Non-Bruxer	 62 (56.4) 48 (43.6)	 40 (36.4) 70 (63.6)	 102 (46.4) 118 (53.6)

SD = Standard Deviation

The Job Demand-Control Model was constructed by diving both demand and control into two groups (low and high), then cross-tabulating the two groups of demand with that of control. As seen in table 2, any participant with high demand and low control was considered under stress. According to the Job Demand-Control Model, pilots had more occupational stress than non-pilots (45.5% and 27.3%, respectively).

Table 2: Job Demand-Control Model for the study subjects.

	Control	Demand		Total
		Low N (%)	High N (%)	N (%)
Pilot	High	14 (12.7)	26 (23.6)	40 (36.4)
	Low	20 (18.2)	50 (45.5)	70 (63.6)
	Total	34 (30.9)	76 (69.1)	110 (100.0)
Non-Pilot	High	34 (30.9)	18 (16.3)	52 (47.3)
	Low	28 (25.5)	30 (27.3)	58 (52.7)
	Total	62 (56.4)	48 (43.6)	110 (100.0)
All	High	48 (21.8)	44 (20.0)	92 (41.8)
	Low	48 (21.8)	80 (36.4)	128 (58.2)
	Total	96 (43.6)	124 (56.4)	220 (100.0)

Pilots were more under occupational stress compared to non-pilots (45.5% vs. 27.3%, OR = 2.2, 95% CI =1.0-4.9, p=0.037). In addition, pilots exhibited more bruxism compared to non-pilots (52.7% vs. 30.9%, OR = 2.5, 95% CI =1.1-5.4, p=0.016). When both occupational stress (high) and bruxism were combined, pilots revealed more cases compared to non-pilots (23.6% vs. 7.3%, OR = 3.9, 95% CI =1.7-9.2, p=0.001). (Table 3)

Table 3: The relationship between occupational stress, bruxism and combined bruxism and high stress with occupation (pilot vs. non-pilot).

		Pilots N (%)	Non-Pilots [a] N (%)	OR (95% CI)	P -value
Stress	Low Stress	60 (54.5)	80 (72.7)	2.2 (1.0-4.9)	0.037*
	High Stress	50 (45.5)	30 (27.3)		
Bruxism	Non-Bruxer	52 (47.3)	76 (69.1)	2.5 (1.1-5.4)	0.016*
	Bruxer	58 (52.7)	34 (30.9)		
Bruxism and High Stress	Absent	84 (76.4)	102 (92.7)	3.9 (1.7-9.2)	0.001*
	Present	26 (23.6)	8 (7.3)		
Total		110 (100)	110 (100)		

OR = Odds ratio, 95% CI = 95% Confidence intervals
[a] Reference group
* Significant at p<0.05

Logistic regression analysis with the status of bruxism as the dependent variable was presented in table 4. There was a significant association between bruxism and type of occupation (Pilot vs. non-pilot) controlling for occupational stress and smoking in both the univariate and multivariate logistic regression test; OR=2.5 (95% CI =1.1-5.4, p= 0.016) and OR=2.6 (95% CI = 1.2.-5.8, p= 0.02), respectively.

Table 4: Univariate and multivariate logistic regression analysis with the status of bruxism as the dependent variable.

	Univariate OR (95% CI)	p-value	Multivariate OR (95% CI)	p-value
Occupational Stress High Stress Low stress [a]	1.0 (0.5-2.3)	0.535	1.1 (0.5-2.6)	0.763
Occupation Pilot Non-pilot [a]	2.5 (1.1-5.4)	0.016*	2.6 (1.2.-5.8)	0.02*
Smoking Yes No [a]	1.4 (0.7-3.0)	0.254	1.4 (0.7-3.2)	0.364

OR = Odds ratio, 95% CI = 95% Confidence intervals
[a] Reference groups
* Significant at $p<0.05$

DISCUSSION

This is the first study that explores the prevalence of bruxism and occupational stress in Saudi Arabian military pilots. In the present study, bruxism was apparently more noticeable in pilots (52.7%) compared to non-pilots (30.9%). The results of this study fall in the range of prevalence of bruxism in military pilots reported in other international studies that ranged from 30.4% to 69% (13, 14, 19, 20). When compared with other populations with different occupations associated with stress, the prevalence of bruxism ranged from 50% to 60% (11, 12, 21, 22). Some other global studies assessed the prevalence of bruxism in the general population without associating occupation and the range was 20% to 30% (23, 24). The differences in the prevalence of bruxism in these studies can be explained by different study design factors such as the use of different bruxism indices, the calibration of examiners, the clinical set up among other possible factors. These epidemiological studies with different study designs and populations assessed the presence of bruxism as a deteriorating oral condition with or without occupational stress as a possible confounding risk factor.

The use of the Job Content Questionnaire in this study helped with the assessment of occupational stress in the study subjects. High job demand and low job control jointly will lead to job strain as shown by the Job Demand Control model (16), which has been widely used in occupational stress epidemiological research (25, 26). In this study, pilots were more under stress compared to non-pilots (45.5% and 27.3%, respectively). Several cardiovascular risk factors such as blood pressure, heart rate, body mass index (BMI), serum total cholesterol levels, and cigarette smoking were found to be associated with job strain in workers (27, 28). The Job Demand–Control model was also helpful in determining the primary causes of job strain, which were administrative factors and the work atmosphere (29). In addition, the Job Demand–Control model was used to assess the relationship between psychological job demand and general fatigue as well as reduced activity (30). Therefore, the consequences of occupational stress should not be ignored as can be seen from the aforementioned studies, where high occupational stress levels were associated with poor health and increased fatigue.

The present study also shed light on the combined effect of occupational stress and bruxism. High occupational stress with bruxism was calculated for pilots and non-pilots; 23.6% and 7.3%, respectively. In addition, pilots were almost 4 times more likely to have high occupational stress with bruxism compared to non-pilots. The results in this study are consistent with previous results addressing the association between occupational stress and bruxism in pilots (13, 14, 19, 20). On the other hand, Bauer et al. (29) studied the effect of occupational stress on helicopter emergency service pilots from four European countries and Barbarewicz et al. (30) observed the psychophysical stress and strain among maritime pilots in Germany. In both studies, the side effects of occupational stress included general health and psychological problems that include clenching of teeth and possible bruxism. The association between occupational stress and bruxism can be observed in other jobs and different nations using several occupational stress instruments (12, 22)

Given that there is clear evidence from the results of this study and from different studies on the side effects of occupational stress and bruxism, the prevention or reduction of the magnitude of stress derived from occupation needs to be emphasized. These are recommendations to overcome or prevent the consequences of occupational stress and bruxism in fighter pilots. Firstly, fighter pilots have to be introduced to conscious awareness and they need to refrain from vigorous clenching when under stress. Second, meditation and relaxation exercises can be offered in way to reduce the effects of excessive bruxism. In addition, occlusal splints or mouth guards can be manufactured to prevent physical contact of the occlusal surfaces, thus preventing tooth wear (5, 14, 19)

Limitations

The study faced a major obstacle during the data collection phase with low participation (33%) of military pilots to be included in the study sample. Pilots were busy with military duties and the time frame for clinical examination and questionnaire was limited as there was a need to extend the data collection period to accommodate as many participants as possible. Thus, the difficulty faced with recruitment of pilots to the study might introduce selection bias. It was important to mention that there were no previous dental records for comparison purposes to follow cases with time. Due to the cross-sectional nature of the present study, it is difficult to draw any causal relationship between occupational stress and bruxism. Some of the issues raised with using questionnaires for data collection that respondents might underreport or overreport occupational stress due to recall bias. Therefore, the findings of this study should be interpreted carefully while generalizing to pilots' population in non-military organizations. Further studies are required to address any limitations encountered.

CONCLUSION

Within the limitations of this study, pilots demonstrated significantly higher occupational stress and bruxism than non-pilots. Pilots were four times more likely to have stress and bruxism compared to non-pilots. Further investigations are necessary to examine a possible causal relationship between occupational stress and bruxism. It is necessary to establish basic programs for the treatment and control of occupational stress and treat pathologies that may compromise the military performance of pilots of the Saudi Arabian Air Force.

DISCLOSURE

o Ethical approval: the study was approved by the Ethics and Research Committee at the College of Dentistry, Imam Abdulrahman Bin Faisal University (EA: 202058).

o Informed consent: 220 Study subjects consented to participate this study.

o Registry and the Registration No. of the study/Trial: "N/A"

o Animal Studies: "N/A"

o Conflict of Interest: None

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