Effectiveness of Deep Breathing Exercises on Bruxism among Dental Students in Riyadh, Saudi Arabia

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Abstract

Background: Dental education and practice have been acknowledged as one of the most challenging and stressful fields. Scientific literature has shown that dental students display high levels of perceived stress as well as higher prevalence of self-reported bruxism.

Objectives: To assess the effectiveness of a deep breathing exercises approach to manage bruxism among a cohort of dental students with self-reported bruxism.

Methods: This experimental study was conducted in two phases among 48 undergraduate dental students in the preclinical and clinical years who self-reported bruxism as well exhibited common signs and symptoms of bruxism. Following their response to a pre-validated questionnaire which assessed the presence of bruxism as well as perceived stress the eligible participants were examined for common signs and symptoms of bruxism to confirm the diagnosis. In phase two, following informed consent the participants were asked to perform a 10-minute deep breathing exercise protocol once daily for a period of four weeks. The occlusal Bite force was evaluated using Flexiforce® (Tekscan) device pre- and post- intervention and data were compared and analyzed using JMP statistical software.

Results: The results demonstrated that 25.3% of the dental students at KSAU-HS had bruxism. Moreover, the most common sign of bruxism was linea alba (cheek bite keratosis) which has been found in 76% of our participants. Paired sample t-test showed a statistically significant difference, and the mean post intervention bite force was found to be 65.6 N less than the pre- intervention values, and a p value of < 0.0001. However, there was no significant difference between the pre- and post-intervention perceived stress levels among the participants.

Conclusion: Breathing exercises have been effective in decreasing the occlusal bite force of patients diagnosed with bruxism thus we recommend considering them an effective adjunctive therapy to treat bruxism and incorporate them into the clinical practice.

***Keywords:** Perceived Stress; Occlusal Bite Force; Parafunctional Habits; Behavioral Therapy; Bruxism; Dental Students; Perceived Stress; Breathing Exercises*

Abbreviations

EMG: Electromyography; PSG: Polysomnography; ELF: The Economical Load and Force Measurement System; TMD: Temporomandibular Disorder; COD: College of Dentistry; KSAU-HS: King Saud Bin Abdulaziz University for Health Sciences; KAIMRC: King Abdullah International Medical Research Center; PSM-9: Perceived Stress Measure

Introduction

Bruxism is a multifactorial functional disorder characterized mostly by grinding, and clenching, causing muscles hyperactivity [1]. It has been reported that temporomandibular pain affects approximately 10% of the adult population and is considered to be the most common chronic orofacial pain condition [2]. Bruxism is diagnosed by the presence of aligned dental wear associated with the presence of one of the following signs or symptoms: self-report of tooth-clenching, tenderness of masticatory muscles, discomfort in the jaw muscles upon waking [1].

The diagnosis of bruxism can be based on multiple aspects such as history taking, self-reported questionnaire, clinical examination, and recording the muscle activity and patient sleep by using electromyography (EMG) and polysomnography (PSG) [3]. The reliability of the self-report method alone to determine the existence of sleep bruxism has been demonstrated to be low [3]. Bite force evaluation is considered an important parameter to evaluate the efficacy of the masticatory system and Multiple devices have been used to assess it one of them is FlexiForce (Tekscan, Inc., South Boston, USA) [4,5]. Which consist of three parts a thin plastic piezoelectric sensor, Windows-based software, and a USB- interface electronic handle, all parts together are called the Economical Load and Force Measurement (ELF) system which is user friendly and cost effective. The sensors are small and ultrathin which makes them fit in the dental arch easily, moreover, they can measure up to 4500 N [4,5].

Different therapies have been suggested to manage bruxism, such as behavioral techniques, intraoral devices, and medications, yet the scientific evidence on their effectiveness is relatively limited [6]. Sometimes, a clinical assessment is needed to rule out any medical disorder or medication that could be behind the appearance of bruxism (secondary bruxism) in certain patients [6]. Counselling on relaxation techniques has been suggested as the first step in the therapeutic intervention and is considered not harmful, despite the insufficient evidence of its efficacy [6]. A review of literature analyzing seven different treatment interventions of physical therapy, including cognitive behavioral therapy, therapeutic exercises, and muscular relaxation concluded very low-quality evidence in improving muscle pain and activity, stress, and anxiety in patients with bruxism, and this is mainly due to poor methodological quality of the studies included in the articles [7]. According to Perciavalle., *et al*. deep breathing exercises have a positive effect on mood and stress reduction using self-reported surveys [8].

According to Al-Sowygh, dental students displayed relatively high perceived stress scores and the more they advanced in their studies the higher their stress scores. Moreover, bruxism has been associated with higher levels of emotional stress, so when the stress increases the signs and symptoms of bruxism get worse [1,9]. A study done by Shokry., *et al*. among dental students in Saudi Arabia concluded the presence of Temporomandibular Disorder (TMD) symptoms among the participants who self-reported bruxism [10] the stressors affecting the participants included time and schedule pressures, management of clinics and uncooperative patients, and the extremely technical and intensive nature of work. These factors may result in more stressful days that would result in inadequate sleep leading to bruxism [10].

Although, the current literature focused on multiple strategies for the management of bruxism including the occlusal intervention, behavioral approach, and pharmacological approach; there is a paucity of scientific proof regarding their effectiveness [6].

Aim of the Study

Therefore, in this study we aim to assess the effectiveness of deep breathing exercises approach to manage bruxism among a group of dental students from different levels.

Materials and Methods

Study design

A quasi-experimental study was used to study the effectiveness of deep breathing exercise on bruxism among dental students at King Saud Bin Abdulaziz University for Health Sciences (KSAU-HS), Riyadh, Saudi Arabia.

Study population

The study was conducted in the open dental clinics ground and first floor of College of Dentistry (COD), King Saud Bin Abdulaziz University for Health Sciences (KSAU-HS), Riyadh, Saudi Arabia. The ethical approval from the IRB office Of King Abdullah International Medical Research Center (KAIMRC) was obtained prior to the commencement of this study. The study was targeted initially to all the 397 dental students of COD, KSAU-HS to see the prevalence of self-reported bruxism and based on previous literature it was estimated that around 31.1% or 123 students might present with bruxism [10]. The participants included in the study were dental students at COD, KSAU-HS that were not aware of any medical problems and reported having bruxism such as teeth grinding. On the other hand, students having orofacial pain related to dental, systemic, traumatic, or neuropathic origin, degenerative diseases, periodontal disorders, pregnant, removable prosthodontic appliances, orthodontic appliances, using medications such as (sedative, anxiolytics) were excluded from the study as these would have had an effect on the outcome of the breathing exercises and the bite force readings due to disruption of equal force distribution.

Questionnaire

The study was conducted in two phases. In the first phase, a pre-validated questionnaire was distributed among male and female dental students to assess the presence of bruxism and its related factors [11]. The questionnaire consisted of two sections. The First section was about the demographic data which included age, gender, level of education and the students' identification number.

The second part was assessing the prevalence of bruxism and it consisted of eight questions pre-validated questionnaire from a study done by Wincor., *et al*. in 2010 that examined any possible associations between self-reported bruxism, stress, desirability of control, dental anxiety, and gagging. The questions checked if the participants had signs or symptoms such as clicking, grinding, tooth wear or pain in the jaw and the temple, etc. The questionnaire refers to what the participants experienced during the past 6 months, the participant can answer with yes, no, and I don't know for each question. Respondents were scored as suffering from active sleep bruxism if their answer was (yes) to question 1 and/or question 2, in addition to at least one (yes) answer to a symptom listed in question 3 [12].

The third outcome was evaluating the degree of stress affecting the participants using the 9-item Perceived Stress Measure (PSM-9) which is a validated survey that reports the level of stress on an 8-point scale (1=not at all, 8=extremely) by asking about the feelings and thoughts that the participants might have experience in the past month [13]. After that, the outcome was analyzed by taking the sum of the 9 items. After that the participants who consented to participate in the second phase of the study were assigned with a reference number. Based on the data collected using the questionnaire, potential candidates were contacted for further clinical examination to confirm the diagnostic criteria of bruxism (that was discussed previously in the literature and only those who didn't meet the inclusion criteria were excluded in the second phase of the study).

Exposure

In the second phase of the study, after the examination the participants were instructed to perform deep breathing exercise once a day before bedtime for a period of four weeks. The exercise was based on a study that was done by Alzahem., *et al.* in 2015, where participants were instructed to inhale from right nose opening deeply and hold for 5 - 6 seconds, then exhale slowly from left nose opening, after that inhale from left and exhale from the right nose and so on for 10 minutes [14]. The participants' performance was tracked everyday through a diary writing checklist that was documented by the participants. This is was done to ensure patients compliance and minimize any bias.

Data collection

The effectiveness of these exercises was evaluated using two outcome measures. These outcomes were recorded at two points of time, the pre-intervention (R1), the post-intervention records were taken after 6 weeks of preforming the exercises (R2). The bite force was measured from both right and left side using Flexiforce® (Tekscan, Inc., South Boston, USA) device through a sensor that calibrated the bite force in newton and the data was analyzed as a continuous measurement. (R1) and (R2) were taken by two calibrated examiners to minimize bias.

Statistical analysis

The readings were recorded using the reference number to the data collection sheet. All the readings were transferred into excel by an independent examiner and the data were coded, cleaned and analyzed using JMP statistical software. All variables were summarized and reported using descriptive statistics. The pre and post intervention bite force readings were summarized and reported in terms of mean and standard deviation. Categorical variables such as gender and educational level were summarized and reported in terms of frequency of distribution. All categorical and interval variables were compared statistically using Chi-Square test for independence and paired sample T-test, respectively. All statistical tests were declared significant at α level of 0.05 or less.

Results

After distributing the questionnaire among the 397 dental students to assess the prevalence of Bruxism, 367 responses were collected, the analysis of the questionnaire revealed that 93 students (25.3%) had self-reported bruxism with at least one symptom and their distribution can be seen in table 1. Out of which 77 agreed to participate in the intervention and after the clinical examination 29 were excluded due to the following reasons: Medications (5), nightguard (1), Braces (5), having no first molar (2), no show (8), and noncompliance (8). The clinical examination for signs symptoms revealed that 76% of the participants had Linea alba, 64% TMJ clicking/popping, 39% scalloped tongue and tooth wear and attrition, 20% head and neck pains, 17% masseter tenderness, and only 5% had a history of locked jaw (Figure 1). Thus, 48 participants met the inclusion criteria of the study, their age ranged from 19 - 25 years. Of these 25 were male, 23 were female, and 21 were in their pre-clinical years of study and 27 in their clinical years (Table 2).

Variable	N (%)
Age, years (mean ± SD)	(21.55 ± 1.23) (19 - 25)
Gender	
Male	44 (47.3%)
Female	49 (52.7%)
Year of study	
Pre clinical	51 (54.84%)
Clinical	42 (45.16%)

***Table 1:** Prevalence of self-reported bruxism among dental students.*

Variable	N (%)
Age, years (mean ± SD)	(21.55 ± 1.23) (19 - 25)
Gender	
Male	25 (52.1%)
Female	23 (47.9%)
Batch	
Preclinical	27 (56.25%)
Clinical	21 (43.75%)

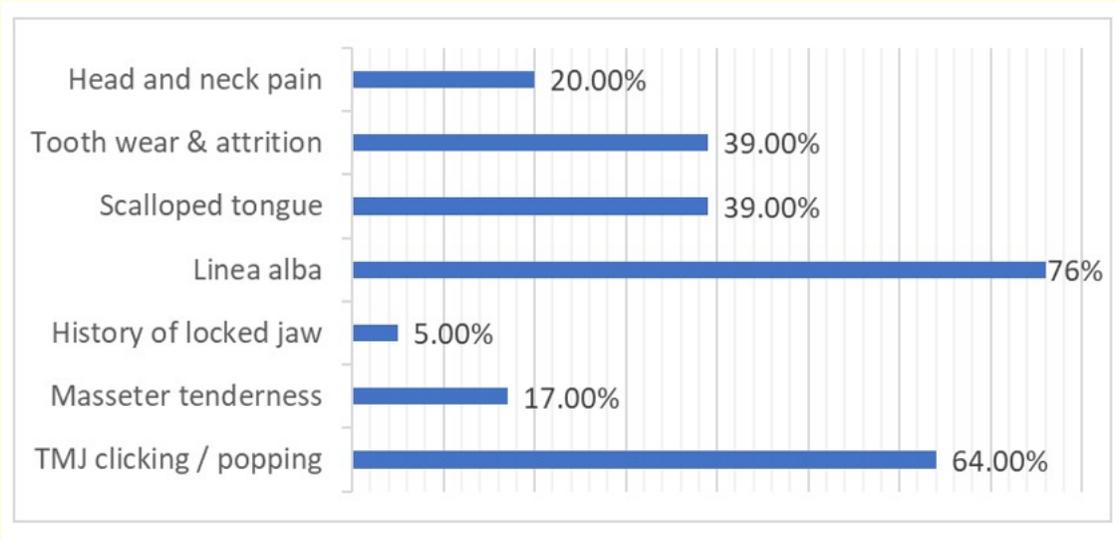***Table 2:*** *Descriptive data of the sample.*

Figure 1: *The revealed diagnostic symptoms of bruxism among participants after clinical examination.*

The bite force at pre-intervention was found to be higher than those at post intervention in both left and right sides. Moreover, there was significant difference at 95% confidence levels in the pre and post intervention biteforce for the right side with a reduction of 65.67 N and a p value of < 0.0001. Similarly, the left side biteforce measurements showed that there was significant difference (p < 0.05) between the pre and post intervention. With a mean difference of -66.1. Nevertheless, there was no significant difference between the left and right biteforce at both times. No significant difference in bite force was found based on gender, yet it showed significant difference among which year of study.

Regarding perceived stress levels, there was no significant difference at 95% confidence levels between the pre and post intervention stress levels. Lastly, table 3 summarizes the statistical data mentioned above.

Variable	Pre-intervention	Post-intervention	Mean differance	Std Error	T-test P value
Bite force Left	223.92 ± 126.01 N	157.81 ± 112.03 N	-66.1	14.27	< 0.0001
Bite Force Right	226.21 ± 123.45 N	160.54 ± 107.03 N	-65.67	14.55	< 0.0001
Stress level	44.04	43.13	-0.913	1.37	0.25

Table 3: *Bite force and stress level pre and post- intervention.*

Discussion

One of the most widely used methods to assess the prevalence of bruxism is using questionnaires or self-reporting which may not be the most accurate way, thus the presence of bruxism was confirmed using a clinical examination to assess multiple signs and symptoms, the most common one being linea alba (cheek bite keratosis) which was found in 76% of our participants and most participants had 2 to 3 symptoms (31% and 29%) respectively. Furthermore, the prevalence of bruxism among our sample (25.3%) was less than in a study done by Shokry., *et al.* (31.1%) [10].

Flexiforce (Tekscan, Inc., South Boston, USA), a Piezoelectric transducer, that is readily available commercially, with a Coefficient of Variation around 5.6%. which was less accurate than a conventional load cell (CV 1%), but accurate enough to be used in the study of bite force [4,15] it has the advantage of being small and thin and easy to bite which will help in participants having minimal jaw opening, the sensors are sensitive, and it was recommended to protect it using a protective coating. Many methods work and a well-protected sensor can be constructed easily [15]. Each sensor must be calibrated separately; we calibrated the sensors using finger pressure [15].

Our results showed a decrease in the bite force following the intervention. the results are similar to an article was done by Alkan., *et al.* where they investigated the short-term effects of occlusal splint therapy, a maxillary full-coverage hard acrylic splint was applied to the five patients and it was observed that the occlusal contact area and bite force decreased with treatment [16]. In addition, they stated that There were significant differences in the bite force and occlusal contact area between pre-treatment and at 3 months of treatment [16]. That confirms our findings and support the use of deep breathing exercises as well as splint therapy to manage bruxism.

On the other hand, we found no significant difference in the perceived stress levels pre and post intervention among our participants but that could be due to the short study period we had (four weeks), or the proximity of the post intervention response to the participants' exam periods.

Limitations of the Study

Participants' compliance was a major limitation of this study since it was conducted during the stressful times of the COVID-19 pandemic, another factor is the duration of these exercise which some of the participants found to be longer than anticipated, which lead to a lack of compliance leading to the exclusion of these participants from the sample. Furthermore, the duration of the study did not allow us to explore the long-term effects of this exercise in comparison to different exercise protocols, exercise duration and interval of the exercise regimen (every other day, twice a day etc.). lastly, although the elf system can measure high occlusal bite forces, its accuracy was doubted in previous studies [15] yet we found it acceptable due to the fact that it gave us constant and reliable readings when repeated by both examiners. (the study group diversity only dental students).

Future Recommendations

We advise a good protocol for monitoring and motivating participants to ensure compliance, further investigations of this measurement method involving a control group, larger diverse study population and a longer follow-up period. Additionally, we suggest compar-

ing different treatment options such as medications, and occlusal splint therapy and deep breathing exercise or a combination of these methods over a longer period to determine an effective approach to manage bruxism. Lastly, we suggest the use of a more reliable method to measure the effectiveness of these approaches.

Conclusion

Based on our results, breathing exercises have been effective in decreasing the occlusal bite force of patients diagnosed with bruxism thus we recommend considering them an effective adjunctive therapy to treat bruxism and incorporate them into the clinical practice.

Acknowledgements

Conflict of Interest

The author reports no conflicts of interest in this work. This research did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethics Statement

The ethical approval from the IRB office Of King Abdullah International Medical Research Center (KAIMRC) was obtained prior to the commencement of this study, as well as the consent of the study participants.

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