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Effect of Bruxism and Gender on Maximal Bite Force

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Abstract

This research was done to evaluate the effect of gender and bruxism on maximal bite force in the population of Ahmedabad, Gujarat. The examination of all patients was done to evaluate the presence of bruxism. For group establishment, each individual has gone through initial anamnesis where they were divided into four groups namely: bruxists, non-bruxists, male and female. The maximal bite force was recorded using gnathodynamometer at first molar on each side. The highest value was recorded. The mean bite force was statistically higher for bruxists and males. The use of gnathodynamometer could help and evaluate the presence of such habits and the patients can be counselled about this well in advance before this condition affects the dentition and later leads to breakdown of dentition.

Keywords: Bite Force, Bruxism, Parafunctional Habit, Gnathodynamometer.

Introduction

Bruxism is defined as the repetitive jaw muscle activity characterized by the clenching or grinding of teeth. It can be categorized into a wake bruxism (AB) and sleep bruxism (SB). When the intensity of forces of the activity exceeds past the adaptive capacity of the system it has shown to have detrimental effects on the structural integrity of stomatognathic system by this sleep related movement disorder. In earliest of 19th century the first scientific surveys were conducted and the term "la bruxomaine "was first introduced in the year 1907 by Marie and Pietkiewiczin. (1)

In dentistry, bruxism has gained a particular importance because it leads to effects like breakdown of restoration, damage to hard tissues, muscle pain and also in some cases temporomandibular joint disorders. (2)

Patients with periodontal disease have shown to have higher incidence of bruxism. (3) "Jaw play" like oral tissue biting, nail biting, foreign object biting and clenching are

the parafunctional activities that could be collectively called as “jaw hyperactivity”. [4]

Many techniques are available for diagnosis of bruxism ranging from questionnaires, clinical assessment (tooth wear and tooth wear index), ambulatory EMG monitoring, detection of bite force, wear facets on intraoral appliance and full audio-video Polysomnography. Polysomnography is considered the gold standard diagnostic tecnique. However, PSG is very costly and time consuming for data evaluation. [5]

Bite force is generated as a result of coordination between different components of masticatory system (muscles, bones and teeth) and determination of bite force is important in diagnosing any disturbance in stomatognathic system. The capacity of mandibular elevator muscles to perform maximum strain of mandibular teeth against maxillary teeth under favourable condition and the force generated is what we know as maximum bite force. The probable relationship between bite force and bruxism is uncertain. It has also been suggested that gender plays a key role in the maximum bite force. Based on that, the aim of this study is to determine the influence of gender and bruxism on the maximum bite force. [6]

Material and Method

Sample: A convenience sampling of forty adults from both genders, bruxists as well as non bruxists were selected from the age group of 20-45 years. The subjects were divided into 4 groups according to gender and presence of bruxism.

The subjects were recruited among graduate students of Government dental college and hospital, Ahmedabad as well as patients seeking for regular dental treatment at the hospital. Initially, all individuals were submitted to an initial anamnesis (personal profile, general questions about systemic diseases, as well as a questionnaire about parafunctional habits) and an intraoral physical examination, all performed by the same examiner.

Exclusion Criteria

The exclusion criteria were:

- History of oral and maxillofacial surgery
- Presence of neurological, psychiatric or motor disorder.
- TMD treatment and use of medicines at the moment of the research
- Removable or fixed partial or total oral prosthesis,
- Large facial skeletal alterations (typical Class II and Class III individuals),
- Treatment with regard to occlusal splint
- More than two missing posterior teeth (excluding 3rd molars)
- Presence of gross malocclusion, specifically: anterior open bite, unilateral cross bite, over jet higher than 6 mm, closing arc interference that results in a difference from centric relation to maximum intercuspation higher than 5mm.

Inclusion Criteria

The inclusion criteria included:

- Intact dental arch with no more than two posterior teeth missing (excluding of 3rd molars).
- Presence of no more than three fillings.
- Class 1 neutro-occlusion according to Angle’s classification with bilateral simultaneous contact)

Clinical Questionnaire

After that, a specific questionnaire, suggested by Molina, et al., in 1999 was performed which included [7]:

1. Do you wake up in the morning or during the night grinding or clenching?

2. Do you feel fatigue or masticatory muscle pain on awakening?

3. Do you wake up in the morning or during the night with the jaws locked?

4. Do you feel discomfort on the teeth on awakening?

5. Do you have recent history of chronic dislocation of permanent or temporary restorations?

6. Do you have recent history (last six months) of noises associated with nocturnal teeth grinding as reported by a third person?

Physical Examination

Physical examination included observation of:

1. Attrition on occlusal or incisal surfaces.
2. Detectable scars and changes in buccal mucosa.
3. Indentations on lateral border of tongue.
4. Hypertrophy of masticatory muscle was verified by means of digital palpation in maximum intercuspation.

After this process, the subjects included in this study in terms of presence or absence of bruxism were divided into two groups: the study and the control group. The study group consisted of 20 subjects with bruxism (study group) and 20 subjects without bruxism (control group) with age group of 20-45 yrs. Further this group was subdivided based on gender as male group and female group. Information about the research goal and objectives, as well as about the procedures to be conducted was provided to all individuals.

Procedure

Bite force was measured by a digital dynamometer adapted for oral conditions. This appliance is an instrument which is used for measuring force and uses electronic technology and comprises of bite fork and digital body. The appliance presents a scale in kg or N, selector switch for the traction or compression functions, a button for 'set zero' and a selector switch for the 'peak' option. The 'set zero' allows the values obtained to be accurately controlled. The position 'peak' records and saves the greatest force applied during the test.

Digital Dynamometer

Before recording the bite force, the individuals were seated in upright position and previously trained to perform their strongest bite on the device. The bite fork of gnathodynamometer was covered with plastic sleeve that acts as a barrier against subject's contamination. The measurements were performed bilaterally over 1st molar region on right and left side and the highest value was recorded as maximum bite force on both the sides in kg.

BITE FORCE VALUES WERE RECORDED BILATERALLY ON 1ST MOLAR REGION

Results

The distribution of mean age for the sample is shown in Table 1. The mean values of maximum bite force, by group and gender, and respective standard deviations, are shown on Table 2 and Table 3.

Table 1: Mean Of Age (In Years) In Each Group

Group	Male	Female
Bruxist	35	34
Non Bruxist	34	25

Table 2: Mean And Standard Deviation Of Bite Force Obtained From Bruxist

Side	Gender	Maximum Bite Force	Mean of Bite Force	Standard Deviation	P Value
Right	Male	52.348kg	47.9766	3.584715	<0.001
	Female	43.458kg	36.6034	7.184164	
Left	Male	54.708kg	48.1757	4.358631	<0.001
	Female	42.376kg	36.7013	6.190377	

Table 3: Mean And Standard Deviation Of Bite Force Obtained From Non-Bruxist

Side	Gender	Maximum Bite Force	Mean Of Bite Force	Standard Deviation	P Value
Right	Male	46.708kg	39.87760	4.524750	<0.00
	Female	37.702kg	30.96140	3.823880	1
Left	Male	45.607kg	40.71210	3.915799	<0.00
	Female	35.802kg	30.50040	3.913975	1

The highest bite force value in the female non-bruxist group was 37.702kg, and lowest value was 24.132kg. For the male non-bruxist group, such values were, respectively, 46.708kg and 32.187kg. For the female bruxist group, the highest maximum bite force value was 43.458kg, whereas the lowest value was 17.510kg (this was lowest value obtained in the research). For the male bruxist group, the highest value was 54.708kg (this was the highest value obtained on this research), and the lowest value for this group was 41.348kg. A two-way ANOVA test was conducted and it was observed that there was a significant difference ($p<0.001$) in the bite force of patients with bruxism and subjects without bruxism. There was also a significant difference ($p<0.001$) between the genders.

Discussion

A correlation between bite force and Para functional habits i.e. bruxism has been proven by many studies. However, all these studies differ in their approach and their findings. It is very important to consider the factors taken into account while conducting and evaluating these studies. The hypothesis that bruxism is capable to change the bite force by muscle strengthening is still unproved. If the bite force was truly influenced by bruxism, its measurement could be an important feature in the diagnosis of such habit.

A number of studies found higher maximum bite force values for males, in agreement with the present study. [8,9]

A significant differences on the maximum bite force between genders merely for the molar region was identified by Waltimo and Kononen, in 1993, which can perhaps be described by the fact that the bite force on the incisal area could be restricted by the periodontal ligament sensitivity and not by the muscle strength, as in the posterior area of the mouth. [9]

Raadsheer et al. also could not find differences between genders when gauging bite force between canines. He also evaluated the contribution of masseter, temporal and anterior belly of the digastric muscles thickness to human bite force magnitude, and found that the masseter thickness showed significant correlation with the bite force magnitude. [10]

Some authors [8,9] stated that male present higher maximum bite force due to higher muscle strength, while Bakke, et al., found positive correlation between the thickness of masseter muscle and the bite force. [11]

In principle, the strength of the mandibular elevator muscles in terms of maximum bite force differs in much the same way for age and gender. [12] The gender-related difference found in bite force may be a result of anatomic differences. Men's masseter muscles have type II fibers with larger diameter and sectional area than those of women, suggesting that hormonal differences might contribute to the composition of the muscle fibers. [13]

Nunes, conducted a research on the association between sleep bruxism and TMD, and found that TMD individuals are more likely to have pain after bruxism than the control group individuals (asymptomatic bruxists), which could indicate two possibilities: asymptomatic bruxists could be more resistant to fatigue and pain than the experimental group individuals, or a pre-existent TMD process would be required to trigger the pain in bruxists. For symptomatic group, pain plays a modulator role in parafunctional activity, decreasing the EMG activity of masticatory muscles. For the asymptomatic group, on the other hand, the habit (bruxism) would cause dental wear and/or muscle hypertrophy. [14]

Some studies suggested that the jaw-closing muscles of bruxists might have profited from a “training effect” as a result of all this activity, resulting in muscles that are stronger and possibly more resistant to fatigue. [15,16]

Helkimo E Ingervall also found that individuals with clenching and grinding habits were found to have higher bite force only on the incisors, but not on the molars. This happens because the habits are normally performed in noncentric positions, when the required muscles of these positions are exercised (which happens when bite force in the anterior regions are measured), and not in a centric position (which happens when the posterior regions are measured). [17]

Gibbs, et al. found higher bite force values on the posterior region for bruxists than for the control group. Gender distribution and age of the sample, however, were not reported in that study. [18] Also, the bilateral gnathodynamometer used was judged by Tortopidis, et al as the device that has the greatest variability of repeated bite force measurements. [19]

A recent study concludes that maximal bite force was significantly higher in the subjects with bruxism compared to those without bruxism, occlusal contact area was significantly higher in the subjects suffering from bruxism. Maximal bite force was significantly higher in the males compared to the females in all segments of the research. [20]

However, Cosme et al. did not find a noteworthy difference of bite force between persons with bruxism and those without it. [21]

Alkan et al. monitored MBF values in persons with bruxism before and after stabilization splint treatment. They found that the occlusal contact area and bite force decline in patients using a splint for three months. [22] Similar results were demonstrated by Kurita et al.and Karakis et al. [23]

The gold standard diagnostic method for bruxism is the use of polysomnographic recordings in a specialized sleep laboratory. [24] Some studies compared clinical outcomes with the results of polysomnography to diagnose bruxism and found that the clinical criteria had a reliability of 83% in patients with bruxism and 81% in asymptomatic control subjects. [25]

Baba et al. did not find any associations between tooth wear status and ongoing bruxism. Therefore, an insufficient reliability of clinical methods in the diagnosis of bruxism may somewhat affect the results of this study. [26]

Conclusion

Bruxism influences the increase of MBF. Therefore, registration of MBF can be used in the diagnosis and analysis of pathophysiological events during bruxism. Gender is a significant determinant of bite force, which is why gender variance must be taken into account during analysis of MBF. These results may be considered as an initiative calling for further research for the sake of complete clarification of bruxism and its impact on the stomatognathic system.

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