

THE INFLUENCE OF GENDER AND BRUXISM ON HUMAN MINIMUM INTERDENTAL THRESHOLD ABILITY

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ABSTRACT

Objective: To evaluate the influence of gender and bruxism on the ability to discriminate minimum interdental threshold. Material and methods: One hundred and fifteen individuals, representing both genders, bruxers and non-bruxers, with a mean age of 23.64 years, were selected for this study. For group allocation, every individual was subjected to a specific physical examination to detect bruxism (performed by three different examiners). Evaluation of the ability to discriminate minimum interdental threshold was performed using industrialized 0.010 mm-, 0.024 mm-, 0.030 mm-, 0.050 mm-, 0.080 mm- and 0.094 mm-thick aluminum foils that were placed between upper and lower premolars. Data were analyzed statistically by multiple linear regression analysis at 5% significance level. Results: Neither gender nor bruxism influenced the ability to discriminate minimum interdental threshold ($p>0.05$). Conclusion: Gender and the presence of bruxism do not play a role in the minimum interdental threshold.

Key words: Bruxism. Differential threshold.

INTRODUCTION

Epidemiological surveys carried out both in the student population⁴ and in the general population⁸ report that 6 to 20% of adults exhibit tooth clenching or grinding. Bruxism is a harmful oral habit¹⁴ in which excessive occlusal force is applied to the teeth¹².

Sensory receptors found in the periodontium are closely involved in different oral reflexes, including control of the masticatory muscles¹⁸. These receptors are known as periodontal mechanoreceptors and intradental mechanoreceptors¹⁸, and are responsible for the periodontal sensation, which can be measured through two different methods. One method measures the detection of forces applied to the teeth using monofilaments (von Frey hair)^{5,10}, and it refers to the minimal force that can be detected. The other method measures detection of the thickness of small objects such as strips placed between maxillary and mandibular teeth^{5,19}, and it is related to the minimal thickness that can be detected.

An important factor in the neuromuscular system of the maxilla is the minimum interdental threshold ability. Minimum interdental threshold ability corresponds to the individuals' ability to detect objects between the teeth during intercusp

occlusion, and it is of extreme importance in regulating occlusal forces, changes in objects placed between the dental arches and controlling mandibular movements, mainly during the opening reflex of the mandible¹.

Many studies have reported minimum interdental threshold ability by applying different psychophysical methods to individuals with natural and artificial dentition^{3,15,20}. These studies have shown that the human being is very sensitive to small dimensional changes in objects between the dental arches. Minimum interdental threshold values ranging between 8 and 60 mm have been observed in dentate individuals^{15,19,20}. The sensorial receptors associated with this process are located in the periodontium, temporomandibular joints (mechanoreceptors) and muscles (muscle spindles). As excessive occlusal force is applied to the teeth for long periods of time during the night, periodontal sensation in bruxers may differ from that in non-bruxers¹⁷.

Several studies demonstrating the differences that exist in the minimum interdental threshold ability of natural dentition versus various types of prosthetic replacements have been discussed in the literature^{6,16,19}. It has not yet been established, however, whether the minimum interdental threshold can be altered by bruxism. Therefore, the aim of the present study was to assess whether there are changes in

the minimum interdental threshold ability in patients with bruxism.

MATERIAL AND METHODS

The local Research Ethics Committee analyzed and approved this research prior to its beginning (Process n. 146/2002).

Sample Selection

All individuals were properly informed of the study design and the procedures to be carried out by reading an information letter and signed an informed consent form, in which they agreed to participate in the research as volunteers. Recruitment of individuals was done among the Dental School of Bauru employees, dental students and graduate students, and patients attending regular dental treatment clinics.

Initially, all individuals were submitted to a clinical interview (personal profile, general questionnaire about systemic diseases, as well as a questionnaire about parafunctional habits) and an intraoral clinical examination, both performed by the same examiner.

The following questionnaire arguing about temporomandibular disorders (TMDs) was presented to all participants in order to detect the presence of TMD, as an initial exclusion criterion for the present study.

1. Do you have difficulty opening your mouth?
2. Do you have difficulty with mandible side movements?
3. Do you feel discomfort or muscle pain when chewing?
4. Do you have frequent headaches?
5. Do you have neck and/or shoulder pain?
6. Do you have pain in or near the ear?
7. Do you feel any temporomandibular joint noise?
8. Does your occlusion feel "abnormal"?
9. Do you use only one side of your mouth to chew?
10. Do you have face pain when awakening?

Each question offered three answer options: YES, NO and SOMETIMES. Each YES received score 2, each SOMETIMES received score 1 and each NO received score 0. Questions 6 and 7 received score 3 for each YES, corresponding to bilateral symptoms, and score 2 for unilateral symptoms. Question 4 received score 3 when frequent and intense pain was reported².

The sum of the obtained scores allowed sample

classification as: no TMD (total score from 0 to 3), mild TMD (total score from 4 to 8), moderate TMD (total score from 9 to 14) and severe TMD (total score from 15 to 23).

After TMD screening, the following initial exclusion criteria, based on AADS, Lavigne et al., 1996⁹ recommendations, were applied to all participants:

1. More than two missing posterior teeth (excluding third molars);
2. Presence of removable dental prosthesis;
3. Presence of gross malocclusion, specifically: anterior open bite, unilateral cross bite, overjet greater than 6 mm, or closing arch interference that results in a central relation to maximal intercuspation difference higher than 5 mm (TMD development occlusion risk factors, according to Pullinger et al., 1993)¹³.
4. Presence of major neurological, psychiatric or motor disorders⁷.
5. Score >8 on the TMD questionnaire.

The following inclusion criteria were applied to all participants:

1. Age between 14 and 45 years;
2. Presence of all first molars, natural or restored;
3. Score =8 on the TMD questionnaire.

After this process, and distribution according to gender and the presence of bruxism, 115 individuals were selected.

Group Establishment Based on the Presence of Bruxism

A specific questionnaire (Figure 1) based on the one used by Molina et al.¹¹, followed by a specific physical examination, was applied in order to determine the presence of bruxism. Three graduate student examiners, previously calibrated for muscle location and for the amount of pressure to be applied, performed the physical examinations.

Both the questionnaire and the physical examination were performed on the same day by the three examiners, who were blinded to the results and individuals' classifications.

The three examiners performed the physical exams for the detection of bruxism based on the criteria recommended by Lavigne, et al.⁹:

1. Coincident tooth wear;
2. Shiny spots on restorations;
3. Masseter muscle hypertrophy upon digital palpation (scored positive if the muscle volume approximately tripled upon a voluntary clench in maximal intercuspation position).

Each participant was examined by each of the three

1. Do you wake up in the morning or in the night grinding or clenching?
2. Do you feel fatigue or masticatory muscle pain upon awakening?
3. Do you wake up in the morning or in the night with locked jaws?
4. Do you feel discomfort of the teeth upon awakening?
5. Do you have a recent history of chronic dislocation of permanent or temporary restorations?
6. Do you have a recent history (last six months) of noises associated with nocturnal tooth grinding as reported by a third person?

FIGURE 1- Bruxism questionnaire

examiners, and the final diagnosis, bruxer or non bruxer, had to be agreed by the majority of examiners.

The Kappa test was used to determine concordance between examiners for bruxism physical examination. Agreement between examiners for the physical examination detecting bruxism was considered optimal (Kappa value between examiners 1 and 2 = 0.77; Kappa value between examiners 1 and 3 = 0.64; Kappa value between examiners 2 and 3 = 0.62).

The participants ranged in age from 14 to 37 years old. Table 1 presents the mean age (in years) for each group according to the gender.

Minimum Interdental Threshold Assessment

Aluminum foils (CBA, Companhia Brasileira de Aluminium, Sao Paulo, Brazil) with thicknesses of 0.010 mm, 0.024 mm, 0.030 mm, 0.050 mm, 0.080 mm and 0.094 mm, as measured with a digital caliper (Mitutoyo, Mitutoyo do Brasil Ind Com Ltda Sao Paulo, Brazil), were used to determine the minimum interdental threshold.

Before starting the experiment, subjects were instructed that the foil could be present or not (sham insertion) between the teeth. After this, individuals were instructed to relax, concentrate and keep their eyes closed to eliminate any external interference. The aluminum strip was then inserted between the upper and lower premolars¹⁹ (Figure 2) and subjects were requested to answer “YES” or “NO” for the presence or absence of the foil.

The test started with the thickest foil (0.094 mm) decreasing gradually the thickness to the thinnest one (0.010 mm)¹⁹. Twenty insertions for each foil thickness (real and sham insertions) were performed totalizing 120 tests for each individual.

Next, all possible answer combinations were considered:

(YES +, the real positive), (YES -, the false-positive), (NO +, the false-negative) and (NO -, the real negative). The combination (YES+) indicated that the subject perceived the foil that was in fact placed between her teeth. The combination (YES -) means that the individual perceived the foil between the teeth, although nothing was inserted, while (NO +) indicated that the individual failed to recognize the foil in a positive test, and (NO -) indicated a negative response to a test that was also negative.

The sensibility frequency is the result given as a percentage of a YES answer among positive trials (F(YES, +)). However, a F(YES,+) of 100% could be obtained for all foils by merely answering YES to all the tests, regardless of whether the foil was actually inserted or not. In order to avoid this, determination of the minimum interdental threshold ability (Fd%) was measured by the difference in the frequency of “YES” answers between positive (+) and negative (-) trials¹⁹. Yet, to allow for individual comparisons, 50% of the threshold was used by simple linear interpolation between the lowest dimension, giving an “Fd” just above 50%, and the greatest dimension, yielding an “Fd” just below 50%. Thus, the threshold of 50% interocclusal tactile sensibility of each individual was calculated as being the

TABLE 1- Mean age (in years) for each group according to the gender

Group	Female	Male	TOTAL
Control	21.65	25.07	23.36
Experimental	21.00	26.50	23.75
TOTAL	21.32	25.78	23.55



FIGURE 2- Minimum interdental threshold test, with the aluminum foil positioned in the premolar region

TABLE 2- Mean minimum interdental threshold values (in mm) for each group according to the gender the and respective standard deviations

Gender	Female	Male	ALL GROUPS
Control	0.016 (0.006)	0.013 (0.004)	
Experimental	0.013 (0.007)	0.016 (0.009)	
ALL GROUPS			0.015 (0.007)

thickness at which the curve observed intercepted the level of 50%, represented by the symbol S50¹⁹.

Statistical Analysis

Statistical analysis consisted of multiple linear regression analysis with S50 as a dependent variable, and group, gender and age as independent variables. A value of $p < 0.05$ was chosen to indicate statistical significance.

RESULTS

The mean values of the assessed minimum interdental threshold, by group and gender, and their respective standard deviations are shown in Table 2.

No statistically significant differences were found between the genders ($p = 0.84$), nor between groups ($p = 0.74$) or ages ($p = 0.88$), considering the mean S50 value as the dependent variable.

DISCUSSION

When masticating, a person is able to discriminate the dimensions and hardness of the food to be swallowed. There is also an ability to recognize the presence of very small alterations between the occluding teeth^{15,19}, such as occlusal interferences or small objects. Receptors located in the periodontal ligament, in the TMJ (mechanoreceptors), and in the muscles (muscle spindles)^{15,19} are possibly responsible for modulating this highly developed system. The presence of teeth is extremely important in this scenario, since the tactile sensibility of the receptors located in the periodontium plays an important role in the regulation of occlusal forces and mandibular movements¹.

The present results are in agreement with the sensibility curves obtained by Tryde, et al.¹⁹ who found that in patients with teeth, the percentage sensibility was directly proportional to foil thickness. So, the thinner the strip, the lesser the tactile sensitivity.

Our findings indicating no significant difference between the genders agree with those reported by Siirila and Laine¹⁵ and Enkling, et al.³, who found that, in patients with natural teeth, there was no difference in the mean minimum interdental threshold between men and women.

To the best of our knowledge, only one study has addressed the relationship between minimum interdental

threshold ability and the presence of bruxism¹⁷. These authors reported mean value of 17.1 μm (or 0.0171 mm) for bruxers, and a significantly different value of 29.9 μm (0.0299 mm) for non-bruxers. Their results¹⁷, though, disagree with those of the present study in which no difference in the minimum interdental threshold ability was found between individuals with or without bruxism. However, the results of this previous study¹⁷ are difficult to interpret because it involved several limitations, including a small sample size, a narrow subject age range (24 to 28 years) and lack of discrimination between genders. It is also important to highlight the limitations of the methodology employed in the present study as well, such as the fact that the chewing pressure and the dynamics of tactile motion cannot be standardized³.

CONCLUSION

Considering the sample utilized and the methodology employed in this study, it is possible to conclude that, in the presence of bruxism, gender and age do not seem to influence the minimum interdental threshold ability. Further investigations, incorporating a methodology that allows standardizing chewing pressure and tactile motion dynamics, are needed to confirm the present results.

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