

CLINICAL RESEARCH

Occlusal sensitivity in individuals with different frequencies of oral parafunction



Rosaria Bucci, DDS, PhD,^a Michail Koutris, DDS, PhD,^b Frank Lobbezoo, DDS, PhD,^c and Ambra Michelotti, DDS^d

Occlusal tactile perception, also known as occlusal sensitivity, is the ability to detect fine objects between antagonist teeth during maximal intercuspation.¹ It is a refined exteroceptive function of the masticatory system that relies on mechanoreceptors located in the periodontium, in the temporomandibular joint capsule, in the masticatory muscles (muscle spindles), and in the dental pulp.²⁻⁴ In a natural dentition, the minimum interdental threshold ability ranges between 8 and 60 μm .^{1,2}

Tactile information from the masticatory system plays a primary role in oral motor behaviors and refines the functions related to incising and masticating. In particular, the occlusal tactile perception provides sensory feedback that regulates the occlusal force and elicits the jaw-opening reflex during mastication.^{5,6}

The periodontal ligament, which plays a major role in this function, is innervated by sensory nerves. It contains 3 types of nerve endings: free terminations, Ruffini

ABSTRACT

Statement of problem. Oral parafunctional behaviors are characterized by an overuse of the masticatory muscles, thus applying aberrant occlusal force to the teeth for prolonged periods. However, whether increased periodontal receptor activity in individuals with a high degree of oral parafunction alters the occlusal sensitivity is unclear.

Purpose. The purpose of this clinical study was to evaluate occlusal sensitivity in adults reporting a high or low frequency of awake oral parafunctional behaviors, as assessed with the short version of the oral behavior checklist (OBC-It 6).

Material and methods. Self-reporting questionnaires (N=212) were distributed among dental and medical students. Individuals with an OBC-It 6 score below the 20th percentile (low-frequency parafunction [LFP] group: 13 men and 15 women) and above the 80th percentile (high-frequency parafunction [HFP] group: 11 men and 17 women) were selected for the occlusal sensitivity assessment. The occlusal sensitivity was tested with 10 different thicknesses: 9 aluminum foils ranging from 8 μm to 72 μm with a constant increment of 8 μm and 1 sham test without any foil. The testing foils were presented 10 times in random order (100 tests in total). The participants were instructed to close their mouth only once and to report whether they felt the aluminum foil between their teeth. A between-group comparison (HFP versus LFP) was performed for each testing thickness (Student *t* test for unpaired data, Bonferroni correction) ($\alpha=.005$).

Results. For the sham test and for the testing thicknesses between 8 μm and 48 μm , no statistically significant differences were found between the 2 groups. The thicknesses 0.56 mm, 0.64 mm, and 0.72 mm were significantly better perceived in the HFP group than in the LFP group ($P<.005$, $P<.001$, and $P<.001$).

Conclusions. Individuals with a high frequency of self-reported awake oral parafunction presented higher occlusal sensitivity. (J Prosthet Dent 2019;122:119-22)

corpuscles, and lamellar bodies.^{2,7} The mechanoreceptors in the periodontal ligament allow a continuous transfer of information about the direction and magnitude of the forces applied to each tooth.⁸ Therefore, if the

^aPost-doctoral Research Fellow, Department of Neurosciences, Reproductive Sciences and Oral Sciences, School of Orthodontics and Temporomandibular Disorders, University of Naples Federico II, Naples, Italy.

^bAssistant Professor, Department of Oral Kinesiology, Academic Centre for Dentistry Amsterdam (ACTA), MOVE Research Institute Amsterdam, University of Amsterdam and VU University Amsterdam, Amsterdam, the Netherlands.

^cFull Professor, Department of Oral Kinesiology, Academic Centre for Dentistry Amsterdam (ACTA), MOVE Research Institute Amsterdam, University of Amsterdam and VU University Amsterdam, Amsterdam, the Netherlands.

^dAssociate Professor, Department of Neurosciences, Reproductive Sciences and Oral Sciences, School of Orthodontics and Temporomandibular Disorders, University of Naples Federico II, Naples, Italy.

Clinical Implications

Individuals with a high degree of oral parafunctional behavior have some increased occlusal sensitivity. This might contribute to the difficulty encountered by some patients in adapting to new dental restorations.

periodontal ligament is damaged or anesthetized, some sensorimotor functions might be altered or even lost.⁹ However, in patients with removable dentures or dental implants, occlusal sensitivity is reduced but not completely lost.^{2,5,10} This implies that tissues other than the periodontal ligament are also involved in this ability. For instance, authors have reported that after anesthesia of the joint capsule receptors, a significant decrease in the perceptive ability is recorded.¹¹ Notwithstanding, psychophysical studies on the occlusal threshold have clarified that the periodontal mechanoreceptors have a greater role in determining the tactile threshold, whereas the role of the temporomandibular joint receptors appears to be minor. Muscular receptors seem more involved in the detection of larger objects for mouth openings of 5 mm and more. Pulpal receptors are only involved when using thermally conductive materials.²

Oral parafunctional behaviors are described as activities of the mouth beyond its original functions of masticating, swallowing, and talking. Awake parafunctions commonly involve clenching, pressing, touching, or holding teeth together; occluding on or playing with the tongue, cheeks, or lips; or occluding on objects between the teeth.¹²⁻¹⁴ Identifying the presence of awake oral parafunctional behaviors in the natural environment is difficult because of a tendency to be unobservable and a propensity to occur outside usual conscious awareness. Compared with sleep behaviors, awake behaviors are less reliably detectable and have no apparent pathognomonic symptoms.¹⁵

The Oral Behaviors Checklist (OBC) is a questionnaire containing items referring to a variety of not observable behaviors that are reliable when prompted.^{16,17} For this reason, this questionnaire is one of the most frequently used self-reporting instruments to assess awake oral behaviors.

As oral parafunction is often characterized by an overuse of the masticatory muscles, during these activities, aberrant occlusal forces are applied to the teeth for prolonged periods. Hence, the function of the periodontium in individuals with a range of oral parafunctional activities can be modified by the greater activity of the periodontal receptors, thus altering occlusal sensitivity.^{18,19} To the best of the authors' knowledge, studies focusing on the occlusal sensitivity in patients with different degrees of awake self-reported oral parafunctions are lacking. Therefore, the

purpose of this clinical study was to evaluate the difference in the occlusal sensitivity of individuals reporting a high or low frequency of awake oral parafunctional behaviors. The null hypothesis was that individuals with a high frequency of awake self-reported oral parafunctions do not differ in occlusal sensitivity as compared with individuals with a low frequency of those activities.

MATERIAL AND METHODS

This study was approved by the local ethical committee of the University of Naples Federico II (Protocol 57/17). Participants were recruited from dental and medical students of the University of Naples Federico II (Italy). The following were the inclusion criteria: age more than 18 years, willingness to participate in the study, and good general health. Conditions that might affect the sensitivity of the testing site were considered exclusion criteria: absence of first permanent molars, removable denture wearers, presence of severe malocclusion (such as, severe class II, severe class III, posterior reverse articulation), ongoing orthodontic treatment, presence of restorations/endodontic treatment/fixed dental prosthesis/implants on the first permanent molars, and use of drugs affecting the nervous system (such as antiepileptics or anti-Parkinson).

The participants were invited to report their frequency of awake oral parafunctions using the Italian translation of the short version of the OBC (OBC-It 6).²⁰ The 6 items included in the OBC-It 6 ("grind teeth together during waking hours," "clench teeth together during waking hours," "press, touch, and hold teeth together except while eating," "bite, chew, or play with tongue, cheeks, or lips," "hold between the teeth or bite objects," and "use chewing gum") are intended to assess the tooth-clenching-related parafunctional activities of the mouth which might influence periodontal sensation.

The distribution of the OBC-It 6 was calculated to identify 2 groups: a "high-frequency parafunction" (HFP) group (above 80th percentile) and a "low-frequency parafunction" (LFP) group (below 20th percentile). The individuals belonging to the 2 groups were assessed for their occlusal sensitivity using foils of 10 different thicknesses: 9 aluminum foils ranging from 8 μm (0.008 mm) to 72 μm (0.072 mm) with a constant increment of 8 μm and 1 sham test without any foil.²¹ The testing thicknesses and the sham test were placed in the area of the first permanent molars, preferably on the mesiobuccal cusp, and were presented 10 times in random order (100 tests in total). For each participant, the random sequence was generated using a dedicated computer software program. The participants were instructed to close their mouth only once and to report whether they felt the aluminum foil between their teeth (yes or no). The participants were not told of the existence of a sham test. To

avoid any additional information, the buccal mucosa was retracted with a mouth mirror, and headphones with white noise were used to obscure the noises produced by the foils. During the test, participants were asked to keep their eyes closed. The participants' answers were considered correct whenever they were "positive" (yes) for the real testing thicknesses and "negative" (no) for the sham test, and the percentage of correct answers for each thickness was calculated.

Group sample sizes of 28 achieve 80% power to detect a difference of -0.673 between the null hypothesis that both group means are 0.000 and the alternative hypothesis that the mean of group 2 is 0.673 with estimated group standard deviations of 1.000 and 1.000 , respectively, and with a significance level (α) of $.05$ using a 1-sided 2-sample Student *t* test. The mean percentage of correct answers for each thickness was used for the statistical analysis. The between-group comparison (HFP versus LFG) was performed for each thickness with a Student *t* test for unpaired data with Bonferroni correction using a statistical software program (IBM SPSS Statistics, v21.0; IBM Corp) ($\alpha=.005$).

RESULTS

Two hundred and twelve questionnaires were distributed to dental and medical students of the University of Naples Federico II (Naples, Italy). OBC-It 6 scores higher than or equal to 16 were identified for the HFP group, whereas OBC-It 6 scores lower than or equal to 11 were identified for the LFP group. The final sample comprised 56 individuals, equally distributed into the 2 groups (HFP group: 11 men and 17 women; LFP group: group 13 men and 15 women).

For the sham test and for the testing thicknesses between $8\ \mu\text{m}$ and $48\ \mu\text{m}$, no statistically significant differences were found between the 2 groups, whereas the thicknesses $56\ \mu\text{m}$, $64\ \mu\text{m}$, and $72\ \mu\text{m}$ were significantly better perceived in the HFP group than in the LFP group ($P<.005$, $P<.001$, and $P<.001$) (Fig. 1).

DISCUSSION

The purpose of this study was to assess the occlusal sensitivity in 2 groups of healthy participants with different degrees of self-reported oral parafunctions as assessed with the Italian translation of the short form of the OBC-It 6. The results of the study, in accordance with the research hypothesis, demonstrated that individuals with a high frequency of self-reported oral parafunctions show better performance in the occlusal perception test than individuals with a low frequency of those behaviors.

The role of the receptors located in the periodontium in tactile sensibility has been extensively studied in the scientific literature. Authors have reported that the threshold for the interocclusal detection of small objects,

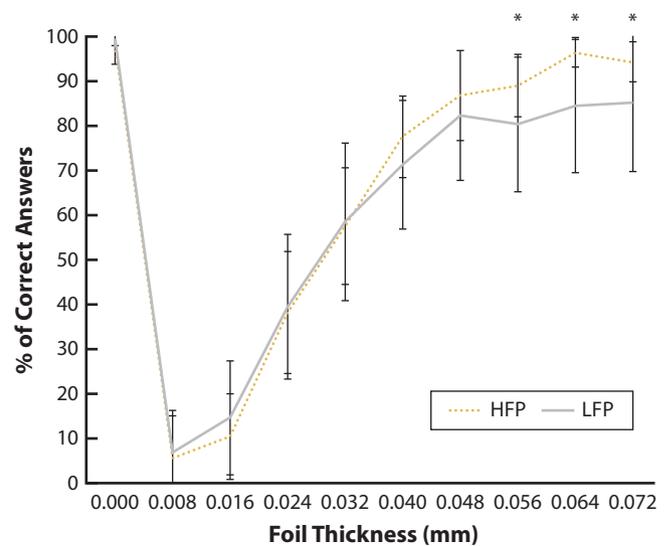


Figure 1. Mean percentage of correct answers for each testing thickness in high-frequency parafunction (HFP) group (dotted line) and in low-frequency parafunction (LFP) group (continuous line). Participants' answers considered correct whenever "positive" (yes) for foil thicknesses (from 0.008 to 0.072) and "negative" (no) for sham test (0.000). Foil thickness of 0.000 indicates results of sham test. Error bars represent 99.5% confidence intervals. Asterisk symbol indicates statistically significant difference in between-group comparison after Bonferroni correction.

such as strips, mainly depends on the activity of the periodontal mechanoreceptors, whereas muscular and articular receptors are responsible for the detection of large objects.² For instance, after the injection of local anesthetics to the examined tooth, a substantial increase in the occlusal threshold has been observed.^{5,9}

The findings of the present study are in agreement with those of previous research in which increased periodontal activity was found in bruxers diagnosed by means of nocturnal electromyography.¹⁸ Similarly, another previous study reported a short-term increase in the occlusal threshold after an intense session of mastication.¹⁹ This supports the hypothesis that hyperactivity of the periodontal ligament, which could be stimulated in patients with oral parafunctions, might enhance occlusal perception. Other authors reported no differences in the minimum interdental threshold ability between individuals with or without bruxism.³ However, the authors performed their analysis on an average value of interocclusal tactile sensibility of each individual, discarding the differences for each thickness.

One possible explanation for the findings of the present study can be found in the brain neuroplasticity mechanism. The brain maintains the capacity to undergo cortical reorganization throughout the life, meaning that repeated peripheral sensory stimuli determine an increase in tactile acuity and discrimination due to the cortical reorganization of the brain area representing the

stimulated part of the body.²² This mechanism has been extensively tested in skin mechanoreceptors. For instance, in professional string-instrument players, the cortical representation of the fingers of the left hand is increased in comparison with that of nonstring players, and the expansion was related to the years of playing the instrument.²³

Sex, age, registration time, or tooth type might have influenced the occlusal perception in the studied sample. However, previous studies have reported no significant role of these variables in detecting the minimal interdental threshold.^{3,5,9}

Self-reporting of jaw parafunctions has been listed among the factors considered as high predictors for the development of temporomandibular disorders (TMDs).¹⁴ A previous study has shown that individuals with chronic TMDs presented altered occlusal discrimination.⁴ However, in pain-free individuals, when delayed onset soreness of the masticatory muscle is experimentally provoked, no alteration in occlusal sensitivity was reported.¹⁶ Therefore, for future studies, self-reporting of TMD pain should be measured as a possible confounding factor.

Limitations of the study are that even though the validity of the OBC questionnaire has been demonstrated in a recent study,²⁴ it is still a subjective instrument that should be used in association with electromyography (EMG) to provide a more reliable and objective measurement of muscle overuse.¹⁶ In addition, the selected sample only included young university students without enrolling individuals from the general population.

CONCLUSIONS

Based on the findings of this cross-sectional clinical study on young healthy volunteers, the following conclusions were drawn:

1. Individuals with a high frequency of self-reported oral parafunctions have a higher occlusal sensitivity than those with a low frequency.
2. Whether parafunctional activities are causing a sensitivity alteration or whether a decrease in occlusal sensitivity can increase parafunctional activities is not yet clear.
3. Longitudinal studies are needed to elucidate this issue.

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Corresponding author:

Dr Rosaria Bucci
Department of Neurosciences, Reproductive Sciences and Oral Sciences
School of Orthodontics and Temporomandibular Disorders
University of Naples Federico II
Via Pansini 5, 80131
Naples
ITALY
Email: rosaria.bucci@unina.it

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