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IN VITRO ASSESSMENT OF GINGIVAL RECESSION IN PATIENTS WITH BRUXISM

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ABSTRACT

Aim of the study: The study aimed to highlight the presence and distribution according to age and the presence of fixed prosthetics of gingival recessions associated with bruxism. **Material and method**: Our study was performed on 86 adult patients examined by CAD-CAM technology. With the aid of GOM ATOS Capsule, we scanned their gypsum cast models. The reference models' scans were later used for measuring the gingival recessions in 142 tooth sites showing signs of recession. The investigated sites were divided according to the patient's age and the presence of prosthetic fixed rehabilitations. After measurements data were recorded with Microsoft Excel 365 software. Statistical analysis involved the Student's t-test and D'Agostino & Pearson normality test. **Results: The gingival recessions had higher values in the older patients' group and those with fixed prosthetic restorations. Conclusions**: Gingival recession in bruxism patients gets more severe with age. Patients with fixed prosthetic works have higher values of the gingival recessions than the non-prosthetic ones, with maximum values at the level of the mandible. Diagnosing and treating gingival recession associated with bruxism requires an extensive patient history and careful monitoring and evaluations.

Keywords: bruxism, gingival recessions, age, fixed prosthetics

INTRODUCTION

The current state of knowledge in the field of bruxism and gingival recession is quite unanimous yet still has many aspects. Bruxism is fundamentally teeth grinding, while the gingival recession is a cause of periodontal ligament loosening. Bruxism can be classified in two ways, the wakening or the sleeping, and in connection to neurological reasons or drug, medication use, which are questionable until today.

Recession, on the other hand, is generally documented as receding gums, classified by many authors. The interval between the cement-enamel junction (CEJ) and gingival margin quantitatively determines the recession. They can appear as localized or generalized gingival recession. Recession can occur with or without loss of the attached tissue [1]. Gingival recession could be caused by periodontal disease, accumulations, inflammation, improper flossing, aggressive tooth brushing, incorrect occlusal relationships, and dominant roots [2]. These can influence tooth sensitivity, plaque retention, caries occurrence, structural integrity, pulp vitality, and they present unique challenges for successful restoration [3-5]. Recessions may determine the clinical crown

look longer, and a varied proportion of the teeth compared with adjacent teeth [6].

A successful diagnosis and treatment plan need keen observation, a thorough patient history, and careful evaluation by the doctor. Gingival recession is affecting almost all middle and older-aged people to some degree [7]. According to the US National Survey, 88% of seniors (aged 65 and over) and 50% of adults (18 to 64 years old) present recession in one or more sites; progressive increase in frequency and extent of recession happens with the increase of age [8]. In the youngest age cohort (30 to 39 years old), the prevalence of recession was 37.8%, and the extent averaged 8.6% in teeth. In contrast, the oldest cohort, aged 80 to 90 years old, had a prevalence of 90.4%, and the extent averaged 56.3% in teeth [8]. Gingival recession associated with any bruxism showed, that the oral surfaces of the lower and upper canines were most frequently affected in the 20–34-year old age group [1].

On the other hand, abrasion is the consequence of friction between a tooth and an exogenous agent. If teeth are threadbare on their occlusal surfaces, incisal surfaces, or both by friction from the food particles, this wear is termed "masticatory abrasion." Masticatory abrasion can also occur on teeth' facial and lingual aspects, as rough food is forced against these surfaces by the tongue, lips, and cheeks during chewing. We should not undervalue the importance of some current diet habits, which are considered "healthy" but potentially destructive to the teeth (granolas, nuts, cereals, and acidic juices). Abrasion can also occur due to overzealous tooth brushing, improper dental flossing, toothpicks, or detrimental oral habits [3,4,10].

The tooth surface lesions are often a multifactorial phenomenon; a corrosive cervical lesion could be worsened by a tooth brushing abrasion [11]. When to these two mechanisms are added, the effect of stress (abfraction) resulting from bruxism or occlusal interference, these lesions then become corrosive-abrasive abfractive in nature [3,12]. These numerous mechanisms can occur either synergistically, sequentially, or alternately. The interaction of chemical, biological, and behavioral factors is crucial and helps to describe why some individuals exhibit more erosion than others [12-14].

In the case of tooth wear, the cement-enamel junction becomes part of the clinical crown, which might suggest gingival retraction; however, apical gingival migration did not necessarily occur [1,15,16].

The study aims to raise awareness to the patient to report even the slightest wear of the tooth enamel to the doctor, as this disease is time-critical due to the fast-evolving irreversible outcome; the doctor has to inform patients and prevent them from consequently profound dental, periodontal, and mental changes.

Our work was designed as an observational in vitro study regarding structural changes that may occur at the gingival level, particularly gingival recessions associated with tooth wearing caused by any bruxism.

We hypothesize that gingival recession in bruxism patients gets more severe with age and that gingival recession is influenced by the presence of prosthetic works in patients with bruxism.

MATERIAL AND METHOD

The study was planned as a retrospective analysis, in which 86 adult patients who required prosthodontic oral rehabilitation based on CAD/CAM technology were observed during the therapeutic stages (figure 1).

Fig. 1 Digital reconstruction mesh of the mandibular area used in the study

The inclusion criteria for the study were:

- age from 18 to 68 years;
- patients suffering from any bruxism, evidenced by tooth wearing, abfraction, and attrition, associated with any type of gingival recession (figure 2,3);
- healthy subjects.

The exclusion criteria were:

- poor oral hygiene associated with dental plaque and over or under gingival calculus
- smokers

Fig. 2 Gypsum cast models showing effects of bruxism on gingival structures

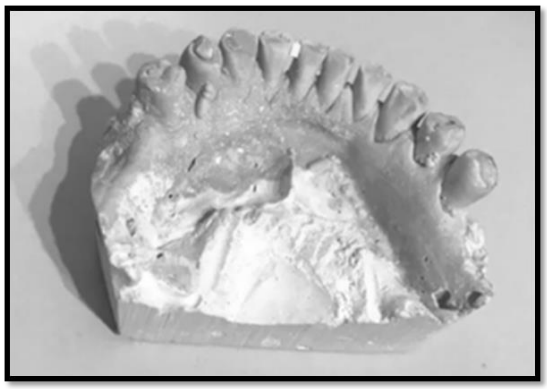

Fig. 3 Gypsum cast models showing excessive tooth wearing caused by bruxism

With the aid of GOM ATOS Capsule (Zeiss™ Gmbh, Braunschweig, Germany), an optical precision measuring machine, we scanned the gypsum cast models. This device uses two 12Mp CCD cameras and a fringe blue light projector to scan the surface (figure 4). Spatial referencing is done with encoded markers, while stereo camera technology provides an over-determined system of equations for each measurement. It can measure the reference markers with a deviation of 3µm to 5µm. Its result is a 3D mesh web created by polygonizing the large number of triangulated points captured by the cameras. The reference models' scans were used as a standard for measuring the gingival recessions later in the study.

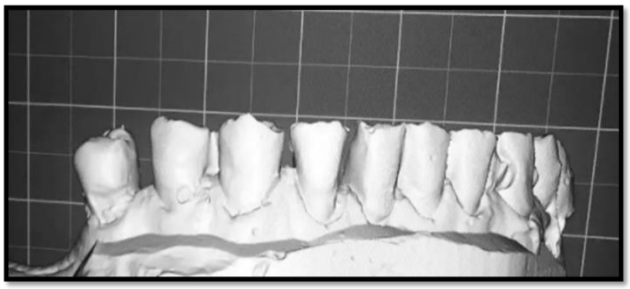

Fig. 4 Digital scan mesh, the web used in the study showing gingival recessions associated with bruxism

In the subsequent stage, we selected from the study models 142 tooth sites showing signs of recession. Since bruxism is a time-dependent

disease, older patients exhibiting higher levels of gingival recession, we decided to split the study group into two sub-groups, as follows:

• Sub-group 1: consisted of 76 sites showing signs of recession in patients between 18 and 38. Thirty-five were at the maxillary level, and 41 were at the mandibular level.

• Sub-group 2: consisted of 66 sites showing signs of recession in patients between 38 and 68 years old. Thirty-one were at the maxillary level, and 35 were at the mandibular level.

Also, because some of the digital models presented signs of recession associated with fixed prosthetic works, we decided to split the study group into two sub-groups as follows:

• Sub-group A: consisted of 68 sites on the digital models, showing signs of recession in patients with old fixed prosthetic works. From them, we located 39 at the maxillary level, and 29 were located at the mandibular level.

• Sub-group B consisted of 74 sites on the digital models, showing signs of recession in patients without fixed prosthetic works. From them, we found 35 at the maxillary level, and 39 were located at the mandibular level.

Later in the study, two of us conducted manual measurements of the gingival recession from the Cemento-Enamel Junction (CEJ) to the free gingival margin, with the help of the GOM Inspect 2020™ (Braunschweig, Germany) software package (figure 5).

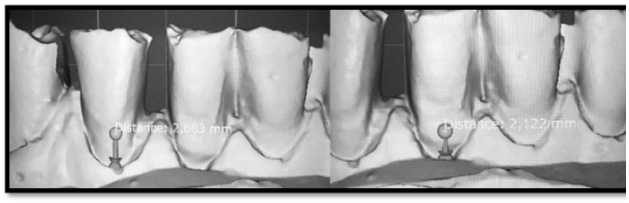

Fig. 5 Manual measurements performed during the study

After precise manual measurements of the 142 sites, which presented signs of recession, data were recorded with the help of Microsoft Excel 365 software. Statistical processing was performed using GraphPad Prism™ V6.01 software for Windows™. Statistical analysis involved the Student's t-test for unpaired (independent) and paired (dependent) data. D'Agostino & Pearson omnibus normality test was used to determine the normality of the statistics. The chosen significance threshold was alpha = 0.05, considering p significant when $p < 0.05$.

RESULTS

Upon visual inspection of the models and precise measuring of them, we noticed the gingival defects on all sites, and their distribution is summarized in Table 1.

Table 1. The average amount of gingival recession in the study groups

Age	18-38 yo	39-68 yo
Average (mm)	2.34	2.88
Maxilla	2.03	3.49
Mandible	2.78	3.25
Minimum	1.52	1.56
Maximum	3.82	4.72
Confidence level (95%)	1.22	1.19

In the study sub-group, one represented by patients aged 18-38 years old, an average value of 2.34 millimetres gingival recession was observed. At the mandibular level, the highest value was observed with an average of 2.78 millimetres (+/- 1.22) SD. The maximum amount of gingival recession was 3.82 millimetres and the lowest was 1.52 millimetres. At the maxillary level, an average amount of 2.03 millimetres was observed.

Sub-group 2, represented by patients aged between 39-68 years old, had an average value of 2.88 millimetres of gingival recession. At the mandibular level, the highest value was observed with an average of 3.25 millimetres (+/- 1.19) SD.

The maximum amount of gingival recession was 4.72 millimetres, and the lowest was 1.56 millimetres. At the maxillary level, an average amount of 3.49 millimetres was determined.

In the study, sub-group A was represented by patients with old fixed prosthetic works

associated with gingival recession; an average value of 3.31 millimetres of gingival recession was observed (Table 2). The highest value was determined at the mandibular level with an average of 3.65 millimetres (+/- 1.13) SD. The maximum amount of gingival recession was 4.81 millimetres and the lowest was 2.38 millimetres.

In the study sub-group B, represented by patients without fix prosthetic works associated with gingival recessions, an average amount of 2.81 millimetres of gingival recession was observed. The highest value was at the mandibular level with an average of 3.45 millimetres (+/- 1.09) SD. The highest value determined in the mandibular level was 3.96 millimetres. The minimum amount of gingival recession was 2.16 millimetres at maxillary level (Table 2).

Table 2. The average amount of gingival recession in the study groups according to the association of gingival recession and prosthetic works

Prosthetic bridge/crown	**Yes**	**No**
Mean (mm)	3.31	2.81
Maxilla	3.05	2.26
Mandible	3.65	3.45
Minimum	2.38	2.16
Maximum	4.81	3.96
Confidence level (95%)	1.13	1.09

DISCUSSIONS

Our study confirms the hypothesis that gingival recession in bruxism patients gets more severe over time passes. In the study sub-group, one represented by patients aged 18-38 years old, we measured an average value of 2.34 millimetres of gingival recession. By comparison, sub-group two, represented by patients aged between 39-68 years old, had an average value of 2.88 millimetres of gingival recession. Study results were similar to those found by Pradeep and Chrysanthakopoulos [9,17].

Patients who wore old fixed prosthetic works had higher values of gingival recessions than non-prosthetic patients, with maximum values at the level of the mandible (an average of 3.65 mm). Our results agree with those in the literature that describes the accentuation of gingival recessions in the case of fixed prostheses [15,18]. These results suggest that when diagnosing gingival recessions associated with bruxism, practitioners most frequently rely on spontaneous patient reports, confirmed by the dental examination, followed by applying an air blast and scratching dentin with a dental explorer.

In 2013, a group of experts describe bruxism as a repetitive jaw-muscle activity identified by clenching or grinding of the teeth and/or bracing or thrusting the mandible. It was specified that bruxism has two distinct circadian manifestations: it can occur during wakefulness (indicated as awake bruxism) or during sleep (indicated as sleep bruxism) [19]. Lately, a revision of the definition was made, in which awake bruxism and sleep bruxism are considered different behaviours observed during wakefulness and during sleep [20]. For this variety, numerous factors play a role, namely the fact that some researchers did not make the distinction between awake bruxism and sleep bruxism, nor the difference between "possible," "probable," and "definite" awake or sleep bruxism. To assess "possible" awake or sleep bruxism, no consensus is achieved on which questions and/or questionnaires should be used to place the diagnosis [20,21].

In literature, statistics supporting the connection of occlusal contacts and bruxism with periodontal disease are contradictory [21]. However, two studies in patients following periodontal maintenance (PM) reported double increases in the risk of tooth loss due to periodontal disease (TLPD) associated with bruxism. Only two studies have addressed the connection between bruxism and TLPD in patients following PM [21]. The outcome of these studies was consequent and showed that bruxism doubled the risk of TLPD, which is

similar to smoking. Yet, bruxism is poorly understood and represents one of the most controversial issues in dentistry. Consequently, it is an object that deserves severe scientific discussion [19,21].

An up-to-date review [22] has found that the prevalence of bruxism in the general population is approximately 25%. In contrast, the double rate of bruxism has been reported in periodontal patients [21]. Therefore, the role of bruxism deserves further research. Abfractions have been set down to occlusal forces on the cervical area of the teeth and fall within the multifactorial etiology of non-carious cervical lesions [23]. Still, these lesions have remained a theoretical process supported by engineering analysis, using finite element models [24].

Only one study reported a 14-year follow-up of a patient with bruxism, abfractions, and we found occlusal wear in the literature at the time of writing [25]. Consequently, the findings presented in this paper cooperate to a better understanding of these lesions. Abfractions have already been associated with bruxism, wear facets, and occlusal disturbances [21,23,26]. The study by Miller et al. (2003) found that 10% of patients with abfractions presented bruxism (eccentric bruxism with increased occlusal attrition), while the remaining 90% showed occlusal disturbances (wear facets, lack of canine guidance, and group function) [26].

CONCLUSIONS

Gingival recession in bruxism patients gets more severe with age. Patients with old fixed prosthetic works have higher values of the gingival recessions than the non-prosthetic ones, with maximum values at the level of the mandible. Diagnosing and treating gingival recession associated with bruxism mean: problem identification, etiological factor removal, and, if necessary, restoration. Due to its multifactorial character, it is not an uncomplicated procedure. A successful diagnosis and treatment plan requires an extensive patient history and careful monitoring and evaluations. Each clinical situation must be treated differently, depending on its particularities.

Conflict of interest: the authors declare no conflict of interest associated with this paper.

Institutional Review Board Statement: the study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of SC Algocalm SRL, Târgu-Mures, Romania, 908/30.03.2021.

Informed Consent Statement: informed consent was obtained from all subjects involved in the study

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