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Title: **Relationship between self-reported bruxism and periodontal status: findings from a cross-sectional study**

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Author Contribution

João Botelho, Vanessa Machado and Luís Proença have made substantial contributions to conception, design and acquisition of data. All authors have made substantial contributions for analysis and interpretation of data; drafting the article or revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Abstract

Background: Several studies seek to prove the relationship between bruxism and periodontal status although it remains unclear and debatable. We aimed to assess the association between self-reported (SR) bruxism with the periodontal status in a large scale survey.

Material and Methods: A total of 1,064 individuals from the southern region of the Lisbon Metropolitan Area (Portugal) were enrolled. Patients were interviewed for the SR bruxism assessment through a self-report questionnaire. Full-mouth periodontal status was assessed with Probing Depth (PD), Clinical Attachment Loss (CAL), Gingival Recession (REC) and Bleeding on Probing (BoP) being measured. The American Association of Periodontology/European Federation of Periodontology 2018 case definitions was used. Logistic regression analyses provided information on the influence of SR bruxism towards periodontitis.

Results: SR bruxers exhibited lower prevalence of periodontitis. Additionally, SR bruxers with periodontitis had PD and CAL significantly lower than patients with only periodontitis. Multivariate analysis suggests that SR bruxism was significantly associated with a lower risk of periodontitis (Odds Ratio [OR] = 0.42 95%CI: 0.32-0.56). Mean PD and CAL were significantly lower in SR bruxers. When assessing the type of SR bruxism, significant differences among mean PD, CAL and BoP levels were also identified.

Conclusion: SR bruxism and periodontal status are negatively associated. SR bruxers exhibit lower odds towards periodontitis and better periodontal clinical characteristics. Further studies are mandatory to clarify these findings.

1. Introduction

Bruxism is a multifaceted phenomenon that has been associated with several factors mediated by the central nervous system [1]. According to an updated international consensus in 2018, bruxism is a repetitive masticatory muscle activity that is not necessarily a disorder in healthy individuals [2]. There are two clearly different entities within the umbrella of bruxism, namely: awake bruxism (AB) and sleep bruxism (SB) [2]. AB is defined as masticatory muscle activity during wakefulness that is characterized by repetitive or sustained tooth contact (such as clenching and grinding) and/or by bracing or thrusting of the mandible and is not dyskinetic in otherwise healthy individuals [2]. SB is a masticatory muscle activity during sleep that is characterized as rhythmic (phasic) or non-rhythmic (tonic) and is not a movement or sleep

disorder in otherwise healthy individuals [2].

Periodontal disease is one of the most prevalent diseases in the world and is undoubtedly a serious public health problem that has a large socioeconomic impact [3,4]. Periodontal disease is characterized by a chronic non-communicable inflammatory condition which results in the progressive destruction of the tooth-supporting tissues due to host's immune response to a complex polymicrobial-driven infection [5–12].

Approaches to assess bruxism can be distinguished as non-instrumental (notably self-report) or instrumental (clinical assessment) [2]. Given the difficulty and inaccuracy on bruxism diagnose patented in literature, a grading system was suggested in 2013 [13] and reviewed in the 2018 consensus [2]. In these, possible sleep/awake bruxism is based on a positive self-report only, probable sleep/awake bruxism is based on a positive clinical examination, with or without a positive self-report and definite sleep/awake bruxism is based on a positive instrumental assessment, with or without a positive self-report and/or a positive clinical inspection. Although this revised grading system seems to point out that self-report is not the ideal way to assess bruxism in the clinical setting, the consensus paper also states that it may be useful [2].

Mastication is the major function of the dentition and, the periodontium is the tooth support mechanism that allows the teeth to fulfill this basic function. Over the past years, the potential deleterious effects of bruxism on the temporomandibular joints, masticatory muscles, and natural teeth have been continually addressed [14–17]. Notwithstanding, the relationship between excessive occlusal force and periodontium remain a complex and controversial issue [18], and only one systematic review [17] investigated the effect of bruxism as a potential risk factor for the teeth-supporting tissues. Despite the limitations, bruxism apparently "cannot cause periodontal damage per se" and the authors underline the need for more research on the association of bruxism and its types on periodontal patients [17].

Given the weak literature references available and considering the hypothesis that bruxism and the periodontium might be linked, this study aimed to assess the association between self-reported (SR) bruxism and periodontal status in a large scale survey.

2. Materials and Methods

2.1. Study design and inclusion criteria

This study was designed as a population-based cross-sectional representative study, geographically stratified, with a target population of inhabitants over 18 years of age (adults

and elderly). It was carried out at the public health centres of Almada and Seixal municipalities, located in the Lisbon Metropolitan Area, in Portugal. Only one health centre had dental treatment facilities, although they do not provide periodontal treatments. The exclusion criteria were: age under 18 years, edentulous patients, unable to participate in the survey and answer questionnaires or if they refuse to reply to the questionnaire. A total of 1,064 participants were enrolled in the study. Data were collected between December 2018 and April 2019. This survey followed the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines [19].

2.2. Sample size estimation

In September 2018, 386,168 inhabitants in the selected age groups lived in the two municipalities (institutional data provided). We based our estimation in a reported national prevalence data of 10.8% and 15.3%, for adults and elderly, respectively (DGS 2015). To achieve an estimate of the periodontitis prevalence in the population, with a margin of error of 3.0%, for a 95% confidence level, a minimum of 962 individuals were required to be examined. We stratified the required sample according to the number of subjects assigned to each health centre (institutional data provided). The invitation to participate in the survey was made by direct contact at the waiting room of the FHU, explaining the purpose of the study and including a description of the clinical examination.

2.3. Participants

The participants were recruited during an epidemiologic study carried out in the southern region of the Lisbon Metropolitan Area, in Portugal - Study of Periodontal Health in Almada-Seixal (SoPHiAS) [20]. Previously, SoPHiAS project was approved by a state-recognized Ethics Committee: the Research Ethics Committee of the Regional Health Administration of Lisbon and Tagus Valley, IP (Registration numbers: 3525/CES/2018 and 8696/CES/2018), and was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2013. All participants gave their previous written informed consent.

2.4. Periodontal examination and diagnosis

Two trained and calibrated examiners (V.M. and J.B.) performed the periodontal diagnosis. The inter-examiner correlation coefficients ranged from 0.98 and 0.99 and between 0.93 and 0.99, for mean Probing Depth (PD) and mean Clinical Attachment Loss (CAL), respectively. Gingivitis and Periodontitis cases were defined according to the AAP/EFP 2017 consensus [8,21], with a patient being a periodontitis case if interdental CAL is detectable at ≥2 non-adjacent teeth, or buccal or oral CAL ≥3 mm with pocketing >3 mm is detectable at ≥2 teeth. At the end of the examination, participants were informed about their periodontal status. Individuals diagnosed with Periodontal Diseases were referred to the Egas Moniz Dental Clinic (EMDC) for its treatment without additional costs.

A full-mouth periodontal examination was performed with a periodontal probe ‖. Third molars, implants and retained roots, were excluded from the examination. Plaque index (PI) [22], gingival recession (REC), probing depth (PD), and bleeding on probing (BoP) were circumferentially recorded at six sites per tooth (mesiobuccal, buccal, distobuccal, mesiolingual, lingual, and distolingual). PD was measured as the distance from the free gingival margin to the bottom of the pocket and REC as the distance from the cementoenamel junction (CEJ) to the free gingival margin, and this assessment was assigned a negative sign if the gingival margin was located coronally to the CEJ. CAL was calculated as the algebraic sum of REC and PD measurements for each site. The measurements were rounded to the lowest whole millimeter. Furcation involvement (FI) was assessed using a Naber probe ¶ [23]. Tooth mobility was further appraised [24].

2.5. SR bruxism assessment

Based on the 2018 consensus, patients with positive SR bruxism were acknowledged as possible bruxers. [2] The questionnaire comprised five previously detailed questions [25]:

1. Sleep grinding item: Are you aware of the fact that you grind your teeth during sleep?
2. Sleep grinding referral item: Has anyone ever told you that you grind your teeth during sleep?
3. Sleep clenching item: Upon awakening in the morning or awakening during the night, do you have your jaws thrust or braced?
4. Awake clenching item: Do you clench your teeth while awake?
5. Awake grinding item: Do you grind your teeth whilst awake?

All questions had a dichotomous yes/no answer [25]. Positive answers for Questions 1 and/or 2 and/or 3 indicated Sleep SR bruxism, and a positive answer to Questions 4 and 5 indicated that the participant had Awake SR bruxism.

2.6. Sociodemographic variables

Sociodemographic data comprised gender, age, educational level (no education, elementary, middle or higher), occupation status (student, employed, unemployed or retired), marital status (single, married / union of fact, divorced or widowed), smoking habits (no smoker, former smoker or current smoker) and average family monthly income (in euros). In the medical questionnaire, patients reported the presence of systemic diseases and medications, in particular, diabetes mellitus (DM).

2.7. Statistical Analysis

Data analysis was performed using SPSS for Windows [#]. Descriptive and inferential statistics methodologies were applied. All patients completed the questionnaires and missing data management was not required. Chi-square test was used to evaluate the association between periodontal condition and sociodemographic variables. Clinical periodontal data were compared among periodontal condition and bruxism status groups by using ANOVA with Brown-Forsythe correction followed by Games-Howell post-hoc test. Odds Ratios (OR) towards periodontitis were calculated, both for univariate and multivariate analyses, through logistic regression procedures. Preliminary analyses were performed using univariate models (see Supplementary Table 1 in online Journal of Periodontology). Next, a multivariate model was constructed for the outcome presence of periodontitis. Only variables showing a significance $p \leq 0.25$ in the univariate model were included in the multivariate forward stepwise procedure. The contribution of each variable to the model was evaluated by Wald statistics. Interactions were also tested for the considered variables. A level of significance of 5% was set in all inferential analyses.

3. Results

3.1. Sample description

The characteristics of the 1,064 participants are shown in Table 1. The mean age of participants with bruxism and without were 60.1 (± 13.0) and 62.8 (± 15.8) years, respectively.

The participants' distribution, considering their periodontal status is presented in Table 2. The prevalence of SR bruxism was found to be higher in individuals without periodontitis when compared to periodontitis participants. Moreover, there were significant differences in the sociodemographic data between non-periodontitis and periodontitis individuals.

After univariate analysis (see Supplementary Table 1 in online Journal of Periodontology), multivariate stepwise procedure confirmed SR bruxism as an important factor towards periodontitis simultaneously to other known risk factors (Table 3). Individuals with SR bruxism exhibited a lower risk towards periodontitis of 58% (OR = 0.42, 95% CI: 0.32-0.56) (Table 3).

Table 4 shows the clinical periodontal characteristics of the participants according to their periodontal and SR bruxism status. PD mean values are significantly different among all groups, with individuals from SR Bruxism group having the overall lower scores and SR Bruxism-P group having a significant difference from P group. Regarding CAL, the mean values are also significantly lower for individuals from SR Bruxism-P group, when comparing to P group. Additionally, SR Bruxism-P group has meaningful lower mean recession levels than P group.

Table 5 presents the clinical periodontal characteristics based on the SR bruxism questionnaire. Overall, individuals with awake/sleep SR bruxism pattern have the lowest values of PD, CAL and BoP. Further, patients with the awake SR bruxism form have significantly lower PD levels compared to probable no SR bruxism and sleep bruxism patients. In terms of recession, no significant differences were identified among the SR bruxism groups, although they differ from the no SR bruxism group.

4. Discussion

In this cross-sectional study, we hypothesized that bruxism and the periodontal status might be linked. To test this hypothesis, we have assessed a representative population for periodontal status and SR bruxism along with other significant confounding variables. Hence, we have compared the periodontal clinical characteristics according to their SR bruxism status. Also, bruxism was appraised in a multivariate analysis with known risk factors towards periodontitis. Overall, we show that SR bruxism is associated with less prevalence of periodontitis, lower

periodontal measures and is a relevant factor for periodontitis.

These findings have wide implications. (1) To the best of our knowledge, this study is the first to investigate the association between periodontal condition and SR bruxism. (2) Based on a previous recommendation [17], the prevalence of SR bruxism was assessed in a representative sample of patients to study the possible consequences of teeth clenching/grinding on the periodontium. (3) SR bruxism revealed to be a significant factor towards periodontitis, even in a multivariate analysis.

Moreover, SR bruxers had lower risk towards periodontitis (OR = 0.42, 95% CI: 0.32-0.56) even when adjusted for known risk factors. Beyond that, SR bruxers with periodontitis have significant lower average levels of all clinical characteristics (PD, CAL, REC and BoP) than no-periodontitis individuals. Yet, awake and awake/sleep SR bruxism types appear to be the patterns most associated with lower PD and CAL features. As expected, patients with periodontitis have a statistically higher percentage of BoP compared to non-periodontitis patients [25].

Comprehensively, SR bruxers were associated with shallower pocket depths and lower loss of attachment. Concerning the epidemiological nature of this study, the small differences observed are far from clinically significant and demand clinical confirmation. Furthermore, the novelty of these results is the probable effect on healthy periodontium, inasmuch as effect of occlusal discrepancies in active periodontitis lead to deeper pockets and higher risk of tooth loss [26,27]. Therefore, future studies are mandatory to ascertain the cause-effect of bruxism and periodontal status and its clinical implications.

The relationship between bruxism and the periodontium has been much investigated and debated [28-34]. It has been shown that mechanical stresses caused by occlusal overload initiate a cascade event in the periodontal tissues [28]. Moreover, the periodontal ligament plays an important role in balancing and distributing stress into the alveolar bone [29,30], reacting with small teeth movements [31], which in turn leads to a biological cellular response [32–34].

Changes of periodontal tissues caused by occlusal trauma have been proved in animal models, mainly in the periodontal ligament and alveolar bone [35-36]. They conclude that periodontal pressure zones exhibit transient bleeding, edema, thrombosis, increased vascularization, disorganization of periodontal ligament bundles, and alveolar bone resorption [35-36]. However, all evaluations used single-tooth excessive forces models, and unable to inferred conclusions to bruxism contexts.

Furthermore, it is widely defined that excessive occlusal forces do not trigger periodontal

diseases or loss of periodontal attachment, and there is no scientific rationale to prove that excessive occlusal forces cause abfraction or gingival recession [37]. Also, bruxism is unlikely to provoke periodontal damage per se [17]. Clinically, the results of this study meet what is consensually established, which is the absence of periodontal damage triggered by bruxism.

Strengths and Limitations

The main strengths of this study are the representativeness of the sample and potential generalisability, although it requires validation in other settings. Also, the use of up-to-date international case definitions to periodontitis and followed the recommendations of the 2018 bruxism consensus on SR assessment. And, to the best of our knowledge, there is novelty for being first large-based epidemiologic study to address both conditions.

However, there are some shortcomings to remark. The primary limitation is the fact that single-reporting time self-report of bruxism is not the most suitable approach to assess bruxism in the clinical setting, also as far as the discrimination between awake and sleep bruxism is concerned. On the other hand, it remains an inevitable approach to gather data for screening purpose in large-sample epidemiological studies [2,25]. Also, as an observational study, we cannot appraise causality, exposure timing, disease onset and its relation with known periodontitis' risk factors. Notwithstanding, when adjusting for known risk factors, SR bruxism risk towards periodontitis remained significant.

Therefore, future prospective randomized clinical trials using definite bruxism diagnosis are mandatory, as well as laboratory studies to understand the biological and biochemical differences in the periodontal tissues on different bruxism patterns.

5. Conclusions

Within the limitations of this epidemiological study, the results show an association between SR bruxism and periodontitis. SR bruxism was related with less periodontal tissues destruction and lower periodontitis prevalence. Further studies are mandatory to clarify these findings using definite bruxism diagnosis.

FOOTNOTES

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IBM SPSS Statistics version 25.0 for Windows, IBM Corporation, Armonk, NY, USA

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Tables and Figures Legends

Table 1. Sociodemographic characteristics of the participants (N = 1,064).

Table 2. Distribution of the participants according to their periodontal condition with SR bruxism status and sociodemographic variables (N=1,064).

Table 3. Adjusted model (*) with Odds Ratios (OR) and correspondent 95% confidence intervals (95% CI) on potential risk factors towards periodontitis. OR obtained within multivariate logistic regression analysis.

Table 4. Periodontal clinical characteristics (mean PD, CAL, REC and BoP) of the participants as a function of their periodontal condition and SR bruxism status (N=1,064).

Table 5. Clinical periodontal parameters (mean PD, CAL, REC and BoP) of the participants as a function of SR bruxism type (N=1,064).

Table 1. Sociodemographic characteristics of the participants (N = 1,064).

Variable	Total (N=1.064)
Gender	
Male	447 (42.0)
Female	617 (58.0)
Age (years)	
18-30	62 (5.8)
31-40	75 (7.0)
41-50	136 (12.8)

51-60	137 (12.9)
61-70	328 (30.8)
71-80	244 (22.9)
> 80	82 (7.7)
Educational level	
No education	42 (3.9)
Elementary	410 (38.5)
Middle	496 (46.6)
Higher	116 (10.9)
Marital status	
Single	170 (16.0)
Married / Union of fact	684 (64.3)
Divorced	103 (9.7)
Widowed	107 (10.1)
Occupation	
Student	19 (1.8)
Employed	327 (30.7)
Unemployed	163 (15.3)
Retired	555 (52.2)
Monthly family income (€)	
<= 600	337 (31.7)

601-1500	545 (51.2)
> 1500	182 (17.1)
Smoking status	
Non-smoker	626 (58.8)
Former smoker	293 (27.5)
Current smoker	145 (13.6)
Diabetes Mellitus	
No	860 (80.8)
Yes	204 (19.2)
Toothbrushing per day	
0	31 (2.9)
1	302 (28.4)
2+	731 (68.7)
Interproximal Cleaning	
No	718 (67.5)
Occasionally	161 (15.1)
Yes	185 (17.4)

Values expressed as n (%, according to the variables).

Table 2. Distribution of the participants according to their periodontal condition with SR bruxism status and sociodemographic variables (N=1,064).

	Non-Periodontitis (n=427)	Periodontitis (n=637)	P-value
SR Bruxism			
Yes	228 (53.4)	267 (41.9)	**<0.001**
No	199 (46.6)	370 (58.1)	
Gender			
Male	140 (32.8)	307 (48.2)	**<0.001**
Female	287 (67.2)	330 (51.8)	
Age (years)			
18-30	51 (11.9)	11 (1.7)	**<0.001**
31-40	49 (11.5)	26 (4.1)	
41-50	73 (17.1)	63 (9.9)	
51-60	55 (12.9)	82 (12.9)	
61-70	108 (25.3)	220 (34.5)	
71-80	74 (17.3)	170 (26.7)	
> 80	17 (4.0)	65 (10.2)	
Educational level			
No education	11 (2.6)	31 (4.9)	**<0.001**
Elementary	134 (31.4)	276 (43.3)	
Middle	209 (48.9)	287 (45.1)	
Higher	73 (17.1)	43 (6.8)	

Marital status			
Single	104 (24.4)	66 (10.4)	
Married / Union of fact	262 (61.4)	422 (66.2)	
			<0.001
Divorced	33 (7.7)	70 (11.0)	
Widowed	28 (6.6)	79 (12.4)	
Occupation			
Student	18 (4.2)	1 (0.2)	
Employed	165 (38.6)	162 (25.4)	
			<0.001
Unemployed	79 (18.5)	84 (13.2)	
Retired	165 (38.6)	390 (61.2)	
Monthly family income (€)			
<= 600	121 (28.3)	216 (33.9)	
601-1500	217 (50.8)	328 (51.5)	**0.015**
> 1500	89 (20.8)	93 (14.6)	
Smoking status			
Non-smoker	296 (69.3)	330 (51.8)	
Former smoker	85 (19.9)	208 (32.7)	**<0.001**
Current smoker	46 (10.8)	99 (15.5)	
Diabetes Mellitus			
No	374 (87.6)	486 (76.2)	
			<0.001
Yes	53 (12.4)	151 (23.7)	

Toothbrushing per day			
0	7 (1.6)	24 (3.8)	
1	107 (25.1)	195 (30.6)	**0.011**
2+	313 (73.3)	418 (65.6)	
Interproximal Cleaning			
No	254 (59.5)	464 (72.8)	
Occasionally	81 (19.0)	80 (12.6)	**<0.001**
Yes	92 (21.5)	93 (14.6)	

SR – Self-reported.

Values expressed as n (%, within each periodontal condition category). [#]Chi-square test, with significant differences identified in bold ($p<0.05$)

Table 3. Adjusted model (*) with Odds Ratios (OR) and correspondent 95% confidence intervals (95% CI) on potential risk factors towards periodontitis. OR obtained within multivariate logistic regression analysis.

	OR (95% CI) towards Periodontitis	*p*-value
SR Bruxism		
No	1	-
Yes	0.42 (0.32-0.56)	<0.001
Gender		
Male	1	-
Female	0.66 (0.49-0.90)	0.009
Age	1.05 (1.04-1.06)	<0.001
Educational level		
Higher	1	-
Middle	2.22 (1.39-3.54)	0.001
Elementary	2.01 (1.21-3.36)	0.007
No Education	2.11 (0.88-5.06)	0.094
Smoking status		
Non-smoker	1	-
Former smoker	3.52 (2.23-5.54)	<0.001
Current smoker	1.90 (1.33-2.70)	<0.001
Diabetes Mellitus		
No	1	-

Yes	1.55 (1.06-2.26)	0.023

SR – Self-reported, OR - Odds Ratio.

*The model was statistically significant, $\chi 2 = 213.736$, $p < 0.001$, explained 24.6% (Nagelkerke R^2) of the variance and correctly classified 68.7% of cases.

Table 4. Periodontal clinical characteristics (mean CAL, PD, REC and BoP) of the participants as a function of their periodontal condition and SR bruxism status (N=1,064).

Clinical Characteristic	None (n=199)	SR Bruxism (n=228)	Periodontitis (P) (n=370)	SR Bruxism-P (n=267)	*p-value* (a)
PD (mm)	1.59 (± 0.30) [a] [1.55-1.64]	1.44 (± 0.28) [b] [1.40-1.47]	2.34 (± 0.85) [c] [2.25-2.43]	2.06 (± 0.76) [d] [1.97-2.15]	<0.001
CAL (mm)	1.78 (± 0.38) [a] [1.73-1.84]	1.66 (± 0.31) [b] [1.62-1.70]	3.61 (± 1.61) [c] [3.44-3.77]	3.08 (± 1.32) [d] [2.92-3.24]	<0.001
REC (mm)	0.20 (±0.30) [a] [0.15-0.24]	0.23 (± 0.24) [a] [0.20-0.26]	1.28 (± 1.27) [b] [1.15-1.41]	1.02 (± 0.95) [c] [0.91-1.14]	<0.001
BoP (%)	7.8 (± 9.7) [a] [6.5-9.2]	6.2 (± 8.7) [a] [5.1-7.4]	12.5 (± 15.8) [b] [10.8-14.1]	11.8 (± 15.2) [b] [10.0-13.6]	<0.001

SR – Self-reported, CAL - Clinical Attachment Loss, PD - Probing Depth, REC - Recession, BoP - Bleeding on Probing, SB - Self-reported Bruxism

Values expressed as mean (± standard deviation) and [95% confidence interval for mean]

(a) One-way ANOVA with Brown-Forsythe correction followed by Games-Howell post-hoc test. Different letters indicate significant differences between means ($p<0.05$).

Table 5. Clinical periodontal parameters (mean CAL, PD, REC and BoP) of the participants as a function of SR bruxism type (N=1,064).

Clinical Characteristic	No SR bruxism (n=569)	Sleep SR bruxism (n=367)	Awake SR bruxism (n=114)	Awake/Sleep SR bruxism (n=14)	*p-value* (a)
PD (mm)	2.08 (± 0.79) [a] [2.01-2.14]	1.85 (± 0.69) [b] [1.78-1.92]	1.56 (± 0.52) [c] [1.46-1.66]	1.45 (± 0.68) [bc] [1.06-1.84]	<0.001
CAL (mm)	2.97 (± 1.58) [a] [2.84-3.10]	2.51(± 1.24) [b] [2.38-2.64]	2.20 (± 1.15) [b] [1.98-2.41]	2.09 (± 1.10) [b] [1.45-2.73]	<0.001
REC (mm)	0.90 (±1.16) [a] [0.80-0.99]	0.67 (±0.81) [b] [0.58-0.75]	0.64 (± 0.87) [b] [0.48-0.80]	0.64 (±0.78) [b] [0.19-1.09]	<0.001
BoP (%)	10.8 (± 14.1) [a] [9.7-12.0]	9.8 (± 13.8) [b] [8.4-11.2]	8.2 (± 10.1) [c] [6.3-10.0]	2.5 (± 5.1) [c] [0.0-5.5]	<0.001

CAL - Clinical Attachment Loss, SR – Self-Reported, PD - Probing Depth, REC - Recession, BoP - Bleeding on Probing

Values expressed as mean (± standard deviation) and [95% confidence interval for mean]

(a) One-way ANOVA with Brown-Forsythe correction followed by Games-Howell post-hoc test. Different letters indicate significant differences between means ($p<0.05$).