CORRELATION BETWEEN BRUXISM, OCCLUSAL DYSFUNCTION AND MUSCULO-ARTICULAR STATUS

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ABSTRACT

Aim of the study. The objective of the current study is to determine if a correlation exists between bruxism and occlusal dysfunction. It was also investigated whether bruxism is influenced by musclo-articular status and/or is associated with dental-periodontal pathologies including dental wear, dental fissures, gingival retraction or abnormal dental mobility. **Materials and method.** The study was carried out in two stages. In the first phase an original bruxism questionnaire was distributed to the 180 subjects included in the study. Based on the answers two groups were formed: subjects with self-reported bruxism (n=60) and the second group without bruxism (n=120). In the second phase an intraoral examination was performed, including static and dynamic occlusion, masticatory muscles and temporomandibular joint (TMJ) evaluation. Dental signs of bruxism were also identified and registered (dental wear, gingival retraction or dental mobility). **Results.** Occlusal dysfunction and TMJ pain (83,3% vs 16,7%) or disc displacement (80% vs. 20%) were more frequently diagnosed in patients with bruxism. A significant correlation ($p<0,005$) was observed between the presence of bruxism and muscle pain, hypertonia and/or hypertrophy (63%). **Conclusion.** Bruxism is more frequent in patients presenting occlusal imbalance. Dental signs in patients with bruxism are represented by pathological wear, dental fissures or fractures, mobility and gingival retraction. Jaw muscle symptoms (such as pain, hypertonia or hypertrophy) and temporomandibular joint signs (pain or/and disc displacement) often coexist with bruxism.

Key words: bruxism; masticatory muscle activity; temporomandibular disorders (TMDs); dental occlusion

INTRODUCTION

Bruxism is defined as a repetitive jaw-muscle activity characterized by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible (Lobbezoo F *et al.*, 2013). It is a non-functional rhythmic or spasmodic involuntary parafunction of teeth grinding, both during day and/or night, with harmful consequences in the oral cavity, affecting in different proportions all the structures of the dento-maxillary apparatus (De Laat *et al.*, 2002).

The treatment of bruxism is primarily based on a complete diagnosis, its etiology being a subject of permanent debate (Laluque *et al.*, 2017), as the cause and not the effect of this parafunction must be treated. The multifactorial etiology of bruxism has been studied over time, so there are multiple hypotheses on this topic. It is considered that primary bruxism has no medical cause, while secondary bruxism is associated with neurological, psychological pathologies, sleep disorders or various drugs (LAluque *et al.*, 2017, Kato *et al.*, 2003). A percentage of 21-50% of people with sleep bruxism have a family member who had or has this condition, suggesting

that there are genetic factors involved (Murali *et al.*, 2015).

Pathological occlusion is one of the most common causes of bruxism that causes localized pain in the oral cavity. Occlusal interferences are frequently encountered among etiologic factors of bruxism. Elimination of the interferences determined the improvement or sometimes the disappearance of bruxism (Murali *et al.*, 2015, Reddy *et al.*, 2014).

According to the American Academy of Orofacial Pain (AAOP), temporomandibular disorders (TMDs) are defined as "a group of disorders involving the masticatory muscles, the temporomandibular joint (TMJ), and associated structures" (de Leeuw *et al.*, 2013). The multifactorial etiology of TMDs is recognized, however the trauma generated by bruxism has an important role. The muscle overload due to teeth clenching in bruxism could be associated with variations in local blood flow with the possibility of local ischemia with localized pain as a consequence (Monteiro *et al.*, 1988). Pain occurs as a result of the sensitization of nociceptors in masticatory muscles (Mense *et al.*, 1993).

The cause-effect relationship between bruxism and TMDs is still controversial in the literature in the field due to the complexity of the etiology and of the diagnosis for both conditions (Manfredini *et al.*, 2010, Ohrbach *et al.*, 2011).

The objective of the current study is to determine if a correlation exists between bruxism and occlusal dysfunction. It was also investigated whether bruxism is influenced by the musclo-articular status and/or it is associated with dental-periodontal pathologies including dental wear, dental fissures, gingival retraction or dental hypermobility.

MATERIAL AND METHODS

The current research is an analythical, observational, transversal, case-control study. The study was conducted at the Department of Prosthodontics within the Faculty of Dental Medicine of the University of Medicine and Pharmacy "Iuliu Haţieganu" Cluj-Napoca between 10 March – 15 April 2021. The study was approved by the University's Ethics Committee and the informed consent was taken from each subject included in the study.

The sample size was calculated using the following formula: $2n = 2X(Z\alpha/2 + Z\beta)2\ SD2/d$

n: Sample size per group

SD: Pooled standard deviation being 3 in this.

d: Difference in the means (effect size)

Zα/2: Significance level (1.96), Zβ: Power of the study (0.84)

Assuming 80% power, 5% significance level with 95% confidence interval as well as assuming standard 4, the required sample size was 150.

One-hundred-eighty volunteers were included in the study, ages between 22 and 28 years (mean age 24,3± 1,32), 76,6% females (n=138) and 23,3% males (n=42). All participants signed an informed consent form to participate in the study.

Inclusion criteria was good general health, no chronic medication, complete dental arches (wisdom teeth not included), no on-going dental treatment, willing to fully participate in the study. Exclusion criteria was represented by tumors, trauma or surgery in the maxillofacial area, on-going orthodontic treatment, non-treated edentulous patients, extensive prosthodontic treatments, chronic disease (Parkinson, depression, paralysis), current anxiolytic or antidepressant treatments, drugs.

The study was carried out in two stages.

In the first phase an original bruxism questionnaire was distributed to the 180

subjects included in the study. The enclosed questionnaire consisted in questions grouped in 6 sections: general and demographic data, questions about bruxism, stress, awake or sleep bruxism, and one questions about signs of bruxism in the oral cavity (dental wear, gingival retraction, dental fractures/fissures, mobility). Based on the answers two groups were formed: subjects with self-reported bruxism (n=60) and the second group without bruxism (n=120).

The second phase consisted in an intraoral examination, including static and dynamic occlusion, masticatory muscles and TMJ evaluation. Dental signs of bruxism were also identified and registered (dental wear, gingival retraction or dental mobility). All subjects were evaluated by a single examiner, respecting the same methodology. Each participant was subjected to static and dynamic dental occlusion analysis. Static occlusion included maximum intercuspation position and Angle class. As for dynamic occlusion, the mandibular functional movements were examined: protrusion and lateral guidance (both left and right). Working and non-working interferences were identified and registered with articulating paper (Bausch GmbH & co, USA). For each patient an occlusal chart was filled.

All data collected by questionnaire and examination chart were introduced in a Microsoft Excel file, resulting a data base used for further analysis. Qualitative and quantitative data analysis was performed using Microsoft Excel software.

Statistical analysis

Data analysis was performed using SPSS software. ANOVA test was used for comparing the two groups, as well as Spearman's test for establishing correlations. The level of significance was considered $p<0,05$.

RESULTS AND DISCUSSIONS

Considering bruxism frequency, from the total of 180 subjects included in the study, 33.3 % (n=60) presented bruxism, while 67% (n=120) did not present this pathology. Related to bruxism type, a higher frequency was observed for sleep bruxism (48%), comparing to awake (18%), or mixed (34%).

Bruxism was more frequent in patients with occlusal imbalance. Dental signs in bruxism were represented by pathological wear, dental fissures or fractures, mobility and gingival retraction. Their correlation is presented in table 1.

Table 1. Correlation between bruxism, occlusal dysfunction and dental pathologies

	Present N (%)	Absent N (%)	Correlation coefficient **	Sig. (2-tailed)- Spearmen's test *
Bruxism	60 (33.3)	120 (66.7)	1.000	-
Working propulsive interference	84 (46.7)	96 (53.3)	.614	.000
Working propulsive premature contacts	96 (53.3)	84 (46.7)	.236	0.978
Non-working propulsive interference	48 (26.7)	132 (73.3)	.373	.000
Non-working propulsive premature contacts	18 (10)	162 (90)	.000	.001
Working lateral guidance interferences	90 (50)	90 (50)	.566	.000

Working lateral guidance premature contacts	66 (36.7)	114 (63.3)	.489	.000
Non-working lateral guidance interferences	42 (23.3)	138 (76.7)	.111	.136
Non-working lateral guidance premature contacts	12 (6.7)	168 (93.3)	.378	.000
TMJ pain	30 (16.7)	150 (83.3)	.632	.000
Disc displacement	36 (20)	144 (80)	.707	.000
Pathological dental wear	60 (33.3)	120 (66.6)	.705	.000
Detal fissures/fractures	66 (36.7)	114 (63.3)	.929	.000
Pathological dental mobility	12 (6.7)	168 (93.3)	.378	.000
Gingival retraction	78 (43.3)	102 (56.7)	.618	.000

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level.

The correlation between bruxism, age, and gender is presented in fig. 1.

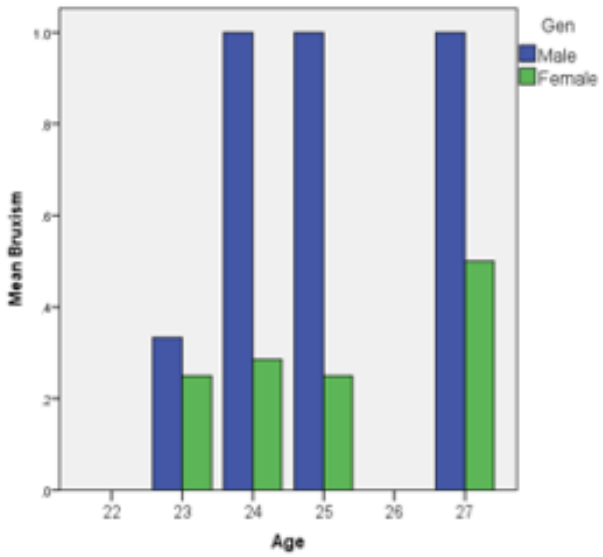

Figure 1. Distribution of patients with bruxism considering age and gender

Occlusal dysfunction and TMJ pain or disc displacement were more frequently diagnosed in patients with bruxism, as presented in fig. 2.

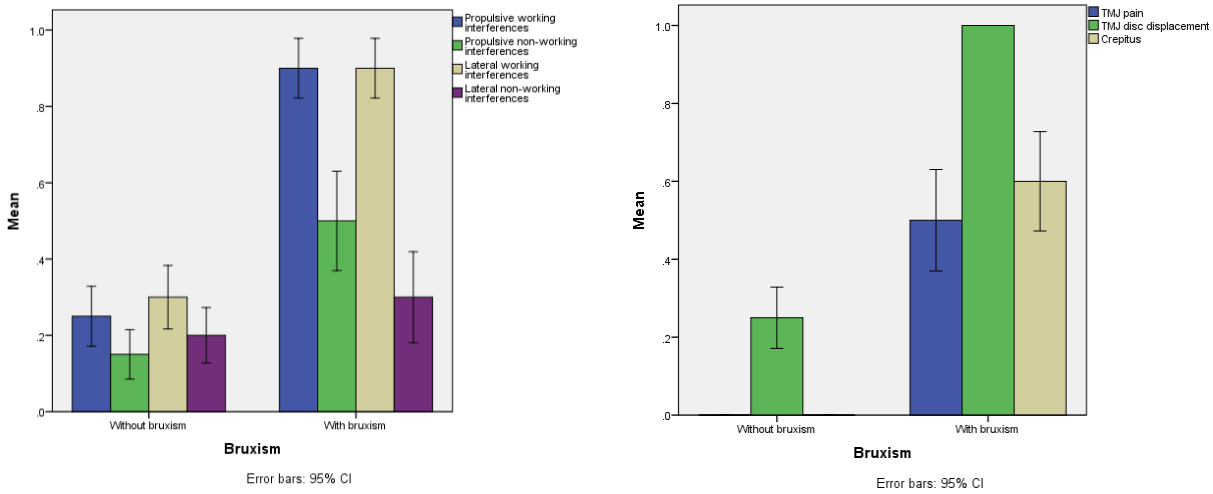

Figure 2 A. Occlusal interferences distribution among bruxism and non-bruxism patients.
B. TMJ pathology distribution among bruxism and non-bruxism patients.

A significant correlation ($p<0,05$) was observed between the presence of bruxism and pain, hypertonia and/or hypertrophy in the jaw muscles as highlighted in fig. 3.

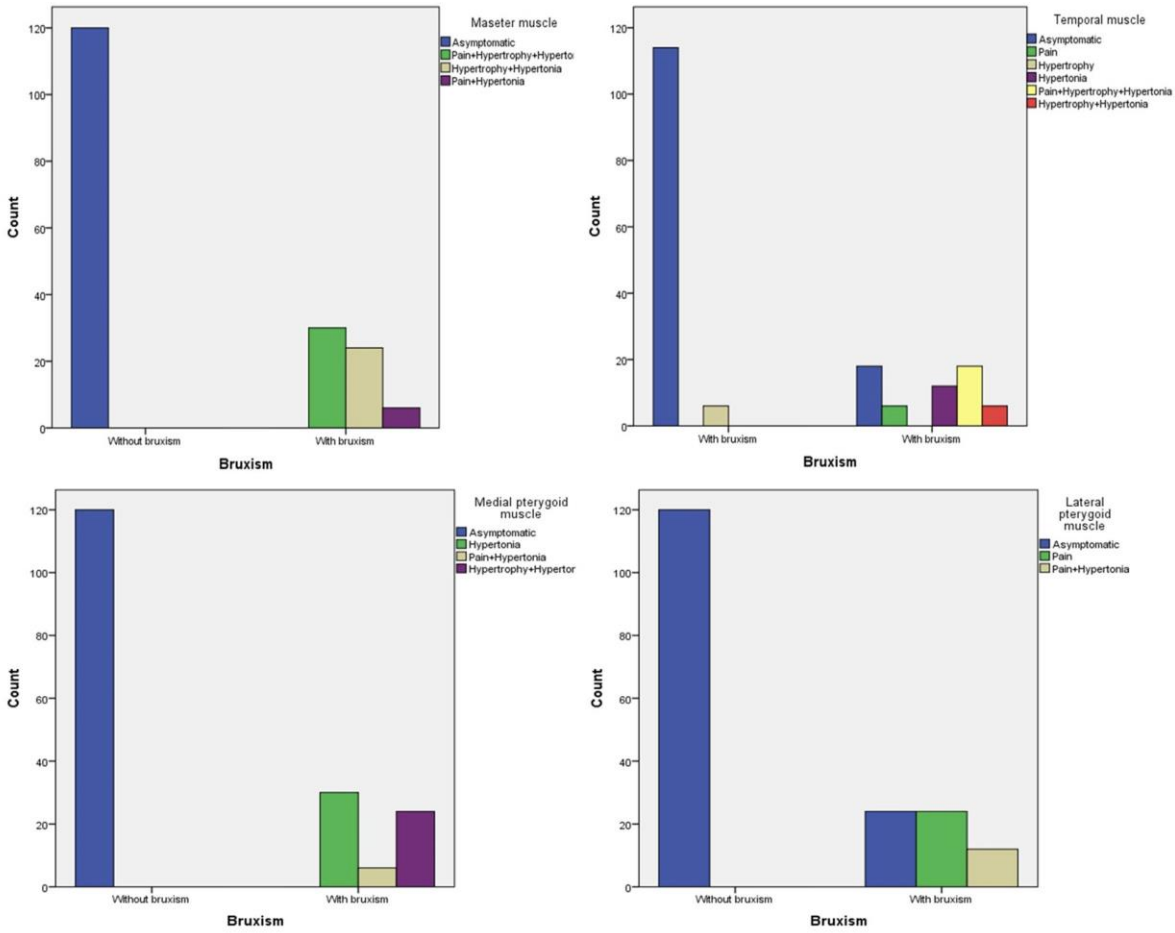

Figure 3. Muscular symptomatology in patients with and without bruxism.

This study analyzed, according to the initial objectives, the possible correlations between bruxism and pathological sign in the dento-maxillary area: occlusal dysfunction, temporomandibular joint and/or muscular pathology. The possible correlation between TMD and bruxism has been evaluated by many studies in the literature. While some research demonstrated a link between bruxism and masticatory muscle pathology (pain, hypertrophy and/or hypertonia) (Ohrbach *et al.,* 2011, Ferndes *et al.,* 2012, von Piekatz *et al.,* 2020), others have not (John *et al.,* 2002, Faphael *et al.,* 2012). The results of the current study indicate a significant correlation between the two pathologies, so patients with bruxism may have a higher risk of TMD development. During human experimental studies, Finiels and Batifol (Finies *et al.,* 2014) observed that in patients with TMD a hyperactivity of painful masticatory muscles is present.

Sleep bruxism might represent and indirect contributing factor to TMD. Shimada et al. (Shimada *et al.,* 2019) evaluated in a recent study, the possible relationship between sleep bruxism and clinical muscle symptoms. The results showed that more diffuse jaw muscle symptoms (such as stiffness, fatigue, pressure, soreness and ache) may play an important role in the development of or transition to manifest TMD pain.

Possible gender correlation with bruxism was not validated in the current study. These results are inconsistent with those reported by Banco Aguillera et al. (Aguilera *et al.,* 2014), Yadav et al. (Yadav *et al.,* 2019), or Huhtela et al (Huhtela *et al.,* 2016), who observed a significant link between female gender and sleep bruxism.

However, the study performed by Berger at. (Berger *et al.,* 2015) showed no statistical association between gender and bruxism.

Patients in younger age present more often bruxism symptomatology. A higher prevalence for bruxism was identified in patients under 25 years old (both males and females), than in those over 25. Similar results were obtained by Manfredini et al (Manfredini *et al.,* 2013), concluding that bruxism tend to decrease with age.

The results of the current study highlighted that bruxism is more frequent in patients presenting occlusal imbalance. Dental signs in patients with bruxism are represented by pathological wear, dental fissures or fractures, mobility and gingival retraction. Further no significant difference were found in left-right and anterior-posterior occlusal contact areas while Gumus et al. (Gumus *et al.,* 2013) have reported that in bruxism patients a larger areas of posterior contact is seen as compared to healthy individuals. Carlsson et al. (Carlsson *et al.,* 2003) and Kerstein and Radke (Kerstein *et al.,* 2017) found that occlusal prematurities and other malocclusions could play a role in increased bruxism in the subjects. However, Adisen et al. (Adisen *et al.,* 2018) and Manfredini et al. (Manfredini *et al.,* 2012) found that there was little correlation between occlusal factors and bruxism.

Limitations of this study need to be considered. Currently there is a lack of valid indices on diagnosing and classifying bruxism, so developing a series of questions regarding bruxism based on the available literature is necessary. Further long-term longitudinal studies would be required to see the evolution pattern of bruxism and possible development of TMD. Occlusal analysis using digital devices would offer more objective data.

CONCLUSIONS

1. Bruxism is more frequent in patients presenting occlusal imbalance.

2. Dental signs in patients with bruxism are represented by pathological wear, dental fissures or fractures, mobility and gingival retraction.
3. Jaw muscle symptoms (such as pain, hypertonia or hypertrophy) and temporomandibular joint signs (pain or/and disc displacement) often coexist with bruxism.

REFERENCES

1. Lobbezoo F., Ahlberg J., Glaros A.G., et al. Bruxism defined and graded: an international consensus. J Oral Rehabil.; 2013:40,(2–4).
2. De Laat A., Macaluso G.M., Sleep bruxism as a motor disorder. Mov Disord.; 2002:17, Suppl 2,(S67-S69).
3. Laluque J.F., Brocard D., Incau E., Understanding BRUXISM. Current Knowledge and Practice. Charenton-le-Pont: Quintessence International Publishing; 2017.
4. Kato T., Thie N.M., Huynh N., Miyawaki S., Lavigne G.J., Topical review: sleep bruxism and the role of peripheral sensory influences. J Orofac Pain; 2003:17,3,(191-213).
5. Murali R.V., Rangarajan P., Mounissamy A., Bruxism: Conceptual discussion and review. J Pharm Bioallied Sci.; 2015:7,Suppl 1,(S265-S270).
6. Reddy S.V., Kumar M.P., Sravanthi D., Mohsin A.H, Anuhya V. Bruxism: a literature review. J Int Oral Health; 2014:6,6,(105-109).
7. de Leeuw R.K.G., Orofacial pain: guidelines for assessment, diagnosis and management. Hanover Park (IL): Quintessence Editorial International; 2013.
8. Monteiro A.A.K.S., Estimation of blood flow by 133 Xe clearance in human masseter muscle during rest, endurance of isometric contraction, and recovery. Arch Oral Biol.; 1988:33, (561–565).
9. Mense S., Nociception from skeletal muscle in relation to clinical muscle pain. Pain.; 1993:54,(241–289).
10. Manfredini D., Lobbezoo F., Relationship between bruxism and temporomandibular disorders: a systematic review of literature from 1998 to 2008. Oral Surg Oral Med Oral Pathol Oral Radiol Endod.; 2010:109,(e26–e50).
11. Manfredini D., Cantini E., Romagnoli M., et al. Prevalence of brux- ism in patients with different research diagnostic criteria for temporomandibular disorders (RDC/TMD) diagnoses. Cranio.; 2003:21,(279–285).
12. Ohrbach R., Fillingim R.B., Mulkey F., Gonzalez Y., Gordon S., Gremillion H., Lim P.F., Ribeiro-Dasilva M., Greenspan J.D., Knott C., Maixner W., Slade G., Clinical Findings and Pain Symptoms as Potential Risk Factors for Chronic TMD: Descriptive Data and Empirically Identified Domains from the OPPERA Case-Control Study. The Journal of Pain; 2011:12, 11.
13. Ferndes G., Franco A.L., Siqueira J.T. Sleep bruxism increases the risk for painful temporomandibular disorder, depression and non-specific physical symptoms. J. Oral Rehabil.; 2012:39,(538-544).
14. von Piekartz H., Rösner C., Batz A., Hall T., Ballenberger N., Bruxism, temporomandibular dysfunction and cervical impairments in females – Results from an observational study, Musculoskeletal Science and Practice; 2020:45.

15. John M.T., Frank H., Lobbezoo F., No association between incisal tooth wear and temporomandibular disorders J. Prosthet. Dent.; 2002:87,(197-203).
16. Faphael K.G., Sirois D.A., Jal M.N., Sleep bruxism and myofascial temporomandibular disorders: a laboratory-based polysomnographic investigationAm Dent Assoc.; 2012:143, (1223-1231).
17. Finiels P.J., Batifol D., The use of botulinum toxin in the treatment of the consequences of bruxism on cervical spine musculature Toxicon; 2014:80,(58-63).
18. Shimada A., Castrillon E.E., Svensson P., Revisited relationships between probable sleep bruxism and clinical muscle symptoms, Journal of Dentistry; 2019:82,(85-90).
19. Aguilera B. Relationship between self-reported sleep bruxism and pain in patients with temporomandibular disorders. Oral Rehabil.; 2014:41,6,(443–450).
20. Yadav S., Yang Y., Dutra E.H., Robinson J.L., Wadhwa S. Temporomandibular Joint Disorders in Older Adults. J Am Geriatr Soc.; 2018:66(6),1213-1217.
21. Huhtela O., Näpänkangas R., Joensuu T., Raustia A., Kunttu K., Sipilä K., Self-reported bruxism and symptoms of temporomandibular disorders in Finnish University students. J Oral Facial Pain Headache; 2016: 62,4,(311–317).
22. Berger M, Szalewski L, Bakalczuk M, Bakalczuk G, Bakalczuk S, Szkutnik J. Association between estrogen levels and temporomandibular disorders: a systematic literature review. Prz Menopauzalny; 2015: 14,(260-70).
23. Manfredini D., Winocur E., Guarda-Nardini L., Paesani D., Lobbezoo F., Epidemiology of bruxism in adults: a systematic review of the literature. J Orofac Pain; 2013:27,2,(99-110).
24. Gümüş H.O., Kılınç H.I., Tuna S.H., Özcan N., Computerized analysis of occlusal contacts in bruxism patients treated with occlusal splint therapy. J Adv Prosthodont; 2013:5,3,(256-261).
25. Carlsson G.E., Egermark I., Magnusson T., Predictors of bruxism, other oral parafunctions and tooth wear over a 20-year follow-up period. J Orofac Pain; 2003:17,(50-57).
26. Kerstein R.B., Radke J., Average chewing pattern improvements following disclusion time reduction. Cranio; 2017:35, 3,(135-151).
27. Adisen M.Z., Okkesim A., Misirlioglu M., Yilmaz S., Does sleep bruxism affect masticatory muscles volume and occlusal force distribution in young subjects? A preliminary study. Cranio; 2018:20,(1-7).
28. Manfredini D., Visscher C.M., Guarda-Nardini L., Lobbezoo F., Occlusal factors are not related to self-reported bruxism. J Orofac Pain; 2012:26,3,(163-167).