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Short Communication

Quantitative and Qualitative Brux checker Analyses: Comparison Number and Size of Tooth Contact Areas in Sleep and Awake Bruxism

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Abstract

Introduction: Bruxism is one of the occlusal functions which should be considered as a potential risk factor for restorative and prosthetic rehabilitation. Visualization and quantification of the extent of teeth grinding helps decision-making for dentists and patients. The lateral and sagittal distribution of the contact areas with the teeth promotes vigilance with regard to the heavily loaded segments of the dental arch and those segments that are not or only slightly involved.

Patients and Method:

Results: Brux Checkers analysis based on number and size of tooth contact areas showed a similar result for one patient, but significantly different results for the other, comparing bruxism when sleep and wake up. Unilateral and sagittal distribution of TCAs based on number and size (mm2) provides insight into the quality of this occlusal function. The distribution of tooth contact areas can be the same during sleep and wakefulness; but such agreement should not be assumed under all circumstances.

Conclusion: Knowing the true contribution of occlusion during clenching helps to plan occlusal changes. The lateral and sagittal distributions of TCAs provide insight into the unconscious occlusal function of bruxism and help identify which occlusal segments are less associated with bruxism. A comparable result for sleep and wake bruxism on Brux Checker should not be taken for granted.

Keywords: Bruxism; Sleep Bruxism; Awake Bruxism; Occlusion; Parafunction; Toot Contact Areas

Abbreviations: TCAs Tooth Contact Areas; BC Brux Checker®; SB Sleep Bruxism

Introduction

Dental practitioners are concerned with the best possible care for their (burns) patients. Since oral restoration always involves irreversible occlusal changes, understanding the location and size of the occlusal contact areas in the dental arch is important to establish a treatment strategy. Understanding the potential risk of bruxism/bruxism will help modify treatment strategies. Teeth grinding may be associated with prosthetic failure [1]. Expert opinions on the best treatment concepts for bruxism (wake and sleep) vary considerably. Instead of the term "therapy", the term "management" is often used [2]. Convenient screening tools to assess bruxism before occlusal intervention are inexpensive, easy to handle, have no side effects, and have additional diagnostic benefits. Brux Checker® (BC; Scheu Dental, DE-58642 Iserlohn, Germany) visualizes the contact points between teeth that form during unconscious grinding or bruxism during wakefulness and sleep. BCs are created for each patient using a die casting technique. First, preliminary data were published, allowing comparison of tooth contact area (TAC) number and size with normal values [3].

A paradigm shift in SB evaluation has occurred in recent years. SB is no longer understood merely as a harmful movement disorder. However, most clinicians mainly focus on the possible negative consequences of bruxism: chipping, occlusal trauma, migration of teeth, temporomandibular disorders [4]. Different, rather controversial opinions on the importance of bruxism in humans in medicine and dentistry persist. Is it an abnormal function, a movement disorder [5]? Or conversely, can bruxism be assessed as a physiologically relevant occlusal function [6]? This view suggests that occlusion represents a secondary function in addition to the primary occlusal functions. The growing acceptance of bruxism (wake and sleep) as a physiological function changes the methodological basis. Today, bruxism (awake and asleep) is classified into possible (based on patient reports), probable (determined by clinical examination) and definite (verified by instrumental analysis) [7]. This classification is not a choice between one or the other. The International Consensus Group issued a clear note in favor of instrumental analysis. Tooth clenching and grinding can be weighted differently depending on the clinical outcome: harmless, of little clinical relevance; at least one negative consequence, such as chipping; or at least one positive outcome, including cessation of respiratory arrest and increased salivation [7].

Preliminary data (young adults, males and females, natural occlusion with minimal restorations) will help to understand better occlusal involvement in bruxism. Based on these data, a quantitative and qualitative appraisal of individual patients is available in daily practice. The mean value of the number of TCAs is ≈28 (sd +/-8). The mean size of TCAs is ≈70mm2 (sd +/-51mm2). The comparison between females and males shows only minor, not significant differences for number and of TCAs: males, an average of ≈29 (sd +/-8) TCA´s with an average size of ≈87mm2 (sd +/-58), while for females, ≈27 (sd + / -7) TCA´s with an average size of ≈56mm2 (sd +/-40mm2). Further attention during the analyses of BC has to be paid to the distribution of TCAs right and left, the transversal (lateral) distribution. The number of TCAs is almost identical on the right and left sides. There are only minor differences in the distribution of the size of TCAs on the right and left. The evaluation of the sagittal distribution considers three sections: anterior (corresponds largely to anterior teeth including the canine), intermediate (corresponds largely to the premolar region), and posterior (corresponds largely to the molar region). The sagittal distribution of TCAs in the upper jaw is ≈8 (sd +/-3) anterior, ≈7.5 (sd +/-2.5) intermediate, and ≈12.5 (sd +/-5) posterior. The following values describe the mean size of TCAs: for the upper occlusion ≈28mm2 (sd +/-24mm2) anterior, ≈14mm2 (sd +/-11mm2) intermediate and 3≈0mm2 (sd +/-25mm2) posterior [3]. The BC visualizes functional TCAs. For this reason, the authors of this article suggest a different, systematic approach for the BC analysis based on numerical data in order to compare the awake and asleep bruxing. This report aims to demonstrate to quantitative and qualitative data of occlusal contacts areas comparison of BC used during sleep and used during work, based on two case presentations.

Participant and Method

Based on two clinical cases, the importance of understanding the differences between bruxing and tooth grinding during sleep and in awake state is highlighted.

Patient 1

30-year-old male with natural occlusion (all 32 teeth present) and minimal restorations; dental class I on both sides; upper dental arch with slight compression in the premolar area, slight anterior narrowing in the lower jaw, isolated gingival recessions, and occlusal abrasions on the casts. Main concern of the patient: temporomandibular joint noises in both temporomandibular joints during (wider) mouth opening. In addition, the patient reports gastrointestinal reflux, sensitive teeth, slight headache and tension in the neck/throat along with postural problem. The patient is aware of grinding and clenching of teeth and wants to prevent tooth destruction and deterioration of joint noises and headache.

Patient 2

33-year-old female with natural occlusion (wisdom teeth absent) and minor occlusal restorations in the molar region; dental class I on both sides; narrow upper arch, crowding in the lower anterior arch; gingival recession and class V lesion in both arches, most evident in upper canines and premolars right and left. Main concern: gingival recessions and joint noises left TMJ. In addition, the patient reports gastritis, headache (bilateral temporal and occipital region, tension type headache, during night and also in the afternoon), tinnitus right side combined with a feeling of swelling and sometimes hearing impairment and neck spasm. The clinical muscle and joint examination (palpation) supports a tentative diagnose myofascial pain syndrome with TMJ involvement. Both patients received two BC, along with the instructions to use one BC during sleep (one night), the other BC during work (full day). After the BC have been returned to the dental clinic, a digital analytic process was performed online, and the clinic received two reports with the results in tabular, graphical and verbal form, one for the clinic, one for the patient in an electronic format (pdf).

Results and Discussion

Results for Patient 1

The following comparison of the TCAs on sleep and awake BC show almost identical results in the lateral and sagittal distribution of the TCAs (Figure 1). The lateral distribution of right versus left is very similar: awake BC with total 45 TCAs (61.7mm2), of which

23 (51.1%) TCAs (30.9mm2, 50.1%) are on the right side and 22 (48.9%) TCAs (30.8mm2, 49.9%) on the left side; asleep BC with total 45 TCAs (59.2mm2), of which 25 (55.6%) TCAs (29.4mm2, 49.6%) are on the right side and 20 (44.4%) TCAs (29.8mm2, 50.4%) on the left side. The sagittal distribution of anterior versus intermediate versus posterior reveals differences as well: awake BC anterior 19 (42.2%) TCAs (25.7mm2, 41.6%), intermediate 4 (8.9%) TCAs (6.7mm2, 10.8%) and posterior 22 (48.9%) TCAs (29.4mm2, 47.6%); asleep BC anterior 16 (35.6%) TCAs (20.8mm2, 35.2%), intermediate 7 (15.6%) TCAs (8.4mm2, 14.2%) and posterior 22 (48.9%) TCAs (30.0mm2, 50.7%). The following comparison of the TCAs on sleep and awake BC demonstrate a significant difference, especially in the lateral distribution of the TCAs for patient 2 (Figure 2). The lateral distribution of right versus left shows significant differences for the awake BC with total 17 TCAs (32.1mm2), of which 6 (35.3%) TCAs with a size of 9.5mm2 (29.6%) are located on the right side and 11 (64.7%) TCAs with a size of 22.6mm2 (70.4%) are located on the left side. The lateral distribution for the asleep.

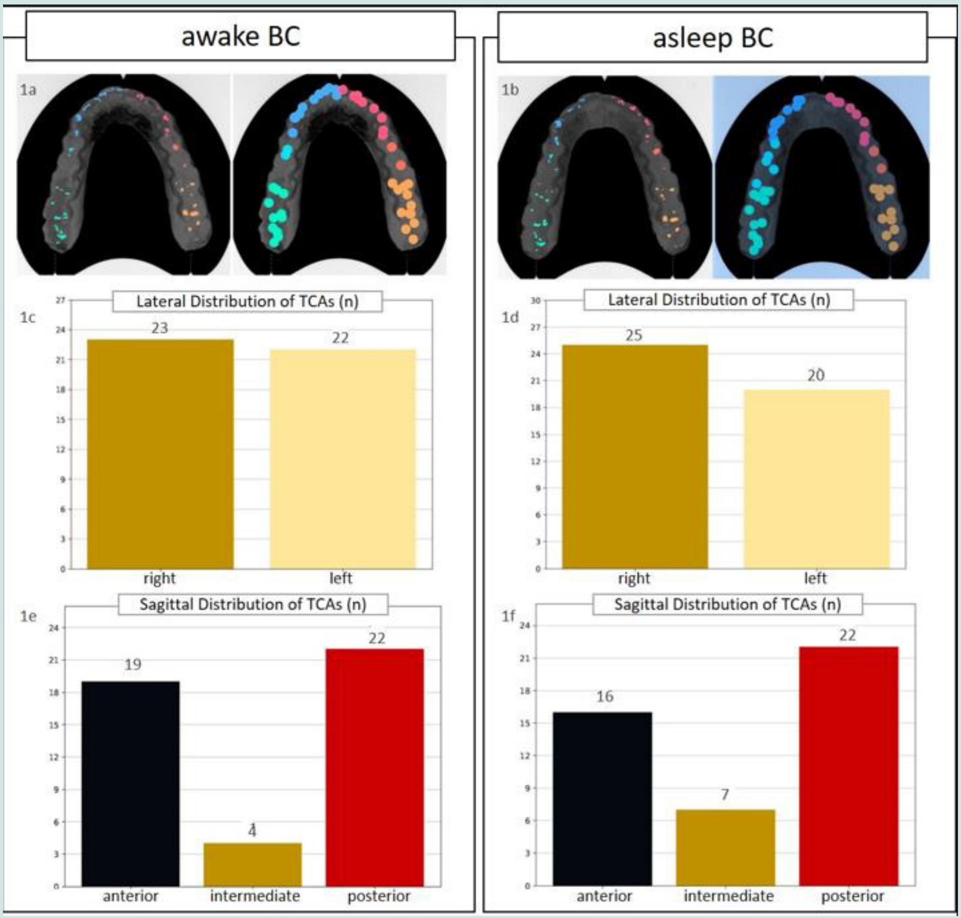

Figure 1: Comparison of the two Brux Checker® (BC) of patient 1: 1a, 1c and 1e show the results for awake bruxism, 1b, 1d and 1f the results for bruxism during sleep; the transversal distributions are similar for awake and asleep grinding pattern
1a, 1b: highlighted tooth contact areas with allocation to occlusal segments and visualization of the size tooth contact areas, equal diameters of the circles indicate similar expansion of the tooth contact areas.
1c, 1d: right and left distribution for number of TCAs.
1e, 1f: distribution TCAs in sagittal direction – anterior vs. intermediate vs. posterior.

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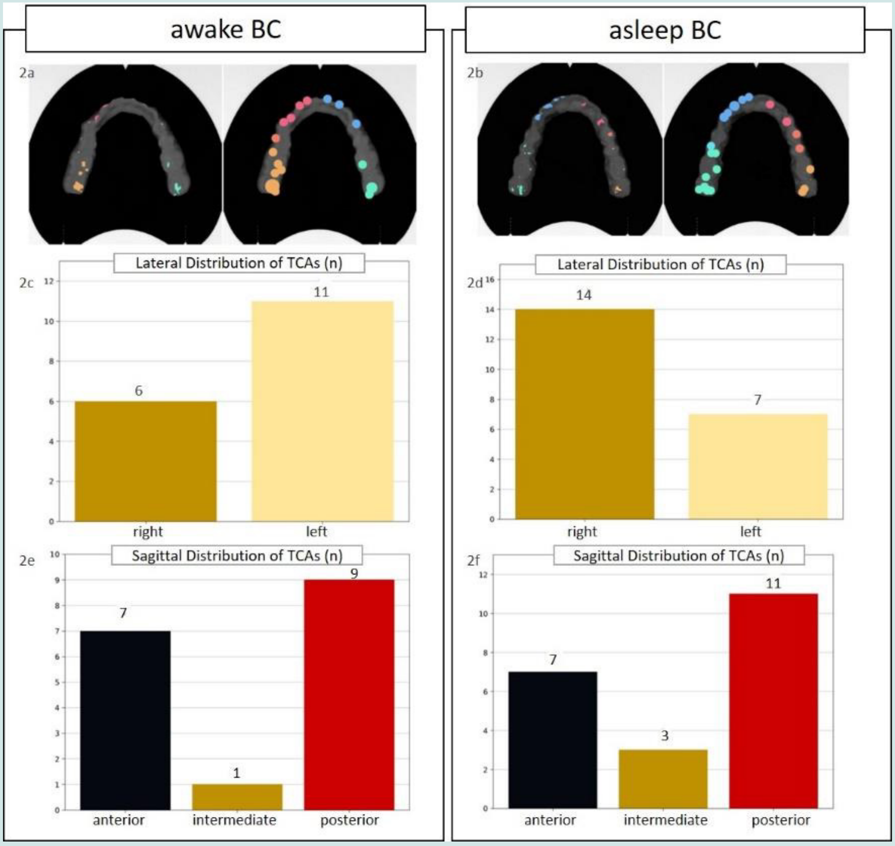

Figure 2: Comparison of the two Brux Checker® (BC) of patient 2: 2a, 2c and 2e show the results for awake bruxism, 2b, 2d and 2f the results for bruxism during sleep; the transversal distributions are very different for awake and asleep grinding pattern
2a, 2b: highlighted tooth contact areas with allocation to occlusal segments and visualization of the size tooth contact areas, equal diameters of the circles indicate similar expansion of the tooth contact areas.
2c, 2d: right and left distribution for number of TCAs.
2e, 2f: distribution TCAs in sagittal direction – anterior vs. intermediate vs. posterior.

BC discloses significant differences

total 21 TCAs with a size of 36.9mm2, of which 14 (66.7%) TCAs with a size of 23.0mm2 (62.3%) are located on the right side and 7 (33.3%) TCAs with a size of 13.9mm2 (37.7%) are located on the left side. The sagittal distributions anterior versus intermediate versus posterior reveals for the BC used during sleep or in wake state are not so varying in the number of TCAs (awake BC anterior 7 (41.2%), intermediate 1 (5.9%), posterior 9 (52.9%); asleep BC anterior 7 (33.3%), intermediate 3 (14.3%), posterior 11 (52.4%). Significant differences are obvious in the size of the TCAs (awake BC anterior 5.3mm2 (16.6%), intermediate 0,2mm2 (0.8%), posterior 26.5mm2 (82.6%); asleep BC anterior 21.0mm2 (56.8%), intermediate 4.2mm2 (11.5%), posterior 11.7mm2 (31.7%). Occlusal rehabilitation aims to harmonize occlusion. This harmonization is traditionally seen from centric contacts and eccentric protrusive and laterotrusive guidance. Symmetric distribution of TCAs and a sagittal distribution following the accepted occlusal concepts (anterior control, posterior support, mutual protection) enables the clinician to establish objectives in occlusal function bruxism. Using the mean size of the TCAs for total, right, left, anterior, intermediate, and posterior helps estimate the distribution's uniformity within the arch. Using such key figures will help to understand the occlusal asymmetry and disharmony (Table 1). Comparing the results of patient 1 with the preliminary standard values show, that the number of TCAs (45) is above average (28 +/-8) for both awake and asleep bruxism. The size of the TCAs (61.7mm2) is slightly lower than the average. The almost identical pattern of tooth contacts in sleep and in the waking state can also be represented by the mean size of all TCAs (Table 1). In contrast, the comparison of the results for patient 2 show a different outcome: the number of TCAs (17 awake BC, 21 asleep BC) are slightly reduced (28 +/-8). The size of the TCAs (32.1mm2 awake BC, 36.9mm2 asleep BC) is reduced, compared to the mean values. The very different pattern of tooth contacts in sleep and in the waking state can also be represented by the mean size of all TCAs, especially in the distribution (Table 1).

Table 1: quantitative analyses of the Brux Checker® for patient 1 and 2. Additionally, mean sizes of the TCAs are displayed (highlighted columns) - the significantly different values for patient 2 indicate that the distribution of the TCAs in the dental arch vary substantially. In addition, it can be recognized that teeth grinding is performed very differently during awake and asleep state.

	case 1						case 2					
	awake			asleep			awake			asleep		
	n	mm2	mean size	n	mm2	mean size	n	mm2	mean size	n	mm2	mean size
TCAs	45	61.7	1.371111111	45	59.2	1.315555556	17	32.1	1.888235294	21	36.9	1.757142857
total n	23	30.9	1.343478261	25	29.4	1.176	6	9.5	1.583333333	14	23	1.642857143
right	22	30.8	1.4	20	29.8	1.49	11	22.6	2.054545455	7	13.9	1.985714286
left	19	25.7	1.352631579	16	20.8	1.3	7	5.3	0.757142857	7	21	3
anterior	4	6.7	1.675	7	8.4	1.2	1	0.2	0.2	3	4.2	1.4
intermediate	22	29.4	1.336363636	22	30	1.363636364	9	26.5	2.944444444	11	11.7	1.063636364
posterior			0.331521739			0.314			2.744444444			1.936363636

Conclusion

Knowing the actual involvement of occlusion during bruxing allows refining required occlusal changes. TCAs' lateral and sagittal distribution provides deep insight in the unconscious occlusal function of tooth grinding and helps to realize those occlusal segments less involved in the bruxing pattern. The dental professionals may approximate the individual TCAs with the data on the number and size of the TCAs in natural occlusion to understand the amount of occlusal involvement of the individual patient. In addition, comparing the occlusal grinding pattern during sleep and awake state may modify the treatment details, such as the prescription pattern of intraoral splints (night, day, 24h). A similar result for sleep and awake Bruxing on the Brux Checker should not be taken for granted.

The visualization of the tooth grinding pattern helps the patient better understand the bruxing function. In addition, the comprehension of possible risk for the natural teeth and surrounding tissues and restorative materials raises. In the authors' opinion, the quantitative approach to bruxing tooth contact areas will simplify the assessment of this occlusal unconscious function, both diagnostically and therapeutically. The author suggests, that additional to total number and size of tooth contact areas the lateral and sagittal distribution (qualitative analysis) has to be considered and should not obscure the dental arch segments not involved in bruxing. In the future, the quantitative and qualitative occlusal analysis will possibly allow a better understanding for the occlusal involvement in dysfunctional problem. Further research projects are required.

Conflict of Interest

A Slavicek (scientific advisor, lecturer), F Slavicek (CEO) and G Slavicek (owner, head R&D) declare a conflict of interest due to their involvement in the company Orehab Minds (Orehab Minds GmbH, DE-70567 Stuttgart, Germany; https://www.orehab-minds.com) that developed the automatic Brux Checker® analysis and now distribute it under the product name DRS BRUX.

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