The effectiveness of bruxchecker in diagnosing sleep bruxism

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ABSTRACT

Objective: The objective of this study was to identify and compare the loss of red coloration on BruxChecker between two groups: those without sleep bruxism (No SB) and those with sleep bruxism (SB). Additionally, the study aimed to assess the efficacy of BruxChecker in diagnosing sleep bruxism. **Methods:** A cross-sectional study was conducted on 40 participants from the Clinic of the Faculty of Odonto-Stomatology, University of Medicine and Pharmacy, Ho Chi Minh City. Data collection involved participants wearing BruxChecker for two consecutive nights. The study then involved identifying and comparing the results between the two groups, as well as classifying the tooth grinding patterns. Significant differences ($p<0.001$) were found in the discoloration level of red on BruxChecker between the two groups: those without sleep bruxism and those with sleep bruxism. **Results:** The study found that the overall rate of mediotrusive grinding was 80% in the sleep bruxism group, compared to only 12.5% in the no sleep bruxism group. **Conclusion:** BruxChecker is effective in diagnosing sleep bruxism. Moreover, BruxChecker has been demonstrated to be a useful tool for examining grinding patterns during sleep bruxism.

Keywords: *BruxChecker, grinding pattern, sleep bruxism*

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INTRODUCTION

Bruxism is a parafunctional activity characterized by repetitive jaw-muscle movements, including clenching, grinding, bracing, or thrusting of the mandible. It is classified into two types: awake bruxism and sleep bruxism (SB), with the latter often linked to sleep-related movement disorders. Although bruxism is not life-threatening, it contributes to various masticatory system disorders, including occlusal trauma, tooth wear, abfractions, tooth migration, and temporomandibular dysfunction (TMD). These conditions significantly affect quality of life and can lead to the failure of dental restorations [1].

Diagnosing bruxism remains challenging due to its multifactorial etiology and variable clinical presentation. Common diagnostic methods include patient-reported questionnaires, clinical examinations, and evaluation of tooth wear patterns. However, these methods are subjective and may not reliably differentiate between current and historical bruxism. More objective approaches, such as electromyography (EMG) and polysomnography, provide precise measurements of bruxism activity but are expensive and impractical for routine clinical use. Furthermore, polysomnography may alter sleep conditions, potentially influencing masseter muscle activity [2].

To address these limitations, the BruxChecker has been introduced as a novel diagnostic tool for assessing bruxism. This transparent, thin (0.1 mm) appliance is worn overnight and records tooth contact patterns through areas of discoloration on its surface. BruxChecker offers several advantages, including ease of use, high patient acceptance, and minimal influence on occlusion or muscle activity. Recent studies suggest that it effectively differentiates between tooth grinding patterns in SB patients and provides insights into occlusal relationships and temporomandibular joint (TMJ) status. However, there is limited research comparing BruxChecker findings between individuals with and without SB [3].

This study aimed to evaluate the effectiveness of BruxChecker in diagnosing SB by comparing discoloration patterns between individuals with and without SB. Additionally, it seeks to classify tooth grinding patterns and explore their relationship with bruxism severity. By providing a non-invasive and cost-effective approach, BruxChecker has the potential to enhance bruxism diagnosis and treatment planning in clinical practice.

MATERIALS AND METHODS

Participants

Participants were selected after undergoing a dental examination at the Clinic of the Faculty of Odonto-Stomatology, University of Medicine and Pharmacy, Ho Chi Minh City. They were divided into two groups: sleep bruxism (SB) and no sleep bruxism (No SB). All subjects were healthy adults aged 20 to 40 years, with at least six teeth on each side. Exclusion criteria included jaw muscle activity associated with sleep disorders, medical or neurological conditions, medication use, or substance use disorders. The diagnosis of SB was based on the American Academy of Sleep Medicine (AASM) criteria [3]. Participants in the No SB group were selected based on the absence of self-reported or partner-reported tooth grinding sounds during the night over the past six months. Additionally, they exhibited no symptoms such as abnormal tooth wear, muscle fatigue, pain, jaw locking upon awakening, or masseter hypertrophy upon voluntary clenching.

A total of 40 volunteers (17 males and 23 females) with a mean age of 24 years (range: 20–31 years) met the inclusion criteria and participated in the study. The participants were evenly divided into two groups, with 20 individuals in each. All subjects were instructed to wear the BruxChecker during sleep for two consecutive nights.

Identification and comparison of discoloration levels on BruxChecker

Each BruxChecker tray was coded to ensure blinding. An independent assessor who was not involved in the study evaluated the discoloration.

Tools for evaluation

A transparent plastic sheet, divided into 1 mm^2 squares, was affixed to a glass surface, which was securely positioned parallel to the floor. During evaluation, each BruxChecker tray was placed under the glass, making contact at three points: one at the incisor/canine region and two at the premolar/molar regions. A magnifying glass was used for accurate observation, with both the observer's eyes and the magnifying glass positioned perpendicular to the glass surface.

A semi-quantitative rating scale was developed by the authors to assess discoloration levels on the BruxChecker:

0: No discoloration
1: Discoloration at a point (S1: width < 1 mm, length < 1 mm)
2: Discoloration in a line (S2: width < 1 mm, length > 1 mm)
3: Discoloration of a small area (S3: width 1–3 mm, length ≥ 1 mm)
4: Discoloration of a large area (S4: width ≥ 3 mm, length ≥ 3 mm)
5: Perforation of the tray

Classification of tooth grinding patterns using BruxChecker

Tooth grinding patterns were identified based on the discolored areas on the BruxChecker tray. Two types of grinding were observed:

- Laterotrusive side grinding (LG)
- Mediotrusive side grinding (MG)

Laterotrusive grinding patterns were classified into three categories:

- Incisor-Canine (IC): Discoloration on canines, with or without incisors.
- Incisor-Canine-Premolar (ICP): Discoloration on premolars, with or without canines and incisors.
- Incisor-Canine-Premolar-Molar (ICPM): Discoloration on molars, with or without premolars, canines, and incisors.

Mediotrusive side grinding was classified as follows:

- No contact: No discoloration on the first and second molars unilaterally.
- Mediotrusive grinding (MG): Discoloration on the first and second molars unilaterally.
- Each of the three laterotrusive patterns (IC, ICP, ICPM) was either accompanied by MG or not, resulting in a total of six grinding pattern classifications.

Statistical analysis

A t-test was conducted to compare the levels of discoloration between the SB and No SB groups. A p-value of <0.05 was considered statistically significant. Statistical analyses were performed using SPSS.

RESULTS

The study found significant differences ($p < 0.001$) in discoloration levels between the two groups, with the SB group showing a higher average rate (3.36 ± 0.35) compared to the No SB group (2.03 ± 0.80). BruxChecker effectively identified different grinding patterns, including laterotrusive and mediotrusive movements, demonstrating its potential as a reliable diagnostic tool for SB assessment (Figure 1).

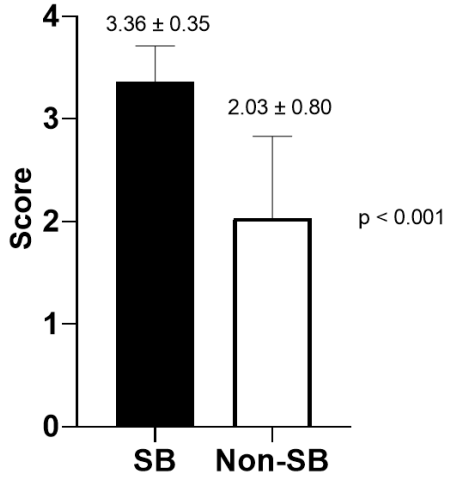

Figure 1. *Average discoloration score of bruxchecker trays*

Regarding the distribution of discoloration scores on BruxChecker trays between individuals with and without sleep bruxism (SB). Lower discoloration levels (scores 0–2) were more common in the No SB group (46.8%) compared to the SB group (6.8%), indicating less grinding activity. Moderate discoloration (score 3) was the most frequent category in both groups, but it was higher in SB (55.7%) than in No SB (46.1%). Severe discoloration (scores 4–5), including tray perforation, was significantly more prevalent in the SB group (35%), whereas only 4.3% of the No SB group reached score 4, and none exhibited score 5 (Table 1).

Table 1. *Distribution of discoloration scores on bruxchecker trays*

Discoloration score	**SB (%)**	**No SB(%)**
0–2 (Low)	6.8	46.8
3 (Moderate)	55.7	46.1
4 (Severe)	35.0	4.3

In terms of the distribution of tooth grinding patterns in individuals with and without sleep bruxism (SB) based on BruxChecker analysis. Incisor-canine (IC) grinding was more common in the No SB group (17.5%) compared to the SB group (2.5%), while premolar and molar grinding patterns (ICP, ICPM) appeared in both groups but were more prevalent in SB when combined with mediotrusive grinding (MG). Notably, mediotrusive grinding was significantly higher in the SB group (80%) compared to the No SB group (12.5%), highlighting a key difference between the two groups. The most frequent pattern in SB individuals was the combined laterotrusive and mediotrusive grinding (ICPM+MG), observed in 52.5% of cases, whereas it was absent in No SB individuals (Table 2).

Table 2. *Distribution of tooth grinding patterns based on bruxchecker analysis*

Grinding Pattern	SB (%)	No SB (%)
IC (Incisor-Canine)	2.5	17.5
ICPM + MG	52.5	0
MG (Mediotrusive)	80	12.5
SB, Sleep bruxism		

DISCUSSIONS

Bruxism is a complex condition that remains challenging to diagnose due to its multifactorial etiology and variability in clinical presentation. Traditional diagnostic methods, such as self-reported questionnaires, clinical examinations, and tooth wear assessments, have limitations in accuracy and objectivity. While electromyography (EMG) and polysomnography provide precise evaluations, their cost and practicality restrict their widespread use in clinical settings. As an alternative, BruxChecker has emerged as a simple, non-invasive tool to assess bruxism-related tooth grinding patterns, offering insights into occlusal forces and their impact on dental health.

The study demonstrated that BruxChecker effectively differentiates between individuals with and without sleep bruxism (SB). Significant differences ($p < 0.001$) were observed in the level of red discoloration on BruxChecker trays, with SB patients exhibiting more extensive wear and

discoloration, including perforation in severe cases. This aligns with previous studies that have used similar devices, such as Bruxcore, to quantify bruxism severity based on tray wear patterns. However, unlike Bruxcore, which has a thickness of 0.6 mm and may influence muscle activity, BruxChecker is only 0.1 mm thick, making it less likely to interfere with occlusal function [4,5].

Furthermore, the study revealed distinct differences in tooth grinding patterns between SB and No SB groups. The SB group exhibited a significantly higher prevalence of mediotrusive grinding (80%) compared to the No SB group (12.5%), reinforcing previous findings that mediotrusive contacts play a crucial role in SB pathophysiology. Additionally, complex grinding patterns, such as incisor-canine-premolar-molar (ICPM) combined with mediotrusive grinding (MG), were present in 52.5% of SB cases but entirely absent in the No SB group. These findings suggest that BruxChecker can help clinicians better understand occlusal dynamics and identify individuals at higher risk for temporomandibular dysfunction (TMD) and dental restoration failure [6–8].

Although BruxChecker provides valuable clinical insights, it has some limitations. First, it does not distinguish between different types of jaw movements, such as functional activities (e.g., swallowing, speech) and parafunctional activities (e.g., bruxism). Additionally, while the presence of discoloration indicates jaw-muscle activity during sleep, it does not directly measure the intensity or frequency of bruxism episodes. Future studies should explore the integration of BruxChecker with EMG or other biometric monitoring tools to enhance diagnostic accuracy.

CONCLUSIONS

BruxChecker is a promising diagnostic aid for assessing sleep bruxism, providing objective data on grinding patterns and occlusal contacts. Its ease of use, affordability, and minimal impact on occlusion make it a viable option for routine clinical application. However, further research is needed to refine its diagnostic capabilities and explore its role in long-term bruxism management strategies.

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Conflicts of Interest: The authors declare no conflict of interest.

REFERENCES

1. Lobbezoo F, Ahlberg J, Glaros AG, et al.: Bruxism defined and graded: an international consensus. J Oral Rehabil. 2013, 40:2–4. 10.1111/joor.12011
2. Manfredini D, Ahlberg J, Aarab G, et al.: Standardised tool for the assessment of Bruxism. J Oral Rehabil. 2024, 51:29–58. 10.1111/joor.13411
3. Błaszczyk B, Martynowicz H, Niemiec P, et al.: Sleep bruxism and obstructive sleep apnea are not risk factors for tension-type headache (TTH): A polysomnographic study. J Clin Med. 2024, 13:3835. 10.3390/jcm13133835
4. Tago C, Aoki S, Sato S: Status of occlusal contact during sleep bruxism in patients

who visited dental clinics – A study using a Bruxchecker®. CRANIO®. 2018, 36:167–73. 10.1080/08869634.2017.1295125
5. Saczuk K, Lapinska B, Wilmont P, Pawlak L, Lukomska-Szymanska M: The Bruxoff device as a screening method for sleep bruxism in dental practice. J Clin Med. 2019, 8:930. 10.3390/jcm8070930
6. Park B-K, Tokiwa O, Takezawa Y, Takahashi Y, Sasaguri K, Sato S: Relationship of tooth grinding pattern during sleep bruxism and temporomandibular joint status. CRANIO®. 2008, 26:8–15. 10.1179/crn.2008.003
7. Braz de Oliveira M, Almeida A, Félix S, Rua J, Cebola P, Godinho C: Sleep bruxism: the complexity of a definitive diagnosis – case report. Ann Med. 2021, 53:. 10.1080/07853890.2021.1897389
8. Besirevic-Bulic F, Schmid-Schwap M, Kundi M, Sagl B, Piehslinger E: Wear management of colored foils for the assessment of sleep bruxism patterns—A prospective, randomized crossover study. Diagnostics. 2023, 13:172. 10.3390/diagnostics13020172