ASSESSMENT OF THE RELATIONSHIP BETWEEN TEMPOROMANDIBULAR JOINT SOUNDS AND BRUXISM

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SUMMARY:
Aim of the study: The study aims to assess the possible relationship between bruxism and TMJ sounds.
Material and methods: The relationship between temporomandibular joint (TMJ) sounds and bruxism was evaluated in a sample composed of 62 females and 39 males varied in age from 21 to 56 years with a mean age of 40.0±1.07. The participants were informed about the purpose of this study, and they gave their consent. The main methods we used in registering TMJ sound were palpation and auscultation. A self-administered Bruxism Assessment Questionnaire assessed bruxism.

Results: The prevalence of bruxism in study group was 60.39% (n = 61) – sleep bruxism (SB) and awake bruxism (AB) were 38.2% and 23.4%, respectively. A total of 53.47% (n = 54) of the sample exhibited some type of clicking joint sound. Chi-square test for independence (with Yates Continuity Correction) indicated significant association between bruxism and TMJ sounds, \( \chi^2 (1, n = 101) = 4.183, p = .046, \phi = .28 \).

Conclusions: Biomechanical factors seem to play a significant role in TMJ disk displacement development. Based on the research, it should be concluded that bruxism may be associated with joint pathologies, such as disc displacement and joint noises.

Keywords: bruxism, disc displacement, teeth grinding, temporomandibular disorders, TMJ sounds,

INTRODUCTION
Typically temporomandibular disorder (TMD) is defined as a “group of disorders involving the masticatory muscles, the temporomandibular joint (TMJ), and the associated structures” [1]. They are primarily characterized by joint and muscular pain, noise in the temporomandibular joints (TMJ), and limited mandibular movements. Although the typical temporomandibular joint is described as silent, sounds can be heard in individuals who may or may not present pain symptoms [2]. Clinically, TMJ noise is related to the internal derangement of TMJ [3].

Temporomandibular joint (TMJ) sounds are the main symptoms of temporomandibular disorders. The TMJ internal derangement is an abnormal positional relationship between the disc and the condyle, articular eminence, and articular fossa [4]. Abnormal positioning may cause TMJ sounds and pain and may limit jaw function. The movement of the disc may result in a clicking, snapping, and popping sound known as an opening and closing click.

Articular sounds of the clicking type as during mouth opening and closing are characteristic clinical signs of disc displacement with reduction (DDWR) [5]. TMJ clicking corresponds from 18 to 26.2% of clinical symptoms of TMD and is one of the most common complaints of patients. According to a systematic review, 14.0% of the children or adolescents had clinical TMJ sounds [6], while a current investigation detected an even higher percentage up to 31.9% for German adolescents [7].

The American Academy of orofacial pain (AAOP) defined bruxism as “diurnal or nocturnal parafunctional activity including clenching, bracing, gnashing, and grinding of the teeth.” The published data reveal that the prevalence of bruxism in students in Brazil was 31.6% in this population [8]. The most associated factors with bruxism were stress, muscle pain, TMJ pain, and TMJ noise.

The most common symptom of joint disfunction is TMJ clicking (30.7%), followed by TMD pain (16.3%) and TMJ crepitus (10.3%) [9]. DDWR can occur in 33% of asymptomatic individuals [10]. Among the intra-articular disorders of the TMJ, disc displacement with reduction (DDWR) corresponds to 41% of TMD clinical diagnoses [11]. TMJ clicking corresponds to 26.2% of clinical signs of TMD and is one of the most common complaints of patients [12].

Based on the evidence, the relationship between bruxism and TMD is still controversial in the literature due
to the complexity of the etiology and diagnostic of both disorders [13-15].

All in all, the risk factors for TMJ sounds are still not fully understood, and biomechanical and anatomical causes seem to affect changes in the TMJ.

This study aimed to assess the possible relationship between bruxism and TMJ sounds.

**MATERIAL AND METHODS**

One hundred and thirty (130) participants with temporomandibular joint (TMJ) sounds were preliminarily selected for this clinical study. The association between joint sounds and bruxism we evaluated in a sample composed of 71 females and 59 males ranging in age from 21 to 56 years with a mean age of 36.2±1.0. Before the clinical trial, we notified the patients about the purpose of this study, and all participants gave their consent. In addition, all participants completed self-administered questionnaires consisting of questions about bruxism. According to RDC/TMD Axis IIa diagnostic criteria, the patients underwent routine clinical examination. It was performed only by one expert investigator to minimize error.

1. **TMJ sounds diagnosis**

Trained dentists examined temporomandibular joint sounds according to the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) [3]. The DC/TMD, which is a standardized tool to diagnose TMD, presents the following diagnostic criteria for DDWR and presence for at least one of the following symptoms:

- TMJ noise(s) present with jaw movement or function in the last month;
- Clicking, popping, or snapping noise detected with palpation during at least one of three repetitions of opening or closing movement(s);
- Clicking, popping, or snapping noise detected with palpation during at least one of three lateral or protrusive movement(s).

The main symptom of disc displacement with reduction is a click sound during jaw movements. It must be reciprocal (audible during both jaw opening and jaw-closing activities) and not fixed (loud during the jaw opening and jaw-closing movements).

2. **Bruxism Diagnosis**

The study exclusively used self-reports in bruxism diagnosis for identifying possible bruxers. Sleep bruxism (SB) was evaluated by a questionnaire recommended by the American Academy of Sleep Medicine [16] as follow:

1. Are you aware of grinding your teeth frequently during sleep, or has anyone heard you? (yes/no)
2. Are you consider that your dentition is worn down more than normal? (yes/no)
3. Are you familiar with any of the following signs and symptoms upon awakening? (yes/no):
   - Sensation of fatigue, tightness, or soreness of your jaw upon awakening?
   - Feeling that your teeth are clenched or that your mouth is sore upon awakening?
   - Aching of your temples upon awakening?
   - Difficulty in opening your mouth wide upon awakening?
   - Tension in your jaw joint upon awakening and feeling as if you have to move your lower jaw to release it?
   - Hearing or feeling a “click” in your jaw joint upon awakening that disappears afterward?
4. Do you grind your teeth or clench your jaws during wakefulness? (yes/no)

The respondents were determined to suffer from possible SB if their answer to question 1 or 2 was “yes” or at least one “yes” answer to a symptom listed in question 3. The “yes” response to Question 4 indicated that the participant had possible AB.

**Statistical analysis**

Statistical analysis was performed using the IBM SPSS Statistics software package (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). Descriptive methods of categorical and quantitative variables (mean, median, standard deviation, minimum and maximum) were used. The relationship between bruxism and occlusal factors was evaluated with the chi-square test.

**RESULTS**

There were 54 participants (53.47%) diagnosed with TMJ sounds. The prevalence of bruxism was 60.39% (n = 61) – SB and AB were 37.2% and 23.19%, respectively. No significant difference was observed between females and males for both TMJ sounds (p = 0.852) and bruxism (0.448) (Table 1).

### Table 1. Descriptive statistics of bruxism and TMJ sounds by gender among the study group and crosstabulation

<table>
<thead>
<tr>
<th>Gender</th>
<th>TMJ sounds</th>
<th>Yes</th>
<th>Male</th>
<th>19</th>
<th>Female</th>
<th>35</th>
<th>Total</th>
<th>54</th>
<th>Value</th>
<th>0.576</th>
<th>df</th>
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<tbody>
<tr>
<td></td>
<td>No</td>
<td>20</td>
<td>20</td>
<td>62</td>
<td>47</td>
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<td>Total</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Total</td>
<td>39</td>
<td>62</td>
<td>101</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bruxism</td>
<td>Yes</td>
<td>24</td>
<td>24</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td>Total</td>
<td>39</td>
<td>62</td>
<td>101</td>
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</table>
Correlation analysis was used to identify the correlation between the TMJ sounds and bruxism. Chi-square test for independence (with Yates Continuity Correction) indicated significant association between bruxism and TMJ sounds, $\chi^2 (1, n = 101) = 4.183$, $p = .046$, $\phi = .28$. We found that the size of the effect of the above indicators is close to medium based on benchmarks suggested by Cohen (.10 for small effect, .30 for medium effect, and .50 for large effect). Results of the analysis are reported in Table 2.

Table 2. Association and effect size between bruxism and TMJ sounds

<table>
<thead>
<tr>
<th></th>
<th>Asymp. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
</tr>
<tr>
<td>Pearson Chi-Square</td>
<td>4.827</td>
</tr>
<tr>
<td>Continuity Correction</td>
<td>3.972</td>
</tr>
</tbody>
</table>

The results of this study demonstrate a positive relationship between bruxism and TMJ sounds.

Fig. 1. Distribution of bruxism and TMJ sounds among the study population.

A positive correlation sign indicates that the increase in the size of factor bruxism enhances the possibility of TMJ sounds.

DISCUSSION

This study tries to assess the possible relationship between bruxism and internal derangement of TMJ caused by mechanical overloading. Many clinical studies have investigated this correlation in recent years, producing a range of contradictory results and conclusions. Based on the evidence, the relationship between bruxism and TMD is still controversial in the literature. That may be due to the complexity of the etiology and diagnostic of both disorders [13].

Most studies explained a TMJ sound by the movement of the articular disc onto the condyle during jaw movements. This pathological movement is caused by displacing the articular disc with reduction (DDWR) [10]. Disc disorders (DD) is a condition that implicates no discomfort for the patient, yet it can induce pain or limitations in jaw movements during the mastication process [17, 18]. Our data agree with the research carried out by Marpaung C et al., which showed that biomechanical factors play a significant role in TMJ disk displacement development [19].

Earlier studies [20, 13] hypothesized that such symptoms might be caused by anatomical and functional disturbances in the TMJ. However, several studies suggest that clenching and grinding, especially during the daytime, are positively correlated with disc displacement and TMJ sounds, consistent with our results.

The shear stresses estimated in research for bruxism, but especially those obtained in sustained clenching can cause damage in the articular disc, leading to TMDs [21].

Although the studies showed a high risk of bias, the qualitative analysis of individual studies showed that children with bruxism have a greater chance of developing TMD [14] and prospectively displacing TMJ disc.

Reports show that bruxism was more often associated with TMJ symptoms, increasing the risk of TMJ pain, noise, and limited mouth opening. Based on research [22], we concluded that excessive load affecting temporomandibular joints caused by chewing and occlusal forces generated during parafunction and in people with defined long-term bruxism has crucial importance on biomechanical disc properties and hence the course of temporomandibular joint conditions. The results of previous reports significantly associated crepitus and temporomandibular joint sounds with oral behaviors [9]. An identical conclusion was reached by other studies showing that stress, muscle pain, temporomandibular joint (TMJ) pain, and TMJ noise were significantly associated with bruxism [8].

The analysis of short and long-term studies showed that parafunctional habits, such as bruxism, have been associated with hyperactivity of the masticatory muscles. The resultant loading to the temporomandibular joint (TMJ) is subject to changes in cartilage and disc [23]. The study explains the effect of clenching direction on the stress distribution in the TMJ in parafunction might result in increased stresses on the TMJ disc and the condylar and temporal articular surfaces. A previous study established that the higher stresses are concentrated in the lateral region during prolonged clenching. That could imply that TMJ disorders are related to damage or wear in the disc and the condylar cartilage occur when dysfunctional displacements are present [24].

According to other authors, the interaction between sleep and awake bruxism may increase joint sounds and TMD [25]. Among harmful oral habits, bruxism has been
CONCLUSION
Within the limitations of this study, we concluded that oral parafunction, especially bruxism, was associated with joint pathology as disc displacement and joint noises. TMJ disc displacement and TMJ sounds are commonly asymptomatic conditions, and no treatment is usually required since the structures in this region may change and adapt. Treatment should be done when the noise is accompanied by pain. Bruxism generally appears to be a significant factor in contributing to TMJ disorders. A clinical investigation should be performed to confirm and generalize these findings.

Consent for publication
Written informed consents for publication of any associated data were obtained from all patients.

REFERENCES:


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