

# Sleep Bruxism and Gastroesophageal Reflux. A Scoping Review

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**Objective:** To provide a scoping review of the literature by assessing all the English-language papers that investigated the relationship between sleep bruxism (SB) and gastroesophageal reflux disease (GERD).

**Methods:** On September 2025, a systematic search was conducted in the National Library of Medicine (PubMed), Scopus, and Web of Science databases to identify all published articles assessing the relationship between SB and GERD, using various assessment approaches. The selected articles were assessed independently by two authors according to a structured reading of the articles' format (PECO).

**Results:** Out of 174 references that were initially retrieved, 7 articles met the inclusion criteria and were thus included in the review. The studies were divided into 2 categories based on the type of SB assessment: 1. self-report and clinical assessment (n = 4), and 2. instrumental examination (n = 3). All studies found a positive correlation between SB and GERD.

**Conclusion:** This review supports a relationship between SB and GERD; however, underlying mechanisms remain unclear due to methodological heterogeneity, limited evidence strength, and variability in assessment methods. Future investigations should adopt standardized assessments for both SB and GERD and more thoroughly examine their relationship with coexisting sleep-related disorders and alterations in sleep architecture.

**Keywords:** sleep bruxism, masticatory muscle activity, gastroesophageal reflux, GERD

## Introduction

### Rationale

Dental sleep medicine (DSM) is the discipline that focuses on exploring the interrelationships among various sleep-related conditions (ie, sleep-related breathing disorders, orofacial pain, oral-moistening disorders, mandibular movement disorders, and gastroesophageal reflux), aiming to enhance their early detection in the dental setting and to prevent their potential adverse outcomes.<sup>1,2</sup> Within this framework, sleep bruxism (SB) and gastroesophageal reflux disorder (GERD) are two common sleep-related conditions that have received particular interest from dental practitioners due to their co-occurrence in the general population and their impact on the stomatognathic system.<sup>1</sup>

SB is defined as a masticatory muscle activity during sleep that is characterized as rhythmic (phasic) or non-rhythmic (tonic).<sup>3</sup> According to a recent review, the prevalence of SB in adults is 21%<sup>4</sup> depending on the assessment criteria used and the geographic area. Data based solely on self-report indicate a prevalence of 12.8% among adults,<sup>5</sup> whilst prevalence is higher if the polysomnography-based (PSG) criteria for SB are adopted. The highest prevalence of SB was observed in North America at 31%, followed by South America at 23%, Europe at 21%, and Asia at 19%.<sup>4</sup> Although SB is no longer considered a disorder per se, but rather a potential sign of an underlying condition,<sup>6,7</sup> it may lead, in certain individuals, to negative consequences in the stomatognathic system, such as mechanical tooth wear, temporomandibular disorders (TMDs), and prosthodontic complications.<sup>8–13</sup> Notably, the global co-occurrence of bruxism and



TMDs has been estimated at 17%, with marked geographical variability, and the mean prevalence of TMDs among individuals with bruxism is reported to be 63.5%.<sup>4</sup>

GERD is a medical condition involving the retrograde movement of gastric contents into the oesophagus and, in some cases, beyond the upper oesophageal sphincter (UES), potentially affecting upper airway and digestive tract structures such as the pharynx, larynx, and oral cavity.<sup>14</sup> Its occurrence in the general population is considerable, with a questionnaire-based prevalence estimate ranging from 13 to 19%.<sup>15,16</sup> Typical clinical manifestations include pyrosis, regurgitation, retrosternal discomfort, chronic cough, laryngitis, and dental erosion.<sup>14</sup> Over time, GERD may contribute to persistent inflammation of the oesophageal mucosa and heighten the risk of developing oesophageal adenocarcinoma.<sup>17</sup> Additionally, GERD is considered an important risk factor for intrinsic chemical tooth wear.<sup>18</sup> Evidence suggests that patients with GERD have an up to 4 times increased odds ratio of presenting erosive tooth wear.<sup>19</sup>

The relationship between SB and GERD has been a topic of interest,<sup>20</sup> due to the higher prevalence of SB in individuals with GERD compared with the general population (73.7% vs. 12.8%).<sup>5,21,22</sup> Nevertheless, while there are many studies showing an association between SB and GERD, little is known about the possible pathophysiological mechanisms linking these two clinical conditions. Indeed, diagnostic discrepancies in the assessment of SB (self-report vs. (PSG) and GERD (symptom-based assessment vs. pH-metry) represent a major challenge in investigating their relationship.<sup>23</sup> In this context, a comprehensive article that compares existing findings, summarizes the potential pathophysiological links between SB and GERD, and maps the associated diagnostic limitations is currently lacking.

## Objective

A scoping review was considered the most appropriate methodological approach for investigating the relationship between SB and GERD, given the heterogeneity and fragmentation of the existing literature.<sup>1,23</sup> Studies in this field span multiple disciplines, including dentistry, sleep medicine, and gastroenterology, and showed highly variable study designs, diagnostic criteria, and outcome measures for both conditions. Moreover, the available evidence is largely observational, often based on small sample sizes, preliminary data, or non-uniform assessment methods. Within this framework, a scoping review is more suitable than a systematic or metanalytic assessment that might be hampered by the inhomogeneity of available data.<sup>24</sup> The aim of this scoping review is to map the extent, nature, and characteristic of the available evidence on the relationship between SB and GERD and answer to the following questions, if possible: 1. Which pathophysiological mechanisms and interactions may account for the relationship between SB and GERD? 2. What are the principal research gaps and diagnostic limitations regarding the relationship between SB and GERD? 3. What are the considerations for future research topics?

## Materials and Methods

### Protocol and Registration

The search was conducted between September 22 and September 25, 2025. The protocol of the present scoping reviews was registered in the Centre for Open Science database (DOI: <https://doi.org/10.17605/OSF.IO/N6ZPK>) with the aim of providing a track of the methodology adopted and allowing the reproducibility of the study.

### Eligibility Criteria

The literature search was limited to articles written in English, involving adult populations (aged over 18). The inclusion criteria were as follows:

1. Studies conducted on human subjects (randomized controlled trials [RCTs] or observational studies);
2. Studies providing clinical research data on the relationship between SB and GERD based on any type of assessment strategy (subject-, clinically-, or instrumentally based);
3. Articles published in English.

Exclusion criteria were:

1. Animal or in vitro research;
2. Preprint articles;
3. Systematic and narrative reviews;
4. Case reports, case series;
5. Letters to the editor, conference abstracts, opinion pieces;
6. Studies involving populations with other medical conditions.

No limitations were applied for the years of publication. Articles in the press and grey literature were not considered.

## Information Sources

The search was initially conducted in the National Library of Medicine's Medline database (PubMed) using Medical Subjects Headings (MeSH) terms. Subsequently, the same search strategy was applied to the Scopus and Web of Science databases. In case the articles were not retrievable from the databases, the authors were contacted via private email.

## Search

The Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist was followed.<sup>25</sup>

The search was carried out to identify all peer-reviewed articles published in the English language that were relevant to the topic of this review: "the relationship between SB and GERD". To identify a list of potential papers for inclusion, the search query used was: ("sleep bruxism"[MeSH Terms] OR "bruxism" OR "tooth grinding" OR "tooth clenching" OR "rhythmic masticatory muscle activity" OR "RMMA") AND ("gastroesophageal reflux"[MeSH Terms] OR GERD OR "acid reflux"). No search filters were applied, and no year restriction was applied.

## Selection of Sources of Evidence

Two reviewers (M.P., O.I.S) independently screened all the articles obtained by the before mentioned search strategy, performing a first screening at title and abstract levels for potential eligibility. If at least one author suggested an abstract to be of potential interest, or if an abstract was not available, the study was retained for the full-text assessment. In case the full text was of potential interest to at least one reviewer, it was included in the list of papers of potential interest. The full-text assessment of all the articles that were of potential interest after the first screening was carried out independently by the same review pairs, who were blind to each other, to understand whether the papers met the inclusion criteria. EndNote (version 21, Clarivate Analytics, Philadelphia, PA) was used as a software for deduplication. Subsequently, the search strategy was implemented by reviewed the reference lists of the selected studies. All included studies were treated equivalently, regardless of their study design. The inter-reliability (IRR) of the screening between the two reviewers was 0.94 (Cohen's kappa).

## Data Charting Process

Data extraction was performed by the two main reviewers through an Excel-calibrated form, according to the specified eligibility criteria. The forms were developed, calibrated, and validated after multiple rounds of discussion among the authors of the papers. The data extraction was independently performed by two reviewers (M.P., O.I.S.), who were blinded to each other. In case of disagreement regarding the extracted data, a third reviewer was consulted to solve all the conflicts (D.M.).

## Data Items

The form contained the name of the study, country, eligibility criteria, study design, sample size, mean age, sex, assessment strategy for SB, diagnostic or screening approach for GERD, and follow-up.

## Synthesis of Results

The selected articles were analysed using a PECO-like structured approach,<sup>26</sup> namely Population, Exposure, Comparison, and Outcome. A Narrative system of the results was adopted. The Population (P) component included information on the demographic characteristics of the study population. The Exposure (E) referred to the presence of GERD and/or SB. The Comparison (C) component described the control groups, depending on the study design (ie, individuals without SB or individuals without GERD). The Outcome (O) component summarized the findings regarding the potential relationship between SB and GERD. In addition, the main conclusions of each study were extracted and summarized.

## Results

### Selection of Sources of Evidence

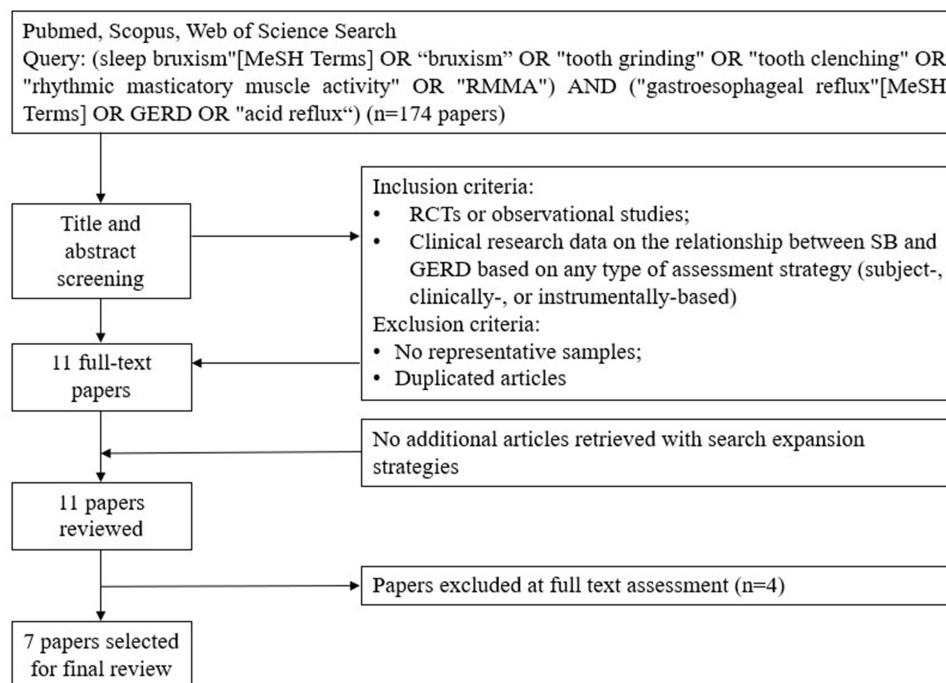
The search query identified 174 articles. All the articles that were of potential interest were retrievable from the literature, with no need of contacting the authors. Title and abstract screening led to the exclusion of 163 articles, which did not fulfil the inclusion criteria, and the full text was retrieved from the remaining 11 articles. Of these, one paper was excluded because it described a single case report,<sup>27</sup> and three papers were excluded because they enrolled individuals without bruxism.<sup>28–30</sup> Thus, seven articles were selected for inclusion in the review.<sup>21,22,31–35</sup> See Figure 1 for a flowchart of the in- and exclusion process.

Based on the criteria adopted for bruxism assessment, the selected articles were then divided into two categories: 1. questionnaire/self-report and clinical assessment (n = 4),<sup>21,22,34,35</sup> and 2. instrumental (electromyographic [EMG]-[PSG]) assessment (n = 3).<sup>31–33</sup>

### Characteristics of Sources of Evidence

Four studies investigated the relationship between SB and GERD using self-reported assessments (Table 1). Of these, three studies<sup>21,34,35</sup> also included a clinical evaluation of bruxism. In total, the study populations comprised more than 2.800 participants.

Following the criteria of the American Academy of Sleep Medicine,<sup>36</sup> the two Li et al studies and the study by Mengatto et al assessed SB through self- or partner-reports of teeth clenching or grinding during sleep in the past six



**Figure 1** Flowchart of the in- and exclusion process.

**Table 1** Features and Main Findings of Factors Associated with Sleep Bruxism (SB) and Gastro-Oesophageal Reflux (GERD)

Study's First Author and Year	Type of Study	Population (Patients/ Problem)	Exposure (Presence of GERD and/or SB)	Comparison (Control Group)	Outcome
Pollis 2024 <sup>22</sup>	Cross-sectional	325 subjects (57.4% female); Mean $\pm$ SD age=40.3 $\pm$ 14.0 years	SB assessment: self-report; GERD assessment: self-report.	Group comparison of GERD-related symptoms between individuals with and without self-report SB.	A weak positive correlation between current SB and GERD was found ( $r=0.112$ ; $p=0.044$ ). No significant differences in GERD-related symptoms between groups emerged.
Li 2018 <sup>34</sup>	Prospective case-control	363 consecutive bruxers and 363 matched controls. Aged 18–72 years	SB assessment: self-report and clinical; GERD assessment: self-report.	Presence of GERD-related symptoms in individuals with and without self-reported bruxism	GERD was associated with bruxism (OR: 5.30 CI95%: 2.62–10.70). Patients with a longer duration of GERD symptoms had a higher odds ratio for bruxism than those with a shorter duration
Li 2018 <sup>35</sup>	Prospective case-control	887 consecutive bruxers and 887 matched controls. Aged 18–75 years	SB assessment: self-report and clinical; GERD assessment: self-report.	Presence of GERD-related symptoms in individuals with and without self-reported bruxism	GERD was associated with bruxism (OR, 6.87; 95% confidence interval (CI), 4.34–10.88). GERD was associated with all types of bruxism (sleep bruxism alone, odds ratio, 6.71, 95% CI, 4.22–10.68); awake bruxism alone, odds ratio, 13.06, 95% CI, 5.32–32.05; overlap of sleep bruxism and awake bruxism, odds ratio, 6.48, 95% CI, 3.05–13.77).
Ohmure 2016 <sup>33</sup>	Double-blind placebo-controlled investigation	12 patients (7 males and 5 females); Mean $\pm$ SD age=30.3 $\pm$ 7.9 years	SB assessment: PSG GERD assessment: self-report and esophagogastroduodenoscopy.	Case: administration of PPI; Control: placebo	PPI administration yielded a significant reduction in the frequency of EMG bursts, RMMA episodes, and grinding noise. No significant differences were observed regarding the swallowing events and sleep variables
Mengatto 2013 <sup>21</sup>	Prospective case-control	45 subjects (71.1% female); Mean $\pm$ SD age=44.6 $\pm$ 14.0 years	SB assessment: self-report and clinical; GERD assessment: self-report and pH manometry/ endoscopy.	Group comparison (G1: bruxism without GERD 26; G2: bruxism with GERD 19).	GERD was a strong predictor of SB, with an adjusted OR of 6.58 ( $p<001$ )
Miyawaki 2004 <sup>32</sup>	Cross-sectional	12 subjects (8 female); Mean $\pm$ SD age=24.0 $\pm$ 2.1 years	SB assessment: EMG; GERD assessment: pH manometry.	No	The frequency of RMMA was significantly higher during periods of decreased oesophageal pH than during other times.
Miyawaki 2003 <sup>31</sup>	Prospective case-control	10 bruxers (5 female); Mean $\pm$ SD age=27.0 $\pm$ 7.0 years) 10 matched controls (4 female); mean $\pm$ SD age=26.4 $\pm$ 4.7 years	SB assessment: EMG; GERD assessment: oesophageal pH metric and pH manometry.	Case: administration of PP; Control: placebo	The bruxers showed higher frequency of RMMA episodes and a higher frequency and percentage of time of gastroesophageal reflux episodes with a pH less than 4.0 and 5.0 than the control group. The frequency of RMMA episodes after the release of the medication from the proton pump inhibitor was significantly lower than that after administration of the placebo in the control and bruxism groups.

**Abbreviations:** SD, Standard Deviation; SB, Sleep Bruxism; RMMA, Rapid Masticatory Muscle Activity; GERD, Gastro-oesophageal Reflux Disease; PSG, Polysomnography; EMG, Electromyography; PPI, Proton Pump Inhibitor; OR, Odds Ratio.

months.<sup>21,34,35</sup> They also included a clinical examination based on the presence of one or more of the following signs or symptoms: abnormal tooth wear or wear on restorations; jaw-muscle discomfort upon awakening; jaw locking upon awakening; and/or temporal headaches. Instead, Pollis et al<sup>22</sup> investigated SB behaviors according to the Subject-Based Assessment strategy outlined in the Standardized Tool for the Assessment of Bruxism (STAB), Axis A, Domain A1.<sup>37</sup> They assessed the frequency of clenching and grinding during sleep in the last month (“current SB”) using the following response options: “never”, “less than one night/month”, “one to three nights/month”, “one to three nights/week”, “four to seven nights/week”, or “I don’t know”. They also asked participants whether they had clenching or grinding habits during sleep in the past (“history of SB”), with a yes/no response format.

All four studies assessed GERD using the GERD-Q questionnaire, a validated self-report assessment strategy used for the diagnosis of gastroesophageal reflux. It was developed as part of the international DIAMOND study and later validated across multiple languages and clinical contexts.<sup>38</sup> Mengatto et al was the only study in which GERD diagnoses were also confirmed via medical pH-metry and endoscopic records.<sup>21</sup>

Regarding study design, three studies employed a prospective case-control approach, with group comparisons based either on the presence of bruxism<sup>34,35</sup> or on the presence of GERD.<sup>21</sup> In contrast, Pollis et al conducted a cross-sectional investigation at the general population level.<sup>22</sup>

Three studies investigated the relationship between SB and GERD using instrumentally based assessment strategy (Table 1).<sup>31–33</sup> Altogether, the three studies included 44 participants.

To assess EMG activity, two studies employed a portable EMG device for overnight monitoring,<sup>31,32</sup> while one study used PSG recordings.<sup>33</sup> In two studies, surface EMG electrodes were placed bilaterally on the masseter and temporalis muscles,<sup>32,33</sup> whereas in the other study, EMG activity was recorded unilaterally from the anterior temporal muscle.<sup>33</sup> All the studies included two consecutive recording nights, with the first night serving for adaptation.

According to Lavigne’s criteria for diagnosis of SB, an SB episode was defined as an event of masticatory muscle activity during sleep, consisting of either: (1) at least three consecutive phasic bursts lasting 0.25–2 s each, (2) a tonic burst lasting more than 2 s, or (3) a mixed pattern combining both phasic and tonic components, with an amplitude exceeding approximately 20–25% of maximum voluntary contraction.<sup>39</sup> Bursts with greater amplitude than the 10% maximum voluntary contraction (MVC) value with duration exceeding 0.25 s were selected.<sup>39</sup>

However, all three studies also referred to SB episodes as rhythmic masticatory muscle activity (RMMA) episodes, defined as sequences of rhythmic EMG bursts occurring at a frequency of approximately 1 Hz and consisting of three or more consecutive bursts, in accordance with established criteria.<sup>7,39</sup>

In addition, in one study, Miyawaki et al defined individuals with SB as those presenting more than four sleep bruxism episodes per hour of sleep and/or more than 25 EMG bursts per hour, together with more than two tooth-grinding sounds per hour of sleep.<sup>31</sup>

In the two studies by Miyawaki et al, oesophageal pH was measured using a standard 24-hour ambulatory portable pH-metric and manometric system.<sup>31,32</sup> In contrast, Ohmure et al assessed GERD using the Frequency Scale for the Symptoms of GERD (FSSG)<sup>40</sup> and esophagogastroduodenoscopy.<sup>33</sup>

Concerning the study design, one study was a randomized double-blind placebo-controlled investigation, aimed to examining the relationship between RMMA and GERD episodes, as well as evaluating the efficacy of a proton pump inhibitor (PPI) on SB.<sup>33</sup> The other two studies were prospective observational investigations.<sup>31,32</sup> Notably, Miyawaki et al also conducted a double-blind, placebo-controlled, clinical study to assess the efficacy of PPI on SB.<sup>31</sup>

With regard to the evaluation of potential confounders, only one study investigated sleep apnea (self-reported), symptoms of anxiety and depression, alcohol consumption, and smoking, including these variables in the statistical analysis.<sup>34</sup> The study also excluded individuals with neurological and psychiatric disorders, sleep disorders, and those taking sleep medications.<sup>34</sup> Four studies excluded individuals with sleep problems, psychiatric and neurological or movement disorders, the use of sleep medications, and medications that may affect gastric and salivary secretion.<sup>21,31,33,35</sup> Mengatto et al additionally excluded individuals with a BMI >35.<sup>21</sup> Finally, Pollis et al and Miyawaki et al (2004) included volunteer participants.<sup>22,32</sup>

## Results of Individuals Sources of Evidence

In terms of results, all papers based on the self-report assessment found a statistically significant correlation between SB and GERD. Specifically, Pollis et al reported a positive correlation between current SB and GERD ( $r = 0.112$ ;  $p = 0.044$ ).<sup>22</sup> The other three studies found significant associations between GERD and SB, with the following odds ratios:

- OR = 5.30; 95% CI: 2.62–10.70<sup>34</sup>
- OR = 6.87; 95% CI: 4.34–10.88<sup>35</sup>
- OR = 6.58; 95% CI: 1.40–30.98<sup>21</sup>

All three studies based on the instrumental assessment reported a significant correlation between SB and GERD. Two studies found that PPI administration significantly reduced the frequency of EMG bursts and RMMA episodes.<sup>31,33</sup> In 2003, Miyawaki et al reported that the SB group exhibited a significantly higher frequency and percentage of time of gastroesophageal reflux episodes (mean  $\pm$  SD:  $0.5 \pm 0.9$  and  $3.6 \pm 1.6$  per hour) compared with controls (mean  $\pm$  SD:  $0.0 \pm 0.0$  and  $0.1 \pm 0.3$  per hour). While in healthy individuals it is physiological to expect 1 to 5 GERD episodes during one night of sleep, individuals with SB have been found to have this number increased up to fourfold.<sup>29</sup> In 2004, Miyawaki et al showed a significantly higher frequency of RMMA and clenching episodes during periods of decreased oesophageal pH compared with other periods.<sup>32</sup> It must be remarked that while in healthy individuals it is not expected to have a frequency of more than 4 episodes of SB<sup>39</sup> per hour, patients with GERD manifested up to 12 episodes of SB per hour.<sup>32</sup>

## Synthesis of the Results

This scoping review found that patients with GERD have a 5- to 6-fold higher likelihood of SB compared to healthy individuals. Moreover, the use of PPIs appears to significantly reduce the number of EMG burst. In these patients, EMG burst also seem to fluctuate in a pattern largely influenced by oesophageal pH.

## Discussion

### Summary of Evidence

This study aims to provide a conceptual review of the current evidence regarding the relationship between sleep bruxism (SB) and gastroesophageal reflux disease (GERD).

Based on the observational studies included in this scoping review, the prevalence of SB in individuals with GERD appears to be higher than in the general population.<sup>21,22,34,35</sup> In particular, patients with GERD may present a five- to six-fold increased odds of SB compared with healthy individuals.<sup>21,34,35</sup> Two main, non-mutually exclusive hypotheses have been proposed to explain the relationship between SB and GERD: (1) a possible protective role of SB in individuals with GERD, and (2) a shared underlying mechanism, as both conditions are linked to sleep arousals and sleep fragmentation.

### Protective Effect of SB in Individuals with GERD

As highlighted in the 2018 consensus paper<sup>7</sup> and reaffirmed in a recent update,<sup>3</sup> the concept of bruxism has been completely redefined. SB is increasingly understood not as a disorder per se, but as a broad construct encompassing diverse phenomena that may have negative consequences, be neutral, or even confer potential benefits.<sup>41</sup> Notably, it has been suggested that SB could exert a protective role in individuals with GERD by mitigating the risk of intrinsic chemical tooth wear through the stimulation of salivary glands.<sup>7</sup>

Such hypothesis is supported by Miyawaki et al who observed that SB events may arise as a consequence of acid reflux episodes, observing that most gastroesophageal reflux events coincided with both RMMA episodes and EMG bursts, likely associated with swallowing.<sup>31</sup> They further reported that GERD therapy via PPI drugs, which increases gastric and oesophageal pH, contributes to reduce the RMMA frequency compared with placebo.<sup>31</sup>

Subsequent studies by Miyawaki and Ohmure, both included in this review, reported findings consistent with these observations.<sup>32,33</sup> Miyawaki et al asserting that most jaw muscle activities occurred in relation to GERD in the supine position, concluded that preventing both GERD and sleeping in the supine position might be effective in decreasing the

frequency of EMG bursts.<sup>32</sup> Meanwhile, Ohmure et al asserted that the administration of PPI significantly reduced the frequencies of RMMA episodes and EMG bursts.<sup>33</sup>

Although conducted in individuals without SB and therefore not included in the present scoping review, a study by Ohmure et al provides data supporting the aforementioned hypothesis. Specifically, following the administration of an acidic infusion, the authors observed significantly higher frequencies of EMG bursts, RMMA episodes, and swallowing compared with placebo.<sup>29</sup> These findings aligned to the hypothesis that RMMA may facilitate oesophageal acid clearance by stimulating salivary secretion.

### Micro-Arousal and Sleep Disruption

Sleep micro-arousals are defined as abrupt shifts in electroencephalographic (EEG) frequency lasting at least 3 s, preceded by a minimum of 10 s of stable sleep, and accompanied by an increase in sympathetic activity.<sup>42</sup> According to Lavigne et al, micro-arousals are characterized by a sequence of physiological responses (ie, increases in brain, cardiac, and muscle activity) culminating in RMMA, which represents the terminal event.<sup>43</sup> As mentioned in the study of Miyawaki et al, since swallowing occurs after RMMA episodes in approximately 50% of cases and RMMA frequency is elevated during gastroesophageal reflux events,<sup>31</sup> it has been suggested that SB, in certain instances, develop secondary to GERD, with micro-arousal acting as the common underlying mechanism.

The other studies included in this review did not directly address the relationship with arousals. However, the hypothesis of an association between arousals and sleep fragmentation has been investigated in the existing literature. Orr et al, who examined the impact of different volumes of acid infused into the oesophagus observed that larger acid volumes provoked faster arousal from sleep and shortened the latency to the first swallowing event.<sup>44</sup> Such findings led the authors to hypothesize that both the arousal response and swallowing serve as protective mechanisms to prevent mucosal injury from refluxed gastric contents.

While a certain number of micro-arousals and RMMA episodes during the night are considered physiological, their increased frequency of these events may reflect the underlying sleep instability.<sup>43</sup> In 2024, Manfredini et al highlighted a potential association between arousal-related RMMA and sleep disorders that “may compromise sleep continuity”.<sup>6</sup> In one of the studies by Li et al, it was reported that the association between SB and GERD was partially mediated by depression, anxiety, and impaired sleep quality.<sup>35</sup>

Although not included in this review, two studies addressing this topic deserve mention. In an observational study involving over 500 participants, Ju et al reported that GERD was significantly associated with poor sleep quality (adjusted OR = 3.5; 95% CI: 1.3–9.3) and a higher frequency of spontaneous arousals.<sup>45</sup> Moreover, a recent review suggested that fluctuations in sleep stages and cycles may influence the occurrence of RMMA/SB and micro-arousals.<sup>46</sup>

In this view, the direct relationship between SB, GERD, and micro-arousal frequency has been called into question, with sleep architecture appearing to play a role in modulating this interaction. As such, the literature on the specific potential pathophysiological link between SB, GERD, and micro-arousals remains inconclusive and represents an important area to be addressed in future studies.

## Limitations

This scoping review has some limitations. Due to the nature of the adopted methodology, our discussion does not allow for definitive conclusions. The heterogeneity of approaches and contexts analysed makes synthesis challenging and may reduce the generalizability of the results. In particular, the main limitations include populations heterogeneity, limited evidence strength, and variability in assessment methods.

## Populations Heterogeneity

Elucidating the relationship between SB and GERD is further challenged by the generally small sample sizes of most available studies, which restrict statistical power, limit meaningful comparisons across outcomes, and reduce the generalizability of the findings. In addition, as highlighted in the Results, the recruited populations were heterogeneous, and only one study adequately controlled for potential confounding variables related to comorbidities (ie, neurological or psychiatric disorders), sleep (ie, sleep apnea and other sleep disorders, use of sleep-related medications) and lifestyle (ie, symptoms of

anxiety and depression, alcohol consumption, and smoking status).<sup>34</sup> Across the remaining studies,<sup>21,22,31–33,35</sup> exclusion criteria varied substantially further contributing to population heterogeneity and limiting the external validity of the findings.

## Limited Evidence Strength

Although PSG-based investigations suggest that acid exposure or reflux-related stimuli may be associated with micro-arousals and subsequent activation of RMMA, several limitations should be acknowledged. These studies are limited in their ability to establish temporal sequencing and causality, making it difficult to determine whether reflux events trigger RMMA and micro-arousals, result from them, or simply co-occur due to shared underlying mechanisms.<sup>31–33</sup> Concerning the outcomes of PPI administration on SB in individual with GERD, Ohmure et al suggests caution since the therapeutic effect of PPI appears modest and highly variable among individuals, with post-treatment frequencies of RMMA episodes and EMG bursts often remaining higher than those observed in healthy controls.<sup>33</sup> In addition, acid suppression may have been insufficient in some patients due to interindividual variability in PPI metabolism and dosing, while non-acidic reflux components may also contribute to symptom generation.<sup>33</sup>

## Variability in Assessment Methods

The seven studies included in this scoping review were classified according to the STAB methodology (self-report, clinical evaluation, instrumental assessment).<sup>47</sup> The STAB is a multidimensional evaluation system that assesses bruxism.<sup>37</sup> It consists of an Axis A for the evaluation of bruxism status and potential consequences based on the different methods available, ie, the subject based (self-report), the clinically based (clinical examination), and instrumentally based ((eg. wake-time and night-time electromyography and polysomnography)) assessment, and an Axis B evaluating risk factors and co-occurring underlying conditions (eg, anxiety and depression, gastroesophageal reflux disease, and orofacial motor disorders). Although the STAB is a relatively recently developed conceptual framework and therefore still requires robust validation, its use, either in full or in selected components, or the screening instrument BruxScreen<sup>48</sup> as a reference assessment strategy may permit physicians begin to speak the same language, adopting standardized tools to assess bruxism and guarantee the comparability between studies.<sup>49–51</sup>

Considering these premises, the different methods adopted to assess SB present a significant challenge regarding the comparison of the data. One study investigated SB behaviors according to the Subject-Based Assessment strategy proposed by STAB without including any clinically and instrumentally based strategy.<sup>22</sup> Three observational studies used both self-report and clinical examination, considering abnormal tooth wear or wear on restorations, jaw muscle discomfort upon awakening, jaw locking upon awakening, and temporal headaches.<sup>21,34,35</sup> However, it is important to underline that tooth wear, given its multifactorial aetiology, is not considered a good marker for SB.<sup>52–54</sup> Moreover, the wide spectrum of wear types, such as mechanical and chemical tooth wear (intrinsic and extrinsic), derives from multiple aetiologies, including grinding, clenching, and oral acid exposure.<sup>18,55</sup> Finally, three studies used an instrumentally based assessment strategy following the SB diagnostic criteria based on Lavigne's studies.<sup>39,43</sup> However, a methodological limitation across the included studies concerns the inconsistent distinction between isolated EMG bursts and RMMA episodes. While EMG bursts represent basic, nonspecific muscle activation events that may occur in a variety of physiological or sleep-related contexts, RMMA reflects an organized and rhythmic motor pattern that is more closely associated with the old concept of SB events in relation with microarousals.<sup>56</sup> Failure to differentiate between these two phenomena may have led to an overestimation or misclassification of jaw muscles activity. In addition, EMG criteria used to detect SB are of limited clinical value and currently no consensus exists. Different authors proposed different values with a very high heterogeneity<sup>57</sup> and the use-specific indexes on the measurement of sleep bruxism activity in its continuum, such as the bruxism work index (BWI) and bruxism time index (BTI).<sup>58,59</sup>

Similarly, for the assessment of GERD, differences in the evaluation methods adopted across the various studies do not allow for a reliable comparison and may affect the interpretation of the association between sleep bruxism and GERD. Specifically, three studies relied exclusively on the GERD-Q questionnaire,<sup>21,34,35</sup> two studies confirmed the self-reported assessment with instrumental investigations (pH-metry and endoscopic evaluation),<sup>21,33</sup> and the remaining two studies used instrumental investigations alone.<sup>31,32</sup>

## Future Directions

The relationship between SB and GERD is far from being clarified. Both the two main hypotheses (ie, protective effect of SB and association with arousal and sleep disruption) have received support from only few studies. Notably, given the hypothesized protective role of SB through salivatory stimulation, micro-arousals may also be interpreted as a consequence of GERD events, subsequently triggering SB episodes and an increase in salivation.<sup>7,28</sup> Thus, in future investigations, it could be reasonable to consider the two hypotheses as complementary aspects of the same phenomenon.

To strengthen the evidence, studies on larger populations that are adequately controlled for potential confounding variables related to sleep and lifestyle are recommended. Self-reported assessment should be complemented by instrumental methods. Oesophageal pH metric and pH manometry are required to effectively detect acidification events in the upper digestive tract, while new portable EMG devices allow exploring the entire spectrum of muscle behaviors,<sup>58–60</sup> going beyond the simple count of SB events.<sup>61</sup> Indeed, bruxism is a multifaceted condition whose expression is modulated by several comorbid factors including psychological stress,<sup>62–65</sup> exogenous factors (eg, medication use, alcohol consumption, tobacco use),<sup>66,67</sup> and underlying sleep disorders.<sup>43,68,69</sup> Consequently, classifying individuals as bruxers or non-bruxers solely on the basis of instrumental diagnostic criteria appears reductive. Future research should therefore move beyond the mere assessment of associations between RMMA and GERD and investigate these events in relation to sleep stages and sleep cycles. Advancing toward a more refined phenotyping of bruxism and adopting a broader, more comprehensive evaluation framework are strongly recommended.

## Conclusion

The relationship between sleep bruxism (SB) and gastroesophageal reflux disease (GERD) remains a matter of debate. In this scoping review, the literature available was examined, supporting the existence of a relationship between SB and GERD. However, the underlying pathophysiological mechanisms remain unclear due to the heterogeneity of approaches, the limited strength of evidence and the different assessment strategies. Future studies should employ standardized strategies for SB and GERD assessment and place greater emphasis on exploring their relationship with other sleep-related conditions and sleep architecture.

## Data Sharing Statement

The data underlying this article will be shared on reasonable request to the corresponding author.

## Author Contributions

M.P.: conceptualization, data curation, formal analysis, investigation, methodology, validation, visualization, writing – original draft, writing – review and editing. D.M.: conceptualization, data curation, supervision, validation, visualization, writing – original draft, writing – review and editing. A.C.: data curation, methodology, supervision, visualization, validation, writing – review and editing. O.I.S.: conceptualization, data curation, formal analysis, investigation, validation, visualization, writing – original draft, writing – review and editing. F.L.: conceptualization, methodology, supervision, validation, visualization, writing – review and editing.

All authors gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agreed to be accountable for all aspects of the work.

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interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this article.

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