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Título: Prevalência e associação entre bruxismo e lesões cervicais não cariosas em adultos: uma revisão sistemática e meta-análise

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Orientador(a): Prof.(a) Beatriz Dulcineia Mendes de Souza, Dr.(a)

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Ana Paula Braghini

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O presente trabalho em nível de Mestrado foi avaliado e aprovado, em 02 de agosto de 2023 pela banca examinadora composta pelos seguintes membros:

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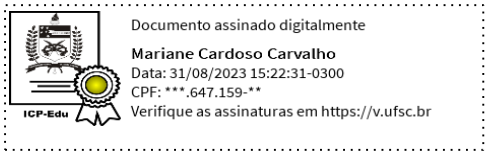

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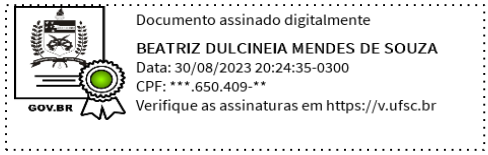

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Florianópolis, 2023.

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“É sempre pela jornada e por quem nos tornamos ao percorrer ela. E isso inclui as pessoas com as quais vamos dividi-la.” (MELO, 2023)

APRESENTAÇÃO

Esta dissertação foi originalmente escrita como dois artigos na língua inglesa, intitulados “Prevalence of bruxism in adults with non-carious cervical lesions: a systematic review and meta-analysis” e “Association between bruxism and non-carious cervical lesions in adults: a systematic review and meta-analysis”. O primeiro será submetido na revista Clinical Oral Investigations e o segundo na revista Journal of oral rehabilitation. Essas pesquisas foram realizadas em parceria com as pesquisadoras MSc Lígia Figueiredo Valesan, MSc Adriana Battisti Archer, MSc Helena Polmann e Drª. Beatriz Dulcineia Mendes de Souza, da Universidade Federal de Santa Catarina (UFSC); bem como, o pesquisador Dr. Eduardo Januzzi coordenador do Centro de Dor Orofacial do Hospital Mater Dei, em Belo Horizonte, Dr. Paulo Vinicius Soares, da Universidade Federal de Uberlândia, Dr. Giancarlo de La Torre Canales, da Egas Moniz School of Health and Science, Drª. Thays Crosara Abrahão Cunha, coordenadora do curso de Capacitação em Odontologia do Sono - Neon Cursos - Belo Horizonte, MG e Dra. Cristine Miron Stefani da Universidade de Brasília.

A dissertação será apresentada com a seguinte estrutura:

1. Introdução
2. Justificativa
3. Objetivos
4. Artigo 1: Prevalence of bruxism in adults with non-carious cervical lesions: a systematic review and meta-analysis.
5. Artigo 2: Association between bruxism and non-carious cervical lesions in adults: a systematic review and meta-analysis.
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RESUMO

Objetivos: Avaliar e sumarizar a evidência disponível sobre a prevalência e associação entre lesões cervicais não cariosas (LCNC) e bruxismo em adultos. **Métodos:** Duas revisões sistemáticas (RS) foram realizadas: 1 – Prevalência de bruxismo em adultos com lesões cervicais não cariosas e 2 – Associação entre bruxismo e lesões cervicais não cariosas em adultos. Em ambas foram realizadas buscas em seis bases de dados principais (Embase, PubMed, LILACS, Web of Science, Scopus) e em três bases de literatura cinzenta (Google Scholar, LIVIVO e ProQuest). Apenas estudos transversais foram incluídos na primeira RS e na segunda foram incluídos estudos transversais e caso-controle. Nestes estudos, os pacientes deveriam ter dentição permanente, avaliarem a presença de LCNC e a de bruxismo por métodos validados como questionários, avaliação clínica ou polissonografia e eletromiografia. Sem restrições quanto ao gênero ou idioma. A qualidade metodológica foi avaliada usando Checklists específicos do Instituto Joanna Briggs (JBI) e a certeza da evidência no estudo de associação foi avaliada através do *Grading of Recommendatios Assessment, Development and Evaluation* (GRADE). A meta-análise na primeira RS foi realizada no software R e a segunda no software RevMan. **Resultados:** No artigo 1, de 2.821 registros identificados, 16 estudos foram incluídos, com 3.787 participantes de 9 países. A prevalência global estimada de bruxismo em adultos com LCNC foi de 28,88% (IC95%: 19,03 – 39,82). Nenhum dos estudos incluídos apresentou todas as respostas afirmativas no questionário JBI e questões sobre amostra, métodos validados para avaliar as condições e se as condições foram medidas de forma padrão foram as questões com mais respostas “não”. No artigo 2, dos 2.821 registros identificados, 19 estudos atenderam aos critérios de inclusão e, destes, 12 foram incluídos na análise quantitativa. A qualidade metodológica foi considerada baixa, com apenas um artigo com boa qualidade. Odds ratio foi de 1,57 (IC95%: 1,19-2,08) nos estudos transversais e nos estudos caso-controle não foi encontrada associação significativa. Nenhum estudo com avaliação definitiva do bruxismo foi identificado. A certeza geral da evidência foi muito baixa. **Conclusão:** A prevalência geral de bruxismo em adultos com LCNC foi de aproximadamente 29%. Além disso, o bruxismo está associado à LCNC em adultos. Devido à baixa certeza da evidência gerada, deve-se ter cautela ao interpretar estes achados.

Palavras-chave: Bruxismo; Lesão cervical não cariosa; Revisão Sistemática.

ABSTRACT

Objectives: Evaluate and summarize the available evidence on the prevalence and association between bruxism and non-carious cervical lesions (NCCL) in adults. **Methods:** Two systematic reviews (SR) were conducted: 1 - Prevalence of bruxism in adults with NCCL and 2 - Association between bruxism and NCCL in adults. Both reviews involved searches in 6 main databases (Embase, PubMed, LILACS, Web of Science, Scopus) and 3 grey literature databases (Google Scholar, LIVIVO, and ProQuest). Only cross-sectional studies were included in the first SR, and both cross-sectional and case-control studies were included in the second SR. In these studies, patients were required to have permanent dentition. The presence of NCCL and bruxism were assessed using validated methods such as questionnaires, clinical evaluation, polysomnography and electromyography. There were no restrictions regarding gender or language. The methodological quality was assessed using specific checklists from the Joanna Briggs Institute (JBI), and the certainty of evidence in the association study was evaluated using the *Grading of Recommendations Assessment, Development, and Evaluation* (GRADE). Meta-analysis in the first SR was conducted using R software and for the second SR, RevMan software was used. Results: In article 1, out of 2,821 identified records, 16 studies were included, involving 3,787 participants from 9 countries. The estimated overall prevalence of bruxism in adults with NCCL was 28.88% (95% CI: 19.03-39.82). None of the included studies had all affirmative answers in the JBI questionnaire, and questions regarding sample, validated methods to assess the conditions, and whether the conditions were measured in a standardized way had the highest proportion of "no" responses. In article 2, out of the 2,821 identified records, 19 studies met the inclusion criteria, and 12 of these were included in the quantitative analysis. The methodological quality was considered low, with only one article having a good one. The odds ratio was 1.57 (95% CI: 1.19-2.08) in cross-sectional studies, and no significant association was found in case-control studies. No study with definitive evaluation of bruxism was identified. The overall certainty of evidence was very low. Conclusion: The overall prevalence of bruxism in adults with NCCL was approximately 29%. Furthermore, bruxism is associated with NCCL in adults. Due to the low certainty of the generated evidence, caution should be exercised in interpreting these findings.

Keywords: Bruxism; Non-carious cervical lesion; Systematic Review.

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LISTA DE ABREVIATURAS E SIGLAS

Do Inglês:

AASM - American Academy of Sleep Medicine
AB - Awake bruxism
B - Bruxism
CI - Confidence Interval
EMG - Electromyography
GRADE - Grading of Recommendations Assessment, Development and Evaluation
JBI - Joanna Briggs Institute
LILACS - Latin American and Caribbean Health Sciences
MA - Meta analysis
N - No
NA - Not applicable
NB - No bruxism
NCCL - Non-carious cervical lesion
NR - Not reported
OR - Odds ratio
PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols
PSG - Polysomnography
RevMan - Review Manager software
SB - Sleep bruxism
SD - Standard deviation
SR - Systematic Review
STAB - Standardised Tool for the Assessment of Bruxism
TWI – Tooth wear index
U - Unclear
Y - Yes

Do português:

BS - Bruxismo do sono

BV - Bruxismo da vigília

JCE - Junção cemento-esmalte

LCNC - Lesão cervical não cariosa

RS - Revisão sistemática

SNC - Sistema nervoso central

LISTA DE SÍMBOLOS

% - Percentual

± - Mais ou menos

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1. INTRODUÇÃO

1.1 LESÃO CERVICAL NÃO CARIOSA

A lesão cervical não cariosa (LCNC) é caracterizada pela perda de tecido dental na junção cemento-esmalte (JCE), tanto nas faces vestibular, lingual e interproximal do dente (LEVITCH et al., 1994). A JCE é uma região vulnerável, já que o esmalte dessa região é apenas uma fina camada e, se expostos, a dentina e o cemento são friáveis aos impactos do meio bucal (WALTER et al., 2014).

Esta lesão ocorre pela interação de mecanismos mecânicos e químicos. Os mecânicos são decorrentes de estresse oclusal e da fricção, e o mecanismo químico pela exposição do dente à corroentes ácidos (BARTLETT and SHAH, 2006; GRIPPO et al., 2012).

Durante o movimento excursivo da mandíbula, as forças de compressão, tensão, flexão e cisalhamento são distribuídas em todas as faces do dente. Quando é gerada uma força oclusal maior do que o dente pode suportar resulta numa perda patológica de estrutura dental na cervical denominada abfração, que ocorre longe do local onde ocorreu a força inicial (oclusal) (GRIPPO, 1991).

Sabe-se que o esmalte dental é resistente à compressão. Entretanto, se submetido à força de tensão, que ocorre principalmente durante a parafunção, possui baixa resistência levando a rupturas, especialmente na região de fulcro (BARTLETT and SHAH, 2006; WOOD et al. 2008). Outro mecanismo mecânico é a fricção, que leva a perda de tecido duro pelo atrito de um material sobre outro. Ela pode ser dividida em atrição e abrasão (GRIPPO et al., 2012).

Atrição é a perda de tecido devido ao contato dente a dente, durante atividades fisiológicas, como a mastigação ou em atividades parafuncionais, como o bruxismo, resultando em facetas de desgaste na incisal dos dentes (GRIPPO et al., 2012).

Na abrasão acontece a fricção de algum material no dente, como escova dental ou dentifrício. O movimento promove microdeformação da superfície dental, à medida que absorvem a energia cinética do movimento. Quando as partículas voltam para a posição original, elas liberam energia armazenada em forma de calor, o que pode promover o desgaste. Porém, essa não é considerada

a causa principal dessas lesões, pois não explica a ocorrência de lesões subgengivais, onde a escova não alcança (BHUNDIA et al., 2019).

Biocorrosão é a perda de estrutura dental por dissolução, geralmente causado por um ácido de origem não bacteriana que diminui o pH bucal. O ácido pode ser de origem endógena como do estômago em pacientes que possuem refluxo gastroesofágico ou comportamentos associados à anorexia e bulimia ou de origem exógena como em pacientes com uma dieta considerada ácida, com alto consumo de frutas e refrigerantes (GRIPPO, 1991).

É importante observar que os mecanismos participantes do desenvolvimento das lesões não são fatores isolados, mas fatores associados que podem estar atuando sinergicamente para iniciar e promover o desenvolvimento dessas lesões (LEVITCH et al., 1994). Ainda são necessários estudos com um bom delineamento metodológico para avaliar carga oclusal, escovação e dieta e entender qual o papel de cada componente e suas relações para o desenvolvimento da LCNC (BHUNDIA et al., 2019).

1.2 BRUXISMO

O bruxismo, que pode ser um fator de risco para LCNC pela sobrecarga que gera no sistema estomatognático (BRANDINI et al., 2012) é caracterizado como uma atividade repetitiva da musculatura mastigatória que acontece pelo apertar, bater e ranger os dentes ou deslocar e manter a mandíbula na mesma posição (LOBBEZOO et al., 2013).

Deslocar ou manter a mandíbula em determinada posição, sem o contato dentário também faz parte do conceito de bruxismo, denotando que o bruxismo é regulado centralmente e não perifericamente e que esta atividade envolve mais do que o contato dental (LOBBEZOO et al., 2013).

Ao contrário da lesão cervical não cariosa que pode ter relação com a oclusão do paciente (BRANDINI et al., 2012), o bruxismo não é mediado por fatores periféricos, como a oclusão, mas sim, pelo sistema nervoso central (SNC) (LOBBEZOO and NAEIJE, 2001).

O bruxismo pode ser classificado de duas formas: do sono (BS) e da vigília (BV). O BS é uma atividade dos músculos da mastigação durante o sono. Não é um distúrbio do sono ou do movimento em indivíduos saudáveis

(LOBBEZOO et al., 2018). O BV é uma atividade dos músculos da mastigação durante a vigília caracterizada pelo contato repetitivo ou sustentado dos dentes ou apenas por forçar e manter a mandíbula em determinada posição, sem necessariamente tocar os dentes (LOBBEZOO et al., 2018).

O BV pode ser considerado mais prevalente, porém o BS foi mais pesquisado no passado, por isso muitos artigos se referem a apenas “bruxismo”, sem fazer distinção entre os dois (MELO et al., 2019).

Em indivíduos saudáveis, o bruxismo deve ser considerado como uma alteração de comportamento ou apenas um comportamento motor com etiologia multifatorial que pode ser fator de risco para outras condições. Para ser um fator de risco depende dos cofatores de risco interagindo para aumentar a probabilidade de uma consequência especifica para saúde (LOBBEZOO et al., 2018).

A detecção do bruxismo pode ser feita por meio de questionários, relato do paciente ou de terceiros, exame físico e exames, como polissonografia (PSG) e eletromiografia (EMG) (LOBBEZOO et al., 2018). Detectar o bruxismo é algo desafiador, por isso foi criado um sistema de classificação em 2013 que sugere classificar tanto o BS quanto o BV como “possível”, quando há um auto-relato do paciente por meio de questionários ou anamnese; “provável”, quando se percebe sinais ao exame clínico com ou sem relato do paciente; ou “definitivo” através de auto-relato, exame clínico e polissonografia para o BS, com gravações de áudio e vídeo e eletromiografia para o BV, preferencialmente combinado com algum método ecológico de avaliação, como o uso de aplicativos (LOBBEZOO et al., 2013).

1.2 BRUXISMO E LESÃO CERVICAL NÃO CARIOSA

De acordo com um estudo transversal de 2007, cerca de 40% de pacientes com LCNC apresentam BS, e os primeiros pré-molares superiores são os dentes mais afetados (OMMERBORN et al., 2007).

Algumas teorias podem explicar a relação entre bruxismo e LCNC, como na abfração, em que forças oclusais criam tensões no esmalte e na dentina na área cervical gerando uma LCNC (TAKEHARA et al., 2008).

Outra hipótese seria o fato da atrição causar o desgaste da ponta do canino, perdendo-se a guia em canino, gerando uma desoclusão em grupo e consequente sobrecarga em pré-molares e molares (SILVA et al., 2013; YANG et al., 2016).

Assim, hábitos parafuncionais, como o bruxismo, podem ser um fator agravante para o desenvolvimento da LCNC (SENNA et al., 2012), visto que a duração e a magnitude das forças durante o bruxismo são muito maiores do que durante a atividade funcional (MICHAEL et al., 2009).

Dessa forma, a presença de facetas de desgaste não deveria ser o único fator analisado, pois podem ser apenas uma cicatriz de BS. Além disso, o apertamento dental não gera facetas de desgaste, mas também pode gerar flexão no dente. Pela LCNC ser de origem multifatorial, deve-se atentar ao fato de que existem outros fatores atuando sinergicamente ao bruxismo, para iniciar ou perpetuar a LCNC, como a biocorrosão e abrasão (MICHAEL et al., 2009).

2. JUSTIFICATIVA

O bruxismo pode ser classificado como um comportamento inofensivo em pacientes saudáveis, porém a alta atividade dos músculos da mastigação aumenta o risco de consequências negativas para a saúde oral (LOBBEZOO et al., 2018). Assim, o bruxismo pode ser considerado um fator de risco para outros acometimentos orais, como as LCNC. Os movimentos excursivos da mandíbula, que levam a uma flexão do dente para vestibular, são ampliados pela duração e a magnitude das forças durante o bruxismo gerando deformações na região cervical (BRANDINI et al., 2012; LOBBEZOO et al., 2018), podendo levar a uma LCNC.

Até então, há muitos estudos que estudam a prevalência e a associação entre as duas condições. Porém não foi realizada uma revisão sistemática (RS) para resumir e avaliar criticamente as evidências disponíveis sobre as questões: “Qual a prevalência de bruxismo em adultos com lesão cervical não cariosa?” e “Em adultos, existe associação entre bruxismo e a ocorrência de lesões cervicais não cariosas?”. Portanto, justificando estes estudos.

3. OBJETIVOS

3.1 OBJETIVOS GERAIS

- Determinar a prevalência de bruxismo em adultos com LCNC;
- Verificar a possível associação entre bruxismo e a ocorrência de LCNC em adultos.

3.2 OBJETIVOS ESPECÍFICOS

- Determinar a prevalência de bruxismo em adultos com LCNC de acordo com:

a) Classificação de bruxismo (provável e possível);
b) Região geográfica da população investigada.

- Verificar a possível associação entre bruxismo e LCNC de acordo com:

a) Desenho do estudo (transversais ou caso-controle).

4 ARTIGO 1

Prevalence of bruxism in adults with non-carious cervical lesion: a systematic review and meta-analysis

Running title: Prevalence of bruxism in non-carious cervical lesions

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Abstract

Objetives: Systematically review the literature about the prevalence of bruxism in adults with non-carious cervical lesion (NCCL).

Methods: Embase, PubMed, Latin American and Caribbean Health Sciences (LILACS), Web of Science, Scopus, LIVIVO and grey literature search was performed. Cross-sectionals studies assessing the prevalence of bruxism in adults with NCCL were included. Two authors independently read the articles, collected the information and assessed the methodological quality of the included studies. That one was assessed using the Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data (JBI) and the "R Statistics" software was used to perform meta-analyses.

Results: From 2821 records identified, 16 studies were included, with 3787 participants from 9 countries. The overall estimated prevalence of bruxism in adults with NCCL was 28,88% (95%CI: 19.03 – 39.82). None of the included studies presented all question with "yes" in the JBI questionnaire and questions about sample frame, validated methods to assess the conditions and if the conditions were measured in a standard way were the questions with more "no" answers.

Conclusion: Overall pooled prevalence of bruxism in adults with NCCL was approximately 29%.

Keywords: Prevalence; Bruxism; Non-carious cervical lesion; Adults.

1. Introduction

The term non-carious cervical lesion (NCCL) describe the loss of mineralized dental tissue at the cementoenamel junction due to various processes unrelated to dental caries [1]. It can be defined by various terms such as abfraction, erosion, abrasion and root defects [2]. NCCL has a multifactorial origin, resulting from the interaction of mechanical and chemical mechanisms, such as occlusal stress, friction and biocorrosion [3].

The occlusal stress generated during a parafunction exceeds the enamel resistance, causing a rupture away from the site of stress, at the cervical region[4, 5]. Friction can be divided into attrition, which is the loss of tissue due to tooth-to-tooth contact, and abrasion, which is wear caused by a material on the tooth, such as a toothbrush, for example. Biocorrosion occurs when teeth are exposed to acidic agents that decrease oral pH, resulting in dissolution of the dental structure [3]. Thus, occlusal stress synergistically acts with corrosive and abrasive factors, leading to NCCL [6].

Bruxism is a condition defined as a repetitive masticatory muscle activity that can occur through grinding or clenching of the teeth or thrusting of the mandible. It can be divided into awake bruxism (AB) or sleep bruxism (SB) [7]. The prevalence of AB ranges from 22% to 30% and for SB from 1% to 15% [8].

In the assessment of bruxism, it is possible to inquire about the history and awareness of bruxism, if the patient has any symptoms and clinical signs, as well as conduct examinations such as electromyography and polysomnography[9]. Some conditions are risk factors or may be associated with the occurrence of bruxism, such as dental wear, psychosocial factors, obstructive sleep apnea, gastroesophageal reflux and some medications [9].

The relationship between NCCL and occlusal load, which can be caused by bruxism, has been discussed in other articles [10, 11], but there is still no consensus on the prevalence of bruxism in patients with NCCL. Therefore, this study aims to systematically review the literature to estimate the worldwide prevalence of bruxism in adults with NCCL.

2. Methods

2.1 Eligibility criteria

The inclusion criteria were based on PECOS acronym, in witch: P) Adults over 15 years old; E) Presence of non-carious cervical lesion; C) Not applicable; O) Prevalence of bruxism among patients with non-carious cervical lesion and S) Cross-sectional. This SR included studies that assessed bruxism through any method, such as: self-report, questionnaires, interview by a trained dentist, clinical examination, electromyography, polysomnography or any record device to visualize the grinding pattern during sleep bruxism [12]. Also included studies that used other terms related to bruxism, such as clenching and grinding the teeth. Non carious cervical lesion assessed through clinical examination, by visual and tactile analysis of teeth and casts. The distribution and severity of tooth wear might be graded using the Tooth Wear Index (TWI), the Smith and Knight Index or Basic Erosive Wear Examination (BEWE) index. No restriction criteria regarding language and publication time were applied.

The following exclusion criteria were applied: 1) Studies with children; 2) Studies that have a very specific population, such as psychoactive drug users or psychiatric patients; 3) Studies that did not provide the prevalence of bruxism related to NCCLs or did not provide bruxism data separately from other types of parafunctions; 4) Studies in which NCCLs diagnostic criteria and/or bruxism assessment criteria was not reported or not sufficiently described; 5) Studies that considered occlusal factors the only sign of bruxism; 6) Abstracts, reviews, letters, conference abstracts, personal opinions, case reports, protocols, posters and laboratory research; 7) Full text not available even after trying to contact the corresponding authors or any of the coauthors (three attempts in a three week period, through e-mail or through the "research gate" website). In case of no response, with the help of an experienced librarian, was performed a search of the eligible article through the integrated search service of the university library. If both methods proved unsuccessful, the study was excluded; 8) Case-control studies.

2.2 Information sources

A literature search was performed on July 11th, 2022. Individual search strategies with terms such as “bruxism”, “non-carious cervical lesion” and its synonyms were conducted for each of the main bibliographic database: Embase, PubMed (including MEDLINE), Latin American and Caribbean Health Sciences (LILACS), Web of Science, Scopus and LIVIVO. A grey literature search was performed on Google Scholar and ProQuest Dissertations & Theses. Appropriate truncation and word combinations were elaborated and adapted for each of the electronic databases with help of a health science librarian. Hand-search of the bibliographic references of the included studies and Experts on the subject were contacted to recommend additional studies to be included. The references were managed and duplicated references were removed using a reference manager (EndNote X9, Thomson Reuters, Philadelphia, PA).

2.3 Search strategy

The search strategy was designed by an experienced librarian (KML) from Federal University of Santa Catarina and is shown in detail for each database in Table S1. No restrictions about time or language were applied.

2.4 Selection process

Two independent reviewers (APB and LFV) selected the included articles in two phases. Firstly (phase-1), the two reviewers evaluated the titles and abstracts according the eligibility criteria; secondly (phase-2), they reviewed full-texts and select articles by the same criteria as phase-1; then, they crosschecked all the information found. If disagreements arise, a third reviewer (ABA) participated before a final decision were made in both phases. In both phases an online software program (Rayyan, Qatar Computing Research Institute) were used for screening and applying the eligibility criteria by the reviewers separately.

2.5 Data collection process and Data items

Two independent reviewers (APB and LFV) collected data from the selected articles. Once collected, they crosschecked the retrieved information with the third reviewer (ABA). The information collected were: author; year and country of publication; origin, size, age range and/or mean age of the sample, groups considered; clinical characteristics, such as type of bruxism and bruxism detection method, NCCL detection method, type and classification; outcome measure (prevalence of bruxism in adults with NCCL). Any disagreement was discussed between them. If any required data were missing, three attempts were made to contact the corresponding authors by email.

2.6 Methodological Quality

Joanna Briggs Institute Critical Appraisal Tool for Studies Reporting Prevalence Data[13] were used to assessed the methodological quality of the selected studies. Once again two independent reviewers (APB and LFV) evaluated the included studies and then crosschecked the retrieved information with the third reviewer (3R). All decisions about the scoring system were agreed upon by all reviewers prior to critical appraisal assessments. Any disagreement was settled by the third reviewer (ABA). This methodological quality assessment tool consists of nine questions, with the possibility of four answers: Yes (Y), No (N), Unclear (U) or Not applicable (NA). A pilot methodological evaluation was carried out with four studies included, and then the definitive classification parameters were established (Table S4). All reviewers agreed with the decisions about the evaluation system.

2.7 Effect measures and Synthesis methods

The prevalence of bruxism in adults with NCCL was considered the primary outcome of this SR, expressed through absolute and relative frequencies and their 95% confidence intervals (95% CI). A proportion meta-analysis was performed to assess the overall pooled prevalence of bruxism in patients with NCCL, using the R Statistics Software version 2023.03.1. The meta-analysis was performed and studies were not excluded due to heterogeneity or methodological quality. It was performed subgroup analysis considering the classification of bruxism (probable and possible) and the geographical region of the investigated population. Statistical heterogeneity was quantified using the I^2 test, tau² (τ^2), prediction interval and p value were analyzed.

It was not possible perform subgroups analysis, as planned in the protocol, considering the classification of the bruxism (Bruxism, Sleep Bruxism or Awake Bruxism), because the studies did not used this classification; subject's characteristics (adults/elderlies and by gender), because the studies did not make that distinction prevalence; and diagnostic criteria of NCCL, because only a few studies actually classificated the lesion.

2.8 Publication bias

Publication bias was assessed by using an alternative funnel plot based on proportion against a measure of precision (sample size), as recommended for non-comparative outcomes such as proportions[14]. Transformed proportion data were used instead of raw proportion data due to better statistical properties for meta-analysis, as proposed by Hunter et al.[14]. Moreover, the Egger's regression test was carried out to test for funnel plot asymmetry.

3. Results

3.1 Study selection

From 2821 records identified by searches in the databases, 1213 remained after the duplicates removal. After the first phase of reading title and abstracts, 53 were full text read in the second phase. After reading the full texts, 16 studies were included for quantitative analysis.

Three studies were included by manually searching the reference list of included articles (Figure 1). Further information about the 37 excluded articles is available in Table S2.

Table 1 shows the descriptive characteristics of the 16 studies included. Among the studies published from 2006 to 2022, 7 were from Brazil[15-21], 2 from Cuba[22, 23] and from Sudan[24], China[25], Romania[26], Japan[27], Germany[28], Greece[29] and Poland[30] only one in each, with a total of 3787 participants.

3.2 Study Characteristics

The age of the participants ranged from 15 to 93 years old, with one study specifically focusing on elderly patients aged 60 years and above [20]. The majority of the studies investigated a sample of the general population, where the presence of NCCL was assessed along with the evaluation of risk factors, including bruxism. In four four studies [16, 27, 30, 31], all patients in the sample had NCCL, and the presence of bruxism was investigated. In two studies[28, 29], bruxism was initially examined in the sample, followed by the assessment of NCCL occurrence. Only in one study [22] all patients presented bruxism. In another two studies [15,18], the samples consisted exclusively of dentistry students.

3.3 Results of individual studies

All articles assessed bruxism through questionnaries, most of it created by the authors and only two used the AASM (American Academy of Sleep Medicine) validated questionnaire[16, 28]. Some authors also conducted a clinical examination to identify signs of bruxism [16, 22, 24, 27,28,30].

Four articles did not differentiate between AB and SB, using the generic term "bruxism" and reporting prevalence rates of NCCL ranging from 16.31% to 60%[22, 23, 25, 27]. Among the included studies, only one provided data specifically on SB, with a prevalence of 25.27%[33]. Other study[25] employed a classification of bruxism as "Often and Always," "Sometimes," and "Never," considering both "Often and Always" and "Sometimes" as indicative of bruxism. Another one classified bruxism using symbols (-, ±, +, ++, and +++), considering the +, ++, and +++ categories as indicative of bruxism [27].

One study inquired about "nighttime and daytime bruxism", but reported a prevalence of 28% for only “bruxism” and NCCL [26]. Another one questioned about clenching during the day and grinding at night, but presents a prevalence of 16.67% for patients with "bruxism" and NCCL [29]. One article inquired about and presents data on NCCL and bruxism (74%), clenching (62%), and grinding the teeth (42%) [16]. Other one included questions about parafunctional habits such as clenching, grinding, bruxism, and tension of the masseter in relation with NCCL. The results showed a prevalence of 62.90% for clenching, 33.06% for grinding, and 22.58% for both habits [30].

Another two studies inquired about bruxism and clenching, but in the results, it was presented only the term "bruxism," with prevalence rates of 9.73% [18] and 5% [24]. Other three [17, 21, 15] inquired and report results for bruxism and clenching separately, with prevalence rates ranging from 2.5% to 11.36% for bruxism and 21.25% to 22.72% for clenching. Two others questioned and presented results for clenching (14.28% to 36.40%) [20] and grinding (10.98% to 25%) [19], without mentioning bruxism.

The diagnosis of NCCL was mostly performed through clinical examination [15, 18, 21-23, 25, 26, 34], using a periodontal probe to detect irregularities in the cervical area [16, 32], wedge-shaped with sharp edges [28], visible V-shaped vestibular lesion [29] and angular lesions and saucer shaped-lesions [27]. Some studies also employed the analysis of models with a magnifying glass glass [35], wax pattern [24] and intraoral photographs [29].

Regarding the classification of dental wear, three used the Smith and Knight Tooth Wear Index (TWI) [16, 15, 30].One made some modifications to this index [25] and other used a TWI modified by Fares et al. (2009) [24]. Finally, “non-carious cervical lesions” was the term used to the lesions in 12 studies and 4 used abfraction [20, 22, 24, 29].

3.4 Methodological quality assessment

Overall, none of the included studies obtained a “yes” response in all 9 questions of the JBI checklist. One study almost had all “yes” answers, but presented an “unclear” answer regarding the use of validated methods for assessing the conditions, because did not used a validated questionnaire for bruxism detection (question 6). All the studies appropriate address the sample frame to the target population (question 1), except for one study that presented an “unclear” response. Fifteen of the 16 studies described the subjects and the settings in detail (question 4), but only 1 properly recruited participants (question 2). Only 2 studies measured the conditions (bruxism and NCCL) in a reliable way for all participants with intra and inter-observer reliability of the operators (question 7). Most studies used questionnaires for bruxism detection, but only a few with validated questionnaires or methods. As well as clear description of methods for detecting NCCL, resulting in only 4 studies with “yes” responses (question 6). Twelve studies performed adequate statistical analysis (question 8), but only 3 performed analysis about the participant’s losses in the study (question 9). The criteria used for each domain is in detail in Table S4 and a complete description of the methodological quality assessment for each included study is provided in Table S4.

3.5 Synthesis of results

The overall pooled prevalence of bruxism in adults with NCCL was 28,88% (IC 95%: 19.03 – 39.82) (Figure 2). Since I^2 >50% was considered to be an indication of high heterogeneity, most of the meta-analysis showed considerable heterogeneity.

A separated meta-analysis was perfomed accordingly of detection of bruxism, in probable and possible. The pooled prevalence of probable bruxism in adults with NCCL was 40,99% (IC 95%: 19.90 – 63.96), with 751 participants and possible bruxism was 28,88% (95%CI: 19.03 – 39.82), with 3036 participants (Figure 3).

Another meta-analysis was performed based on geographical location (Figure 4). Seven studies were conducted in Brazil, with a prevalence of 24.91% (95%CI: 11.04 - 42.01), with 726 individuals and representing 43.5% of the total included studies. Another two studies were conducted in Cuba, with a prevalence of 54.99% (95%CI: 45.97 - 64.14), representing 12.4% of the total included studies. Of the remaining countries, it presented only one study per country, therefore, was carried a MA was conducted based on continent. South America and Central America presented the same studies mentioned above. Africa had only one study, with a prevalence of 5% (95%CI: 2.31 - 9.28), while two studies from Asia were included, with a total prevalence of 27.44% (95%CI: 7.60 - 53.72). Europe had four studies with a total prevalence of 32.55% (95%CI: 14.54 - 53.67), representing 24.8% of the included studies.

3.6 Reporting publication bias

A funnel plots was performed (Figure 5) for all included studies. There was no clear evidence of asymmetry in the funnel plot, additionally, Egger's test result was not significant (p= 0.2082).

4. Discussion

This systematic review aimed to investigate the prevalence of bruxism in adults with NCCL, a condition that causes overload on the stomatognathic system and can damage the dental structure. Despite the controversy regarding the role of occlusal factors, occlusal stress is correlated with NCCL progression [36]. The results of the present study showed a prevalence of bruxism in adults with NCCL of 28.88%. Two SR from 2012 and 2013 suggested that the presence of wear facets, which are a sign of bruxism, occlusal contact and premature contacts in centric relation are related to NCCL [11, 37]. However, a more recent SR did not provide evidence that occlusal load alone can generate NCCL, without the presence of other causes or contributing factors[10].

NCCL is a multifactorial condition, and the combination of occlusal load generated by bruxism, for example, along with other mechanical processes such as tooth brushing, and chemical processes such as gastroesophageal reflux or an acidic diet, increases the probability of NCCL development[38]. Moreover, it is well-established that NCCL tends to increase with age due to prolonged exposure to risk factors and the gradual progression of NCCL over time[1], without significant gender differences[39]. Although the original plan was to calculate the prevalence based on age and gender, there was a substantial variation in the age ranges among the included studies, and none of the articles grouped the data by gender. Therefore, future studies should adopt standardized age groups to facilitate data grouping.

The presence of NCCLs can occur simultaneously with root exposure, leading patients to experience aesthetic concerns and dentin hypersensitivity[40]. These conditions are associated with the thickness and width of keratinized tissue in the area, and patients with a thin gingival phenotype are more likely to develop these lesions[41]. Only four studies [15, 18, 26, 28] included in this SR evaluated hypersensitivity in relation to NCCL, and all of them reported an association between hypersensitivity and NCCL.

In this SR, the prevalences of probable and possible bruxism were analyzed based on self-reports and positive clinical inspection [42]. Among patients with NCCL, the prevalence of possible bruxism was 22.15%, while probable bruxism had a prevalence of 40.99%. None of the articles included in this review mentioned the 2013 consensus, and none used instrumental assessment methods such as EMG or PSG to identify bruxism. In clinical practice, self-report and/or physical examination are often sufficient for identifying bruxism, and there is no consensus on cutoff points for examinations that can confirm the presence of bruxism, as these methods can be expensive[43]. Most included studies used questionnaires, but few used validated questionnaires or mentioned the specific questions asked to participants. Only two studies[16, 28] followed the criteria of the AASM for bruxism detection. This lack of standardization and clarity in bruxism detection had the most negative impact on the methodological quality of the studies. The use of questionnaires is a method that can introduce memory bias and subjectivity[44], therefore, the prevalence of probable bruxism determined through clinical examination may be the most reliable.

Most of the included articles did not distinguish between AB and SB, thus the generic term "bruxism" was used. It is known that these two types of bruxism have differences in their etiology and, as a result, in their consequences as well. Some articles mentioned parafunctional habits such as clenching and grinding of the teeth. According to the 2013 consensus [7], these habits are part of the definition of bruxism, and for this reason, these articles were included.

There was variability regarding the sample in the included articles. Some studies, as part of inclusion criteria, all the patients had NCCL. While others had two groups: one with patients with bruxism and another with patients without bruxism. The third type of study, which was more common, had a sample consisting of two groups: one with patients who had NCCL and another with patients without NCCL. Additionally, some included studies had dental students in the sample [15, 18], which may have overestimated the prevalence in this review due to the prior knowledge of these students about the condition. This high heterogeneity among the included studies limits the generalization of the results.

Asymmetry in the funnel plot was analyzed by the Egger's test. The funnel plot of all included studies presented one considerably large sample size (over 2000), while the other studies presented sample sizes no larger than 250 individuals. Since Eggers's test was not significant it could be hypothesized that the asymmetry observed could be attributable to the study with large sample, not due to publication bias per se. Given that the included studies had small sample sizes, substantial heterogeneity was observed, and the results showed a wide confidence interval, caution should be exercised regarding the internal validity of these findings.

Considering the limitations identified in this review, it is recommended that future studies address more representative samples and better describe the diagnostic methods based on validated criteria, such as STAB [45] and BruxScren [46] and considering the differences between AB and SB. Based on the obtained results, the implications of this study for clinical practice are significant, as a substantial prevalence of bruxism was found in patients with NCCL. Furthermore, oral health policies should consider the importance of early diagnosis and appropriate management of bruxism as strategies to prevent or minimize non-carious cervical lesions.

5. Conclusion

The worldwide prevalence of bruxism in adults with NCCL was 28,88%. There was a great methodological variability in the studies, demonstrating that further studies are needed to assess changes in prevalence in the medium and long term, considering the advances in the detection of bruxism and the standardization of the definition of NCCL.

6. Other information

This SR was developed following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA) [47]. The protocol was registered at the International Prospective Register of Systematic Reviews platform (PROSPERO; Center for Reviews and Dissemination, University of York; and the National Institute for Health Research) on October 17th, 2022 under registration number CRD42022362968.

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Table 1 - Summary of the characteristics of the included studies (n=16).

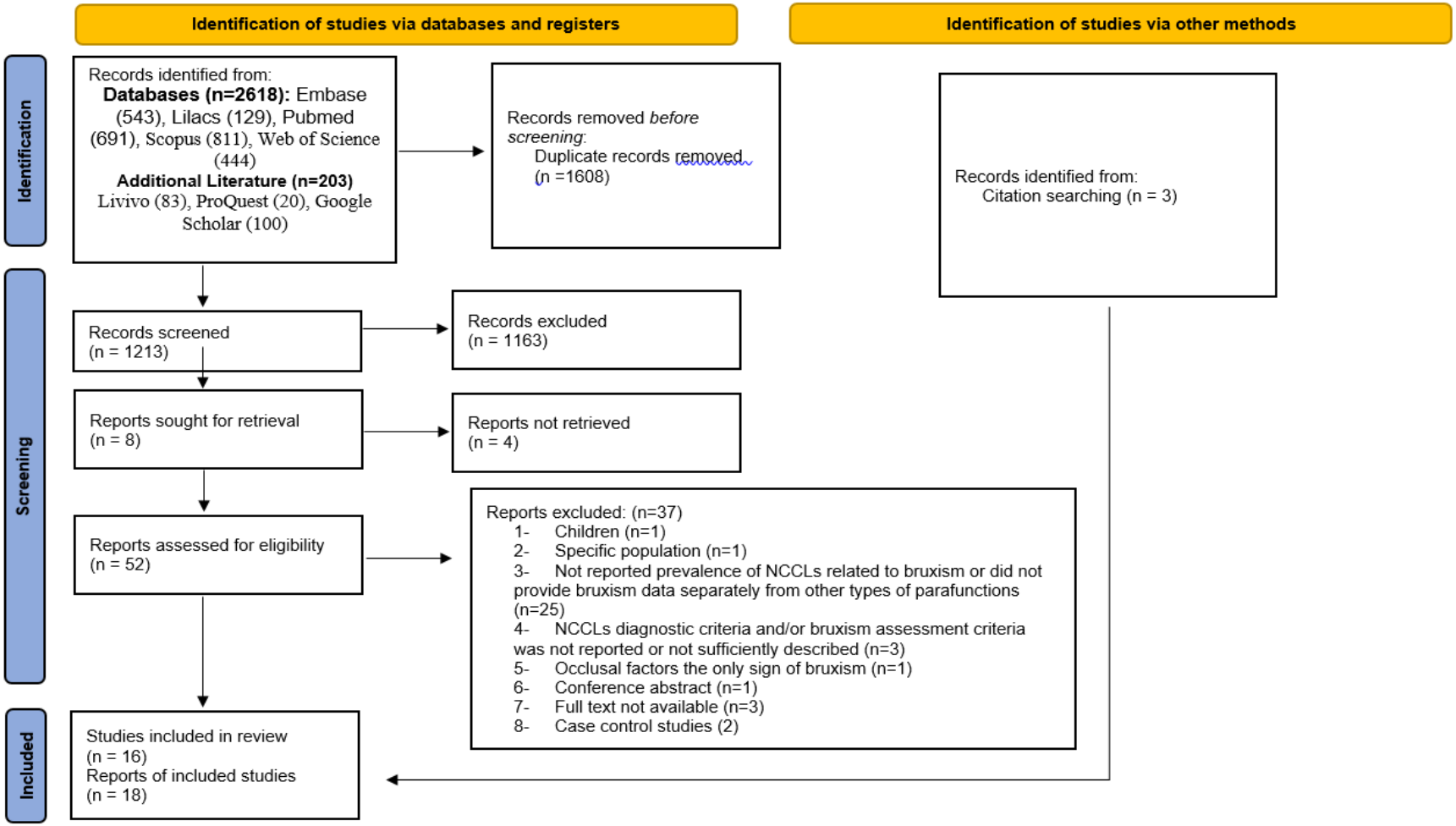
STUDY		**POPULATION**		**BRUXISM**		**NCCL**		
Author (Year); Country	Sample size (% of women)	Age (mean±SD, range)	Sample, groups considered	Bruxism Detection and Classification	Classification of Bruxism	NCCL detection	Type and Classification of NCCL	Prevalence (%)
Aguiar (2012); Brazil	50 (72%)	20-62 years	All with NCCL	Questionnaire and clinical examination (AASM)	Probable Bruxism, Grind and Clench	Clinical examination, irregularity in the cervical area	NCCL, TWI by Smith and Knight	**Bruxism** 37 **Clench** 31 **Grind** 21
Bismar et al. (2021); Cuba	97 (57%)	34-48 years	All with bruxism	Questionnaire and clinical signs	Probable Bruxism	Clinical examination	Abfraction; combination of attrition, erosion, abrasion or abfraction, NR	**Bruxism** 49
Brandini et al. (2012); Brazil	132 (77%)	19-58 years	Control (80) NCCL (52)	Questionnaire	Possible Bruxism	Clinical examination	NCCL, NR	**Bruxism** 15 **Clench** 30
Crisóstomo et al., (2021); Brazil	185 (52%)	22.7±2.3, 18-37 years	Control (143) NCCL (42) Dentistry Students	Questionnaire	Possible Bruxism	Clinical examination	NCCL, NR	**Bruxism** 18
Figueiredo et al. (2015); Brazil	88 (63%)	18-71 years	Control (30)* NCCL (58)*	Questionnaire	Possible Bruxism, Clench and Grind	Analysis of plaster models with magnifying glass	NCCL, NR	**Clench** 32* **Grind** 22*

Gaffar et al. (2012); Sudan	180 (59%)	20-70 years	Control (163) NCCL (17)	Questionnaire and clinical examination	Probable Bruxism	Clinical examination, casts examination and wax pattern	Abfraction, MTWI by Fares et al., 2009	**Bruxism** 9
González García et al. (2020); Cuba	80 (60%)	18-62 years	All with NCCL	Questionnaire	Possible Bruxism	Clinical examination	NCCL, combination of erosion, abrasion and/or abfraction, NR	**Bruxism** 48
Jiang et al. (2011); China	2128* (50%)*	35-44 years, 65-74 years	Control (1099)* NCCL (1029)*	Questionnaire	Possible Bruxism	Clinical examination	NCCLs, MTWI by Smith and Knight	**Bruxism** 347*
Marinescu et al. (2017); Romania	50 (64%)	18-56 years	Control (19) NCCL (31)	Questionnaire	Possible Bruxism	Clinical examination	NCCL, NR	**Bruxism** 14
Molena et al. (2008); Brazil	91 (53%)	71±8, 60-93 years	Control (51)* Abfraction (40)*	Questionnaire	Possible Bruxism, Clench and Grind	Clinical examination, irregularity in the cervical area	Abfraction, erosion and abrasion, NR	**Clench** 13 **Grind** 10
Morigami et al. (2011); Japan	209 (44%)	54.3±13, 22-83 years	All with NCCL	Questionnaire and clinical signs	Probable Bruxism	Clinical examination, angular lesions and saucer shaped-lesions	NCCL, NR	**Bruxism** 85*
Oliveira et al. (2010); Brazil	100 (74%)	18-64 years	Control (44) NCCL (56)	Questionnaire	Possible Bruxism and Clench	Clinical examination	NCCL, NR	**Bruxism** 4 **Clench** 10

Ommerborn et al. (2007); Germany	91 (64%)*		28.37±4,89, 20-39 years	Control (33) SB (58)	Questionnaire and clinical examination (AASM)	Probable SB	Clinical examination, wedge-shaped, with sharp edges	NCCL, NR	**SB** 23
Tomasik et al. (2006); Poland	124 (48%)		15-75 years	All with NCCL	Questionnaire and clinical examination	Probable Bruxism, Clench and Grind	Clinical examination	NCCL, TWI by Smith and Knight	**Clench** 78 **Grind** 41 **Both** 28
Tsiggos et al. (2008); Greece	102 (47%)*	**5**	**44.6±5.7, 30-55 YEARS**	Control (52) Bruxism (50)	Questionnaire	Possible Bruxism	Examination of casts, intraoral photographs, visible V-shaped ves-tibular lesions	Abfraction, NR	**Bruxism** 17
Yamashita et al., (2014); Brazil	80 (NR)	**6**	**18-27 YEARS**	Control (18) NCCL (62) Dentistry students	Questionnaire	Possible Bruxism and Clench	Clinical examination	NCCL, TWI by Smith and Knight	**Bruxism** 2 **Clench** 17

*=calculated by the author.
Abbreviations: AASM=American Academy of Sleep Medicine; MTWI=modified tooth wear index; NCCL=non carious cervical lesion; NR=not reported; SB=sleep bruxism; TWI=tooth wear index.

Figure 1- Flow diagram of literature search and selection criteria.



From:Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/

Figure 2 – Meta-analysis of prevalence of bruxism in adults with non-carious cervical lesion

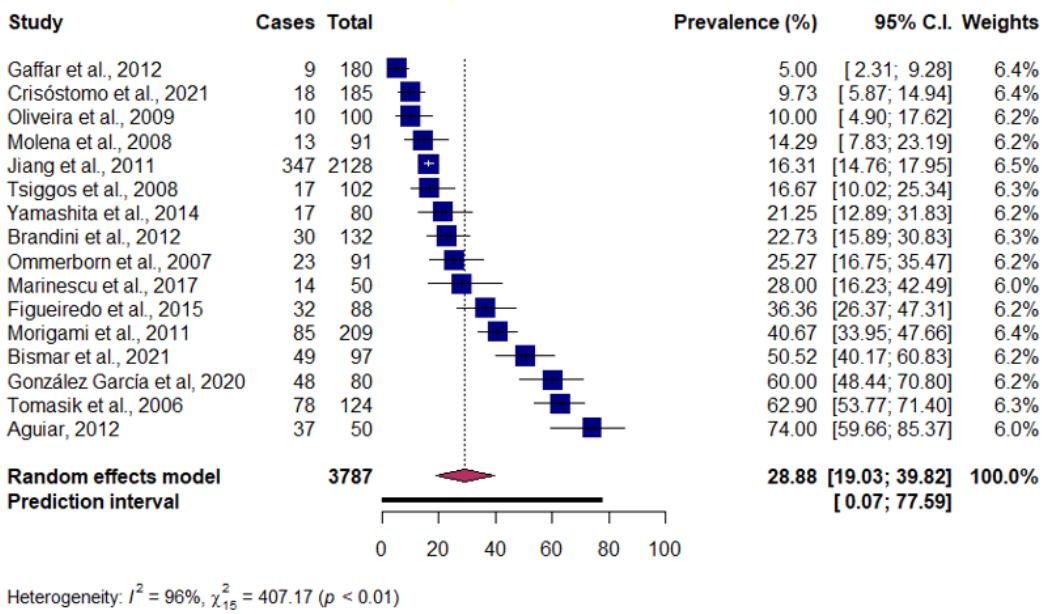


Figure 3 – Additional meta-analysis of prevalence of bruxism in adults with non-carious cervical lesion accordingly to classification of bruxism

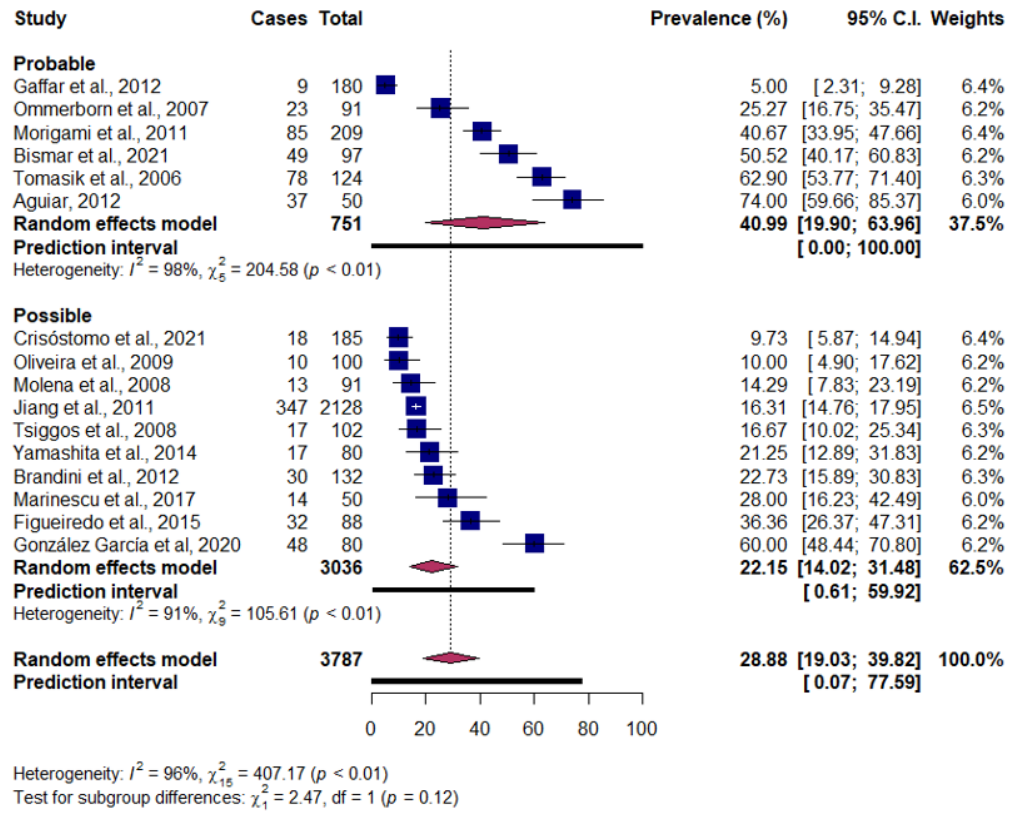


Figure 4 - Overall meta-analyses of prevalence of bruxism in adults with non-carious cervical lesion in continents.

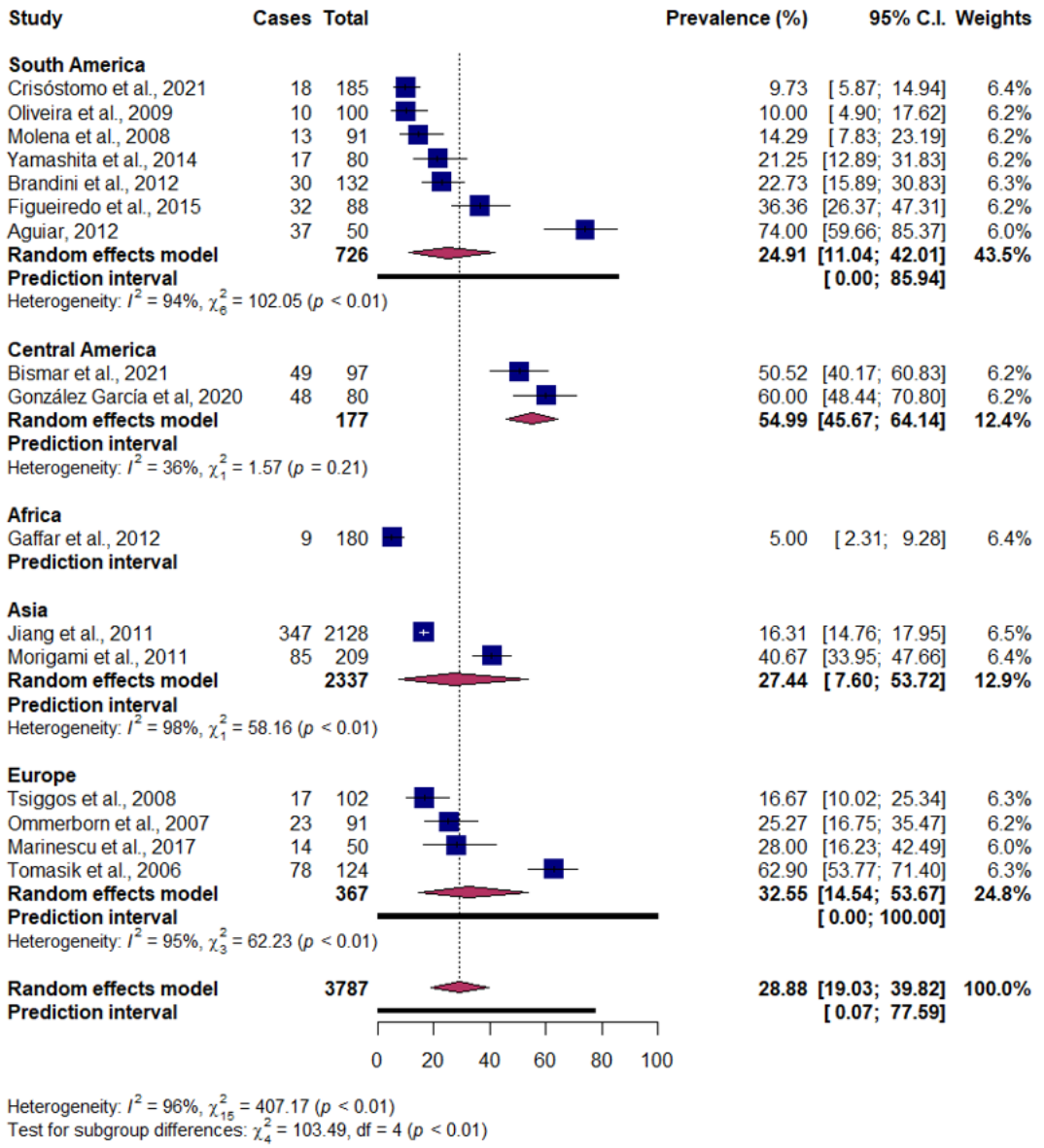


Figure 5 - Funnel plot for publication bias assessment considering all studies.

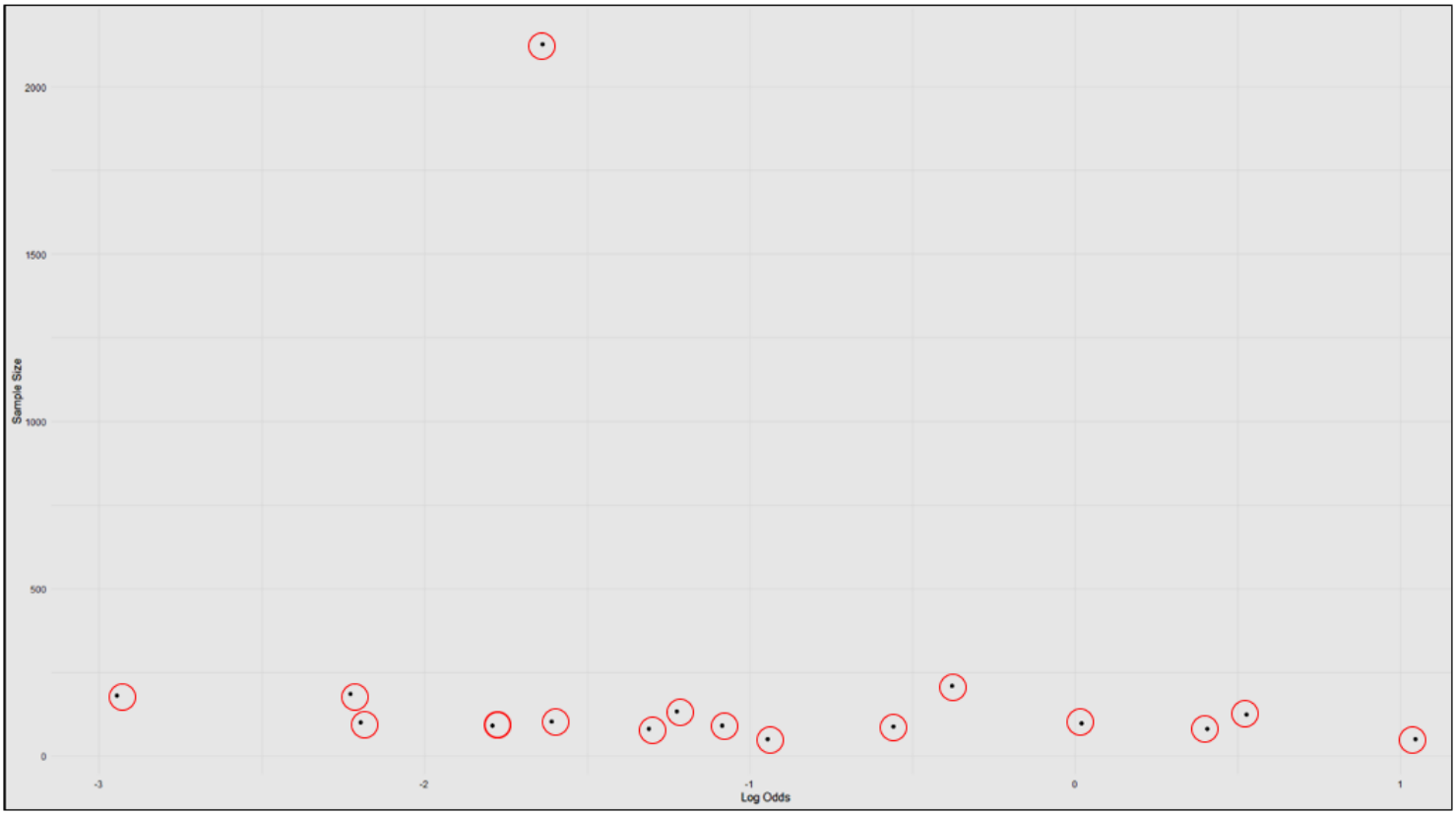
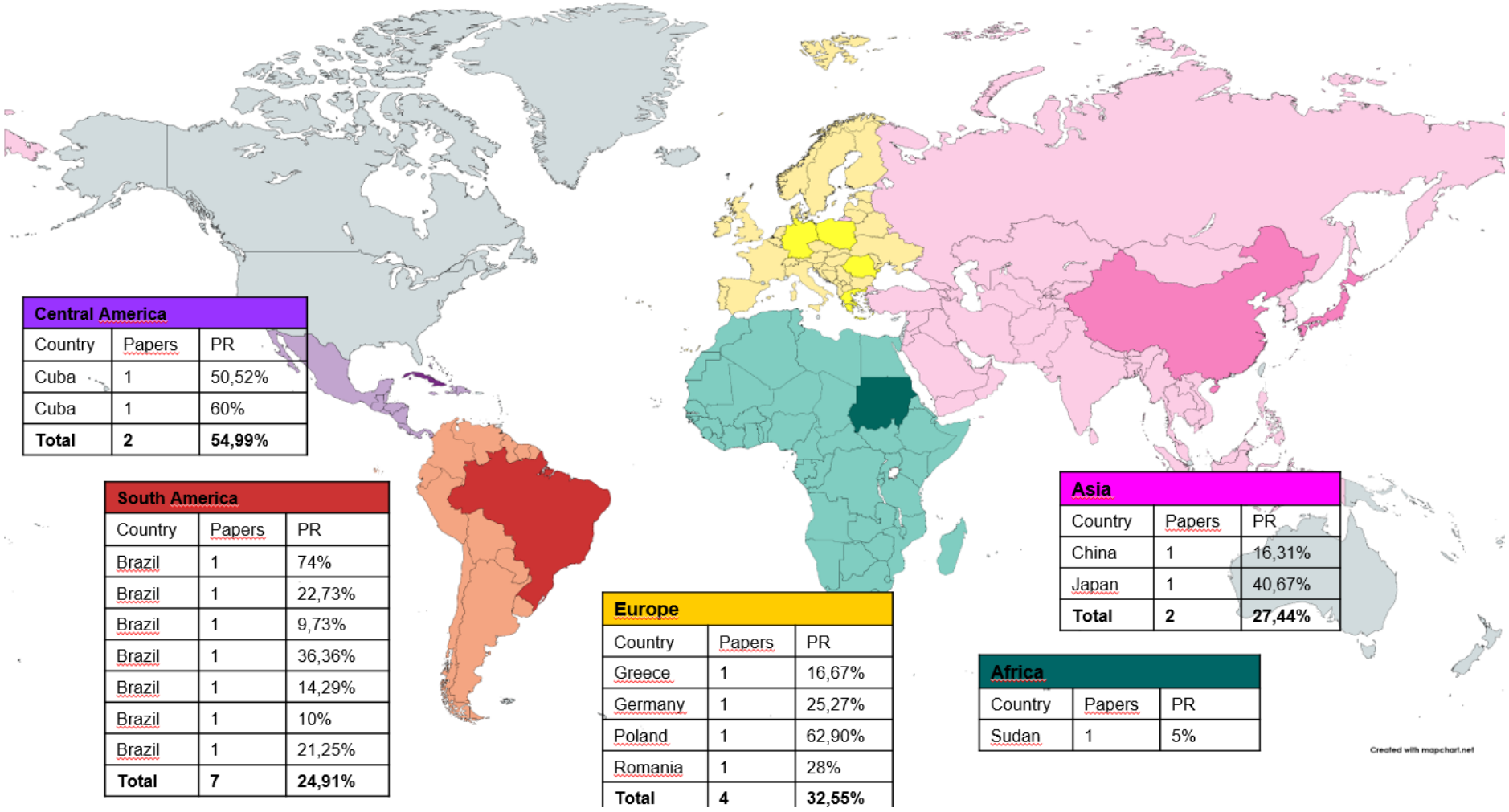


Figure 6 – Prevalence of bruxism in adults with non-carious cervical lesion by continent.



Central America		
Country	Papers	PR
Cuba	1	50,52%
Cuba	1	60%
Total	**2**	**54,99%**

South America		
Country	Papers	PR
Brazil	1	74%
Brazil	1	22,73%
Brazil	1	9,73%
Brazil	1	36,36%
Brazil	1	14,29%
Brazil	1	10%
Brazil	1	21,25%
Total	**7**	**24,91%**

Europe		
Country	Papers	PR
Greece	1	16,67%
Germany	1	25,27%
Poland	1	62,90%
Romania	1	28%
Total	**4**	**32,55%**

Asia		
Country	Papers	PR
China	1	16,31%
Japan	1	40,67%
Total	**2**	**27,44%**

Africa		
Country	Papers	PR
Sudan	1	5%

Created with mapchart.net

Table S1 – Databases and search strategies.

Database	Search strategy
Medline / PubMed	("Tooth Abrasion"[MeSH Terms] OR "Tooth Abrasion"[All Fields] OR "Dental Abrasion"[All Fields] OR "Dental Abrasion"[All Fields] OR "attrition"[All Fields] OR "abrasion"[All Fields] OR "abfraction"[All Fields] OR "Tooth Erosion"[MeSH Terms] OR "Tooth Erosion"[All Fields] OR "Tooth Erosions"[All Fields] OR "tooth surface loss"[All Fields] OR "Tooth Wear"[MeSH Terms] OR "Tooth Wear"[All Fields] OR "Tooth Wears"[All Fields] OR "Dental Wear"[All Fields] OR "noncarious cervical lesions"[All Fields] OR "noncarious cervical lesion"[All Fields] OR "NCCL"[All Fields] OR "NCCLs"[All Fields] OR "non-caries cervical lesions"[All Fields] OR "non-carious cervical lesions"[All Fields] OR "non-carious cervical lesion"[All Fields] OR "noncarious dental lesions"[All Fields] OR "non-carious dental lesions"[All Fields] OR "root defects"[All Fields] OR "root defect"[All Fields] OR "Tooth Attrition"[MeSH Terms] OR "Tooth Attrition"[All Fields] OR "Dental Attrition"[All Fields] OR "Occlusal Wear"[All Fields] OR "Occlusal Wears"[All Fields]) AND ("Bruxism"[MeSH Terms] OR "Bruxism"[All Fields] OR "Teeth Grinding Disorders"[All Fields] OR "Bruxomania"[All Fields] OR "bruxisms"[All Fields] OR "bruxers"[All Fields] OR "bruxing"[All Fields] OR "bruxists"[All Fields] OR "bruxist"[All Fields] OR "bruxer"[All Fields] OR "clenching"[All Fields] OR "Sleep Bruxism"[MeSH Terms] OR "Sleep Bruxism"[All Fields] OR "parafunction"[All Fields] OR "parafunctional habit"[All Fields] OR "parafunctional habits"[All Fields] OR "awake bruxism"[All Fields])
Scopus	TITLE-ABS-KEY("Tooth Abrasion" OR "Dental Abrasion" OR "Dental Abrasion" OR "attrition" OR "abrasion" OR "abfraction" OR "Tooth Erosion" OR "Tooth Erosions" OR "tooth surface loss" OR "Tooth Wear" OR "Tooth Wears" OR "Dental Wear" OR "noncarious cervical lesions" OR "noncarious cervical lesion" OR "NCCL" OR "NCCLs" OR "non-caries cervical lesions" OR "non-carious cervical lesions" OR "non-carious cervical lesion" OR "noncarious dental lesions" OR "non-carious dental lesions" OR "root defects" OR "root defect" OR "Tooth Attrition" OR "Dental Attrition" OR "Occlusal Wear" OR "Occlusal Wears" OR "Dental Wears" OR "Dental Attritions") AND TITLE-ABS-KEY("Bruxism" OR "Teeth Grinding Disorders" OR "Bruxomania" OR "bruxisms" OR "bruxers" OR "bruxing" OR "bruxists" OR "bruxist" OR "bruxer" OR "clenching" OR "Sleep Bruxism" OR "parafunction" OR "parafunctional habits" OR "awake bruxism" OR "parafunctional habit" OR "Teeth Grinding Disorder" OR "Sleep Bruxisms" OR "Nocturnal Teeth Grinding Disorder")
Web of Science	TS=("Tooth Abrasion" OR "Dental Abrasion" OR "Dental Abrasion" OR "attrition" OR "abrasion" OR "abfraction" OR "Tooth Erosion" OR "Tooth Erosions" OR "tooth surface loss" OR "Tooth Wear" OR "Tooth Wears" OR "Dental Wear" OR "noncarious cervical lesions" OR "noncarious cervical lesion" OR "NCCL" OR "NCCLs" OR "non-caries cervical lesions" OR "non-carious cervical lesions" OR "non-carious cervical lesion" OR "noncarious dental lesions" OR "non-carious dental lesions" OR "root defects" OR "root defect" OR "Tooth Attrition" OR "Dental Attrition" OR "Occlusal Wear" OR "Occlusal Wears" OR "Dental Wears" OR "Dental Attritions") AND TS=("Bruxism" OR "Teeth Grinding Disorders" OR "Bruxomania" OR "bruxisms" OR "bruxers" OR "bruxing" OR "bruxists" OR "bruxist" OR "bruxer" OR "clenching" OR "Sleep Bruxism" OR "parafunction" OR "parafunctional habit" OR "parafunctional habits" OR "awake bruxism" OR "Teeth Grinding Disorder" OR "Sleep Bruxisms" OR "Nocturnal Teeth Grinding Disorder")
EMBASE	('tooth abrasion'/de OR 'tooth abrasion' OR 'dental abrasion' OR 'attrition'/de OR 'attrition' OR 'abrasion'/de OR 'abrasion' OR 'abfraction' OR 'tooth erosion'/de OR 'tooth erosion' OR 'tooth erosions' OR 'tooth surface loss' OR 'tooth wear'/de OR 'tooth wear' OR 'tooth wears' OR 'dental wear' OR 'noncarious cervical lesions' OR 'noncarious cervical lesion' OR 'nccl' OR 'nccls' OR 'non-caries cervical lesions' OR 'non-carious cervical lesions' OR 'non-carious cervical lesion' OR 'noncarious dental lesions' OR 'non-carious dental lesions' OR 'root defects' OR 'root defect' OR 'tooth attrition'/de OR 'tooth attrition' OR 'dental attrition' OR 'occlusal wear' OR 'occlusal wears' OR 'dental wears' OR 'dental attritions') AND ('bruxism'/de OR 'bruxism' OR 'teeth grinding disorders' OR 'bruxomania' OR 'bruxisms' OR 'bruxers' OR 'bruxing' OR 'bruxists' OR 'bruxist' OR 'bruxer' OR 'clenching' OR 'sleep bruxism'/de OR 'sleep bruxism' OR 'parafunction' OR 'parafunctional habits' OR 'awake bruxism'/de OR 'awake bruxism' OR 'parafunctional habit' OR 'teeth grinding disorder'/de OR 'teeth grinding disorder' OR 'sleep bruxisms' OR 'nocturnal teeth grinding disorder')

ProQuest Dissertation and Thesis	**1** noft("Tooth Abrasion" OR "Dental Abrasion" OR "Dental Abrasion" OR "attrition" OR "abrasion" OR "abfraction" OR "Tooth Erosion" OR "Tooth Erosions" OR "tooth surface loss" OR "Tooth Wear" OR "Tooth Wears" OR "Dental Wear" OR "noncarious cervical lesions" OR "noncarious cervical lesion" OR "NCCL" OR "NCCLs" OR "non-caries cervical lesions" OR "non-carious cervical lesions" OR "non-carious cervical lesion" OR "noncarious dental lesions" OR "non-carious dental lesions" OR "root defects" OR "root defect" OR "Tooth Attrition" OR "Dental Attrition" OR "Occlusal Wear" OR "Occlusal Wears" OR "Dental Wears" OR "Dental Attritions") AND noft("Bruxism" OR "Teeth Grinding Disorders" OR "Bruxomania" OR "bruxisms" OR "bruxers" OR "bruxing" OR "bruxists" OR "bruxist" OR "bruxer" OR "clenching" OR "Sleep Bruxism" OR "parafunction" OR "parafunctional habits" OR "awake bruxism" OR "parafunctional habit" OR "Teeth Grinding Disorder" OR "Sleep Bruxisms" OR "Nocturnal Teeth Grinding Disorder")
LILACS	**2** ("Tooth Abrasion" OR "Dental Abrasion" OR "Dental Abrasion" OR "attrition" OR "abrasion" OR "abfraction" OR "Tooth Erosion" OR "Tooth Erosions" OR "tooth surface loss" OR "Tooth Wear" OR "Tooth Wears" OR "Dental Wear" OR "noncarious cervical lesions" OR "noncarious cervical lesion" OR "NCCL" OR "NCCLs" OR "non-caries cervical lesions" OR "non-carious cervical lesions" OR "non-carious cervical lesion" OR "noncarious dental lesions" OR "non-carious dental lesions" OR "root defects" OR "root defect" OR "Tooth Attrition" OR "Dental Attrition" OR "Occlusal Wear" OR "Occlusal Wears" OR "Dental Wears" OR "Dental Attritions" OR "Abrasão Dentária" OR "Abrasão dos Dentes" OR "Abrasión de los Dientes" OR "Abrasión Dental" OR "Abrasión Dentaria" OR "Erosão Dentária" OR "Erosão do Dente" OR "Erosão dos Dentes" OR "Erosión de los Dientes" OR "Erosion Dental" OR "Erosión Dentaria" OR "Erosión del Diente" OR "Desgaste Dentário" OR "Desgaste do Dente" OR "Desgaste Oclusal dos Dentes" OR "Desgaste Oclusal Fisiológico dos Dentes" OR "Desgaste Proximal dos Dentes" OR "Desgaste Proximal Fisiológico dos Dentes" OR "Desgaste de los Dientes" OR "Alisamiento Dental" OR "Desgaste Dental" OR "Desgaste Oclusal de los Dientes" OR "Desgaste Proximal de los Dientes" OR "Desgaste del Diente" OR "Atrito Dentário" OR "Atrito dos Dentes" OR "Atrición Dental" OR "Atrición Dentaria" OR "Atrición Excesiva de los Dientes" OR "Atrición de los Dientes") AND ("Bruxism" OR "Teeth Grinding Disorders" OR "Bruxomania" OR "bruxisms" OR "bruxers" OR "bruxing" OR "bruxists" OR "bruxist" OR "bruxer" OR "clenching" OR "Sleep Bruxism" OR "parafunction" OR "parafunctional habits" OR "awake bruxism" OR "parafunctional habit" OR "Teeth Grinding Disorder" OR "Sleep Bruxisms" OR "Nocturnal Teeth Grinding Disorder" OR bruxismo OR "Ranger de Dentes" OR "Rechinamiento de Dentes" OR "Rechinamiento de los Dientes" OR "Rechinamiento Dental" OR "Bruxismo do Sono" OR "Bruxismo Noturno" OR "Bruxismo del Sueño" OR "Apretamiento Dental Nocturno" OR "Bruxismo Nocturno" OR "Trastorno de Rechinamiento Nocturno de los Dientes") AND (db:("LILACS"))
LIVIVO	**3** ("Tooth Abrasion" OR "Dental Abrasion" OR "Dental Abrasion" OR "attrition" OR "abrasion" OR "abfraction" OR "Tooth Erosion" OR "Tooth Erosions" OR "tooth surface loss" OR "Tooth Wear" OR "Tooth Wears" OR "Dental Wear" OR "noncarious cervical lesions" OR "noncarious cervical lesion" OR "NCCL" OR "NCCLs" OR "non-caries cervical lesions" OR "non-carious cervical lesions" OR "non-carious cervical lesion" OR "noncarious dental lesions" OR "non-carious dental lesions" OR "root defects" OR "root defect" OR "Tooth Attrition" OR "Dental Attrition" OR "Occlusal Wear" OR "Occlusal Wears" OR "Dental Wears" OR "Dental Attritions") AND ("Bruxism" OR "Teeth Grinding Disorders" OR "Bruxomania" OR "bruxisms" OR "bruxers" OR "bruxing" OR "bruxists" OR "bruxist" OR "bruxer" OR "clenching" OR "Sleep Bruxism" OR "parafunction" OR "parafunctional habits" OR "awake bruxism" OR "parafunctional habit" OR "Teeth Grinding Disorder" OR "Sleep Bruxisms" OR "Nocturnal Teeth Grinding Disorder")
Google Scholar	**4** (attrition OR abrasion OR Erosion OR "noncarious cervical lesions" OR "noncarious cervical lesion") AND (Bruxism OR parafunction OR "parafunctional habit")

Search strategies were performed for each database by using specifics words combinations and truncations with the support of a librarian.

Table S2 - Excluded articles and reasons for exclusion.

Author, Year	Reason for exclusion
Ahmed et al 2009[1]	4
Ahmed et al 2014[2]	3
Alam et al 2022[3]	4
Alvarez-Arenal et al 2019[4]	8
Al-Zarea 2012[5]	3
Brandini et al 2012[6]	3
Corrêa 2008[7]	1
Diraçoğlu et al 2011[8]	3
El-Swiah 2001[9]	7
Khalil et al 2020[10]	3
Khan et al 1998[11]	3
Khan et al 1999[12]	3
Kitasako et al 2021[13]	3
Kosovel et al 1986[14]	3
Lima et al 2005[15]	3
Martinović et al 2019[16]	7
Maślanka et al 1970[17]	7
Mengatto et al 2013[18]	3
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Nascimento et al 2022 [20]	8
Ogunyinka 2001[21]	3
Pegoraro et al 2005[22]	3
Pereira 2015[23]	3
Pintado et al 1997[24]	3
Prymas et al 2013[25]	3
Rafeek et al 2006[26]	3
Rodríguez Chala et al 2016[27]	4
Sadaf et al 2014[28]	5
Sawlani et al 2016[29]	3
Sayed et al 2017[30]	2
Shah et al 2009[31]	3
Smith et al 2008[32]	3
Tokiwa et al 2008[33]	3
Tomasik et al 2009[34]	7
Wei et al 2016[35]	3
Yang et al 2016[36]	3
Zuza et al 2019[37]	3

1- studies with children (n=1), 2-specific population (n=1), 3-not reported prevalence of NCCLs related to bruxism or did not provide bruxism data separately from other types of parafunctions (n=25), 4- NCCLs diagnostic criteria and/or bruxism assessment criteria was not reported or not sufficiently described (n=3), 5–occlusal factors the only sign of bruxism (n=1), 6–conference abstract (n=1), 7-full text not available (n=4), 8- case-control studies (n=2).

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Table S3 - Methodological quality assessed by the Joanna Briggs Institute Critical Appraisal tools - Checklist for Studies Reporting Prevalence Data.

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Aguiar, 2012	Y	N	N	Y	Y	Y	Y	Y	Y
Bismar et al, 2021	Y	N	Y	Y	N	U	N	N	N
Brandini et al, 2012	Y	N	Y	Y	N	U	N	Y	N
Crisóstomo et al., 2021	Y	N	N	Y	Y	N	N	Y	N
Figueiredo et al, 2015	Y	N	N	Y	N	N	N	Y	N
González et al, 2020	Y	N	N	Y	Y	N	N	N	Y
Gaffar et al, 2012	Y	N	N	Y	N	U	N	Y	N
Jiang et al, 2011	Y	Y	Y	Y	Y	U	Y	Y	Y
Marinescu et al, 2017	Y	N	N	Y	N	N	N	N	N
Molena et al, 2008	Y	N	N	Y	Y	U	N	Y	N
Morigami et al, 2011	Y	N	N	Y	N	U	N	Y	N
Oliveira et al, 2009	Y	N	N	Y	N	N	N	N	N
Ommerborn et al, 2007	Y	N	N	Y	N	Y	N	Y	N
Tomasik et al, 2006	Y	N	N	Y	N	Y	N	Y	N
Tsiggos et al, 2008	Y	N	N	Y	Y	Y	U	Y	N
Yamashita et al., 2014	U	N	N	U	N	U	N	Y	N

Note:

1. Q1-Q9: questions to assess the methodological quality, as listed below:

Q1: Was the sample frame appropriate to address the target population?

Q2: Were study participants recruited in an appropriate way?

Q3: Was the sample size adequate?

Q4: Were the study subjects and setting described in detail?

Q5: Was data analysis conducted with sufficient coverage of the identified sample?

Q6: Were valid methods used for the identification of the condition?

Q7: Was the condition measured in a standard, reliable way for all participants?

Q8: Was there appropriate statistical analysis?

Q9: Was the response rate adequate, and if not, was the low response rate managed appropriately?

2. Y:yes; N: no; U: unclear.

Table S4 - Joanna Briggs classification determined by authors.

	Question	Classification		
		Y	N	U
1.	Was the sample frame appropriate to address the target population?	Sample representative of the population, with the same characteristics and proportional.	Sample was not representative of the population.	No clear description of the sample.
2.	Were study participants recruited in an appropriate way?	Selection method of the sample was clearly defined or random sampling method used.	No description of the selection method or the article used a convenience sample.	No clear description of the selection method.
3.	Was the sample size adequate?	Sample size calculation was performed, it was adequate and respected by the researches.	No description of the sample size calculation.	Not clear description of the method of sample calculation.
4.	Were the study subjects and setting described in detail?	Study sample described in sufficient way (age, sex, proportion M:F, sociodemographic variables).	Studies that did not described the study sample.	No clear description of the sample.

5.	Was data analysis conducted with sufficient coverage of the identified sample?	Clear description of data about refuse or dropout rates.	No identified or mentioned these data.	Not clear if the study identified the data or not mentioned the reasons for dropout.
6.	Were valid methods used for the identification of the condition?	Bruxism (validated questionnaire and/or clinical signs) and NCCL (clinical examination and/or examination of casts) were identified by validated and well-describe methods.	No clear description of the method used for identification or not validated methods/questionnaires were used to identified any of the conditions.	Used validated method for identification of only one condition (NCCL or Bruxism) or only described the diagnostic method of only one condition.
7.	Was the condition measured in a standard, reliable way for all participants?	The operator that performed the diagnostic of bruxism and NCCL was trained and was performed intra e inter-observer reliability of the operators.	No mention about the training operator and no included inter and intra-observer for assessing the validity and reliability.	The operator was trained for diagnose only one condition (NCCL or bruxism) or the reliable test was performed in only one condition.
8.	Was there appropriate statistical analysis?	When it was detailed which analytical techniques were used and percentages were given with confidence	Percentages did not present confidence intervals. Inappropriate statistical	Not clear about the analysis and if the method used was adequate.

		intervals. Adequate calculation for the research method.	analysis or did not presented the statistical analysis.	
9.	Was the response rate adequate, and if not, was the low response rate managed appropriately?	The response rate was adequate or the authors adequately managed and explained why the response rate was low.	There was no analysis about the losses in the study or not explained or compared with the remaining participants.	The quality of the relate was low.

Notes: Y: yes; N: no; U: unclear.

5 ARTIGO 2

Association between bruxism and non-carious cervical lesions in adults: a systematic review and meta-analysis

Running title: Association bruxism and non-carious cervical lesion

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ABSTRACT

Objetcives: The purpose of this systematic review was to evaluate the association between bruxism and non-carious cervical lesions in adults.

Methods: The inclusion criteria were studies with patients with permanent dentition that evaluated the presence of NCCL and assessed the presence of bruxism through validated methods, such as questionnaire, clinical assessment or polysomnography/electromyography in those patients. No restriction on gender or language. The databases searched were Embase, PubMed, LILACS, Web of Science, Scopus, Google Scholar, LIVIVO and ProQuest and 3 grey literature databases (Google Scholar, LIVIVO, and ProQuest). Quality of evidence was evaluated using the Joanna Briggs Institute Critical Appraisal Checklists and certainty of evidence using GRADE (Grading of Recommendations Assessment, Development and Evaluation). Meta-Analysis was performed with RevMan 5.4 software.

Results: From 2821 records identified, 19 studies met the inclusion criteria, and of these, 12 were included in quantitative analysis. The overall methodological quality was low, only one study had all “yes” answers in the JBI questionnaire. Odds Ratio was 1.57 (95%CI: 1.19-2.08) in cross-sectional studies and in case-control studies was not found significant association. No study with definitive assessment of bruxism was identified. The overall certainty of evidence was very low.

Conclusion: Bruxism was associated with NCCL. Due to the very low level of evidence, caution should be applied when considering these findings.

KeyWords:

1. Introduction

Non-carious cervical lesion (NCCL) is characterized by the loss of dental structure in the cemento-enamel junction region unrelated to bacteria [1]. The prevalence of NCCL is around 46% and tends to increase with age [2]. Several terms can be used to refer to this lesion due to its multifactorial character, such as root defects, abfraction, abrasion and erosion, etc. [2].

NCCL occurs through three main mechanisms: occlusal stress, friction and biocorrosion. Endogenous factors such as parafunction, premature contacts, gastric acid, chewing and tongue action and exogenous factors such as hygiene habits, occupational factors and diet can contribute to the loss of dental structure [3].

Bruxism, which can be a risk factor for NCCL due to the overload it generates in the stomatognathic system [4], is characterized as a repetitive activity of the masticatory muscles that occurs through clenching, grinding and gnashing of the teeth or maintaining the jaw in the same position [5]. It can occur during wakefulness (awake bruxism or AB) or during sleep (sleep bruxism or BS) [5]. AB may be considered more prevalent, but BS has been more extensively researched in the past, which is why many articles refer to it simply as "bruxism", without making a distinction between the two [6].

It is possible to evaluate the status of bruxism and possible consequences on joints, muscles, intraoral and extraoral tissues, restorations and teeth (wear facets, fractured cusps, NCCL, etc.) through self-report, clinical evaluation and tests such as polysomnography (PSG) and electromyography (EMG). Also, identify risk and etiological factors and comorbidities associated with bruxism, such as gastroesophageal reflux (GERD), medication use, and sleep-related conditions [7, 8].

A systematic review (SR) from 2017 concluded that there is an association between occlusal stress and NCCL [9]. In another SR, self-reported BS was considered an aggravating factor for the development of NCCL [10]. However, no literature records have been found so far regarding reviews that investigated the association between bruxism and the occurrence of NCCL, highlighting the relevance of the present study.

2. Methods

2.1) Eligibility criteria

This SR was based on the PECOS acronym: P: Adults; E: Bruxism; C: Absence of bruxism; O: Presence of non-carious cervical lesion; S: Case-control, cross-sectional and cohort studies. The inclusion criteria were studies with patients with permanent dentition, no restrictions on gender and ethnicity, with at least 20 teeth, studies that evaluated the presence of bruxism through validated methods and assessed the presence of NCCL in those patients. Sleep bruxism should have been assessed through any of the following diagnostic criteria: questionnaire, clinical assessment or PSG. Awake bruxism should have been assessed through self-report (questionnaires, oral history), clinical inspection, EMG recordings and ecological momentary assessment.

The exclusion criteria was studies with children, studies with psychoactive drug users, psychiatric patients, studies that did not provide the association of NCCLs with bruxism or did not provide bruxism data separately from other types of parafunctions, studies that did not provide NCCL data separately from other types of wear, studies in which NCCLs diagnostic criteria and/or bruxism assessment criteria was not reported or not sufficiently described, studies that considered occlusal factors the only sign of bruxism, abstracts, reviews, letters, conference abstracts, personal opinions, case reports, protocols, posters and pre-clinical research (in vitro, ex-vivo, in animals), full text not available even after trying to contact the corresponding author (three attempts in a three week period, through e-mail or through the "research gate" website). In case of no response, with the help of an experienced librarian, was performed a search of the eligible article through the integrated search service of the university library. If both methods proved unsuccessful, the study was excluded.

2.2) Information sources and Search strategy

The searches were performed on July 11th, 2022 and applied in the following main electronic databases: Embase, PubMed (including MEDLINE), Latin American and Caribbean Health Sciences (LILACS), Web of Science and Scopus. A grey literature search was performed on Google Scholar, LIVIVO and ProQuest. Appropriate truncation and word combinations were elaborated and adapted for each of the electronic databases with help of a health science librarian. Hand-search of the bibliographies from included studies in the SR and researchers with expertise in the area was contacted. It was not used filters for time nor language restrictions. Duplicate studies were removed by using a software program (EndNote X7; Thomson Reuters). The full search strategies for each database are in presented in Table S1. No restrictions about time or language were applied.

2.3) Selection process

Two independent reviewers (APB and HP) selected the included articles in two phases, with the aid of a software program (Rayyan Online; Qatar Computing Research Institute). Firstly (phase-1), the two reviewers evaluated the titles and abstracts according the eligibility criteria; secondly (phase-2), they checked full-texts and select articles by the same criteria as phase-1; then, they crosschecked all the information found. If disagreements arise, a third reviewer (ABA) participated before a final decision was made in both phases. If important data for the review were missing or unclear, three attempts were made to contact the study corresponding author to resolve or clarify the problem by sending an email to the corresponding author. In case of no response, the article was excluded.

2.4) Data collection process and Data items

The data collection followed the same process. The information collected were: author, type of study, year of publication; country; characteristics of patients (sample size and age); clinical characteristics (NCCL diagnostic method, type and classification and bruxism diagnostic method and classification) and main conclusion (Table 1). A third reviewer (ABA) was consulted

in the event of disagreement. If the required data were not complete, the authors could be contacted by email for 3 consecutive weeks as an effort to recover any unpublished data.

2.5) Methodological quality assessment

The methodological quality of the selected studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for analytical cross-sectional and case-control studies. The critical appraisal tool has eight questions for cross-sectional and ten questions for case-control. The questions address sample characteristics, the measurement of exposure, the conditions being studied and any confounding factors. The answers might be “yes”, “unclear”, “no” or “not applicable”.

2.6) Effect measures

The primary outcome assessed was the association between bruxism and NCCL. The effect measure was the odds ratios according to the four groups (with bruxism/with NCCL; without bruxism/with NCCL/; with bruxism/without NCCL; without bruxism/without NCCL/), with 95% confidence intervals (CI).

2.7) Synthesis methods

The effect measure adopted was the odds ratio of the occurrence of NCCL in adults with bruxism, compared to those without bruxism (dichotomous variable) and its 95% confidence intervals (95%CI) were considered. The statistical method used was Mantel-Haenszel analysis for dichotomous variables, with a random-effects model. Heterogeneity was assessed using I^2 statistics, with a value higher than 50% considered substancial heterogeneity. Significance level was set at 5%. Forest plots were generated with the Review Manager software (RevMan 5.4, Copenhagen, Denmark).

Subgroup analyzes was conducted, considering the study design. Although subgroup analysis considering the country and sample origin, classification of the bruxism and subjects characteristics was planned in the protocol, none was performed due to the inability to combine studies. Sensitivity analysis was not performed to explore the effects of methodological quality as none of the studies included in the meta-analysis (MA) exhibited good methodological quality.

2.8) *Confidence in cumulative evidence*

A summary of overall strength of evidence available was performed using “Grading of Recommendations Assessment, Development and Evaluation” (GRADE). A summary of findings table was generated using online software (GRADEpro GDT; the GRADE Working Group) [11].

3. Results

3.1 Study selection

From 2821 records identified by databases searches, 1213 remained after the duplicates removal. After the first phase of reading title and abstracts, 72 were full text read in the second phase. After reading the full texts, 19 studies were included, 7 for qualitative analysis and 12 for quantitative analysis review (Figure 1). Further information about the 52 excluded articles is available in Table S2.

Some studies were almost included [12], however did not report the number of patients without NCCL. Another one was not included because the inclusion criteria required the presence of NCCL in the sample [13] and other one inclued children aged 12 and above in their sample [14].

3.2 Study Characteristics

Among the 19 included studies, published from 1996 to 2022, 7 studies were carried out in Brazil [15-21], 2 in China [22, 23], 2 in Japan [24, 25], 2 in Germany [26, 27] and 1 of each in Spain [28], Romania [29], Greece [30], Sudan [31], Trinidad [32] and United States of America [33]. A total of 8967 participants were evaluated, with sample size range from 50 [29] to 2128 [34] and age ranged from 18 to 93 years old. One study specifically focused on elderly individuals aged 60-93 years [35]. The included studies had a cross-sectional design, totalizing 16 studies with 8,083 participants and 3 case-control studies with 884 participants.

3.3 Methodological quality assessment

Based on criteria set out in Table S4 and considering the different study types, the methodological quality in the included studies was low. Only one cross-sectional study [23] met all the criteria with “yes” responses, while another study [24] presented one “unclear” response due to a lack of clear description regarding bruxism diagnostic method. Among the others studies, at least one “no” response was recorded for the other questions. More than half of the studies received a “no” or “unclear” response regarding the detection method of the exposure since it was not employed a reliability test between intra and inter-examiners (question 3 of the cross-sectional questionnaire and question 4 of the case-control questionnaire). Additionally, a majority of the studies did not investigate the presence of gastroesophageal reflux, which is a confounding factor for both conditions (NCCL and bruxism), nor did employ strategies to address these confounding factors (question 5 and 6 of the cross-sectional questionnaire and question 6 and 7 of the case-control questionnaire). A comprehensive description of the methodological quality assessment for each included study can be found in Table S3.

3.4 Results of individual studies

The articles included in the analysis employed different sample designs. The most common approach was to divide the sample into two groups, one consisting of patients with non-carious cervical lesions (NCCL) and the other comprising patients without NCCL, to investigate the risk factor of bruxism for lesion development. In the second study design, the sample was also divided into two groups, one consisting of patients with bruxism and the other without bruxism, to observe their relationship with NCCL [26, 30].

Most of the articles assessed bruxism through questionnaires, with only a few through clinical examination [19, 23, 26, 31]. The detection of NCCL was predominantly based on visual analysis, with some studies utilizing the analysis of plaster models with magnifying glass [15], casts examination [31] and intraoral photographs [36]. The term "NCCL" was most commonly used to refer to the lesion in the majority of the articles. Only one study employing the term "cervical defect” [23] and four studies used "abfraction" [27, 31, 18, 36].

Some articles raise questions about AB and SB but present the results simply as "bruxism" [19, 23, 29, 36]. Only one article question and present results separately for AB and SB [28] and another provides data specifically on SB [26]. Some articles report only the generic term "bruxism" [17, 25, 32, 37]. One study classified bruxism as "often and always," "sometimes," and "never" [22] and other [27] classified it as “never”, “sometimes and always”. " In these articles, we considered "often and always," "sometimes," and "sometimes and always" as "bruxism." Four articles, in addition to assessing bruxism, separately evaluated the habit of clenching the teeth [16, 20, 21, 33]. Another study, in addition to these, also assessed teeth grinding [31] and two articles mention only clenching and grinding of the teeth without specifically mentioning “bruxism” [15, 18].

Table I shows the descriptive characteristics of the 19 studies included.

Seven studies were excluded from the MA. One evaluated patients with and without SB but was not included in the MA due to the method used to detect probable bruxism [26]. This study shows an association between NCCL and bruxism, as well as two other studies, with OR=19.25 [95%CI=6-61.75][31] and OR=1.0 [95%CI=0.5-2.1][32], but they were not included in MA because it only presented odds ratio (OR). Other four studies [23, 25, 37, 38] demonstrated no association between bruxism and NCCL, indicating a lack of consensus among the studies that were not included in the MA.

3.5 Results of syntheses

The MA was performed according to the study design to avoid bias. In the MA of cross-sectional studies, it was included only possible bruxism. A MA was performed for dichotomous outcomes in 9 cross-sectional studies and 3 case-control studies, using OR and the Mantel-Haenszel analysis method.

A positive association was found between non-carious cervical lesion and bruxism in cross-sectional studies ($p<0.05$) and presented OR of 1.57 (95%CI: 1.19 – 2.08, n= 1362), indicating that individuals with possible bruxism have a 1.57 times higher likelihood of developing NCCL compared to those without bruxism. One study [22] presented a narrower confidence interval (95%CI: 1.32 – 1.92) and a larger sample size (n=3157), which contributed to its higher weight of 38% in the analysis. The heterogeneity among cross-sectional studies was 26%, as determined by the I^2 statistic, indicating low heterogeneity between the studies.

In case-control studies, the OR was 1.27 (95%CI: 0.91 – 1.78, n = 884), however did not show a significant association between bruxism and NCCL ($p>0.05$). One study [33], which had the most weight in this MA, did not demonstrate a significant association. The heterogeneity among the case-control studies was substantial, with a value of 57% according to the I^2 test.

Figure 2 and 3 summarizes the results from the meta-analysis.

3.6 Confidence in cumulative evidence

The Grading of Recommendations Assessment, Development and Evaluation was done according studies design and cross-sectional studies were separated according bruxism detection. The confidence in cumulative evidence was considered very low because of high risk of bias, inconsistency, indirectness and imprecisions observed within the included studies. The summary of these findings can be found in Table 2.

4. Discussion

This meta-analysis investigated the available evidence regarding the association between bruxism and non-carious cervical lesions (NCCL) in adults. According to the obtained results, there is an association between the two conditions, and patients with bruxism are at least once more likely to develop an NCCL. This finding is supported by other articles that demonstrate dental wear resulting from occlusal load [9, 16, 39, 40]. However, the results of this MA should be interpreted with caution due to the low methodological quality of the studies and the low certainty of the generated evidence. Additionally, no significant association was found in case-control studies, and no cohort study was included. The majority of studies included in this review are cross-sectional, meaning that the condition was analyzed at a single point in time, which prevents a longitudinal assessment and hinders the inference of causality between the conditions which implies that the conditions were analyzed at a single point in time, which prevents an over time assessment and hinders the inference of causality between the conditions[41].

Bruxism is defined as a repetitive activity of the masticatory muscles characterized by clenching or grinding of the teeth and/or bracing or thrusting of the mandible[42]. This definition was established in a consensus in 2013, and many articles included in this systematic review were conducted prior to this date and did not adopt this definition.

Bruxism is classified according to its circadian manifestation, being divided into sleep bruxism (SB) and awake bruxism (AB) [5]. In SB, there are predominantly episodes of grinding the teeth [43]. Although enamel is resistant to compression, it has low resistance when subjected to tensile forces, which primarily occur during SB, leading to fractures, especially in the fulcrum [44, 45]. Furthermore, the force exerted during SB is greater than in physiological activities during the day [46], resulting in excessive overload on the teeth.

In AB, the patient maintains repetitive or sustained dental contact [42] for a longer period of time without movement, resulting in compression of the enamel [4]. The static movement of dental clenching also causes dental loss in the cervical region [47], which can generate a concentration of traumatic force on a misaligned tooth, for example [4]. In addition to the type of

movement performed during bruxism, the direction and duration of the movement are also factors that contribute to the progression of the lesion [48]. Only two articles [26, 49] used the circadian classification when presenting the results, and it was considered as "bruxism," which may have introduced biases in this systematic review.

Non-carious cervical lesion, according to the Glossary of Prosthodontic Terms, refers to the pathological loss of hard tooth substance caused by biomechanical loading forces [50]. Its etiology is multifactorial, with factors such as tension, biocorrosion, and friction acting synergistically. In this study, we evaluated it solely in relation to occlusal load, but it is necessary to consider, for diagnosis and treatment, the role of hygiene habits, eating disorders, diet, and age [3, 51].

Erosion and abrasion are important factors in the development of NCCL. Most of the studies did not assess confounding factors such as GERD, which can interfere in bruxism and NCCL. The relationship between GERD and bruxism is that the movement performed by the mouth can neutralize the acidic pH from GERD through saliva stimulation, which acts as a protective factor for the teeth [52]. On the other hand, GERD can also accelerate dental wear caused by bruxism due to the demineralization of dental tissues caused by acid[53, 54]. Therefore, GERD, which is a confounding factor for both conditions in this systematic review, was evaluated in some articles as a risk factor for NCCL [18, 21, 23, 29, 32, 33, 37, 55, 56], but only one study assessed GERD as a risk factor for bruxism as well [23].

In relation to NCCL, there was no standardization regarding the method of detection, the terms used to refer to the lesions, and the classification of wear. Some studies adopted their own classification, while others modified the Tooth Wear Index (TWI) by Smith and Knight (1984) or by Fares et al. (2009), and some did not even mention the classification. Terms such as NCCL, abfraction, and cervical wear were used in different studies. In 2023, a diagnostic criteria (DC-TW) was published [57], which proposes a standardized assessment of dental wear. That criteria emphasizes that complaints related to aesthetics and dentin hypersensitivity and signs such as mandibular torus, cracks within the enamel and shiny facets are related to mechanical factors such as bruxism and should be evaluated. Diagnostic criteria like these, when applied, facilitate the comparison of research results, which was not possible in this systematic review.

There is no consensus on phenotyping the clinical signs associated with subtypes of dental wear [57]. However, according to the findings of this systematic review, bruxism and NCCL have a bidirectional relationship: individuals diagnosed with bruxism should be considered a high-risk group for the development of NCCL, and the presence of NCCL in a patient should be a signal to investigate the presence of bruxism.

In the analysis of methodological quality, only one article [23] met all the criteria positively, but it was not included in the meta-analysis as it only presented OR data. Furthermore, strategies to deal with confounding factors, such as statistical analyses, were not considered adequate in the majority of studies. The most appropriate way to adjust for potential confounders would be through multivariate analysis[58], but not all studies conducted it. Additionally, different terms like "parafunctional habits," "parafunctional activities," "presence of parafunction," "self-reported bruxism," "bruxism," or "teeth grinding or clenching" were used indiscriminately, without an established concept. For this reason, the studies were considered heterogeneous and exhibited substantial variability in study design, sample, bruxism and NCCL diagnostic criteria, and clinical outcomes. The methods used to diagnose bruxism were poorly described, highly heterogeneous, and not validated in the literature. It is also worth noting that the included studies did not specifically evaluate bruxism but rather various other factors associated with the lesion. Therefore, it is possible that the diagnosis of bruxism was not conducted by orofacial pain experts, which could have influenced the results.

5. Conclusion

On the basis of the limited available evidence, results of our review indicated that there is association between bruxism and NCCL. Even though primary articles with clear description of the bruxism detection method and a properly distinction between AB and SB are needed, these findings shows that it is important to investigate and control bruxism in patients with NCCL. Moreover, clinicians should consider the complex interactions between age, habits and acids for the formation of NCCL.

6. Other information

This SR was developed following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA) [59]. The protocol was registered at the International Prospective Register of Systematic Reviews platform (PROSPERO; Center for Reviews and Dissemination, University of York; and the National Institute for Health Research) on December 7th, 2022 under registration number CRD42022328741.

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[52] OHMURE, H. et al. Influence of Experimental Esophageal Acidification on Sleep Bruxism: a Randomized Trial. **Journal of Dental Research,** v. 90, n. 5, p. 665-671, 2011/05/01 2011. ISSN 0022-0345. Disponível em: < https://doi.org/10.1177/0022034510393516 >. Acesso em: 2023/05/03.

[53] NOTA, A. et al. Correlation between Bruxism and Gastroesophageal Reflux Disorder and Their Effects on Tooth Wear. A Systematic Review. **J Clin Med,** v. 11, n. 4, Feb 19 2022. ISSN 2077-0383 (Print)2077-0383.

[54] WETSELAAR, P. A.-O. et al. Associations between tooth wear and dental sleep disorders: A narrative overview. n. 1365-2842 (Electronic).

[55] ALVAREZ-ARENAL, A. et al. Non-carious cervical lesions and risk factors: A case-control study. **J Oral Rehabil,** v. 46, n. 1, p. 65-75, Jan 2019. ISSN 0305-182x.

[56] TOMASIK, M. [Analysis of etiological factors involved in noncarious cervical lesions]. **Ann Acad Med Stetin,** v. 52, n. 3, p. 125-36, 2006. ISSN 1427-440X (Print)1427-440x.

[57] WETSELAAR, P. A.-O. et al. Developing diagnostic criteria for tooth wear, a preliminary beta version based on expert opinion, and a narrative literature review. LID - 10.1111/joor.13499 [doi]. n. 1365-2842 (Electronic).

[58] HIDALGO, B.; GOODMAN, M. Multivariate or multivariable regression? **Am J Public Health,** v. 103, n. 1, p. 39-40, Jan 2013. ISSN 0090-0036 (Print)0090-0036.

[59] PAGE, M. J. et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. **Bmj,** v. 372, p. n71, Mar 29 2021. ISSN 0959-8138 (Print)0959-8138.

Table 1 - Summary of descriptive characteristics of included articles (n=19).

Author (year); Country; Study design	Sample size (total number of participants, % of women)	Age (mean±SD or range in years)	Bruxism diagnostic methods and classification	NCCL diagnostic methods and type	Descriptive findings (number of individuals presenting bruxism and/or NCCL)		Main findings (Odds ratio [95%CI; p-value] or other pertinent findings)	Main conclusion
					Bruxism	**Non Bruxism**		
Alvarez-Arenal et al. (2019); Spain; Case-control	Total 280 (62%)	18-29 years	Questionnaire (Possible AB and SB)	Clinical examination, NCCL	**AB+SB+ Both** Total (175) NCCL (96) Non NCCL (79)	**No AB+ SB+Both** Total (105) NCCL (44) Non NCCL (61)	AB/NCCL (OR=1.80 [95%CI=0.89-3.62]; p>0.05) SB/NCCL (OR=1.14 [95%CI=0.62-2.08]; p>0.05) Both AB-SB/NCCL (OR=2.63 [95%CI=1.35-5.12]; p<0.05) NB/NCCL (Reference category; p>0.05)	There is an association between presence of both sleep and awake bruxism and occurrence of NCCL
Bader et al., (1996); USA; Case-control	Total 264 (59%)	18-48 years.	Questionnaire (Possible Bruxism and Clench)	Clinical examination, NCCL	Total (61) NCCL (36) Non NCCL (25)	Total (203) NCCL (101) Non NCCL (102)	NR	There is no association between bruxism and NCCL
					Clench Total (123) NCCL (62) Non NCCL (61)	**No Clench** Total (141) NCCL (75) Non NCCL (66)		

Bernhardt et al., (2006); Germany; Cross-sectional	Total 2707 (53%)	20-59 years	Questionnaire (Possible Bruxism)	Clinical examination, Abfraction	NR	NR	B Sometimes/abfraction (OR=1.21[95%CI=1-1.49];p<0.05) B Often and Always/abfraction (OR=1.16[95%CI=0.82-1.54;p>0.05)	Bruxism was not associated with abfraction
Brandini et al., (2012); Brazil; Cross-sectional	Total 132 (77%)**	19-58 years	Questionnaire (Possible Bruxism and Clench)	Clinical examination, NCCL	Total (36) NCCL (15) Non NCCL (21)	Total (96) NCCL (37) Non NCCL (59)	B/NCCL (p>0.05) Clench/NCCL (p<0.05)	There is association between tooth clenching and NCCL
					Clench Total (61) NCCL (30) Non NCCL (31)	**No Clench** Total (71) NCCL (22) Non NCCL (49)		
Crisóstomo et al., (2021); Brazil; Cross-sectional	Total 185 (52%)	22.7±2.3	Questionnaire (Possible Bruxism)	Clinical examination, NCCL	Total (69) NCCL (18) Non NCCL (51)	Total (116) NCCL (24) Non NCCL (92)	B/NCCL (p>0.05)	No correlation between the presence of NCCL and bruxism
Figueiredo et al., (2015); Brazil; Cross-sectional	Total 88 (63%)	18-71 years	Questionnaire (Clench and Grind)	Analysis of plaster models with magnifying glass, NCCL	**Clench** Total (41) NCCL (32) Non NCCL (9)	**No Clench** Total (47) NCCL (26) Non NCCL (21)	Clench/NCCL (p<0.05) Grind/NCCL (p>0.05)	There is association between tooth clenching and NCCL
					Grind Total (7) NCCL (3) Non NCCL (4)	**No Grind** Total (7) NCCL (3) Non NCCL (4)		

Gaffar et al., (2012); Sudan; Cross-sectional	Total 180 (59%)	20-70 years	Questionnaire and clinical examination (Probable Bruxism, Clench and Grind)	Clinical examination, casts examination and wax pattern, abfraction	NR	NR	B/NCCL (OR=19.25[95%CI=6-61.75];p<0.05) Clench/NCCL (OR=1.21[95%CI=0.14-10.30];p>0.05) Grind/NCCL (OR=3.48[95%CI=0.64-18.82];p>0.05)	Bruxism might be associated with NCCL
Jiang et al., (2011); China; Cross-sectional	Total 2128 (50%)**	35-44 and 64-74 years	Questionnaire (Possible Bruxism)	Clinical examination, NCCL	Total (613) NCCL (347) Non NCCL (266)	Total (1515) NCCL (682) Non NCCL (833)	B Often and always/NCCL (OR=1.37[95%CI=1.08-1.75];p<0.05) B Sometimes/NCCL (OR=1.26[95%CI=1.04-1.58];p<0.05) NB/NCCL (OR=1[95%CI=1];p>0.05)	Bruxism is associated with NCCL
Kitasako et al., (2021); Japan; Cross-sectional	Total 1108 (51%)	49.1, 15-89 years	Questionnaire (Possible Bruxism)	Clinical examination, NCCL	NR	NR	B/NCCL (OR=1.29[95%CI=0.95-1.74];p>0.05)	No association was found between NCCL and bruxism

Li et al., (2018); China; Cross-sectional	Total 726 (50%)	22-39 years	AASM (Probable SB or AB)	Clinical examination, wear on cervical area/cervical defect	NR	NR	B/NCCL (OR=1.03 [95%CI=0.44-2.41]; p>0.05)	There is no association between cervical wear and bruxism
Marinescu et al., (2017); Romania; Cross-sectional	Total 50 (64%)	18-56 years	Questionnaire (Possible AB and SB)	Clinical examination, NCCL	Total (19) NCCL (14) Non NCCL (5)	Total (31) NCCL (17) Non NCCL (14)	NR	NCCL have a multifactorial etiology involving bruxism
Molena et al., (2008); Brazil; Cross-sectional	Total 91 (53%)	71±8.60-93 years	Questionnaire (Clench and Grind)	Clinical examination, Abfraction	**Clench** Total (27) NCCL (13) Non NCCL (12) **Grind** Total (18) NCCL (10) Non NCCL (8)	**No Clench** Total (66) NCCL (27) Non NCCL (29) **No Grind** Total (73) NCCL (30) Non NCCL (43)	Clench/Abfraction (p>0.05) Grind/Abfraction (p>0.05)	There is no relation between tooth clenching and grinding and the occurrence of the lesions
Nascimento et al., (2022); Brazil; Case-control	Total 340 (50%)**	21-80 years	Extra-intra-oral examination, anamnesis and † (Probable AB and SB)	Clinical examination, NCCL	Total (7) NCCL (3) Non NCCL (4)	Total (333) NCCL (65) Non NCCL (268)	B/NCCL (OR=3.09 [95%CI=0.67-14.15]; p>0.05)	No association was found between bruxism and NCCL

Oliveira et al., (2010); Brazil; Cross-sectional	Total 100 (74%)	18-64 years	Questionnaire (Possible Bruxism and Clench)	Clinical examination, NCCL	Total (13) NCCL (4) Non-NCCL (9) **Clench** Total (29) NCCL (10) Non-NCCL (19)	Total (87) NCCL (40) Non-NCCL (47) **No Clench** Total (71) NCCL (34) Non-NCCL (37)	B/NCCL (p>0.05) Clench/NCCL (p>0.05)	There is no association between bruxism or tooth clenching with NCCL
Ommerborn et al., (2007); Germany; Cross-sectional	Total 91 (64%)**	28.37±4.39, 20-39 years	AASM (Probable SB)	Clinical examination, NCCL	Total (58) NCCL (23) Non-NCCL (35)	Total (33) NCCL (4) Non-NCCL (29)	B/NCCL (p<0.05)	SB is associated with NCCL
Smith et al., (2007); Trinidad; Cross-sectional	Total 156 (67%)	40.6, 16-73 years	Questionnaire (Possible Bruxism)	Clinical examination, NCCL	NR	NR	B/NCCL (OR=1.0 [95%CI=0.5-2.1];p>0.05)	Significant association between NCCL and bruxism
Takehara et al., (2008); Japan; Cross-sectional	Total 159 (0%)	36.2± 12.3, 20-50 years	Questionnaire (Possible Bruxism)	Clinical examination, NCCL	NR	NR	B/NCCL (OR=0.75 [95%CI=0.30-1.89]; p>0.05)	No significant association was found between bruxism and NCCL
Tsiggos et al., (2008); Greece; Cross-sectional	Total 102 (47%)**	44.6±5.7	Questionnaire (Possible AB and SB)	Casts examination, Intraoral photographs; Abfraction	Total (50) NCCL (17) Non-NCCL (33)	Total (52) NCCL (8) Non-NCCL (44)	B/NCCL (p<0.05)	Significant association between bruxism and the occurrence of abfraction

Yamashita et al., (2014); Brazil; Cross-sectional	Total 80 (NR)	18-27 years	Questionnaire (Possible Bruxism and Clench)	Clinical examination, NCCL	Total (2) NCCL (2) Non-NCCL (0) **Clench** Total (23) NCCL (17) Non-NCCL (6)	Total (30) NCCL (24) Non-NCCL (6) **No Clench** Total (30) NCCL (24) Non-NCCL (6)	B/NCCL (p>0.05)	There is no association between bruxism or tooth clenching with NCCL

Legend:**:calculated by the author; 95%CI: 95% confidence Interval; OR: odds ratio; SD: standard deviation; AASM:American Academy of Sleep Medicine; AB:awake bruxism; B:bruxism; NCCL:non carious cervical lesion; NR:not reported; SB:sleep bruxism; NB:no bruxism.

Table 2 - GRADE Summary of Findings Table.

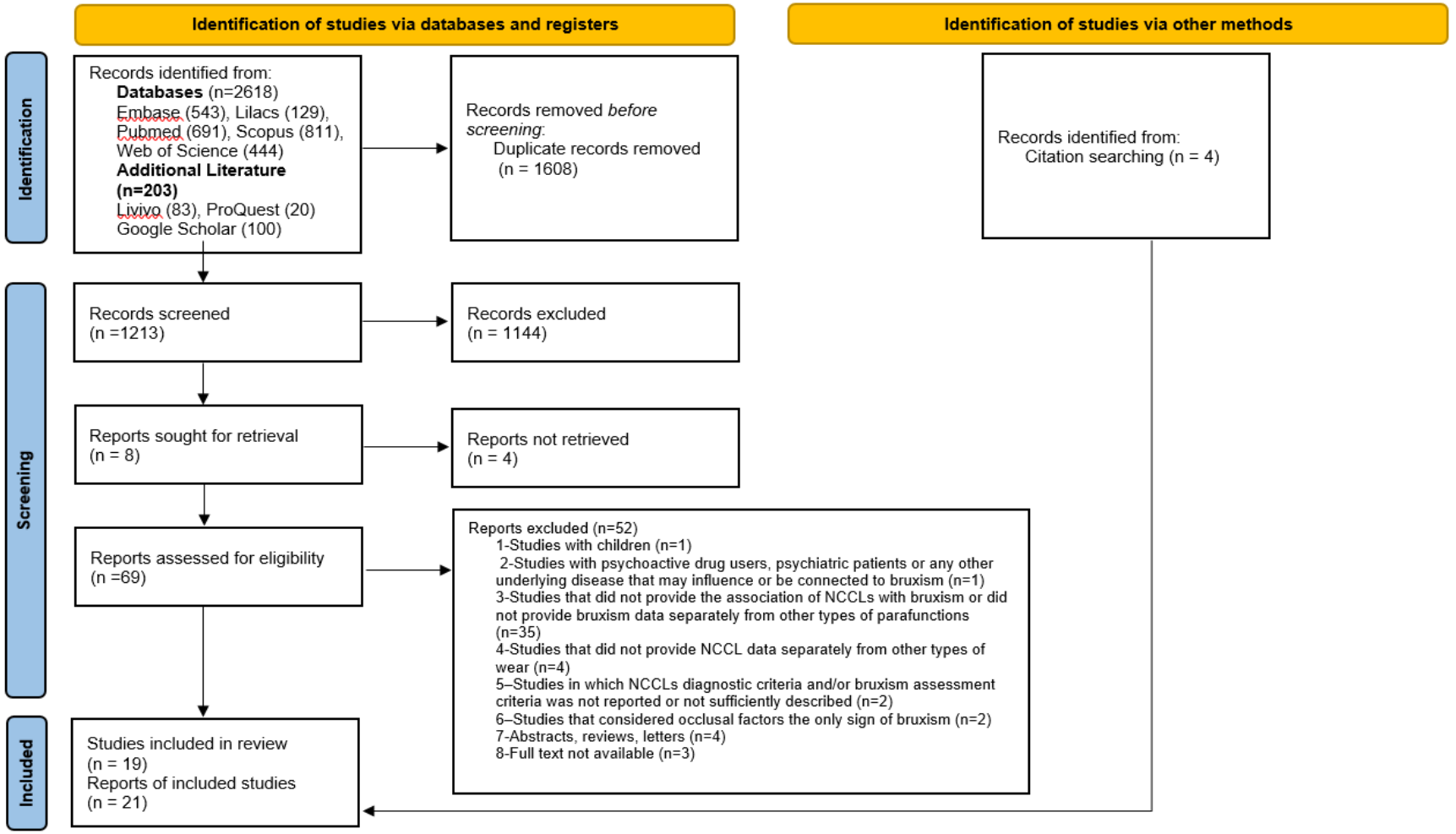
Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	[intervenção]	[comparação]	Relative (95% CI)	Absolute (95% CI)		
Cross-sectional (questionnaire)												
13	observational studies	very serious[a]	very serious[b]	serious[c]	not serious[d]	none	498/932 (53.4%)	864/1999 (43.2%)	**OR 1.57** (1.19 to 2.08)	**11 more per 100** (from 4 more to 18 more)	⊕◯◯◯ Very low	IMPORTANT
Cross-sectional (clinical examination)												
3	observational studies	serious[e]	serious[f]	not serious	serious[g]	none			not estimable		⊕◯◯◯ Very low	IMPORTANT
Case-control												
3	observational studies	serious[e]	serious[b]	serious[c]	serious[h]	none	161 cases 184 controls		not estimable	-	⊕◯◯◯ Very low	IMPORTANT
							-	0.0%				

2) **CI:** confidence interval; **OR:** odds ratio

6 *Explanations*

a. Risk of Bias was considered serious because most of the studies did not state whether confounders were identified and how to deal with them
b. Bruxism was assessed through different questions
c. Different terms were used as bruxism within the studies
d. CI do not cross the nulity line and OIS was achieved
e. High and moderate risk of bias for many domains judged for the included studies according to the JBI ckecklist
f. Inconsistency in the findinds. 2 studies found positive associations and 1 did not find association between the variables studied.
g. CI was high in one study and one did not present CI
h. CI cross the nulity line

Figure 1. Flow diagram of literature search and selection criteria.



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/

Figure 2 – Meta-analysis of possible bruxism and non-carious cervical lesions (NCCL) in adults (cross-sectional studies).

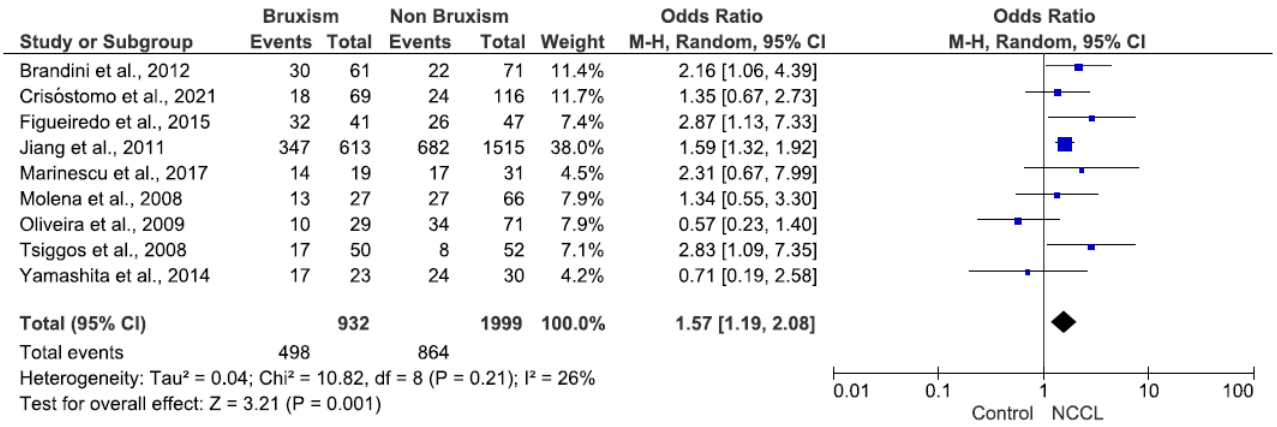


Figure 3 – Meta-analysis of bruxism and non-carious cervical lesions (NCCL) in adults (case-control studies).

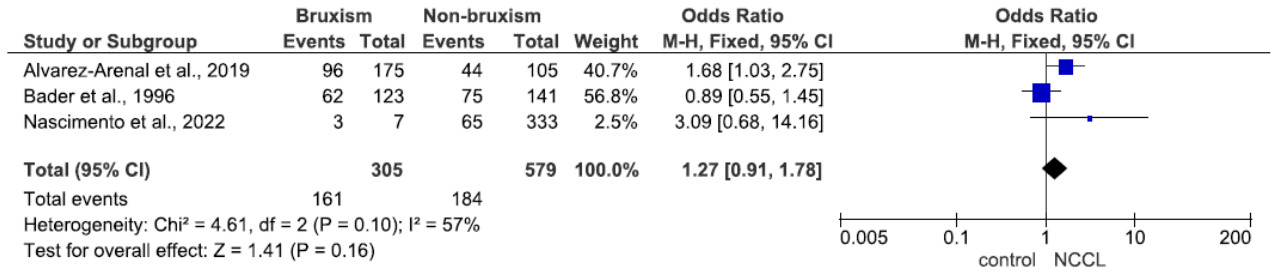


Table S1 – Databases and search strategies.

Database	Search strategy
Medline / PubMed	("Tooth Abrasion"[MeSH Terms] OR "Tooth Abrasion"[All Fields] OR "Dental Abrasion"[All Fields] OR "Dental Abrasion"[All Fields] OR "attrition"[All Fields] OR "abrasion"[All Fields] OR "abfraction"[All Fields] OR "Tooth Erosion"[MeSH Terms] OR "Tooth Erosion"[All Fields] OR "Tooth Erosions"[All Fields] OR "tooth surface loss"[All Fields] OR "Tooth Wear"[MeSH Terms] OR "Tooth Wear"[All Fields] OR "Tooth Wears"[All Fields] OR "Dental Wear"[All Fields] OR "noncarious cervical lesions"[All Fields] OR "noncarious cervical lesion"[All Fields] OR "NCCL"[All Fields] OR "NCCLs"[All Fields] OR "non-caries cervical lesions"[All Fields] OR "non-carious cervical lesions"[All Fields] OR "non-carious cervical lesion"[All Fields] OR "noncarious dental lesions"[All Fields] OR "non-carious dental lesions"[All Fields] OR "root defects"[All Fields] OR "root defect"[All Fields] OR "Tooth Attrition"[MeSH Terms] OR "Tooth Attrition"[All Fields] OR "Dental Attrition"[All Fields] OR "Occlusal Wear"[All Fields] OR "Occlusal Wears"[All Fields]) AND ("Bruxism"[MeSH Terms] OR "Bruxism"[All Fields] OR "Teeth Grinding Disorders"[All Fields] OR "Bruxomania"[All Fields] OR "bruxisms"[All Fields] OR "bruxers"[All Fields] OR "bruxing"[All Fields] OR "bruxists"[All Fields] OR "bruxist"[All Fields] OR "bruxer"[All Fields] OR "clenching"[All Fields] OR "Sleep Bruxism"[MeSH Terms] OR "Sleep Bruxism"[All Fields] OR "parafunction"[All Fields] OR "parafunctional habit"[All Fields] OR "parafunctional habits"[All Fields] OR "awake bruxism"[All Fields])
Scopus	TITLE-ABS-KEY("Tooth Abrasion" OR "Dental Abrasion" OR "Dental Abrasion" OR "attrition" OR "abrasion" OR "abfraction" OR "Tooth Erosion" OR "Tooth Erosions" OR "tooth surface loss" OR "Tooth Wear" OR "Tooth Wears" OR "Dental Wear" OR "noncarious cervical lesions" OR "noncarious cervical lesion" OR "NCCL" OR "NCCLs" OR "non-caries cervical lesions" OR "non-carious cervical lesions" OR "non-carious cervical lesion" OR "noncarious dental lesions" OR "non-carious dental lesions" OR "root defects" OR "root defect" OR "Tooth Attrition" OR "Dental Attrition" OR "Occlusal Wear" OR "Occlusal Wears" OR "Dental Wears" OR "Dental Attritions") AND TITLE-ABS-KEY("Bruxism" OR "Teeth Grinding Disorders" OR "Bruxomania" OR "bruxisms" OR "bruxers" OR "bruxing" OR "bruxists" OR "bruxist" OR "bruxer" OR "clenching" OR "Sleep Bruxism" OR "parafunction" OR "parafunctional habits" OR "awake bruxism" OR "parafunctional habit" OR "Teeth Grinding Disorder" OR "Sleep Bruxisms" OR "Nocturnal Teeth Grinding Disorder")
Web of Science	TS=("Tooth Abrasion" OR "Dental Abrasion" OR "Dental Abrasion" OR "attrition" OR "abrasion" OR "abfraction" OR "Tooth Erosion" OR "Tooth Erosions" OR "tooth surface loss" OR "Tooth Wear" OR "Tooth Wears" OR "Dental Wear" OR "noncarious cervical lesions" OR "noncarious cervical lesion" OR "NCCL" OR "NCCLs" OR "non-caries cervical lesions" OR "non-carious cervical lesions" OR "non-carious cervical lesion" OR "noncarious dental lesions" OR "non-carious dental lesions" OR "root defects" OR "root defect" OR "Tooth Attrition" OR "Dental Attrition" OR "Occlusal Wear" OR "Occlusal Wears" OR "Dental Wears" OR "Dental Attritions") AND TS=("Bruxism" OR "Teeth Grinding Disorders" OR "Bruxomania" OR "bruxisms" OR "bruxers" OR "bruxing" OR "bruxists" OR "bruxist" OR "bruxer" OR "clenching" OR "Sleep Bruxism" OR "parafunction" OR "parafunctional habit" OR "parafunctional habits" OR "awake bruxism" OR "Teeth Grinding Disorder" OR "Sleep Bruxisms" OR "Nocturnal Teeth Grinding Disorder")
EMBASE	('tooth abrasion'/de OR 'tooth abrasion' OR 'dental abrasion' OR 'attrition'/de OR 'attrition' OR 'abrasion'/de OR 'abrasion' OR 'abfraction' OR 'tooth erosion'/de OR 'tooth erosion' OR 'tooth erosions' OR 'tooth surface loss' OR 'tooth wear'/de OR 'tooth wear' OR 'tooth wears' OR 'dental wear' OR 'noncarious cervical lesions' OR 'noncarious cervical lesion' OR 'nccl' OR 'nccls' OR 'non-caries cervical lesions' OR 'non-carious cervical lesions' OR 'non-carious cervical lesion' OR 'noncarious dental lesions' OR 'non-carious dental lesions' OR 'root defects' OR 'root defect' OR 'tooth attrition'/de OR 'tooth attrition' OR 'dental attrition' OR 'occlusal wear' OR 'occlusal wears' OR 'dental wears' OR 'dental attritions') AND ('bruxism'/de OR 'bruxism' OR 'teeth grinding disorders' OR 'bruxomania' OR 'bruxisms' OR 'bruxers' OR 'bruxing' OR 'bruxists' OR 'bruxist' OR 'bruxer' OR 'clenching' OR 'sleep bruxism'/de OR 'sleep bruxism' OR 'parafunction' OR 'parafunctional habits' OR 'awake bruxism'/de OR 'awake bruxism' OR 'parafunctional habit' OR 'teeth grinding disorder'/de OR 'teeth grinding disorder' OR 'sleep bruxisms' OR 'nocturnal teeth grinding disorder')

ProQuest Dissertation and Thesis	noft("Tooth Abrasion" OR "Dental Abrasion" OR "Dental Abrasion" OR "attrition" OR "abrasion" OR "abfraction" OR "Tooth Erosion" OR "Tooth Erosions" OR "tooth surface loss" OR "Tooth Wear" OR "Tooth Wears" OR "Dental Wear" OR "noncarious cervical lesions" OR "noncarious cervical lesion" OR "NCCL" OR "NCCLs" OR "non-caries cervical lesions" OR "non-carious cervical lesions" OR "non-carious cervical lesion" OR "noncarious dental lesions" OR "non-carious dental lesions" OR "root defects" OR "root defect" OR "Tooth Attrition" OR "Dental Attrition" OR "Occlusal Wear" OR "Occlusal Wears" OR "Dental Wears" OR "Dental Attritions") AND noft("Bruxism" OR "Teeth Grinding Disorders" OR "Bruxomania" OR "bruxisms" OR "bruxers" OR "bruxing" OR "bruxists" OR "bruxist" OR "bruxer" OR "clenching" OR "Sleep Bruxism" OR "parafunction" OR "parafunctional habits" OR "awake bruxism" OR "parafunctional habit" OR "Teeth Grinding Disorder" OR "Sleep Bruxisms" OR "Nocturnal Teeth Grinding Disorder")
LILACS	("Tooth Abrasion" OR "Dental Abrasion" OR "Dental Abrasion" OR "attrition" OR "abrasion" OR "abfraction" OR "Tooth Erosion" OR "Tooth Erosions" OR "tooth surface loss" OR "Tooth Wear" OR "Tooth Wears" OR "Dental Wear" OR "noncarious cervical lesions" OR "noncarious cervical lesion" OR "NCCL" OR "NCCLs" OR "non-caries cervical lesions" OR "non-carious cervical lesions" OR "non-carious cervical lesion" OR "noncarious dental lesions" OR "non-carious dental lesions" OR "root defects" OR "root defect" OR "Tooth Attrition" OR "Dental Attrition" OR "Occlusal Wear" OR "Occlusal Wears" OR "Dental Wears" OR "Dental Attritions" OR "Abrasão Dentária" OR "Abrasão dos Dentes" OR "Abrasión de los Dientes" OR "Abrasión Dental" OR "Abrasión Dentaria" OR "Erosão Dentária" OR "Erosão do Dente" OR "Erosão dos Dentes" OR "Erosión de los Dientes" OR "Erosion Dental" OR "Erosión Dentaria" OR "Erosión del Diente" OR "Desgaste Dentário" OR "Desgaste do Dente" OR "Desgaste Oclusal dos Dentes" OR "Desgaste Oclusal Fisiológico dos Dentes" OR "Desgaste Proximal dos Dentes" OR "Desgaste Proximal Fisiológico dos Dentes" OR "Desgaste de los Dientes" OR "Alisamiento Dental" OR "Desgaste Dental" OR "Desgaste Oclusal de los Dientes" OR "Desgaste Proximal de los Dientes" OR "Desgaste del Diente" OR "Atrito Dentário" OR "Atrito dos Dentes" OR "Atrición Dental" OR "Atrición Dentaria" OR "Atrición Excesiva de los Dientes" OR "Atrición de los Dientes") AND ("Bruxism" OR "Teeth Grinding Disorders" OR "Bruxomania" OR "bruxisms" OR "bruxers" OR "bruxing" OR "bruxists" OR "bruxist" OR "bruxer" OR "clenching" OR "Sleep Bruxism" OR "parafunction" OR "parafunctional habits" OR "awake bruxism" OR "parafunctional habit" OR "Teeth Grinding Disorder" OR "Sleep Bruxisms" OR "Nocturnal Teeth Grinding Disorder" OR bruxismo OR "Ranger de Dentes" OR "Rechinamiento de Dentes" OR "Rechinamiento de los Dientes" OR "Rechinamiento Dental" OR "Bruxismo do Sono" OR "Bruxismo Noturno" OR "Bruxismo del Sueño" OR "Apretamiento Dental Nocturno" OR "Bruxismo Nocturno" OR "Trastorno de Rechinamiento Nocturno de los Dientes") AND (db:("LILACS"))
LIVIVO	("Tooth Abrasion" OR "Dental Abrasion" OR "Dental Abrasion" OR "attrition" OR "abrasion" OR "abfraction" OR "Tooth Erosion" OR "Tooth Erosions" OR "tooth surface loss" OR "Tooth Wear" OR "Tooth Wears" OR "Dental Wear" OR "noncarious cervical lesions" OR "noncarious cervical lesion" OR "NCCL" OR "NCCLs" OR "non-caries cervical lesions" OR "non-carious cervical lesions" OR "non-carious cervical lesion" OR "noncarious dental lesions" OR "non-carious dental lesions" OR "root defects" OR "root defect" OR "Tooth Attrition" OR "Dental Attrition" OR "Occlusal Wear" OR "Occlusal Wears" OR "Dental Wears" OR "Dental Attritions") AND ("Bruxism" OR "Teeth Grinding Disorders" OR "Bruxomania" OR "bruxisms" OR "bruxers" OR "bruxing" OR "bruxists" OR "bruxist" OR "bruxer" OR "clenching" OR "Sleep Bruxism" OR "parafunction" OR "parafunctional habits" OR "awake bruxism" OR "parafunctional habit" OR "Teeth Grinding Disorder" OR "Sleep Bruxisms" OR "Nocturnal Teeth Grinding Disorder")
Google Scholar	(attrition OR abrasion OR Erosion OR "noncarious cervical lesions" OR "noncarious cervical lesion") AND (Bruxism OR parafunction OR "parafunctional habit")

Search strategies were performed for each database by using specifics words combinations and truncations with the support of a librarian.

Table S2 - Excluded articles and reasons for exclusion.

Author, Year	Reason for exclusion
Addy et al 2006[1]	7
Aguiar 2012[2]	3
Ahmed et al 2009[3]	5
Al-Zarea 2012[4]	4
Alajbeg et al 2012[5]	3
Alam et al 2022[6]	5
Barranca et al 2004[7]	3
Barlett et al 2011[8]	3
Bismar et al 2021[9]	3
Brandini et al 2012[10]	3
Chuajedong et al 2002[11]	3
Correia et al 2021[12]	6
Dantas et al 2014[13]	3
Delgado et al 2010[14]	3
Dıraçoğlu et al 2011[15]	3
El-Swiah 2001[16]	8
Faye et al 2006[17]	3
Gillborg et al 2020[18]	3
González Garcia et al 2020[19]	3
Hernandez et al 2021[20]	3
Khan et al 1997[21]	7
Khan et al 1998[22]	3
Khan et al 1999[23]	3
Kosalram et al 2014[24]	3
Kosovel et al 1986[25262627]	3
Lima et al 2005[26]	3
Martinović et al 2019[27]	8
Maślanka et al 1970[28]	8
Miranda et al 2017[29]	3
Morigami et al 2011[30]	3
Oginni et al 2002[31]	4
Oudkerk et al 2020[32]	3
Pegoraro et al 2005[33]	3
Pereira 2015[34]	3
Pettengill 2011[35]	7
Pintado et al 1997[36]	3
Piotrowski et al 2001[37]	3
Prymas et al 2013[38]	3
Rafeek et al 2006[39]	4
Rodriguez et al 2016[40]	3
Romero 2012[41]	3
Sadaf et al 2014[42]	6
Sawlani et al 2016[43]	3
Sayed et al 2017[44]	2
Shah et al 2009[45]	3
Tokiwa et al 2008[46]	3
Tomasik et al 2006[47]	3

Tomasik et al 2009[48]	8
Wei et al 2016[49]	4
Yang et al 2016[50]	3
Žuvela et al 2011[51]	3
Zuza et al 2019[52]	1

1-Studies with children (n=1), 2-Studies with psychoactive drug users, psychiatric patients or any other underlying disease that may influence or be connected to bruxism (n=1), 3-Studies that did not provide the association of NCCLs with bruxism or did not provide bruxism data separately from other types of parafunctions (n=35), 4-Studies that did not provide NCCL data separately from other types of wear (n=4), 5–Studies in which NCCLs diagnostic criteria and/or bruxism assessment criteria was not reported or not sufficiently described (n=2), 6–Studies that considered occlusal factors the only sign of bruxism (n=2), 7-Abstracts, reviews, letters (n=3), 8-Full text not available (n=4).

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Table S3 – Methodological quality assessed by the Joanna Briggs Institute Critical Appraisal tools - Checklist for Analytical Cross-Sectional and Case-control studies.

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9*	Q10*
Alvarez-Arenal et al., 2019	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Bader et al., 1996	N	Y	Y	N	Y	Y	Y	N	N	Y
Bernhardt et al., 2006	U	Y	Y	Y	N	N	Y	Y		
Brandini et al., 2012	Y	Y	Y	Y	N	N	N	Y		
Crisóstomo et al., 2021	Y	Y	N	Y	N	N	N	N		
Figueiredo et al., 2015	Y	Y	Y	U	N	N	N	Y		
Gaffar et al., 2012	N	Y	Y	Y	N	N	N	Y		
Jiang et al., 2011	Y	Y	Y	Y	N	N	Y	Y		
Kitasako et al., 2021	Y	Y	U	Y	Y	Y	Y	Y		
Li et al., 2018	Y	Y	Y	Y	Y	Y	Y	Y		
Marinescu et al., 2017	N	Y	Y	Y	Y	N	U	N		
Molena et al., 2008	Y	Y	Y	Y	Y	Y	N	Y		
Nascimento et al., 2022	Y	Y	Y	Y	Y	N	N	N	N	Y
Oliveira et al., 2009	Y	Y	Y	Y	N	N	N	N		
Ommerborn et al., 2007	Y	Y	Y	Y	N	N	Y	N		
Smith et al., 2007	N	Y	Y	Y	Y	Y	Y	Y		

Takehara et al., 2008	Y	Y	Y	Y	N	N	N	Y
Tsiggos et al., 2008	Y	Y	Y	Y	N	N	Y	N
Yamashita et al., 2014	Y	U	N	Y	Y	N	Y	N

Note:
1. Q1-Q9: questions to assess the methodological quality by the study design, as listed below:
Q1: Were the criteria for inclusion in the sample clearly defined? (cross-sectional); Were the groups comparable other than the presence of disease in cases or the absence of disease in controls? (case-control);
Q2: Were the study subjects and the setting described in detail? (cross-sectional); Were cases and controls matched appropriately? (case-control);
Q3: Was the exposure measured in a valid and reliable way? (cross-sectional); Were the same criteria used for identification of cases and controls? (case-control).
Q4: Were objective, standard criteria used for measurement of the condition? (cross-sectional); Was exposure measured in a standard, valid and reliable way? (case-control);
Q5: Were confounding factors identified? (cross-sectional); Was exposure measured in the same way for cases and controls? (case-control);
Q6: Were strategies to deal with confounding factors stated? (cross-sectional); Were confounding factors identified? (case-control);
Q7: Were the outcomes measured in a valid and reliable way? (cross-sectional); Were strategies to deal with confounding factors stated? (case-control).
Q8: Was appropriate statistical analysis used? (cross-sectional); Were outcomes assessed in a standard, valid and reliable way for cases and controls? (case-control);
Q9: Was the exposure period of interest long enough to be meaningful? (case-control);
Q10: Was appropriate statistical analysis used? (case-control);
2. Y:yes; N: no; U: unclear; NA: not applicable.
3. *Questions asked only for case-control studies.

Table S4 - Joanna Briggs classification determined by authors.

Study design	**Checklist**	**Classification**		
		Y	N	U
Cross-sectional	1. Were the criteria for inclusion in the sample clearly defined?	When authors provide clear, well defined, namely inclusion and exclusion criteria	When no inclusion/exclusion criteria presented	When criteria were not specified with sufficient detail
	2. Were the study subjects and the setting described in detail?	Study sample described with sufficient detail, with the sample comparable with the population	No description of the population details	No clear description of the population details
	3. Was the exposure measured in a valid and reliable way?	Clearly description of the use a questionnaire or index validated for measure the signs and symptoms, assessing with gold standard, and included intra e inter-observer reliability of bruxism	Not used validated method and not included inter and intra-observer for assessing the validity and reliability	Not clear description of the method of detection of NCCL/bruxism
	4. Were objective, standard criteria used for	All participants were examined the same way	Studies that did not followed the same criteria for diagnostic of NCCL	Does not report how the subjects were examined

	measurement of the condition?			
	5. Were confounding factors identified?	Identified confounding factor as presence of gastroesophageal reflux	No identified these confounding factor	Not clear if the study identified these confounding factor
	6. Were strategies to deal with confounding factors stated?	Used strategies to deal with confounding factors, as multivariate regression, or combination and stratification of the sample	Confounding factors were not reduced in data analysis	NA
	7. Were the outcomes measured in a valid and reliable way?	Determine the instrument and how was the measurement of NCCL	Did not determine the criteria for diagnosis and measurement of NCCL	Unclear instrument used for diagnostic and measurement
	8. Was appropriate statistical analysis used?	When it was detailed which analytical techniques were used and how specific confounders were measured. Performed regression	Did not perform regression analyzes and did not presented the statistical analysis	Not clear about the analyses and if the method used was adequate
Case-control	Were the groups comparable other than the presence of disease in cases or the absence of disease in controls?	Adults without NCCL (control) are representative of the adults with NCCL (case). Control were selected based on similarity with	When study presented selection bias, that groups are not comparable	Unclear selection of adults without NCCL and adults with NCCL

		the cases on characteristics such as age, sex, but not the exposition		
	Were cases and controls matched appropriately?	Adults without NCCL were from the same source population the produced adults with NCCL	Adults without NCCL were not from the same source population the produced adults with NCCL, or not presented the source of the sample	NA
	Were the same criteria used for identification of cases and controls?	Cases and controls were clearly defined, with the same eligibility criteria (clinical inspection of the cervical area)	When did not define if the identification of cases and controls was based on clinical inspection of the cervical area)	Not clear what characteristics of criteria was used
	Was exposure measured in a standard, valid and reliable way?	Describe clearly the diagnosis of NCCL (clinical examination). Reliability with inter and intra-observer	Did not present the method of diagnostic of NCCL, neither validity nor reliability	Describe unclearly the measured of NCCL

	Was exposure measured in the same way for cases and controls?	Exposure measures should be the same to adults with and without NCCL	When did not determine if the measurement of exposure was the same for cases and controls	Unclear if there were same procedures for cases and controls
	Were confounding factors identified?	Identified confounding factor as presence of erosion in the cervical area and/or the presence of GERD and/or genetics	No identified any confounding factor	Not clear if identified these confounding factor
	Were strategies to deal with confounding factors stated?	All confounding factors were reduced in data analysis (matching or stratifying)	Confounding factors were not reduced in data analysis	NA
	Were outcomes assessed in a standard, valid and reliable way for cases and controls?	Established which instrument and how was the measurement of bruxism. Also, if the operator that collected data was trained	Did not determine the criteria for obtained the diagnostic of bruxism	Unclear instrument used and how collected the data of bruxism
	Was the exposure period of interest long enough to be meaningful?	When the exposure time was sufficient enough to show an association between the NCCL and bruxism	Did not determine the exposure time period	Not clear if the time was sufficient enough to show an association
	Was appropriate statistical analysis used?	Methods section detailed which analytical techniques were used and how confounders were measured. Also, performed regression	Did not perform regression analyzes or did not	Not clear if there was a more appropriate alternate statistical

| | | |

6 CONSIDERAÇÕES FINAIS

Com base nos resultados obtidos, as implicações deste estudo para a prática clínica são significativas, visto que encontramos uma prevalência substancial de bruxismo em pacientes com LCNC. Além disso, o bruxismo está associado à formação de LCNC em adultos. Pacientes com bruxismo apresentam pelo menos uma vez mais chance de desenvolver LCNC. Nenhum dos estudos incluídos avaliou o bruxismo definitivo, através de exames. Além disso, não foi possível realizar distinção entre AB e SB.

Políticas de saúde bucal devem considerar a importância do diagnóstico precoce e do manejo adequado do bruxismo como estratégias para prevenir ou minimizar as lesões cervicais não cariosas. Profissionais da saúde devem estar atentos sobre esta possibilidade durante a primeira consulta, incluindo na anamnese questões sobre a ocorrência de hábitos parafuncionais, realizar o exame clínico de mucosas e língua em busca de sinais de bruxismo e dos dentes em busca de sinais de LCNC ainda em estágio iniciais.

Ademais, as complexas interações entre idade, hábitos e ácidos podem ser importantes para o desenvolvimento da LCNC. Sinais e sintomas de bruxismo e sua correta classificação como AB e SB devem ser levados em consideração e devidamente avaliados, a fim de obter uma compreensão mais completa dos mecanismos envolvidos nessa relação. Novos estudos são necessários para avaliar as mudanças na prevalência a médio e longo prazo, considerando os avanços na detecção do bruxismo e na padronização da definição da LCNC.

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APÊNDICE A – Registro do Protocolo do Artigo 1

Systematic review

*Fields that have an **asterisk (*)** next to them means that they **must be answered.** **Word limits** are provided for each section. You will be unable to submit the form if the word limits are exceeded for any section. Registrant means the person filling out the form.*

1. * Review title.

Give the title of the review in English

Prevalence of non-carious cervical lesion in patients with bruxism: a systematic review

2. Original language title.

For reviews in languages other than English, give the title in the original language. This will be displayed with the English language title.

3. * Anticipated or actual start date.

Give the date the systematic review started or is expected to start.

01/01/2022

4. * Anticipated completion date.

Give the date by which the review is expected to be completed.

01/02/2023

5. * Stage of review at time of this submission.

This field uses answers to initial screening questions. It cannot be edited until after registration.

Tick the boxes to show which review tasks have been started and which have been completed.

Update this field each time any amendments are made to a published record.

The review has not yet started: No

Review stage	Started	Completed
Preliminary searches	Yes	No
Piloting of the study selection process	Yes	No
Formal screening of search results against eligibility criteria	No	No
Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

Provide any other relevant information about the stage of the review here.

6. * Named contact.

The named contact is the guarantor for the accuracy of the information in the register record. This may be any member of the review team.

Ana Paula Braghini

Email salutation (e.g. "Dr Smith" or "Joanne") for correspondence:
Miss Braghini

7. * Named contact email.

Give the electronic email address of the named contact.

ana_braghini@hotmail.com

8. Named contact address

PLEASE NOTE this information will be published in the PROSPERO record so please do not enter private information, i.e. personal home address

Give the full institutional/organisational postal address for the named contact.

Rua Delfino Conti

9. Named contact phone number.

Give the telephone number for the named contact, including international dialling code.

48998353662

10. * Organisational affiliation of the review.

Full title of the organisational affiliations for this review and website address if available. This field may be completed as 'None' if the review is not affiliated to any organisation.

Universidade Federal de Santa Catarina

Organisation web address:

11. * Review team members and their organisational affiliations.

Give the personal details and the organisational affiliations of each member of the review team. Affiliation refers to groups or organisations to which review team members belong.
NOTE: email and country now MUST be entered for each person, unless you are amending a published record.

Miss Ana Paula Braghini. Federal University of Santa Catarina
Miss Ligia Figueiredo Valesan. Universidade Federal de Santa Catarina
Miss Adriana Battisti Archer. Universidade Federal de Santa Catarina
Dr Thays Crosara. Neon Cursos
Dr Eduardo Januzzi. Hospital Mater Dei
Dr Paulo Vinicius Soares. Universidade Federal de Uberlândia

12. * Funding sources/sponsors.

Details of the individuals, organizations, groups, companies or other legal entities who have funded or sponsored the review.

Miss Adriana Battisti Archer and Miss Ligia Figueiredo Valesan are supported by CAPES (Coordination for the Improvement of High Education Personnel, Ministry of Education, Brazil.

APÊNDICE B – REGISTRO DO PROTOCOLO DO ARTIGO 2

PROSPERO
International prospective register of systematic reviews

NHS
National Institute for Health Research

UNIVERSITY of York
Centre for Reviews and Dissemination

Systematic review

A list of fields that can be edited in an update can be found here

1. * Review title.

Give the title of the review in English

Association between bruxism and non-carious cervical lesions in adults: a systematic review

2. Original language title.

For reviews in languages other than English, give the title in the original language. This will be displayed with the English language title.

3. * Anticipated or actual start date.

Give the date the systematic review started or is expected to start.

23/03/2022

4. * Anticipated completion date.

Give the date by which the review is expected to be completed.

23/06/2023

5. * Stage of review at time of this submission.

This field uses answers to initial screening questions. It cannot be edited until after registration.

Tick the boxes to show which review tasks have been started and which have been completed.

Update this field each time any amendments are made to a published record.

The review has not yet started: No

PROSPERO
International prospective register of systematic reviews

NHS National Institute for Health Research

Review stage	Started	Completed
Preliminary searches	Yes	No
Piloting of the study selection process	No	No
Formal screening of search results against eligibility criteria	No	No
Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

Provide any other relevant information about the stage of the review here.

6. * Named contact.

The named contact is the guarantor for the accuracy of the information in the register record. This may be any member of the review team.

Ana Paula Braghini

Email salutation (e.g. "Dr Smith" or "Joanne") for correspondence:

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7. * Named contact email.

Give the electronic email address of the named contact.

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APÊNDICE C – PRISMA 2020 CHECKLIST DO ARTIGO 1

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	1,2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	2
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	2
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	2,3
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	3
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	3
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	3
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	4
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	4
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	4
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	4
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	4
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	4
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	4
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	4
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the	4

Section and Topic	Item #	Checklist item	Location where item is reported
		model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	4
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	4
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	4
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	NA
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	5
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	5
Study characteristics	17	Cite each included study and present its characteristics.	5
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	6
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	5
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	6, 7
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	7
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	7
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	7
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	NA
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	8
	23b	Discuss any limitations of the evidence included in the review.	8
	23c	Discuss any limitations of the review processes used.	8
	23d	Discuss implications of the results for practice, policy, and future research.	9
OTHER INFORMATION			

Section and Topic	Item #	Checklist item	Location where item is reported
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	9
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	9
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	9
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	9
Competing interests	26	Declare any competing interests of review authors.	10
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	10

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

APÊNDICE D – PRISMA 2020 CHECKLIST DO ARTIGO 2

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	1, 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	2
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	2
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	3
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	3
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	3
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	4
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	4
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	4
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	4
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	4
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	4, 5
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	5
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	5
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	5
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the	5

Section and Topic	Item #	Checklist item	Location where item is reported
		model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	5
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	5
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	5
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	5
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	5
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	5
Study characteristics	17	Cite each included study and present its characteristics.	5
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	5
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	5, 6
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	6
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	6
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	6
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	6
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	6
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	6
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	7
	23b	Discuss any limitations of the evidence included in the review.	7
	23c	Discuss any limitations of the review processes used.	7
	23d	Discuss implications of the results for practice, policy, and future research.	8
OTHER INFORMATION			

Section and Topic	Item #	Checklist item	Location where item is reported
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	8
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	8
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	8
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	9
Competing interests	26	Declare any competing interests of review authors.	9
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	9

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

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