Advances in Oral and Maxillofacial Surgery 23 (2026) 100682

Contents lists available at ScienceDirect

Advances in Oral and Maxillofacial Surgery

journal homepage: www.sciencedirect.com/journal/advances-in-oral-and-maxillofacial-surgery

Bruxism and temporomandibular disorders:biopsychosocial framework for diagnosis and management

Alessio Danilo Inchingolo [a,2], Grazia Marinelli [a,2], Benito Francesco Pio Pennacchio [a], Roberto Vito Giorgio [a], Valeria Colonna [a], Francesco Inchingolo [a,*], Andrea Palermo [b], Angelo Michele Inchingolo [a,c,1], Gianna Dipalma [a,c,d,1]

[a] Department of Interdisciplinary Medicine, University of Bari "Aldo Moro", 70121, Bari, Italy
[b] Department of Sperimental Medicine, University of Salento, Italy
[c] Department of Biomedical, Surgical and Dental Sciences, Milano University, Italy
[d] Link Campus University, Roma, Italy

ARTICLE INFO

Keywords:
Bruxism
Temporomandibular disorders
Orofacial pain
Biopsychosocial model
Chronic pain

ABSTRACT

Objective: Bruxism and temporomandibular Disorders (TMD) frequently co-occur and represent a major source of chronic OFP. Traditional biomechanical approaches have shown limited ability to account for symptom heterogeneity, pain persistence, and variable treatment outcomes. This systematic review aimed to synthesize current evidence on the biological, psychological, and social determinants of bruxism-related TMD within a biopsychosocial framework.

Methods: A systematic search of major electronic databases was performed to identify clinical and observational studies examining the relationship between bruxism and TMD. Studies investigating biological mechanisms, psychological factors, sleep-related variables, and social or behavioral influences were included. Data were extracted and synthesized according to established guidelines for systematic reviews.

Results: Evidence indicates that bruxism-related TMDs arise from complex interactions between peripheral and central mechanisms. Psychological factors, including ANX, perceived stress, depressive symptoms, emotional dysregulation, and pain catastrophizing, were consistently associated with increased muscle activity, enhanced pain perception, and greater risk of chronicity. Sleep disturbances and stress-related neuroendocrine activation emerged as relevant contributors, while structural and occlusal factors alone showed limited and inconsistent associations with symptom severity.

Conclusions: Bruxism-related TMDs are best conceptualized within a biopsychosocial model integrating biological vulnerability, psychological processes, and social context. Exclusive reliance on mechanical paradigms may result in incomplete diagnosis and suboptimal management. Incorporating psychosocial assessment and interdisciplinary, patient-centered interventions may improve clinical outcomes and long-term prognosis.

1. Introduction

Temporomandibular Disorders (TMDs) encompass a diverse group of conditions affecting the Temporomandibular Joint (TMJ), masticatory muscles, and related craniofacial structures, and represent one of the most frequent sources of persistent Orofacial Pain (OFP)[1–3]. These disorders are commonly associated with functional limitations, psychosocial burden, and reduced quality of life [4,5]. Bruxism, characterized by repetitive jaw-muscle activity such as clenching or grinding of the teeth during sleep or wakefulness, frequently co-occurs with TMDs and has been increasingly identified as a clinically relevant factor influencing pain intensity, symptom persistence, and functional

* Corresponding author.
E-mail addresses: ad.inchingolo@libero.it (A.D. Inchingolo), graziamarinelli@live.it (G. Marinelli), benitofrancescopio.pennacchio@uniba.it (B.F. Pio Pennacchio), robertovito.giorgio@uniba.it (R.V. Giorgio), valeriacolonna@uniba.it (V. Colonna), francesco.inchingolo@uniba.it (F. Inchingolo), andrea.palermo@unisalento.it (A. Palermo), angeloinchingolo@gmail.com (A.M. Inchingolo), gianna.dipalma@uniba.it, g.dipalma@unilink.it (G. Dipalma).
[1] These authors contributed equally as last authors.
[2] These authors contributed equally as first authors.

https://doi.org/10.1016/j.adoms.2026.100682
Received 13 May 2026; Accepted 15 May 2026
Available online 16 May 2026

impairment[6–9].

Although both TMDs and bruxism are highly prevalent, their clinical management remains complex and often unsatisfactory. Diagnostic uncertainty, symptom variability, and inconsistent therapeutic outcomes continue to challenge clinicians[10–13]. Historically, these conditions have been primarily interpreted through a biomechanical and occlusal lens, with emphasis placed on peripheral factors such as occlusal discrepancies, joint morphology, and mechanical overload of musculoskeletal tissues[14–16]. However, this reductionist approach has proven insufficient to explain the wide heterogeneity of clinical manifestations, the weak association between structural findings and symptom severity, and the tendency toward chronic pain observed in a significant proportion of patients [17–19].

Contemporary research increasingly supports the view that TMDs and bruxism are not solely peripheral disorders, but rather conditions arising from complex interactions between biological, psychological, and social processes[20–23]. Dysregulation of central pain modulation, alterations in motor control, stress-related neuroendocrine responses, emotional factors, and sleep disturbances have all been implicated in symptom development and maintenance[24–26]. In this perspective, bruxism is progressively conceptualized as a centrally regulated behavior, while TMDs are increasingly recognized as part of a broader group of chronic pain conditions characterized by substantial psychosocial modulation[27–30].

Psychological factors appear to play a particularly influential role in bruxism-related TMD. A growing body of evidence links Anxiety (ANX), depressive symptoms, perceived stress, emotional dysregulation, and maladaptive cognitive patterns—such as pain catastrophizing—to increased jaw-muscle activity and enhanced pain perception. Importantly, these psychological variables are not merely secondary reactions to chronic pain[31–34]. Rather, they actively contribute to symptom amplification, reduced pain thresholds, and sustained muscle tension. ANX, in particular, has been associated with increased Awake Bruxism (AB) behaviors and altered nociceptive processing, suggesting a direct effect on both parafunctional activity and pain experience[35–37].

Among psychological determinants, perceived stress has consistently emerged as one of the strongest correlates of both bruxism and TMD. Exposure to chronic stressors, demanding work environments, and emotional overload has been linked to increased clenching activity, muscle hyperactivity, and worsening of OFP[38–41]. From a neurobiological standpoint, activation of the hypothalamic–pituitary–adrenal axis and the sympathetic nervous system may induce changes in muscle tone, pain modulation, and inflammatory processes, thereby providing a plausible mechanistic pathway through which stress exacerbates bruxism-related TMD symptoms[42–44].

Individual differences in emotional regulation and coping strategies further modulate clinical outcomes. Patients exhibiting maladaptive coping styles, reduced resilience, or limited emotional awareness tend to report greater pain severity, higher levels of disability, and poorer responses to conservative interventions[45–48]. Within this context, bruxism has been hypothesized to function as a non-conscious motor expression of unresolved emotional tension, consistent with models of stress-related motor behaviors and central nervous system involvement (Fig. 1).

Sleep-related mechanisms add an additional layer of complexity [48, 49]. Psychological distress is strongly associated with disrupted sleep architecture and increased arousal frequency, both of which are known to facilitate Sleep Bruxism (SB) episodes[50–53]. This bidirectional interaction between sleep disturbances, emotional factors, and muscle activity further supports a biopsychosocial conceptualization of bruxism-related TMD[54–56].

The biopsychosocial model offers an integrative framework capable of capturing these multidimensional interactions, acknowledging that biological susceptibility, psychological processes, and social context jointly shape symptom expression, pain chronicity, and treatment response[57–60]. Clinically, reliance on a predominantly mechanical paradigm may lead to incomplete diagnostic formulations and suboptimal management strategies [60–62]. While occlusal appliances and other conventional approaches may be beneficial for selected patients, their isolated use often fails to address the multifactorial nature of these conditions[63–66].

The purpose of this systematic review is to synthesize current evidence regarding the biological, psychological, and social determinants of TMD associated with bruxism, and to explore their implications for diagnosis, prognosis, and clinical management within a biopsychosocial framework[67–69]. By integrating these domains, this review aims to support the development of more personalized, interdisciplinary, and evidence-based approaches to the care of patients with TMDs and bruxism [69,70].

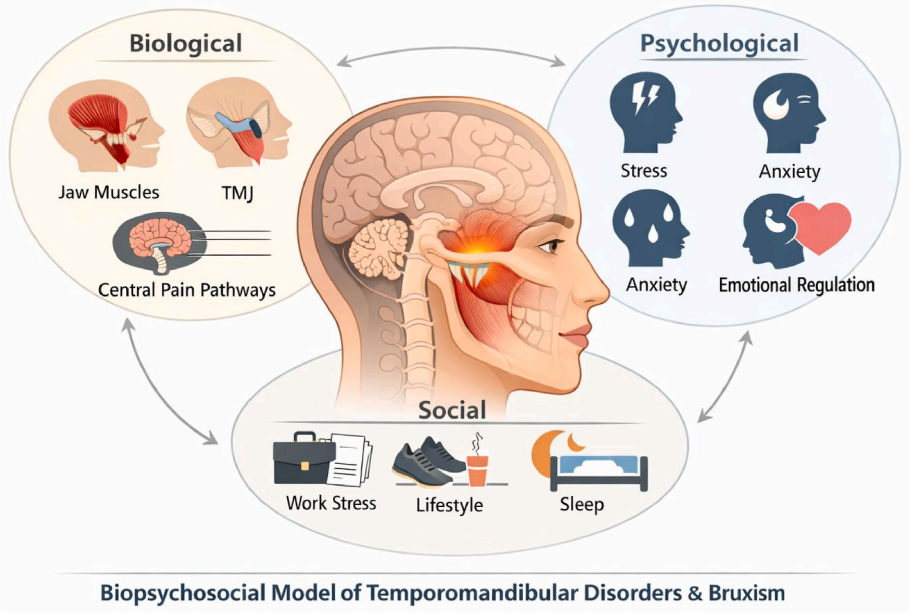

Fig. 1. Biopsychosocial model of TMD and bruxism, showing the interplay of biological, psychological, and social factors in symptom development and maintenance.

2. Materials and methods

2.1. Protocol and registration

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The review aimed to evaluate the role of the biopsychosocial model in the diagnosis, assessment, and clinical management of TMD and bruxism. The current systematic review was conducted following the International Prospective Register of SR Registry procedures (PROSPERO id: 1299331)

2.2. Search process

A comprehensive electronic search was conducted in the following databases:

- PubMed/MEDLINE
- Scopus
- Web of Science Core Collection

Searches covered the period January 2015 – January 2026, limited to English-language studies involving adult human participants. Controlled vocabulary (MeSH terms) and free-text keywords related to TMD, bruxism, OFP, and biopsychosocial/psychological/behavioral factors were used. The complete search strategies used for each database are reported below:

Pubmed:

("TMJ Disorders"[MeSH] OR "OFP"[MeSH] OR ″ Myofascial Pain (MP) Syndromes"[MeSH] OR "Bruxism"[MeSH] OR TMD[Title/Abstract] OR TMD[Title/Abstract] OR TMJ disorders[Title/Abstract] OR OFP[Title/Abstract] OR MP[Title/Abstract] OR bruxism[Title/Abstract]) AND ("Biopsychosocial Model"[MeSH] OR biopsychosocial [Title/Abstract] OR psychosocial[Title/Abstract] OR "Psychological Factors"[MeSH] OR psychological factors[Title/Abstract] OR "Social Factors"[MeSH] OR "Stress, Psychological"[MeSH] OR ANX[Title/Abstract] OR DEP[Title/Abstract] OR coping[Title/Abstract] OR catastrophizing[Title/Abstract] OR "Central Sensitization"[MeSH]) AND ("Diagnosis"[MeSH] OR diagnosis[Title/Abstract] OR clinical assessment[Title/Abstract] OR management[Title/Abstract] OR "Multidisciplinary Care"[MeSH] OR multidisciplinary[Title/Abstract])

Web Of Science:

(ALL=("TMD" OR TMD OR bruxism OR "OFP") AND ALL=(biopsychosocial OR psychosocial) AND ALL=(diagnosis OR management))

Scopus:

TITLE-ABS-KEY("TMD" OR TMD OR bruxism OR "OFP")

AND TITLE-ABS-KEY(biopsychosocial OR psychosocial) AND TITLE-ABS-KEY(diagnosis OR management)

2.3. Inclusion and exclusion criteria

The reviewers worked in groups to assess all relevant studies that evaluated studies considering eligible if they met the following criteria:

Inclusion Criteria:

- Adult participants (≥18 years) with TMD and/or bruxism
- Studies addressing psychological, behavioral, or social factors within a biopsychosocial framework
- Studies reporting on diagnosis, clinical assessment, management, or treatment outcomes
- Original research (observational, cohort, cross-sectional, interventional, qualitative)
- Open-access and written in English;
- Conductedon human participants;
- Included adults aged 19 years and older;
- Full-text articles available for review;

Exclusion Criteria:

- Pediatric studies (<18 years), in vitro, animal studies
- Case reports or case series
- Narrative reviews or systematic reviews
- Studies focusing exclusively on occlusion or mechanical aspects without psychosocial evaluation
- Off-topic articles
- In vitro or laboratory-based experiments.

2.4. PICO question

The research question was formulated according to the PICO framework, used in qualitative research to structure clinical research questions. In this study, the PICO addressed the following question:

Population (P): In patients with TMD and bruxism.

Intervention (I): How does the application of a biopsychosocial framework.

Comparison (C): Compared with traditional biomedical approaches.

Outcome (O): Contribute to improved diagnostic conceptualization, clinical management, and patient-centered outcome. (Tab. 1)

2.4.1. Data synthesis and quality assessment

Methodological quality was assessed according to study design:

- Newcastle–Ottawa Scale (NOS) for observational studies
- Cochrane Risk of Bias tool for interventional trials

Due to heterogeneity in study designs, outcomes, and assessment tools, a narrative synthesis was conducted. Results were organized into the following domains:

1. Psychological factors (ANX, Depression (DEP), stress, catastrophizing)
2. Behavioral factors (AB, oral parafunctional behaviors, coping)
3. Sleep-related factors (SB, sleep quality, arousals)
4. Central sensitization and painmodulation
5. Implications for diagnosis and clinical management

2.5. Data processing

Five independent reviewers (R.V.G., V.C., B.F.P.P., A.M.L and F.I.) assessed the methodological quality and risk of bias of the included studies using the Cochrane Risk of Bias 2 (RoB 2) tool. The tool evaluates five key domains such as selection, measurement validity, confounding, and data analysis. Discrepancies in scoring were resolved through discussion and consensus, with support from additional reviewers (G.D., A. D.I., A.P., G.M. and A.M.I.) when needed. The reviewers screened all retrieved records based on predefined inclusion and exclusion criteria. After screening, a total of 1065 articles were imported into Zotero (version 6.0.36) for organization and full-text analysis.The process of study identification, screening, eligibility, and inclusion is summarized in the PRISMA flow diagram (Fig. 2) (see Table 1).

3. Results

3.1. Selected studies and their characteristics

The systematic search process, conducted according to PRISMA guidelines (Fig. 2), identified a total of 1065 records from three major databases: PubMed (n = 626), Scopus (n = 251), and Web of Science (n = 188). After the removal of 199 duplicates, 866 articles were screened by title and ab-stract. Following the application of the predefined inclusion and exclusion criteria, 513 full-text articles were assessed for eligibility. Of these, 499 were excluded for the following reasons: systematic reviews (n = 199), in vitro studies (n = 143), case report (n

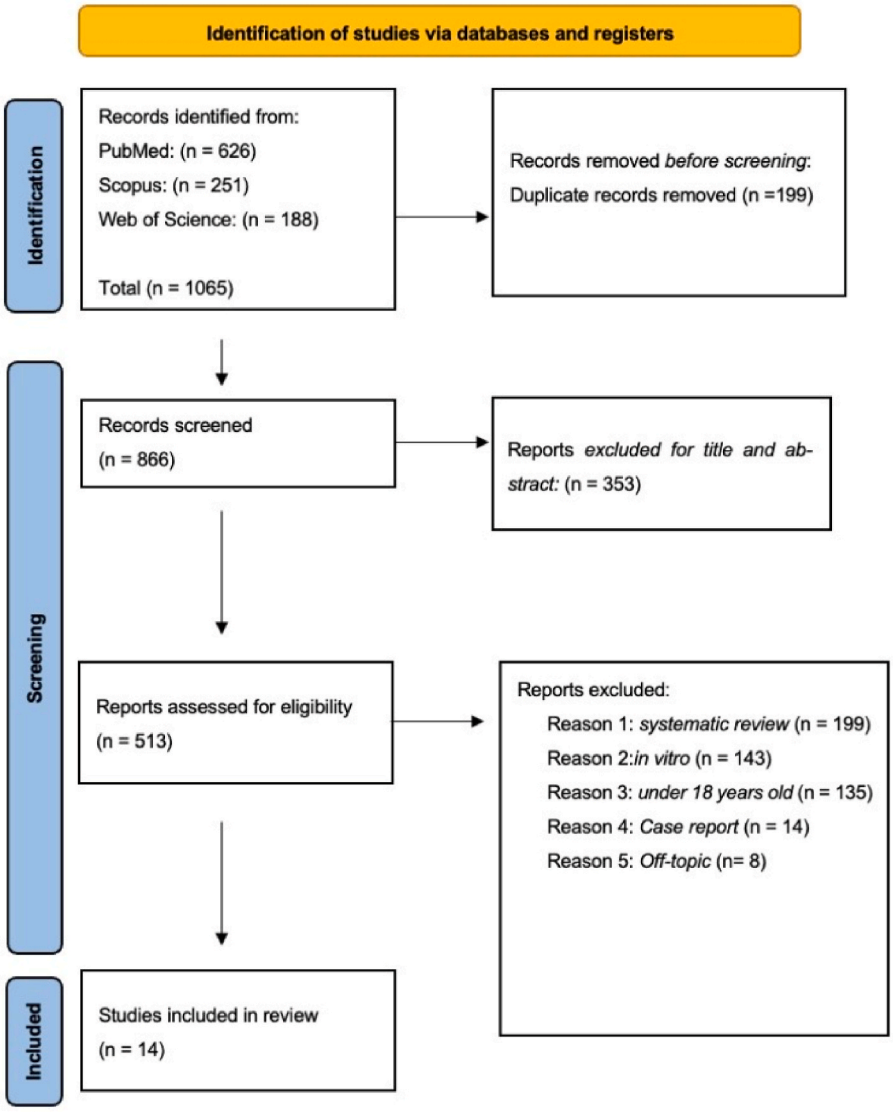

Fig. 2. PRISMA flowchart.

Table 1
Pico question.

P	I	C	O
Patients with TMD and/or bruxism-related OFP	Biopsychosocial models for diagnosis and clinical management	Biomedical or single-domain approaches (when applicable)	Improved diagnostic understanding, pain outcomes, functional status, and clinical decision-making.

= 14), participants under 18 years of age (n = 135)and off-topic articles (n = 8). Ulti-mately, 14 randomized controlled trials (RCTs) met all inclusion criteria and were included in the final synthesis (Table 2).

3.1.1. Study Characteristics

3.1.2. Domain synthesis

Psychological: ANX, DEP, stress, and catastrophizing strongly influence pain intensity, chronicity, and treatment response.

Behavioral: AB and parafunctional behaviors mediate the relationship between stress and symptom severity. Coping strategies influence functional outcomes.

Sleep-Related: SB and poor sleep quality increase muscle activity and pain perception.

Central Sensitization: Widespread pain, somatization, and hyperalgesia are linked to treatment-resistant TMD pain.

Methodological quality assessment - Risk of Bias.

3.2. Quality and risk of bias assessment for the included studies

The methodological quality and risk of bias of the included studies were assessed according to study design. Observational studies were evaluated using the **Newcastle–Ottawa Scale (NOS)**, which assesses three broad domains: selection of study groups, comparability of groups, and ascertainment of exposure or outcome (Table 3). Interventional trials were assessed using the **Cochrane Risk of Bias 2 (RoB 2) tool**, which evaluates five key domains: (1) bias arising from the randomization process, (2) bias due to deviations from intended interventions, (3) bias due to missing outcome data, (4) bias in the measurement of the outcome, and (5) bias in the selection of the reported result (Table 4).

Each study was independently reviewed by multiple investigators, and discrepancies were resolved through discussion and consensus,

Table 2
Summary of the studies selected and included in the systematic review, indicating au-thors, publication year, study design, sample characteristics, interventions, and main outcomes.

Article Title	Country	N	Study Design	Population	FactorsAssessed	Outcomes	MainFindings
AgnieszkaPrzystanska et al.(2019) [71]	Finland	120	Cross-sectional	Adult TMD	Behavioral, psychosocial	Pain, oralbehaviors	Parafunctional behaviors correlate with pain intensity
KarolinaWalczynska-Dragon et al. (2025) [35]	Germany	90	Cross-sectional	TMD &bruxism	Behavioral, psychosocial	Pain, coping	Biopsychosocial factors influence bruxism severity
MieszkoWieckiewicz et al. (2022) [56]	Poland	200	Cohort	Adult TMD	ANX, DEP, stress	Pain, disability	Psychologicaldistresspredictschronicity
ArvidIjin et al. (2025) [21]	Finland	95	Cross-sectional	Adult TMD	Parafunctions, psychosocial	Widespreadpain	Parafunctions mediate painseverity
Magdalena Osiewicz et al. (2020) [72]	Italy	150	Observational	Adult TMD	ANX, coping, catastrophizing	Pain, functionallimitation	High catastrophizing → worseoutcome
PiotrSeweryn et al. (2024) [73]	Finland	110	Prospectiveobservational	Adult TMD	Somatization, centralsensitization	Painintensity, disability	Widespread pain associated with psychosocial stress pain intensity
SaranyaVarun et al. (2023) [2]	Sweden	85	Cross-sectional	Masticatorymyalgia	Painreferral, psychosocial	Pain, disability	Pain referral associated with psychosocial factors
Giancarlo De La Torre Canales et al. (2019) [74]	Brazil	130	Cross-sectional	TMD	DEP, somatization	Pain, QoL	DEPcorrelates with disability
Brigitte Ohlmann et al. (2020) [51]	Italy	70	Cross-sectional	Sleepbruxism	Sleepquality, stress	Painintensity	Sleep fragmentation increases pain severity
LujainAlSahman et al. (2025) [75]	Switzerland	100	Comparative	TMD	Quality of life, psychosocial	Pain, functionallimitation	Psychosocial impact affects oral health-related QoL
Nour Ibrahim et al. (2023) [10]	Middle East	65	Observational	TMD	Coping, alexithymia, oralbehaviors	Pain, functionallimitation	Maladaptivecoping → higherpain
Melissa de Oliveira Melchior et al. (2025) [76]	Spain	60	Interventional	TMD women	Mindfulness, coping	Pain, psychologicaldistress	Mindfulness reduces pain and distress
Jared G. Smith et al. (2020) [77]	Germany	75	Observational	Orofacialpain	Central sensitization	Pain, psychosocialmeasures	Central sensitizationmediatespain
ParvanehBadri et al. (2025) [42]	USA	50	Observational	Orofacialpain	Psychologicaldistress	Pain, QoL	Chronic pain associated with distress

involving additional reviewers when necessary to ensure consistency and accuracy. Overall, the quality assessment indicated that the majority of studies were of **high methodological quality**, with low risk of bias in both observational and interventional designs. A few studies showed some concerns in specific domains, particularly in selection or randomization procedures.

The methodological quality of the included studies was assessed according to study design. Observational studies (cross-sectional, cohort, and comparative studies) were evaluated using the Newcastle–Ottawa Scale (NOS), applying an adapted version for cross-sectional studies when appropriate. The NOS assesses three domains: selection of participants, comparability of study groups, and assessment of outcomes or exposures.

The single interventional study included in the review was evaluated using the Cochrane Risk of Bias tool (RoB 2), which assesses bias arising from the randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selective reporting.

4. Discussion

The findings of this systematic review reinforce the interpretation of TMD (TMD) and bruxism as multifactorial conditions that cannot be sufficiently explained by a purely biomechanical or biomedical paradigm[78–80]. Instead, the available evidence supports a biopsychosocial framework in which psychological, behavioral, sleep-related, and neurophysiological mechanisms interact dynamically to influence symptom onset, severity, and persistence[81–84].

In addition, the heterogeneity of findings across studies highlights the need for caution when interpreting causal relationships between bruxism, TMD, and psychosocial variables[85–88]. Differences in diagnostic criteria, assessment tools, and study populations may partially explain inconsistencies in reported associations [88–90]. Nevertheless, the convergence of evidence across observational, prospective, and interventional designs strengthens the overall validity of a biopsychosocial interpretation [77,91,92]. Future research should prioritize standardized diagnostic frameworks and longitudinal methodologies to better clarify temporal relationships and mechanisms underlying symptom progression and treatment response[76,93–95].

4.1. Psychological factors and emotional distress

Psychological factors consistently emerged as significant contributors to both bruxism and TMD-related pain. ANX, depressive symptoms, perceived stress, and emotional dysregulation were repeatedly associated with greater pain intensity, increased functional limitation, and a higher likelihood of symptom chronicity[77,96–98]. Several studies identified psychological vulnerability as a relevant predictor of both the severity and persistence of bruxism [98,99].

Importantly, psychological distress appears to influence not only symptom expression but also diagnostic complexity and treatment outcomes[100–102]. An interdisciplinary cross-sectional investigation explicitly conceptualized bruxism within a biopsychosocial model, underscoring the importance of incorporating psychological evaluation into standard clinical assessment[103–106]. Longitudinal evidence further demonstrated that ANX, DEP, and perceived stress significantly contribute to pain-related disability in individuals with TMD, highlighting the temporal stability of these associations[107–110].

In chronic TMD populations, depressive symptoms and somatization were strongly linked to pain-related impairment, suggesting that psychological distress plays a modulatory role in both pain perception and functional disability[111–115]. Collectively, these findings support the routine inclusion of structured psychological screening in the diagnostic and therapeutic management of TMD [115–117].

Table 3
Newcastle–Ottawa scale (NOS).

Articletitle	Study design	Selection	Comparability	Outcome/Exposure	Overallquality
AgnieszkaPrzystanska et al. [71]	Cross-sectional	★★	★	★★	★★★ (Good)
KarolinaWalczynska-Dragon et al. [35]	Cross-sectional	★★★	★	★★	★★★ (Good)
MieszkoWieckiewiczet al. [56]	Prospectivecohort	★★★	★★	★★★	★★★★ (High)
Arvidlljinet al. [21]	Cross-sectional	★★★	★	★★	★★★ (Good)
Magdalena Osiewicz et al. [72]	Observational	★★	★	★★	★★★ (Good)
PiotrSeweryn et al. [73]	Prospectiveobservational	★★★	★★	★★	★★★★ (High)
SaranyaVarunet al. [2]	Controlledobservational	★★★	★★	★★	★★★★ (High)
Giancarlo De La Torre Canales et al. [74]	Cross-sectional	★★	★★	★★	★★★ (High)
Brigitte Ohlmann et al. [51]	Cross-sectional	★★	★	★★	★★★ (Good)
LujainAlSahman et al. [75]	Comparative observational	★★★	★★	★★	★★★★ (High)
Nour Ibrahim et al. [10]	Cross-sectional	★★	★★	★★	★★★ (High)
Jared G. Smith et al. [77]	Comparative observational	★★★	★★	★★	★★★★ (High)
ParvanehBadri et al. [42]	Observationalcohort	★★★	★★	★★	★★★★ (High)

* adapted for cross-sectional studies where applicable.
NOS.
★★★★ = high quality.
★★★ = good quality.
★★ = moderate quality.

Table 4
Cochrane risk of bias (RoB 2).

Articletitle	Randomizationprocess	Deviations from intendedinterventions	Missingoutcome data	Measurement of the outcome	Selection of reportedresults	Overallrisk of bias
Melissa de Oliveira Melchior et al. [76]						
Judgment:						
						Hight Some concerns Low

4.2. Behavioral factors and parafunctional activities

Behavioral variables, particularly oral parafunctional activities and AB, appear to mediate the relationship between psychological stress and clinical manifestations of TMD [118–120]. In tertiary care populations, parafunctional behaviors were strongly associated with pain widespreadness and psychosocial vulnerability, indicating that such behaviors may reflect centrally mediated stress responses rather than isolated mechanical habits[121–124].

Additional evidence suggests that maladaptive coping strategies and other behavioral predictors significantly influence pain severity and disability [124–126]. Emotional processing deficits, including alexithymia, were also associated with increased oral parafunctions and poorer clinical outcomes, further supporting the close interaction between emotional regulation and behavioral expression in TMD pathophysiology[127–131]. These observations indicate that behavioral assessment and targeted interventions should be considered integral components of comprehensive TMD management rather than adjunctive measures[73,132–134].

4.3. Sleep-related factors

Sleep-related mechanisms represent an additional dimension contributing to both bruxism and TMD symptomatology [134]. Several studies reported significant associations between SB and TMD-related signs and symptoms, suggesting that sleep disturbances may exacerbate masticatory muscle activity and pain sensitivity[135–137].

Sleep-related factors appear to interact with psychological distress and behavioral patterns, potentially contributing to symptom persistence and treatment resistance [137–139]. Although SB alone does not fully explain the presence or severity of TMD pain, its inclusion within a broader biopsychosocial diagnostic framework allows for a more comprehensive understanding of interindividual variability in clinical presentation[75,140–142].

4.4. Central sensitization and pain modulation

Alterations in central pain processing were consistently implicated in more complex and chronic TMD presentations [142,143]. A high prevalence of central sensitization and somatization was observed, particularly among patients reporting widespread pain and elevated levels of disability [71,144,145]. Differences in pain referral patterns and biopsychosocial profiles further supported the involvement of altered central pain modulation, especially in cases of masticatory myalgia [146–148].

Moreover, variations in psychosocial functioning across different OFP phenotypes suggest that central mechanisms interact closely with psychological factors to shape symptom expression [148–150]. Evidence from multidisciplinary clinical settings confirms that chronic OFP is frequently accompanied by significant psychological distress, reinforcing the central role of biopsychosocial integration in understanding and managing TMD-related pain[151–154].

4.5. Impact on quality of life and patient-centered outcomes

Beyond pain intensity alone, TMD exerts a substantial negative impact on oral health–related quality of life. Comparative studies demonstrated that psychosocial burden contributes significantly to functional, emotional, and social impairment, outcomes that are often underrepresented in traditional biomedical models[155–158].

Notably, interventional studies indicate that targeting psychological and behavioral dimensions can yield clinically meaningful improvements [158–160]. Mindfulness-based approaches, for example, have been shown to reduce both pain intensity and psychological distress in women with chronic painful TMD, supporting the clinical relevance of integrative, patient-centered treatment strategies[161–163].

4.6. Clinical implications

Overall, the evidence synthesized in this review supports a transition toward biopsychosocially informed diagnosis and management of bruxism-related TMD [163,164]. Such an approach allows clinicians to:

- identify psychological and emotional contributors to pain
- address maladaptive behaviors and oral parafunctions
- recognize the role of sleep-related factors
- detect features suggestive of central sensitization

Adopting this framework facilitates personalized, interdisciplinary care, enhances clinical decision-making, and may reduce the risk of symptom chronicity[165–167].

5. Conclusions

The findings derived from the selected original studies consistently demonstrate that bruxism-related TMD are best understood as biopsychosocial conditions, shaped by interacting psychological, behavioral, sleep-related, and central pain mechanisms. Integrating these dimensions into clinical practice enhances diagnostic accuracy, supports patient-centered management, and offers a more effective pathway for improving outcomes in individuals affected by TMD.

Declaration of competing interest

The authors declare that they have no known competing financial interestsor personal relationships that could have appeared to influence the work reported in this paper.

Abbreviation

AB	Awake Bruxism
ANX	Anxiety
DEP	Depression
MP	Myofascial Pain
OFP	Orofacial Pain
SB	Sleep Bruxism
TMD	Temporomandibular Disorders
TMJ	Temporomandibular Joint

References

[1] Büyüknalbant E, Aydınbelge M, Sarı Ş, Demir P. A case-control study on the relationship between sleep bruxism and mental health conditions, depression and anxiety, in children. Sci Rep 2025;15:37886. https://doi.org/10.1038/s41598-025-21679-y.

[2] Varun S, Anderson GC, Hodges JS, Zhang L, Schiffman EL. A controlled study of biopsychosocial differences observed in masticatory myalgia with and without pain referral. J Oral Facial Pain Headache 2023;37:131–8. https://doi.org/10.11607/ofph.3317.

[3] A histological and clinical evaluation of long-term outcomes of bovine bone-derived xenografts in oral surgery: a systematic review. Available online: https://www.mdpi.com/2079-4983/16/9/321. [Accessed 2 February 2026].

[4] Isacco CG, Ballini A, De Vito D, Nguyen KCD, Cantore S, Bottalico L, Quagliuolo L, Boccellino M, Di Domenico M, Santacroce L, et al. Rebalancing the oral microbiota as an efficient tool in endocrine, metabolic and immune disorders. Endocr Metab Immune Disord Drug Targets 2021;21:777–84. https://doi.org/10.2174/1871530320666200729142504.

[5] Gargiulo Isacco C, Inchingolo AD, Nguyen Cao KD, Malcangi G, Paduanelli G, Pham Hung V, Tran Cong T, Bordea IR, Scarano A, Laforgia A, et al. The bad relationship, osteo-decay and diabetes type 2 searching for a link: a literature review. J Biol Regul Homeost Agents 2021;35:253–69. https://doi.org/10.23812/21-2supp1-26.

[6] Dworkin SF, Turner JA, Mancl L, Wilson L, Massoth D, Huggins KH, LeResche L, Truelove E. A randomized clinical trial of a tailored comprehensive care treatment program for temporomandibular disorders. J Orofac Pain 2002;16:259–76.

[7] A study of the influence of occlusal factors and parafunctional habits on the prevalence of signs and symptoms of TMD. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/11887598/. [Accessed 2 February 2026].

[8] Advances in orofacial pain research: a bibliometric analysis. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/40895114/. [Accessed 2 February 2026].

[9] Grabe HJ, Frommer J, Ankerhold A, Ulrich C, Groger R, Franke GH, Barnow S, Freyberger HJ, Spitzer C. Alexithymia and outcome in psychotherapy. Psychother Psychosom 2008;77:189–94. https://doi.org/10.1159/000119739.

[10] Ibrahim N, Chamoun WT, El-Outa A Alexithymia. Oral behaviors, and temporomandibular disorders: a dark triad? Middle East Curr Psychiatry 2023;30:111. https://doi.org/10.1186/s43045-023-00383-5.

[11] AMCOP Bio-Activators: An innovative solution in interceptive orthodontics for the treatment of malocclusions and orofacial dysfunctions | oral and implantology: A Journal of Innovations and Advanced Techniques for Oral Health Available online: https://oimplantology.com/index.php/oimplantology/article/view/68 (accessed on 2 February 2026).].

[12] Crandall JA. An introduction to orofacial pain. Dent Clin North Am 2018;62:511–23. https://doi.org/10.1016/j.cden.2018.05.001.

[13] Esteve M, Rosales-Leal JI. Analysis of temporomandibular disorders, bruxism and well-being in patients with fibromyalgia syndrome: a case-control study. J Oral Rehabil 2025;52:350–6. https://doi.org/10.1111/joor.13908.

[14] Assessment of awake bruxism by a novel bruxism screener and ecological momentary assessment among patients with masticatory muscle myalgia and healthy controls. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/37036436/. [Accessed 2 February 2026].

[15] Assessment of pain location according to different types of bruxism. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/40129434/. [Accessed 2 February 2026].

[16] Ferreira MC, Porto de Toledo I, Dutra KL, Stefani FM, Porporatti AL, Flores-Mir C, De Luca Canto G. Association between chewing dysfunctions and temporomandibular disorders: a systematic review. J Oral Rehabil 2018;45:819–35. https://doi.org/10.1111/joor.12681.

[17] Malcangi G, Patano A, Ciocia AM, Netti A, Viapiano F, Palumbo I, Trilli I, Guglielmo M, Inchingolo AD, Dipalma G, et al. Benefits of natural antioxidants on oral health. Antioxidants 2023;12:1309. https://doi.org/10.3390/antiox12061309.

[18] Pabst A, Kämmerer PW, Heimes D, Zeller A-N, Quarta M. Botulinum toxin for bruxism treatment: a nationwide study among oral and maxillofacial surgeons in Germany. Clin Oral Invest 2024;28:501. https://doi.org/10.1007/s00784-024-05898-7.

[19] Macrì F, Dipalma G, Inchingolo AM, Inchingolo F, Maspero C, Giannini L. Breastfeeding vs. formula feeding on maternal oral health: periodontal and microbiological changes in the postpartum period: an observational longitudinal study. Front Oral Health 2026;7. https://doi.org/10.3389/froh.2026.1747704.

[20] Emshoff R, Bertram F, Schnabl D, Emshoff I. Association between chronic tension-type headache coexistent with chronic temporomandibular disorder pain and limitations in physical and emotional functioning: a case-control study. J Oral Facial Pain Headache 2017;31:55–60. https://doi.org/10.11607/ofph.1654.

[21] Iljin A, Assila I, Näpänkangas R, Teerijoki-Oksa T, Tolvanen M, Sipilä K. Association between parafunctional behaviors, clinical diagnoses, psychosocial factors and pain widespreadness in Finnish TMD pain patients in tertiary care. J Oral Facial Pain Headache 2025;39:173–83. https://doi.org/10.22514/jofph.2025.074.

[22] Association between Parafunctional Behaviors, Clinical Diagnoses. Psychosocial factors and pain widespreadness in Finnish TMD pain patients in tertiary care. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/41436114/. [Accessed 2 February 2026].

[23] Restrepo C, Ortiz AM, Henao AC, Manrique R. Association between psychological factors and temporomandibular disorders in adolescents of rural and urban zones. BMC Oral Health 2021;21:140. https://doi.org/10.1186/s12903-021-01485-4.

[24] Laforgia A, Inchingolo AD, Piras F, Colonna V, Giorgio RV, Carone C, Rapone B, Malcangi G, Inchingolo AM, Inchingolo F, et al. Therapeutic strategies and genetic implications for periodontal disease management: a systematic review. Int J Mol Sci 2024;25:7217. https://doi.org/10.3390/ijms25137217.

[25] De Meyer MD, De Boever JA. [the role of bruxism in the appearance of temporomandibular joint disorders]. Rev Belge Med Dent 1984;52:124–38. 1997.
[26] The prevalence of TMD in Polish young adults. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/26646470/. [Accessed 2 February 2026].
[27] Association of occlusal wear facets in patients with temporomandibular disorders. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/34938006/. [Accessed 2 February 2026].
[28] Association of oral parafunctional habits with anxiety and the big-five personality traits in the Saudi adult population. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/33551622/. [Accessed 2 February 2026].
[29] Association of psychological distress and widespread pain with sympatoms of temporomandibular disorders and self-reported bruxism in students. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/34289266/. [Accessed 2 February 2026].
[30] Ekman A, Rousu J, Näpänkangas R, Kuoppala R, Raustia A, Sipilä K. Association of self-reported bruxism with temporomandibular disorders - northern finland birth cohort (NFBC) 1966 study. Cranio J Craniomandib Sleep Pract 2023;41:212–7. https://doi.org/10.1080/08869634.2020.1853306.
[31] Inchingolo AM, Marinelli G, Inchingolo F, Giorgio RV, Colonna V, Pennacchio BFP, Del Fabbro M, Tartaglia G, Palermo A, Inchingolo AD, et al. Autologous tooth-derived biomaterials in alveolar bone regeneration: a systematic review of clinical outcomes and histological evidence. J Funct Biomater 2025;16:367. https://doi.org/10.3390/jfb16100367.
[32] Nykänen L, Lobbezoo F, Kämppi A, Manfredini D, Ahlberg J. Awake bruxism in temporomandibular disorders patients referred to tertiary care: a retrospective study on its assessment and TMD management. J Oral Rehabil 2024;51:181–7. https://doi.org/10.1111/joor.13559.
[33] Biopsychosocial factors associated with the subcategories of acute temporomandibular joint disorders. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/22292135/. [Accessed 2 February 2026].
[34] Bruxism and botulinum injection: challenges and insights. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/37510701/. [Accessed 2 February 2026].
[35] Walczyńska-Dragon K, Grzybowska-Ganszczyk D, Hadzik P, Fiegler-Rudol J, Dubiel-Holecko I, Nitecka-Buchta A, Baron S. Bruxism as a biopsychosocial disorder: an interdisciplinary cross-sectional study. J Clin Med 2025;14:6803. https://doi.org/10.3390/jcm14196803.
[36] Şahin T. Bruxism awareness and self-assessment in dental clinical students: a questionnaire-based study. BMC Oral Health 2024;24:1223. https://doi.org/10.1186/s12903-024-04997-x.
[37] Catastrophizing has a better prediction for TMD than other psychometric and experimental pain variables. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/33273993/. [Accessed 2 February 2026].
[38] Sousa CRA, Arsati YB, de OL, Velly AM, Silva CAL da, Arsati F. Catastrophizing is associated with pain-related disability in temporomandibular disorders. Braz Oral Res 2023;37:e070. https://doi.org/10.1590/1807-3107bor-2023.vol37.0070.
[39] Chen X, Cheng Z, Xu J, Wang Q, Zhao Z, Jiang Q. Causal effects of autoimmune diseases on temporomandibular disorders and the mediating pathways: a mendelian randomization study. Front Immunol 2024;15:1390516. https://doi.org/10.3389/fimmu.2024.1390516.
[40] Gupta AK, Singh RK, Dutta A, Monisha VS, Singh N, Kumari S. Central sensitization and somatization in adults with temporomandibular disorders: a prospective study. J Pharm BioAllied Sci 2025;17:S2190–2. https://doi.org/10.4103/jpbs.jpbs_773_24.
[41] Rantala MAI, Ahlberg J, Suvinen TI, Savolainen A, Könönen M. Chronic myofascial pain, disk displacement with reduction and psychosocial factors in Finnish non-patients. Acta Odontol Scand 2004;62:293–7. https://doi.org/10.1080/00016350410001775.
[42] Badri P, Hernández I, Long J, Amin M, Friesen R. Chronic orofacial pain and psychological distress: findings from a multidisciplinary university clinic. J Oral Facial Pain Headache 2025;39:152–62. https://doi.org/10.22514/jofph.2025.057.
[43] Clinical orofacial characteristics associated with risk of first-onset TMD: the OPPERA prospective cohort study -. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/24275222/. [Accessed 2 February 2026].
[44] Clinical, Psychological. Sensory characteristics associated with headache attributed to temporomandibular disorder in people with chronic myogenous temporomandibular disorder and primary headaches - PubMed. Available online: https://pubmed.ncbi.nlm.nih.gov/34022805/. [Accessed 2 February 2026].
[45] Cognitive and emotional characteristics of alexithymia: a review of neurobiological studies. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/12781307/. [Accessed 2 February 2026].
[46] Cognitive domain impairments in chronic painful temporomandibular disorders: associations with pain intensity, hypervigilance and catastrophising: a cross-sectional analysis. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/40990683/. [Accessed 2 February 2026].
[47] Common therapeutic approaches in sleep and awake bruxism - an overview. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/36444852/. [Accessed 2 February 2026].
[48] Evaluation of the relationship between bruxism And/or temporomandibular disorders and stress, anxiety, depression in adults: a systematic review and qualitative analysis. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/40127752/. [Accessed 21 April 2026].
[49] Manfredini D, Ahlberg J, Lavigne GJ, Svensson P, Lobbezoo F. Five years after the 2018 consensus definitions of sleep and awake bruxism: an explanatory note. J Oral Rehabil 2024;51:623–4. https://doi.org/10.1111/joor.13626.
[50] Correlation of RDC/TMD Axis I Diagnoses and Axis II Pain-Related Disability. A multicenter study. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/20628773/. [Accessed 2 February 2026].
[51] Ohlmann B, Waldecker M, Leckel M, Bömicke W, Behnisch R, Rammelsberg P, Schmitter M. Correlations between sleep bruxism and temporomandibular disorders. J Clin Med 2020;9:611. https://doi.org/10.3390/jcm9020611.
[52] Yap AUJ, Tan KBC, Chua EK, Tan HH. Depression and somatization in patients with temporomandibular disorders. J Prosthet Dent 2002;88:479–84. https://doi.org/10.1067/mpr.2002.129375.
[53] The efficacy of a new AMCOP® elastodontic protocol for orthodontic interceptive treatment: a case series and literature overview. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/35055811/. [Accessed 2 February 2026].
[54] The efficacy of microcurrent electrical nerve stimulation in treating masticatory myofascial pain: a systematic review and meta-analysis. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/34957937/. [Accessed 2 February 2026].
[55] Erdil D, Bagis N, Eren H, Camgoz M, Orhan K. The evaluation of the relationship between changes in masseter muscle thickness and tooth clenching habits of bruxism patients treated with botulinum toxin A. J Med Ultrasound 2023;31:22–8. https://doi.org/10.4103/jmu.jmu_51_22.
[56] Wieckiewicz M, Jenca A, Seweryn P, Orzeszek S, Petrasova A, Grychowska N, Winocur-Arias O, Emodi-Perlman A, Kujawa K. Determination of pain intensity, pain-related disability, anxiety, depression, and perceived stress in Polish adults with temporomandibular disorders: a prospective cohort study. Front Integr Neurosci 2022;16:1026781. https://doi.org/10.3389/fnint.2022.1026781.
[57] Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the international RDC/TMD consortium network* and orofacial pain special interest group†. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/24482784/. [Accessed 2 February 2026].
[58] De Souza Tesch R, Fernandes FS, Favilla EE, De Goffredo Filho GS, De Queiroz Faria Goes CP. Differences in non-specific physical symptom levels and pressure pain thresholds between patients with masticatory myofascial pain and arthralgia. Cranio J Craniomandib Sleep Pract 2020;38:389–95. https://doi.org/10.1080/08869634.2018.1531207.
[59] Reis PHF, Laxe LAC, Lacerda-Santos R, Münchow EA. Distribution of anxiety and depression among different subtypes of temporomandibular disorder: a systematic review and meta-analysis. J Oral Rehabil 2022;49:754–67. https://doi.org/10.1111/joor.13331.
[60] Determination of daytime clenching events in subjects with and without self-reported clenching. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/23902342/. [Accessed 21 April 2026].
[61] Inchingolo AD, Marinelli G, Limongelli L, Inchingolo F, Favia G, Ferrante L, Di Noia A, Maspero C, Palermo A, Inchingolo AM, et al. Dietary and complementary oral supplements for the management of chronic diseases in children: a systematic review. Front Pediatr 2025;13:1710200. https://doi.org/10.3389/fped.2025.1710200.
[62] Effects of Resveratrol. Curcumin and quercetin supplementation on bone Metabolism-A systematic review. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/36079777/. [Accessed 21 April 2026].
[63] Sleep Disturbed. Anxiety and stress are possible risk indicators for temporomandibular disorders with myofascialpain. PubMed Available online, https://pubmed.ncbi.nlm.nih.gov/29263515/. [Accessed 2 February 2026].
[64] Chun Y, Jo JH, Park JW. Does physical activity level have an impact on long-term treatment response in temporomandibular disorders: protocol for a prospective study. BMC Oral Health 2022;22:401. https://doi.org/10.1186/s12903-022-02428-3.
[65] AlSahman L, AlBagieh H, AlSahman R, Mehta NR, Correa LP. Does salivary cortisol serve as a potential biomarker for temporomandibular disorders in adults? BMC Oral Health 2024;24:1364. https://doi.org/10.1186/s12903-024-05131-7.
[66] Amorim CSM, Espirito Santo AS, Sommer M, Marques AP. Effect of physical therapy in bruxism treatment: a systematic review. J Manip Physiol Ther 2018;41:389–404. https://doi.org/10.1016/j.jmpt.2017.10.014.
[67] Effectiveness of herbal medicines with anti-inflammatory, antimicrobial, and antioxidant properties in improving oral health and treating gingivitis and periodontitis: a systematic review. Available online: https://www.mdpi.com/2072-6643/17/5/762. [Accessed 2 February 2026].
[68] Santos Miotto Amorim C, Firsoff EFO, Vieira GF, Costa JR, Marques AP. Effectiveness of two physical therapy interventions, relative to dental treatment in individuals with bruxism: study protocol of a randomized clinical trial. Trials 2014;15:8. https://doi.org/10.1186/1745-6215-15-8.
[69] Effects of 4-Week Diacutaneous Fibrolysis on Myalgia. Mouth opening, and level of functional severity in women with temporomandibular disorders: a randomized controlled trial. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/32893024/. [Accessed 2 February 2026].
[70] Dipalma G, Inchingolo AD, Cardarelli F, Di Lorenzo A, Viapiano F, Ferrante L, Inchingolo F, Venere DD, Palermo A, Marinelli G, et al. Effects of AMCOP® elastodontic devices on skeletal divergence and airway dimensions in growing patients. J Clin Med 2025;14:5297. https://doi.org/10.3390/jcm14155297.
[71] Przystańska A, Jasielska A, Ziarko M, Pobudek-Radzikowska M, Maciejewska-Szaniec Z, Prylińska-Czyżewska A, Wierzbik-Strońska M, Gorajska M, Czajka-Jakubowska A. Psychosocial predictors of bruxism. Biomed Res Int 2019;2019:2069716. https://doi.org/10.1155/2019/2069716.

[72] Osiewicz M, Lobbezoo F, Ciapała B, Pytko-Polończyk J, Manfredini D. Pain predictors in a population of temporomandibular disorders patients. J Clin Med 2020;9:452. https://doi.org/10.3390/jcm9020452.

[73] Seweryn P, Waliszewska-Prosol M, Straburzynski M, Smardz J, Orzeszek S, Bombala W, Bort M, Jenca A, Paradowska-Stolarz A, Wieckiewicz M. Prevalence of central sensitization and somatization in adults with temporomandibular Disorders-a prospective observational study. J Oral Facial Pain Headache 2024; 38:33–44. https://doi.org/10.22514/jofph.2024.037.

[74] Canales GDLT, Guarda-Nardini L, Rizzatti-Barbosa CM, Conti PCR, Manfredini D. Distribution of depression, somatization and pain-related impairment in patients with chronic temporomandibular disorders. J Appl Oral Sci 2019;27:e20180210. https://doi.org/10.1590/1678-7757-2018-0210.

[75] AlSahman L, AlBagieh H, AlSahman R, Correa LP, Mehta NR. Functional, physical and psychosocial impacts of oral health-related quality of life in temporomandibular Disorders-A comparative study. Diagnostics 2025;15:602. https://doi.org/10.3390/diagnostics15050602.

[76] de Oliveira Melchior M, Magri LV, Díaz-Serrano KV, Júnior EBC, Fregni F, Pacheco-Barrios K, Lacchini R, Leite-Panissi CRA, Gherardi-Donato ECS. Impact of a mindfulness-based intervention on pain and psychological factors in women with chronic painful temporomandibular disorders. J Oral Rehabil 2025;52: 2269–81. https://doi.org/10.1111/joor.70028.

[77] Smith JG, Karamat A, Melek LN, Jayakumar S, Renton T. The differential impact of neuropathic, musculoskeletal and neurovascular orofacial pain on psychosocial function. J Oral Pathol Med 2020;49:538–46. https://doi.org/10.1111/jop.13071.

[78] Kadıoğlu MB, Sezer M, Elbasan B. Effects of manual therapy and home exercise treatment on pain, stress, sleep, and life quality in patients with bruxism: a randomized clinical trial. Medicina (Kaunas) 2024;60:2007. https://doi.org/10.3390/medicina60122007.

[79] Gomes CAF, de P, El-Hage Y, Amaral AP, Herpich CM, Politti F, Kalil-Bussadori S, Gonzalez T de O, Biasotto-Gonzalez DA. Effects of massage therapy and occlusal splint usage on quality of life and pain in individuals with sleep bruxism: a randomized controlled trial. J Jpn Phys Ther Assoc 2015;18:1–6. https://doi.org/10.1298/jjpta.Vol18_001.

[80] The effectiveness of curcumin in treating oral mucositis related to radiation and chemotherapy: a systematic review. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/39456414/. [Accessed 2 February 2026].

[81] The effectiveness of physiotherapy for chronic headaches in patients with temporomandibular disorders: a systematic review. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/41064810/. [Accessed 2 February 2026].

[82] The effects of periodontal treatment on rheumatoid arthritis and of anti-rheumatic drugs on periodontitis: a systematic review. PubMed Available online, https://pubmed.ncbi.nlm.nih.gov/38139057/. [Accessed 2 February 2026].

[83] Knibbe W, de Jongh A, Acar-Ceylan K, Al Hamami Z, Visscher CM, Lobbezoo F. The effects of trauma-focused treatment on painful temporomandibular disorders, awake bruxism and sleep bruxism in patients with severe post-traumatic stress disorder. J Oral Rehabil 2024;51:2019–28. https://doi.org/10.1111/joor.13785.

[84] Enhanced sympathetic cardiac modulation in bruxism patients. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/16770525/. [Accessed 2 February 2026].

[85] Warzocha J, Gadomska-Krasny J, Mrowiec J. Etiologic factors of temporomandibular disorders: a systematic review of literature containing diagnostic criteria for temporomandibular disorders (DC/TMD) and research diagnostic criteria for temporomandibular disorders (RDC/TMD) from 2018 to 2022. Healthcare (Basel) 2024;12:575. https://doi.org/10.3390/healthcare12050575.

[86] Inchingolo AM, Dipalma G, Bassi P, Lagioia R, Cavino M, Colonna V, de Ruvo E, Inchingolo F, Giudice G, Palermo A, et al. Evaluation of surgical protocols for speech improvement in children with cleft palate: a systematic review and case series. Bioengineering (Basel) 2025;12:877. https://doi.org/10.3390/bioengineering12080877.

[87] Crincoli V, Inchingolo AD, Marinelli G, Lagioia R, Bassi P, Ciocia C, Calò F, Deodato R, Marsella G, Inchingolo F, et al. Evaluation of the possible correlation between dental occlusion and craniomandibular disorders by means of teethan® electromyography: clinical-observational study on 20 patients. J Clin Med 2025; 14:5508. https://doi.org/10.3390/jcm14155508.

[88] Dioguardi M, Cantore S, Scacco S, Quarta C, Sovereto D, Spirito F, Alovisi M, Troiano G, Aiuto R, Garcovich D, et al. From bench to bedside in precision medicine: diabetes mellitus and peri-implantitis clinical indices with a short-term follow-up: a systematic review and meta-analysis. J Personalized Med 2022;12: 235. https://doi.org/10.3390/jpm12020235.

[89] Dioguardi M, Cazzolla AP, Arena C, Sovereto D, Caloro GA, Dioguardi A, Crincoli V, Laino L, Troiano G, Lo Muzio L. Innate immunity in children and the role of ACE2 expression in SARS-CoV-2 infection. Pediatr Rep 2021;13:363–82. https://doi.org/10.3390/pediatric13030045.

[90] Inchingolo F, Hazballa D, Inchingolo AD, Malcangi G, Marinelli G, Mancini A, Maggiore ME, Bordea IR, Scarano A, Farronato M, et al. Innovative concepts and recent breakthrough for engineered graft and constructs for bone regeneration: a literature systematic review. Materials 2022;15:1120. https://doi.org/10.3390/ma15031120.

[91] L T Thayer M, Ali R. The dental demolition Derby: bruxism and its impact - part 1: background. Br Dent J 2022;232:515–21. https://doi.org/10.1038/s41415-022-4143-8.

[92] The development and pilot testing of the OroFacial awakening symptoms questionnaire (OFASQ). PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/40129431/. [Accessed 2 February 2026].

[93] Genetic pattern, orthodontic and surgical management of multiple supplementary impacted teeth in a rare, cleidocranial dysplasia patient: a case report. PubMed Available online, https://pubmed.ncbi.nlm.nih.gov/34946295/. [Accessed 2 February 2026].

[94] Home Page: Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology Available online: https://www.oooojournal.net/(accessed on 2 February 2026).].

[95] Harper DE, Sayre K, Schrepf A, Clauw DJ, Aronovich S. Impact of fibromyalgia phenotype in temporomandibular disorders. Pain Med 2021;22:2050–6. https://doi.org/10.1093/pm/pnab077.

[96] Dipalma G, Marinelli G, Bassi P, Lagioia R, Calò F, Cavino M, Inchingolo F, Vinjolli F, Bordea IR, Minervini G, et al. Impact of functional therapy on skeletal structures and airways in patients with class II malocclusion: Comparison of treatment in prepubertal and pubertal phases. Life 2025;15:1144. https://doi.org/10.3390/life15071144.

[97] Qamar Z, Alghamdi AMS, Haydarah NKB, Balateef AA, Alamoudi AA, Abumismar MA, Shivakumar S, Cicciù M, Minervini G. Impact of temporomandibular disorders on oral health-related quality of life: a systematic review and meta-analysis. J Oral Rehabil 2023;50:706–14. https://doi.org/10.1111/joor.13472.

[98] Dipalma G, Inchingolo AD, Inchingolo F, Charitos IA, Di Cosola M, Cazzolla AP. Focus on the cariogenic process: microbial and biochemical interactions with teeth and oral environment. J Biol Regul Homeost Agents 2021;35. https://doi.org/10.23812/20-747-A.

[99] Ballini A, Dipalma G, Isacco CG, Boccellino M, Di Domenico M, Santacroce L, Nguyễn KCD, Scacco S, Calvani M, Boddi A, et al. Oral microbiota and immune system crosstalk: a translational research. Biology 2020;9:131. https://doi.org/10.3390/biology9060131.

[100] Using propensity score subclassification to estimate the population-average causal effect of temporomandibular dysfunction experience on oral health-related quality of life among Australian adults. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/39959951/. [Accessed 2 February 2026].

[101] Treatment of sleep disturbances in trauma-affected refugees: study protocol for a randomised controlled trial. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/29110681/. [Accessed 2 February 2026].

[102] Tchorz JP, Ladar P, Lessani M, Fitzek S. Incidence of cracked teeth before, during, and after the Covid-19 Pandemic-A retrospective analysis in a German private general practice. Clin Exp Dent Res 2025;11:e70239. https://doi.org/10.1002/cre2.70239.

[103] Hirsch C, John MT, Lobbezoo F, Setz JM, Schaller H-G. Incisal tooth wear and self-reported TMD pain in children and adolescents. Int J Prosthodont (IJP) 2004; 17:205–10.

[104] Influence of depression and somatization on acute and chronic orofacial pain in patients with single or multiple TMD diagnoses. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/22053545/. [Accessed 2 February 2026].

[105] Influence of psychological symptoms and related disability on central sensitization inventory score of individuals with temporomandibular disorders: a cross-sectional study. PubMed Available online, https://pubmed.ncbi.nlm.nih.gov/41151381/. [Accessed 2 February 2026].

[106] The Association Between Temporomandibular Disorders and Tinnitus. Evidence and therapeutic perspectives from a systematic review. Available online: https://www.mdpi.com/2077-0383/14/3/881. [Accessed 2 February 2026].

[107] Pergamalian A, Rudy TE, Zaki HS, Greco CM. The association between wear facets, bruxism, and severity of facial pain in patients with temporomandibular disorders. J Prosthet Dent 2003;90:194–200. https://doi.org/10.1016/s0022-3913(03)00332-9.

[108] Chattrattrai T, Aarab G, Su N, Blanken TF, Mitrirattanakul S, Lobbezoo F. The association of self-reported awake bruxism and sleep bruxism with temporomandibular pain and dysfunction in adult patients with temporomandibular disorders. Clin Oral Invest 2023;27:7501–11. https://doi.org/10.1007/s00784-023-05338-y.

[109] Machado NAG, Costa YM, Quevedo HM, Stuginski-Barbosa J, Valle CM, Bonjardim LR, Garib DG, Conti PCR. The association of self-reported awake bruxism with anxiety, depression, pain threshold at pressure, pain vigilance, and quality of life in patients undergoing orthodontic treatment. J Appl Oral Sci 2020; 28:e20190407. https://doi.org/10.1590/1678-2019-0407.

[110] Cigdem Karacay B, Sahbaz T. Investigation of the relationship between probable sleep bruxism, awake bruxism and temporomandibular disorders using the diagnostic criteria for temporomandibular disorders (DC/TMD). Dent Med Probl 2023;60:601–8. https://doi.org/10.17219/dmp/158926.

[111] Is biofeedback through an intra-aural device an effective method to treat bruxism? Case series and initial experience. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/33374709/. [Accessed 2 February 2026].

[112] Key factors associated with oral health-related quality of life (OHRQOL) in Hong Kong Chinese adults with orofacial pain. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/21718748/. [Accessed 2 February 2026].

[113] Mindfulness level influences the frequency, amplitude and duration of awake bruxism episodes during standardised mental capacity tasks. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/41246994/. [Accessed 2 February 2026].

[114] Costa YM, Ariji Y, Ferreira DMaO, Bonjardim LR, Conti PCR, Ariji E, Svensson P. Muscle hardness and masticatory myofascial pain: assessment and clinical relevance. J Oral Rehabil 2018;45:640–6. https://doi.org/10.1111/joor.12644.

[115] Lobbezoo F, Ahlberg J, Raphael KG, Wetselaar P, Glaros AG, Kato T, Santiago V, Winocur E, De Laat A, De Leeuw R, et al. International consensus on the assessment of bruxism: report of a work in progress. J Oral Rehabil 2018;45: 837–44. https://doi.org/10.1111/joor.12663.

[116] Corriero A, Giglio M, Soloperto R, Inchingolo F, Varrassi G, Puntillo F. Microbial symphony: exploring the role of the gut in osteoarthritis-related pain. A narrative review. Pain Ther 2024;13:409–33. https://doi.org/10.1007/s40122-024-00602-9.
[117] No dose-response association between self-reported bruxism and pain-related temporomandibular disorders: a retrospective study - PubMed available online. https://pubmed.ncbi.nlm.nih.gov/30365573/. [Accessed 21 April 2026].
[118] Physical. Psychological and socio-demographic predictors related to Patients' Self-Belief of Their Temporomandibular Disorders' aetiology. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/33051894/. [Accessed 21 April 2026].
[119] Yamaguchi T, Mikami S, Maeda M, Saito T, Nakajima T, Yachida W, Gotouda A. Portable and wearable electromyographic devices for the assessment of sleep bruxism and awake bruxism: a literature review. Cranio J Craniomandib Sleep Pract 2023;41:69–77. https://doi.org/10.1080/08869634.2020.1815392.
[120] Prevalence of Awake. Sleep bruxism in Israel under conditions of collective stress and influential factors. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/41456541/. [Accessed 21 April 2026].
[121] Oral clinical and radiological signs of excessive occlusal forces in bruxism - PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/40150044/ (accessed on 2 February 2026).
[122] Almoznino G, Zini A, Zakuto A, Sharav Y, Haviv Y, Hadad A, Chweidan H, Yarom N, Benoliel R. Oral health-related quality of life in patients with temporomandibular disorders. J Oral Facial Pain Headache 2015;29:231–41. https://doi.org/10.11607/ofph.1413.
[123] John MT, Reissmann DR, Schierz O, Wassell RW. Oral health-related quality of life in patients with temporomandibular disorders. J Orofac Pain 2007;21:46–54.
[124] Therapeutic strategies and genetic implications for periodontal disease management: Syst Rev - PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/39000324/(accessed on 21 April 2026).
[125] Manfredini D, Ahlberg J, Aarab G, Bracci A, Durham J, Ettlin D, Gallo LM, Koutris M, Wetselaar P, Svensson P, et al. Towards a standardized tool for the assessment of bruxism (STAB)-overview and general remarks of a multidimensional bruxism evaluation system. J Oral Rehabil 2020;47:549–56. https://doi.org/10.1111/joor.12938.
[126] Verhoeff MC, Lobbezoo F, Ahlberg J, Bender S, Bracci A, Colonna A, Dal Fabbro C, Durham J, Glaros AG, Häggman-Henrikson B, et al. Updating the bruxism definitions: report of an international consensus meeting. J Oral Rehabil 2025;52:1335–42. https://doi.org/10.1111/joor.13985.
[127] AlSahman L, AlBagieh H, AlSahman R. Oral health-related quality of life in temporomandibular disorder patients and healthy Subjects-A systematic review and meta-analysis. Diagnostics 2024;14:2183. https://doi.org/10.3390/diagnostics14192183.
[128] Cao Y, Yap AU, Lei J, Zhang M-J, Fu K-Y. Oral health-related quality of life of patients with acute and chronic temporomandibular disorder diagnostic subtypes. J Am Dent Assoc 2022;153:50–8. https://doi.org/10.1016/j.adaj.2021.07.011.
[129] Oral splints for patients with temporomandibular disorders or bruxism: a systematic review and economic evaluation. PubMed Available online, https://pubmed.ncbi.nlm.nih.gov/32065109/. [Accessed 2 February 2026].
[130] Orofacial pain conditions and impact on quality of life in community-dwelling elderly people in Hong Kong. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/17312643/. [Accessed 2 February 2026].
[131] Wan KY, McMillan AS, Wong MCM. Orofacial pain symptoms and associated disability and psychosocial impact in community-dwelling and institutionalized elderly in Hong Kong. Community Dent Health 2012;29:110–6.
[132] Sarlani E, Balciunas BA, Grace EG. Orofacial Pain–Part I: assessment and management of musculoskeletal and neuropathic causes. AACN Clin Issues 2005;16:333–46. https://doi.org/10.1097/00044067-200507000-00007.
[133] Margiotta F, Hannigan A, Imran A, Harmon DC. Pain, perceived injustice, and pain catastrophizing in chronic pain patients in Ireland. Pain Pract 2017;17:663–8. https://doi.org/10.1111/papr.12501.
[134] Correlation between mandibular central incisor proclination and gingival recession during fixed appliance therapy. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/12071607/. [Accessed 17 December 2024].
[135] Inchingolo AM, Inchingolo AD, Morolla R, Riccaldo L, Guglielmo M, Palumbo I, Palermo A, Inchingolo F, Dipalma G. Pre-formed crowns and pediatric dentistry: a systematic review of different techniques of restorations. Available online: https://www.jocpd.com/articles/10.22514/jocpd.2025.001. [Accessed 2 February 2026].
[136] Christidis N, Lindström Ndanshau E, Sandberg A, Tsilingaridis G. Prevalence and treatment strategies regarding temporomandibular disorders in children and Adolescents-A systematic review. J Oral Rehabil 2019;46:291–301. https://doi.org/10.1111/joor.12759.
[137] Corriero A, Gadaleta RM, Puntillo F, Inchingolo F, Moschetta A, Brienza N. The central role of the gut in intensive care. Crit Care 2022;26:379. https://doi.org/10.1186/s13054-022-04259-8.
[138] The effects of periodontal treatment on rheumatoid arthritis and of anti-rheumatic drugs on periodontitis: a systematic review. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/38139057/. [Accessed 21 April 2026].
[139] Charitos IA, Inchingolo AM, Ferrante L, Inchingolo F, Inchingolo AD, Castellaneta F, Cotoia A, Palermo A, Scacco S, Dipalma G. The gut microbiota's role in neurological, psychiatric, and neurodevelopmental disorders. Nutrients 2024;16:4404. https://doi.org/10.3390/nu16244404.
[140] Felin GC, Tagliari CV da C, Agostini BA, Collares K. Prevalence of psychological disorders in patients with temporomandibular disorders: a systematic review and meta-analysis. J Prosthet Dent 2024;132:392–401. https://doi.org/10.1016/j.prosdent.2022.08.002.
[141] De La Torre Canales G, Câmara-Souza MB, Muñoz Lora VRM, Guarda-Nardini L, Conti PCR, Rodrigues Garcia RM, Del Bel Cury AA, Manfredini D. Prevalence of psychosocial impairment in temporomandibular disorder patients: a systematic review. J Oral Rehabil 2018;45:881–9. https://doi.org/10.1111/joor.12685.
[142] Signorini L, Ballini A, Arrigoni R, De Leonardis F, Saini R, Cantore S, De Vito D, Coscia MF, Dipalma G, Santacroce L, et al. Evaluation of a nutraceutical product with probiotics, vitamin D, plus banaba leaf extracts (Lagerstroemia speciosa) in glycemic control. Endocr Metab Immune Disord Drug Targets 2021;21:1356–65. https://doi.org/10.2174/1871530320666201109115415.
[143] Santacroce L, Di Cosola M, Bottalico L, Topi S, Charitos IA, Ballini A, Inchingolo F, Cazzolla AP, Dipalma G. Focus on HPV infection and the molecular mechanisms of oral carcinogenesis. Viruses 2021;13:559. https://doi.org/10.3390/v13040559.
[144] Psychologic impact of chronic orofacial pain: a critical review. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/35943323/. [Accessed 2 February 2026].
[145] Psychopathological profile of patients with different forms of bruxism. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/21221680/. [Accessed 2 February 2026].
[146] Yao Y, Cai B, Fan S, Yang HX, Zhang YX, Xu LL. The association between forward head posture and masticatory muscle pressure pain thresholds in patients with temporomandibular joint dissorders: a cross-sectional observational study. Clin Oral Invest 2023;27:353–60. https://doi.org/10.1007/s00784-022-04739-9.
[147] Tian Y, Tan Y, Yang M, Lv X, Zheng Y, Zhang Q, Sun Y, Wang J, Xiong X. The association between specific oral behaviors and the number of temporomandibular disorder symptoms in the general population: a cross-sectional study. J Pain Res 2024;17:3565–75. https://doi.org/10.2147/JPR.S490269.
[148] Hilgenberg-Sydney PB, Lorenzon AL, Pimentel G, Petterle RR, Bonotto D. Probable awake bruxism - prevalence and associated factors: a cross-sectional study. Dental Press J Orthod 2022;27:e2220298. https://doi.org/10.1590/2177-6709.27.4.e2220298.oar.
[149] Nilsson I-M. Reliability, validity, incidence and impact of temporormandibular pain disorders in adolescents. Swed Dent J Suppl 2007:7–86.
[150] Self-reported bruxism and temporomandibular disorders: findings from two specialised centres - PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/22251149/(accessed on 21 April 2026).
[151] Relations between Alexithymia and Anhedonia. A study in eating disordered and control subjects. PubMed Available online, https://pubmed.ncbi.nlm.nih.gov/16633294/. [Accessed 2 February 2026].
[152] Blanco Aguilera A, Gonzalez Lopez L, Blanco Aguilera E, De la Hoz Aizpurua JL, Rodriguez Torronteras A, Segura Saint-Gerons R, Blanco Hungría A. Relationship between self-reported sleep bruxism and pain in patients with temporomandibular disorders. J Oral Rehabil 2014;41:564–72. https://doi.org/10.1111/joor.12172.
[153] Reported concepts for the treatment modalities and pain management of temporomandibular disorders -. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/26644030/. [Accessed 2 February 2026].
[154] Research policy for people with multiple long-term conditions and their carers. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/35721799/. [Accessed 2 February 2026].
[155] Manfredini D, Lobbezoo F. Role of psychosocial factors in the etiology of bruxism. J Orofac Pain 2009;23:153–66.
[156] Huhtela OS, Näpänkangas R, Joensuu T, Raustia A, Kunttu K, Sipilä K. Self-reported bruxism and symptoms of temporomandibular disorders in Finnish university students. J Oral Facial Pain Headache 2016;30:311–7. https://doi.org/10.11607/ofph.1674.
[157] van der Meulen MJ, Lobbezoo F, Aartman IHA, Naeije M. Self-reported oral parafunctions and pain intensity in temporomandibular disorder patients. J Orofac Pain 2006;20:31–5.
[158] Alona E-P, Amit S, Khalil M, Ilana E. Temporal patterns of bruxism behaviors: multiple day recording with portable electromyography. Sci Rep 2026;16:1046. https://doi.org/10.1038/s41598-025-30704-z.
[159] Temporomandibular Disorders in a Tertiary Clinic: Associations with Pain, Chronicity, sleep versus awake bruxism, and psychological Factors-a retrospective study - PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/41607328/ (accessed on 21 April 2026).].
[160] Wahlund K. Temporomandibular disorders in adolescents. Epidemiological and methodological studies and a randomized controlled trial. Swed Dent J Suppl 2003:2–64. inside front cover.
[161] Firmani M, Reyes M, Becerra N, Flores G, Weitzman M, Espinosa P. Sleep bruxism in children and adolescents]. Rev Chil Pediatr 2015;86:373–9. https://doi.org/10.1016/j.rchipe.2015.05.001.
[162] Wang J-J, Jin A-H, Hu L-M, Tu X-W, Huang X-P, Mo L-C. Sleep duration and overactive bladder syndrome in US adults: a propensity score matching cohort study using NHANES 2005-2018. Front Neurol 2025;16:1537796. https://doi.org/10.3389/fneur.2025.1537796.
[163] The association between temporomandibular disorders signs and symptoms, bruxism, and health variables: a cross-sectional study. PubMed Available online: https://pubmed.ncbi.nlm.nih.gov/39520496/. [Accessed 21 April 2026].
[164] Inchingolo F, Inchingolo AM, Malcangi G, De Leonardis N, Sardano R, Pezzolla C, de Ruvo E, Di Venere D, Palermo A, Inchingolo AD, et al. The benefits of probiotics on oral health: systematic review of the literature. Pharmaceuticals 2023;16:1313. https://doi.org/10.3390/ph16091313.
[165] Inchingolo AM, Inchingolo AD, Nardelli P, Latini G, Trilli I, Ferrante L, Malcangi G, Palermo A, Inchingolo F, Dipalma G. Stem cells: present

understanding and prospects for regenerative dentistry. J Funct Biomater 2024; 15:308. https://doi.org/10.3390/jfb15100308.

[166] Barbosa T de S, Miyakoda LS, Pocztaruk R de L, Rocha CP, Gavião MBD. Temporomandibular disorders and bruxism in childhood and adolescence: review of the literature. Int J Pediatr Otorhinolaryngol 2008;72:299–314. https://doi.org/10.1016/j.ijporl.2007.11.006.

[167] Crincoli V, Cannavale M, Cazzolla AP, Dioguardi M, Piancino MG, Di Comite M. Temporomandibular disorders and oral features in idiopathic inflammatory myopathies (IIMs) patients: an observational study. Int J Med Sci 2021;18: 3158–70. https://doi.org/10.7150/ijms.45226.