

Minireview Article

Teaching of Temporomandibular Joint Dysfunction and Orofacial Pain in Undergraduate Dentistry Programs: A Scoping Review

ABSTRACT

Temporomandibular Joint Disorders (TMD) and Orofacial Pain (OFP) represent complex musculoskeletal and neuromuscular conditions that significantly affect patients' quality of life and pose clinical challenges to healthcare professionals. Studies indicate that up to 70% of the population shows signs and symptoms of TMD, with 5-12% requiring treatment due to disabling conditions. Education on TMD and OFP in undergraduate Dentistry programs is crucial for preparing future dentists for accurate diagnosis and management of these conditions. However, gaps in education — often restricted to outdated, mechanistic approaches — undermine comprehensive student training and hinder the implementation of evidence-based practices. This study is a scoping review aiming to analyze and map the literature on TMD and OFP education in undergraduate Dentistry programs. The research was based on articles published in major scientific databases and followed methodological criteria recommended by the Joanna Briggs Institute. Among the 83 initially identified studies, nine were selected for detailed analysis after applying inclusion and exclusion criteria. The results revealed significant variation in pedagogical practices, underscoring the lack of uniformity in TMD education, which is frequently superficial and fragmented. Moreover, the shortage of specialized educators exacerbates educational gaps, leaving students unprepared for adequate TMD and OFP clinical management. The study concludes that urgent curriculum reform is necessary, integrating the latest scientific evidence to promote a biopsychosocial and interdisciplinary approach to teaching these conditions. The formal recognition of TMD and OFP as specialized areas and the implementation of National Curriculum Guidelines to ensure their inclusion in Dentistry programs are essential to preparing future dentists to address the clinical challenges posed by these complex conditions and provide more comprehensive and humanized care.

Keywords: Orofacial Pain; Temporomandibular Joint Dysfunction Syndrome; Dental Schools; Curriculum; Teaching.

1. INTRODUCTION

Temporomandibular Disorders (TMD) and Orofacial Pain (OFP) have long been recognized as complex musculoskeletal and neuromuscular conditions that significantly impact oral health and general well-being. The temporomandibular joint (TMJ) plays a critical role in oral function, and its dysfunction can lead to debilitating pain, limited mandibular movement, and other associated symptoms (McNeill, 1997; Barros et al., 2009; Conti et al., 2012; Choi et al., 2013; Leeuw & Klasser, 2018; AAOP, 2023).

Historically, TMD and OFP were often misunderstood, with early literature attributing their causes primarily to occlusal discrepancies and dental malocclusions. However, advances in pain science and dentistry have shifted the paradigm toward a multifactorial understanding, incorporating biomechanical, psychological, and social determinants. Despite these advancements, TMD education in undergraduate dentistry programs remains inconsistent across different institutions and countries (Ommerborn et al., 2009; Aggarwal et al., 2011; Simm & Guimarães, 2013; Alonso et al., 2014; Machado, Lima, Conti, 2014; Al-Khotani et al., 2015; Magri et al., 2018; Araújo et al., 2019; Heir, 2019; Rahmeier et al., 2021).

The prevalence of TMD-related symptoms is strikingly high, affecting up to 70% of the population, with 5–12% requiring treatment due to persistent or disabling conditions (Sharma et al., 2011; NIH, 2014; Lomas et al., 2018; Conti, 2021). Given this widespread occurrence, there is an urgent need to ensure that dental professionals receive comprehensive training in the assessment, diagnosis, and management of TMD and OFP.

Despite this necessity, studies indicate that educational approaches remain outdated in many dental schools. Curricula often emphasize traditional mechanistic models, neglecting interdisciplinary pain management strategies and psychosocial aspects of pain perception. As a result, many graduating dental students feel inadequately prepared to manage TMD patients in clinical practice (Ommerborn et al., 2009; Aggarwal et al., 2011; Simm & Guimarães, 2013; Alonso et al., 2014; Machado, Lima, Conti, 2014; Al-Khotani et al., 2015; Magri et al., 2018; Araújo et al., 2019; Heir, 2019; Rahmeier et al., 2021).

Management of TMD primarily involves symptom control, with conservative approaches yielding favorable outcomes during the early intervention window. However, patients with chronic orofacial pain, particularly those with comorbid conditions, present a greater challenge to healthcare professionals (Heir, 2019).

Pain is an unpleasant sensory and emotional experience associated with, or resembling, that is linked to actual or potential tissue damage (Dworkin & LeResche, 1992). However, pain is inherently subjective. The experience of pain is influenced not only by the magnitude of the actual or potential injury but also by the individual's emotional state and the context in which the noxious stimulus is received (McCulloch Gallagher & Sandbrink, 2019; Karos et al., 2020; Greene & Manfredini, 2021; Salinas Fredricson et al., 2023).

The lack of uniformity in TMD education results in OFP, prevalent in both primary healthcare and other levels of care, becoming not only a clinical challenge for general dentists but also an economic burden for the country and a psychological obstacle for patients (Wolf et al., 2006; Wolf et al., 2008; Aggarwal et al., 2011). For instance, in Brazil, TMD and OFP were recognized as specialties by the Federal Council of Dentistry (CFO) in 2002 and currently account for 1.1% of dental specialists, including 820 women and 737 men (CFO, 2024). Additionally, the new National Curriculum Guidelines (DCNs) for Dentistry recommend that starting in 2024, programs should structure their curricula based on health conditions or life cycles (Brasil, 2021). This approach considers outcomes, unresolved challenges, emerging demands from the health reality, and changes stemming from scientific advancements and professional practice. Previously focused on uniprofessional treatment, the emphasis now shifts toward quality of life, comprehensive interprofessional care, and timely intervention.

In light of this, this review aims to analyze scientific articles addressing TMD and OFP education and its integration into practice and curricula across all levels of undergraduate Dentistry programs (Miguel et al., 2024).

2. METHODOLOGY

This study employed a scoping review methodology following the guidelines of the Joanna Briggs Institute (JBI) (Aromataris et al., 2024). Scoping reviews are particularly useful for synthesizing evidence in emerging areas where definitions and frameworks are still evolving. This type of review emphasizes the range and scope of existing studies (Coelho et al., 2021; Guedes & Valente, 2023).

3. RESEARCH QUESTION IDENTIFICATION

This review aimed to map the literature on the teaching of Temporomandibular Joint Disorders (TMD) and Orofacial Pain (OFP) in undergraduate Dentistry programs within higher education institutions. From this perspective, the study contributes to understanding the evolution of education in Dentistry and the dynamics of studies within the health education field concerning TMD and OFP. The analysis was guided by two primary research questions:

1. What is the scope of the published literature focusing on TMD and OFP education in undergraduate Dentistry programs?
2. How is TMD and OFP education integrated into undergraduate Dentistry curricula?

The study design was structured using the mnemonic strategy PCC (Population, Concept, and Context) to guide data collection and assist in identifying key topics. This approach, as outlined in the methodology proposed by Aromataris (2024), directed both the search process and the refinement of inclusion and exclusion criteria employed in this review. In the context of dental education, the study examines three critical factors related to the teaching of Temporomandibular Disorders (TMD). The Population (P) consists of professionals, educators, and students in the field of Dentistry, who are directly involved in the dissemination and acquisition of knowledge on TMD. The Concept (C) pertains to the structure and approach of TMD within dental curricula, including the organization of content, depth of coverage, and pedagogical strategies adopted to facilitate learning. Finally, the Context (C) encompasses the teaching methodologies and the level of integration of TMD within higher education institutions, analyzing how the subject is incorporated into academic programs and the instructional techniques employed to enhance comprehension and clinical application. Understanding these factors is essential for evaluating the effectiveness of current educational approaches and identifying areas for improvement in TMD instruction within dental training.

4. SEARCH STRATEGY

The search was conducted across the following databases: ScienceDirect, Virtual Health Library (BVS), PubMed, Latin American and Caribbean Health Sciences Literature (LILACS), Cochrane Library, and Scientific Electronic Library Online (SciELO).

The search terms used, based on the Medical Subject Headings (MeSH) and Health Sciences Descriptors (DeCS) platforms, were: "dentistry AND education AND temporomandibular joint dysfunction syndrome" combined using Boolean operators. Inclusion criteria were studies focusing on TMD and OFP education in undergraduate dentistry programs, published in English, Portuguese, or Spanish.

The search was carried out in July 2024, incorporating gray literature and articles published in Portuguese, English, and Spanish, aiming for maximum comprehensiveness.

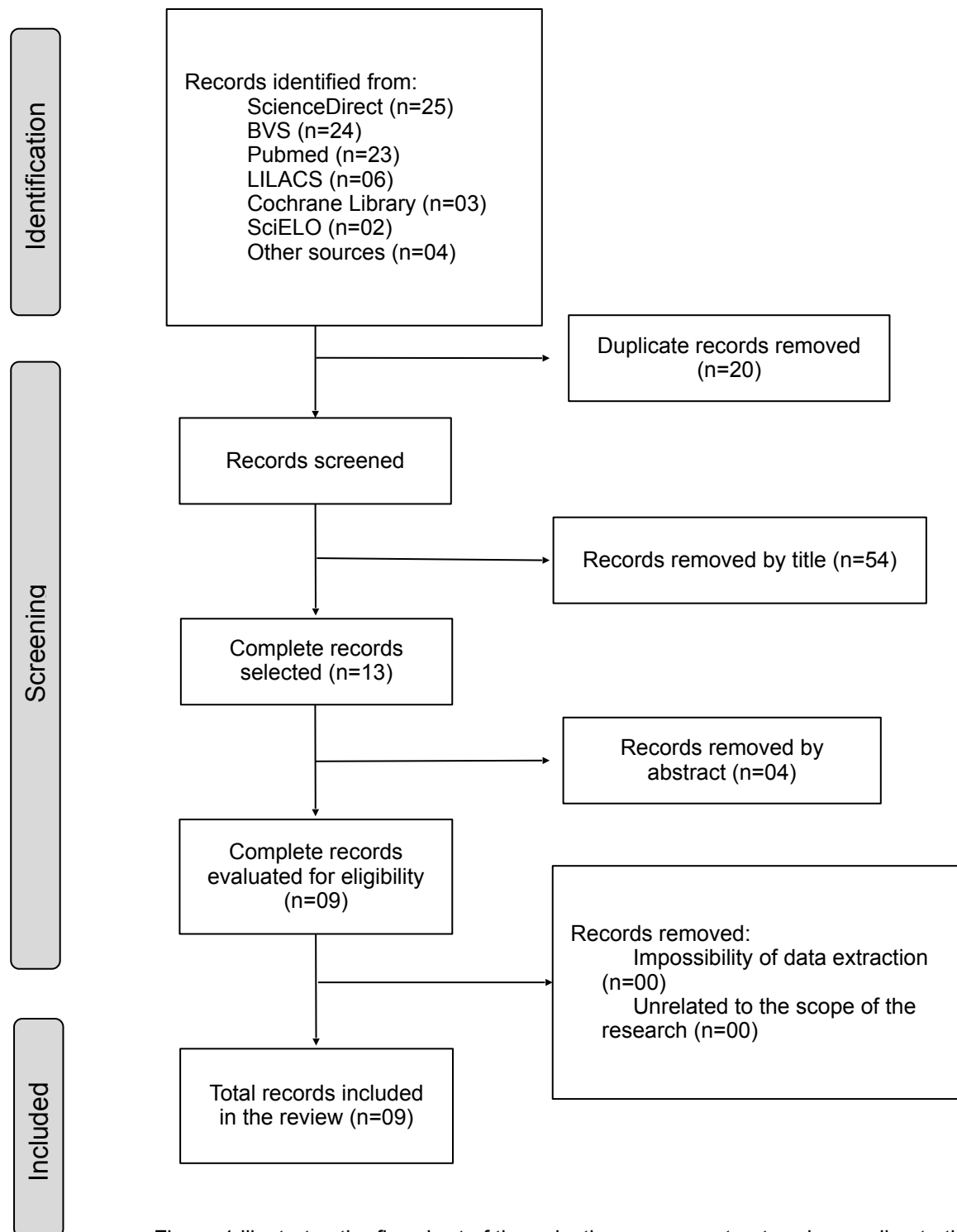


Figure 1 illustrates the flowchart of the selection process, structured according to the PRISMA statement standard (Moher, 2009):

A total of 87 studies were identified across the databases, distributed as follows: 25 from ScienceDirect, 24 from BVS, 23 from PubMed, 6 from LILACS, 3 from Cochrane Library, 2 from SciELO, and 4 from other sources. From these, 9 met the final inclusion criteria after removing duplicates and irrelevant articles. Data were analyzed qualitatively to map common themes and educational trends.

5. SELECTION OF ARTICLES AND THESES

The selection of articles and theses was guided by inclusion and exclusion criteria designed to focus the discussion on the topic. These criteria are outlined in Table 1 below:

Table 1. Inclusion and Exclusion Criteria for the Review

Criteria	Description
Inclusion	Articles and gray literature focusing on the teaching of Temporomandibular Disorders (TMD) and Orofacial Pain (OFP) in undergraduate Dentistry programs; Studies published in English, Portuguese, and Spanish.
Exclusion	Studies where data extraction was not possible.

Source: Rodacoski; Pires; Bellani, 2025.

The search identified 87 studies, of which 20 duplicates were removed using the Rayyan platform (Qatar Computing Research Institute). Among the remaining 67 articles, 54 were excluded after title screening, and four more were excluded after abstract evaluation, leaving nine articles for further review. None of these nine articles were excluded due to data extraction issues or lack of relevance to the research scope. Ultimately, five articles were included in the review, based on consensus among blind and independent reviewers.

In September 2024, the study was registered and approved as an Open-Ended Registration on the Open Science Framework (OSF) platform, with the access code DOI: 10.17605/OSF.IO/5HM4U.

6. RESULTS

The analysis identified key aspects of teaching Temporomandibular Disorders (TMD) and Orofacial Pain (OFP) in undergraduate Dentistry programs. The evidence revealed significant gaps in academic curricula and educational practices adopted by higher education institutions. Out of the 87 initially identified articles, nine were selected for detailed analysis after duplicate removal and the application of inclusion and exclusion criteria. These articles provided a comprehensive overview of the current educational approaches to TMD and OFP in universities within a global context.

The key findings indicate considerable variation in pedagogical practices among higher education institutions. A lack of uniformity in the teaching of Temporomandibular Disorders (TMD) was widely identified, with significant differences in the number of hours

dedicated to the subject and the depth with which the content is addressed. While some universities provide more robust training, others include TMD and Orofacial Pain (OFP) education superficially, often integrating these topics into broader courses, such as Pathology and Preventive Dentistry.

It was observed that Dentistry students demonstrate limited knowledge of TMD and bruxism, with an average accuracy of only 54% on questions related to the topic (Rahmeier et al., 2021). This finding reflects the insufficiency of academic training and suggests that the current content does not adequately prepare students to address these conditions in clinical practice.

Another significant issue identified was the predominance of outdated approaches in curricula, with excessive emphasis on occlusal and biological factors, rather than adopting a more contemporary biopsychosocial perspective. These methodologies were found to be inadequate, perpetuating outdated concepts and failing to align with current guidelines for the management of OFP, which requires a more holistic understanding of the factors involved (Araújo et al., 2019).

Furthermore, the absence of specialized faculty in TMD and OFP was identified as an obstacle to adequate education. The shortage of specialists in academic staff limits universities' ability to provide in-depth training in this area, resulting in fragmented and often insufficient learning experiences.

Thus, the findings of this review highlight the need for curricular reform that incorporates TMD and OFP education more comprehensively, following the latest scientific evidence and pedagogical guidelines that emphasize an interdisciplinary and biopsychosocial approach. The implementation of National Curriculum Guidelines (NCGs) that structure the inclusion of these topics is essential to prepare future dentists to address the clinical challenges posed by these complex conditions.

Table 2. Descriptive Summary of the Analyzed Studies

Authors and Year	Country	Institution	Participants	Description
Aggarwal et al., 2011	United Kingdom	University of Manchester	General and specialist dentists	The study investigated knowledge about chronic OFP. Specialists outperformed general dentists in identifying OFP-related conditions. Significant gaps in understanding the prevalence and specific symptoms highlighted the need for greater curricular inclusion.

Al-Khotani <i>et al.</i> , 2015	Sweden and Saudi Arabia	Karolinska Institutet	Dentists and physicians	<p>The authors compared knowledge about OFP in children and adolescents between Swedish and Saudi professionals. Swedish professionals showed higher agreement with specialists, while Saudi professionals exhibited larger knowledge gaps, emphasizing the need for curriculum modernization.</p>
Alonso <i>et al.</i> , 2014	United States of America	Case Western Reserve University	Third- and fourth-year Dentistry students	<p>The study evaluated students' perceptions of their competence in OFP. Fourth-year students felt more comfortable diagnosing and treating intraoral pain compared to third-year students. However, significant gaps in managing psychogenic pain were identified, highlighting areas for curriculum improvement.</p>
Araújo <i>et al.</i> , 2019	Brazil	Veiga de Almeida University (UVA)	Dentists	<p>A questionnaire on TMD and its relationship with occlusal factors was applied to 2,500 dentists in Piauí, Brazil. Of these, 434 were eligible. Results showed most gained knowledge about occlusion and TMD during their undergraduate studies. Additionally, 41% (181) were treated with TMD, while 63% (277) were referred patients.</p>

Machado; Lima; Conti, 2014	Brazil	University of São Paulo	Not applicable	Conducted a bibliographic review on the Brazilian Coordination for the Improvement of Higher Education Personnel (CAPES) portal and PubMed, analyzing theses and dissertations on TMD and OFP. A total of 731 studies were recorded: 421 master's theses and 195 doctoral dissertations. Additionally, 576 articles involving Brazilian researchers were published between 2000 and 2013, indicating growing interest in the area.
Magri <i>et al.</i> , 2018	Brazil	University of São Paulo	Not applicable	A retrospective, longitudinal, and descriptive study collected data from the Clinical Informatics System of the Ribeirão Preto Faculty of Dentistry, covering TMD and OFP care from 2006 to 2016. Results showed an increase in the number of treated patients, discharges, and education on pain management and self-care, as well as a reduction in referrals to other disciplines, indicating greater diagnostic accuracy.

Ommerborn <i>et al.</i> , 2009	Germany	Heinrich Heine University Düsseldorf	General and specialist dentists	A questionnaire was used with dentists to identify the most common therapies for craniomandibular disorders. The study found occlusal splints to be the most frequently used therapy, followed by physical therapy. Significant differences in treatment practices were observed between general dentists and specialists.
Rahmeier <i>et al.</i> , 2021	Brazil	Federal University of Santa Maria (UFSM)	Dentistry students	A questionnaire with 15 questions (open-ended and multiple-choice) on TMD and bruxism was applied to 20 students from the 7th and 10th semesters at UFSM. The results showed an average of 54% correct answers, revealing limited student knowledge of TMD and bruxism.

<p>Simm; Guimarães, 2013</p>	<p>Brazil</p>	<p>Maringá University Center</p>	<p>Dentistry program coordinators and directors</p>	<p>Questionnaires were applied to coordinators and directors of Dentistry programs in Brazilian schools, collecting data on the number of hours dedicated to teaching pain mechanisms. A total of 53 Dentistry schools participated. Results showed an average of 4,530 hours allocated to the course, with significant variations in the proportion of hours dedicated to teaching OFP and TMD.</p>
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Source: Rodacoski; Pires; Bellani, 2025.

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7. DISCUSSION

A major finding of this review is the urgent need for curriculum reform in TMD and OFP education. Many dental students graduate without sufficient training in diagnosing and managing these conditions, leading to suboptimal patient care.

The analysis of TMD and OFP education in Dentistry programs reveals significant gaps, highlighting the need for a more comprehensive curriculum aligned with contemporary needs in dental practice (Ommerborn et al., 2009; Aggarwal et al., 2011; Simm & Guimarães, 2013; Alonso et al., 2014; Machado, Lima, Conti, 2014; Al-Khotani et al., 2015; Magri et al., 2018; Araújo et al., 2019; Heir, 2019; Rahmeier et al., 2021).

Current training for dentists often perpetuates outdated approaches, focusing primarily on occlusal and somatic factors while neglecting essential biopsychosocial aspects necessary for effectively understanding and managing these complex conditions (Araújo et al., 2019).

Studies from North America and the UK highlight a continued reliance on outdated occlusal theories, with limited incorporation of biopsychosocial approaches to pain management. US dental students often struggle with diagnosing neuropathic and psychogenic pain due to inadequate curriculum exposure (Alonso et al. 2014).

Sweden has been a leader in recognizing TMD as a specialized field, integrating advanced coursework and clinical training into undergraduate programs (Al-Khotani et al., 2016). Germany also incorporates craniomandibular disorder education; however, there remains a gap between undergraduate knowledge and the actual management practices of general practitioners (Ommerborn et al., 2009).

Brazil officially recognized TMD and OFP as a specialty in 2002, but integration into undergraduate curricula remains inconsistent (CFO, 2024). Studies show that while certain universities have adopted comprehensive TMD training, many still treat it as a secondary topic, covered within general pathology or prosthodontics courses (Magri et al., 2018; Araújo et al., 2019).

Studies involving students and practicing dentists, such as the one conducted at UFSM, indicate that a significant portion of students consider their knowledge base insufficient to address TMD disorders and OFP conditions (Rahmeier et al., 2021). Additionally, research conducted in the state of Piauí, Brazil, with dentists, revealed gaps in training, particularly regarding the relationship between TMD and occlusal factors (Araújo et al., 2019). These findings demonstrate that, while many students and dentists have been exposed to these topics during their education, the majority describe their learning as fragmented and insufficient (Rahmeier et al., 2021; Araújo et al., 2019).

A consistent theme across the reviewed articles is the excessive emphasis on biological and somatic approaches in TMD and OFP education, particularly regarding occlusal factors, to the detriment of a holistic understanding that includes psychosocial dimensions (Simm & Guimarães, 2013; Machado et al., 2014; Magri et al., 2018; Araújo et al., 2019; Rahmeier et al., 2021). This bias is also reflected in clinical practice, where outdated treatments, such as occlusal adjustments, are still widely used despite current evidence favoring more effective and less invasive approaches (Magri et al., 2018; Araújo et al., 2019).

Another significant challenge is the shortage of TMD and OFP specialists in the faculty of Dentistry programs. Oftentimes, OFP is addressed superficially within basic science courses, without proper integration into the multidisciplinary approaches essential for comprehensive dental education (Simm & Guimarães, 2013). The lack of specialized faculty limits the ability of universities to provide in-depth training, leaving students unprepared to handle the clinical challenges posed by these conditions.

Recent years have seen important advances, such as the establishment of the Brazilian Society of TMD and OFP, which has worked to systematize and disseminate

knowledge in the field, promote more specialization courses, and encourage academic research on the topic. Moreover, there has been a noticeable increase in academic output and the availability of specialization courses, reflecting a growing interest in and need for specialized training (Magri et al., 2018; Machado et al., 2014).

The experience accumulated at the University of São Paulo (USP) over a decade in treating patients with TMD and OFP demonstrates the importance of educational practices focused on pain management, self-care, and multidisciplinary approaches. While this integrative model has proven effective in managing these conditions, it remains limited to a few centers of excellence and is not yet a reality for most Brazilian universities (Magri et al., 2018).

A global comparison of TMD and OFP education and recognition reveals significant structural differences among the analyzed countries. In Sweden, the formalization of TMD and OFP as a specialty since 1993 and its inclusion in undergraduate curricula ensure robust training for both general practitioners and specialists (Al-Khotani et al., 2016). In Germany, while craniomandibular disorders are included in undergraduate curricula and occlusal splint therapy is widely used, there is still a need to improve undergraduate and postgraduate curricula and offer continuing education to bridge the gap between scientific discoveries and clinical practice (Ommerborn et al., 2014). In the United States and the United Kingdom, despite efforts to integrate OFP into curricula, gaps persist, particularly in areas such as neuropathic and psychogenic pain, as well as in standardization and interdisciplinarity (Alonso et al., 2014; Aggarwal et al., 2011). In Saudi Arabia, the absence of specialty recognition and the limited inclusion of OFP in undergraduate education result in deficient training, with an exclusive focus on surgical modalities and neglect of essential conservative approaches. Across all contexts, challenges in managing complex conditions like chronic OFP underscore the need to modernize curricula, enhance interdisciplinarity, and promote continuing education.

Thus, there is a pressing need for curricular reform that incorporates the latest guidelines for TMD and OFP education. Dentistry programs must adopt an interdisciplinary and biopsychosocial approach, equipping students with a comprehensive and effective understanding of the various dimensions of managing these disorders. Furthermore, curricula must be updated according to the latest scientific evidence, fostering the development of competencies that enable more comprehensive and patient-centered treatment.

The implementation of National Curriculum Guidelines (NCGs) that integrate these advancements and promote high-quality training in TMD and OFP is crucial for adequately preparing future dentists. Through a restructured education, it will be possible to address current deficiencies and improve the quality of dental care.

Integrating an interdisciplinary approach involving dentistry, psychology, physiotherapy, and neurology could significantly improve educational outcomes. Countries such as Sweden and Germany have successfully implemented interdisciplinary models in their dental curricula.

Beyond undergraduate training, continuing education programs play a crucial role in keeping practitioners updated on the latest developments in TMD management. Workshops, certification courses, and clinical residencies should be encouraged to address knowledge gaps.

8. CONCLUSIONS

This review underscores significant deficiencies in the education of Temporomandibular Disorders (TMD) and Orofacial Pain (OFP) within undergraduate dentistry programs. These deficiencies stem from the absence of standardized curricula, insufficient clinical exposure, and the persistence of outdated, mechanistic teaching models that fail to align with contemporary scientific evidence. Despite the increasing recognition of

TMD and OFP as critical components of dental practice, many institutions still struggle to incorporate comprehensive, evidence-based training into their curricula.

A primary issue identified is the inconsistency in knowledge acquisition among students due to the lack of dedicated coursework on TMD. In many programs, TMD and OFP topics are covered sporadically within broader courses such as general pathology, prosthodontics, or occlusion, rather than being treated as distinct subjects requiring specialized instruction. This fragmented approach limits students' ability to develop a thorough understanding of the complex, multifactorial nature of these conditions. Moreover, students often graduate with minimal exposure to patients suffering from TMD and OFP, which further exacerbates their lack of clinical competence. Without structured, hands-on experience, the transition from theoretical knowledge to practical application remains a significant challenge.

Another critical barrier is the scarcity of educators with specialized expertise in TMD and OFP. The limited number of faculty members with advanced training in these areas restricts the depth and quality of instruction, resulting in inadequate preparation for future dental professionals. This shortage of qualified educators also means that many institutions rely on outdated teaching models, emphasizing occlusal and biomechanical factors while neglecting the psychological and social dimensions of pain. The persistence of such outdated paradigms leads to a limited understanding of modern pain management strategies, thereby hindering the adoption of a more holistic, patient-centered approach.

Addressing these educational shortcomings requires the implementation of standardized curriculum guidelines that explicitly integrate TMD and OFP into dental training. Such guidelines should promote a multidisciplinary and biopsychosocial framework, ensuring that students develop the competencies necessary to diagnose and manage these conditions effectively. An interdisciplinary approach involving dentistry, psychology, physiotherapy, and neurology would provide a more comprehensive educational foundation, enabling future dentists to adopt evidence-based strategies that reflect the latest advancements in pain science and clinical practice.

The field of dentistry is currently undergoing a paradigm shift from mechanistic, symptom-based treatment models to a more holistic, patient-centered approach that considers biological, psychological, and social determinants of health. In this context, curriculum reform and specialized training are crucial for equipping dental professionals with the skills required to manage the complexities of TMD and OFP effectively. The integration of modern pain science, updated diagnostic criteria, and non-invasive treatment modalities should become fundamental components of dental education.

To bridge the current gaps in TMD and OFP education, dental schools must adopt innovative, evidence-based teaching methodologies, enhance clinical training opportunities, and prioritize faculty development programs. Additionally, continuing education and postgraduate specialization programs should be promoted to ensure that practicing dentists remain updated on advancements in TMD and OFP management.

Future research should focus on evaluating the impact of curriculum reforms on clinical outcomes, identifying best practices for teaching TMD and OFP, and exploring new methods for integrating interdisciplinary training into dental education. Studies assessing how curriculum changes influence patient care and professional competency will be instrumental in shaping the next generation of dental education policies.

In conclusion, the findings of this review emphasize the urgent need for academic reform in the education of TMD and OFP. By addressing these deficiencies, future generations of dentists will be better equipped to diagnose, manage, and treat patients with these conditions, ultimately leading to improved patient outcomes and a higher standard of dental care. Implementing structured, evidence-based educational strategies will not only enhance students' competence but also contribute to the broader goal of improving pain management within dental practice.

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