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CURRENT PERSPECTIVES ON DIAGNOSIS AND PAIN MANAGEMENT OF TEMPOROMANDIBULAR DISORDERS: A LITERATURE REVIEW

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ABSTRAK

Temporomandibular Disorder (TMD) merupakan salah satu kondisi nyeri orofasial kronis yang paling umum, yang melibatkan sendi temporomandibular (TMJ), otot-otot mastikasi, dan struktur di sekitarnya. TMD memiliki etiologi multifaktorial dan dapat berdampak negatif terhadap kualitas hidup dengan menyebabkan nyeri, keterbatasan gerakan mandibula, bunyi sendi, serta gangguan fungsi. Tinjauan literatur ini bertujuan untuk mengevaluasi bukti terkini mengenai efektivitas berbagai pendekatan manajemen nyeri untuk TMD. Metode penelitian ini meninjau artikel ilmiah yang dipublikasikan dalam lima tahun terakhir dari jurnal seperti Journal of Clinical Medicine, Journal of Oral Rehabilitation, BMC Oral Health, serta publikasi terkait lainnya dari berbagai basis data ilmiah nasional dan internasional dengan kata kunci yang berkaitan dengan gangguan TMJ dan manajemen nyeri. Artikel yang dipilih meliputi randomized controlled trials (RCTs), double-blind trials, controlled clinical trials, crossover trials, pilot studies, prospective studies, narrative reviews, dan systematic reviews. Hasil dan pembahasan menunjukkan bahwa pendekatan konservatif dan multidisiplin tetap menjadi strategi penatalaksanaan yang paling efektif untuk TMD. Terapi manual yang dikombinasikan dengan latihan terapeutik secara konsisten meningkatkan penurunan nyeri, mobilitas rahang, dan fungsi mandibula. Modalitas fisik seperti low-level laser therapy (LLLT), pulsed electromagnetic field therapy (PEMF), dan terapi ultrasound juga menunjukkan hasil yang bermanfaat. Terapi farmakologis dan injeksi botulinum toxin tipe A dapat memberikan manfaat tambahan pada kasus tertentu. Kesimpulan: terapi kombinasi yang melibatkan rehabilitasi fisik, edukasi pasien, dan dukungan manajemen farmakologis tampaknya memberikan manfaat klinis terbesar bagi pasien dengan TMD.

Kata kunci: *gangguan temporomandibular, sendi temporomandibular, manajemen nyeri, terapi manual, fisioterapi*

ABSTRACT

Temporomandibular Disorder (TMD) is one of the most common chronic orofacial pain conditions involving the temporomandibular joint (TMJ), masticatory muscles, and surrounding structures. TMD has a multifactorial etiology and may negatively affect quality of life by causing pain, limited mandibular movement, joint sounds, and functional impairment. This literature review aimed to evaluate recent evidence regarding the effectiveness of various pain management approaches for TMD. This study methods reviewed scientific articles published within the last five years from journals including the Journal of Clinical Medicine, Journal of Oral Rehabilitation, BMC Oral Health, and other related publications from various national and international scientific databases with keywords related to TMJ disorders and pain

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management. Selected articles include randomized controlled trials (RCTs), double-blind trials, controlled clinical trials, crossover trials, pilot studies, prospective studies, narrative reviews, and systematic reviews. Results and Discussions demonstrated that conservative and multidisciplinary approaches remain the most effective management strategies for TMD. Manual therapy combined with therapeutic exercise consistently improved pain reduction, jaw mobility, and mandibular function. Physical modalities such as low-level laser therapy (LLLT), pulsed electromagnetic field therapy (PEMF), and ultrasound therapy also showed beneficial outcomes. Pharmacological therapy and botulinum toxin type A injections may provide additional benefits in selected cases. Conclusion: combination therapy involving physical rehabilitation, patient education, and supportive pharmacological management appears to provide the greatest clinical benefit for patients with TMD.
Keywords: *temporomandibular disorder, temporomandibular joint, pain management, manual therapy, physiotherapy*

INTRODUCTION

Temporomandibular Disorder (TMD) is a general term referring to disorders involving the temporomandibular joint (TMJ), characterized by craniofacial pain affecting the joint, masticatory muscles, or muscles innervating the head and neck. TMD is one of the most common chronic orofacial pain conditions and may negatively affect patients' quality of life. Globally, the prevalence of TMJ disorders is estimated to affect approximately 34% of the world population, with geographic variations reported across regions, including Asia (33%), South America (47%), North America (26%), and Europe (29%). Based on age distribution, TMJ disorders are most frequently observed in individuals aged 18–60 years (41%), followed by individuals aged <18 years (27%) and those aged >60 years (36%) (Grzegorz et al., 2024). The prevalence of TMD is significantly higher in women than in men, with a female-to-male ratio of 5:1, and its occurrence tends to increase with age (Blanca et al., 2023).

TMD has a multifactorial etiology. The most commonly reported contributing factors among patients with temporomandibular disorders include parafunctional habits such as clenching (60%) and bruxism (30%), history of orthodontic treatment (20%), third molar extraction (19%), general dental treatment (14%), jaw trauma (6%), tracheal intubation (4%), and orthognathic surgery (1%) (Giuseppe et al., 2023).

In TMD, twelve clinical signs and symptoms may be identified, including arthralgia, myalgia, local myalgia, myofascial pain, myofascial pain with referral, four types of disc displacement disorders (disc displacement with reduction, disc displacement with intermittent locking, disc displacement without reduction with limited opening, and disc displacement without reduction without limited opening), degenerative joint disease, subluxation, and headache attributed to TMD (Schiffman et al., 2023). Among these manifestations, the most frequently reported symptoms are TMJ clicking sounds (13.26%), TMJ pain (12.49%), and tension of the masticatory muscles (12.15%). The duration of symptoms commonly ranges from 1–5 years to more than 5 years (David et al., 2023).

TMD is considered one of the leading causes of non-dental orofacial pain. Mandibular movement requires coordinated interaction between the muscles and joints to maximize function while minimizing damage to surrounding structures. The temporomandibular joint possesses unique structural characteristics, consisting of two joints separated by an articular disc located between the mandibular condyle and the temporal bone. The inferior joint, situated between the mandibular condyle and the articular disc, primarily performs rotational or hinge

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movements, whereas the superior joint, located between the temporal bone and the articular disc, mainly facilitates translational or gliding movements (Han Qin et al., 2024).

Pain arising from any joint structure, including the TMJ, is referred to as arthralgia. Such pain originates from the articular surfaces when the joint is subjected to muscular loading. Arthralgia therefore arises from nociceptors located within the soft tissues surrounding the joint. Three periarticular tissues contain these nociceptors: the discal ligaments, capsular ligaments, and retrodiscal tissues (Flavia Penteado et al., 2020). When these ligaments are stretched or the retrodiscal tissues are compressed, nociceptors transmit pain signals that are perceived as joint pain. Patients are generally unable to distinguish among these anatomical structures; thus, stimulation of nociceptors in any of these tissues is interpreted as TMJ pain. Activation of nociceptors also produces inhibitory effects on the muscles responsible for mandibular movement. Consequently, sudden and unexpected pain immediately halts mandibular movement through a nociceptive reflex mechanism. In cases of chronic pain, mandibular movement becomes limited and more deliberate due to protective co-contraction mechanisms (Hye-Min Ju et al., 2021).

Based on these findings, many patients require adequate medical management for more complex TMD conditions. Temporomandibular joint disorders may interfere with daily activities; however, accurate diagnosis accompanied by appropriate therapeutic interventions may help reduce pain, improve jaw function, and enhance patients' quality of life. Various therapeutic approaches have been proposed for the management of TMD symptoms, including self-care measures at home (such as compress application, dietary modification, relaxation techniques, and limiting excessive mouth opening), patient education, physiotherapy, pharmacological therapy including analgesics, anti-inflammatory drugs, and muscle relaxants, occlusal appliances, prosthodontic rehabilitation, and surgical intervention in severe cases (Wan et al., 2025).

Along with the rapid advancement of science and technology in dentistry, numerous recent studies have been conducted to evaluate the effectiveness and development of therapeutic approaches for TMD pain management. Therefore, this study aims to review and analyze current scientific literature regarding the development and effectiveness of various pain management strategies for TMD. Through this literature review, it is expected that a comprehensive scientific overview of the latest effective therapies can be obtained, thereby providing an evidence-based foundation for determining more optimal approaches in the management of TMD.

RESEARCH METHODS

Examination of the temporomandibular joint (TMJ) begins with structured anamnesis and comprehensive physical examination to establish an accurate diagnosis of Temporomandibular Disorder (TMD). Anamnesis is directed toward identifying the chief complaint, onset and duration of symptoms, pain characteristics, aggravating and relieving factors, parafunctional habits such as bruxism and clenching, history of trauma, previous dental or orthodontic treatment, and psychosocial factors that may contribute to TMD symptoms. Clinical evaluation generally follows the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD). Physical examination includes assessment of pain location, mandibular movement, maximum mouth opening, interincisal relationship, deviation during jaw movement, and palpation of the TMJ and masticatory muscles to evaluate tenderness, muscle spasm, clicking, or crepitation during mouth opening and closing.

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Supporting investigations such as panoramic radiography, magnetic resonance imaging (MRI), and cone beam computed tomography (CBCT) are frequently used to support clinical findings and confirm the diagnosis. Panoramic radiography allows visualization of the jaws, dentition, and TMJ structures in a single image and is commonly used as an initial radiographic examination. MRI is considered the gold standard for evaluating soft tissue structures of the TMJ, including the articular disc, ligaments, joint effusion, and inflammatory changes. Meanwhile, CBCT provides detailed three-dimensional visualization of osseous structures and is useful for detecting degenerative bony changes, condylar erosion, osteophyte formation, cortical abnormalities, and joint remodeling that may not be clearly visible on conventional radiographs.

This literature review analyzed recent scientific articles related to TMD, including studies discussing prevalence, clinical manifestations, diagnostic methods, etiology, and therapeutic management. The reviewed literature consisted mainly of randomized controlled trials (RCTs), prospective studies, pilot studies, review articles, systematic reviews, and meta-analyses, taken from the last five years. The findings from the selected studies were systematically analyzed and are summarized in the following table.

RESULT AND DISCUSSION

Result

A total of 20 studies that met the inclusion criteria were analyzed in this literature review. The characteristics and main findings of the included studies are presented in Table 1. The reviewed articles investigated various pain management interventions for *temporomandibular disorders* (TMD), including manual therapy, therapeutic exercise, *low-level laser therapy* (LLLT), *botulinum toxin type A* (BoNT-A) injection, magnetic stimulation, oral appliance therapy, and pharmacological treatment. As shown in Table 1, most studies reported positive outcomes in reducing pain intensity and improving mandibular function. Manual therapy combined with therapeutic exercise consistently demonstrated superior effectiveness compared with single-modality interventions. Several randomized controlled trials reported significant improvements in pain reduction, jaw mobility, and functional outcomes when manual therapy was incorporated into conventional treatment programs.

In addition, studies evaluating physical therapy modalities, such as LLLT, *extremely low-frequency magnetic field* (ELF-MF), and *pulsed electromagnetic field* (PEMF) therapy, demonstrated favorable effects on pain relief and functional recovery. These interventions were generally considered safe and effective non-invasive treatment options for patients with TMD. The findings summarized in Table 1 also indicate that BoNT-A injections may provide beneficial effects in managing chronic myofascial TMD, particularly in reducing pain intensity and tenderness. However, the magnitude and duration of treatment effects varied across studies. Furthermore, oral appliance therapy and pharmacological interventions were found to contribute to symptom improvement, especially when combined with other conservative treatment approaches. Overall, the evidence presented in Table 1 suggests that multimodal treatment strategies integrating manual therapy, therapeutic exercise, physical therapy modalities, and conservative management approaches provide the most favorable outcomes for TMD pain management. These interventions not only reduce pain but also improve jaw function and patients' quality of life.

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Table 1. Results of Literature Study

No.	Author (Year)	Study Design	Intervention	Main Findings
1	Barone et al. (2021)	Controlled clinical trial	Rhythmic TMJ mobilization	Provided short-term therapeutic benefits in TMD patients.
2	Gębska et al. (2023)	Randomized controlled trial	Therapeutic exercise, massage therapy, and PIR	Combined manual therapy and exercise were effective; massage therapy showed greater benefits than PIR.
3	Rezaie et al. (2022)	Randomized controlled trial	TMJ and cervical manual therapy	Improved pain relief and jaw function.
4	Oliveira-Souza et al. (2024)	Randomized controlled trial	Neck motor control training	Reduced pain and improved quality of life.
5	Javed et al. (2024)	Randomized clinical trial	PIR versus Bowen's therapy	Both were effective, but PIR showed superior outcomes.
6	Babiloni et al. (2024)	Randomized controlled trial	Repetitive transcranial magnetic stimulation (*rTMS*)	Produced slight short-term pain reduction.
7	Serrano-Hernanz et al. (2023)	Randomized clinical trial	Pressure Release Technique (PRT)	Improved pain and functional outcomes.
8	Kubala et al. (2022)	Prospective clinical study	ELF-MF and LED therapy	Reduced pain and improved patient comfort.
9	Friscia et al. (2024)	Prospective clinical study	PEMF therapy after orthognathic surgery	Reduced postoperative pain and swelling.
10	Shah et al. (2024)	Randomized controlled trial	Manual therapy combined with physical therapy	More effective than physical therapy alone.
11	Bachani et al. (2025)	Pilot study	Stabilization splint with therapeutic exercise	Improved jaw function and reduced TMD symptoms.
12	Sood (2025)	Narrative review	Non-invasive physiotherapy interventions	Effective in reducing pain and improving jaw function.
13	Canales et al. (2022)	Controlled clinical trial	BoNT-A injection	Provided long-term pain relief in persistent MFP-TMD.
14	Rezazadeh et al. (2022)	Randomized clinical trial	BTX-A versus placebo	Improved TMD symptoms, although differences were not always significant.
15	Kim et al. (2023)	Pilot study	BoNT/A injection	Reduced tenderness but did not improve maximum mouth opening.
16	Canales et al. (2021)	Randomized controlled trial	BoNT-A and oral appliance therapy	Both interventions significantly reduced pain and disability.

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No.	Author (Year)	Study Design	Intervention	Main Findings
17	Nambi et al. (2021)	Randomized controlled trial	LLLT combined with physiotherapy	Effective for TMJ pain and orofacial myalgia management.
18	Mohammed et al. (2025)	Randomized clinical trial	LLLT 635 nm	Reduced pain and improved jaw function.
19	Sulaiman et al. (2025)	Controlled clinical trial	LLLT 635 nm	Reduced pain and improved quality of life.
20	Dammling et al. (2022)	Narrative review	Pharmacological therapy	Beneficial for pain reduction and functional improvement, especially when combined with conservative treatment.

Discussion

Based on the reviewed literature, various approaches have been developed for the management of temporomandibular disorders (TMD), with most studies demonstrating positive outcomes in reducing pain and improving mandibular function. Conservative and non-invasive therapies remain the primary treatment modalities because they are relatively safe, effective, and associated with minimal side effects. The majority of studies included in this review reported improvements in pain intensity, maximum mouth opening, jaw mobility, muscle activity, and quality of life following therapeutic intervention.

Manual therapy and exercise therapy were among the most frequently investigated interventions and consistently demonstrated beneficial effects in patients with TMD. Studies by Gębska et al. (2023), Rezaie et al. (2022), and Shah et al. (2024) showed that combining manual therapy with therapeutic exercises resulted in greater pain reduction and improvement in jaw mobility compared with exercise therapy alone. These findings suggest that manual therapy may reduce muscle hyperactivity, improve joint mobility, and decrease musculoskeletal tension associated with TMD. Furthermore, cervical interventions were also found to contribute positively to treatment outcomes, indicating the close anatomical and functional relationship between the cervical region and the temporomandibular joint.

Several physical modalities such as low-level laser therapy (LLLT), pulsed electromagnetic field therapy (PEMF), repetitive transcranial magnetic stimulation (rTMS), ultrasound therapy, and extremely low-frequency magnetic field therapy also demonstrated therapeutic benefits. Studies by Mohammed et al. (2025) and Sulaiman et al. (2025) reported that LLLT effectively reduced pain intensity and improved mouth opening in patients with TMD. Similarly, Friscia et al. (2024) found that PEMF therapy reduced postoperative pain and swelling following orthognathic surgery. However, not all physical modalities demonstrated long-lasting effects. Babiloni et al. (2024) observed only mild and temporary pain reduction following rTMS therapy. These findings indicate that although physical modalities may provide symptomatic relief, the duration and consistency of their therapeutic effects may vary depending on the treatment protocol and patient characteristics.

Botulinum toxin type A (BoNT-A) therapy has also gained attention as a potential treatment for myofascial TMD pain. Studies by Canales et al. (2022) and Kim et al. (2023) demonstrated significant reductions in pain intensity, muscle tenderness, and headache symptoms following BoNT-A injections. Nevertheless, other studies such as Rezazadeh et al. (2022) reported no statistically significant differences between BoNT-A and placebo injections for some clinical outcomes. These inconsistent findings suggest that although BoNT-A may

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benefit selected patients, further studies with larger sample sizes and standardized protocols are still required to determine its long-term effectiveness and safety.

Pharmacological therapy continues to play an important role in TMD management, particularly for pain control and inflammation reduction. According to Dammling et al. (2022), nonsteroidal anti-inflammatory drugs (NSAIDs) and muscle relaxants remain common first-line medications for TMD treatment. Other medications such as antidepressants, anticonvulsants, and anxiolytics may also be beneficial in chronic or complex cases. However, pharmacologic therapy is generally used as part of a multidisciplinary approach rather than as a standalone treatment because prolonged medication use may increase the risk of adverse effects and drug dependency.

Psychosocial factors were also highlighted in several studies included in this review. Anxiety, depression, sleep disturbances, pain catastrophizing, and reduced quality of life were commonly associated with chronic TMD pain. Studies evaluating manual therapy, exercise therapy, and BoNT-A injections reported improvements not only in physical symptoms but also in psychosocial outcomes. These findings support the biopsychosocial model of TMD, emphasizing that effective management should address both physical and psychological aspects of the disorder.

Despite the promising outcomes reported in the reviewed studies, several limitations were identified. Many studies involved relatively small sample sizes, short follow-up periods, and heterogeneous treatment protocols. Variations in diagnostic criteria, intervention duration, and outcome measurements also make direct comparison between studies difficult. Therefore, additional well-designed randomized controlled trials with larger populations and standardized methodologies are necessary to establish stronger evidence regarding the most effective TMD pain management strategies.

Overall, the findings of this literature review suggest that conservative and multidisciplinary approaches remain the most effective strategies for managing TMD pain. Combination therapies involving manual therapy, therapeutic exercise, physical modalities, patient education, and pharmacological support appear to provide the greatest clinical benefits. Future research should focus on developing standardized treatment protocols and evaluating the long-term effectiveness of emerging therapies for temporomandibular disorders.

CONCLUSION

The findings of this literature review indicate that the management of temporomandibular disorders (TMD) has developed considerably through the use of various conservative and minimally invasive therapeutic approaches. Most reviewed studies demonstrated that these interventions were effective in reducing pain intensity, improving mandibular mobility, and enhancing patients' functional abilities and quality of life. Among the available approaches, combination therapies, particularly manual therapy accompanied by therapeutic exercises and patient education, tended to provide more consistent and favorable clinical outcomes than single-treatment modalities.

Adjunctive therapies such as low-level laser therapy, electromagnetic therapy, pharmacological management, and botulinum toxin injections also showed potential benefits in selected patients, although the effectiveness and duration of therapeutic effects varied among studies. These findings suggest that TMD management should not rely on a single intervention, but rather on a comprehensive treatment approach tailored to the patient's clinical condition, functional limitations, and psychosocial factors. Nevertheless, the currently available evidence still presents several limitations, including small sample populations, heterogeneous

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methodologies, and limited long-term follow-up. Therefore, future research involving larger randomized controlled trials and standardized treatment protocols is still necessary to strengthen the scientific evidence regarding the most effective and sustainable therapeutic strategies for temporomandibular disorders.

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