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# General approaches and surgical treatment on the temporomandibular joint dysfunctions: a systematic review

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## Abstract

**Introduction**: Temporomandibular dysfunction (TMD) encompasses a group of disorders of the masticatory system, broadly divided into muscle conditions and those that affect the temporomandibular joint (TMJ). TMD is a common condition whose signs appear in up to 60 to 70% of the population. The peak incidence is observed in adults aged 20 to 40 years. Orofacial pain is a common presentation in general practice contexts. For most patients, a conservative approach to managing TMD should be adopted. Up to 40% of symptomatic patients have spontaneous resolution of their symptoms without treatment, and 14 and 50-90% of patients have relief with conservative therapy. **Objective:** To present the main current considerations on temporomandibular dysfunctions, through a systematic literature review. **Methods:** The present study followed a model of systematic literature review presenting and discussing case series, prospective, retrospective, randomized, double-blind, placebo-controlled trials in humans with a publication time of the last ten years were selected and analyzed, with a total of 15 articles, following the rules of PRISMA. **Major findings and conclusion:** TMJ can be affected by infectious and inflammatory processes, vitamin or hormone deficiencies, and changes in shape caused by trauma or parafunction. Also, chewing teeth and muscles may be involved in common pathological manifestations that together constitute the symptoms of TMD. TMD is multifactorial, being associated with muscle hyperactivity, trauma, emotional stress, malocclusion, and numerous other predisposing, precipitating, or prolonged factors of this condition. The occlusal plates are used as a reversible therapy, to temporarily promote an orthopedically more stable joint position and provide a more adequate muscular function. They can be used as protection for teeth and support structures against abnormal forces or of great intensity and duration.

**Keywords:** Temporomandibular Dysfuctions. Temporomandibular Joint. Orofacial pain. Clinical diagnosis. Surgical treatments.

## Introduction

Temporomandibular dysfunction (TMD) encompasses a group of disorders of the masticatory system, broadly divided into muscle conditions and those that affect the temporomandibular joint (TMJ) [1]. TMD is a common condition whose signs appear in up to 60 to 70% of the population. The peak incidence is observed in adults aged 20 to 40 years. Women are at least four times more likely to suffer from the disorder. Although signs of TMD are common, the reported prevalence of symptomatic disease requiring treatment occurs in only 5% to 12% of the population [2,3]. In general terms, TMD usually refers to pain involving TMJ and adjacent structures, as well as dysfunction of the joint itself [3].

Orofacial pain is a common presentation in general practice contexts [4]. Clinical evaluation and diagnosis of TMD can be achieved in the context of primary care and, in most cases, the disorder can be managed using a conservative approach. Imaging is not essential but

should be considered when symptoms are severe or when there is a history of trauma. In most cases, a conservative therapy test should be offered prior to referral to specialist care [4].

The term TMD has been defined as a collective term that encompasses some clinical problems related to masticatory musculature, TMJ or both. TMD is characterized as a complex picture involving masticatory muscles, TMJ and associated structures; and may present: facial pain, joint pain, and noise, head and neck pain, hypertrophy of the masticatory muscles and limitation of mandibular movements [5]. For most patients, a conservative approach to managing TMD should be adopted. Up to 40% of symptomatic patients have spontaneous resolution of their symptoms without treatment, 14 and 50-90% of patients have relief with conservative therapy. For the general practitioner, non-pharmacological and pharmacological treatments represent the main options available [5].

The most common complaint of patients with functional disorders of the masticatory apparatus is muscle pain, associated with functional activities and that is aggravated by manual palpation or functional manipulation of muscles [6]. There is a consensus in the current literature that this etiology would be multifactorial, with contributing etiological factors that could be predisposing, initiating or perpetuating TMD [7].

The diagnosis of TMD includes the patient's history, clinical examination, and complementary tests, and most of the information for a correct diagnosis is obtained in the patient's anamnesis [7]. There are currently several treatment modalities for TMD, which may be patient education and self-care, behavior modification (including relaxation techniques), medications; physical therapy, stabilizing occlusal plates, occlusal therapy (orthodontics, oral rehabilitation) and surgery. Thus, multidisciplinary therapy would often be indicated, favoring the prognosis when several therapeutic modalities are used together. Studies also show that invasive and irreversible therapies were not superior to conservative and reversible therapies in the long term, so the initial treatment plan should always be started by the use of lower cost and more conservative therapies [8].

Among the conservative and reversible modalities, we have counseling, change in behavioral habits, diaphragmatic breathing, physiotherapy, medications and the use of occlusal plaques [8]. The occlusal plaque is the most popular therapeutic modality for the control of pain in patients with TMD. Its ease of manufacturing and low operating costs, combined with success in about 70.0% to 90.0% of cases, when associated with other therapeutic modalities, may explain its popularity in the dental community [9].

The stabilizing occlusal plaque also called the conventional or Michigan MRI, is the most used because it causes a lower risk of irreversible occlusal alterations to the patient anterior open bite, dental extrusions, pathological migrations [10].

Therefore, the present study aimed to present the main current considerations and surgical treatment of temporomandibular dysfunctions through a systematic literature review.

## Methods

### Study Design

This study followed the international systematic review model, following the PRISMA (preferred reporting items for systematic reviews and meta-analysis) rules. Available at: http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1. Accessed on: 12/20/2024. The AMSTAR 2 (Assessing the methodological quality of systematic reviews) methodological quality standards were also followed. Available at: https://amstar.ca/. Accessed on: 12/20/2024.

### Search Strategy and Search Sources

The literature search process was carried out from November 2024 to January 2025 and developed based on Web of Science, Scopus, PubMed, Lilacs, Ebsco, Scielo, and Google Scholar, covering scientific articles from various periods to the present day. The following descriptors were used in health sciences (DeCS/MeSH): *Temporomandibular Joint. Temporomandibular Dysfuctions. Orofacial pain. Clinical diagnosis. Surgical treatments*, and the Boolean "and" was used between the MeSH terms and "or" between the historical findings.

### Study Quality and Risk of Bias

Quality was classified as high, moderate, low, or very low regarding the risk of bias, clarity of comparisons, precision, and consistency of analyses. The most evident emphasis was on systematic review articles or meta-analyses of randomized clinical trials, followed by randomized clinical trials. Low quality of evidence was attributed to case reports, editorials, and brief communications, according to the GRADE instrument. The risk of bias was analyzed according to the Cochrane instrument by analyzing the Funnel Plot graph (Sample size versus Effect size), using Cohen's test (d).

### Summary of Findings

A total of 120 articles were found and submitted

to eligibility analysis, with 16 final studies selected to compose the results of this systematic review. The listed studies were of medium to high quality (Figure 1), considering the level of scientific evidence of studies such as meta-analysis, consensus, randomized clinical, prospective, and observational. Biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies presented homogeneity in their results, with $X^2$=77.9%>50%. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 20 studies with a high risk of bias and 31 studies that did not meet GRADE and AMSTAR-2.

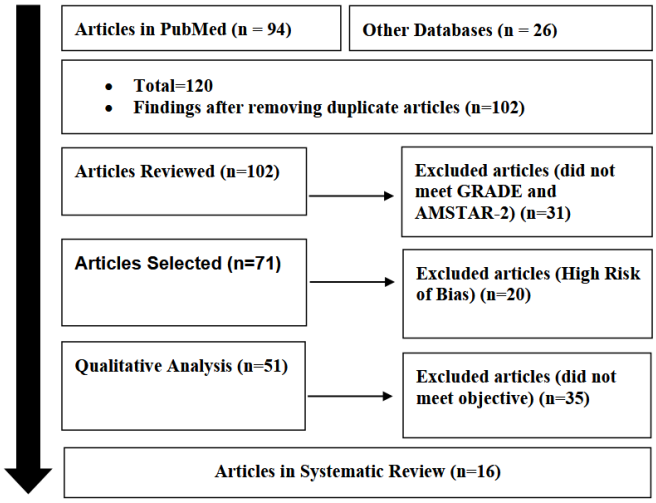


Figure 1. Flowchart showing the article selection process. Source: Own Authorship.

Figure 2 presents the results of the risk of bias of the studies using the Funnel Plot, showing the calculation of the Effect Size (Magnitude of the difference) using Cohen's Test (d). Precision (sample size) was determined indirectly by the inverse of the standard error (1/Standard Error). This graph had a symmetrical behavior, not suggesting a significant risk of bias, both among studies with small sample sizes (lower precision) that are shown at the base of the graph and in studies with large sample sizes that are presented at the top.

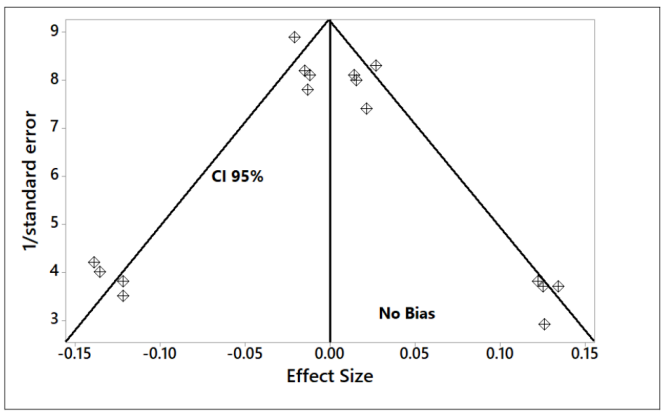


Figure 2. The symmetrical funnel plot suggests no risk of bias among the studies with small sample sizes that are shown at the bottom of the graph. High confidence and high recommendation studies are shown above the graph (n=16 studies).

## Temporomandibular Dysfunction - Major Considerations

The temporomandibular joint (TMJ) is the joint formed by the temporal bone of the skull with the mandible, consisting of the articular disc, retrodiscal tissue, synovial membrane, articular cartilage, articular capsule, and articular surface, formed by the mandible condyle joint and temporal bone fossa. Any problem that interferes with the functioning of this complex system of muscles, ligaments, discs, and bones can result in pathology called TMD [1-6].

In this scenario, TMJ may be affected by infectious and inflammatory processes, vitamin or hormone deficiencies, and changes in shape caused by trauma or parafunction. Also, chewing teeth and muscles may also be involved by common pathological manifestations that together constitute the symptoms of TMD [11-13]. Thus, TMD is defined as functional disorders of the masticatory system, including signs and symptoms, involving the masticatory muscles and their supporting structures and the TMJ itself [13].

In this context, the etiology of TMD is multifactorial, being associated with muscle hyperactivity, trauma, emotional stress, malocclusion and numerous other predisposing, precipitating or prolonged factors of this condition. Several factors can cause TMD [14]. There is no common cause, but trauma may be the main cause of this functional change. TMD may be present in all people, but it is more common in white women, usually in their third decade of life. In addition, TMDs can be divided into muscles when they affect only the chewing muscles and neck; articular, which are characterized by internal disorders of the joint and joint muscles, covering both the musculature and the joint; disc displacement, caused by movement or trauma without borders [14].

In this sense, the symptoms are very subjective and may be linked to other medical problems (depression, otological or rheumatological problems), the dentist is often the last health professional to be sought [15]. Due to the morphological and functional complexity of TMJ, some non-masticatory painful orofacial manifestations of multifactorial etiology are also observed under different aspects, such as neuromuscular, psychological and anatomical factors. Still, arthritis and ankylosis are the pathological changes in TMJ, affecting the bilateral bone structures of women and men over 60 years [15].

In addition, other authors have recommended a thorough clinical examination, as orofacial pain is often confused with other painful conditions such as dental conditions, oral infections, infections caused by otitis and sinusitis, back, neck and muscle pain. chewing and nerves [1].

TMJ is a thermo-arthrodial joint and is formed by the insertion of the mandibular condyle in the glenoid fossa of the temporal bone. It is a complex synovial system composed of two joints separated by the articular disc [2]. It is the most widely used joint in the body3 and allows a wide range of movements needed for chewing, swallowing and communication. The relevant musculature involved in TMD is the primary chewing muscles, including the masseter, temporal, and medial and lateral pterygoid muscles. The TMJ sensory innervation involves branches of the third division of the trigeminal nerve, including the auriculotemporal and masseteric nerves. Importantly, the auriculotemporal nerve also provides some sensory innervation to the temporal region, outer ear, and tympanic membrane and is highly sensitive to pain responses [3].

In this sense, the etiology of TMD is little known but probably multifactorial and includes anatomical, pathophysiological and psychosocial factors [4]. Successful management of the disorder involves identifying and managing these predisposing and contributing factors. Wherever possible, it is important to distinguish between myofascial causes of TMD and intra-articular disorders of the joint itself [5]. Myofascial disorders result from tension, fatigue or spasm of the masticatory muscles, while intra-articular disorders result from mechanical or inflammatory disorders of the joint itself. Musculoskeletal dysfunction is the most common cause of TMD [6-9].

In this context, parafunctional behaviors such as bruxism, teeth grinding, clenching and abnormal posture, stress and anxiety may contribute to pain and masticatory muscle spasm [10]. Cognitive and psychiatric disorders such as depression and anxiety, and autoimmune disorders, fibromyalgia, and other chronic pain conditions are also often associated with TMD and may signal that symptoms may be a component of a more complex regional pain syndrome [11].

Intra-articular causes of TMD include internal joint disorder, osteoarthritis, capsular inflammation, hypermobility, and traumatic injury. Inflammatory conditions, such as rheumatoid arthritis and ankylosing spondylitis, can also lead to internal joint disorders. Articular dislocation of the disc from the normal position is the most common intra-articular cause of TMD. It is important to note, however, that disc displacement is a common finding in the general population and most are asymptomatic. There is minimal evidence that occlusion abnormalities contribute to TMD [11].

## Signals and Symptoms

There are many signs and symptoms that may be related to TMD. Among the most common are a pain in the chewing muscles and / or TMJ. The main symptoms presented were TMJ pain, headache, cracking, earache, joint pain, facial pain, functional limitation, chewing pain, ringing in the ear and jaw pain [12].

In this sense, the headache also comprises a symptom associated with TMD. It is estimated that 80% of all reported headaches are associated with muscle sources. Therefore, it is understood that head and neck muscle activities probably play an important role in the etiology of many headaches. Thus, treatment aimed at decreasing muscle hyperactivity can have a significant effect on headache reduction [13]. The causes of headache may be constant excitement of the sympathetic nervous system and the mechanism of hormonal response to stress, macro trauma, unilateral chewing, tooth clenching, bruxism, muscle changes resulting from occlusal interference, and disorders of the circulatory system of the muscle [13].

## Differential Diagnosis

Importantly, many orofacial and otological conditions can mimic TMD. On the other hand, the assumption that TMD is the cause of a patient's symptoms may result in a more sinister pathology [14]. TMD is a clinical diagnosis and a complete history of presentation and physical examination should be performed, paying particular attention to the site, onset, character of pain, radiation, duration, and associated symptoms. Usually, patients describe TMJ or jaw pain as the predominant symptom [14].

This pain may refer to the scalp or neck and is usually exacerbated by chewing, yawning or speaking for long periods. Difficulty opening the mouth, clicking, snapping or crackling in the TMJ itself and briefly locking the jaw on opening and closing the jaw are also frequently reported. Orofacial pain not associated with jaw movement may suggest another cause for the patient's symptoms. Headache, particularly tension-type headache, is a common presentation in the primary health care setting, and it is well established that TMD and the primary headache disorder are comorbid diseases [15].

Also, otological symptoms, including earache, tinnitus, ear fullness, vertigo, and subjective hearing impairment, are also reported in patients with TMD. These symptoms are more common in patients with the myofascial disorder than in those with intra-articular disc disorder, possibly because of the shared embryonic

origin of the masticatory muscles and some middle ear structures [14,15].

In addition, physical examination should include complete palpation of the TMJ and chewing muscles, noting any abnormal mandibular movement, tenderness, and signs of bruxism. Normal maxillary opening values are 35 to 45 mm; a value less than 25 mm suggests dysfunction without translation within the joint [13-15]. TMJ examination can be enhanced by placing a finger on the ear canal and palpating the anterior canal wall while the patient opens and closes the mouth. The crackling experienced at this location is related to the rupture of the joint surface and may suggest the presence of osteoarthritis. The use of a stethoscope to elevate the TMJ may be a useful complement to confirm the presence of crackling [10,12].

In this sense, a clicking or clicking sensation when opening the mouth may suggest dislocation of the articular disc. Malocclusion of teeth should be observed if present; However, this does not contribute to TMJ manifestation and orthodontic referral is not recommended for this finding alone [5-7]. In general terms, tenderness caused by TMJ palpation, joint clicking and crackling are signs of intra-articular disturbance, while pain in jaw movement, headache and referred pain are suggestive of a muscle problem. The examination should also include otoscopy to eliminate otological causes, an inspection of the oral cavity and palpation of the neck muscles [8].

Although TMD is widely a clinical diagnosis, imaging can be useful, especially when the history and examination findings are unclear [3]. Plain radiography and computed tomography may reveal severe degenerative joint disease and especially rule out fractures and dislocations as a cause of patient symptoms. Panoramic radiography, including orthopantomogram, is a simple and useful screening tool that should be used at the beginning of diagnosis to rule out common odontogenic causes of facial pain and to assess joint pathology. Ultrasound is not sensitive for the diagnosis of intra-articular osteoarthritis but may be useful in assessing disc position in TMJ disorders [4].

MRI is currently the gold standard for TMD research. The advantage of magnetic resonance imaging is the ability to evaluate soft tissue structures, dislocation of the articular disc and the presence of joint effusion with a high degree of specificity and sensitivity. Given the high cost of magnetic resonance imaging, it is predominantly used in severe treatment situations [5].

Non-pharmacological treatments include patient education and tranquility, jaw rest, mild diet, warm pain compress, and passive stretching exercises [6]. Stretching and jaw exercises can improve range of motion, but not necessarily pain. Given the high degree of association between TMD and cognitive factors, education and tranquility are particularly important, and cognitive behavioral therapy is beneficial for short- and long-term pain management in patients with TMD [6].

Behavioral changes, including improved sleep hygiene, stress reduction, and the elimination of parafunctional habits such as clenching and grinding teeth, are particularly important. The use of occlusal and nonocclusive splints is controversial and the evidence to support their use is inconclusive. They may benefit a select group of patients that severe bruxism and night siege. Referral to a dentist for precise splint adjustment may be considered for these patients, given the cost of occlusal splints [7]. Intramuscular botox injections have been shown to be effective in myofascial causes of TMD pain and tension-type headache. Immobilization of TMJ has no benefit and may actually worsen symptoms due to muscle contractures and fatigue. Physical therapy has been shown to be effective in managing TMD, 20 especially with regard to improving joint range of motion, and referral should be considered in refractory cases [8].

Unless contraindicated, non-steroidal inflammatory drugs represent the first-line pharmacological agents used for acute and chronic TMD-associated pain [9]. Muscle relaxants, such as benzodiazepines, may be useful in patients with recurrent masticatory muscle spasm and chronic bruxism, where relaxation techniques are ineffective. Tricyclic antidepressants such as amitriptyline can be tested as they are often effective in other chronic and regional pain disorders. Drugs have shown to have little or no benefit in the treatment of TMD include tramadol, topical preparations such as diclofenac, selective serotonin reuptake inhibitors, serotonin-norepinephrine reuptake inhibitors, and monoamine oxidase inhibitors. Opioids are not recommended for the treatment of chronic TMD pain [9].

Because of the high concurrency of cognitive and psychosocial factors that affect many patients with TMD, referral to a pain specialist should be considered for those resistant to conservative measures, particularly when the patient's symptoms may be suspected to be part of. of a more complex regional pain syndrome [10]. Referral to a maxillofacial surgeon should be considered in patients who do not respond to conservative treatment, patients with severe TMJ pain and / or dysfunction, and patients with a history of trauma or fracture of the TMJ complex. In addition, patients with persistent or aggravated pain.8 or those with other red flag symptoms with no identifiable source should be referred for specialist care for further

investigation because of rare neoplastic causes such as TMJ fibrosarcoma and chondrosarcoma, as well as malignant diseases of the TMJ parotid, were occasionally diagnosed as TMD. In cases without these symptoms, it is reasonable to test conservative treatment for six to eight weeks before referral [11].

In this sense, two review studies described the management of TMD. Thus, TMD disorders are still being intensely discussed in the literature. Traditionally, attention is mainly devoted to occlusion and its relationship to these disorders. The conclusions reached are often contradictory. Considering the definitions of temporomandibular and craniomandibular dysfunctions/disorders and occlusion, a possible explanation for this controversy can be found in the subsequent methodological problems of the studies. Based on Medline's research of these terms over the past 40 years, related to contemporary terms such as "Evidence-Based Dentistry" and "Evidence Pyramid", these methodological aspects are examined, resulting in recommendations for future occlusal TMD research and therapy [15,16].

## Conclusion

The occlusal plates are used as a reversible therapy, with the purpose of temporarily promoting an orthopedically more stable joint position and providing a more adequate muscular function. They can be used as protection for teeth and support structures against abnormal forces or of great intensity and duration. They have been shown to be successful in the treatment of TMD signs and symptoms, but should not be used as the sole treatment modality. They are palliative devices, which are, they treat symptoms and not the causes of TMD because they are of multifactorial etiology.

## CRediT

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No additional data are available.

## Conflict of Interest

The authors declare no conflict of interest.

## Similarity Check

It was applied by Ithenticate®.

## Application of Artificial Intelligence (AI)

Not applicable.

## Peer Review Process

It was performed.



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