International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

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ARTICLE TITLE	TEMPOROMANDIBULAR JOINT DISORDER - A COMPLEX PROBLEM REQUIRING A MULTIDISCIPLINARY APPROACH - A LITERATURE REVIEW
ARTICLE INFO	Anna Maryńczak, Martyna Mocarska, Anna Orłowska, Katarzyna Strakowska, Laura Opalska, Adrianna Muciek, Jan Mencel, Nicole Nitschke, Anita Krowiak, Karolina Krowiak. (2025) Temporomandibular Joint Disorder - a Complex Problem Requiring a Multidisciplinary Approach - a Literature Review. *International Journal of Innovative Technologies in Social Science*. 3(47). doi: 10.31435/ijitss.3(47).2025.3609
DOI	https://doi.org/10.31435/ijitss.3(47).2025.3609
RECEIVED	20 July 2025
ACCEPTED	24 August 2025
PUBLISHED	05 September 2025
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TEMPOROMANDIBULAR JOINT DISORDER - A COMPLEX PROBLEM REQUIRING A MULTIDISCIPLINARY APPROACH - A LITERATURE REVIEW

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ABSTRACT

Temporomandibular disorder (TMD) encompasses various conditions affecting the masticatory muscles, temporomandibular joints (TMJs), and related structures. Due to the complexity of the etiology, the diagnosis and management of TMD remain a challenge where consensus is still lacking in many aspects. TMD is characterized by a wide range of symptoms - from disorders strictly resulting from impaired joint function, such as restricted jaw movement and joint sounds, to less obvious manifestations including headache, otologic symptoms, and retro-orbital pain. Treatment of TMD requires an individual approach to each patient and includes physiotherapy, dental or orthodontic care, and in some cases pharmacological or surgical treatment.

KEYWORDS

Temporomandibular Joint, Temporomandibular Joint Disorder, Bruxism, Pain

CITATION

Anna Maryńczak, Martyna Mocarska, Anna Orłowska, Katarzyna Strakowska, Laura Opalska, Adrianna Muciek, Jan Mencel, Nicole Nitschke, Anita Krowiak, Karolina Krowiak. (2025) Temporomandibular Joint Disorder - a Complex Problem Requiring a Multidisciplinary Approach - a Literature Review. *International Journal of Innovative Technologies in Social Science*. 3(47). doi: 10.31435/ijitss.3(47).2025.3609

Introduction.

Temporomandibular disorder (TMD) is a multifactorial group of musculoskeletal disorders often with combined etiologies that demand different treatment plans. While pain is the most common reason why patients decide to seek help, TMD is not always painful. Pain is often described by patients as a headache, prompting patients to seek the help of neurologists, surgeons, and ultimately dentists [1]. TMDs are the most common reason for seeking dental care other than dental pain [2]. They are most frequently seen in people aged between 20 and 40 years, and more common in women due to hormonal changes and greater influence of psychosocial factors. Thus, it can be concluded that TMD is a civilization problem, which may escalate due to the increasing pace of life, omnipresent stress, and improper use of the masticatory system [1]. TMDs seem to be biopsychosocial in nature, i.e. caused by several risk factors such as psychosocial, autonomic and genetic factors [3]. Notably, there is evidence that the prevalence of TMD appears to be on the rise in contemporary years [4]. A recent systematic review and meta-analysis in 2021 concluded that the prevalence of TMD was 31% for adults and 11% for children and adolescents [5]. Bruxism is a parafunctional behaviour also prevalent in the population which has a role in TMD [6].

Numerous treatment modalities have been proposed over the years, with some becoming obsolete while others are gaining in popularity [4]. TMD represents a significant and complex health problem, with opinions regarding the appropriate course of management often equivocal.

Due to the complexity of the subject, we aim to highlight the challenges associated with the diagnosis and treatment of TMD. In our study, we also focus on symptoms that are less obvious and not always linked with TMD by many specialists. Such signs include headache and otological manifestations like tinnitus, dizziness, and ear pain. These symptoms significantly diminish the patients' quality of life and may lead to a deterioration in mental health, which in turn can exacerbate TMD - thus creating a vicious cycle of mutually worsening conditions.

The structure and function of the temporomandibular joints

The TMJ is formed by the articulation between the mandible and the temporal bone of the cranium. The mandibular component consists of the condylar process and the condylar neck, while the cranial component comprises the squamous part of the temporal bone, including the glenoid fossa and the articular tubercle [7]. The articulating surfaces are covered by fibrocartilage and separated from each other by an articulating disc (meniscus) [7]. The two joint cavities created by the articulating disc are lined with synovial membranes. These

articulating surfaces, together with the disc and joint cavities, are enclosed within a joint capsule [8]. The joint operates with the support of muscles and ligaments attached to the joint capsule, the condylar neck, and the mandibular body. The TMJ receives its nerve supply from the Mandibular branch (V3) of the Trigeminal nerve. Sensory innervation to the joint is provided by the Auriculotemporal and Masseteric branches, while motor innervation to the muscles of mastication is also carried by V3 [7,8]. TMJ functions as a unit composed of two joints on either side of the skull, connected by a single bone, the mandible. As a result, the two TMJs cannot operate independently. This unique anatomical arrangement is unlike any other in the body, where no other pair of joints is structurally linked to function in such coordinated unison [2]. The movement of the TMJ is distinctive, often described as a ginglymo-arthroidal joint meaning it can perform both hinge and translation movements [2]. Movement of the TMJ is limited by the anatomy of the musculoskeletal framework and the occlusal relationship between the maxillary and mandibular dentition [2].

Risk factors of temporomandibular joint disorders

Macro-trauma refers to incidents that cause head injury, such as accidents, falls, sports-related impacts, forceful intubation, physical abuse, third molar extractions, and prolonged dental procedures. Micro-trauma encompasses awake and sleep bruxism, along with other parafunctional habits like gum chewing, nail-biting, and lip or cheek biting. Trauma can serve as both a predisposing and initiating factor in the onset of TMD [2]. Bruxism may be a risk factor for various adverse oral health outcomes, including masticatory muscle pain, temporomandibular joint pain, and severe tooth wear. Bruxism and TMD can occur independently of each other. Clinical signs of bruxism (parafunction) include cracked teeth, recurrent restoration failures, chipping of incisal edges, wear facets, tooth mobility, masseteric hypertrophy, buccal mucosa ridging, and scalloping of the tongue's lateral border [9,10]. Evidence suggests an association between TMD and various chronic pain conditions. Examples of comorbid pain disorders include fibromyalgia, chronic widespread pain, irritable bowel syndrome, lower back pain, migraine, chronic regional pain syndrome, chronic fatigue syndrome, tension-type headache, chronic pelvic pain, post-surgical pain, and other forms of neuropathic pain [11]. Comorbid conditions that may specifically impact the TMJ include rheumatoid arthritis, juvenile idiopathic arthritis, systemic lupus erythematosus, osteoarthritis, psoriatic arthritis, and neoplasia [12].

Biopsychosocial factors

Apart from physical causes, the association between biopsychosocial factors and TMD has been described. Similar to other chronic pain conditions, such as back pain and headache, it appears that there are those in the population who are at risk for developing symptomatic TMD, and who also share a certain psychological profile and dysfunction [13,14]. Furthermore, in individuals with pre-existing TMD, symptoms may worsen during periods of stress. For instance, recent studies have indicated that lockdowns and social isolation during the COVID-19 pandemic were associated with an increased prevalence of depressive symptoms, stress, and TMD-related pain [15,16]. In particular, a high incidence of exposure to stressful life events and elevated levels of anxiety and stress-related somatic symptoms have been reported in TMD patients.

Diagnosis

The signs and symptoms of TMD can resemble those of other orofacial pain conditions. While an accurate physical diagnosis of the specific type of TMD is valuable for formulating an effective treatment plan, it may not always be straightforward. Obtaining a thorough patient history is a crucial component in diagnosing TMJ disorders [4]. Apart from the chief complaint, inquiries should be made regarding any history of trauma or previous episodes, aggravating factors, such as eating, talking, yawning or spontaneous background pain, and any previous investigations or treatment [4].

While clinical examination is considered the most important process in the diagnosis of TMD, imaging may serve as a valuable adjunct in selected cases [4]. Although plain radiographs such as orthopantomograms provide limited diagnostic information, they are convenient and straightforward to use and help exclude certain differential diagnoses affecting the bony TMJ, including fractures, ankylosis, growth abnormalities, and neoplasms [4]. However, when further information is desired, magnetic resonance imaging is the gold standard for TMJ imaging and is useful in assessing the status of the osseous, as well as the non-osseous structures of the TMJs, such as the masticatory muscles, ligaments and the cartilaginous disc [17]. Cone-beam computed tomography has been used to further assess the osseous structure of the TMJ [18]. Ultrasound has the advantages of being non-invasive, cheap, and widely available in many health institutions, yet its effectiveness as a diagnostic method remains to be confirmed [19]. Apart from the different imaging modalities available,

other investigations are not commonly done for most diagnoses of TMD, except in specific indications. For example, blood investigations may be done for TMD related to systemic conditions, such as rheumatoid arthritis or gout. In the case of uncertain diagnoses of rare diseases or neoplasms, tissue biopsies might be taken, which may be done by fine-needle aspiration, arthroscopic or open joint approach. [4].

Some of the differential diagnoses of orofacial pain that may mimic TMD are listed in Table 1.

Table 1. Differential diagnoses. Modified from Kumar et al., 2013 [20]

Differential diagnosis	Examples
Neuropathic Pain	Trigeminal neuralgia
	Glossopharyngeal neuralgia
	Postherpetic neuralgia
Odontogenic Pain	Dental caries
	Periodontal disease
	Dental sensitivity
Headaches not Attributed to TMD	Migraine
	Cluster headache
	Tension-type headache
	Temporal arteritis
Intracranial pain	Infection
	Bleeding
	Tumours
	Aneurysms

Clinical manifestations

Table 2 summarizes the most common complaints of patients with temporomandibular joint disorders. Intriguingly, some signs and symptoms resolve spontaneously even without treatment, whereas others persist for years despite the implementation of all treatment options [4].

Table 2. TMD symptoms based on Beaumont et al., 2020 [2].

The most common complaints	Less frequently reported, but still present
Restricted jaw movement	Reduced hearing
Headache	Feeling of blocked ears
Preauricular pain and ear pain	Tinnitus
Facial pain	Toothache/sensitivity/Tooth mobility
Bruxing/clenching	Occlusal disturbance
Joint sounds	Retro-orbital pain
Difficulty eating	Pain with swallowing
Neck/shoulder pain	Paresthesia/swelling of face
	Sleep disturbance

- Pain

Pain associated with temporomandibular disorders can arise from various sources, both central and peripheral. A 2020 study by Yin et al. showed that TMD is linked to functional and structural changes in key brain regions, including the primary somatosensory cortex, prefrontal cortex, and basal ganglia. These findings highlight the importance of considering neurological factors when making treatment decisions for TMD [21]. The pain may radiate to different regions, such as the dental arches, ears, temples, forehead, occiput, cervical region of the spine or shoulder girdle [22]. Headache attributed to temporomandibular dysfunction is characterized by a history of temporal pain of any nature. The pain can be modified by mandibular movement, function, and parafunction. Upon physical examination, pain in the temporalis region can also be observed in provocative tests. Pain may occur during palpation and when testing jaw opening [23].

- Symptoms related to the hearing organ:

Otologic symptoms related to TMD such as hearing loss, vertigo, dizziness, ear pain, and tinnitus were described in the literature [24]. TMD and otologic symptoms may be linked due to the close proximity of the middle ear and TMJ [25]. This close anatomical and functional relationship between these two structures is mediated by the anterior malleolar ligament (AML), the sphenomandibular ligament (SML), and the discomallear ligament (DML). In addition, DML, distinct from AML, is a key player in the mobility of the malleus, a bone in the middle ear, with its structure potentially affecting outcomes in TMJ surgery and conditions leading to anterior displacement of the articular disc. These ligaments can be stretched during TMJ use affecting middle ear structures like the eardrum and malleus [26]. The relationship between the TMJ and the middle ear depends on which ligament is present, the structure of the ligament (whether collagenous or elastic), and the width of the petrotympanic fissure. Also, the overactivity of masticatory muscles could influence the association between tinnitus and TMD, since these muscles which are involved in TMD share the trigeminal nerve with muscles involved in the function of the eustachian tube, which indeed includes the lateral and medial pterygoids muscles [3]. In addition, studies have demonstrated a high frequency of otologic symptoms in TMD patients with tinnitus representing 52.1% of the otologic symptoms [24]. A recent systematic review examined the association between TMD and tinnitus [3]. It has been shown that there is a strong significant association between TMD and tinnitus, but further research is needed to unravel the nature

of this association and its clinical implications. Among patients with TMD, 57.5% also displayed tinnitus. In contrast, among patients with tinnitus, 92.9% also suffered from TMD.

- Intraoral symptoms

A vast majority of patients suffer from intraoral signs of masticatory dysfunction, including increased sensitivity of the teeth due to abfraction and pathological attrition, gingival recessions, teeth hypermobility and bone support loss. In addition, teeth impressions on soft tissues are observed, including teeth impressions on the tongue and cheek mucosa [22].

Treatment options

Over time, a wide range of treatment methods for TMD have been suggested - some have fallen out of use, while others are becoming increasingly favoured. However, due to the varied nature of TMD symptoms, no single approach is effective for all cases. An ongoing debate in the literature about both diagnosis and management protocols means that treatment decisions are often heavily shaped by the experience and judgment of the clinician [4]. The primary goals of TMD treatment are to reduce pain and enhance jaw function. In addition, therapies aimed at promoting behavioural changes can play a key role in decreasing muscle tension and parafunctional habits. At present, physically repositioning the disc in cases of internal derangement is not typically a main treatment objective, as it often does not correlate with clinical improvement - unless disc displacement is accompanied by inflammation, in which case it should be specifically addressed [27, 28]. Symptoms of TMD should be addressed promptly, as chronic pain becomes more difficult to manage due to psychological deterioration and somatization [29].

- Natural methods

Acupuncture, a well-known technique from traditional Chinese medicine, is commonly used for managing chronic pain. The acupuncture points often overlap with trigger points and are associated with areas that have a high concentration of A-δ and C fibre nerve endings responsible for transmitting pain signals. Warm compress therapy is recommended for chronic inflammation and muscle strains, with an ideal temperature of 35–40°C applied for 20–30 minutes. In contrast, cold compresses are effective for acute inflammation accompanied by pain and swelling [30, 31].

- Physiotherapy

Physiotherapy is a discipline of health science that aims to eliminate, alleviate, and prevent various ailments, as well as restore functional ability through movement and various physical agents. Physiotherapists are part of the treatment process in the case of dysfunctions involving the neuromuscular, musculoskeletal, and other systems [32]. In their work, physiotherapists use kinesiotherapy and physical therapy techniques. Massage is used for myofascial pain in order to achieve pain relief and improve muscle length and flexibility, as well as loosen fascia. The frequency of massage sessions should be 30 minutes twice a week. With subsequent visits, the treatment should be applied with increasing force [33, 34].

- Interventional Methods-Splint Therapy

Occlusal splint therapy can be used in all TMD; however, it is vitally important to use the right splint for the patient's unique situation. An occlusal splint is an appliance that affects the mutual relationship of the upper and lower teeth and, consequently, the relationship of the condylar process to the mandibular fossa and articular eminence within the TMJ. The purpose of splints is to stabilize occlusion or to protect teeth from excessive abrasion [35, 36]. Multiple studies have shown that splint therapy can significantly reduce or even eliminate pain symptoms in patients. For disc displacement cases, repositioning splints are used to stabilize the mandible in a centric relation. In contrast, for masticatory muscle disorders, relaxation splints are employed to minimize the impact of parafunctional activities [37, 38].

- Pharmacotherapy

The choice to use medications for TMD should be based on a careful evaluation of the potential risks and benefits. Commonly prescribed drugs for TMD management include pain relievers, nonsteroidal anti-inflammatory drugs, anticonvulsants, muscle relaxants, and benzodiazepines [1].

- Minimally Invasive Options - Arthroscopy, Arthrocentesis and Intra-Articular Injections

TMJ arthroscopy may involve lysis and lavage of the superior joint space, as well as operative procedures, such as repositioning of a displaced disc, arthroplasty, and removal of inflamed tissues and adhesions. The efficacy of arthroscopy has since been well-recognized and has been found that the therapeutic effect was mainly due to lysis and lavage but not disc position [39, 40]. It was due to this finding that a modification was made, where lysis and lavage were performed without arthroscopic view. This was termed arthrocentesis whose efficacy has since been well-documented [41, 42, 43]. Despite the reported efficacy, arthroscopy is seldom required in TMD patients, even in cases of true arthrogenous disorders. Additionally, arthrocentesis is still considered to be a controversial procedure [44], despite the documented efficacy and low complication rates. The reasons for this controversy are as follows. Firstly, some cases of TMD improve with mere conservative options, or even without treatment. Additionally, many cases of TMD are due to multiple etiologies, which may require a multimodal approach before any clear clinical improvement can be appreciated. In addition, intra-articular injection of corticosteroids is a simple and very effective treatment, which may be attempted before arthrocentesis. In short, minimally invasive procedures may be the answer in those patients with true arthrogenous TMD not responsive to conservative treatment options, whose condition also lacks a significant biopsychosocial component.

- Open Joint Surgery

Open surgical treatment for TMD is now rarely performed and is typically reserved for specific indications or advanced stages of the disease. However, in certain conditions such as ankylosis and neoplasms, surgery may be the only effective option - requiring the release of ankylosis or removal of the tumour, respectively. Open joint procedures may involve disc repositioning, osteophyte removal, excision of pathological tissue, or TMJ biopsy. In recent years, significant progress has been made in TMJ replacement using alloplastic prostheses [45, 46].

Conclusions

The temporomandibular joint, which provides essential biological activities, including chewing and speaking, is one of the most intricate and frequently utilized joints in the human body. Although TMD is not life-threatening, it can have a profound impact on a person's quality of life as the symptoms, when chronic, are extremely difficult to manage and often require multidisciplinary intervention. The term TMD is not a diagnosis but rather a broad term that contains a number of disease entities, such as pain in masticatory muscles and temporomandibular joints, headache, disturbances in jaw movements and sounds in joints while opening and closing the mouth. The treatment process should be preceded by a thorough diagnostic process, taking into account the etiology of the disorder. Although the etiology of TMD is complicated, it is likely multifactorial with biomechanical, neuromuscular, psychosocial, and biological influences. Plausible causes involve trauma, functional shift, parafunctional habits, occlusal overloading, increased joint friction, depression, stress, and anxiety. The role of each of these potential components is still controversial, and they can contribute either independently or collectively.

Having reviewed the relevant literature, the authors emphasize the need to combine multiple methods. For severe pain, pharmacotherapy may be used, while in other cases, it will be more appropriate to apply a combination of splint therapy and physiotherapy. The use of physiotherapy as a conservative intervention method for the treatment of TMD, such as temporomandibular pain, painful clicking, disorders of the masticatory musculature, articular disc disorders, and psychosocial issues, is well-supported by sufficient scientific evidence.

Moreover, one determinant of successful TMD treatment, which is frequently overlooked, is the practitioner's knowledge and beliefs concerning the disorder itself. Thus, patients are often misdiagnosed and undergo various therapies for unrelated disorders; a fact that frequently leads to frustration, dissatisfaction, and compromised quality of life.

Due to the common nature of TMD and the increasing incidence in society, further research into effective diagnosis and improved treatment methods is needed. Future interdisciplinary analysis in physiotherapy and dentistry should include large sample sizes of experimental studies and further investigation of the development of physiotherapy and dentistry techniques used in clinical practice to treat patients with TMD.

Authors' contributions statement
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All authors have reviewed and agreed to the publication of the final version of the manuscript.

Conflict of Interest Statement: No conflicts of interest.
Funding Statement: The study did not receive any specific funding.
Informed Consent Statement: Not applicable.
Ethics Committee Statement: Not applicable.

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