

Temporomandibular Disorders (TMD) and Splint Therapy: A Comprehensive Review of Pathophysiology, Diagnosis, and Treatment Strategies

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ABSTRACT

Temporomandibular Disorders (TMDs) are a series of musculoskeletal ailments pertaining to the temporomandibular joint (TMJ), masticatory muscles, and are associated structures. They present with pain, dysfunction, and reduced quality of life. Splint therapy is one of the most common non-surgical treatments for TMD, with the objectives of providing symptomatic relief and helping in the restoration of jaw function. This review article attempts to provide a holistic approach to TMDs: their etiology, clinical presentation, and the place of splint therapy in its management. The article also mentions the classification of splints, mechanisms of their action, and evidence for their effectiveness. Finally, it cites the disadvantages and limitations of splint therapy and emphasizes that management of TMDs would be the most efficient through a multidisciplinary approach

Keywords: Temporomandibular Disorders (TMD), Temporomandibular Joint (TMJ), Splint Therapy, Bruxism, Jaw Dysfunction, Myofascial Pain, Disc Displacement

INTRODUCTION

Temporomandibular Disorders (TMD) constitute a common cause of orofacial pain and dysfunction, with an incidence of 5-12% in the population¹(Okeson, 2019). The pathology may involve the TMJ, masticatory muscles, or both, leading to symptoms such as pain in the jaw and around the ear, clicking and/or popping sounds, limited mouth opening, and headache. The etiology of TMD is multifactorial and includes biomechanical, neurologic, and neuromuscular factors, which makes diagnosis and disease

management difficult. Among the most commonly used conservative management options for TMD is splint therapy, which provides a non-invasive method of symptom control and improvement of jaw function. The current paper reviews the available knowledge on TMD, the role of splint therapy in its management, and evidence of its efficacy.

Etiology and Pathophysiology of TMD:

TMD true etiology typically is multifactorial with etiological factors including:

- Occlusal Discrepancies: Malocclusion or irregular bite alignment may place abnormal stress on TMJ and the muscles surrounding it ^[1].
- Trauma: Any direct injury to the jaw or TMJ, such as a blow or accident, can lead to TMD ^[2].
- Bruxism is habit of grinding and clenching the teeth. Bruxism can cause excessive wear and tear on the TMJ and muscles ^[3].
- Stress and psychological factors of developed TMD: Depression, anxiety, and stress may increase symptoms, with an increase in the muscle tension and parafunctional habits ^[4].
- Arthritis: Inflammatory arthritic conditions, for example, osteoarthritis or rheumatoid arthritis, may affect the TMJ ^[5].
- Genetic tendency: There is a familial clustering of TMD suggesting a genetic predisposition ^[6].

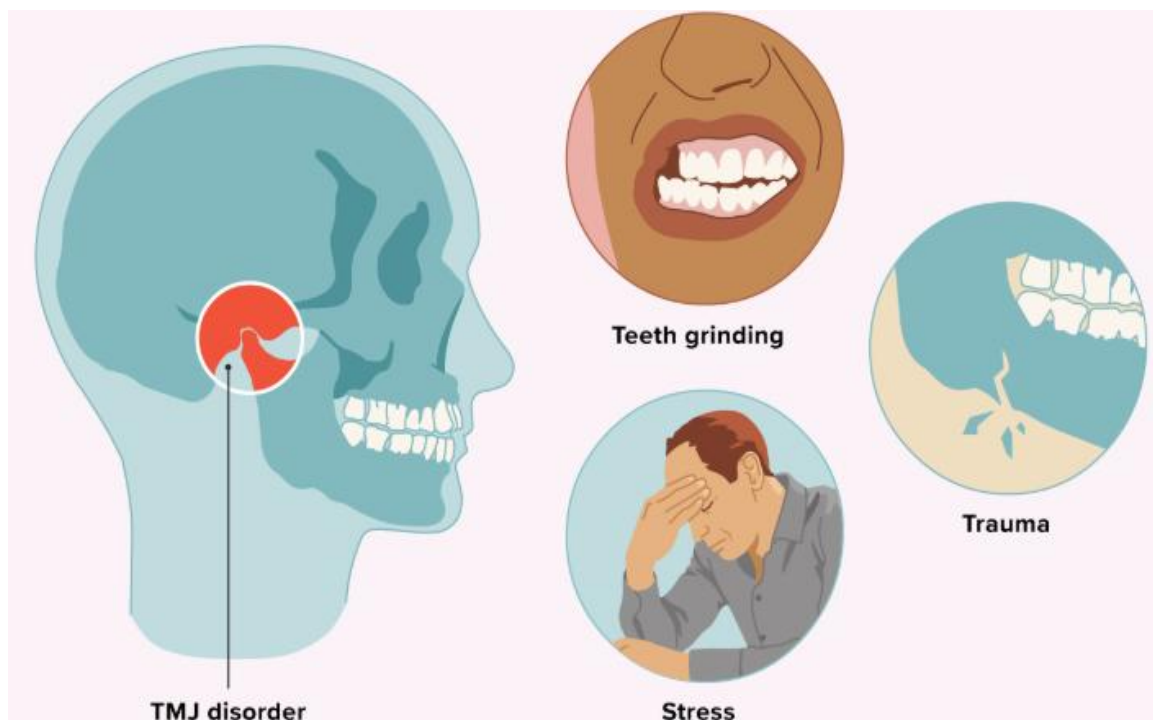


FIG 1. Etiology and Pathophysiology of Temporomandibular Joint (TMJ) Disorders¹³

Differentiating Between Orofacial Myofunctional Disorders (OMD) and Temporomandibular Disorders (TMD)

1. Definition and Overview:

- **Orofacial Myofunctional Disorders (OMD):**
 - Oral myofunctional disorders are abnormal patterns muscle function in the orofacial region, at rest or during functional activities such as swallowing, speaking, chewing the tongue, lips and jaw ^[7].
 - Misuse of tongue - usually accompanies by incorrect tongue posture, tongue thrusting, mouth breathing, and other habits of dysfunction ^[8].

- OMD is commonly found in children. However, if not treated, it can stay with the person through adulthood ^[7].
- **Temporomandibular Disorders (TMD):**
 - Temporomandibular disorder refers to any of a collection of musculoskeletal disorders of the temporomandibular joint and associated structures, characterized by pain around the TMJ and in the It is described by ache, dysfunction and restraint in the movement of the jaw ^[2].
 - TMD is more common in adults particularly women aged between 20 and 40 years ^[1].

2. Etiology and Contributing Factors:

• OMD:

- ✓ Habitual factors. Thumb sucking, long use of pacifier, tongue thrusting, mouth breathing, and nail biting [8].
- ✓ Structural factors could be malocclusion enlarged tonsils/ adenoids, orofacial anomalies (e.g. cleft palate)
- ✓ Neuromuscular factors: Incompetent muscle coordination or tone in the orofacial area [8].
- ✓ Developmental factors may include impaired development of oral functions such as communication and swallowing [7].

• TMD:

- Biomechanical Factors: Trauma to the jaw malocclusion or parafunctional habits e.g. bruxism clenching [1].
- Psychological factors like stress, anxiety, and depression can exacerbate muscle tension and parafunctional habits [4].

- Joint-specific factors: Disc displacement arthritis or degenerative arthritis [2].
- Genetic predisposition: Tendency towards TMD within the family (Michelotti & Iodice,2010)

3. Clinical Manifestations:

• OMD:

- ✓ Abnormal tongue posture: The resting tongue posture is abnormal (e.g., tongue thrust, low tongue posture) [7].
- ✓ Typical swallowing patterns with the tongue thrusting against the teeth. [8].
- ✓ Speech-related issues: Articulation abnormalities, such as lisping or some problems with pronouncing some sounds [7].
- Facial characteristics: Open lip posture or long facial morphology [8].
- ✓ Dental structure: Malocclusion, tooth alignment, or excessive wear [7].
- ✓ Breathing pattern habits: Habitual mouth breather as a result of an airway obstruction or habit [7].



FIG 2. Symptoms of OMD¹⁵

• TMD:

- ✓ Pain in the facial, jaw, TMJ area, or ear pain. Pain that is commonly worsened by the opening or closing movement of the jaw or by chewing [1].
- Joint sounds: Clicking, popping or crepitus of the TMJ with movement of the jaw [2].
- ✓ Restricted jaw movement: Mouth opening is impaired or the jaw has a sense of locking [1].
- ✓ Head and ear pain: referred pain to the head, neck, or ears [3].
- ✓ Muscle tenderness is a sensitivity or trigger points upon palpation of the masticatory muscles [4].

- ✓ Change in bite: Changes in the way upper and lower teeth fit together or pain when biting/chewing ^[1].

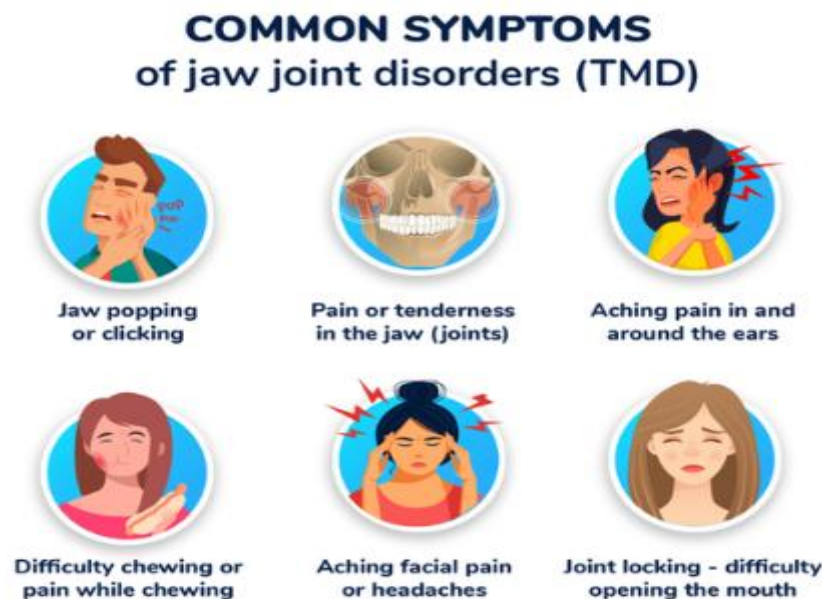


FIG 3. Symptoms of TMD¹⁴

4. Diagnostic Criteria:

- OMD:
- ✓ Diagnosis from clinical assessment of orofacial muscle function, including:
- ✓ Tongue posture and movement observation ^[7].
- ✓ Swallowing pattern assessment (e.g., tongue thrusting) ^[8].
- ✓ Speech and breathing pattern evaluation ^[7].
- ✓ Identification of causative factors are mostly (e.g., malocclusion, enlarged tonsils) ^[7].
- ✓ The Orofacial Myofunctional Evaluation (OME) might be employed as tools ^[7].
- TMD:
- ✓ Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) is used for diagnosis which includes: TMJ and Masticatory Muscle Clinical Examination is a ^[2].
- ✓ Evaluating of jaw movement and sounds from the joints ^[1].
- ✓ Imaging procedures (e.g., MRI, CT) in case joint pathology is suspected ^[2].

- ✓ Symptoms that are reported from the person himself, for example, pain and dysfunction ^[1].

5. Treatment Approaches:

OMD:

- ✓ Myofunctional therapy: Exercises for re-education of the tongue, lip, and facial muscles for adequate posture and function ^[7].
- ✓ Speech therapy is required to correct articulation disorders. This is associated with OMD ^[8].
- ✓ Orthodontic intervention is used to correct malocclusion or dental alignment problems ^[7].
- ✓ ENT evaluation. To correct airway obstruction (e.g., enlarged tonsils/adenoids) ^[8].
- ✓ Behavioral modification is the use of conditioning methods to eliminate habits such as thumb sucking or mouth breathing ^[7].

TMD:

- ✓ Splint therapy Individual appliances on the oral cavity to alleviate pain and assist in jaw function ^[1].

- ✓ Physical therapy exercises can improve jaw mobility and reduce muscle strain [3].
- ✓ Pharmacotherapy: Conventional medications including NSAIDs, muscle relaxants, or antidepressants [4].
- ✓ Behavioral interventions: Stress management and cognitive-behavioral therapy [1].
- ✓ Surgical intervention was also indicated in some extreme cases. Such radical measures as arthrocentesis or joint replacement may be required. [5].

6. Key Differences:

| Feature | OMD | TMD |
|------------------|--|---|
| Primary Focus | Muscle dysfunction in the orofacial region. | Joint and muscle dysfunction in the TMJ. |
| Common Symptoms | Tongue thrusting, mouth breathing, speech issues. | Jaw pain, joint noises, limited jaw movement. |
| Etiology | Habitual, structural, or developmental factors. | Biomechanical, psychological, or joint-related factors. |
| Age Group | More common in children. | More common in adults. |
| Diagnostic Tools | Orofacial Myofunctional Evaluation (OME). | DC/TMD criteria, imaging studies. |
| Treatment | Myofunctional therapy, speech therapy, orthodontics. | Splint therapy, physical therapy, pharmacotherapy. |

7. Clinical Differentiation:

- History and Examination OMD focuses on habits i.e. thumb sucking/tongue thrusting, speech patterns, and breathing [7].
- The temporomandibular disorders (TMD) category focuses on the major symptoms; pain during chewing, joint clicking or popping
- Functional Assessment:
- OMD is associated with aberrant swallowing or articulatory patterns [8].
- TMD sufferers typically complain of pain or reduced jaw functionality during opening and closing movements [2].
- Imaging and Diagnostic Tests:
- OMD rarely requires imaging unless structural anomalies are suspected, such as enlarged tonsils [7].
- TMD may require imaging such as MRI to identify joint pathology (Schiffman et al., 2014)
- Both conditions must be diagnosed and treated if present through a thorough evaluation.

deviated jaw posture and be a contributor to TMD [8].

- ✓ Parafunctional habits (e.g., clenching) related to TMD can worsen OMD symptoms [1].

OMD and TMD have some overlapping characteristics but differ as separate entities with different etiology, clinical presentation, and treatment. OMD is mainly associated with muscle dysfunction in the orofacial area that is often related to a habit or development, while TMD is marked by pain and masticatory muscle dysfunction of the TMJ. Diagnosis has to be accurate and is completed via a thorough clinical assessment, in which history, an exam, and in some cases, imaging is used. Both conditions may need a multidisciplinary approach, particularly when they occur simultaneously.

8. Overlap and Comorbidity:

Occasionally, OMD and TMD can co-occur. For instance:

- ✓ Mouth breathing for a long period (a common feature of OMD) can cause

The pathophysiology of TMD includes inflammation, muscle hyperactivity, and altered joint mechanics. Inflammatory mediators released in response to injury or stress can result in pain and inflammation in the TMJ and associated tissues. Muscle hyperactivity is due to parafunctional habits

or stress, causing muscle fatigue, tenderness, and pain. Altered joint mechanics, such as disc displacement or joint degeneration, can also result in dysfunction or pain ^[1].

TMD diagnosis is based on a combination of a detailed clinical examination, patient history, and imaging such as MRI or CT scans, if needed. The Diagnostic Criteria for TMD (DC/TMD) are a set of standardized criteria used to make a diagnosis based on physical examination data and patient self-report ^[2].

4. Splint Therapy for TMD:

Splint therapy is a conservative treatment modality for TMD. In this technique, oral appliances are used to reduce the symptoms and improve the operation of the jaw. Splints are custom-made devices that cover the dental arches and are intended to reposition the jaw, reduce muscle activity, and stabilize the TMJ. The main objectives of splint therapy are to reduce pain, improve the operation of the jaw, and prevent further damage to the TMJ and adjacent structures ^[1].

5. Types of Splints:

Temporomandibular disorders (TMD) are the prime source of orofacial pain and dysfunction that affects an estimated 5% to 12% of the population ^[1]. These disorders affect the TMJ, masticatory muscles, or the combination of both, which presents as pain in the jaw, clicking, restricted mouth opening, and headache. One of the most

common conservative treatments for TMD is a splint therapy that provides a minimally invasive solution for symptom control and improvement of the jaw function. Nonetheless, the success of a splint therapy depends on the prescribed type of splint that is based on individual TMJ pathology. The aim of this article is to offer guidance on the optimal splint for the type of TMD.

6. Type of TMD and Relevant Splints

TMD is generally divided into three main categories: muscle disorder, disc displacement, and degenerative joint diseases. Each TMD category corresponds to a specific splint that is prescribed to address the pathology and alleviate the symptoms.

6.1. Muscle-Related Disorders:

- Characteristics: Aching and tenderness of the masticatory muscles usually brought on by nonfunctional habits (e.g., bruxism, clenching) or muscle hyperactivity ^[1].
- Recommended Splint: Stabilization Splint. Mechanism of Action: It ensures equal occlusal contact and a drop in muscle activity and encourages a stable jaw position ^[9].
- Indications. Pain myofascial. Tonic tension of the muscle. bruxism
- Evidence: Evidence exists that stabilizing splints markedly reduce pain and improve the jaw function in muscles TMD patients ^[10].



FIG 4. Stabilization Splint ^[11].

6.2. Disc Displacement

- Symptoms: Clicking, popping, or locking of the TMJ due to articular disc displacement (Schiffman et al., 2014).
- Preferred Splint: Anterior Repositioning Splint. The Effector: It moves the mandible ahead which urges pressure off from the TMJ and advances disc alignment ^[1].
- Indications: Patients with disc displacement with or without reduction.
- Research: Anterior repositioning splints have been found to correct disc position and decrease joint noise in disc displacement patients ^[9].



FIG 5. Anterior Repositioning Splint ^[11].

6.3. Degenerative Joint Conditions:

- Characteristics: Pain and impairment from degenerative TMJ changes, such as osteoarthritis or rheumatoid arthritis ^[5].
- Recommended Splint: Pivot Splint.
- Mechanism of Action: Decreases TMJ pressure by providing a pivot point allowing the joint to rest and recover ^[1].
- Indications: Individuals with degenerative joint disease or severe joint pain.
- Documentation: Pivot splints alleviate pain in addition to boosting the joint function among individuals who have a degenerative joint illness ^[5].



FIG 6. Pivot Splint ^[11].

7. Mechanisms of Action:

Numerous mechanisms function with splints decreasing symptoms of TMD.

- Muscle Reduction: Splints can relieve the hyperactivity of the muscles of mastication, which leads to a decrease in

tension and pain by offering the stable position of the jaw ^[1].

- Repositioning of the joint by splints is possible: Splints could change the alignment of the disc and joint, thereby reducing joint noise and improving function ^[9].
- Occlusal Stabilization: Splints provide the teeth with balanced contact, which diminishes the stress on the TMJ and prevents wear resulting from parafunctional habits ^[3].
- Protection: Splints act as a bulwark, protecting the teeth and TMJ from further destruction resulting from bruxism or clenching ^[5].

8. Practical Considerations for Splint Selection:

Needed is the compliance of the patient. The success of splint therapy relies on the use of the splint. The patient needs to know about the need to wear the splint as instructed ^[1].

- Price and Availability: Custom splints may be expensive and require trained labor. Healthcare providers must take into account a patient's access to care and economic status when they prescribe a splint ^[3].

On the negative side, patients may experience some transient discomfort or changes in the bite using a splint. These changes are usually minimal and go away on their own within a short period, yet, they are a source of non-compliance ^[5].

Efficacy varies. The efficacy of splint treatment can vary with the nature of the TMD and the patient. It is generally more efficacious for muscle-related TMD than joint-related TMD ^[9].

9. Evidence for Splint Therapy:

Many investigations have been conducted to determine the efficiency of splint therapy for TMD. The findings differ from one study to another.

- Pain reduction: Multiple studies have suggested that splints reduce the pain experienced by TMD patients.

The first example is a systematic review ^[9], which showed that the use of stabilization splints reduced pain more than nothing or a placebo.

- Enhanced Function: Following splint use, one may experience increased jaw mobility and function. In particular, this is commonly noted with muscular TMD patients, in whom splints reduce muscle tension and increase range of motion ^[1].
- Long-term Benefits: Despite the identification of short-term benefits, the long-term results are divisive. On one hand, some patients realize long-lasting improvements, while others may need secondary treatments or interventions ^[10].
- However, the uniformity isn't complete. The evidence shows that splints aren't more effective compared to placebo or other conservative approaches such as physical therapy or behavioral therapy. The heterogeneity of results can be blamed on differences in splint designs, patient selection, and compliance with therapy ^[9].

10. Limitations and Considerations:

As successfully healing as Ancestors Medicine can be, it is not without its downsides.

- Patient Compliance: The efficacy of splint therapy is dependent on the proper wearing of the splint. Patients who do not wear the splint as directed may not achieve the full benefits ^[1].
- Cost and Accessibility: Personalized splints may be expensive with professional fabrication which may create an access barrier to some patients, particularly in limited resource areas ^[3].
- Adverse effects: Transient discomfort or changes in bite may have been noted in some individuals using a splint. These effects are generally infrequent, mild, and transient, but may act as a barrier to compliance ^[5].
- Variable Efficacy. Efficacy of splint therapy varies based on TMD type and

patient. Splints may be more effective in muscle-type TMD than in joint-type TMD [9].

11. Multidisciplinary Approach to TMD Management:

The multifactorial origins of TMD may require a multidisciplinary approach for best results. Many other different kinds of modalities may be used in addition to splint therapy.

- Physical Therapy: Exercises to improve mobility and strengthen muscles in the jaw [1].

Behavioral Interventions: Stress management and cognitive-behavioral therapy to treat the psychological aspects jaw [4].

- Pharmacotherapy NSAIDs, muscle relaxants, or antidepressants to treat pain and inflammation [3]

Surgical interventions are considered in severe cases, such as arthrocentesis or joint replacement⁵

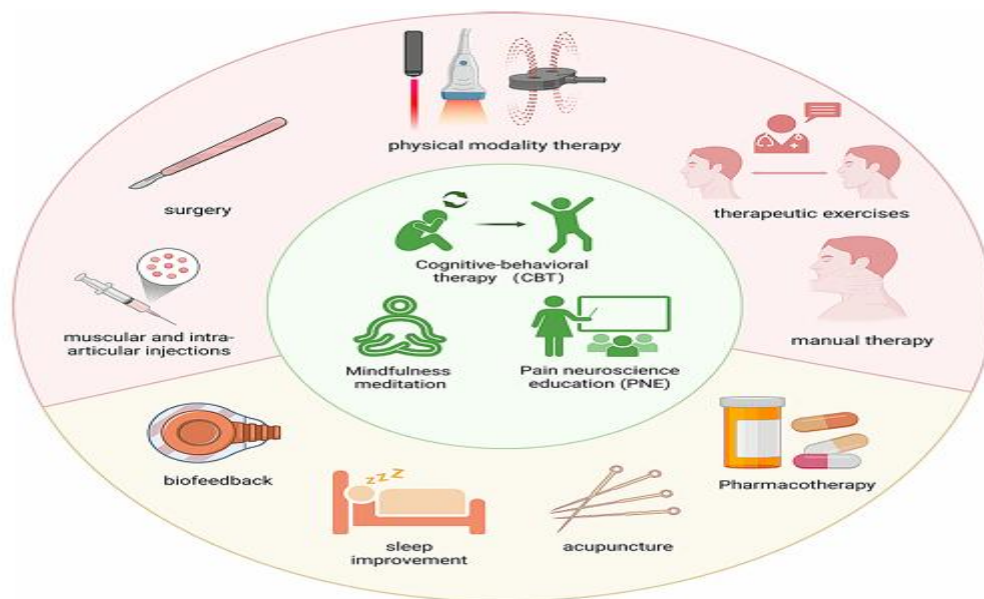


FIG 7. Clinical therapy for managing TMDs symptoms and mental health disorders [12].

A fully individualized treatment plan based on the needs of the patient is critical for successful TMD management.

CONCLUSION

Splint therapy is still a crucial part in the treatment of patients having a TMD, especially in those patients who have a muscle disorder or have mild to moderate joint disease. The evidence has demonstrated effectiveness in terms of pain relief and function improvement, but further research is necessary for optimization of the design and to define patients who are likely to get more benefit from this proposed treatment. Also, using a treatment strategy such as physical therapy in conjunction with

behavioral treatments and drug treatment can improve the outcome of a patient with TMD. The clinician will approach the recommendation to use splint as part of the TMD treatment plan involving the specific patient's requirements and needs, the patient's values, and presentation.

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