Temporomandibular Disorders and Its Management in Dentistry: A Review

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Abstract

Temporomandibular disorders (TMD) is a collective term for a group of musculoskeletal conditions involving pain and/or dysfunction in the masticatory muscles, temporomandibular joints (TMJ) and associated structures. It is the most common type of non-odontogenic orofacial pain and patients can present with pain affecting the face/head, TMJ and/or teeth, limitations in jaw movement and sounds in the TMJ during jaw movements. Comorbid painful and non-painful conditions are also common among individuals with TMD. The diagnosis of TMD have significantly improved over time with the recent Diagnostic Criteria for TMD (DC/TMD) being reliable and valid for most common diagnoses, and an efficient way to communicate in multidisciplinary settings. This classification covers 12 most common TMD, including painful (myalgia, arthralgia and headache attributed to TMD) as well as the non-painful (disc displacements, degenerative joint disease and subluxation) TMD diagnoses. Recent studies have demonstrated that the pathophysiology of common painful TMD is biopsychosocial and multifactorial, where no one factor is responsible for its development.

Importantly, research has suggested different predisposing, initiating and perpetuating factors, including both peripheral and central mechanisms. This is an active field of investigation and future studies will not only seek to clarify specific causal pathways but translate this knowledge into mechanism-directed diagnosis and treatment. In accordance with this complex aetiology, current evidence supports primarily conservative multidisciplinary treatment including self-management strategies, behavioural therapy, physical therapy and pharmacotherapy. The aim of this review is to present an overview of most recent developments in aetiology, pathophysiology, diagnosis and management of TMD.

Key words: *TMD, Etiology, Diagnosis, Management.*

Introduction:

Temporomandibular disorders (TMD) is a collective term for a group of musculoskeletal conditions involving pain and/or dysfunction in the masticatory muscles, temporomandibular joints (TMJ) and associated structures. Temporomandibular disorders (TMD) are characterized by craniofacial pain involving the joint, masticatory muscles, or muscle innervations of the head and neck[1]. TMD is a major cause of non-dental pain in the orofacial region. Up to 70% of TMD patients suffer from pathology or malpositioning of the TMJ disc, termed "internal derangement" (ID).

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Incidence of TMD:

Population-based studies show that TMD affects 10% to 15% of adults, but only 5% seek treatment[2,3]. A large multisite prospective cohort study in the USA (OPPERA study) estimated that each year 4% of TMD-free adults aged 18–44 years develop clinically confirmed first-onset painful TMD, and that annual incidence increases with age (18–25 years = 2.5%; 25–34 years = 3.7% and 35–44 years = 4.5%)[4]. Some studies also indicate the percentage of population affected by temporomandibular disorders (TMD) to be as high as 56% to 87.7% of the world population [5,6]. The incidence of TMD peaks from 20 to 40 years of age and symptoms occur disproportionately between the sexes, TMD is twice as common in women than in men and carries a significant financial burden from loss of work[7],[8].

Etiology and predisposing factors for TMD:

Factors predisposing to the development of TMD can be systemic, psychological (personality and behavior), and structural (malocclusion and other types of occlusal discrepancies, joint laxity, and others)[9,10]. The etiology of TMD is multifactorial and can also include biologic, environmental, social, emotional, and cognitive triggers. Factors consistently associated with TMD include other pain conditions (e.g., chronic headaches), fibromyalgia, autoimmune disorders, sleep apnea, and psychiatric illness. A prospective cohort study with more than 6,000 participants showed a twofold increase in TMD in persons with depression (rate ratio = 2.1; 95% confidence interval, 1.5 to 3; $P < .001$) and a 1.8-fold increase in myofascial pain in persons with anxiety (rate ratio = 1.8; 95% confidence interval, 1.2 to 2.6; $P < .001$).5 Smoking is associated with an increased risk of TMD in females younger than 30 years[11].

TMD is categorized as intra-articular (within the joint) or extra-articular (involving the surrounding musculature)[12]. Musculoskeletal conditions are the most common cause of TMD, accounting for at least 50% of cases[13,14].

Diagnosis of TMD:

The diagnosis of TMD is based largely on history and physical examination findings. The symptoms of TMD are often associated with jaw movement (e.g., opening and closing the mouth, chewing) and pain in the pre-auricular, masseter, or temple region. Another source of orofacial pain should be suspected if pain is not affected by jaw movement. Adventitious sounds of the jaw (e.g., clicking, popping, grating, crepitus) may occur with TMD, but also occur in up to 50% of asymptomatic patients.1 A large retrospective study (n = 4,528) conducted by a single examiner over 25 years noted that the most common presenting signs and symptoms were facial pain (96%), ear discomfort (82%), headache (79%), and jaw discomfort or dysfunction (75%)[15].

A variety of diseases affects the TMJ and includes the following:

1) Congenital and developmental malformations of mandible and cranial bones

2) Acquired disorders including neoplasia and fractures, dislocation, ankylosis and disc displacement

3) Inflammatory diseases that produce synovitis and capsulitis

4) A wide variety of arthritis

5) Various post treatment conditions

6) Habits related to stress such as clenching, bruxism.

According to some studies, the occlusal factors are of minor etiological importance for pain and functional disorders in the masticatory system, but the role of occlusion in the etiology of TMD is still controversial[16,17].

Malocclusion and TMJ disorders are 2 separate entities, but both are quite prevalent in different groups of population. As the function of TMJ is directly related to the mandibular movements as guided by occlusion, researchers from every part of the world have been trying to find the association between malocclusion and

TMJ disorders. Some investigators have stated that joint sounds are related to orthodontic malocclusions, but a final conclusion has not been reached[18,19].

The role of malocclusion as a potential risk factor for development TMDs has been progressively disproved in the past[20]. As a consequence, all treatment modalities and plans to correct malocclusions and/or to achieve ideal functional occlusion are not reliable treatment option for TMD management[21,22].

The currently available literature suggests that the orthodontic treatment does not provide any further advantages in management/prevention of TMD[23,24]. Hence, Orthodontic treatment cannot be considered to neither decrease nor increase the risk for TMD[24].

Several studies in spite of being longitudinal gave heterogeneous results, since they failed in defining TMD management as their primary treatment goal and include uninform sample with diverse forms of malocclusion and age groups including older individuals[25].

Even the studies using modern and sophisticated diagnostic tools such as magnetic resonance imaging(MRI) and long-term follow-up studies have failed to resolve the controversy concerning Orthodontic treatment-TMD correlation. The focus of etiological factors of temporomandibular disorders TMD has progressively shifted from physical to central factors[26].

Based on such an ongoing paradigm change, a much-diminished role is assigned to the features of natural dental occlusion as risk factors for TMD, in favor to central factors (ie, psychological and psychosocial factors, pain sensitivity, genetic determinants)[27].

Clinical Management:

An analysis of current non-invasive, minimally invasive, and fully invasive management options now follows. The ultimate goals of the presented modalities are to: 1) increase mandibular range of motion, 2) decrease joint and masticatory muscle pain and inflammation, and 3) prevent further degenerative change in articulating tissues, including direct or indirect joint damage.[28]

Non-Invasive:

The non-invasive modalities implemented most commonly include physical therapy, occlusal splints and/or adjustments, and pharmacologics. Beginning first with physical therapy, electrophysical modalities and manual/exercise techniques are used to relieve pain in the joint and masticatory muscles, and improve range of motion.[29] Electrophysical modalities include transcutaneous electric nerve stimulation (TENS), ultrasound, and laser.[30] Such modalities are implemented to reduce inflammation, increase local blood flow, and promote muscle relaxation.28 Current research does not point to any significant decrease in pain in electrophysically treated patients. In fact, one study of 23 bruxists showed a significant increase in range of motion and a decrease in muscular activity with muscular awareness relaxation training over the TENS treatment group.[31] Furthermore, these techniques offer the potential to "re-teach" and rehabilitate the musculature. This observation is especially noted in patients exhibiting stress-related habits.

Also non-invasive, occlusal splints and occlusal adjustments work to establish balance in the occlusion and TMJs. The occlusion, or bite position, is a third and important element in the joint system and is the element often addressed by general dentists. The ultimate goal of splints and adjustments is to minimize pain in the joint and masticatory muscles by establishing stability. Furthermore, as reviewed by Ingawale and Goswami,[32] splints may be used to control bruxism, which has been associated with tooth attrition, malocclusion, myofacial pain, and masticatory muscle strain, fatigue, and fibrosis. Occlusal splints and adjustments may be suggested to reestablish balance in the joint system, but the long-term effectiveness of this therapy remains controversial.[32]

Regarding pharmacologic agents, commonly prescribed non-steroidal anti-inflammatory drugs (NSAIDs) offer advantages in reducing inflammation. Research, however, is needed to exploit long-term use and to identify whether the advantages in management

of pain and inflammation outweigh the negative side effects.[33] Muscle relaxants may also be prescribed for treatment of muscle pain and/or spasm.[34] However, studies have failed to demonstrate that muscle relaxants are any more effective in pain relief than NSAIDs. To improve their benefit, muscle relaxants are often used in combination with NSAIDs.

Minimally Invasive:

Minimally invasive modalities for management of TMD symptoms include sodium hyaluronate and corticosteroid injections, arthrocentesis, and arthroscopy. With research indicating both regenerative and degenerative responses to such injections, their use remains controversial.[34] The pathophysiology of the disease indicates there may be more significant potential for these injections in early stages of degeneration when inflammation first begins to exacerbate tissue catabolism.[35]

Similar to intra-articular injections, arthrocentesis and arthroscopic surgery are minimally invasive techniques requiring entrance into the joint capsule to lubricate articulating surfaces and reduce inflammation. During arthrocentesis, a sterile needle is used to drain fluid from the joint.[36] After draining, the joint is flushed of debris and inflammatory cytokines using a sterile solution.[36]

While arthroscopic surgery and arthrocentesis may be used to lubricate joint surfaces and reduce inflammation, further research is needed to identify long-term advantages especially in the absence of disc repositioning or replacement.[37, 38]

Invasive:

For the 5% of TMD patients whose nonsurgical methods fail, open joint surgery may be necessary to restore mandibular motion and mitigate orofacial pain.[39] Most commonly, open joint surgery may include discectomy, reshaping or reconstruction of the articulating surfaces, and implantation of autologous or alloplastic materials.[40] Total joint replacement, the most invasive option, may become necessary when joint degeneration and pain exceed the potentials of the less invasive surgical methods. Condylar replacements in clinical use include autologous costochondral grafts, but autologous full joint replacements are not currently available.

Conclusion

To address the mechanically demanding and biochemically active environment of the TMJ, tissue engineering is emerging as a suitable option for replacing diseased, displaced, or degenerated tissues. Characterizing the biochemical and biomechanical properties of the joint structures, including the condyle, TMJ disc, superior articulating surface, and disc attachments, in both healthy and diseased cases, continues to facilitate the development and validation of tissue engineering strategies. Simultaneously, characterization efforts are aiding researchers and clinicians in developing their understanding of TMD etiology and progression. Thus far, native tissue characterization studies have identified distinct differences between the biochemical and biomechanical properties of the TMJ disc and condyle, thus calling for concurrent, yet independent, tissue engineering strategies. With refined design objectives and validation metrics, and with a growing awareness of TMD as a pathology in need of clinical action, it can be expected that tissue engineering for both the mandibular condyle and TMJ disc will progress significantly over the next decade.

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References

1. Scrivani SJ, Keith DA, Kaban LB. Temporomandibular disorders. *N Engl J Med*. 2008; 359(25): 2693-2705.
2. Gonçalves DA, Camparis CM, Speciali JG, et al. Temporomandibular disorders are differentially associated with headache diagnoses: a controlled study. *Clin J Pain*. 2011; 27(7): 611-615.

3. Lim PF, Smith S, Bhalang K, et al. Development of temporomandibular disorders is associated with greater bodily pain experience. *Clin J Pain*. 2010; 26(2): 116-120.
4. Slade GD, Fillingim RB, Sanders AE, Bair E, Greenspan JD, Ohrbach R et al. Summary of findings from the OPPERA prospective cohort study of incidence of first-onset temporomandibular disorder: implications and future directions. J Pain 2013;14:T116–24.
5. Deng YM, Fu MK, Hagg U. Prevalence of temporomandibular joint dysfunction (TMJD) in Chinese children and adolescents: a cross-sectional epidemiological study. Euro J Orthod. 1995;17(4):305-309.
6. Elfving L, Helkimo M, Magnusson T. Prevalence of different temporomandibular joint sounds, with emphasis on discdisplacement, in patients with temporomandibular disorders and controls. Swed Dent J. 2002;26(1):9-19.
7. Maixner W, Diatchenko L, Dubner R, et al. Orofacial pain prospective evaluation and risk assessment study—the OPPERA study. *J Pain*. 2011; 12(11 suppl): T4-T11.e1-2.
8. Farrar WB, McCarty WL Jr. The TMJ dilemma. J Ala Dent Assoc. 1979; 63:19–26. [PubMed: 297713]
9. Carlsson GE, Helkimo E, Helkimo M, et al. Disorders of the temporomandibular joint. Sver Tandlakarforb Tidn.1970;62(21):1072-1119.
10. Egermark-Eriksson I, Ingervall B, Carlsson GE. Orthodontic treatment of patients with dysfunctions of the temporomandibular joint. Sver Tandlakarforb Tidn. 1975;67(7):404-415.
11. Sanders AE, Maixner W, Nackley AG, et al. Excess risk of temporomandibular disorder associated with cigarette smoking in young adults. *J Pain*. 2012; 13(1): 21-31.
12. Okeson JP. Joint intracapsular disorders: diagnostic and nonsurgical management considerations. *Dent Clin North Am*. 2007; 51(1): 85-103.
13. Reiter S, Goldsmith C, Emodi-Perlman A, et al. Masticatory muscle disorders diagnostic criteria: the American Academy of Orofacial Pain versus the research diagnostic criteria/temporomandibular disorders. *J Oral Rehabil*. 2012; 39(12): 941-947.
14. Stohler CS. Muscle-related temporomandibular disorders. *J Orofac Pain*. 1999; 13(4): 273-284.
15. Cooper BC, Kleinberg I. Examination of a large patient population for the presence of symptoms and signs of temporomandibular disorders. *Cranio*. 2007; 25(2): 114-126.
16. Rauhala K, Oikarinen KS, Raustia AM. Role of temporomandibular disorders (TMD) in facial pain: occlusion, muscle and TMJ pain. J Craniomandibular Prac. 1999;17(4):254-261.
17. Carlsson GE, Dahlstrom L, Haraldson T, et al. Disk dislocation in the joint. Preliminary results from conventional physiologic occlusal treatment. Sver Tandlakarforb Tidn. 1986;78(8):405-409.
18. Luther F. Orthodontics and the temporomandibular joint: where are we now? Part 2. Functional occlusion, malocclusion, and TMD. Angle Orthod. 1998;68(4):305-318.
19. Henrikson T. Temporomandibular disorders and mandibular function in relation to Class II malocclusion and orthodontic treatment: a controlled, prospective and longitudinal study. Swed Dent J Suppl. 1999;134:1-144.
20. Tu¨ rp JC, Greene CS, Strub JR. Dental occlusion: a critical reflection on past, present and future concepts. J Oral Rehabil. 2008;35:446–453.
21. Manfredini D, Bucci MB, Montagna F, Guarda-Nardini L. Temporomandibular disorders assessment: medicolegal considerations in the evidence-based era. J Oral Rehabil. 2011;38:101–119.
22. Greene CS, Obrez A. Treating temporomandibular disorders with permanent mandibular repositioning: is it medically necessary? Oral Surg Oral Med Oral Pathol Oral Radiol. 2015;119:489–498.
23. Mai T, Okamoto T, Kaneko T, Umeda K, Yamamoto T, Nakamura S. Long-term follow-up of clinical symptoms in TMD patients who underwent occlusal reconstruction by orthodontic treatment. Eur J Orthod. 2000;22:61–67.
24. Henrikson T, Nilner M. Temporomandibular disorders, occlusion and orthodontic treatment. J Orthod. 2003;30: 129–137.

25. Egermark-Eriksson I, Carlsson GE, Magnusson T, Thilander B. A longitudinal study on malocclusion in relation to signs and symptoms of craniomandibular disorders in children and adolescents. Eur J Orthod. 1990;12:399-407.
26. Greene CS. The etiology of temporomandibular disorders: implications for treatment. J Orofac Pain. 2001;15:93–105.
27. Manfredini D, Perinetti G, Guarda-Nardini L. Dental malocclusion is not related to temporomandibular joint clicking: a logistic regression analysis in a patient population. Angle Orthod. 2014;84:310–315.
28. Tanaka E, Detamore MS, Mercuri LG. Degenerative disorders of the temporomandibular joint: etiology, diagnosis, and treatment. J Dent Res. 2008; 87:296–307. [PubMed: 18362309]
29. McNeely ML, Armijo Olivo S, Magee DJ. A systematic review of the effectiveness of physical therapy interventions for temporomandibular disorders. Phys Ther. 2006; 86:710–25. [PubMed: 16649894]
30. Gray RJ, Quayle AA, Hall CA, Schofield MA. Physiotherapy in the treatment of temporomandibular joint disorders: a comparative study of four treatment methods. Br Dent J. 1994; 176:257–61. [PubMed: 8186034]
31. Treacy K. Awareness/relaxation training and transcutaneous electrical neural stimulation in the treatment of bruxism. J Oral Rehabil. 1999; 26:280–7. [PubMed: 10232855]
32. Ingawale S, Goswami T. Temporomandibular joint: disorders, treatments, and biomechanics. Ann Biomed Eng. 2009; 37:976–96. [PubMed: 19252985]
33. Manjanna KM, Shivakumar B, Pramod Kumar TM. Microencapsulation: an acclaimed novel drug-delivery system for NSAIDs in arthritis. Crit Rev Ther Drug Carrier Syst. 2010; 27:509–45. [PubMed: 21175420]
34. Dionne RA. Pharmacologic treatments for temporomandibular disorders. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1997; 83:134–142. [PubMed: 9007937]
35. Mountziaris PM, Kramer PR, Mikos AG. Emerging intra-articular drug delivery systems for the temporomandibular joint. Methods. 2009; 47:134–40. [PubMed: 18835358]
36. Nitzan DW, Price A. The use of arthrocentesis for the treatment of osteoarthritic temporomandibular joints. J Oral Maxillofac Surg. 2001; 59:1154–9. discussion 1160. [PubMed: 11573170]
37. Laskin, DM. Surgical Management of Internal Derangements. In: Laskin, DM.; Greene, CS.; Hylander, WL., editors. TMDs an evidenc-based approach to diagnosis and treatment. Hanover Park: Quintessence Publishing Co; 2006. p. 476).
38. Holmlund A. Diagnostic TMJ arthroscopy. Oral Surg Oral Diagn. 1992; 3:13–8. [PubMed: 8529146]
39. Dolwick MF, Dimitroulis G. Is there a role for temporomandibular joint surgery? Br J Oral Maxillofac Surg. 1994; 32:307–13. [PubMed: 7999739]
40. Holmlund A. Diagnostic TMJ arthroscopy. Oral Surg Oral Diagn. 1992; 3:13–8. [PubMed: 8529146].