

# Overlaid temporomandibular joint disorders and otology symptoms – A diagnostic approach and management considerations for otolaryngologists and dentists

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## ABSTRACT

There is an overlap of symptoms related to temporomandibular joint disorders (TMD) and otological diseases. It becomes empirical to differentiate the two conditions since the prevalence of otalgia, tinnitus, headache, etc., in TMD patients may be as high as 50%. This review paper discusses the overlapping symptoms, diagnostic work up and treatment strategies for TMD, aiding both the oral physician and otolaryngologist to be able to treat the patient in a holistic manner.

**Key words:** *Temporomandibular joint disorders, Otological disease, Tinnitus, Otolaryngology, Oral Physician*

The functional disorders of the masticatory organ are the third most common stomatological diseases, with its chronicity and widespread prevalence is considered a population disease. Temporomandibular joint dysfunction or disorder (TMD) occurs in more than 10% population, restricting individual's capability to perform everyday functions at home and work. According to the epidemiological data, TMD is more common in males than in females [1]. Temporomandibular joint (TMJ) and the auditory canal share a common anatomical wall, embryologically develop from the same brachial arch thus have the same nerve supply. This could lead to common clinical manifestations as well as reference of symptoms from one another. Along with secondary or referred otalgia, TMD also poses a diagnostic challenge to otolaryngologists as orofacial pain, headache, and otology symptoms are very common in TMD, and mimic a number of otolaryngological conditions. Misdiagnosis of TMD can lead to unnecessary investigation and treatment, resulting in further patient suffering. The differential diagnosis often relies on thorough history and examination; however, the dental causes are commonly overlooked. According to Yanagisawa *et al.*, secondary otalgia due to dental disorders account for 50% of all cases referred to TMJ clinic [2]. TMDs are characterized by various signs and symptoms including pain and dysfunction of TMJ and/or masticatory musculature. Apart from these sites of pain and dysfunction, other areas of face and neck such as temporal, occipital, frontal areas of head, and auricular area can also be involved [3,4]. The patients may also experience pain in the cervical region, TMJ noises, limitation of mouth opening, or deranged mandibular movements [1,5-7]. Otological symptoms have been implicated in the predisposition,

initiation, and perpetuation of TMD [7]. The otologic symptoms of TMD within the stomatognathic system include, otalgia, tinnitus, hypersensitivity to sounds, fullness/plugging sensation, vertigo, and hearing loss [1,8,9]. The purpose of this review is to understand and differentiate TMD conditions from other otolaryngologic conditions and to discuss a diagnostic workup for these patients along with a strategic treatment plan.

## HISTORY

Relationship between TMD and ear ache was first reported by Wright in 1920, in a description of deafness due to position of mandible and TMJ [10]. In 1934, Costen sensed the possibility of a causal link between tinnitus and TMJ, describing a series of related symptoms that characterized the well-known syndrome [11]. In 1950s, Schwartz gave new interpretative models aiming to emphasize more on muscular and emotional factors. In 1960s and 1970s Moulton, Laskin, and Dworkin suggested an etiopathogenic and pathophysiological interpretation in which occlusal, muscular, and psychological components compete with each other in a multifactorial model [12-14]. Since the 1990's, research has shed light on neurophysiopathological aspects of craniofacial pain and concept of "Chronic pain from deafferentation" triggered by peripheral nerve damage and maintained by phenomena related to neuroplasticity.

## PROPOSED MECHANISM OF TMD AND OTALGIA

The mechanism behind TMD causing otalgia and otolaryngological symptoms remains diffuse and unclear. Some of the theories proposed by researchers are as follows:

- Direct mechanical stimulation of malleus through its connection to TMJ by means of discomalleolar ligament (Pintos Ligament). Pinto described a pseudo-ligamentous connective structure present in fetal age, a thin ligament which is able to mobilize the tympanum-ossicular unit as a result of condylar disk movements [15,16].
- The masseter muscles, tensor veli palatini, and tensor tympani have a common embryological origin from the first pharyngeal pouch and share innervation of trigeminal nerve with TMJ which allows reference of pain from TMJ to the ear. [17,18].
- The contraction of blood vessels supplying the hearing receptor, or an oral parafunctional activity (bruxism) can lead to microtraumas in the vicinity of the TMJ which could lead to TMD.
- Cervical spine pathology can cause referred otological symptoms and pain in the TMJ and orofacial areas. This is due to anatomical proximity of the cervical spine and otological or TMJ nerve root synapse. Cervical spine musculature contributes to TMJ stability; contraction of cervical spine activates nerve roots, leading to referral pain, and other symptoms [19].

### PREVALENCE OF CROSS SYMPTOMS

Although TMD may not cause classically an ENT problem, often causes otological symptoms, is commonly seen in otolaryngology outpatient clinic. A meta-analysis reviewed five studies which used RDC/TMD for TMJ evaluation; they found that the prevalence of tinnitus was higher in patients with TMDs (35.8%–60.7%) than in patients without TMDs (9.7%–26.0%). The odds ratio of suffering from tinnitus among patients with TMDs was 4.45 [20]. Similar findings were observed by Stephan *et al.*, who further concluded that ENT symptoms were found to be more common in patients who presented myofascial pain and less in those with intra-articular disc disorder [21]. Majersio *et al.* (2016) evaluated frequency of otological symptoms and its association with TMD and concluded that 68% had ear symptoms, 44% had fullness of ear, and 37% had impaired hearing [22].

Maciel *et al.* in their study found significant associations between TMD and otological symptoms especially tinnitus, ear pain, feeling of hearing loss, and vertigo. There were also significant associations with non-otological symptoms such as back pain, headache, neck pain, pain in the eye, and dizziness with increasing symptoms associated with a progressive increase in the severity of TMD [23]. Few researchers have concluded that otolaryngologic symptoms were found to be more common in patients with TMD than in normal population [7,24]. Bernhardt (2004) screened tinnitus patients for the presence of TMD and found 60% of tinnitus patients exhibited more than two symptoms of TMD [25]. Rahena *et al.* found tinnitus to be associated with pain on pressure in masticatory muscles and the TMJ, mandibular overclosure, and posterior displacement of condyle. They concluded that tinnitus may have a central component but can

be modified by voluntary orofacial movements including tooth clenching [17].

Some investigators have hypothesized that eustachian tube dysfunction, masticatory muscle dysfunction, or reflex-sympathetic vasospasm of labyrinthine vessels occur secondary to abnormal stimulation of autonomic nerves of TMJ [17]. TMD is also classified as a subset of primary headache disorders by the International Headache Society. Findings from epidemiological and experimental intervention studies indicate that TMD is a chronic pain condition that can occur in association with some other common chronic pain conditions, notably headaches, pain in neck and shoulder area, and back pain. Headache is regarded as the most common symptom of TMD patients, while 55% of chronic headache patients referred to a neurologist had signs and symptoms of TMD [7].

### DIAGNOSIS AND DIFFERENTIATION

Literature shows a high prevalence of overlap of symptoms between otological diseases and TMD. After a thorough examination of the ear and its structures, if symptoms such as otalgia, tinnitus, headache, and neck pain are unrelated to otological diseases, otolaryngologists should perform a preliminary examination of the TMJ and dentition to look for any other signs. Diagnosis of TMD is difficult as it presents a variety of symptoms that are not exclusive to the temporomandibular disorder. In this section, we discuss a few diagnostic guidelines, investigative tools, and treatment options for TMD. The examination of TMJ and its associated structures as described below can be easily performed in their clinical set up by the otolaryngologists; the patients with positive findings can be referred to the oral physicians for a more comprehensive evaluation and management. A thorough case history, complete oral, and general examination along with investigative tools are required to attain a diagnosis. Signs and symptoms of myofascial pain or masticatory muscle disorders include generalized pain of insidious onset in masticatory muscles and associated structures during function and in response to palpation.

During extra-oral and TMJ examination, one must observe facial swelling (pericoronitis or dental abscess), masseter hypertrophy, or inflammation of TMJ. One should also assess the pattern of mouth opening and look for any jerky or excessive lateral movements of lower jaw or subluxation of TMJ. TMJ should be palpated for tenderness. Mouth opening must be measured and interincisal opening of <3.5 cm will be considered as trismus, suggestive of mechanical block or more commonly inflammatory restriction due to pain or spasm. Intraoral examination may show signs of inflammation/infection including ulceration, tooth wear-bruxism, appearance of white linear scarring on the buccal mucosa adjacent to occlusal plane (due to chronic traumatic irritation), and along lateral border of tongue. Tenderness of lateral and medial pterygoid is most consistent finding in TMDs. General condition of gingivae and teeth provide rapid assessment of patient's general oral health. Gross discrepancies in the upper

and lower jaws suggested by severe overjet (>3 mm), reverse incisal overlap, and excessive overbite should be looked for. Malocclusion may cause significant stress on TMJ and therefore may predispose to TMJ dysfunction and pain. Excessive tooth wear is a good sign of bruxism, a major contributory factor to TMJ dysfunction syndrome.

The tool of diagnostic criteria for TMDs was developed based on recommended criteria for more accurate diagnosis [26,19]. The most reliable diagnostic criteria have been found to be RDC-TMD or its modification, i.e., DC-TMD (2014). This considers temporomandibular disorders across two axes; physical dysfunction and psychological impact of temporomandibular disorder both influence the management and prognosis. The diagnosis is in four categories: TMJ disorders, masticatory muscle disorders, headache attributed to temporomandibular disorders, and problems with associated structures. Common signs and symptoms for joint disorder include clicking on joint opening and closing; jaw locking and limited opening; inability to close without maneuvers; and clicking or crepitus. Onset is acute, pain is well-localized. However, the diagnosis of internal derangement is the most difficult and painstaking. A comprehensive criterion for the diagnosis of disk displacements or internal derangement of TMJ is shown in Table 1 [27]. A screening tool, proposed by Zaho *et al.* [28], is useful to determine if TMD is likely (Table 2).

A thorough ENT examination and audiometry should also be conducted to rule out any otolaryngological conditions.

As proposed by Stephan *et al.*, 21 Red Flag symptoms which include emotional or psychological stress, medication usage, vertebrobasilar insufficiency, upper cervical spine instability, cardiac diseases, central neurological dysfunction, cranial nerve dysfunction, extreme weight changes, and concurrent infection should be evaluated and identified in patients with otological and TMD symptoms to look for any alternate diagnosis. Radiographic investigations include conventional TMJ radiography such as transcranial, transpharyngeal, and transorbital views, which however give limited information for diagnosis of TMD. CT and CBCT scanning is useful in detecting bony pathologies in TMJ; OPG may be useful only in detecting significant bony deformity but will not identify intra-articular TMJ pathology. MRI is useful to identify soft-tissue pathology and internal derangements. The use of MRI needs to be tailored to each patient and is generally only indicated when patients fail simple pharmacological and non-invasive treatment.

## MANAGEMENT OF TMD

Successful treatment of TMD leads to resolution of otolaryngological symptoms. Treatment must be based on symptoms and results of thorough examination and investigations as required. In most cases, muscular pain and joint dysfunction occur concurrently [24]. The patient education to reduce stress and understand the disease is an essential first step in management

**Table 1: Criteria for diagnosis of TMDs [27]**

	Disc displacement with reduction	Disc displacement without reduction
History	Joint pain (variable)	Joint pain (variable) Limited opening Previous clicking with intermittent locking Sensation that something in the joint blocks opening
Physical examination	Jaw Tenderness Reciprocal clicking Jaw deviated to side of click until click occurs, then returns to midline.	Jaw tenderness (variable) Limited opening and lateral movement toward opposite side Jaw deviated towards affected side Terminal stretch produces increased joint pain
Imaging	Not diagnostic	Non-diagnostic
Special diagnostic study	Condylar path: Deflections as click occurs Diagnostic Splints: Eliminate symptoms Arthrograms or MRI: Displaced disc that reduces on opening.	Arthrograms or MRI: Displaced disc that does not reduce on opening Manipulation: May reduce disc and return to clicking.

**Table 2: Screening tool for TMD [28]**

Questions	Score
Have you had pain in the face, jaw, temple, in front of the ear or in the ear in the past month?	4
Are you older than 36 years?	3
During the past 6 months, have you had problems with headaches and migraine?	1
Does your present jaw problem prevent or limit you from chewing, yawning, or having your usual facial expression?	1
Does your jaw clack or pop suddenly when chewing?	1
Examinations	
Joint pain on mouth opening	
Muscle pain on protrusive jaw movements	
Joint sounds on mouth closing	
Joint pain on palpation	

\*if the total score is <3, it is predicted that there is no temporomandibular joint dysfunction, if score is more than three, examinations are performed. If none of the findings are positive, it is likely that there is no TMJ dysfunction, otherwise it is predicted that TMJ dysfunction is present

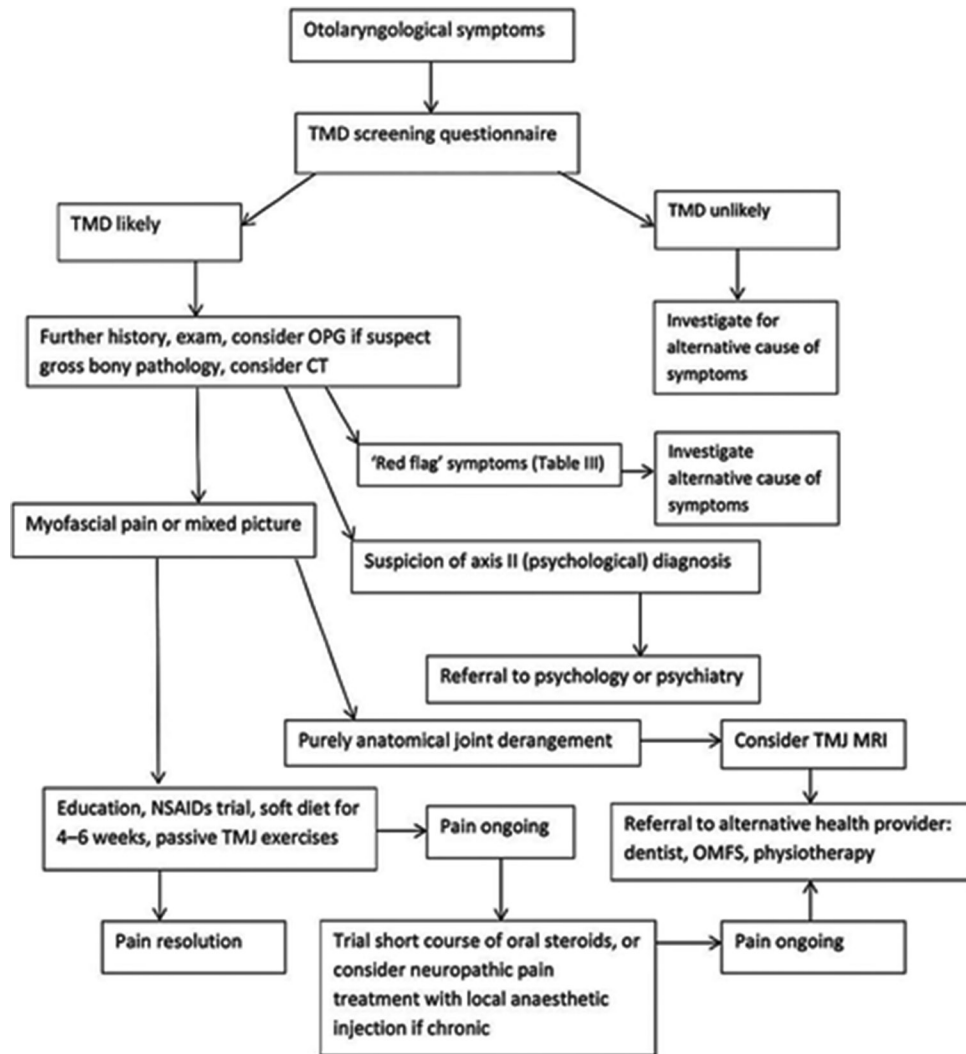


Figure 1: Proposed management pathway for suspected temporomandibular disorder by Stephan [21]

[24,29]. Awareness of disease and reduction of exacerbating habits of bruxism, parafunctional jaw movements, and jaw clenching reduce the masticatory load on the TMJ. Management includes a soft diet, heat, and cold pack application to the site of pain, relaxation techniques, and use of passive jaw movement devices to prevent TMJ muscular atrophy [30]. The pharmacologic treatment includes various drugs to reduce pain and discomfort including NSAIDs, COX-2 inhibitors, and Opioid analgesic such as Tramadol, and Muscle relaxants such as tizanidine, cyclobenzaprine, and tricyclic antidepressants [31].

Oral appliances are regarded as useful adjuncts for treating TMD patients as they reduce loading on TMJ, reduce muscle activity, reduce headache triggered by sleep bruxism, allow for deprogramming of TMJ-fossa relationships, and protect occlusal surfaces of teeth. The authors suggest that oral appliances should be viewed as “oromandibular crutches,” analogous to neck braces or ankle support orthotics as they provide symptomatic relief while patients are recovering. Referral to dentists for fabrication of jaw splints/oral appliances is appropriate [32]. Physiotherapy and TMJ exercises can be used in the recovery process [30,33]. The most important factors to consider when prescribing an exercise program is repetition, compliance, and involvement of

affected musculature. Richardson *et al.* found that in patients with myofascial pain, those who repeated the exercises most frequently were the patients who reported the greatest reduction in jaw pain [32]. Multiple studies based on TMJ exercises have been conducted. Populations and exercise methods are varied, and so drawing conclusions regarding the most effective mobility exercises are problematic. However, their common features are stretching and movement of the masticatory muscles to prevent atrophy.

Some other effective treatment modalities that have been suggested in literature are dry needling, short or long acting anesthetics, steroids, deep pressure massage, stretch therapy with spray, ultrasound, and transcutaneous electric nerve stimulation [33]. If these options fail, it is unlikely that the symptoms will resolve with non-surgical intervention, and so referral to oral and maxillofacial surgeons can be considered. The patients who develop significant psychological stress should be referred to psychology. Psychologists can work on relaxation, stress management, cognitive-behavioral therapy, and other psychological aspects. To summarize, the management of patients with symptoms which overlay TMD and otological conditions, the authors suggest a very comprehensive and useful diagnostic

workup and management pathway proposed by Stephan *et al.* (Fig. 1) [21].

## CONCLUSION

Temporomandibular disorders present with symptoms related to muscular pain and/or mechanical joint dysfunction. Tinnitus and facial pain are more common in temporomandibular disorder patients with depressive symptoms. ENT symptoms are more common in patients with myofascial pain rather than intra-articular disk disorders. Otolaryngological symptoms are more common in patients with TMD than in normal population. We conclude that since the symptoms of TMD are overlaid with otological symptoms, such patients may commonly visit otolaryngologists. A comprehensive evaluation as suggested in this article from the literature would be a good tool for the otolaryngologists as well as dentists to follow for better management of TMD patients.

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