

Temporomandibular disorder in otolaryngology: systematic review

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Abstract

Background: Temporomandibular disorder poses a diagnostic challenge to otolaryngologists as orofacial pain, headache and otology symptoms are very common in temporomandibular disorder, and mimic a number of otolaryngological conditions. Missed diagnosis of temporomandibular disorder can lead to unnecessary investigation and treatment, resulting in further patient suffering.

Objectives: To review the current literature and propose management pathways for otolaryngologists to correctly differentiate temporomandibular disorder from other otolaryngological conditions, and to initiate effective treatment for temporomandibular disorder in collaboration with other health professionals.

Method: A systematic review using PubMed and Medline databases was conducted, and data on temporomandibular disorder in conjunction with otolaryngological symptoms were collected for analysis.

Results: Of 4155 potential studies, 33 were retrieved for detailed evaluation and 12 met the study criteria. There are questionnaires, examination techniques and radiological investigations presented in the literature to assist with distinguishing between otolaryngological causes of symptoms and temporomandibular disorder. Simple treatment can be initiated by the otolaryngologist.

Conclusion: Initial temporomandibular disorder treatment steps can be undertaken by the otolaryngologist, with consideration of referral to dentists, oral and maxillofacial surgeons, or physiotherapists if simple pharmacological treatment or temporomandibular disorder exercise fails.

Key words: Temporomandibular Joint Disorders; Temporomandibular Joint; Temporomandibular Joint Dysfunction Syndrome

Introduction

Temporomandibular disorder or temporomandibular joint (TMJ) dysfunction affects between 5 and 70 per cent of the Caucasian population, and is commonly seen in otolaryngology out-patient clinics.^{1–4} Although not classically an ENT problem, temporomandibular disorder often causes otolaryngological symptoms. This leads to ENT referral for further investigation.⁴

This literature review gives guidance in identifying when otolaryngological symptoms are secondary to temporomandibular disorder and advises on appropriate management from an otolaryngologist's perspective.

Materials and methods

A search of Medline (Embase) and PubMed was performed from the date of each database inception to 30 March 2015, with an update on 1 July 2015. The

search was performed using the following combinations of key words: 'temporomandibular disorder' together with 'diagnostic criteria', 'symptoms', 'otolaryngology', 'management', 'physiotherapy', 'radiography', 'classification', 'prognosis', 'ear, nose and throat' and 'type'.

The inclusion criteria were: abstracts, case reports, case series, literature reviews, retrospective analyses, clinical trials, randomised controlled trials and systematic reviews (written in English language only) that discussed temporomandibular disorder in conjunction with otolaryngological symptoms; if appropriate, these needed to describe interventions. The treatment methods needed to be conservative, well described and reproducible in an ENT out-patient setting.

Studies were excluded if: there was no consideration of otolaryngological symptoms; there were no specific investigation or management recommendations made (where appropriate); conservative management had

previously failed and further conservative options were not pursued; or the only management options described fell outside the scope of an otolaryngologist's consulting room (i.e. requiring surgical intervention). These criteria were considered exclusively and in combination with one another.

Following amalgamation of the current data and previous reviews, this review aimed to provide a streamlined, evidence-based approach to management of temporomandibular disorder in an otolaryngologist out-patient setting.

Results

The combined searches yielded a total of 4155 different studies. The majority of studies on temporomandibular disorder had been conducted by oral and maxillofacial surgeons or dentists. There were few studies on temporomandibular disorder that were relevant to otolaryngologists. After further evaluating titles and abstracts, a total of 33 studies were considered potentially relevant. The final review of all 33 publications identified a total of 12 papers that met the inclusion and exclusion criteria;^{1–12} these were included in the systematic literature review on temporomandibular disorder in otolaryngology. The flow diagram for study selection is shown in Figure 1.

The characteristics of included studies are demonstrated in Table I. Of the 12 studies, 7 were systematic reviews, 2 were retrospective analyses, 1 was a randomised controlled trial, 1 was a clinical trial and 1 was a case series.^{1–12}

In general, the included reviews were of poor quality. All the included reviews lacked detail

regarding the method of literature collection and analysis, and instead were based more on expert opinion. The included publications were lacking in: detail regarding the method of information collection and synthesis, clear and descriptive management options, and discussion regarding included study quality. The case series had small sample sizes. The retrospective analysis, the clinical trial and the randomised controlled trial had larger patient numbers and provided clear detail as to how they reached their conclusion.

The distinct lack of high quality trials in the area upon which this review is based was very restrictive. Nevertheless, the authors have compiled recommendations and findings, and presented them in a format that can be followed in an otolaryngologist's consulting room setting.

Discussion

Defining temporomandibular disorder

Temporomandibular disorder involves pain and dysfunction to the TMJ, jaw, and the muscles controlling these structures.³

There are a variety of criteria to classify temporomandibular disorder; the more commonly mentioned tool is the Diagnostic Criteria for Temporomandibular Disorders.⁵ This considers temporomandibular disorder across two axes. Axis I represents physical dysfunction and axis II reflects the psychological impact of temporomandibular disorder. Both are important to consider as they influence management options and prognosis.⁶ The Diagnostic Criteria for Temporomandibular Disorders tool encompasses four categories. Each person can have only one diagnosis from each category, but can have diagnoses from multiple categories. These categories are divided into the following: (1) TMJ disorders; (2) masticatory muscle disorders; (3) headache attributed to temporomandibular disorder; and (4) problems with associated structures.⁵

Temporomandibular joint disorders describe anatomical dysfunction of the joint. Such derangement can cause synovitis, pain over the TMJ, a popping noise upon disc reduction, and limited range of motion with mouth opening and jaw locking.^{2,6,7}

Masticatory muscle disorders usually have no evidence of anatomical pathology. They cause symptoms including facial pain, masticatory muscle point tenderness, jaw dysfunction, otolaryngological symptoms and muscle stiffness.^{6,7} These symptoms are commonly associated with TMJ dysfunction. Otolaryngological symptoms, stress and anxiety are more commonly associated with masticatory muscle disorders than anatomical TMJ derangement.^{2,3,7}

The precise association between headache and temporomandibular disorder is unclear. It is known that temporomandibular disorder and headache can occur concurrently, that increased temporomandibular disorder symptoms can worsen headache, and that

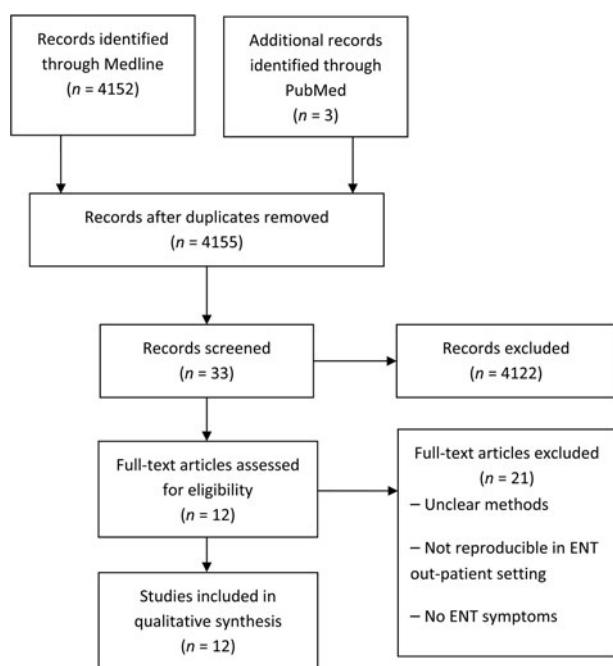


FIG. 1

Flow diagram for study selection

TABLE I
CHARACTERISTICS OF INCLUDED STUDIES

Authors	Study type	Participants (n)	Incidence of ENT symptoms (%)	Intervention	Conclusion
Ferendiuk <i>et al.</i> ¹	Retrospective analysis	1208 case reports (78.8% females, 21.2% males)	5.71 – otalgia 3.72 – tinnitus 1.16 – hearing impairment 0.75 – vertigo 0.33 – sore or burning throat 0 – hearing loss	N/A	Consider TMD as cause of ENT symptoms
Shaffer <i>et al.</i> ²	Review article	N/A	N/A	Thorough physical exam including cervical spine	Implement RDC/TMD criteria for diagnosis
Israel & Davila ³	Review article	N/A	13.8–85 – tinnitus	Conservative management. Patient referred if chronic or anatomical derangement	ENT symptoms caused by TMD often resolve with treatment. CT & MRI can be used in diagnosis
Sharma <i>et al.</i> ⁴	Review article	N/A	N/A	N/A	TMD has multifactorial pathogenesis
Schiffman <i>et al.</i> ⁵	Review article		N/A	N/A	Classify TMD based on new DC/TMD protocol, updated from RDC/TMD
Look <i>et al.</i> ⁶	Retrospective analysis	230	N/A	Diagnosis based on RDC/TMD criteria	Plain radiographs poor at detecting TMJ degeneration. RDC/TMD alone as diagnostic classification leaves room for misdiagnosis
Scrivani <i>et al.</i> ⁷	Review article	N/A	N/A	Rest, education, passive TMJ stretching, NSAIDs, antidepressants	Not clearly stated
Elberg <i>et al.</i> ⁸	Randomised controlled trial	60	N/A	Stabilisation appliance	Statistically significant reduction in headache with TMD treatment
Dym & Israel ⁹	Review article	N/A	N/A	Soft diet, education, splints, muscle relaxants, NSAIDs, antidepressants	CT &/or MRI for patients who have not responded to conventional management
Zhao <i>et al.</i> ¹⁰	Clinical trial	381	N/A	N/A	Screening checklist based on RDC/TMD criteria has high validity
Fricton ¹¹	Review article	N/A	N/A	Soft diet, ice packs, NSAIDs & over-the-counter analgesic, oral splints, jaw exercises	If prolonged pain course (>6 months), recommend multidisciplinary team involvement
Richardson <i>et al.</i> ¹²	Case series	3	N/A	Tongue, jaw & cheek stretching exercises, lateral motion, protrusion	High compliance & high level of pain at start of treatment associated with best outcome

N/A = not available; TMD = temporomandibular disorder; RDC/TMD = Research Diagnostic Criteria for Temporomandibular Disorders; CT = computed tomography; MRI = magnetic resonance imaging; DC/TMD = Diagnostic Criteria for Temporomandibular Disorders; TMJ = temporomandibular joint; NSAIDs = non-steroidal anti-inflammatory drugs

treatment of temporomandibular disorder can result in reduced headache severity.^{5,8}

Cervical spine pathology can result in: deranged mobility of the TMJ,² referred pain to the TMJ and surrounding structures, otalgia, vertigo, and tinnitus.¹³

Prevalence

The prevalence of temporomandibular disorder is 5–70 per cent.^{1,2,4} Pain is a major symptom in 40 per cent of patients.¹ It has been reported that 40–75 per cent of the population have one sign of temporomandibular disorder and 33 per cent have one symptom.⁷ It is a disease of young to middle-aged females, with a female-to-male ratio ranging from 3:1 to 9:1.

Incidence decreases in both sexes after the age of 55 years.^{7,9}

Referred ENT symptoms

Temporomandibular disorder presents with symptoms related to muscular pain and/or mechanical joint dysfunction. It is common for associated ENT symptoms to occur.^{1,14} In these cases, otolaryngologists may become involved following referral from general practitioners or other sources. ENT symptoms have been reported at varying frequencies, with otalgia ranging from 5 to 30 per cent and tinnitus from 30 to 85 per cent. Tinnitus and facial pain are more common in temporomandibular disorder patients with depressive

symptoms.^{1,3} ENT symptoms are more common in patients who present with myofascial pain rather than intra-articular disc disorder. Otolaryngological symptoms are more common in patients with temporomandibular disorder than in the normal population.³ A review by Ramirez *et al.* found that common otological symptoms, in order of frequency, are: otalgia, tinnitus, aural fullness, vertigo and subjective hearing impairment.¹⁴

The mechanism behind TMJ dysfunction producing otalgia and other otolaryngological symptoms remains unclear. The masseter muscles, the facial muscles and the ear muscles (tensor palate and tensor tympani) have a common embryonic origin from the first pharyngeal pouch, and share innervation with the TMJ.¹⁵ This may allow pain referral from the TMJ to the ear, and potentially explains why otological symptoms occur more frequently with myofascial pain.^{1,3}

Cervical spine pathology can cause referred otological symptoms and pain in the TMJ and orofacial areas. This is due to the anatomical proximity of the cervical spine and otological or TMJ nerve root synapse,¹³ and because of the cervical spine musculature's contribution to TMJ stability and movement.² Contraction of the cervical spine muscles activates nerve roots, leading to referral of pain or other symptoms. Cervical spine pathology can result in myofascial TMJ pain. This is possibly secondary to muscle contraction around the cervical spine, resulting in sustained contraction of the masticatory muscles, initiating or perpetuating myofascial pain.^{5,13}

Diagnosis and differentiation from other causes

Diagnosis of temporomandibular disorder can be difficult: temporomandibular disorder presents with a variety of symptoms, and the presenting symptoms are not exclusive to temporomandibular disorder. The Diagnostic Criteria for Temporomandibular Disorders tool was developed based on recommended criteria for a more accurate diagnosis.^{5,6} The most common diagnoses are divided into two categories: myofascial pain and joint disorders. These are not mutually exclusive, and patients commonly exhibit features of both categories.⁹ Myofascial pain symptoms and signs include: pain in the masticatory muscles and structures (temple, front of ear, jaw), functionally and in response to palpation; pain reproducible on palpation; and generalised pain of insidious onset. Joint disorder signs and symptoms include: clicking on jaw opening and closing; jaw locking and limited opening; an inability to close the jaw without specific manoeuvres; joint crepitus or clicking; acute onset, well-localised pain; and limited jaw opening, lateral movement or protrusion.^{3,5,9}

In patients who are referred to an otolaryngologist for investigation of ENT symptoms known to occur in temporomandibular disorder, a screening tool, proposed by Zhao *et al.*, can be used to determine if temporomandibular disorder is likely (Table II).¹⁰

TABLE II
TEMPOROMANDIBULAR DISORDER SCREENING CHECKLIST¹⁰

<p>Questions*</p> <ul style="list-style-type: none"> - Have you had pain in the face, jaw, temple, in front of ear or in the ear in the past month? Score of 4 - Are you older than 36 years? Score of 3 - During the last 6 months, have you had problems with headache or migraine? Score of 1 - Does your present jaw problem prevent or limit you from chewing, yawning or having your usual facial appearance? Score of 1 - Does your jaw clack or pop when you open or close your mouth, or when chewing? Score of 1 <p>Examinations†</p> <ul style="list-style-type: none"> - Joint pain on mouth opening - Muscle pain on protrusive jaw movement - Joint sounds on mouth closing - Joint pain on palpation
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*If the total questions score is less than 3, it is predicted that there is no temporomandibular joint (TMJ) dysfunction; if the total score is 3 or more, the listed examinations are performed. †If none of the examination findings are positive, it is likely that there is no TMJ dysfunction; otherwise, it is predicted that TMJ is present.

In the case of a positive screening test, exploring the symptomatology further can allow patients to be classified as having either myofascial or joint disturbance. Intra-articular pain is well localised and acute, whilst myofascial pain is more generalised and of insidious onset.^{3,9} A history of mandibular parafunction, including jaw clenching or bruxism, is known to contribute to temporomandibular disorder. Temporomandibular disorder, particularly the myofascial variant, and cervical spine pain co-exist in up to 70 per cent of

TABLE III
'RED FLAG' SYMPTOMS

<p>Emotional or psychological stress Medication usage Vertebrobasilar insufficiency Upper cervical spine instability Cardiac disease Central neurological dysfunction Cranial nerve dysfunction Extreme weight changes Concurrent infection²</p>

TABLE IV
NORMAL MANDIBULAR MOVEMENT MEASUREMENTS

Measurement	Definition	Normal distance (mm)
Interocclusal distance	Distance from superior surface of lower incisors to inferior surface of upper incisors	35–55
Lateral deviation	Distance from midline of maxillary central incisors to midline of mandibular central incisors	8–15 ^{3,7}

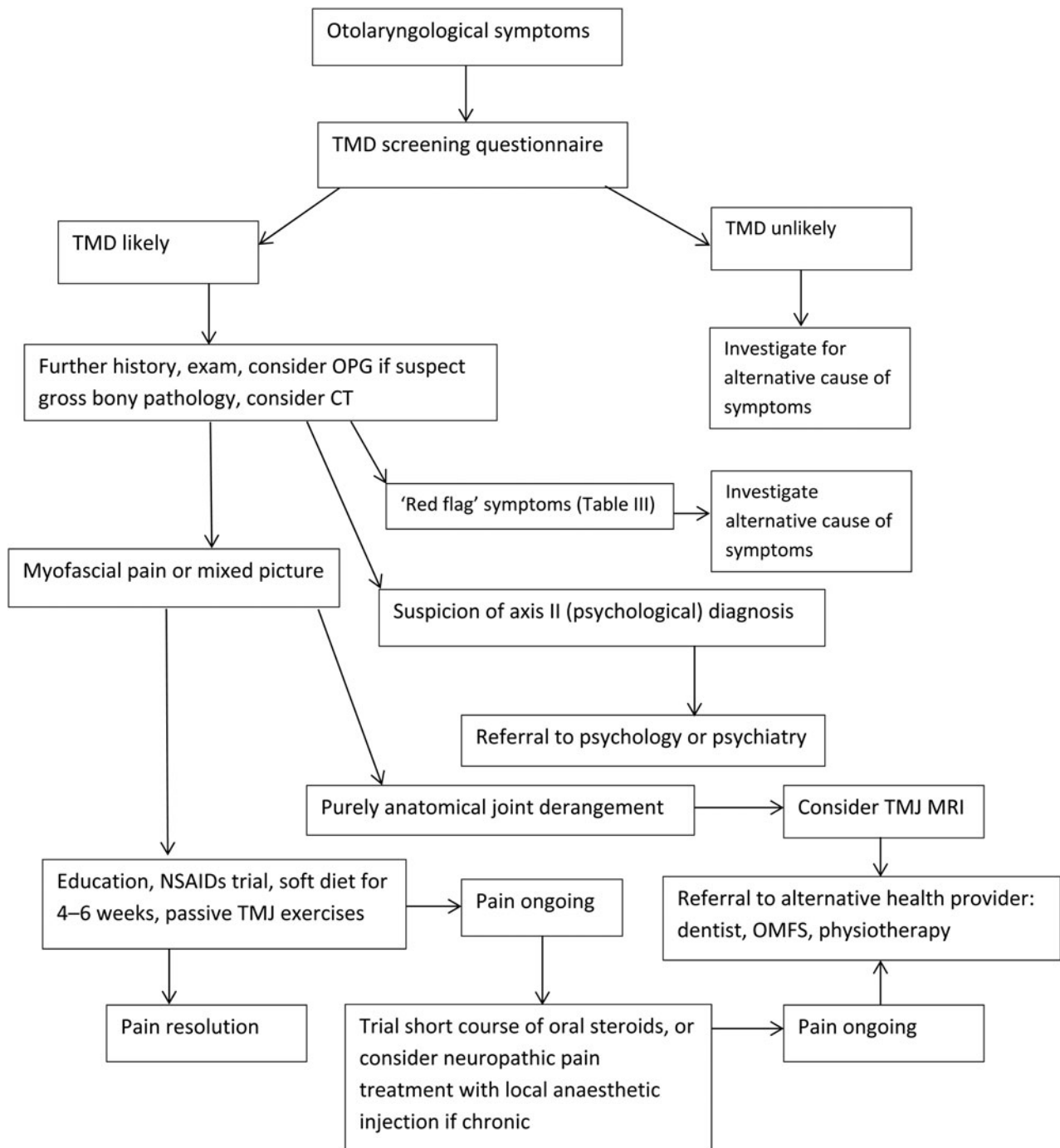


FIG. 2

Proposed management pathway for suspected temporomandibular disorder. TMD = temporomandibular disorder; OPG = orthopantomography; CT = computed tomography; TMJ = temporomandibular joint; MRI = magnetic resonance imaging; NSAIDs = non-steroidal anti-inflammatory drugs; OMFS = oral and maxillofacial surgery

cases.¹³ Thus, cervical spine pathology must also be considered in temporomandibular disorder patients. Systemic features of illness must be explored, as connective tissue and neurological disorders can cause TMJ discomfort.^{3,7}

Any 'red flag' symptoms must be identified to allow further investigation of an alternative diagnosis as a cause of the otolaryngological or TMJ symptoms (Table III). Tinnitus can be a symptom of many otolaryngological diseases, such as Ménière's disease,

cerebellopontine angle tumours and otosclerosis, and so strong clinical suspicion must be maintained.³

A thorough ENT examination must be conducted to exclude any true otolaryngological conditions. Additional examination for temporomandibular disorder involves examination of the neck, cervical spine, and extraoral and intraoral structures. General observation of the patient for jaw asymmetry and tension is the initial step. Wear patterns on the teeth can give an indication of asymmetrical loading. The

TMJs are palpated for pain, as can occur in synovial inflammation. The muscles of mastication are palpated, as tenderness of these areas is associated with myofascial pain.^{3,4} Passive mandibular movement is measured in terms of interocclusal distance, lateral deviation and protrusion (Table IV). Examination must finish with cranial nerve examination and sensory examination. Any patient describing sensory loss needs to have this mapped out. Sensory loss in myalgia tends not to be in an anatomical distribution. If it follows a sensory nerve, further investigation into an underlying cause for the sensory loss (e.g. neoplasia) must be completed.^{2-4,7}

Further investigation is based on symptomatology. Audiometry is indicated if otological symptoms are present. Look *et al.*,⁶ and Israel and Davila,³ found that computed tomography (CT) scanning was useful in detecting hard tissue pathology and magnetic resonance imaging (MRI) was useful in identifying soft tissue pathology. These methods were significantly more sensitive and specific than panoramic films in detecting TMJ pathology.⁶ Orthopantomography is useful only in detecting significant bony deformity, and will not identify intra-articular TMJ pathology.⁴ The use of CT and MRI needs to be tailored to each patient, and is generally only indicated when patients fail simple pharmacological treatment or if there is evidence of underlying pathology (e.g. neoplasia).^{3,9} In these cases, referral to oral and maxillofacial surgeons or dentists may be appropriate.

Treatment options for otolaryngologists

The literature suggests that successful treatment of temporomandibular disorder leads to resolution of the otolaryngological symptoms.^{1,3,7}

Treatment is determined by symptomatology. However, it can be difficult to determine if facial muscle pain is primary or a result of intra-articular joint dysfunction. In most cases, muscular pain and joint dysfunction occur concurrently.³ Patient education is an essential first step in management.^{3,11} Areas to cover include awareness and reduction of exacerbating habits; for example, jaw clenching at times of stress, or eating hard foods that place greater load on the muscles of mastication. Management includes a soft diet, heat pack application to the site of pain, relaxation techniques and use of passive jaw movement devices to prevent TMJ muscular atrophy.¹⁶ Referral to dentists for interventions including jaw splints and movement devices to prevent clenching, overuse and muscle atrophy is appropriate.

Physiotherapy and TMJ exercises can be used in the recovery process.^{9,11} The most important factors to consider when prescribing an exercise programme are repetition, compliance and involvement of affected musculature. Richardson *et al.* found that in patients with myofascial pain, those who repeated the exercises the most frequently were the patients who reported the greatest reduction in jaw pain.¹²

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 is problematic. Additionally, the exercises are described in such limited detail that reproducing them in a clinician's office is difficult.¹¹ Their common features are stretching and movement of the masticatory muscles to prevent atrophy.^{9,11} Pain control is a crucial step in management, to avoid the development of allodynia and chronic pain.¹¹ Regular non-steroidal anti-inflammatory drug (NSAID) use for 7–14 days, accompanied by a soft, no-chew diet, is effective in reducing intra-articular inflammation.^{3,9,11} In patients who do not respond to NSAIDs, a short course of oral steroid can be effective. Chronic neuropathic pain can be managed with a trial of gabapentin or tricyclic antidepressant.^{4,7} If these options fail, it is unlikely that the symptoms will resolve with non-surgical intervention,³ and so referral to oral and maxillofacial surgeons can be considered. Patients who develop significant psychological stress should be referred to psychology.¹¹

Based on the literature review, the authors propose a management pathway for otolaryngologists, to correctly differentiate temporomandibular disorder from other otolaryngological conditions, and to initiate effective treatment for temporomandibular disorder in collaboration with other health professionals (Figure 2). The authors recognise the limitations of these recommendations, given that a single author performed the literature search, that minimal data are sourced from randomised controlled trials and that the available reviews on the topic are of poor quality.

- **Temporomandibular disorder is common in ENT given the relationship between temporomandibular disorder and otolaryngological symptoms**
- **Diagnosis and further investigation can be performed by a treating otolaryngologist**
- **There are conservative management options with high likelihood of symptom resolution that otolaryngologists can prescribe, prior to dentist or oral and maxillofacial surgeon referral**

Prognosis

Prognosis is variable depending on the form of temporomandibular disorder the patient has. Forty per cent of cases resolve spontaneously⁷ and 70–90 per cent of cases resolve with conservative management.^{9,17} If initial medical management with NSAIDs fails, patients are unlikely to improve with further non-surgical intervention.³

Conclusion

The prevalence of otolaryngological symptoms in temporomandibular disorder makes it paramount for otolaryngologists to differentiate temporomandibular disorder from true otolaryngological causes of the symptoms. After diagnosis of temporomandibular disorder is established, simple pharmacological management, counselling and TMJ exercise can be initiated by otolaryngologists. The involvement of other health professionals, including dentists, oral and maxillofacial surgeons, physiotherapists, and psychologists, is crucial if initial treatment fails. Further research into the benefit of specific jaw exercises and conservative management with a randomised controlled trial is an essential next step in determining 'gold standard' management of temporomandibular disorder.

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Dr L Stepan takes responsibility for the integrity of the content of the paper

Competing interests: None declared
