Review Article

Otalgia from temporomandibular disorder in Ear, Nose and Throat surgery: a literature review and diagnostic algorithm

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Background and Objective: Temporomandibular disorder (TMD) describes a group of conditions characterised by pain or dysfunction in the temporomandibular joint and the muscles that control its movement. Patients with pain-related TMD frequently report otalgia and may be referred to an Ear, Nose and Throat (ENT) surgeon for additional workup. The aim of this study is to review and synthesise the current evidence to outline the role of the otolaryngologist in the diagnosis and multidisciplinary management of otalgia from TMD.

Methods: A structured review of the literature was conducted using PubMed, EMBASE, Web of Science, and Cochrane for articles in English on otalgia from TMD from inception until March 20, 2023. Two authors independently reviewed the studies and the findings of relevant articles were included.

Key Content and Findings: Seventy-eight studies were incorporated in this review. ENT surgeons should maintain a high index of suspicion for TMD in patients presenting with otalgia to their clinics, particularly where primary ear disease is excluded. The diagnosis of TMD can be made easily using the TMD-pain screener based on the presence of otalgia modified by movement of the jaw and elicitation of familiar pain on palpation of the temporals and master muscles. Still, the ENT surgeon should consider and exclude alternative or co-existing causes of otalgia, particularly head and neck malignancy. ENT surgeons are responsible for commencing conservative management and involving a multidisciplinary care team of physiotherapists, dental practitioners, mental health professionals, and oral and maxillofacial surgeons.

Conclusions: ENT surgeons can use the evidence-based diagnostic algorithm to promptly diagnose and commence multidisciplinary treatment in patients presenting with otalgia from TMD to their clinic.

Keywords: Earache; temporomandibular joint disorders (TMJ disorders); otolaryngology; diagnosis

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Introduction

Patients with otalgia will commonly be referred to Ear, Nose and Throat (ENT) surgeons. Whilst otalgia is often due to primary pathology affecting the ear itself, secondary causes where the pain is referred from other head and neck sites can be just as frequent (1,2). Temporomandibular disorder (TMD) describes a group of conditions characterised by pain or dysfunction in the temporomandibular joint (TMJ) and the muscles that control its movement. Patients with TMD experience impaired quality of life with evidence

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Table 1 Population, context, and outcome of studies included in the review

Item	Description
Population	Patients with otalgia
Context	Co-existing or causative temporomandibular disorder
Outcome	The role of the otolaryngologist in the diagnosis and management

demonstrating increased rates of chronic pain, social dysfunction, sleep disruption, and restriction on daily activities (3,4). Whilst TMD is not classically thought of as an ENT pathology, patients with pain-related TMD frequently report pain in or in front of the ear in addition to other otological symptoms including tinnitus, hearing loss, aural fullness, and vertigo (2,5-7). Consequently, many patients suffering from otalgia will naturally be referred to an ENT surgeon for additional workup following a normal otoscopic examination but without appropriate recognition of TMD (8).

ENT surgeons play a pivotal role in diagnosing and commencing early multidisciplinary treatment in patients presenting with otalgia from TMD to their clinic (9,10). The Committee on Temporomandibular Disorders recently highlighted numerous pertinent challenges affecting patient care including a continuing notion that TMD is primarily a dental issue despite patients presenting to diverse healthcare providers, substantial delays in diagnosis and treatment due to the complex origin and pathophysiology of pain in the head and neck region, and a lack of coordinated and multidisciplinary treatment (11,12). These challenges are especially notable in ENT settings but can be ameliorated by an understanding and utilisation of the simple, clear, and reliable diagnostic definition for TMD as published in the dual-axis Diagnostic Criteria for TMD (DC/TMD) (7). The aim of this study is to review and synthesise the current evidence to outline the role of the otolaryngologist in the diagnosis and multidisciplinary management of otalgia from TMD. We present this article in accordance with the Narrative Review reporting checklist (available at https://www.theajo.com/article/view/10.21037/ajo-23-42/rc).

Methods

A review of the literature was performed based on the intended population, context, and outcome (PCO) outlined in *Table 1*. A search was performed in the PubMed, EMBASE, Web of Science, and Cochrane databases for articles in English on otalgia from TMD from inception until March 20, 2023. A combination of the following search terms was used in each database: ("otalgia" OR "earache" OR "ear pain") AND ("temporomandibular joint dysfunction syndrome" OR "TMJ*" OR "TMD*" OR "temporomandibular joint*").

Following the removal of duplicates, two authors independently reviewed the titles and abstracts of studies using the Rayyan web application (13) (Rayyan Systems Inc., United States) for potential relevance. The eligibility of these article's full texts were evaluated and their reference lists were screened for any additional relevant articles. Consensus was obtained by discussion between the authors where disagreement arose. The inclusion criteria included: English language, subjects of all ages, subjects with otalgia relating to TMD, and full-text availability. Animal studies, case reports, and narrative reviews were excluded. The selected articles were read in full and their salient findings were incorporated into an evidence-based discussion of the prevalence, diagnosis, and multidisciplinary management of otalgia from TMD.

Results

A total of 1,086 articles were identified using the search terms listed above (*Figure 1*). Only 674 articles remained after the removal of duplicates. There were 155 articles discussing otalgia from TMD in their title of abstract and following the removal of 20 articles where no full text was available, the full text of the remaining 135 were evaluated. Another 15 articles were identified from the citation lists of these articles. Seventy-eight studies were finally included in this review. The reasons for exclusion of studies included: narrative review articles (n=22), incorrect outcome (n=20), incorrect population (n=18), and incorrect publication type (n=10).

Discussion

The prevalence of otalgia from TMD

It is pivotal that ENT surgeons recognise the prevalence of otalgia from TMD to enable prompt diagnosis. Pain-related TMD affects approximately 10% of the general population over the age of 18 (14). The proportion of these patients reporting otalgia varies considerably in published

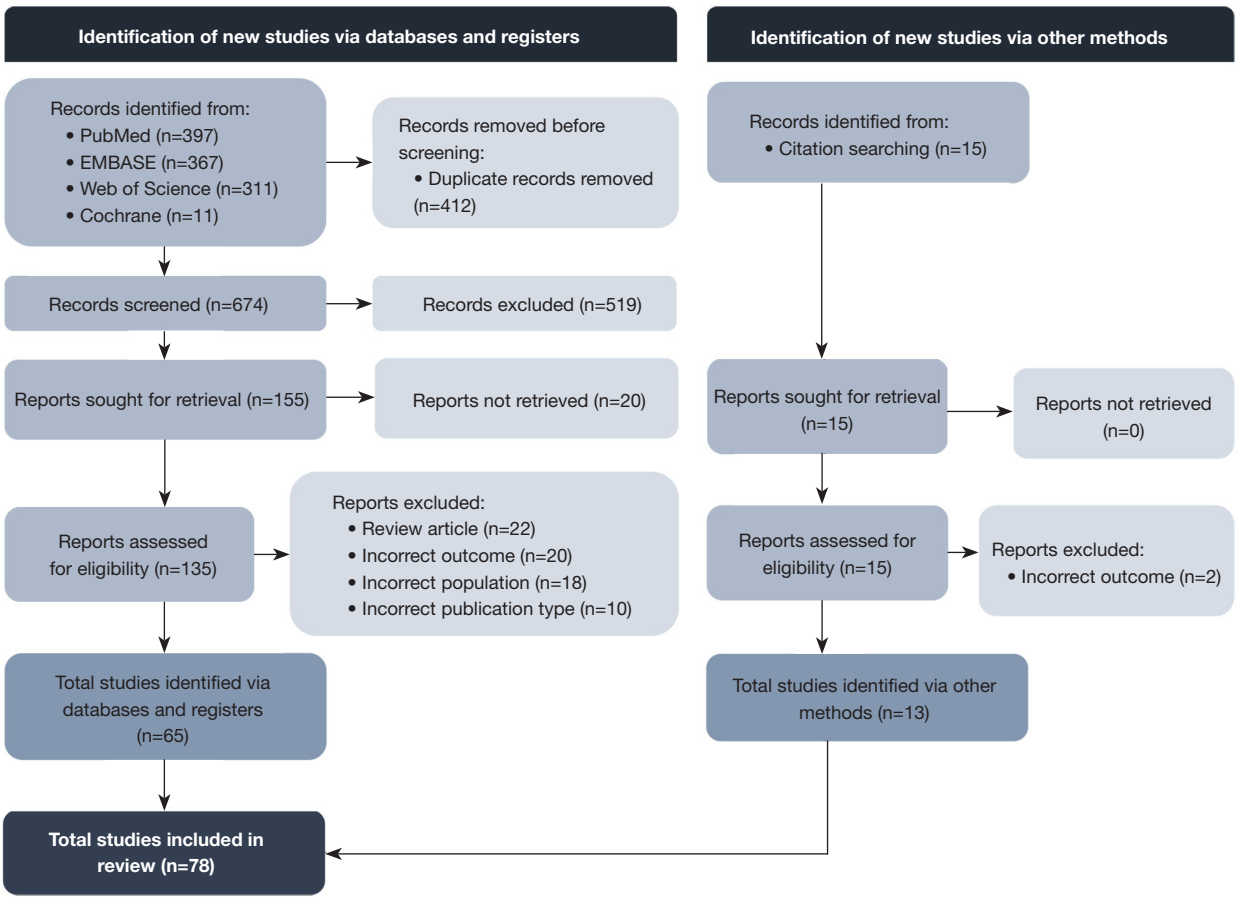

Figure 1 PRISMA flow diagram detailing the review process. PRISMA, Preferred Reporting Items for Systematic reviews and Meta-Analyses.

studies with rates ranging from 3% to 100% of the total TMD population (9,15-30). Still, the statistically significant association between TMD and the presence of otalgia has been repeatedly evidenced (31-36). The explanation for the substantial variability is not completely clear but may reflect the subjective nature of assessing TMD and its symptoms and multiple studies with very small sample sizes (31,37-49), introducing cognitive bias. Instead, those studies with larger cohorts and systematic reviews synthesising multiple cohort studies provide higher level evidence on the overall prevalence. Cooper and Kleinberg (50) found that 82.4% of 4,528 subjects with TMD suffered from at least one otological symptom with otalgia being the most common in 52.2% of the total population. Ramirez *et al.* (51) reviewed 46 studies in 2008 and noted otalgia to affect 51.1% of those with TMD, again the most prevalent otological symptom. Interestingly, Porto De Toledo *et al.* (52) instead found ear fullness to be the more common (74.8%), however, they nevertheless highlighted a rate of otalgia from TMD in 55.1% of patients. It can be ascertained from this that roughly half of the patients with TMD will experience otalgia.

As the patients comprising the aforementioned studies included those presenting to a variety of clinicians ranging from primary care physicians to medical and surgical specialists, these findings may not be generalisable to ENT surgeons (43,53). Only a few studies have investigated this population specifically but have also found considerable rates of otalgia from TMD. For example, Brookes *et al.* (42) and Adegbiji *et al.* (43) concluded that 82.2% and 100% of patients diagnosed with TMD in their ENT clinic suffered from otalgia, respectively. Cox (54) instead found the ear to be one of and the most painful sites in only 35% and 6% of patients with TMD presenting to their private

ENT practice. When evaluating those who present with otalgia to their clinic, Anwar *et al.* (55) and Fenton *et al.* (53) illustrated that 10% and 15% fulfilled the diagnosis for TMD, respectively. Moreover, when only including those with referred otalgia, Sumitha and Joseph (56) demonstrated that TMD comprised approximately half of all subjects. ENT surgeons should maintain a high index of suspicion for TMD in patients presenting with otalgia to their clinics, particularly where primary ear disease is excluded (56-58).

A diagnostic algorithm for patients with suspected otalgia from TMD

The diagnosis of pain-related TMD is made on history and physical examination findings alone (7,52). In the clinical evaluation of patients presenting with suspected otalgia from TMD, it is the role of the ENT surgeon to not only confirm the diagnosis of TMD but to also exclude alternative or co-existing causes of otalgia. An evidence-based diagnostic algorithm for otolaryngologists that can be applied in clinical settings and facilitate prompt treatment is presented in *Figure 2*. Each component of the diagnostic algorithm is expanded upon in the following sections.

History

ENT surgeons should first characterise the patient's otalgia in more detail by taking a history. For a diagnosis to be made, it is required that this pain be modified—meaning elicited, exacerbated, or alleviated—by movements of the jaw such as those with chewing, clenching, talking, or yawning (7,59). This pain will be unilateral in most cases and bilateral symptoms should prompt suspicion for an alternate pathology (30,43). In addition to ear pain, patients may also report co-existing pain at other sites including the TMJ, masseter, pre-auricular, and temporal regions (59). The nature and timing of otalgia are unreliable indicators of TMD, as exemplified through inconsistencies in these descriptions in the literature and should not be used to inform the diagnosis (36,60). These differences may reflect the multitude of unique theorised pathophysiological pathways underlying otalgia from TMD (50). Despite these differences, the pain in those with otalgia from TMD is significantly more severe than other forms of painful TMD, translating to a greater proportion of patients seeking help and requiring treatment (19,21,28,36,50,61-65). Every ENT surgeon should familiarise themselves with and routinely apply the six-item TMD-pain in their clinical practice to rapidly and confidently diagnose TMD (*Table 2*) (66). A score greater than or equal to three demonstrates a 99.1% sensitivity and 96.9% specificity for differentiating pain-related TMD from healthy controls

Although non-pain symptoms are not needed to diagnose TMD, they should still be screened for as they help to characterise disease burden and may illuminate alternative or additional pathologies. Functional symptoms including jaw stiffness and adventitious sounds such as clicking, popping, and crepitus may support the presence of intra-articular TMD such as disc displacement, degenerative joint disease, or subluxation (7). However, these symptoms may be present in a large proportion of asymptomatic patients. It is increasingly recognised that TMD is frequently associated with additional otological symptoms (18,33-35,37,39,51,67-73). Therefore, patients should be asked about the presence of aural fullness, hearing loss, vertigo, and tinnitus with clinicians appreciating that the presence of these do not necessarily suggest an alternate diagnosis and may instead actually represent more severe forms of TMD (63).

It is critical to not miss alternative or co-existent red-flag diagnoses contributing to the patient's otalgia. Those with TMD alone should not report swelling, warmth, and redness over the TMJ site or any motor and sensory difficulties (8). The presence of a previous medical or surgical otological history increases the likelihood of primary otalgia. Systemic symptoms including fever, nausea and vomiting, and reduced level of activity in the context of an underlying middle or outer ear infection should be ruled out, particularly in the paediatric population where acute otitis media is especially common (30). In older patients with significant risk factors, additional symptoms from head and neck malignancies including throat pain, dysphagia, oral cavity ulcers, and neck lumps must be assessed (53,74). Anwar *et al.* (55) showed that 3.3% of hypopharyngeal and 2% of laryngeal carcinomas present with otalgia as the primary complaint. In a cohort of 52 patients with nasopharyngeal carcinoma, Epstein and Jones (75) demonstrated that 15.4% presented with otalgia with one diagnosis being missed in a patient incorrectly diagnosed with TMD.

The population groups frequently experiencing otalgia seem to reflect the epidemiology of TMD overall. Studies consistently evidence that females more often report and report a larger number of otological symptoms than males (15,16,27-29,61). Moreover, those commonly affected tend to be middle-aged (15,27). This reflects higher rates of self-reported life stress and, hence, bruxism in these

Figure 2 Diagnostic algorithm for patients presenting with suspected otalgia from TMD to ENT clinics. TMD, temporomandibular disorder; TMJ, temporomandibular joint; PHQ-4, The Patient Health Questionnaire-4; GCPS, Graded Chronic Pain Scale; JFLS, Jaw Function Limitation Scale; ENT, Ear, Nose and Throat.

groups (16,20,32,48). Although children are less likely to suffer from TMD compared to adults, ENT surgeons must appreciate the substantial likelihood of its presence in the context of otalgia with normal ear examination. This is supported by Blake *et al.* (49) who showed that 67% of children presenting to ENT clinics with otalgia and normal

Table 2 TMD-pain screener for application in routine clinical settings

1. In the last 30 days, how long did any pain last in your jaw or temple area on either side?
a) No pain
b) Pain comes and goes
c) Pain is always present
2. In the last 30 days, have you had pain or stiffness in your jaw on awakening?
a) No
b) Yes
3. In the last 30 days, did the following activities change any pain (that is, make it better or make it worse) in your jaw or temple area on either side?
A. Chewing hard or tough food
a) Yes
b) No
B. Opening your mouth or moving your jaw forward or to the side
a) Yes
b) No
C. Jaw habits such as holding teeth together, clenching, grinding, or chewing gum
a) Yes
b) No
D. Other jaw activities such as talking, kissing, or yawning
a) Yes
b) No

An "a" response receives 0 points; a "b" response 1 point; a "c" response 2 points. A total score greater than or equal to 3 demonstrates a 99.1% sensitivity and 96.9% specificity for differentiating pain-related TMD from healthy controls. Adapted with permission from Gonzalez YM, Schiffman E, Gordon SM, *et al.* Development of a brief and effective temporomandibular disorder pain screening questionnaire: reliability and validity. *J Am Dent Assoc* 2011;142:1183-91. Copyright 2011 by American Dental Association. TMD, temporomandibular disorder.

ear drums had evidence of TMD.

As described in the Axis II (contributing factors) of the DC/TMD, clinicians should apply the biopsychosocial model to their patient's pain and evaluate for the resulting distress and disability from TMD (8). TMD alone is strongly correlated with increased rates of somatisation, anxiety, and depression and notably, this may even be more prominent in those experiencing otalgia (27,76,77). Lam *et al.* (21) demonstrated that TMD had a statistically significantly greater negative impact on normal life functions in subjects with otological symptoms compared to those without. Kuttila *et al.* (20) showed that subjects with otalgia were more likely to have an obvious treatment need, and hence were more likely to pay more visits to a physician than other groups. In settings where pain has persisted beyond 6 months, prior treatment has been unsuccessful, and/or there is concern for significant distress, ENT surgeons should utilise core Axis II instruments including The Patient Health Questionnaire-4 (PHQ-4), Graded Chronic Pain Scale (GCPS), and the Jaw Function Limitation Scale (JFLS) (7,78). These questionnaires ultimately assist in identifying potential barriers to treatment response, contributors to chronicity, and targets for further intervention. Positive findings may indicate referral to a qualified mental health professional as part of the treatment plan.

Physical examination

The role of the physical examination is to confirm or reject the diagnosis of TMD in patients suspected based on historical findings. However, even in patients with symptoms highly suggestive of TMD, ENT surgeons must firstly exclude primary causes of otalgia through inspection of the external auditory canal (EAC) and tympanic membrane with otoscopy, where a standard evaluation of its colour and mobility and for the presence of scarring or perforation is performed. Additional examination for any cranial nerve dysfunction and abnormalities on nasopharyngoscopy is paramount to avoid a missed diagnosis of a head and neck lesion that may explain the patient's pain and require urgent intervention (53,59,75).

The TMJ, oral cavity, and masticatory muscles should then be assessed using inspection and palpation (51,64). Facial asymmetry and mild deviation of the chin on inspection may be consistent with TMD, however, considerable swelling, erythema, or deviation indicate alternative diagnoses (59,79). Inspection of the oral cavity may reveal features consistent with bruxism such as worn incisal edges, flattened occlusal surfaces of the molar teeth, and scalloping of the lateral borders of the tongue (60). The essential examination criteria for the diagnosis of TMD is the elicitation of familiar pain—which is like or akin to the otalgia the patient has been experiencing—on palpation of the muscles of mastication and active opening of the jaw (7). Studies have demonstrated the correlation between otalgia

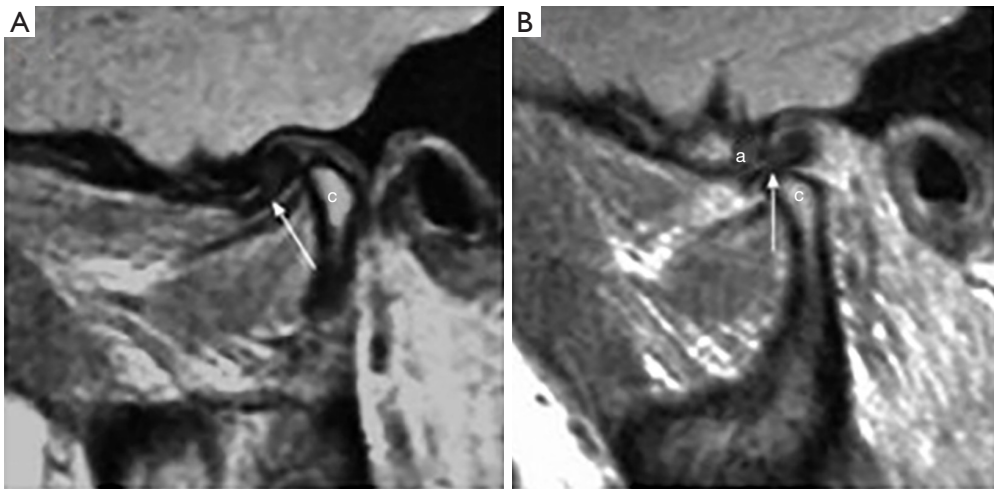

Figure 3 Sagittal magnetic resonance imaging demonstrated anterior displacement of the temporomandibular articular disc with reduction (open access source: Bag AK, Gaddikeri S, Singhal A, *et al*. Imaging of the temporomandibular joint: An update. World J Radiol 2014;6:567-82). (A) Closed-mouth position showing disc (arrow) anteriorly displaced in front of the mandibular condyle (the letter c). (B) Open-mouth position showing reduction of disc (arrow) between articular eminence (the letter a) and the mandibular condyle (the letter c).

from TMD and more severe tenderness over muscles including the temporalis, masseter, geniohyoid, digastric, sternocleidomastoid, trapezius, posterior cervical muscles, and medial and lateral pterygoids (17,30,40,43,65,79). However, the DC/TMD states that only the temporalis and masseter muscles are reliable, with other locations such as the lateral pterygoid and palpation of the posterior TMJ through the EAC commonly tender in unaffected patients, resulting in false positives (7,80). In addition to familiar pain on jaw opening, patients with TMD may exhibit abnormal mandibular movement, decreased range of motion, or clicking/popping noises. However, as previously described, this tends to be less common amongst the pain-related TMD population and instead represents a patient experiencing a TMJ joint disorder (37,43,79).

Investigations

As TMD is a clinical diagnosis, few studies explore the utility of diagnostic studies in otalgia from TMD. Nevertheless, there remains a role for imaging in certain instances (81). One such scenario is where primary otalgia has been excluded but no clear secondary cause of otalgia, including TMD, can be confidently diagnosed (82). ENT surgeons can utilise imaging in patients suspected of having severe intra-articular TMD based on clinical history or examination findings including abnormal mandibular movement, decreased range of motion, or clicking/popping noises. Imaging is also of particular importance in selected patients with persistent symptoms despite conservative management who may require referral to oral and maxillofacial surgeons for potential operative intervention. Whilst plain radiography can identify any acute fractures, dislocations, or severe degenerative disease, the more useful imaging modalities for detecting subtle degenerative changes and soft-tissue abnormalities are computed tomography (CT) and magnetic resonance imaging (MRI), respectively (59). These may reveal alternate pathology or increase the likelihood of otalgia from TMD by evidencing exposure of bone, overgrowth of synovium, or internal derangement of the joint including intra-articular effusion or a malpositioned articular disc (*Figure 3*) (83,84).

The ENT surgeon in the multidisciplinary team

Although ENT surgeons will not personally initiate surgical treatment once the diagnosis of TMD has been made, they are integral in commencing conservative management and involving a multidisciplinary care team (12). Non-operative treatment modalities should be offered to the patient in the first instance and include patient counselling, dietary modification, stress-reduction techniques, pharmacotherapy (such as non-steroidal anti-inflammatory drugs, muscle relaxants, and intra-articular injections), and early referral

to a physiotherapist for muscular massage and provision of TMJ mobilisation and stability exercises (85). The detailed aspects and evidence surrounding these approaches are outside the scope of this study and are not discussed here. Still, it is important to highlight that these conservative therapies have been repeatedly evidenced to significantly improve or resolve the symptoms of TMD, including otalgia (26,38,86,87).

The aetiology of otalgia from TMD is multifactorial and the ENT surgeon should acknowledge the beneficial role of collaborating with other healthcare disciplines (52). With the substantial correlation between dental malocclusion and bruxism and TMD defined in the literature, referral to a dentist or orthodontist for a more detailed assessment of dentition and provision of an occlusal appliance where indicated is critical (88). Kutilla *et al.* (88) demonstrated through a randomised-control study that TMD patients who received a stabilisation splint had a statistically significant reduction in the intensity of secondary otalgia whilst the control group did not. However, it is important to note that evidence on splint therapy to manage TMD symptoms and bruxism from available randomised control studies remains mixed and further studies are required (89,90). Dentists are still in a valuable position where routine follow-up facilitates the regular review of treatment adherence and degree of symptom improvement as well as the identification of those who may require further intervention. As emphasised as part of the clinical evaluation, the psychological component of otalgia from TMD must not be neglected, particularly in patients with chronic symptoms or in those where initial therapy has been unsuccessful. Failure to appropriately address stress and anxiety as a contributing factor and consequences of TMD can negatively influence treatment adherence and overall outcomes. In these patients, ENT surgeons should take an active role in suggesting to the patient's primary care physician or independently making the referral to a qualified mental health professional such as a psychologist or psychiatrist (7,91).

In scenarios where conservative management is ineffective, patients are suffering from severe pain or impacted quality of life, or if severe intra-articular disease is suspected, the ENT surgeon should coordinate imaging and referral to an oral and maxillofacial surgeon for surgical consideration (58). Surgical approaches depend on the type of TMD and severity of articular changes and include TMJ arthrocentesis, arthroscopic lavage, arthroplasty, discectomy, condylar surgery, and total joint replacement. Additionally, in patients suffering from otalgia and/or other orofacial symptoms but where TMD and other ENT pathologies are ruled out, ENT surgeons should consider the referral to other clinicians including neurologists and chronic pain specialists to generate a list of potential differential diagnoses (50).

Strengths and limitations

The primary strength of this review related to its comprehensive and exhaustive nature as facilitated by a broad research question and inclusion of many studies. As a result, evidence from the perspective of the numerous specialities and locations typically involved in the care of patients from TMD was incorporated. However, as this was not strictly a systematic review, the quality of evidence is prone to bias from subjectivity and a lack of critical appraisal.

Conclusions

ENT surgeons should maintain a high index of suspicion for TMD in patients presenting with otalgia at their clinics. The diagnosis of TMD can be made easily using the TMD-pain screener based on the presence of otalgia modified by movement of the jaw and elicitation of familiar pain on palpation of the temporalis and masseter muscles. Still, it is the role of the ENT surgeon to also consider and exclude alternative or co-existing causes of otalgia in these patients, particularly head and neck malignancy. To ensure the alleviation of the patient's symptoms, ENT surgeons are responsible for commencing conservative management and involving a multidisciplinary care team of physiotherapists, dental practitioners, mental health professionals, and oral and maxillofacial surgeons.

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Footnote

Reporting Checklist: The authors have completed the Narrative Review reporting checklist. Available at https://www.theajo.com/article/view/10.21037/ajo-23-42/rc

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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