Temporomandibular Disorder and New Aural Symptoms

Kent W. Cox, MD, PhD

Objectives: To report the prevalence and demographics of temporomandibular disorder (TMD) within a population of clinic patients and to describe the prevalence of revisited and new, previously unstudied, aural symptoms described by a sample of these patients with TMD (hereinafter “TMD patients”).

Design: A retrospective evaluation of patient records was completed to determine the percentage and the demographics of TMD patients in a clinical setting. A prospective analysis was done on the self-reported prevalence of previously studied and new aural symptoms of 78 TMD study patients compared with 78 control patients without TMD.

Setting: A private otolaryngology practice in a rural Arizona town.

Patients: Patients with TMD and aural symptoms.

Results: Ten percent of all new otolaryngology clinic patients were diagnosed as having TMD. Of the 78 patients, 27 (35%) listed the ear as one of their sites of pain. The prevalence of each of the 8 aural symptoms assessed was significantly higher in TMD patients compared with controls (P<.001). A warm and/or fluid sensation in the ear and a stuffed cotton sensation in the ear were the most indicative symptoms of TMD because they had the highest relative risk ratios in TMD patients. Aural symptoms of loud noise sensitivity and cold air/wind sensitivity are also relevant and were approximately 5 times more frequent in TMD subjects than in controls.

Conclusions: Patients with TMD are a significant component of otolaryngology practice. There are previously uninvestigated aural symptoms that occur much more frequently in TMD patients than in patients without TMD.


TEMPOROMANDIBULAR DISORDER (TMD) is classified as a subset of primary headache disorders by the International Headache Society. There is no simple and standard definition of TMD. In the medicodental literature, TMD is frequently defined as a collective term describing a complex and broad group of conditions involving the temporomandibular joint (TMJ), muscles of mastication, and associated structures. The scope of the phrase “collective term” can be appreciated by the number of conditions considered to constitute TMD.

These conditions, listed in decreasing rates of occurrence, are as follows: (1) myofascial pain dysfunction; (2) internal derangement; (3) arthritides (osteoarthritis, inflammatory, infectious, and metabolic); (4) hypermobility (subluxation and dislocation); (5) acute trauma (contusions and fractures); (6) ankylosis (true or false); (7) developmental abnormalities (genetic or acquired); and (8) neoplasia (benign or malignant). The 3 cardinal features of TMD are pain, joint noise, and restricted jaw motion. However, the most important part of the clinical evaluation is the history. In addition to TMJ dysfunction and cephalgia, otalgia, tinnitus, and aural fullness have become recognized as characteristic components of TMD.

In several decades of practice, it became clear that nonpediatric patients referred with a diagnosis of ear infections or sinus infections frequently had neither, and the origin of the patients’ symptoms was determined to be TMD. The seemingly high number of these cases led to this study that analyzes the demographics and the prevalence of aural symptoms of patients with TMD (hereinafter “TMD patients”) in a private clinical practice. The prevalence of otalgia, tinnitus, vertigo, and hearing loss is analyzed. More important, new aural symptoms described by TMD patients but not previously evaluated are reported.

METHODS

RETROSPECTIVE DEMOGRAPHIC STUDY

The setting of this study was in my private otolaryngology practice in a retirement town in rural Arizona, with a population base of approxi-
migrating between the head and neck. Palpation of the TMJ and mastoid muscles was done bilaterally to determine the presence of signs and symptoms strongly associated with TMD. In the TMD patients, at least 70% reported painful knots in the presence of signs and symptoms strongly associated with TMD; at least 2 of these signs were present in each of all new patients diagnosed as having TMD were recorded.

The diagnosis of TMD was based on the patient history and results of physical examination. The patients were asked about the presence of signs and symptoms strongly associated with TMD. In the TMD patients, at least 70% reported painful knots in the head and neck, cephalgia increased by chewing gum, bags, and jerky grinding of their teeth under stress; and pain migrating between the head and neck. Palpation of the TMJ and the lateral pterygoid, temporalis, trapezius, and sternocleidomastoid muscles was done bilaterally to determine the presence of pain or tenderness. It is not clear if one can actually palpate the lateral pterygoid muscles themselves, but an attempt to palpate these muscles for tenderness was performed, as described by Cooper.3 Pterygoid pain on finger pressure be-
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The mean age of onset of TMD was 36.5 years, and the mean age of first seeking medical help was 42.8 years.

In a 30-month period, 230 of 2319 new patients were diagnosed as having TMD. From past experience, TMD patients usually described their episodes of vertigo as short in duration and entailing more of a sense of unsteadiness than rotary motion. In the questionnaire, 1 of the 8 symptoms was collectively presented as “dizziness, spinning, or loss of equilibrium” and the study patients were asked to respond yes or no if 1 or more of these symptoms lasted less than 5 minutes. Prevalences of other symptoms, such as tinnitus and fullness, have been studied elsewhere but were included in this study as a comparison to lend credibility to the prevalences of new aural symptoms reported herein. These new aural symptoms on the questionnaire include loud noise sensitivity, cold air/wind sensitivity in the ear, and warm and/or fluid sensation in the ear and are new because they have not been previously evaluated. The questionnaire was given sequentially over a 10-month period to all new clinical patients diagnosed as having TMD who had a normal ear examination result (ie, there was no pathological feature in the middle ear, tympanic membrane, or ear canal). Seventy-eight patients returned their questionnaires and comprised the TMD study patients.

To evaluate aural symptom prevalence in non-TMD patients, the aural symptoms section of the questionnaire was presented consecutively to prospective clinic patients who also had normal ear examination results and no history of chronic headaches, migraines, or TMD. These patients also had no recent history of ear infections or rhinosinusitis. The first 78 questionnaires from non-TMD patients who cross matched for gender formed the control group and then their demographics were also tabulated.

The frequency of each of the 8 aural symptoms in TMD and control patients was compared using the Fisher exact test. Statistical calculations were performed using the JMP version 5.1.1 statistical software package (SAS Institute Inc, Cary, North Carolina).

### RESULTS

#### DEMOGRAPHICS

In a 30-month period, 230 of 2319 new patients were diagnosed as having TMD. The demographics of all 230 TMD patients seen in the 30-month period are shown in Table 1. The demographics of the 78 TMD study group patients and the 78 control group patients are also found in Table 1. The Figure compares all 3 groups, and it seems that the 78 TMD study group patients were representative of all 230 TMD patients seen in the clinic during the 30-month period because the demographics of both groups are similar. The control group age distribution is skewed because the median age is 10 years older than that of the TMD study group. The age range of the 230 TMD patients is 10 to 83 years. The median age is 50 years. The female to male ratio is 3.6:1.

### AURAL SYMPTOMS IN TMD

Of the 78 TMD study patients, 27 (35%) listed the ear as one of the sites of their TMD pain. However, the jaw, the back of the head into the neck, the temple, and behind the eyes are more often chosen as sites of pain (Table 2). In

### Table 1. Demographics of All Patients With TMD, the Study Group, and the Control Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Value a</th>
</tr>
</thead>
<tbody>
<tr>
<td>All TMD patients (n = 230)b</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>180 (78)</td>
</tr>
<tr>
<td>Male</td>
<td>50 (22)</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>10-83</td>
</tr>
<tr>
<td>Mean</td>
<td>46.9</td>
</tr>
<tr>
<td>Median</td>
<td>50</td>
</tr>
<tr>
<td>Study group patients (n = 78)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>65 (83)</td>
</tr>
<tr>
<td>Male</td>
<td>13 (17)</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>10-83</td>
</tr>
<tr>
<td>Mean</td>
<td>49.1</td>
</tr>
<tr>
<td>Median</td>
<td>47</td>
</tr>
<tr>
<td>Control group patients (n = 78)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>65 (83)</td>
</tr>
<tr>
<td>Male</td>
<td>13 (17)</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>10-89</td>
</tr>
<tr>
<td>Mean</td>
<td>52.8</td>
</tr>
<tr>
<td>Median</td>
<td>57</td>
</tr>
</tbody>
</table>

Abbreviation: TMD, temporomandibular disorder.

a Data are given as number (percentage) of each group unless otherwise indicated.

b The TMD was diagnosed in 230 of 2319 consecutive patients (10%).

c The mean age of onset of TMD was 36.5 years, and the mean age of first seeking medical help was 42.8 years.

A questionnaire was designed regarding gender, age, and the site of TMD pain. Any TMD patients reporting ear infections, sinusitis, and jaw trauma or jaw surgery were excluded. Nine sites of pain in the head and neck commonly described by TMD patients were presented as choices on the questionnaire. Because TMD cephalgia is multisited, the patients were asked to select their 3 sites of worst pain.

In addition, the TMD study patients were asked about the presence or absence of 8 aural symptoms, which have been noted to occur frequently in TMD. From past experience, TMD patients usually described their episodes of vertigo as short in duration and entailing more of a sense of unsteadiness than rotary motion. In the questionnaire, 1 of the 8 symptoms was collectively presented as “dizziness, spinning, or loss of equilibrium” and the study patients were asked to respond yes or no if 1 or more of these symptoms lasted less than 5 minutes. Prevalences of other symptoms, such as tinnitus and fullness, have been studied elsewhere but were included in this study as a comparison to lend credibility to the prevalences of new aural symptoms reported herein. These new aural symptoms on the questionnaire include loud noise sensitivity, cold air/wind sensitivity in the ear, and warm and/or fluid sensation in the ear and are new because they have not been previously evaluated. The questionnaire was given sequentially over a 10-month period to all new clinical patients diagnosed as having TMD who had a normal ear examination result (ie, there was no pathological feature in the middle ear, tympanic membrane, or ear canal). Seventy-eight patients returned their questionnaires and comprised the TMD study patients.

To evaluate aural symptom prevalence in non-TMD patients, the aural symptoms section of the questionnaire was presented consecutively to prospective clinic patients who also had normal ear examination results and no history of chronic headaches, migraines, or TMD. These patients also had no recent history of ear infections or rhinosinusitis. The first 78 questionnaires from non-TMD patients who cross matched for gender formed the control group and then their demographics were also tabulated.

The frequency of each of the 8 aural symptoms in TMD and control patients was compared using the Fisher exact test. Statistical calculations were performed using the JMP version 5.1.1 statistical software package (SAS Institute Inc, Cary, North Carolina).
reviewing these data, only 6% (5 of 78 patients) selected the ear as the most painful site of their TMD. The prevalence of each of the 8 aural symptoms in the TMD patients and the controls is listed in Table 3. Each aural symptom is found significantly more frequently in the TMD patients compared with the controls (P < .001), each occurring at least 2.4 times more frequently. Only 1 patient in the 78 TMD study patients reported having no aural symptoms. The relative risk ratio is determined by dividing the prevalence of the aural symptom in TMD patients by the prevalence of the same symptom in controls. The relative risk ratio of these 8 aural symptoms is ranked and ranges from 14.0 (stuffed cotton sensation in the ear) to 2.4 (muffled hearing) (Table 4). This means that a patient with TMD is at 14 times greater risk of having a stuffed cotton sensation in the ear than a patient without TMD.

### COMMENT

#### DEMOGRAPHICS

The incidence of TMD in North America is about 10%, and the incidence of this study population is in accordance. This suggests that clinical otolaryngologists might be underdiagnosing TMD if they are not aware of seeing 2 or 3 TMD patients each practice day.

The study patients had TMD symptoms for 6 years before seeking medical help. Significantly more females present with TMD symptoms than males, and in this study, the ratio is 3.6:1, consistent with prior literature. Temporomandibular disorder is rare in the first decade of life but may occur at any age. This study was undertaken in a retirement town, and the mean age of these TMD study patients was a mature 49.1 years. The data likely underrepresent the occurrence of TMD in younger adults. In the Figure, the statistical mode in the study group was 40 to 49 years; it was 60 to 69 years in the control group. The older control group would be expected to have an increased prevalence of recruitment hyperacusis, tinnitus, hearing changes, disequilibrium, and dysesthesias because these conditions increase with age. The increased prevalence of these age-related symptoms has the effect of reducing the relative risk of the TMD symptoms reported in the TMD study group (ie, if the control group were the same age as the study group, the relative risk factors of the 8 aural symptoms would be even higher).

The Figure demonstrates that the incidence of TMD increases progressively until the maximal occurrence at midlife, and then slowly decreases. It is reassuring to TMD patients that TMD is neither progressive nor fatal.

### AURAL SYMPTOMS IN TMD

Although these patients had normal ear examination results, with no apparent ear pathological features, more than one-third of the study group patients reported that otic pain was associated with their TMD. It has been reported that in at least half of otalgia cases, it is not possible to diagnose ear disease. Otalgia in a healthy ear is particularly relevant to otolaryngologists because they can readily discern on examination that the ear is not the primary source of pathological features. On the other hand, primary care physicians may associate ear pain with infection and commonly convince themselves “the eardrum is red” and initiate antibiotic treatment for otitis.

Initially, it was believed that determining the prevalence of previously studied aural symptoms would gauge the accuracy of the data regarding the new aural symptoms in this study. However, the extreme variation in the prevalences of aural symptoms in the literature renders those prior numbers almost meaningless. In a comprehensive review of otic symptoms of TMD patients by
The prevalences of aural symptoms from 40 different studies completed between 1933 and 2004 were compiled. The occurrence of reported values for otalgia, tinnitus, vertigo, hearing loss, and ear fullness each ranged from approximately 10% to 90%. However, in their review article, Ramirez et al made the following generalizations. The reported prevalence of otic pain and other otic symptoms of nonotologic origin in patients with TMD varies from 3.5% to 42%. The frequency of tinnitus in patients with TMD varies from 33% to 76%. Dizziness in patients with TMD ranges from 40% to 70%, and vertigo ranges from 5% to 40%. The prevalence of tinnitus in the healthy adult population is between 14% and 32%,2 tinnitus ranges from 5% to 40%. The prevalence of tinnitus in patients with TMD ranges from 40% to 70%，and vertigo, hearing loss, and ear fullness each varied from approximately 10% to 90%. However, in their review article, Ramirez et al made the following generalizations. The reported prevalence of otic pain and other otic symptoms of nonotologic origin in patients with TMD ranges from 3.5% to 42%. The frequency of tinnitus in patients with TMD ranges from 33% to 76%. Dizziness in patients with TMD ranges from 40% to 70%, and vertigo ranges from 5% to 40%. The prevalence of tinnitus in the healthy adult population is between 14% and 32%2，and this compares favorably with the 27% prevalence in the control group of this study.

The most relevant article to this work is a comparably controlled study of otic symptoms in TMD by Tuz et al.4 In 155 study patients with TMD who reported having auricular symptoms, the frequency of their auricular symptoms vs those of the control group was as follows: tinnitus, 59% vs 26%; vertigo, 46% vs 14%; and hearing loss, 30% vs 14%. Compared with this study, those prevalence rates are approximately 2 times higher for otalgia and half of the values for tinnitus, vertigo, and hearing loss. This might be accounted for by the fact that the older population of our study group (mean age, 49.1 years) will have more auricular symptoms and fewer pain symptoms than their younger study group (mean age, 29.6 years). However, using the study and control prevalence numbers of Tuz et al to calculate the risk ratios of auricular symptoms, we find there is good agreement in the relative risk ratios of tinnitus, vertigo, and hearing loss between the 2 studies. The relative risk ratios of both studies are reported in Table 4 and lend credence to the relative risk ratios of the new auricular symptoms evaluated herein.

Tinnitus, hearing changes (such as a muffled quality or perception of hearing loss), and dysequilibrium or vertigo are 3 auricular symptoms that occur in more than half of the study patients with TMD but are not as useful for recognizing TMD because they are also frequent in the non-TMD population. As examples, tinnitus is the most prevalent ear symptom (76%) in the TMD study patients but has a low relative risk ratio of 2.8 and more than half of the study patients reported muffled hearing, which is only 2.4 times the rate found in the control group.

Several components of auricular symptoms distinct from hearing change, tinnitus, and vertigo were found in the TMD study patients and are much more useful in recognizing TMD. The new auricular symptoms of this study include a warm and/or fluid sensation in the ear, a stuffed cotton in the ear sensation, loud noise sensitivity in the ear, and cold air/wind sensitivity in the ear. The sensations of cotton, warmth, and/or fluid in the ear are present in TMD patients at least 14 times more frequently than in control patients. These symptoms are probably specific descriptors of auricular fullness, which itself was present in 74% of TMD patients. Although warmth and/or fluid sensation in the ear was selected by only 38% of the study group patients, it was the only auricular symptom not present in the control patients.

The higher rates of auricular fullness in this study compared with prior investigations could reflect a selection bias because ear symptoms in the subjects were often the main reason for referral to the otolaryngology clinic. Also, there likely was more extensive questioning regarding the nature of their ear symptoms than in other studies, particularly in research originating from a dental population.

Cold air/wind sensitivity in the ear is 4.4 times more common in the TMD patients than in the control group. Sensitivity of the ear canal to cold air/wind is a telling symptom of TMD. These patients are so aware of this dis-
comfort that they describe carrying cotton or ear covers to protect their ears from cold air or wind. Brief dysequilibrium is reported 3.5 times more often in the study patients than in control patients.

Tinnitus, aural fullness, hyperacusis, and hearing loss have been reported in patients with migrainous vertigo; however, migrainous vertigo is distinguished by spontaneous rotational vertigo, recurrent vestibular symptoms of at least moderate severity that last for hours, a current or previous history of migraine, and at least 1 migraine symptom during at least 2 vertiginous attacks (ie, migrainous headache, photophobia, phonophobia, or visual auras). Migrainous vertigo should be distinguishable from TMD in most cases.

Aural symptoms are a consistent and provocative feature of TMD. Otalgia is often considered to be a referred pain of orofacial origin, but it could also be speculated that otalgia and the sensitivity of the ear canal are influenced by chemical mediators of inflammation associated with the contiguous TMJ. Temporomandibular joint inflammation and arthropathy are related to hypercontractile dystonia of the muscles of mastication and likewise may cause stapedial muscle contractions. Perturbations of ossicular function could be linked to the attenuation of the acoustic reflex and the hyperacusis apparently described by these patients with loud noise sensitivity. Watanabe et al previously associated tinnitus with hypercontractility of the stapedial muscle. They demonstrated that severing the stapedial tendon eliminated subjective tinnitus in their patients. On the other hand, Toller and Juniper determined that there is no statistical difference in the results of the analysis of audiograms, tympanograms, and eustachian tube function in TMD patients compared with their control patients.

Another aural symptom that became prominent during this study, but after it was too late for inclusion, was an “itchy ear” with no evidence of otitis externa. This symptom might be evaluated in future investigations. Anecdotally, we treat the myofascial component of TMD with botulinum toxin type A (Botox) injections and the otalgia/aural symptoms with TMJ lavage or 1 mL of TMJ injections of a mixture of sterile saline, plain lidocaine (Xylocaine), 1%, and triamcinolone (Kenalog), 10 mg/mL, in a 2:1:0.1 ratio. These techniques, along with the patient’s own enhanced understanding of his or her TMD, have provided high overall patient satisfaction, similar to that reported in the literature. Rarely are computed tomographic or magnetic resonance imaging studies of the TMJ or the head believed to be indicated.

The possible cause of aural symptoms has recently been reviewed, and the multifaceted complexity of aural symptoms and TMD is broadly detailed. The authors concluded that the solution to understanding aural symptoms in TMD will be found in open-minded research that integrates the insights and efforts of odontology and otolaryngology.

In conclusion, this article presents some of the demographics and prevalent aural symptoms seen in TMD patients. These patients can present at any age but are typically middle aged and female. They complain of pain in the jaw, temple, and lateral side of the head, with radiation of the pain to the neck. Despite a normal ear examination result, one-third may have otalgia. Warmth, fluid, or a stuffed cotton sensation in the ear, ear sensitivity to loud noise or cold air/wind, or a feeling of aural fullness, especially in the presence of a normal ears, nose, and throat examination result, strongly suggests an underlying TMD. The otolaryngologist’s familiarity and knowledge of the ear, and the awareness of these aural symptoms, should contribute to the recognition and diagnosis of TMD.

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Correspondence: Kent W. Cox, MD, PhD, Summit Health Care Regional Medical Center, 2200 Show Low Lake Rd, Show Low, AZ 85901 (kcox714@yahoo.com).

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REFERENCES


