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 approximately 20,000 people. The study was conducted at the author’s private otolaryngology practice in a rural Arizona town. The study included patients with TMD and aural symptoms. 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.
As described by Cooper, 3 pterygoid pain on finger pressure be-
tempt to palpate these muscles for tenderness was performed,
palpate the lateral pterygoid muscles themselves, but an at-
ence of pain or tenderness. It is not clear if one can actually
mastoid muscles was done bilaterally to determine the pres-
gels, and jerky; grinding of their teeth under stress; and pain
in the head and neck; cephalgia increased by chewing gum, ba-

TMD. In the TMD patients, at least 70% reported painful knots
site of TMD pain. Any TMD patients reporting ear infections,
from all new clinic patients seen from late 1998 and the subse-
mon signs of TMD; at least 2 of these signs were present in each
lateral deviation of the mandible on excursion, and TMJ pain
percontractions of the temporalis and/or trapezius muscle(s),
indicated.

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 di-
agnosed as having TMD. The demographics of all 230
TMD patients seen in the 30-month period are shown
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 patients in the TMD study group were repre-
sentative 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.

Auto 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>
<thead>
<tr>
<th>Group</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>All TMD patients (n = 230)</td>
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<tr>
<td>Gender</td>
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<tr>
<td>Female</td>
<td>180 (78)</td>
</tr>
<tr>
<td>Male</td>
<td>50 (22)</td>
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<tr>
<td>Age, y</td>
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<tr>
<td>Range</td>
<td>10-83</td>
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<tr>
<td>Mean</td>
<td>46.9</td>
</tr>
<tr>
<td>Median</td>
<td>50</td>
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<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>
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<tr>
<td>Range</td>
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</tr>
<tr>
<td>Mean</td>
<td>52.8</td>
</tr>
<tr>
<td>Median</td>
<td>57</td>
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<tr>
<td>Control group patients (n = 78)</td>
<td></td>
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<tr>
<td>Gender</td>
<td></td>
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<tr>
<td>Female</td>
<td>65 (83)</td>
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<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.
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.

### 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 most relevant article to this work is a comparably controlled study of otic symptoms in TMD by Tuz et al. In 153 study patients with TMD who reported having aural symptoms, the frequency of their aural symptoms vs those of the control group was as follows: tinnitus, 59% vs 33%; vertigo, 46% vs 23%; 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 aural 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 aural 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 aural symptoms evaluated herein.

Tinnitus, hearing changes (such as a muffled quality or perception of hearing loss), and dysequilibrium or vertigo are 3 aural 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 aural 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 aural 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 aural 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 aural symptom not present in the control patients.

The higher rates of aural 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 from 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 arthralgia 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. Watatanabe 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 otorhinolaryngologist’s familiarity and knowledge of the ear, and the awareness of these aural symptoms, should contribute to the recognition and diagnosis of TMD.