

**CME CREDIT** **EDUCATIONAL OBJECTIVE:** Readers will listen empathetically to their patients with tinnitus and initiate appropriate referrals

**CRAIG W. NEWMAN, PhD**

Head, Section of Audiology, Head and Neck Institute, Cleveland Clinic; Professor, Department of Surgery, Cleveland Clinic Lerner College of Medicine of Case Western Reserve University

**SHARON A. SANDRIDGE, PhD**

Director, Clinical Audiology Services, Section of Audiology, Head and Neck Institute, Cleveland Clinic

**SCOTT M. BEA, PsyD**

Department of Psychiatry and Psychology, Neurological Institute, Cleveland Clinic; Assistant Professor of Medicine, Cleveland Clinic Lerner College of Medicine of Case Western Reserve University

**KAY CHERIAN, PT, MPT, Cert MDT**

Rehabilitation and Sports Therapy, Neurological Institute, Cleveland Clinic

**NEIL CHERIAN, MD**

Neurological Center for Pain, Neurological Institute, Cleveland Clinic

**KARYN M. KAHN, DDS**

Section of Dentistry, Head and Neck Institute, Cleveland Clinic; Assistant Professor, Case Western Reserve School of Dental Medicine

**JAMES KALTENBACH, PhD**

Director, Otology Research, Department of Neurosciences, Head and Neck Institute and Lerner Research Institute, Cleveland Clinic

# Tinnitus: Patients do not have to ‘just live with it’

## ABSTRACT

Tinnitus is distressing and affects the quality of life for many patients. Because primary care physicians may be the entry point for patients seeking help for tinnitus, we urge them to acknowledge this symptom and its potential negative impact on the patient’s health and quality of life. Physicians should actively listen to the patient and provide hope and encouragement, but also provide realistic expectations about the course of treatment. The patient must also understand that there may be no singular “cure” for tinnitus and that management may involve multidisciplinary assessment and treatment.

## KEY POINTS

The first step is to rule out underlying otologic disease.

Nonotologic interventions range from minimal counseling in the office to referrals to specialists in one or more fields, including audiology, dentistry, neurology, physical therapy, psychology, and psychiatry.

A simple algorithm can help determine if patient education is all that is required or if referral is needed.

UNFORTUNATELY, physicians often tell patients with tinnitus (the perception of noises in the ear, head, or both without an external acoustic source) to simply “learn to live with it.” This type of advice can result in missing the diagnosis of a potentially serious medical condition or, at the very least, in dismissing the patient’s complaints and hence failing to provide any hope of relief—increasing the negative impact on the patient’s quality of life.

*See related patient information, page 320*

The disabling effects of tinnitus resemble those of chronic pain.<sup>1</sup> Specifically, its consequences may include:

- Loss of sleep
- Interference with concentration
- Difficulties functioning at work, at home, and in social relationships
- Negative emotional reactions, including despair, frustration, depression, and suicidal ideation.<sup>2,3</sup>

Chronic tinnitus affects 42 million Americans and is considered “clinically significant” in 10 million adults, and the numbers are increasing.<sup>4-7</sup>

Because primary care physicians may serve as the gatekeepers for tinnitus sufferers, as they do for patients with other chronic health issues, it is important that they understand the underlying mechanisms responsible for tinnitus, its impact, and its management options.

The goal of this article is to provide a basic understanding of tinnitus and its treatment so that physicians can provide hope to its sufferers and know when to initiate appropriate referrals for management.

## ■ WHAT CAUSES TINNITUS?

The precise cause of tinnitus is unknown. However, substantial evidence indicates that it is the result of plastic changes in the auditory system that cause auditory neurons to become hyperactive and to fire more synchronously.

If the auditory system is injured, eg, if outer hair cells have been lost because of noise exposure or ototoxicity, then neurons that normally have low levels of activity in silence begin to fire at a higher rate and more synchronously. Therefore, reduced neural activity from the peripheral system (ie, the cochlea) may result in increased spontaneous neural activity in the central auditory nervous system.<sup>8</sup>

Although most investigators of the neurobiology of tinnitus subscribe to this theory, more than one system must be involved, either simultaneously or interactively, since tinnitus has both auditory and nonauditory components.<sup>9</sup>

Evidence is accumulating that the perception of tinnitus is multimodal and may arise from complex interactions among different sensory and motor systems.<sup>10</sup> For example, some patients with tinnitus can modulate its pitch, loudness, or both by forcefully contracting the muscles in the head, neck, or limbs; by moving the eyes in the horizontal or vertical axis; by placing pressure on myofacial trigger points; by moving the face or mouth; or by applying pressure to the temporomandibular joint.<sup>11,12</sup> Although somatic tinnitus modulation is not yet well understood, it may reflect the interaction between the auditory system and other sensory systems.

Because the underlying mechanisms of tinnitus are complex and may involve more than the auditory system, a multidisciplinary approach to management should be considered.

## ■ RULING OUT HEALTH-THREATENING DISEASE

The complaint of tinnitus should not be taken lightly. True, it may be just a nuisance the patient can learn to ignore. On the other hand, it may negatively affect the patient's quality of life. Worst of all, it could be a symptom of a potentially health-threatening disease.

**TABLE 1**

### Red flags that should prompt a referral to an ear, nose, and throat specialist

Unilateral tinnitus
Pulsatile tinnitus
Tinnitus associated with:
Sudden loss of hearing
Pressure or fullness in one or both ears
Dizziness or balance problems
Fluctuating hearing

Primary care physicians should know the red flags (TABLE 1) for otologic diseases such as vestibular schwannoma, Meniere disease, cholesteotoma, glomus jugulare tumor, and temporal bone trauma and, if these are present, refer patients to an otolaryngologist for a complete cochleovestibular examination.

At the same time, the physician should avoid heightening the patient's preoccupation with the tinnitus by creating unnecessary fear about an underlying cause. This may create further anxiety and exacerbate the patient's perception of tinnitus and emotional reaction to it.<sup>13</sup>

## ■ WHAT IS THE IMPACT OF TINNITUS ON QUALITY OF LIFE?

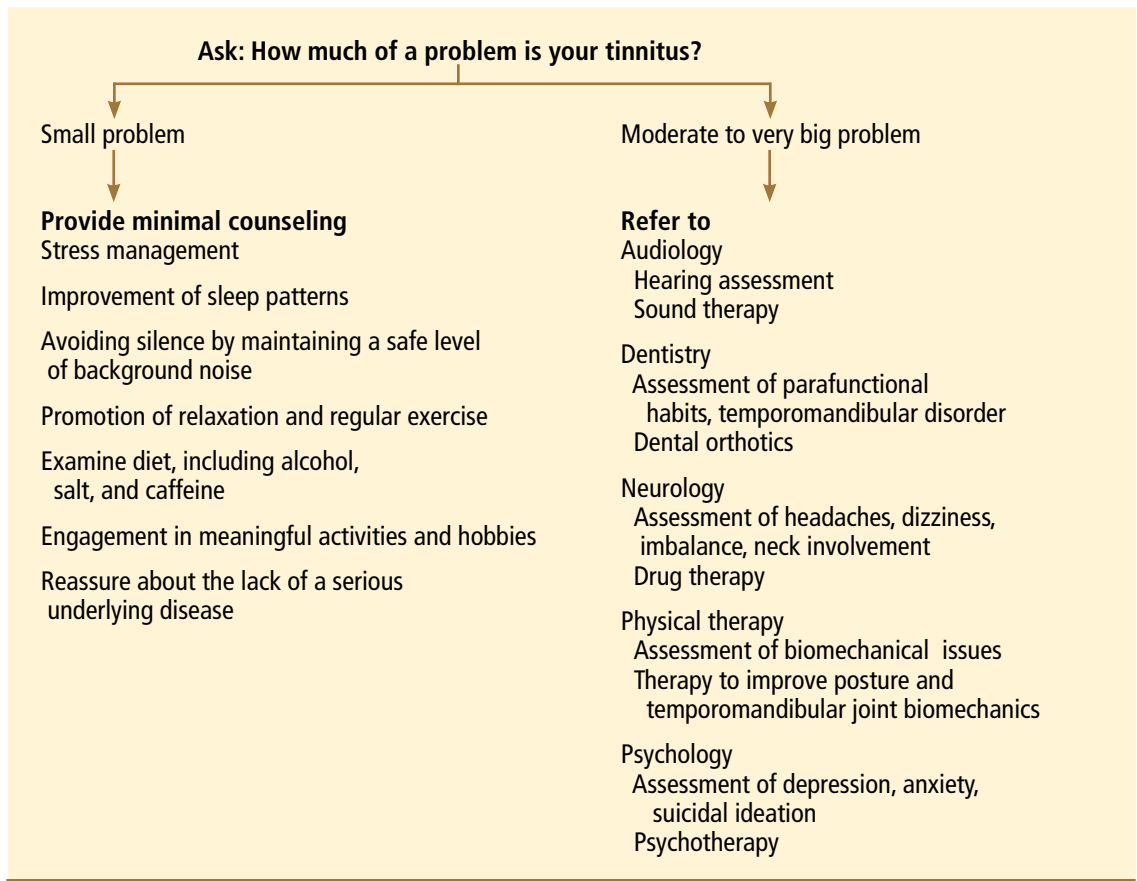
Exploring the impact of tinnitus on the patient's quality of life is important to determine the course of action.

A quick method is simply to ask, "How much of a problem is your tinnitus?" If the patient considers it a small problem, minimum counseling may suffice (FIGURE 1). But if the response suggests a greater impact, an in-depth history should be taken (TABLE 2) to determine the appropriate treatment plan.

Another approach to exploring the impact on quality of life is to ask the patient to list difficulties associated with the tinnitus.<sup>3</sup>

Still another option is to use a standardized screening tool. The Tinnitus Handicap Inventory-Screening Version (THI-S)<sup>14</sup> consists of 10 questions that screen for the psychosocial consequences of tinnitus (TABLE 3). For each question, the patient answers "yes" (worth

**The disabling effects of tinnitus resemble those of chronic pain**



**FIGURE 1**

**The complaint of tinnitus should not be taken lightly**

4 points), “sometimes” (2 points), or “no” (0 points). The possible total score thus ranges from 0 to 40 points; the higher the score, the greater the perceived disability (activity limitation) and handicap (participation restriction). A score of more than 6 points indicates a need for an in-depth evaluation (TABLE 2). Having the patient complete this tool in the waiting room can save precious time and help identify those in need of referral.

**SOME PATIENTS MAY NEED TO SEE ONE OR MORE SPECIALISTS**

Many patients can manage their tinnitus successfully after receiving reassurance and some simple suggestions about how to manage it at home and at work. Helpful techniques can be listed in an information sheet, such as the one that follows this paper, to give to patients.

Patients whose tinnitus is distressing may need referral. Traditionally, the primary care physician refers the patient to an otolaryngol-

ogist. However, the complex nature and etiology of tinnitus may necessitate referring the patient to one or more specialists in addition to an otolaryngologist for further assessment and management. The following sections briefly describe what other specialists offer.

**AUDIOLOGY: TESTING, SOUND THERAPY**

A patient referred to an audiologist may undergo traditional audiologic testing (pure tone and speech thresholds, word recognition), as well as a battery of special psychoacoustic tests. This includes pitch-matching and loudness-matching, evaluation of residual inhibition (suppression of tinnitus after an external masking stimulus has been turned off), and assessing the minimum masking level. These provide a quantitative estimate of the acoustic attributes of the perceived tinnitus. Questionnaires can be used to assess the impact of tinnitus on everyday life and can provide guidance for treatment.<sup>15</sup>

**Real sounds mask the perceived ones**

As treatment, audiologists offer ongoing counseling, encouragement, education, and *sound therapy*, ie, relieving the tinnitus by maintaining a low level of background noise. Several advantages and benefits have been attributed to sound therapy (TABLE 4). A variety of devices can be used.<sup>15</sup>

**Environmental enrichment devices** such as portable machines that generate pleasant sounds (eg, rain, waterfalls, ocean waves), tabletop water fountains, fans, or even televisions or radios can be used to promote relief, provide distraction, and decrease the patient’s awareness of tinnitus.

**Hearing aids** amplify ambient sounds, reducing the perception of tinnitus.<sup>16,17</sup> They also improve communication.

**Sound generators**, worn in the ear, produce a stable broadband signal (“white noise”). These devices may be used by patients who have normal or near-normal hearing sensitivity and therefore neither benefit from nor require amplification.

**Combination instruments** are both hearing aids and white-noise generators. These allow patients who have both hearing loss and tinnitus to use a single device.

**Music** can distract from the tinnitus and help patients relax. Patients may find benefit listening to their preferred music on a personal listening device such as an MP3 or CD player.

Neuromonics Inc. (Bethlehem, PA) makes a sophisticated device for tinnitus treatment. Resembling an MP3 player, it is used with headphones and plays soothing music (baroque or new age) that contains a tinnitus-masking noise. The music is modified to compensate for the patient’s hearing loss, if present. After approximately 2 months of use, the embedded noise is removed to help desensitize the patient to the tinnitus. Results of small trials have been promising.<sup>18,19</sup>

**■ DENTISTRY:  
TREATING TINNITUS BY TREATING TMD**

Temporomandibular disorder (TMD), involving the temporomandibular joints, the muscles of mastication, and the teeth, is as-

**TABLE 2**

**Elements to explore when a patient complains of tinnitus**

**Nature and chief complaint**

- Location (unilateral or bilateral)
- Duration
- Character (pulsatile, intermittent, constant)
- Quality (ringing, hissing, roaring)
- Associated vertigo or hearing loss
- Perceptual characteristics (pitch, loudness)

**Medical and surgical history**

- Noise exposure (occupational, recreational)
- Head trauma
- Medications and ototoxic agents
- Dental problems
- Exacerbating factors (diet, stress, activity level, smoking, alcohol)
- Review of systems
- Prior otologic surgery

**Psychosocial history**

- Level of annoyance
- Sleep disturbance
- Depression, stress
- Suicidality

**Compensation**

- Pursuing compensation, disability, or other legal action related to tinnitus

**Physical examination**

- Otoscopy
- Tuning fork examination
- Test of cranial nerves
- Oral cavity examination
- Palpation of temporomandibular joint and inspection of dentition

**For pulsatile tinnitus**

- Assessment for bruits
- Rate of tinnitus compared to pulse
- Effect of light digital pressure over internal jugular vein
- Effect of turning the head (causing tinnitus of venous origin to subside)

sociated with tinnitus.<sup>20,21</sup> The prevalence of tinnitus in a Cleveland Clinic study of 109 patients with TMD was 36%.<sup>22</sup>

There is also an association between cervical muscle disorders and masticatory muscle function. For example, patients who grind their teeth at night must contract the sternocleidomastoid muscles of the neck to stabilize the head during grinding. Correcting cervical posture,

**TABLE 3**

**The Tinnitus Handicap Inventory-Screening Version (THI-S)**

- Because of your tinnitus, is it difficult for you to concentrate?
- Do you complain a great deal regarding your tinnitus?
- Do you feel as though you cannot escape your tinnitus?
- Does your tinnitus make you feel confused?
- Because of your tinnitus, do you feel frustrated?
- Do you feel that you can no longer cope with your tinnitus?
- Does your tinnitus make it difficult for you to enjoy life?
- Does your tinnitus make you upset?
- Because of your tinnitus, do you have trouble falling asleep at night?
- Because of your tinnitus, do you feel depressed?

For each question, the patient responds with a “yes” (4 points), “sometimes” (2 points), or “no” (0 points). A total score of more than 6 points indicates a need for a more in-depth evaluation (see **TABLE 2**).

ADAPTED FROM NEWMAN CW, SANDRIDGE SA, BOLEK L. DEVELOPMENT AND PSYCHOMETRIC ADEQUACY OF THE SCREENING VERSION OF THE TINNITUS HANDICAP INVENTORY. OTOL NEUROTOL 2008; 29:276–281.

changing the sleep position, and controlling conscious parafunctional habits (eg, clenching the teeth, grinding the teeth together) can decrease many of the symptoms of TMD.

**The dental examination for tinnitus patients**

The dentist looks for a history of TMD symptoms, use of orthotic devices, and head and neck trauma, and performs a clinical examination.

The clinical examination includes mandibular range of motion, auscultation and palpation of the temporomandibular joints, palpation of masticatory and cervical muscles, and cervical range of motion. The intraoral examination includes identifying occlusal attrition patterns, “load testing” of the temporomandibular joints, and identifying premature tooth contacts. Additionally, attempts to restrict jaw opening and lateral movements may modulate the patient’s tinnitus, thus confirming the role of TMD in the patient’s tinnitus.

**How tinnitus is treated by managing TMD**

Tinnitus can be treated by managing TMD, specifically through the use of dental orthotics (splints, nightguards) to improve abnormal jaw mechanics and tracking.<sup>23–25</sup>

Tullberg and Ernberg<sup>26</sup> treated patients with TMD and tinnitus using a variety of methods, including occlusal splinting, jaw muscle exercises, and relaxation. They reported that 43% of the patients experienced an improvement in their tinnitus after these interventions.

A home exercise program may help patients maintain muscle strength and harmony. Self-help therapies provide patients with a protocol to recognize daytime parafunctional habits and provide suggestions to decrease clenching and other overloading of the masticatory system.

In addition, management of TMD-related tinnitus often involves physical therapy, which can include soft-tissue mobilization, deep heat, ultrasound, low-current electrical stimulation, myofascial trigger-point release techniques, and posture retraining. Occlusal correction procedures (bite correction) can often provide long-term stability to the masticatory system.

**■ NEUROLOGY: LOOKING FOR AN UNDERLYING CONDITION**

The comprehensive neurologic evaluation of the tinnitus patient should include a thorough neurologic history, review of systems, examination, and appropriate imaging. The aim is to identify accompanying symptoms or disorders that may help to localize and ultimately diagnose the underlying condition.

Related disorders could manifest with vestibular symptoms (dizziness, imbalance), various pain syndromes including facial pain and headache (tension or migraine),<sup>27</sup> or other cranial nerve disorders such as Bell palsy (facial nerve injury)<sup>28</sup> or trigeminal neuralgia.

**Medical and surgical interventions for tinnitus-associated neurologic conditions**

In cases in which there is a treatable underlying neurologic condition, tinnitus-focused interventions should be deferred until treatment

TABLE 4

**Benefits of sound therapy for tinnitus**

Provides immediate relief, reducing frustration, anxiety, and depression
Restores patients' control over tinnitus rather than feeling controlled by it
Promotes habituation response by neutralizing the threat and fear associated with tinnitus
Distracts from tinnitus
Noninvasive process with no adverse reactions
Contributes to reorganization of the central auditory nervous system underlying tinnitus generation and perception because of neural plasticity

has been completed or discontinued.

At that point, other options including various oral medications (eg, antiarrhythmics, anticonvulsants, benzodiazepines, and antidepressants) and anesthetic blocks (eg, intravenous anesthetic-plus-steroid injections)<sup>29</sup> may be considered on a case-by-case basis. Results of randomized clinical trials of the aforementioned drugs have not been promising<sup>30</sup>; however, drugs that affect the emotional status of the patient by reducing anxiety, depression, and sleep disturbance have been shown to be beneficial.<sup>31,32</sup>

In addition, some experimental surgical treatments (eg, deep brain stimulation, dural grid stimulation)<sup>33,34</sup> are being evaluated and show potential for managing tinnitus.

#### ■ PHYSICAL THERAPY

A preliminary physical therapy evaluation can identify biomechanical problems of the head, neck, and jaw that can contribute to tinnitus.

Subsequent therapy is designed to restore proper cervical and temporomandibular biomechanics and to educate the patient on proper posture, ergonomics, and exercise techniques that together could help minimize these abnormalities and reduce the severity of tinnitus in some patients.<sup>11,24–26,35</sup>

#### ■ PSYCHOLOGY: ADDRESSING DEPRESSION, ANXIETY

Tinnitus exacts an emotional toll on its sufferers. Some estimates suggest that 40% to 50%

of tinnitus patients experience significant perceived handicap and psychological distress.<sup>36</sup> Consequently, many patients respond to the onset of tinnitus with anxiety or depression, or both. Owing to these responses, the chronicity of the condition, and the patient's perception that tinnitus is uncontrollable, tinnitus can produce notable distress and impairment in quality of life.

When a patient's responses include both depression and anxiety, the reduction in quality of life and impairment in coping capacities can be significant.<sup>37</sup> Sleep problems, poor concentration, social withdrawal, feelings of helplessness, avoidance behaviors, and upset in interpersonal relationships are common signs that quality of life is compromised.

One of the greatest challenges for the primary care physician when treating tinnitus patients is attending to their emotional suffering and disability. Simple screening tools can be useful in quickly assessing a patient's emotional response to tinnitus and in helping to enter into a conversation with the patient about this topic. These tools include:

- The THI-S (TABLE 3)<sup>14</sup>
- The Patient Health Questionnaire-9 (PHQ-9)<sup>38</sup>
- The Generalized Anxiety Disorder-7 (GAD-7).<sup>39</sup>

#### Suicidal ideas need to be addressed

The final question on the PHQ-9 asks about suicidal ideation. This cannot be overlooked when assessing patients with tinnitus. The questionnaire invites the patient to communi-

**Patients whose tinnitus is distressing may need a referral**

TABLE 5

**Cognitive behavioral therapy and acceptance and commitment therapy strategies for tinnitus**

**Relaxation exercises**

Aimed at reducing states of hyperarousal and reactivity in response to tinnitus  
Also used to facilitate acceptance and habituation

**Cognitive restructuring**

Designed to alter thoughts and beliefs about tinnitus so that it can be perceived as nonthreatening and ultimately be accepted rather than resisted

**Reducing avoidance behaviors**

Utilized to restore function and quality of life and facilitate habituation

**Reducing checking behaviors**

Designed to limit misinformation, limit disturbability, and facilitate habituation

**Mindfulness**

A meditative discipline designed to help patients notice and label their thoughts and experience with less distress and limit future-oriented tension by focusing on the present moment

**Cognitive defusion**

A set of strategies designed to help patients respond to their own thoughts about tinnitus from a more observational standpoint and ultimately with less emotional distress

**Relapse prevention**

Designed to address potential stressors or changes in tinnitus that may challenge the patient’s coping resources in the future and a review of effective therapeutic strategies to mobilize in these instances

and safety measures with the patient. This requires that the physician be comfortable conducting these conversations in a direct and forthright manner; it also requires that the physician have reliable referrals to qualified mental health practitioners at the ready to assist the distressed tinnitus patient.

Asking a patient to commit to calling 911 or going to the nearest emergency room if he or she has any impulse toward self-harm is a simple option that many distressed patients may have never considered.

**Treatments for depression and anxiety in tinnitus patients**

Some patients may already have been seeing a mental health professional before the onset of tinnitus and may elect to discuss treatment with their current provider. However, many need guidance in selecting appropriate treatment. Their options may include:

**Psychotropic drugs** such as selective serotonin reuptake inhibitors and benzodiazepines, to provide quick relief from debilitating depression and anxiety.

**Cognitive behavioral therapy**, designed to provide a more active and durable adjustment to tinnitus. It is the most widely validated psychotherapeutic treatment approach to tinnitus.<sup>40</sup>

**Acceptance and commitment therapy**, which emphasizes strategies for acceptance, mindfulness, and cognitive defusion (the process of separating thoughts from emotions that have become fused together). There is some preliminary evidence that it also may be effective in reducing the distress of tinnitus sufferers, as well as those with other chronic medical conditions.<sup>41</sup> TABLE 5 contains a sample of the approaches used in cognitive behavioral therapy and acceptance and commitment therapy for tinnitus. ■

cate this rather painful topic to the physician in a direct matter.

The physician should be prepared to address suicidal ideas, plans, means, intentions,

**REFERENCES**

1. Møller AR. The role of neural plasticity in tinnitus. *Prog Brain Res* 2007; 166:37–45.
2. Dobie RA. Overview: suffering from tinnitus. In: Snow JB, ed. *Tinnitus: Theory and Management*. Hamilton, Ontario: BC Decker; 2004:1–7.
3. Tyler RS, Baker LJ. Difficulties experienced by tinnitus sufferers. *J Speech Hear Disord* 1983; 48:150–154.
4. Henry JA, Dennis KC, Schechter MA. General review of tinnitus: prevalence, mechanisms, effects, and management. *J Speech Lang Hear Res* 2005; 48:1204–1235.
5. Hoffman HJ, Reed GW. Epidemiology of tinnitus. In: Snow JB, editor. *Tinnitus: Theory and Management*. Hamilton, Ontario: BC Decker; 2004:16–41.
6. Hoge CW, McGurk D, Thomas JL, Cox AL, Engel CC, Castro CA. Mild traumatic brain injury in U.S. Soldiers returning from Iraq. *N Engl J Med* 2008; 358:453–63.
7. Rauschecker JP, Leaver AM, Mühlau M. Tuning out the noise: limbic-auditory interactions in tinnitus. *Neuron* 2010; 66:819–826.
8. Kaltenbach JA, Zhang J, Finlayson P. Tinnitus as a plastic phenomenon and its possible neural underpinnings in the dorsal cochlear nucleus. *Hear Res* 2005; 206:200–226.
9. Georgiewa P, Klapp BF, Fischer F, et al. An integrative model of developing tinnitus based on recent neurobiological findings. *Med Hypotheses* 2006; 66:592–600.
10. Cacace AT. Expanding the biological basis of tinnitus: crossmodal

origins and the role of neuroplasticity. *Hear Res* 2003; 175:112–132.

11. **Levine RA.** Somatic tinnitus. In: Snow JB, editor. *Tinnitus: Theory and Management*. Hamilton, Ontario: BC Decker; 2004:108–124.
12. **Sanchez TG, Kii MA.** Modulating tinnitus with visual, muscular, and tactile stimulation. *Semin Hear* 2008; 29:350–360.
13. **Schleuning AL, Shi BY, Martin WH.** Tinnitus. In: Bailey BJ, Johnson JT, Newlands SD, et al, editors. *Head and Neck Surgery—Otolaryngology*. 4th ed, vol 2. Philadelphia, PA: Lippincott Williams & Wilkins; 2006:2237–2246.
14. **Newman CW, Sandridge SA, Bolek L.** Development and psychometric adequacy of the screening version of the Tinnitus Handicap Inventory. *Otol Neurotol* 2008; 29:276–281.
15. **Newman CW, Sandridge SA.** Tinnitus management. In: Montano JJ, Spitzer JB, editors. *Adult Audiologic Rehabilitation*. San Diego, CA: Plural Publishing Inc; 2009:399–444.
16. **Kochkin S, Tyler R.** Tinnitus treatment and the effectiveness of hearing aids: hearing care professional perceptions. *Hearing Review* 2008; 15:14–18.
17. **Sheldrake JB, Jasterboff MM.** Role of hearing aids in management of tinnitus. In: Snow JB, editor. *Tinnitus: Theory and Management*. Hamilton, Ontario: BC Decker; 2004:310–313.
18. **Davis PB, Paki B, Hanley PJ.** Neuromonics Tinnitus Treatment: third clinical trial. *Ear Hear* 2007; 28:242–259.
19. **Davis PB, Wilde RA, Steed LG, Hanley PJ.** Treatment of tinnitus with a customized acoustic neural stimulus: a controlled clinical study. *Ear Nose Throat J* 2008; 87:330–339.
20. **Lam DK, Lawrence HP, Tenenbaum HC.** Aural symptoms in temporomandibular disorder patients attending a craniofacial pain unit. *J Orofac Pain* 2001; 15:146–157.
21. **Steigerwald DP, Verne SV, Young D.** A retrospective evaluation of the impact of temporomandibular joint arthroscopy on the symptoms of headache, neck pain, shoulder pain, dizziness, and tinnitus. *Cranio* 1996; 14:46–54.
22. **Kahn K.** Multidisciplinary strategies for managing patients with tinnitus. Poster presented at the American Equilibration Society, Chicago, IL, February 24–25, 2010.
23. **Morgan DH.** Tinnitus caused by a temporomandibular disorder. In: Reich GE, Vernon JA, editors. *Proceedings of the Fifth International Tinnitus Seminar*. Portland, Oregon: American Tinnitus Association; 1996:653–654.
24. **Wright EF, Bifano SL.** Tinnitus improvement through TMD therapy. *J Am Dent Assoc* 1997; 128:1424–1432.
25. **Latifpour DH, Grenner J, Sjö Dahl C.** The effect of a new treatment based on somatosensory stimulation in a group of patients with somatically related tinnitus. *Int Tinnitus J* 2009; 15:94–99.
26. **Tullberg M, Ernberg M.** Long-term effect on tinnitus by treatment of temporomandibular disorders: a two-year follow-up by questionnaire. *Acta Odontol Scand* 2006; 64:89–96.
27. **Volcy M, Sheftell FD, Tepper SJ, Rapoport AM, Bigal ME.** Tinnitus in migraine: an allodynic symptom secondary to abnormal cortical functioning? *Headache* 2005; 45:1083–1087.
28. **Yamamoto E, Nishimura H, Hirono Y.** Occurrence of sequelae in Bell's palsy. *Acta Otolaryngol Suppl* 1988; 446:93–96.
29. **Duckert LG, Rees TS.** Treatment of tinnitus with intravenous lidocaine: a double-blind randomized trial. *Otolaryngol Head Neck Surg* 1983; 91:550–555.
30. **Dobie RA.** Clinical trials and drug therapy for tinnitus. In: Snow JB, editor. *Tinnitus: Theory and Management*. Hamilton, Ontario: BC Decker; 2004:266–277.
31. **Johnson RM, Brummett R, Schleuning A.** Use of alprazolam for relief of tinnitus. A double-blind study. *Arch Otolaryngol Head Neck Surg* 1993; 119:842–845.
32. **Brummett R.** Drugs for and against tinnitus. *The Hearing Journal* 1989; 42:34–37.
33. **Cheung SW, Larson PS.** Tinnitus modulation by deep brain stimulation in locus of caudate neurons (area LC). *Neuroscience* 2010; 169:1768–1778.
34. **Friedland DR, Gaggi W, Runge-Samuels C, Ulmer JL, Kopell BH.** Feasibility of auditory cortical stimulation for the treatment of tinnitus. *Otol Neurotol* 2007; 28:1005–1012.
35. **Simmons R, Dambra C, Lobarinas E, Stocking C, Salvi R.** Head, neck, and eye movements that modulate tinnitus. *Semin Hear* 2008; 29:361–370.
36. **Bauch CD, Lynn SG, Williams DE, Mellon MW, Weaver AL.** Tinnitus impact: three different measurement tools. *J Am Acad Audiol* 2003; 14:181–187.
37. **Bartels H, Middel BL, van der Laan BF, Staal MJ, Albers FW.** The additive effect of co-occurring anxiety and depression on health status, quality of life and coping strategies in help-seeking tinnitus sufferers. *Ear Hear* 2008; 29:947–956.
38. **Kroenke K, Spitzer RL, Williams JB.** The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001; 16:606–613.
39. **Spitzer RL, Kroenke K, Williams JB, Löwe B.** A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med* 2006; 166:1092–1097.
40. **Andersson G.** Psychological aspects of tinnitus and the application of cognitive-behavioral therapy. *Clin Psychol Rev* 2002; 22:977–990.
41. **Hesser H, Westin V, Hayes SC, Andersson G.** Clients' in-session acceptance and cognitive defusion behaviors in acceptance-based treatment of tinnitus distress. *Behav Res Ther* 2009; 47:523–528.

ADDRESS: Craig W. Newman, PhD, Section of Audiology, A71, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, OH 44195; e-mail newmanc@ccf.org.



# LET US HEAR FROM YOU

- Let us hear your opinions about the *Cleveland Clinic Journal of Medicine*.
- Do you like current articles and sections?
- What topics would you like to see covered and how can we make the *Journal* more useful to you?



PHONE 216.444.2661  
 FAX 216.444.9385  
 E-MAIL ccjm@ccf.org  
 WWW <http://www.ccjm.org>

CLEVELAND CLINIC JOURNAL OF MEDICINE  
 Cleveland Clinic  
 9500 Euclid Avenue, NA32  
 Cleveland, Ohio 44195