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Tinnitus in an Audiology Clinic

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Calvin Staples, MSc

Hearing loss and hearing aids dominate the field of audiology –daily clinical routines are measured with performance indicators focused on hearing aid sales, hearing aid satisfaction rates, and hearing aid returns. Best practice techniques are often incorporated or encouraged in order to facilitate hearing aid sales and retention. The clinical audiologist has training that is vastly greater than assessing for hearing loss and fitting hearing aids. One such condition that is well within the scope of the audiology training and professional practice is tinnitus – specifically assessment, counselling and treatment of those who suffer from this wildly common and bothersome condition (Canadian Academy of Audiology, 2002; Gander, Hoare, Collins, Smith, Hall, 2011; American Speech – Language Hearing Association, 2018; Ramage-Morin, Banks, Pineault, & Atrach, 2019). Unfortunately, many tinnitus sufferers struggle to find appropriate clinical service (Tyler, Haskell, Gogel, & Gehringer, 2008).

What should Audiologists consider when booking an appointment for someone who suffers from tinnitus? The answer to this question is held mostly in professional opinion and is debatable. Audiologists are recommended to focus on audiologic assessment, directive and informational counselling, and possible treatment options (Henry, Zaugg, Myers, Kendall, & Michaelides, 2010). Many tinnitus patients never get referred to audiologists for proper assessments and are told there is “nothing to be done” or “learn to live with it” (Gander et al. 2011; Henry et al. 2010). When patients seek out an audiologist they often find very limited options as many audiologists find the idea of focusing clinical practice mainly on tinnitus service is thought to be daunting (Tyler et al., 2008). Thus a service paradox for tinnitus sufferers exists, as there is apparent low comfort level or interest in audiologists providing the necessary services. However, when an audiologist is invested in tinnitus service there may be a lack of referral to audiologists for the appropriate assessment (Gander et al. 2011; Henry et al. 2010). What causes the low number of clinicians committed to providing tinnitus services? – Is it the lack of a cure or the modest scientific evidence to support patient assessment and management techniques? Audiologists and tinnitus sufferers should understand that the lack of a cure does not mean the lack of support or help.

Generally, it is agreed that audiologists should measure hearing thresholds, complete psychoacoustic assessments including pitch matching of the tinnitus and any residual inhibition tasks and incorporate a validated questionnaire to capture the impact on quality of life (Tyler et al., 2008; Gander et al. 2011). In addition to the tests above, it could be argued that audiologists should consider evaluating the middle ear reflex and otoacoustic emissions to further explore the integrity of the auditory system – this topic will be discussed later in this paper. Tinnitus symptoms associated with auditory disease require medical referral and audiologists are trained to determine the need for referral. The common symptoms or audiological findings associated with medical referral include, but not limited to, sudden onset, unilateral tinnitus or hearing loss and tinnitus with a pulsatile quality (Tunkel, Bauer, Sun, Rosenfeld, Chandrasekhar, Cunningham, Archer,

Blakley, Carter, Granieri, Henry, Hollingsworth, Mitchell, Monfared, Newman, Omole, Phillips, Robinson, Taw, Tyler, Waguespack, Whamond,2014; Tyler et al., 2008). Beyond auditory related medical concerns, any sufferer that presents with mental health related concerns should be triaged to the appropriate healthcare professionals (Tunkel et al. 2014). Many tinnitus sufferers are looking for support beyond medical or mental health red flags. What does the audiology service look like for the tinnitus sufferer without the need for medical or urgent support from an allied health care professional?

The hearing aid recommendation would be reasonable to assume as the primary strategy for audiologists attempting to support tinnitus patients. The changes seen in the field of audiology over the past ten years combined with a significant correlation between hearing loss and persistent tinnitus are most likely the drivers of the hearing aid recommendation (Shargorodsky, Curhan, & Farwell, 2010; Sindhusake, Golding, Wigney, Newall, Jakobsen, & Mitchell, 2004). Thus, the outcome of the classic pure tone audiogram often determines next steps. However, audiologists need to step up on a greater role of delivering more detailed assessments and services to tinnitus sufferers – several reasons exist, but primarily the sufferers of tinnitus need educated help and support. The field of audiology should be considered the trained healthcare professional to provide such service. What else can be assessed? Audiologists incorporating ultra-high frequency pure tone audiograms through at least 14kHz, which can obtain a glimpse into higher frequencies. The ultra high frequency results can help tell the story of peripheral hearing damage and lead to a greater discussion regarding reduced peripheral hearing sensitivity as it pertains to informational counselling. An audiometric assessment could be accompanied by otoacoustic emissions (OAEs). The value of OAE outcomes with tinnitus patients is potentially debatable, but OAEs can determine hair cell damage prior to audiometric hearing threshold shift and can facilitate the test battery when the tinnitus is of a cochlear origin (Hoben, Easow, Pevzner, & Parker, 2017; Onishi, Fukuda, & Suzuki, 2004). It as been recommended that OAEs be part of the tinnitus assessment test battery (Gabriels, 2001). Furthermore, acoustic reflex thresholds (ARs) could make a return into the clinical audiology test battery for tinnitus as animal models are revealing a relationship between synaptopathy and the presence of tinnitus (Schaette, & McAlpine, 2011; Valero, Hancock, Liberman, 2016). Changes in the middle ear reflex for those with tinnitus have been seen in human studies as well (Wojtczak, Beim, & Oxenham, 2017). Despite the lack of scientific consensus on which measures to include in a test battery, the insight into the objective changes noted in the above measures, suggests potential benefits of a more expansive test battery for the tinnitus patient. A small caveat exists with ARs – common sense would suggest using this test with caution since tinnitus sufferers may also have reduced sound tolerance.

What about measures to capture the psychoacoustic traits of the tinnitus percept? What frequencies should be assessed? At what levels? With what equipment? It is generally agreed upon that pitch matching, loudness matching, minimal masking levels (MML) and residual inhibition (RI) should all be included within the tinnitus test battery (Henry, & Meikle, 2000; Jastreboff, & Jastreboff, 2000). However, readily available clinical equipment poses a problem. The routine audiometer is usually a poor frequency analyzer (octaves to half-octaves) and patients often report the lack of accuracy of the sound presented when attempting to match the pitch of their tinnitus (Henry, & Meikle, 2000). Thus clinicians might complete the above assessments in a rudimentary format. Still, even with a simple version of loudness matching, pitch matching, MML and RI, the outcomes can help guide the patient-tinnitus-clinician relationship and could facilitate clinically decision-making (Hoare, Edmondson-Jones, Gander, & Hall, 2014; Hoare, Searchfield, El Refaie, & Henry, 2014). Residual inhibition is the temporary suppression of tinnitus after the presentation of a moderate to high level stimulation. The relationship between the duration of the sound presented and the duration of the residual inhibition (e.g. a complete disappearance of the tinnitus) are linear:

in most tinnitus participants the longer you stimulate the longer the tinnitus disappear (Roberts, Moffat, & Bosnyak, 2006). One goal for research would be to determine if a simple test of residual inhibition could be used as a clinical tool to confirm the potential benefit of sound therapy approaches for tinnitus sufferers. A patients displaying long duration of residual inhibition would be consider a better candidate for sound therapy compared to a patients without any residual inhibition. It could be argued that manipulation of the tinnitus percept by achieving RI through the use of a masking signal, centered on the tinnitus pitch is an audiological goal of the tinnitus assessment. In addition, the patient experiencing residual inhibition during the testing session could be more likely to proceed with tinnitus sound therapy.

Non-audiologic assessment tools that facilitate discussion, patient insight and patient engagement include the use of indices or scales to capture the tinnitus disruption on Quality of Life (QoL). Tinnitus can have a significant impact on QoL, primary complaints includes sleep disruption, medication dependence, reduced enjoyment of social actives and reduced ability to enjoy quieter times or an inability to relax, and increased stress in their daily life (Henry, Griest, Thielman, McMillan, Kaelin, & Carlson, 2016; Meikle, Stewart, Griest, & Henry, 2008; Newman, Jacobson, & Spitzer, 1996; Ramage-Morin et al., 2019). These measure facilitate tinnitus management by tracking progress and gaining insight into the suffering of a tinnitus patient. The trained clinician could use these scales to help guide therapy appointments and clinical decision-making (Henry et al. 2016; Meikle, et al. 2008; Newman, Jacobson, & Spitzer, 1996). There are several scales available; the most commonly found in the literature include Tinnitus Functional Index (TFI), Tinnitus Handicap Index (THI), Tinnitus Reaction Questionnaire (TRQ), Tinnitus Handicap Questionnaire (THQ) (Henry et al. 2016; Meikle, et al. 2008; Newman, Jacobson, & Spitzer, 1996). In conjunction with the aforementioned tinnitus related scales, the clinician may wish to use a tool to evaluate mental health, anxiety or depression.

As previously noted, in most cases, the tinnitus sufferer has a treatable hearing loss (Coles, 1995; Dobie, 2004;Johnson, 1998; Schechter, Henry, Zaugg, & Fausti, 2002, Jastreboff 2011). In fact, the audiogram configuration for a tinnitus patient often has a unique shape, whereby the hearing loss is better in the lows frequencies and worse in the high frequencies (Konig et al., 2006; Tan, Lecluyse, McFerran, & Meddis, 2013). This is typical of what is associated with age-related hearing loss or noise induced hearing loss and thus amplification should be recommended. Hearing aids are known to provide relief for tinnitus sufferers both as an environmental amplifier and a sound generator (Surr, Montgomery, & Mueller, 1985; Henry, Zaugg, & Schechter, 2005; Kochkin, & Tyler, 2008; Trotter, & Donaldson, 2008; Schaette et al., 2010; Searchfield et al., 2010; Kochkin, Tyler, Born 2011; McNeill, Távora-Vieira, Alnafjan, Searchfield, & Welch, 2012; Shekhawat, Searchfield, & Stinear, 2013; Shekhawat, Searchfield, Kobayashi, Stinear, 2013). The recommended amplification strategy with hearing aids suggests an openfit hearing aid (if possible) set with reduced sophistication of the adaptive features of expansion, noise reduction and directionality. Hearing aids set to manage tinnitus patients are recommended to limit or disable the use many of these adaptive features, especially those for comfort and soft sounds (Searchfield, 2006; Del Bo, & Ambrosetti, 2007). The goal is to ensure the tinnitus sufferer hears the world around them to provide a natural masking effect and possibly a rewiring of the aberrant neural code that is contributing to the tinnitus percept. Thus, if the default hearing aid settings are used, maximal benefit may be reduced. The regularity of default settings only in the routine hearing aid dispensing is high (Aarts, & Caffee, 2005; Mueller, 2005). A best practice model of hearing aid output verification is unlikely to change for hearing aids set for tinnitus. However it could be argued to incorporate verification techniques with tinnitus patients, as amplification bandwidth could be an important factor when predicting hearing aid success (Del Bo, & Ambrosetti, 2007). A primary goal of using amplification with tinnitus patients is to restore the lost auditory input from the

cochlea and reduce the tinnitus percept (Del Bo, & Ambrosetti, 2007).

What could an audiologist do if a patient refuses to accept the recommendation of hearing aids to manage their tinnitus? In fact, anecdotally, even the discussion of hearing aids can be difficult if the patient has not associated their tinnitus with hearing loss. Furthermore, some patients have tinnitus with a clinically normal audiogram (Schaette, & McAlpine, 2011). The report of normal hearing and tinnitus is not new (Heller, & Bergman, 1953). Thus patients with normal audiograms may still present with abnormalities in auditory function and require counselling and support to improve their coping functions. Clinicians need to realize that abnormal on the audiogram most likely indicates significant auditory damage. Audiology related counselling with regards to tinnitus is usually informational and directive (Tyler et al., 2008; Combs 2014). The standard audiological practice beyond amplification includes Tinnitus Retraining Therapy (TRT), Progressive Tinnitus Management, and Widex Zen Therapy (Combs 2008). The goal of each of these therapy techniques is to educate and support the patient through various forms of counselling strategies to facilitate habituation and to provide some form of sound therapy to help reduce the tinnitus percept (Combs 2008). In most cases, research will demonstrate benefit to patient with counselling and sound therapy (Baguley, McFerran, & Hall, 2013). However, some new data suggests little to no long-term benefit when incorporating sound therapy and counselling (Scherer, & Formby, 2019). It should be noted that those researchers did not investigate if amplification had a greater impact.

Finally, clinically there is little in Canada to offer a patient beyond ear-level sound generators and/or hearing aids. Other countries have several other forms of sound therapy available – DesyncraTM, Neuromonics, and SoundCure, to name a few. The use of these or similar type devices tend to target neuromodulation, relaxation or masking. Patient acceptability is a critical a component when recommending forms of sound therapy (Hoare et al.; 2014). The Cleveland Clinic Sound Therapy Option Profile (STOP) was developed to guide clinicians and patients in treatment decision-making (Newman, & Sandridge, 2006). The outcomes of sound therapy treatments remain modest and require more research before recommended as a treatment for all – at this point it could be argued that one of the limiting factors is how to determine which patient will benefit from which therapy. The heterogeneity of tinnitus is what makes it so difficult to study and most likely so difficult to express confidence in treatment recommendations. The goal of the clinician is to provide support, use a scientific approach to make best recommendations and adapt as the science changes. Those that suffer from tinnitus need support and clarity as how to best manage their condition. ?

REFERENCES

American Speech – Language Hearing Association (2018). Scope of Practice in Audiology [Scope of practice]. Available from https://www.asha.org/uploadedFiles/SP2018-00353.pdf

Aarts, N. L., & Caffee, C. S. (2005). Manufacturer predicted and measured REAR values in adult hearing aid fitting: Accuracy and clinical usefulness. International Journal of Audiology, 44(5), 293-301.

Canadian Academy of Audiology (2002) Scope of Practice [Position Statement on Audiology Scope of Practice]. Available from https://canadianaudiology.ca/professional-resources/scope-of-practice/

Baguley, D., McFerran, D., & Hall, D. (2013). Tinnitus. The Lancet, 382(9904), 1600-1607.

Chung, D. Y., Gannon, R. P., & Mason, K. (1984). Original papers· travaux originaux: factors affecting the prevalence of tinnitus. Audiology, 23(5), 441-452.

Combs, L. M. (2014). Tinnitus Management in Private Practice.

Del Bo, L., & Ambrosetti, U. (2007). Hearing aids for the treatment of tinnitus. Progress in brain research, 166, 341-345.

Gabriels, P. (2001). What the practitioner should know about tinnitus assessment and management. The Hearing Journal, 54(11), 43-49.

Gander, P. E., Hoare, D. J., Collins, L., Smith, S., & Hall, D. A. (2011). Tinnitus referral pathways within the National Health Service in England: a survey of their perceived effectiveness among audiology staff. BMC health services research, 11(1), 162.

Heller, M. F., & Bergman, M. (1953). VII Tinnitus aurium in normally hearing persons. Annals of Otology, Rhinology & Laryngology, 62(1), 73-83.

Henry, J. A., & Meikle, M. B. (2000). Psychoacoustic measures of tinnitus. Journal of the American Academy of Audiology, 11(3), 138-155.

Henry, J. A., Zaugg, T. L., Myers, P. J., Kendall, C. J., & Michaelides, E. M. (2010). A triage guide for tinnitus. Journal of Family Practice, 59(7), 389.

Henry, J. A., Griest, S., Thielman, E., McMillan, G., Kaelin, C., & Carlson, K. F. (2016). Tinnitus Functional Index: Development, validation, outcomes research, and clinical application. Hearing research, 334, 58-64.

Hoare, D. J., Searchfield, G. D., El Refaie, A., & Henry, J. A. (2014). Sound therapy for tinnitus management: practicable options. Journal of the American Academy of Audiology, 25(1), 62-75.

Hoare, D. J., Edmondson-Jones, M., Gander, P. E., & Hall, D. A. (2014). Agreement and reliability of tinnitus loudness matching and pitch likeness rating. PLoS One, 9(12), e114553.

Hoben, R., Easow, G., Pevzner, S., & Parker, M. A. (2017). Outer hair cell and auditory nerve function in speech recognition in quiet and in background noise. Frontiers in neuroscience, 11, 157.

Jastreboff, P. J., & Jastreboff, M. M. (2000). Tinnitus retraining therapy (TRT) as a method for treatment of tinnitus and hyperacusis patients. Journal of the American Academy of Audiology, 11(3), 162-177.

Meikle, M. B., Stewart, B. J., Griest, S. E., & Henry, J. A. (2008). Tinnitus outcomes assessment. Trends in Amplification, 12(3), 223-235.

Newman, C. W., Jacobson, G. P., & Spitzer, J. B. (1996). Development of the tinnitus handicap inventory. Archives of Otolaryngology–Head & Neck Surgery, 122(2), 143-148.

Newman, C. W., & Sandridge, S. (2006). Sound Therapy Option Profile (STOP): a tool for selecting devices used in tinnitus treatment. Audiology Online http://www.audiologyonline.com/articles/sound-therapy-option-profile-stop-974.

Onishi, E. T., Fukuda, Y., & Suzuki, F. A. (2004). Distortion product otoacoustic emissions in tinnitus patients. INTERNATIONAL TINNITUS JOURNAL., 10, 13-16.

Ramage-Morin, P. L., Banks, R., Pineault, D., & Atrach, M. (2019). Tinnitus in Canada. Health reports, 30(3), 3-11.

Roberts, L. E., Moffat, G., & Bosnyak, D. J. (2006). Residual inhibition functions in relation to tinnitus spectra and auditory threshold shift. Acta Oto-Laryngologica, 126(sup556), 27-33.

Schaette, R., & McAlpine, D. (2011). Tinnitus with a normal audiogram: physiological evidence for hidden hearing loss and computational model. Journal of Neuroscience, 31(38), 13452-13457.

Scherer, R. W., & Formby, C. (2019). Effect of Tinnitus Retraining Therapy vs Standard of Care on Tinnitus-Related Quality of Life: A Randomized Clinical Trial. JAMA Otolaryngology–Head & Neck Surgery.

Shargorodsky, J., Curhan, G. C., & Farwell, W. R. (2010). Prevalence and characteristics of tinnitus among US adults. The American journal of medicine, 123(8), 711-718.

Sindhusake, D., Golding, M., Wigney, D., Newall, P., Jakobsen, K., & Mitchell, P. (2004). Factors predicting severity of tinnitus: a population-based assessment. Journal of the American Academy of Audiology, 15(4), 269-280.

Tunkel, D. E., Bauer, C. A., Sun, G. H., Rosenfeld, R. M., Chandrasekhar, S. S., Cunningham Jr, E. R., Archer, S.M., Blakley, B.W., Carter, J.M., Granieri E.C., Henry, J. A., Hollingsworth D., Khan, F.A., Mitchell, J.D., Monfared A., Newman C.W., Omole, F.S., Phillips C.D., Robinson, S.K., Taw, M.B., Tylers, R.S., Waguespack R., Whamond E.J., (2014). Clinical practice guideline: tinnitus. Otolaryngology–Head and Neck Surgery, 151(2_suppl), S1-S40.

Tyler, R. S., Haskell, G. B., Gogel, S. A., & Gehringer, A. K. (2008). Establishing a tinnitus clinic in your practice. American Journal of Audiology.

Valero MD, Hancock KE, Liberman MC. The middle ear muscle reflex in the diagnosis of cochlear neuropathy. Hear Res. 2016;332:29–38. doi:10.1016/j.heares.2015.11.005

Wojtczak, M., Beim, J. A., & Oxenham, A. J. (2017). Weak middle-ear-muscle reflex in humans with noise-induced tinnitus and normal hearing may reflect cochlear synaptopathy. ENeuro, 4(6).