A tool for measuring hyperacusis

By Marsha Johnson

As the head audiologist of two busy tinnitus and hyperacusis clinics near Portland, OR, I am directly involved in observing and charting the progress of patients while they are enrolled in the treatment program.

Approximately 40% of patients who report to this clinic for treatment of tinnitus also display some degree of hyperacusis, which is an abnormally low tolerance for sound levels in persons who, in most cases, have essentially normal hearing. Hyperacusic patients will often display intolerance levels between 25 dB and 90 dB in response to both recorded and live voice stimuli and to tone presentations.

Hyperacusis is relatively uncommon, and currently there is very little in the way of research or clinical data regarding the condition. It is different from recruitment, which is the abnormal growth of loudness in a damaged ear with significant hearing loss. Most hyperacusic patients have hearing within normal limits.

ROUTINE TREATMENT CAN CAUSE PAIN

It is important for audiologists and other clinicians to be mindful of the possibility that a patient has hyperacusis. For clinicians may inadvertently cause pain or increased sensitivity in a hyperacusic patient through improper testing procedures, particularly when using middle ear and ABR test equipment, which both emit tones or clicks that may exceed the tolerance levels of the patient.

Patients in our clinic with severe hyperacusis have reported instances of painful noise presentations during previous routine audiologic care that could have been avoided if the clinician had received proper training in this area. They have also reported that the use of equipment to measure acoustic reflex and reflex decay has not only caused them pain but also, on occasion, has caused elevation in their tinnitus as well. In rare instances, tympanometry probe tones can also cause a problem.

Patients have also told us that increased loudness in their tinnitus as a result of audiologic testing is the most distressing of the negative reactions that may occur during treatment. Patients who perceive a worsening of their tinnitus as a result of acoustic stimulation will often develop phonophobia, or fear of sound.

CALCULATING THE JHQ

Based on extensive experience with hyperacusic patients at this clinic, I have developed a new measurement tool, the Johnson Hyperacusis Dynamic Range Quotient (JHQ), which is presented here in hopes that other audiologists and clinicians will find it useful.

To determine the JHQ, you need to obtain air-conducted thresholds. First, find the patient's uncomfortable loudness levels (UCLs) using recorded materials to increase the accuracy and the re-test reliability. UCLs will be used for general assessment purposes and to compare with other test results to assess the true degree of hyperacusis, although normative data for the relationship between UCLs and loudness discomfort levels (LDLs) have not been established at this time.

Next, find LDLs by tone for each frequency. It is critical that you establish a reliable and standard set of instructions for patients, as studies have demonstrated marked changes in results based on whether patients are told to "choose the level at which they would not like to listen for any length of time" versus being told to "choose the level at which they would not like to listen for 15 minutes or longer."[1]

Use a slow ascending approach with both procedures (UCLs and LDLs) to avoid exceeding the person's tolerance levels. I will often adopt a 1-dB or 2-dB step increase for these processes, particularly when the case history indicates the possibility of severe hyperacusis. Severely hyperacusic patients will often wear earplugs most of the time, complain about traffic noises, barking dogs, clanking dishes, etc., and go to great lengths to avoid noise exposure.

Subtract, by frequency, the threshold level measurement from the loudness tolerance level measurement. This is the hyperacusis dynamic range for that frequency.

To obtain the Johnson Hyperacusis Quotient, add all the ranges together and divide by the number of frequen-

Table 1. *Sample derivation of the Johnson Hyperacusis Quotient*

Frequency	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	6000 Hz	8000 Hz
Air threshold (in dB)	10	15	10	5	10	15	20
LDL (in dB)	45	55	50	55	45	40	35
Subtract threshold from LDL =	35	40	40	50	35	25	15

Total Score = 240 divided by 7 frequencies tested = 34.3 Johnson Hyperacusis Quotient

Table 2. *Hyperacusis rating scale*

Rating	Range of JHQ	Comments
Mild	75-90 dB	Nearly within normal limits
Moderate	50-74 dB	Use ascending approach
Severe	30-49 dB	Careful with tympanometry
Profound	0-29 dB	Careful with voice/equipment

cies tested to obtain an average range. The JHQ has varied from 3 dB to 65 dB in this clinic.

Retesting at 6 and 12 months for progress is standard in this clinic, which uses Pawel Jastreboff's Tinnitus Retraining Therapy as a primary treatment mode.[2] Using this treatment method, I have observed patients whose JHQ has recovered to normal ranges in the first 6 to 9 months.

This procedure is recommended only for hyperacusic patients who have essentially normal hearing thresholds. It is not appropriate for patients with significant hearing loss who may suffer from recruitment or a combination of recruitment and hyperacusis. This means that the majority of the air-conduction thresholds should be no greater than 25 dB, although it is acceptable for a few thresholds to be at or near 30 dB to 35 dB.

Normative data have yet to be collected for this measurement, but here is a preliminary rating scale: Patients with LDLs over 90 dB at any frequency are not hyperacusic at that frequency.

Further research is continuing in this field. Among the subjects being investigated are: the potential use of the JHQ to select patients for special treatment practices; the creation of hyperacusis configuration contours; and the establishment of acceptable changes in test-retest measurements.

I had a conversation recently with David Hawkins, PhD, who first developed LDL measurements as a tool for determining SSPL90 levels for hearing aid fittings.[3] He confirmed that normative data for LDLs in hearing-impaired and normal hearers have not been established. I have submitted a study proposal for funding to remedy this situation.

Your comments and reactions are welcomed. HJ

REFERENCES

1. Bornstein SP, Musick FE: Loudness discomfort level and reliability as a function of instructional use. *Scand Audiol* 1993;22(2):125-131.
2. Jastreboff PJ, Hazell, JW: A neurophysiological approach to tinnitus: Clinical implications. *Br J Audiol* 1993;27(1):7-17.
3. Hawkins DB: Loudness discomfort levels: A clinical procedure for hearing aid evaluations. *J Sp Hear Dis* 1980;45(1):3-15.

OTHER RELEVANT READING

Jastreboff PJ, Gray WC, Gold SL: Neurophysiologic approach to tinnitus patients. *Am J Otol* 1996;17(2):236-240.

Marsha Johnson, MS, CCC-A is one of the few clinicians in the US who is trained and certified in Tinnitus Retraining Therapy, which she provides in her private practice at the Oregon Tinnitus & Hyperacusis Treatment Center, as well for the Portland Otologic Research Foundation with John Epley, MD. She may be reached at her website: mjohnson@www.tinnitus-audiology.com or by telephone at 503/296-7870.