Now Hear This . . .

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What is the best way to teach a patient how to use hearing protection?

Motivating individuals to wear hearing protection when exposed to noise was the topic of our last newsletter. This newsletter continues on a related theme: training individuals in wearing hearing protection to maximize the attenuation of the equipment.

This newsletter will present a summary of research conducted by Antony Joseph for his PhD in audiology at Michigan State University. The title of his thesis was "Attentuation of Passive Hearing Protection Devices as a Function of Group Versus Individual Training." Jerry Punch, PhD, Professor of Communicative Sciences and Disorders, chaired his dissertation committee.

Although Dr. Joseph's work was directed at individuals being provided a hearing conservation program as part of a work-based program, the results of his research are relevant to patients seen in an individual audiologist's office who are exposed to noise through a hobby or around the home.

Dr. Joseph's research had five specific aims:

"(1) Does hearing-loss prevention training result in more effective attenuation by hearing-protection devices? If so, do individual and group training methods result in different degrees of attenuation, and which type of device—premolded or formable earplugs—produces greater attenuation?
(2) What is the variability of attenuation values produced by group versus individual training?
(3) Can attitude-belief characteristics, as measured by a 35-item survey, be used as a valid indicator of whether individual or group training is superior, and for which type of earplug?
(4) Does reading the instructions posted on earplug packaging affect attenuation of formable and premolded earplugs, and to what extent does training, either group or individual, result in additional attenuation?
(5) Can an experienced hearing conservationist satisfactorily judge the adequacy of a subject-fitted hearing-protection device by visual inspection?"

To address these specific aims he used the following methodology:

Subjects were recruited from a large population of Michigan State University students using newspaper advertisements. One hundred eligible normal-hearing subjects, 50 males and 50 females ranging in age from 18 to 41 years, were selected to participate in all of the specified facets of this study. Prospective subjects were first interviewed on the telephone for a screening of their inexperience as hearing-protector users. They had to pass a hearing screening at 25 dB HL at 250 - 8000 Hz (ANSI S3.6, 1996), have normal pinnae and ear canals, be free of pathology and cerumen impaction as verified by otoscopic examination, have no ear problems or recent ear surgery, have no problems in manual dexterity with small objects, be able to read English in small print, use English as their first language, have minimal or no prior experience with hearing protectors (including swim plugs in the past 12 months), and must have never received instruction on the use of hearing protectors.

Group 1 consisted of subjects who fitted the formable device and received individual hearing loss protection (HLP) training. Group 2 consisted of subjects who donned the premolded device and received individual HLP training. Group 3 consisted of subjects who inserted the formable device and received group HLP training. Finally, Group 4 consisted of subjects who used the premolded device and received group HLP training.

Dr. Joseph's concluded the following:

"This investigation has provided compelling evidence that training does have the capacity to optimize the level of hearing protection that is available to users of hearing protection devices (HPDs). **The data indicated that, without training, formable and premolded HPDs were estimated to provide less than 1 dB of real-world protection for 84% of the new employee population.**

A comparison of group and individual training showed that the difference between individual and group training was not clinically or statistically significant, suggesting that group training may be preferable because of the potential cost savings when compared to individual training. There appears to be an added benefit from individual training, however, if the goal of the Hearing Conservation Program (HCP) is to increase the mastery of fitting behaviors exhibited by the worker. Use of a an observational technique developed by the investigator called OPFit showed that individual training, which was comprised of the same didactic method as group training with an additional examiner-fitted earplug experience, resulted in an increase of insertion and verification behaviors when compared to group training. The new OPFit procedure also showed that reading the labeled instructions, obtaining earplug depth, and achieving a good seal were the most advantageous characteristics for optimal fit of the HPD. More investigation is needed to examine the efficacy of OPFit when performed with a group of hearing conservation judges."

Dr. Joseph recognized potential limitations to his study:

"When subjects know they are being studied, they do not behave in the same manner as they would in the field, a phenomenon referred to as the Hawthorne Effect in the literature. In that sense, these data may not be considered real world (RW) measures in the way that some *real-work* studies have removed workers directly from their line of work to be tested immediately, without an opportunity for earplug adjustments. Our subjects were not tested in that fashion because they are not individuals who work in industrial settings and are not HPD users. The only way to capture *real-work* REATs on a new HPD user would be to sample new employees during their first days on the job without providing them with prior notice. If a study were conducted in that way, however, it could be criticized because it would be unethical to withhold HPD training to measure post-training effects.

This study invoked no occupational noise exposure for the subjects and, therefore, raised no ethical issue along those lines. Moreover, it is reasonable to assume that the mean data from this design accurately represent those of new employees, or naïve HPD-user data. In other words, these observations may be referred to as RW or *real-work* data because a subject would likely fit the ear protectors in the same way as in a new RW occupational setting, with the added concern that a job supervisor may be scrutinizing his or her behaviors. Of course, in *real-work* time-delayed observations, earplugs may work their way out of the ears over time and this cannot be reflected in a study like this one, wherein measurements were taken immediately following insertion of the protective device. By the same token, use of an immediate Real-Ear Attenuation at Threshold (REAT) test approach should not disqualify the data from this research from a classification of RW, but only from a classification of time-delayed *real work*. It might also be said that these procedures used here are more akin to the Method B standard (ANSI S12.6 1997). Method B, however, provides subjects with a very different set of instructions. Method B also calls for five unoccluded practice audiograms in the sound field, a 2-minute quiet period prior to fitting the protector for acclimation to the test setting, and two REAT test trials within a single visit to the laboratory. The Method B instructions that are read by the examiner specifically inform the subjects to read the manufacturer's fitting instructions printed on the product packaging. Clearly, this approach has deviated from the RW approach because subjects, as shown in this and other investigations, tend to ignore the manufacturer's instructions.

This study did not require subjects to read the instructions on the label, although the instructions were identified and placed in front of them, which is much more representative of an industrial context. Thus, because these data were neither classifiable as time-delayed *real-work* nor Method B (subject-fit), their classification as real-world untrained headphone measurement and real-world trained headphone measurement seems applicable."

His final summary was:

"This study used the scientific method to determine which method of training, individual or group, was more effective for prospective HPD users. It provided evidence that knowledge and information increases the effectiveness of hearing protectors, which is consistent with the findings of other experimenters. Results of this experiment are generalizable to conditions that include the same protective devices, but not to all earplug designs. Training, whether individual or group, was shown to improve attenuation at all frequencies by a clinically and statistically significant degree. Although the high-frequency REATs of earplugs increased with training, a substantial increase for the low-frequency REATs of the premolded protector resulted in low-frequency attenuation that was similar to the formable protector.

These outcomes were similar to the real-world findings discussed in several classic studies. These studies have illustrated that, on average, workers do not obtain the level of protection posted on the product label. Hearing conservationists should not use laboratory-derived data, therefore, as an estimate of the practical effectiveness of earplugs. Also, OSHA derating is too severe for formable earplugs, so derating by 50% is inaccurate. It may be more precise

to use an approach based on the conditional derating schemes suggested.

If an employer chooses not to provide training—which is not a legal option for general industry and mining—that employer should provide formable, not premolded, devices to employees. For a number of work sectors such as agriculture, entertainment, construction, and railroad engineering, HCP training may be offered at the discretion of the employer. The instructions are more likely to be read, and an adequate seal will more frequently be obtained, with formable earplugs. Achieving depth of the formable device may be a problem, however. Premolded earplugs are not appropriate for higher levels of noise exposure, even when training has been provided for new users. If training is provided, an employer may expect more significant improvement for premolded devices, especially in the low-frequency range. If the employer provides premolded earplugs, individual training should result in the highest protection levels and fitting behaviors for that device.

Because a training effect was observed in a sample of young inexperienced HPD users, it is clear that training is an essential part of the Hearing Loss Prevention Program (HLPP) and should be monitored fundamentally to assure attendance at training prior to noise exposure. Also, to bolster the HPD Program, an appropriate inventory of HPDs and fitting equipment should include a measurement device such as EARGAGE™, a penlight for visual assessments, a full range of earplug sizes, and an equivalent number of small size earplugs if females make up a modest proportion of workers. Hearing conservationists should refrain from one-size-fits-most earplugs, given the prevalence of individuals requiring different-size protective devices for each ear. If attenuation measures are to be conducted, a set of circumaural earphones are a necessary additional test tool.

Not only training, but also an additional crucial element, motivation, might be needed as part of an annual HLPP. This study showed that attenuation and attitude were not associated, but that attitude was associated with HPD use. Depending on the type of information provided, instructional or attitudinal, any assessment of change in the skill or attitude of a worker must be recognized as independent entities because skill and motivation are not related and should be evaluated separately. This does not mean that HCPs should not instill motivation. What it does mean is that the change in Noise Reduction Ratings (subject-fit) should not be viewed as a reflection of the attitude of the employee. Rather, a reliable attitude-belief scale should be used to measure attitude. Furthermore, an effective HLPP should also address feelings of self-efficacy and personal responsibility.

Recommendations made in this paper are tentative, pending further investigation on a wider range of HPDs. For clinical management of individuals exposed to recreational noise, emphasis should be placed on forming a good seal with the earplug of choice and mastering a verification technique, rather than obtaining adequate depth. If a circumaural headset is unavailable, clinicians might consider using supraaural audiometric headphones to test the effectiveness of the earplug fitting and to measure the REAT at 500 Hz (i.e., SAFE500), while ensuring that the supraaural earphone is not in contact with the inserted protective device."

Dr. Joseph's dissertation, either the abstract or the entire document (240 pages in length), are available at:
http://proquest.umi.com/pqdweb?index=1&did=845738231&SrchMode=1&sid=1&Fmt=2&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1174144009&clientId=3552

ANNOUNCEMENT

2nd Annual Michigan Audiology Coalition Conference

Co-sponsored by:
MI Academy of Audiology, MI Educational Audiology Association,
MI Speech-Language-Hearing Association

East Lansing Marriott at University Place
300 MAC Avenue, East Lansing, MI 48823

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Michigan Law Requires the Reporting of Known or Suspected Occupational NIHL

Reporting can be done by:

Internet
www.oem.msu.edu
E-Mail
ODREPORT@ht.msu.edu
FAX
517-432-3606
Telephone
1-800-446-7805
Mail
MIOSHA-MTS Division
P.O. Box 30649
Lansing, MI 48909-8149

Suggested Criteria for Reporting Occupational NIHL

1. A history of significant exposure to noise at work; AND
2. A STS of 10 dB or more in either ear at an average of 2000, 3000 & 4000 Hz. And the employee's total hearing level is 25 dB or more at the same three frequencies. OR
3. A fixed loss.*

*Suggested definitions: a 25 dB or greater loss in either ear at an average of: 500, 1000 & 2000 Hz; or 1000, 2000 & 3000 Hz; or 3000, 4000 & 6000 Hz; or a 15 dB or greater loss in either ear at an average of 3000 & 4000 Hz.

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