More than the Audiogram

We recognize that hearing impaired people have different needs and preferences. Yet we often base the settings of their hearing aids on the audiogram alone

We have seen much advancement in the 'tools' available to hearing care professionals to improve the process of fitting and fine-tuning hearing instruments, especially tools applied through software for programmable instruments. In spite of these new tools, hearing aid fittings are primarily based upon a single source of data: the audiogram. Of course, real-ear measurements have helped make the fittings more technically precise, and the use of outcome measures can improve the counselling process and often client satisfaction. However, we have not made similar progress in changing our fitting habits to address the real performance and lifestyle differences among clients.

Recent studies by Gatehouse [2000] have shown that the "auditory ecology" or auditory lifestyle of the individual can have an important influence on their listening preferences, and thereby the setting of the instrument. In clinical practice, we have several lifestyle and communication performance questionnaires to choose from, even some involving the spouse or significant other. Many would agree that we can gain significant lifestyle information from the basic patient interview. However, we have not yet developed a structured way of incorporating this kind of personal information into the actual instrument settings or the selection of different audiological rationales.

The client's age could be another factor to consider when making more appropriate decisions about fittings and rationales. Baby-boomers are beginning to consider amplification to maintain their very active lifestyles, but a vast majority of today's first-time users still tend to be older adults. Even among this seemingly homogenous group, our older clients may have widely different needs and lifestyles. Our industry is just beginning to investigate how well this important patient group can take advantage of the high resolution and dynamic auditory information provided by today's advanced digital hearing instruments.

We know that the clearest effect of normal aging is a decline of practically all cognitive processes [Salthouse 1991]. It is also well accepted that the comprehension of spoken language involves an enormous and complex data-processing task. Simply by virtue of their hearing loss, hearing impaired listeners miss information in acoustically demanding everyday life situations, even when

using hearing aids. They have to guess and fill in words to get the message. This processing alone may be cognitively demanding. In addition, there are numerous opportunities for cognitive impairments to reduce the success of the listener in understanding speech, even if no 'hearing impairment' is present.

Recent studies by Lunner [2001] suggest that a listener's ability to utilize different kinds of signal processing in the hearing aid may be dependent on their cognitive function. His results indicate that, after controlling for age and hearing loss, there was a significant correlation between the measures of cognitive performance and speech recognition in noise both with and without hearing aids. The results indicate that intact cognitive skills are important for performance in noise, with or without a hearing aid.

A second investigation by Lunner involved using an experimental hearing aid with two alternative modes of signal processing, which differed in the way they reacted in situations dominated by noise. Results indicate that subjects with high scores on the working memory test (used as a measure of cognitive function) were able to identify the situations where the two modes of signal processing behaved differently. However, the subjects with low working memory performance (low cognitive function) were not able to differentiate the two processing modes. Thus, the ability to differentiate between the two noise processing modes was dependent on the cognitive performance.

Gatehouse also looked at the influence of cognitive function on the preferred form of signal processing in a hearing aid. His study indicated that listeners with lower levels of cognitive function tend to achieve better speech test results with (and prefer) slow-release compression over fast-release compression. Furthermore, listeners with high cognitive function tend to show better speech test performance with (and prefer) fast-release compression over slow-release compression.

Age may be the best predictor of cognitive function we have at present, as correlation's between age and cognitive function are high [Baltes & Lindenberger 1997]. The effects of age are slight below about 70 years of age, but increase markedly above that age [Rabbitt et.al. 2001, Baltes &

Lindenberger 1997]. While it is not practical to assess a client's cognitive abilities as part of the hearing rehabilitation process, perhaps this factor will be one to consider more closely.

The results from Gatehouse and Lunner seem to have consequences for research evaluation of different signal processing strategies. All in all, it seems that careful attention should be paid to the cognitive status and auditory lifestyle of hearing aid candidates, as these factors can have a significant influence on the individual's preferences and ability to utilize the signal processing in the hearing aid.

Hearing instrument manufacturers and hearing care professionals need to find simple, efficient methods of obtaining and incorporating the necessary "personal" information into hearing aid fittings, and perhaps tailor the compression characteristics of the instruments to match the users' "processing style" as well as their lifestyle. The audiogram will still be a mainstay of the fitting, but speech understanding and client satisfaction could be further optimized by the use of more individualized fitting strategies.

References

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