

## Article spotlight from the May 2008 issue of *The Hearing Review*

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### Tech Topic

#### Satisfying First-time Hearing Aid Users: A Clinical Study

by George Lindley, PhD, AuD

Despite significant advances in the miniaturization and performance of hearing instruments, the percentage of first-time users has remained fairly static year-to-year. Not surprisingly, so has the average age of the hearing aid user. In order to bring more first-time users into the office, an effective solution for attracting younger patients and those with milder hearing loss is needed. Not only must this solution be attractive cosmetically, it must also provide benefit in the situations of greatest need without associated negatives, such as occlusion and physical discomfort.

The category of non-occluding, miniature BTE devices holds promise for reaching the market of first-time users. This category of devices virtually eliminates the occlusion effect—a major barrier to hearing instrument use by those with milder hearing loss. The devices are cosmetically appealing, easy to fit and use, and offer an instant fitting not possible with older technologies. Recent data suggests that users of this technology are younger with a greater proportion of first-time users.<sup>1</sup> Despite the prevalence of these types of devices, very little *empirical data* is available that describes the nature and amount of benefit one can expect, especially in difficult listening environments.

The Oticon Delta hearing device was designed with the first-time, resistant hearing aid user in mind. With a unique triangular design, numerous color choices, receiver-in-the-ear technology, and in-office fitting and repair, Delta was engineered not to look or feel like a traditional hearing aid (Figure 1). This hearing device has changed the approach many dispensers now take with first-time users. Dispensers talk in terms of "device" versus "hearing aid." The selection of color has taken on a whole new meaning as patients become involved in the selection process in a positive way. Patients can leave the office with the devices on the day of the hearing evaluation.



**FIGURE 1. Oticon Delta hearing device.**

While a unique design can help bring patients into the office, the devices must perform well in situations of need if they are not to be returned or stored in a drawer. In this aspect, the device has also exceeded expectations. According to survey data obtained from approximately 3,000

This article was submitted to *HR* by **George Lindley, PhD, AuD**, Manager of Pediatric Education & Training at Oticon Inc, Somerset, NJ. Correspondence can be addressed to [HREditor@ascendmedia.com](mailto:HREditor@ascendmedia.com) or George Lindley, Oticon Inc, 29 Schoolhouse Rd, Somerset, NJ 08875-6724; e-mail: [gal@oticonusa.com](mailto:gal@oticonusa.com).

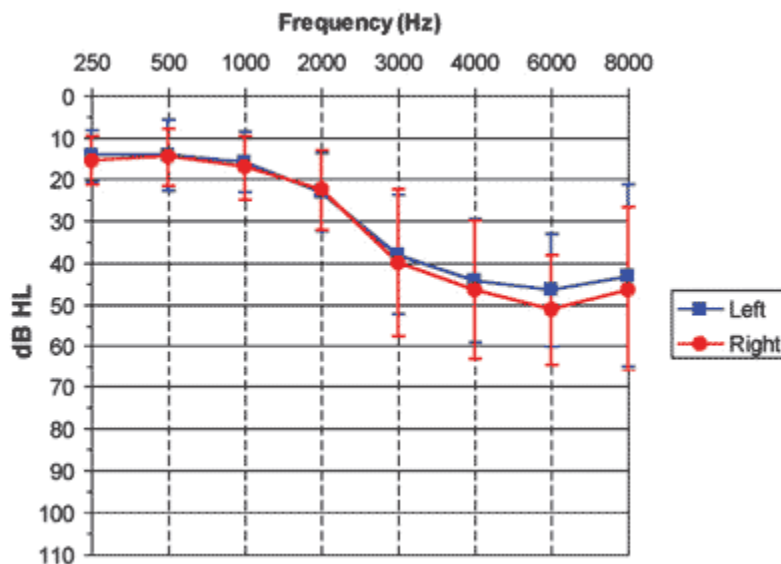
Delta wearers, more than 73% were new users (versus the 39% overall new user rate reported in MarkeTrak VII).<sup>2</sup> More important, 93% reported being satisfied with the device. This indicates that this device represents a viable option for attracting new users to the office.

## Clinical Study Involving First-Time Users

A clinical study was recently conducted to evaluate the benefit provided by Delta to first-time users with mild hearing loss. The primary goal of the study was to determine the degree and nature of benefit that could be expected in this population.

A total of 22 individuals with mild hearing loss and no prior hearing aid experience were recruited for participation in the study. Participants were tested and fitted at one of two sites: The Pennsylvania Ear Institute at the PCO School of Audiology and at Utah State University. Participants ranged in age from 24 to 76 years, with an average age of 55.6 years. There were 8 females and 14 males. Two of the participants were fitted unilaterally due to normal hearing sensitivity in one ear. In instances with asymmetrical hearing loss, appropriate audiologic testing was done to determine that the loss was likely cochlear in nature.

Participants underwent a comprehensive audiologic evaluation prior to participating in the study. Mean audiometric data is provided in Figure 2. All participants had normal to near-normal low frequency hearing sensitivity and high frequency hearing loss in the slight to moderate range. Many of the participants, especially those with milder degree of hearing loss, would not have traditionally been considered hearing aid candidates prior to the advent of non-occluding technologies. However, the participants had enough hearing difficulty in everyday life that they sought help through these clinics.



**FIGURE 2. Mean audiometric data for the participants. Error bars represent one standard deviation.**

Prior to the fitting, loudness discomfort levels (LDLs) were obtained under insert earphones, and the data was entered into the fitting software. The participants' ability to understand speech in noise was assessed using the QuickSIN. With the QuickSIN, a signal-to-noise ratio (SNR) loss is determined. This value reflects how much of an improvement in SNR would be needed in order

for the patient to perform similarly to someone with normal hearing. This measure was conducted under earphones prior to fitting and at 2 months post-fitting in the soundfield while wearing their hearing aid(s).

With the exception of one individual who used custom-fitted Oticon Micromolds, participants were fitted using dome-style earpieces. Two fitting rationales are built in the Delta fitting platform, Clarity and Voice Aligned Compression (VAC). VAC is designed for individuals with a greater degree of hearing loss, especially in the low frequencies. The devices in this study were programmed using the Clarity rationale. This is the default fitting rationale for individuals with good low frequency hearing sensitivity and primary difficulty understanding in background noise. Real-ear measurements were conducted to verify the hearing aid output was approximating that prescribed by the Genie fitting software.

Most participants were seen approximately 2 weeks after the hearing aid fitting for follow-up. For 8 participants, adjustments were made based on the feedback provided during this follow-up visit. For 5 of these participants, less high frequency gain (for soft sounds, loud sounds, or both) was provided. For the remaining 3 participants, gain was increased.

In order to determine the degree of unaided difficulty patients encountered in daily life and to identify specific situations of need, participants were administered the Abbreviated Profile of Hearing Aid Benefit (APHAB) and the Client Oriented Scale of Improvement (COSI).<sup>3,4</sup> The APHAB consists of 24 statements (eg, "I miss a lot of information when I'm listening to a lecture") for which the participant indicates what percentage of the time they have difficulty in each situation, using a scale ranging from 99% (Always) to 1% (Never). Scores can be subdivided into four categories, including listening in relatively favorable conditions, listening in noise, listening in reverberant environments, and the aversiveness of everyday sounds (eg, smoke detector, screeching tires).

The audiologist and participants also completed the COSI. This subjective evaluation tool involves identification of several patient-specific listening situations in which the patient is experiencing communication difficulty. An example could be "difficulty understanding my daughter when communicating on the telephone." The situations are rank ordered according to importance to the patient. These goals can then be revisited post-fitting to determine if improvements are noted.

## Study Results

One striking aspect of the APHAB data (Figure 3) is the level of unaided difficulty reported by these

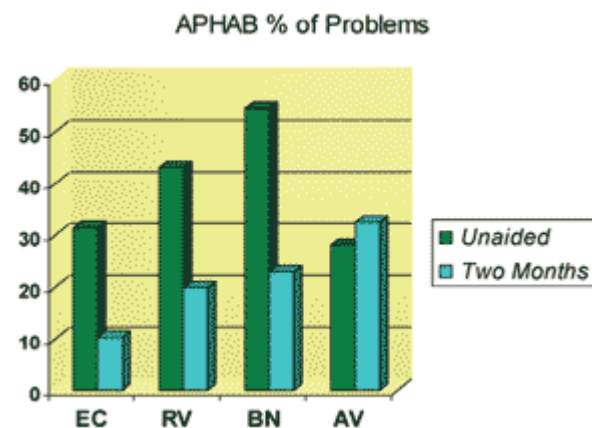


FIGURE 3. APHAB scores obtained pre-fitting and two months post-fitting.

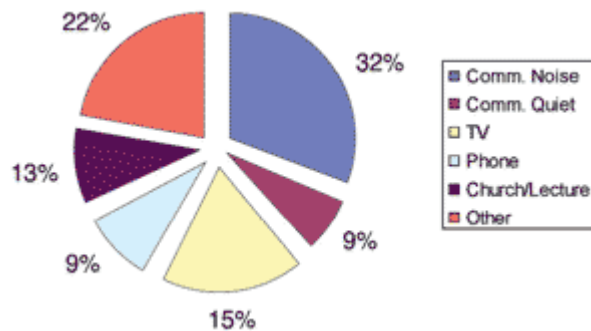
individuals, especially in adverse listening environments. Many participants had normal hearing sensitivity at 2000 Hz, a frequency often used as a barometer for predicting communication difficulty. Participants demonstrated mean unaided QuickSIN SNR loss scores of 3.5 and 3.7 dB in the right and left ears, respectively. This places the group, on average, at the border between near-normal and mild SNR loss according to the QuickSIN manual. For this group, it appears that the objective data may underestimate the degree of difficulty reported in real-world environments.

A series of paired two-sample t-tests was conducted on the data and showed a significant reduction (improvement) in scores obtained on the EC, RV, and BN subscales ( $P < .01$ ). There was no significant difference in pre- and post-fitting AV scores. Taken together, these results show that, at 2 months post-fitting, Delta provided a significant reduction in communication difficulty for these individuals in situations, with reduced cues, background noise, and reverberation.

The AV subscale score is typically higher at post-fitting. This likely reflects the increased audibility of certain environmental sounds that even individuals with normal hearing may find aversive. The small, statistically non-significant change in the AV scores indicates that the test aid provided acceptable listening comfort and sound quality for most of the participants. In addition to statistical significance, the mean subscale differences exceeded the clinical significance guidelines provided by Cox<sup>3</sup> of a 22-point change on at least one of the subscales (EC, RV, BN) or a 5-point change on

all three subscales.

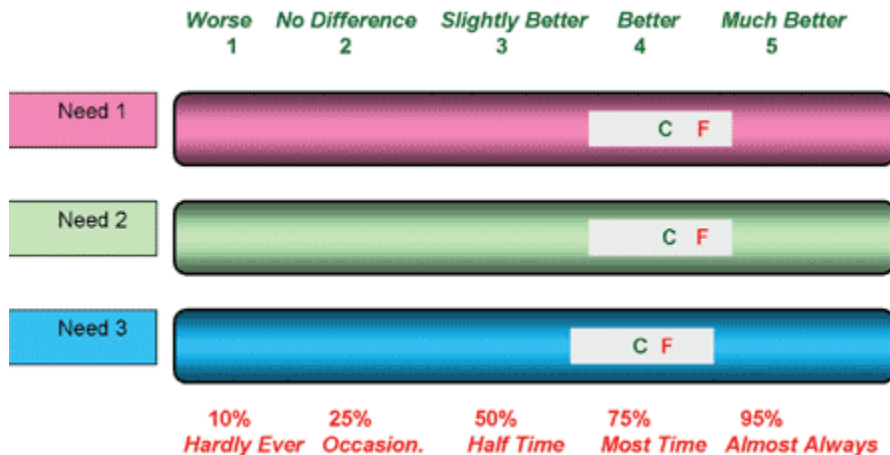
The COSI data indicates that most participants



**FIGURE 4. Listening situations identified by the participants using the COSI.**

participants perceived benefit in their individually determined situations of greatest need. The individual situations identified by the patients were analyzed and broken down into categories (Figure 4). Not surprisingly, situations where background noise was present were identified most frequently as areas in which improvement was desired. Listening improvements in quiet (eg, conversation in quiet, TV, listening at a lecture) were also cited by many of the participants.

For each patient, each specific situation of listening difficulty was rank-ordered in terms of importance (ie, Need #1 was the situation in which the patient was most concerned with achieving benefit, Need #2 was the second most important, etc). The mean change in performance and final ability ratings for the top three situations identified by the participants are summarized in Figure 5. For example, the participants reported an average improvement of 4.2 (just above "Better") for their highest ranked specific listening situation. An average improvement rating between "better" and "much better" was obtained for the top three situations. Final ability was typically rated somewhere between 75% and 100% of the time (eg, can understand in that situation 75% of the time).



**FIGURE 5. Degree of Change and Final Ability for the top three listening situations identified on the COSI. The “C” represents change in performance post-fitting, and the “F” represents the patient's perception of final ability in that situation.**

Aided QuickSIN results were obtained in the soundfield. The mean SNR loss was 0.94, which falls within the "normal" region. This improvement likely reflects contributions both from increased high frequency audibility, as well as testing bilaterally versus unilaterally under earphones. The impact of directionality was not assessed, as the speech and noise were presented from 0° azimuth.

## Discussion

The findings of this investigation demonstrate that Delta provides significant benefit for the first-time user with mild hearing loss, even in situations with background noise and/or reverberation. Importantly, benefit was seen in situations identified by the patient as being most important. There are several audiologic features of Delta that likely contribute to these findings.

Participants were fitted with the Delta 8000 model, which has a bandwidth extending to 8000 Hz. The RITE design also provides a very smooth frequency response. The participants in this investigation likely had useable hearing in the very high frequencies and could take advantage of this extended bandwidth. This is supported by the aided QuickSIN findings that were obtained with both the target signal and the noise coming from the same direction, negating the impact of directionality.

The triangular design of Delta allows for excellent mid-high frequency directionality given the relative positioning of the microphones on the user's ear. This combination of enhanced high frequency audibility and directionality likely contributed to the benefit in adverse listening environments.

The Clarity fitting rationale was designed specifically for performance in background noise. Compression parameters and gain as a function of input level are primarily determined based on what would likely yield the best performance in background noise.

## Summary

The results demonstrate that Delta 8000 fitted using the Clarity rationale provides a significant reduction in communication difficulties for first-time users with mild-to-moderate hearing loss. This performance factor, combined with the unique design, represents a solution for attracting first-time users and hearing aid "resistant" individuals to the office. The data from this study supports the survey data previously collected and suggests a high potential for significant user benefit and satisfaction when using these devices.

## Acknowledgements

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