NOISE REDUCTION TECHNOLOGIES: ARE THEY APPROPRIATE FOR CHILDREN?

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Dr. Wolfe from the Hearts for Hearing Foundation in Oklahoma presented results from an evaluation of the adaptive directional microphone system in the Widex Diva hearing aid. He began by describing the difficulties that hearing impaired people, both children and adults, have hearing in noise. Children often communicate in noisy environments and because their auditory skills are still developing, they do not have the same abilities to detect where the sound is coming from compared to adult listeners.

Different options exist, including improving the signal to noise ratio for the child, FM-systems, directional microphones and noise reduction systems in hearing aids. Many studies have shown that noise reduction systems improve comfort in adult hearing aid users, but no studies have examined the effects in children. The main issue with children is if these systems in general lead to a lack of audibility for sounds important for the child’s language and auditory development.

In regard to directional microphones, several studies have also shown improved performance in adult listeners. But optimal benefit of these systems may require the listener to always face the sound source. But is this the case in children? Dr. Wolfe cited studies showing that children’s ability to direct towards the sound source improve in the first years of life. Based on this finding, omni-directional microphones may be preferred for infants and toddlers, whereas children in pre-school age begin to be able to benefit from directional systems. But no studies have evaluated the effectiveness of adaptive directional systems found in many hearing aids today.

Dr. Wolfe then described the evaluation of the adaptive microphone system in the Diva hearing aid. This system uses digital processing which may limit potential disadvantages associated with the use of directional systems in children. It operates in 15 channels, automatically switches between the two modes, only operates at high input levels and in graded effects relative to the SNR, and uses a slow activation time (5-10 ms) to preserve audibility for important incidental sounds.

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17 children with moderate to severe losses (age range 7-12 years) participated in the study. The children were fitted with Diva 9 and 19 hearing aids, according to the manufacturer's specifications. Word recognition in quiet and in noise was tested in a double blind study in three conditions: (1) Adaptive locator on, (2) Omni-mode, (3) Omni with noise reduction on (i.e. where the gain is reduced when the incoming signal is dominated by non-modulated noise). Subjects used a given mode for 6 weeks. After 1 week of use, the survey “APHAB Subscales for Directional Microphones” was performed with the child. After 6 weeks, word recognition was tested using W-22 word lists in quiet and in noise at 0 and -5 dB SNR. The children ran through all three modes on a random basis, for a total of 18 weeks.

The results showed that in quiet there was no significant difference in the average word-score between the three modes. This was expected, as the systems are not active in quiet surroundings. In noise at 0 dB SNR, the score dropped 29% in the omni mode compared to the Locator mode. In the Omni with noise reduction mode, the score was 5% greater compared to Omni only. Compared to an adult model of 8-15 dB improvement per dB SNR improvement, use of the Locator corresponded to an overall improvement in SNR to 3-4 dB in the group of children. The improvement seen with the noise reduction system was not significant but, on the other hand, the noise reduction system did not reduce the score (as also found in other studies).

The APHAB-survey consisted of a list of questions, asking the child to what degree they experience difficulties in various daily listening situations. Overall, the results showed a similar degree of difficulty across the three modes, i.e. again no adverse effects were seen in one system relative to the others.

In conclusion, this study indicated a significant benefit of automatic adaptive directional systems for school-aged children. Furthermore, most of the children in the study perceived no detrimental effects with the use of digital noise reduction. Dr. Wolfe ended his presentation by elaborating on the new noise reduction technology found in the Widex InTeo hearing aid – technology that also takes the speech intelligibility index into account in its gain reduction. This processing technology may improve the benefit of traditional noise reduction systems, and there is a need for investigating the outcome in hearing impaired children.