

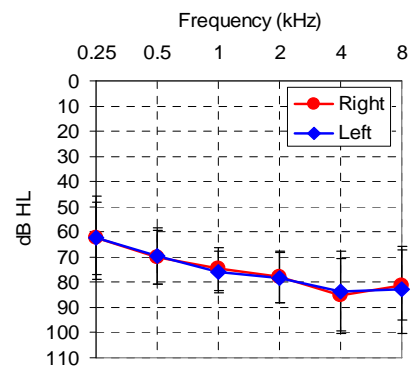
Severe losses: Free signal processing choice is essential

Summary

A multi-site study assessed the benefit of different signal processing schemes (WDRC, SC, linear) in patients with severe hearing losses. The results show that, on average, there is only little difference between these strategies in terms of perceived benefit in daily life. The individual preferences, however, differed considerably and were pronounced. Previous listening experience had a strong impact on preference. These findings support the necessity of having the choice between different strategies for hearing instrument fitting, as in Supero.

Introduction

In sensorineural hearing loss, the more pronounced the hearing impairment, the more restricted the remaining dynamic range that the hearing impaired person can utilize. As hearing loss increases, the hearing instrument has the increasingly difficult task of amplifying incoming signals to lie within the narrow dynamic range available. Wide Dynamic Range Compression (WDRC) hearing instruments attempt to reproduce a broad range of incoming sound levels within the hearing impaired person's narrow "dynamic range window". Linear hearing instruments offer an alternative approach by amplifying incoming sounds equally, regardless of their level and truncating the highest levels (peak clipping) to prevent excessive sound pressure at the eardrum. The linear approach utilizes the available dynamic range but with the added risk of output signal distortion. A compromise



Average audiogram of the trial subjects

between linear and WDRC hearing instruments is to be found in systems that operate in a linear fashion over a wide range of input signals, while compressing sounds that are louder than a certain level (Super Compression – SC).

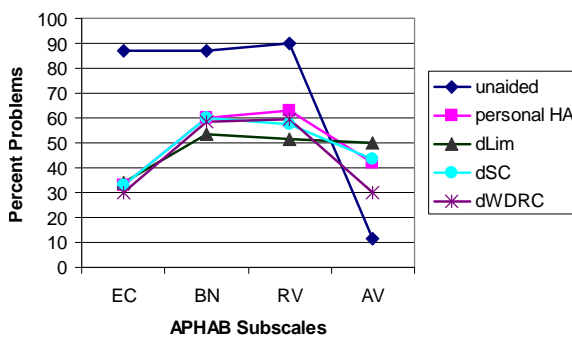
There is no established rule about which of these processing strategies is best for people with severe hearing loss. Thus, a multi-site clinical trial* has been conducted to assess the benefit of different signal processing strategies for these patients, and to evaluate their individual preference after experience in daily life [1].

Setup

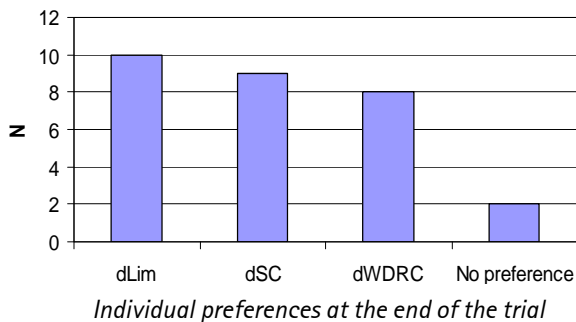
In total, 29 experienced hearing aid users from 45-75 years with severe sensorineural hearing losses participated in the study. They have been fit according to NAL with Supero 412 hearing instruments which can be set to any of the three signal processing schemes described above. The subjects used each of the three strategies at home for 3 weeks. The order was randomized. Two outcome measures were used: (i) the APHAB

questionnaire [2] with the subscales of Ease of Communication (EC), Background Noise (BN), Reverberation (RV), and Aversiveness (AV), and (ii) the IOI-HA [3], a seven question inventory that evaluates how hearing aids are helping in daily life. After each trial session of three weeks, the subjects completed both questionnaires. The study was conducted according to a double-blind design.

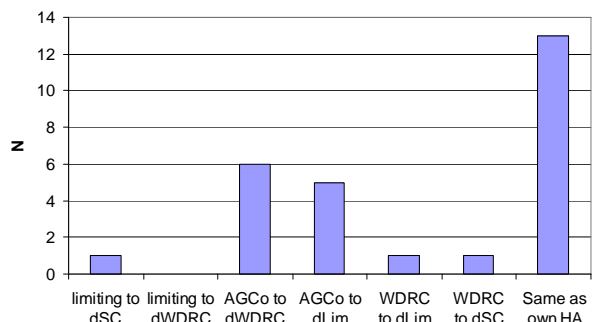
Results



The figure above shows the APHAB scores for each condition. The unaided results indicate that this is a severely challenged group due to their degree of hearing loss. The three signal processing schemes appear to produce similar results and the results are favorable, as compared to a group of mild-to-moderately impaired individuals using linear amplification. There is a trend in the data for the WDRRC processing to be more comfortable (less aversive). The IOI-HA results do not differentiate between the three processing schemes, but illustrate the dependence of this user group on their amplification.



After completion of the three trial sessions, the subjects were asked to indicate their preferred signal processing scheme. Most subjects had a clear preference, but there was no trend towards a preferred overall scheme (see previous picture). A closer look at the individual preferences reveals that 41% of the subjects preferred the signal processing scheme of their personal hearing aids. Moreover, for 62% of all of the subjects, the final preference matched the final listening condition. Thus, previous listening experience had a strong impact on the preferred processing scheme.



Change of individual preference against own HA

In general, the data do not support one specific signal processing strategy for patients with severe hearing losses. However, individual preferences differ, and the preferences are pronounced (due to the high level of dependency on their hearing aids). Thus, having a choice of different signal processing schemes for fitting the hearing aid is important for clients who will often come with extensive previous experience with amplification.

*The study was conducted by Catherine Palmer, University of Pittsburgh, PA (USA), and Nigel Partington, Glan Clwyd District Hospital (UK).

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References

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- [2] Cox R, Alexander G (1995). *Ear & Hearing* 16(2), 176-86
- [3] Cox R, Alexander G, Beyer C (2003). *JAAA*14(8), 403-13