

# Field Study News

## SoundRecover

Significant benefits for children with mild to moderately severe hearing loss

### Summary

The provision of sufficient amplification for high-frequency phonemes, such as /f/, /s/, /sh/ and /z/, is critical for the development of language and speech production. However, although children with mild to moderately severe hearing loss typically receive considerable benefit from hearing instrument (HI) use, they frequently experience difficulty with certain aspects of speech recognition and production. In an attempt to provide greater gain in the high frequencies, HIs manufacturers have developed HIs with active acoustic feedback cancellation and bandwidths that extend past 4000 Hz. Furthermore, SoundRecover, which shifts high-frequency sounds that the child is unable to hear, and compresses them to a lower region where the child can hear better, has been an important recent development.

Using the University of Western Ontario (UWO) Plural Test, this study, including 12 children with a mild to moderately severe hearing loss, compared speech recognition abilities with SoundRecover to those with their own HIs. Results showed significant benefits with SoundRecover and positive subjective reports.

### Introduction

Although children with mild to moderately severe hearing loss typically receive considerable benefit from hearing aid use, they frequently experience difficulty with certain aspects of speech recognition and production. For instance, Stelmachowicz et al. (2002) demonstrated that children with mild to moderately severe hearing loss experience significantly greater difficulty with perception of the phonemes /s/ and /z/ while wearing their personal HIs compared to the performance of children with normal hearing. Additionally, they showed that discrimination of /s/ and /z/ was dependent upon adequate aided audibility through to at least 8000 Hz. An inability to attain these cues through audition can lead to the development of syntactic and semantic errors in language development. Stelmachowicz and colleagues (2002) concluded that the limited bandwidth of contemporary behind-the-ear HIs is responsible for the children's poor discrimination of high-frequency phonemes. SoundRecover is a unique approach designed to lower the frequencies of inputs within a frequency range designated by

the clinician. The primary objective is to restore audibility for high-frequency inputs through to approximately 8000 Hz. SoundRecover compresses the signal above a specified cut-off frequency. The amount of compression applied to this frequency band is specified by the compression ratio. Clinicians are able to adjust these parameters in order to fine-tune the settings. Any acoustic input that exceeds the cut-off frequency is compressed by an amount determined by the compression ratio.

### Goal of the Trial

The benefits of the Phonak Nios micro HIs with SoundRecover in a group of children with a mild to moderately severe hearing loss were examined.

### Set-up of the Study

The study was conducted in the audiology department of the University of Oklahoma City, USA.

Baseline audiologic testing was conducted while the children used their own bilateral digital HIs and with the Nios micro HIs, measuring the percent correct plurals recognition with the University of Western Ontario (UWO) Plural Test (Scollie et al., 2009). The UWO Plural Test is an open-set speech recognition task developed by Prof. Susan Scollie and colleagues specifically for the purposes of evaluating HIs with frequency lowering technology (Glista et al., 2009). The test contains 15 separate monosyllabic and bisyllabic words in both the singular and plural form. It is assumed that correct identification of the plural form of each word requires the child to have access to acoustic energy in the 4000 to 8000 Hz range. In this study, two lists were presented for a total of 60 words in each condition. Real-ear probe microphone measures were conducted to ensure optimal audibility for all children. Further, the new Frequency Lowering Verification test of the Audioscan Verifit was used to ensure audibility for inputs up to 6300 Hz. The aided output for the signal presented at 65 dB SPL was measured with SoundRecover disabled and enabled as shown in Fig. 1. When examining the red line in Fig. 1, it is apparent that components of average conversational speech will be inaudible in the high-frequency region

for this user. Even with a HI, as shown by the green line, these high-frequency components will still be inaudible. However, when SoundRecover is enabled, as shown by the purple line, it will likely provide substantial improvements in the audibility of high-frequency speech components.

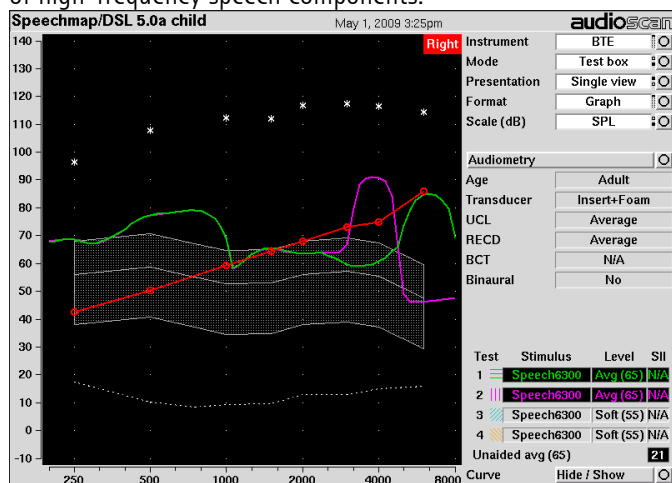


Fig. 1: Using the new verifit tests, these graph shows the real ear aided output for the Frequency Lowering Verification test. The red line indicates unaided thresholds, the green line indicates aided output from Phonak Nios micro HI with SoundRecover disabled, and the purple line indicates aided output from Phonak Nios micro HI with SoundRecover enabled. SoundRecover verification guides available under: [www.phonak.com/pediatric\\_fitting](http://www.phonak.com/pediatric_fitting)

## Subject and Devices

The benefits and limitations of SoundRecover were evaluated in a group of children with ages of 5 to 13 years with a mild to moderately severe hearing loss which were full-time digital HI users. Children's expressive and receptive language aptitudes are within one year of their chronological age, and all children are graduates of Auditory-Verbal therapy. After fitting the children with Phonak Nios HIs they were assigned randomly to one of two groups: 6 children with SoundRecover enabled and 6 with SoundRecover disabled.

## Results

Initial findings from the children fit with SoundRecover yielded positive results according to subjective comments, average recognition of plural words, and individual subject evaluation. Subjective comments revealed that none of the 12 children fitted with the Nios micro HI objected to SoundRecover. In fact, many of the children reported better speech understanding.

Positive subjective reports were corroborated by the UWO Plural Test scores for the first six children who used SoundRecover. On this test, the children achieved a score of 67.7% correct (SD: 13.9) while using their own digital HI. In contrast, the children scored 98.6% correct (SD: .02) after using the Nios micro HI with SoundRecover enabled for approximately 15 minutes. A paired *t*-test indicated that the difference in average performance between the children's own HI and the Nios micro HI with SoundRecover enabled was statistically significant ( $p=.002$ , Fig. 2; Wolfe et al., 2009).

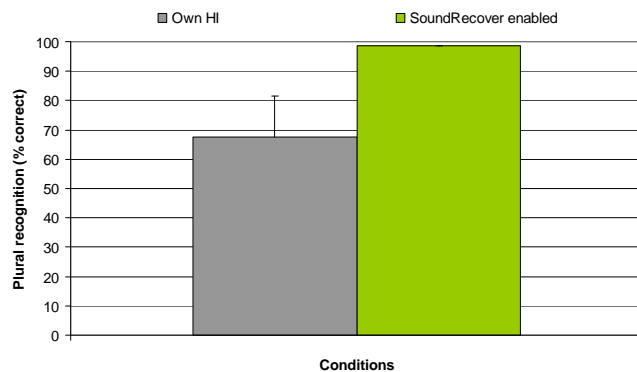


Fig. 2: Mean speech-recognition scores for the University of Western Ontario Plural Test. Significant benefit of SoundRecover enabled compared to the subject's own HI ( $p<0.002$ ).

Children were very pleased with the sound quality of the Nios HI, and one child reported that his mother's speech sounded "crisper". They all exhibited a preference for SoundRecover versus their traditional amplification, although these were all digital HI's. Furthermore, they were very pleased with the aesthetics of the micro-sized Nios.

## Conclusion

The preliminary findings of this study suggest that SoundRecover has the potential to provide substantial improvement in acquisition and identification of high-frequency speech signals and environmental sounds when compared to conventional high-end digital amplification. This study showed initial improvements in speech recognition for high-frequency weighted speech materials. Also, detection thresholds for high-frequency inputs were lower, which may result in improved audibility of high-frequency consonants. This type of full-time access to inputs across the entire speech range is critical for the development of typical speech, language, and auditory skills. It is possible that use of SoundRecover for young children may eliminate many of the deficits researchers have shown to exist for children with mild to moderate hearing loss. In conclusion, SoundRecover should be considered as an option for children with mild to moderately severe hearing loss. Further, research has also shown that SoundRecover benefits children with moderate-to-profound hearing loss (Bagatto et al., 2008).

## References

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