Recent findings in using SoundRecover for Pediatric Applications

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Introduction

- Overview of SoundRecover (non-linear frequency compression; NLFC)
- Visual demonstration of the effect of SoundRecover
- Clinical evidence of the benefit of SoundRecover for mild to moderate hearing losses in children
Perception of high pitch speech sounds

Identification and intelligibility of high frequency speech cues

- Children:
  - Speech production/ language acquisition
- Hearing difficulty:
  - Reduced ability to detect high frequency speech cues like /f/, /s/, /sh/
- Grammatical information:
  - Plural etc.

Speech spectrum

/S/ - male, female, child speaker

- ~ 5 kHz Male
- ~ 6-9 kHz Female
- ~ 9 kHz Child

Pat Stelmachowicz et al., 2000 – 2004, Boys Town

Boothroyd et al, 1992
Stelmachowicz et al, 2001
Frequency Shifting, Frequency Lowering

Cut-off frequency

SoundRecover

Compression ratio

No changes to low frequencies
Compression applied to high frequencies
Consequences of high frequency hearing loss

SoundRecover Spectrograms

„Original Signal“  Simulated high frequency HL  Simulated SoundRecover
SoundRecover
Different SoundRecover settings

Add understanding to hearing with SoundRecover
Extended bandwidth- how much difference is there?

High frequency amplification

- Most modern hearing aids are offering high frequency amplification
- No significant difference in achievable output at high frequencies
- Reason: physical limitations of the acoustical system

Full audibility of high frequency speech sounds can not be restored with conventional amplification
Visual demonstration of SoundRecover

- Phonak Certena Art hearing aid with SoundRecover was fitted to a moderate hearing loss
- Special attention was given to fit the high frequencies
- Two sounds presented to the hearing aid and simultaneously recorded with Aurical Visible Speech system

Comparison of devices

- Phonak Certéna Art
  - SoundRecover ON
- Phonak Certéna Art
  - SoundRecover OFF
- Device B
  - Premium HI with extended bandwidth
- Device C
  - Premium HI with extended bandwidth
Clinical evidence for the benefit of SoundRecover (NLFC) for mild to moderate hearing losses

Evaluation of SoundRecover for School-Age Children

- 15 children with moderate to moderately severe high-frequency SNHL fitted with Phonak Nios micro-sized behind-the-ear hearing aids.

Subject Characteristics

- Full-time users of digital behind-the-ear hearing aids.
- No ANSD (auditory neuropathy spectrum disorder)
- No previous experience with frequency lowering technology
- Oral-Aural communicators with English as primary language
- 5-13 years of age (Mean Age: 10 years, 6 mths)
Procedures

- Evaluated speech production, speech recognition, and aided thresholds with subjects’ own hearing aids and Phonak Nios BTE hearing aids
- Subjects wore Phonak Nios BTE hearing aids for two 6-week periods:
  - SoundRecover Off/ SoundRecover On
- Order in which SoundRecover was used was counterbalanced across subjects
- After completion of the two 6-week trials, the subjects wore the hearing aids with SoundRecover enabled for 6 months

Procedures

- Aided Thresholds
  - 4000, 6000, & 8000 Hz
  - Recorded /sh/ & /s/, Univ Western Ontario

- Speech Recognition
  - University of Western Ontario Plural Test
  - Phonak Logatome Test
  - BKB-SIN
UWO Plural Test

- Female Speaker
- 15 words familiar to school-aged children in both singular and plural form (/s/ or /z/ in final position)
  - Skunk/Skunks
  - Book/Books
  - Fly/Flies
  - Crayon/Crayons
- Presented at 50 dB SPL from loudspeaker 1 meter directly in front of the child.

Phonak Logatome Test

- Adaptive, computer-controlled test
- Female speaker saying, “My name is ..”
  - ASA
  - ASA6K
  - ADA
  - AKA
  - AFA
  - ASHA
  - ATA
- Software tracks level in dB SPL that corresponds to 50% correct performance.
BKB-SIN

- Two 10-sentence lists
- Sentence level at 50 dB HL
- Determines dB SNR for 50% Correct

Results
Aided Thresholds (dB HL)

SoundRecover Off vs SoundRecover On

SoundRecover provides a statistically significant improvement in aided thresholds for all stimuli!

- **4000 Hz**:
  - Own Aids: 29, 21
  - NLFC Off: 32
  - NLFC On: 28

- **6000 Hz**:
  - Own Aids: 28, 26
  - NLFC Off: 33
  - NLFC On: 28

- **8000 Hz**:
  - Own Aids: 47
  - NLFC Off: 28
  - NLFC On: 21

- **/Sh/**:
  - Own Aids: 28
  - NLFC Off: 28
  - NLFC On: 21

- **/S/**:
  - Own Aids: 38
  - NLFC Off: 27
  - NLFC On: 38

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UWO Plural Test

SoundRecover Off vs SoundRecover On

- **UWO Plural Test (% Correct)**
  - NLFC Off: 99.3
  - NLFC On: 83.6

SoundRecover improves speech recognition on UWO Plural Test by 16% points!
Case Study: Olivia, 11y

Jace Wolfe – UWO Plural Test

SoundRecover Off

SoundRecover On
Speech Recognition Threshold (dB SPL) for 7 Nonsense Syllables

SoundRecover improves speech recognition for ASA token by 8 dB!

Speech Recognition in Noise
SoundRecover Off vs SoundRecover On

SoundRecover does not degrade speech recognition in noise!
Aided Thresholds (dB HL)  
**SoundRecover Off vs SoundRecover On**

SoundRecover provides a statistically significant improvement in aided thresholds for all stimuli!

UWO Plural Test  
**SoundRecover Off vs SoundRecover On**

Improvement in speech recognition in quiet observed at 6-month interval.
Logatome Thresholds

Improvement in speech recognition in quiet observed at 6-month interval

Speech Recognition in Noise on BKB-SIN

SoundRecover provides significant improvement in noise after 6 months!
Summary of Jace Wolfe Study

- SoundRecover improves speech recognition and speech production for children with moderate hearing loss.
- SoundRecover should be considered for children with all degrees of hearing loss.
- Children may need to acclimate
  - Initially may complain that sound is shrill or that they hear extra noise.
  - May require time to develop speech recognition and production.
- No child objected to SoundRecover.
- 8/15 preferred the 6-week period using SoundRecover over the 6-week period without SoundRecover (7/15 had no preference).
- Subjects were blinded to settings over 6-week period.

Ears prefer SoundRecover
Proven in 20 + publications

- Dewald N. 2009. Experiences with a wide Application of SoundRecover, Non-linear Frequency Compression. AudiologyOnline, Oktober
- Nyffeler M. 2008: Study finds that non-linear frequency compression boosts speech intelligibility. The Hearing Journal 61(12): 22-26
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www.phonakpro.com/soundrecover