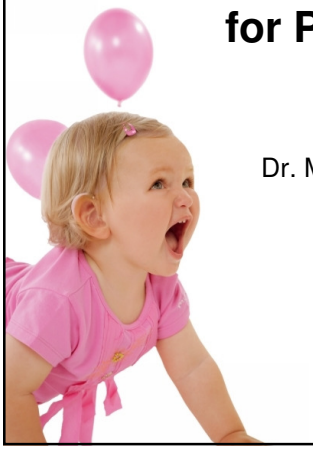
Recent findings in using SoundRecover for Pediatric Applications



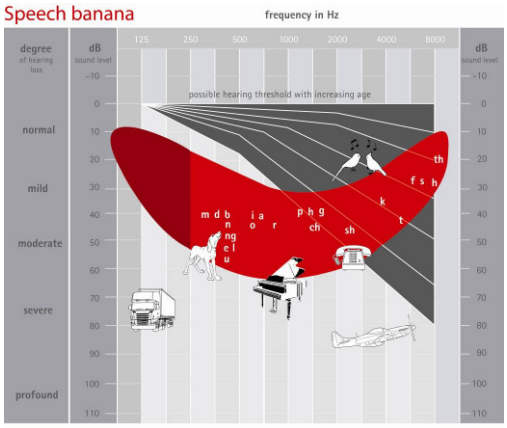
Dr. Myriel Nyffeler, Phonak AG, Stäfa

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



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

- Children:

  Speech production/ language acquisition
- Hearing difficulty:

  Reduced ability to detect high frequency speech cues like /f/, /s/, /sh/
- Grammatical information:

  Plural etc.

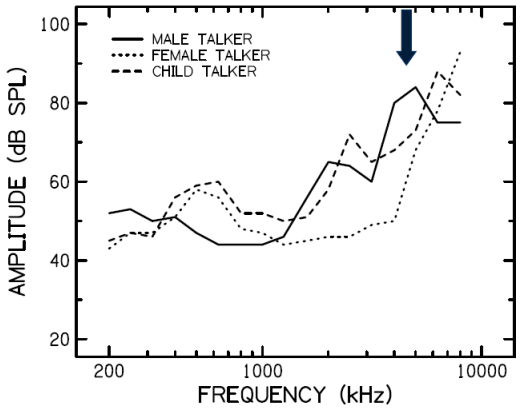
Speech spectrum

/S/ - male, female, child speaker

~ 5 kHz Male

~ 6-9 kHz Female

~ 9 kHz Child

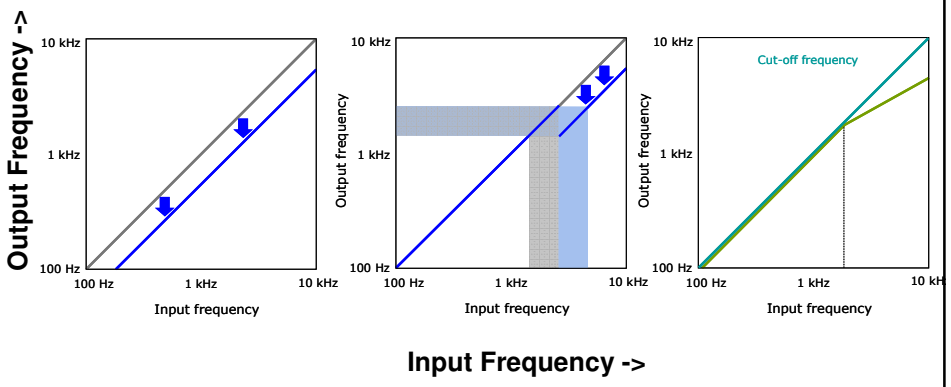


Boothroyd et al, 1992

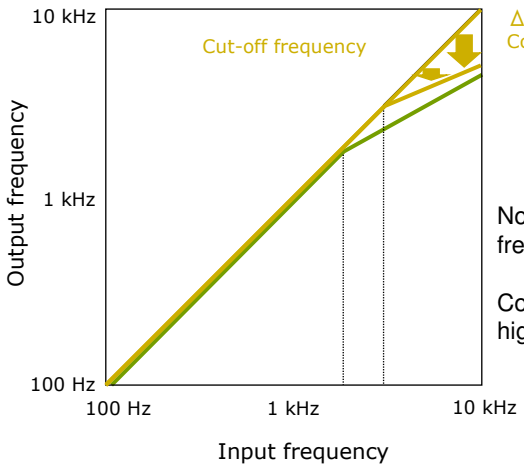
Stelmachowicz et al, 2001

Stelmachowicz Como 2008

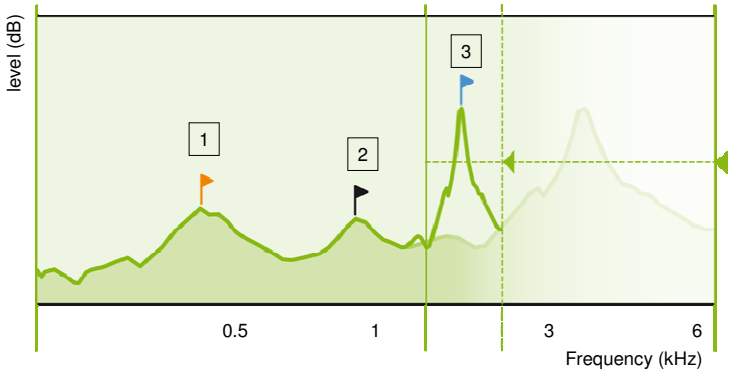
Frequency Shifting, Frequency Lowering



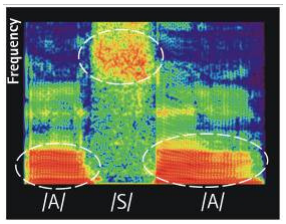
SoundRecover



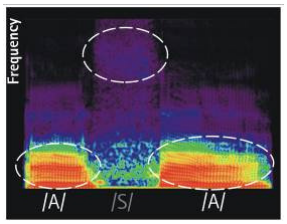
SoundRecover of high frequency hearing loss



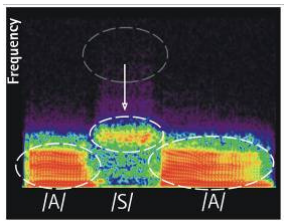
SoundRecover Spectrograms



„Original Signal“

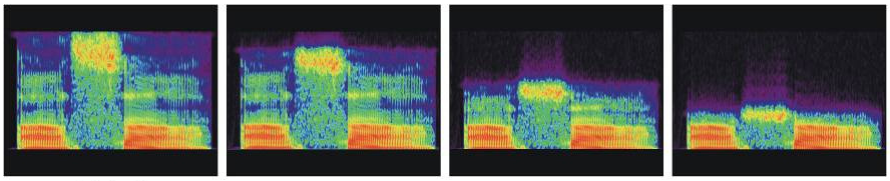


Simulated high frequency HL



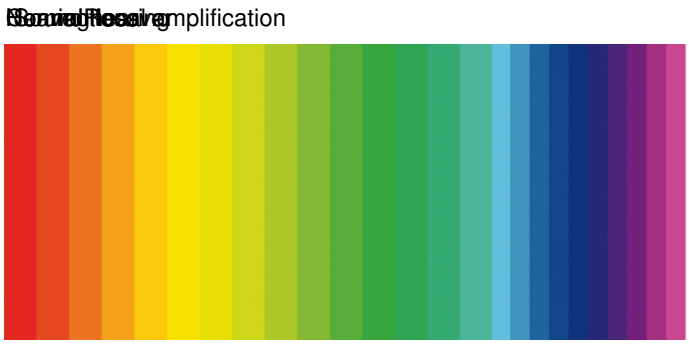
Simulated SoundRecover

SoundRecover
Different SoundRecover settings

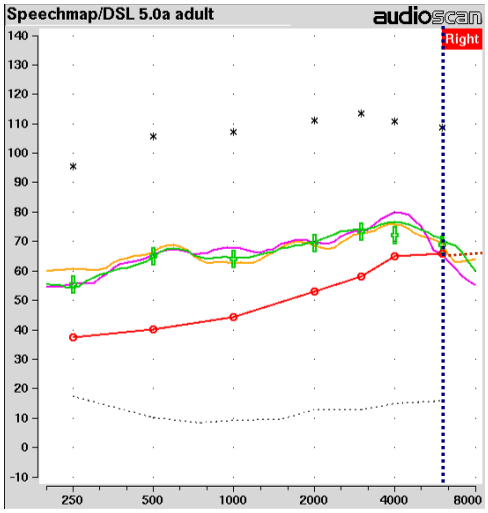


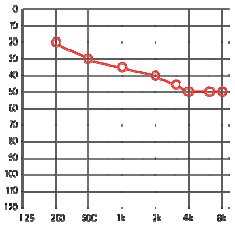
Original | 4000 1.5:1 | 2000 2:1 | 1500 4:1

Add understanding to hearing with SoundRecover



Extended bandwidth- how much difference is there?





Phonak Certéna Art
SoundRecover OFF

Device B
premium HI with extended bandwidth

Device C
premium HI with extended bandwidth

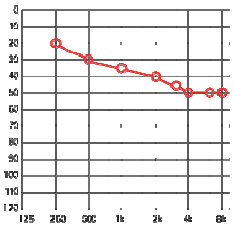
(all three were set to maximum gain for the highest frequencies)

High frequency amplification

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

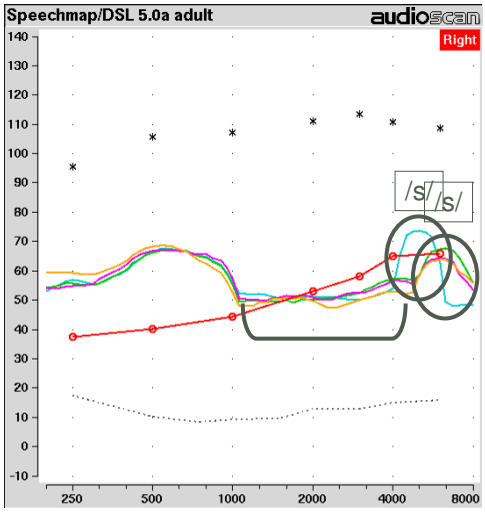
Full audibility of high frequency speech sounds can not be restored with conventional amplifcation

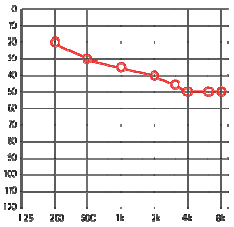
Visual demonstration of SoundRecover



- 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 simultanously 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.

Jace Wolfe, Andrew John, Erin Schafer, Myriel Nyffeler, Michael Boretzki, Teresa Caraway: Evaluation of Non-Linear Frequency Compression for School-Age Children with Moderate to Moderately-Severe Hearing Loss (J Am Acad Audiol 21:1-11 (2010))

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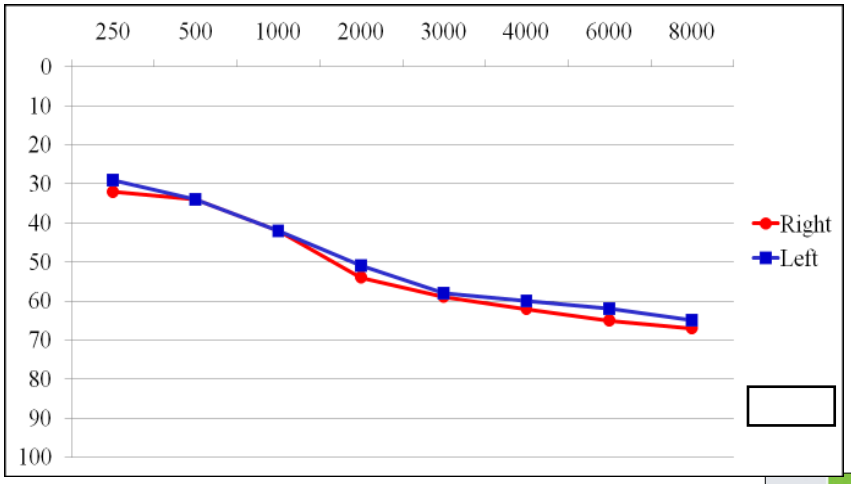
Mean Audiogram



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 counter-balanced across subjects
- After completion of the two 6-week trials, the subjects wore the hearing aids with SoundRecover enabled for 6 months

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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

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UWO Plural Test

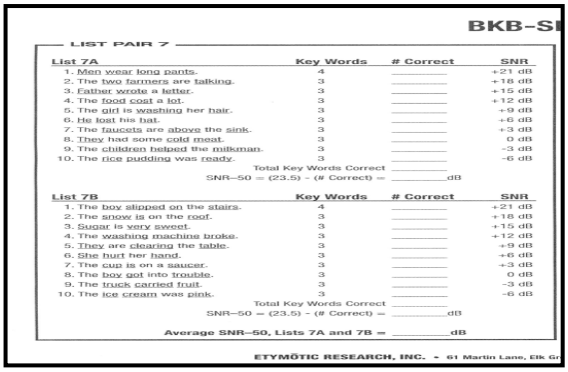
- Female Speaker
- 15 words familiar to school-aged children in both singular and plural form (/s/ or /z/ in final position)
  - Skunk/Skunks
  - Book/Books
  - Fly/Flies
  - Crayon/Crayons
- Presented at 50 dB SPL from loudspeaker 1 meter directly in front of the child.

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



BKB–SI

LIST PAIR 7

List 7A	Key Words	# Correct	SNR
1. Men wear long pants.	4	_____	+21 dB
2. The two farmers are talking.	3	_____	+18 dB
3. Father wrote a letter.	3	_____	+15 dB
4. The food cost a lot.	3	_____	+12 dB
5. The girl is washing her hair.	3	_____	+9 dB
6. He lost his hat.	3	_____	+6 dB
7. The faucets are above the sink.	3	_____	+3 dB
8. They had some cold meat.	3	_____	0 dB
9. The children helped the milkman.	3	_____	-3 dB
10. The rice pudding was ready.	3	_____	-6 dB
Total Key Words Correct		_____	
SNR–50 = (23.5) - (# Correct) =		_____dB	

List 7B	Key Words	# Correct	SNR
1. The boy slipped on the stairs.	4	_____	+21 dB
2. The snow is on the roof.	3	_____	+18 dB
3. Sugar is very sweet.	3	_____	+15 dB
4. The washing machine broke.	3	_____	+12 dB
5. They are clearing the table.	3	_____	+9 dB
6. She hurt her hand.	3	_____	+6 dB
7. The cup is on a saucer.	3	_____	+3 dB
8. The boy got into trouble.	3	_____	0 dB
9. The truck carried fruit.	3	_____	-3 dB
10. The ice cream was pink.	3	_____	-6 dB
Total Key Words Correct		_____	
SNR–50 = (23.5) - (# Correct) =		_____dB	

Average SNR–50, Lists 7A and 7B = _____dB

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Results

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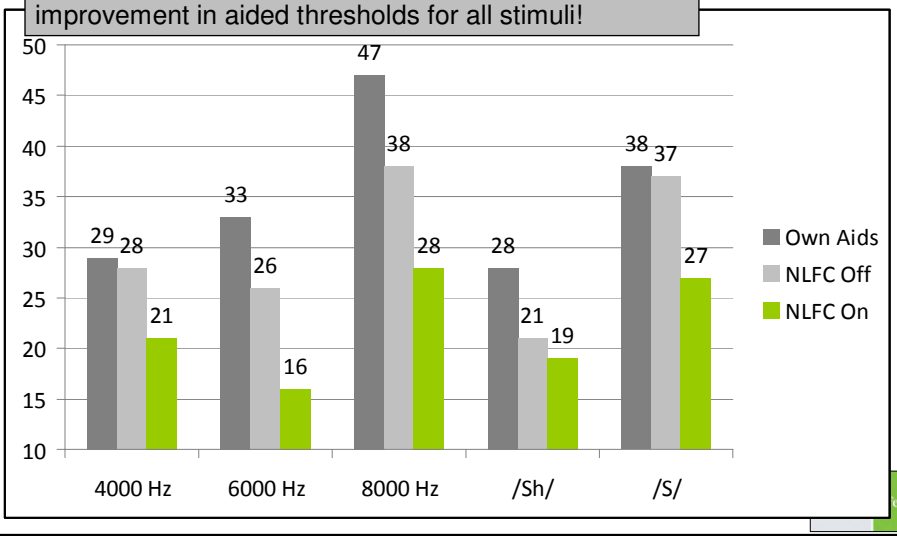
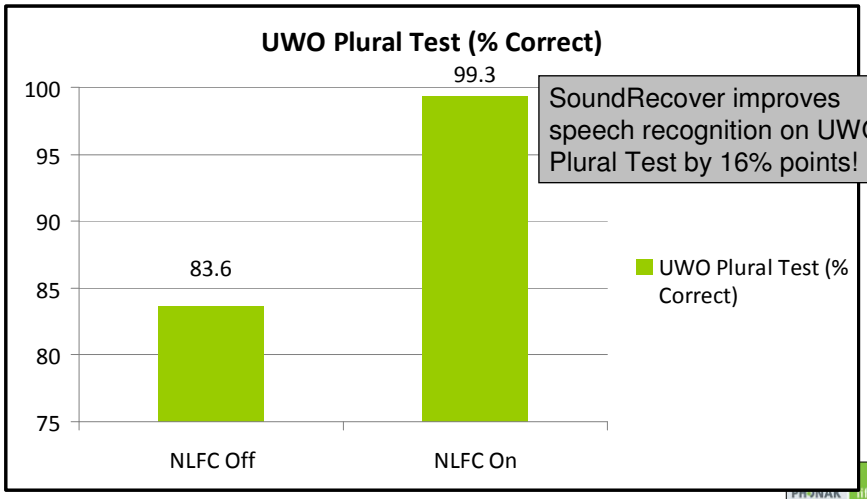
Aided Thresholds (dB HL)
SoundRecover Off vs SoundRecover On

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

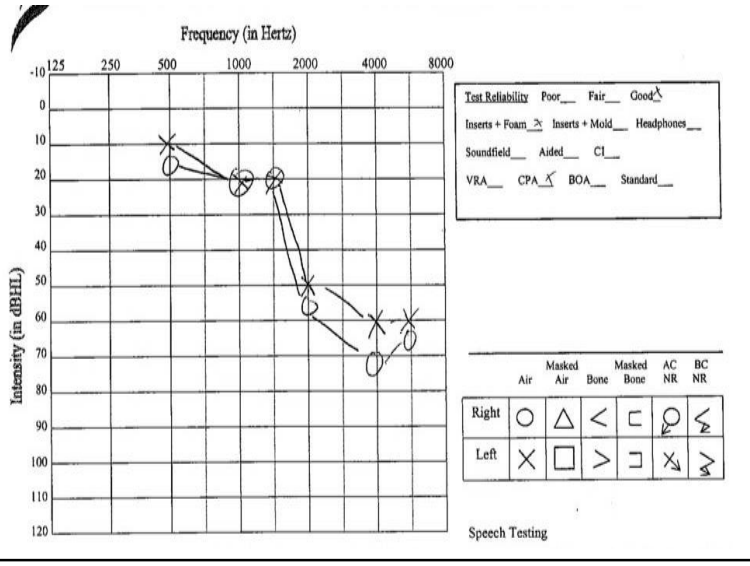


UWO Plural Test
SoundRecover Off vs SoundRecover On



SoundRecover improves speech recognition on UWO Plural Test by 16% points!

Case Study: Olivia, 11y



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Jace Wolfe – UWO Plural Test

SoundRecover Off

SoundRecover On

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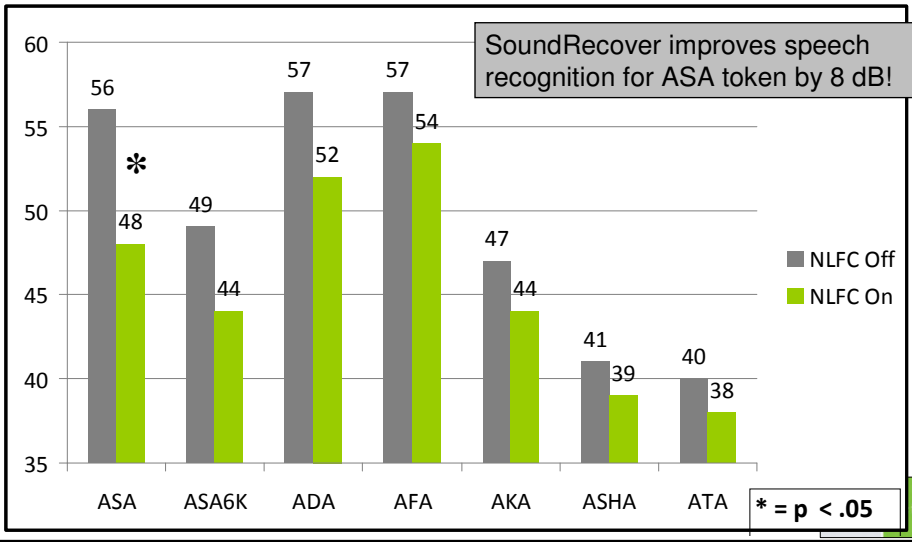
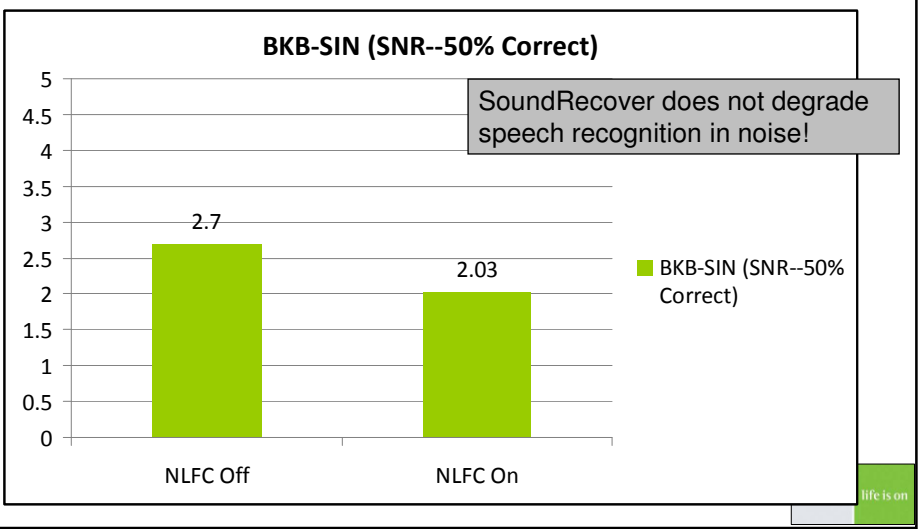
Speech Recognition Threshold (dB SPL) for 7 Nonsense Syllables

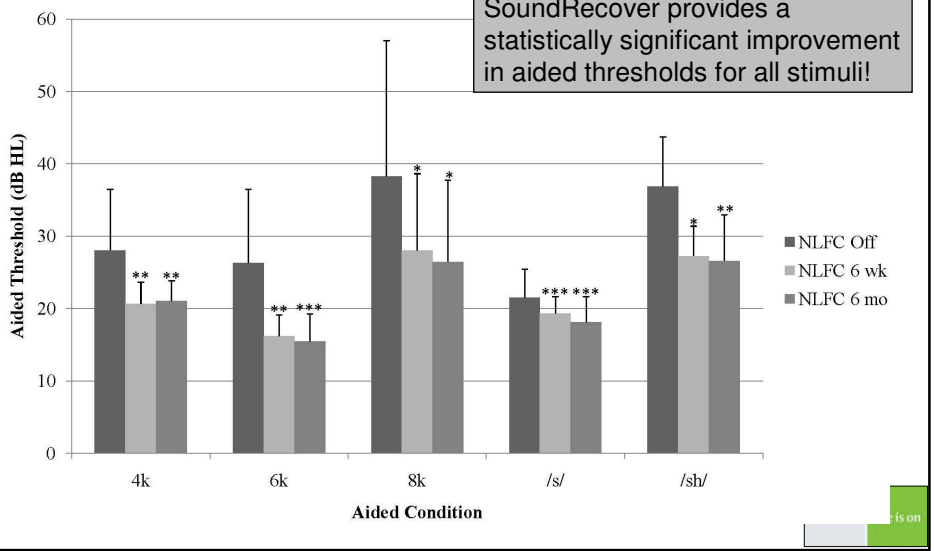


Speech Recognition in Noise SoundRecover Off vs SoundRecover On

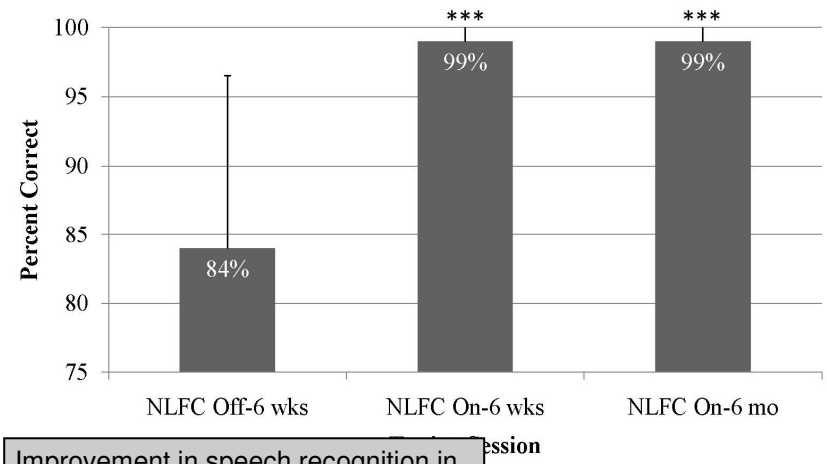


Aided Thresholds (dB HL)
SoundRecover Off vs SoundRecover On

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



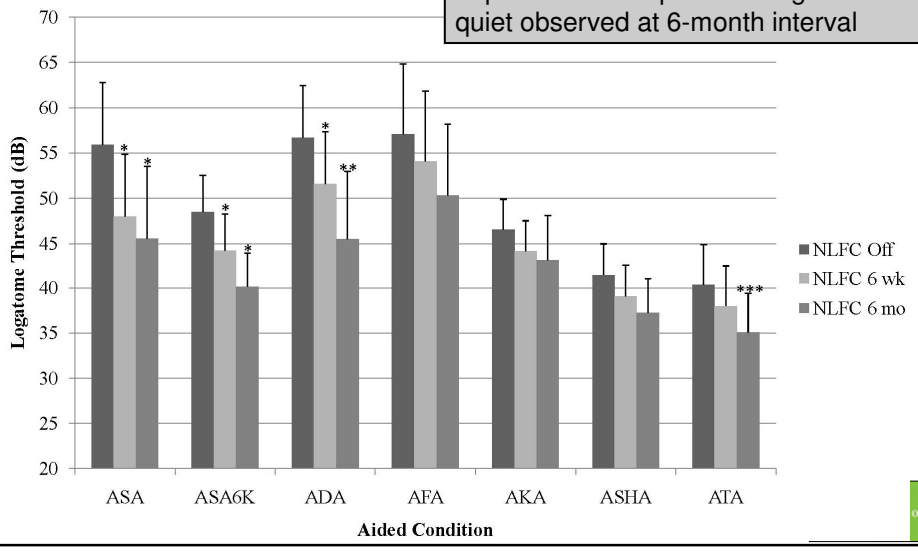
UWO Plural Test
SoundRecover Off vs SoundRecover On



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

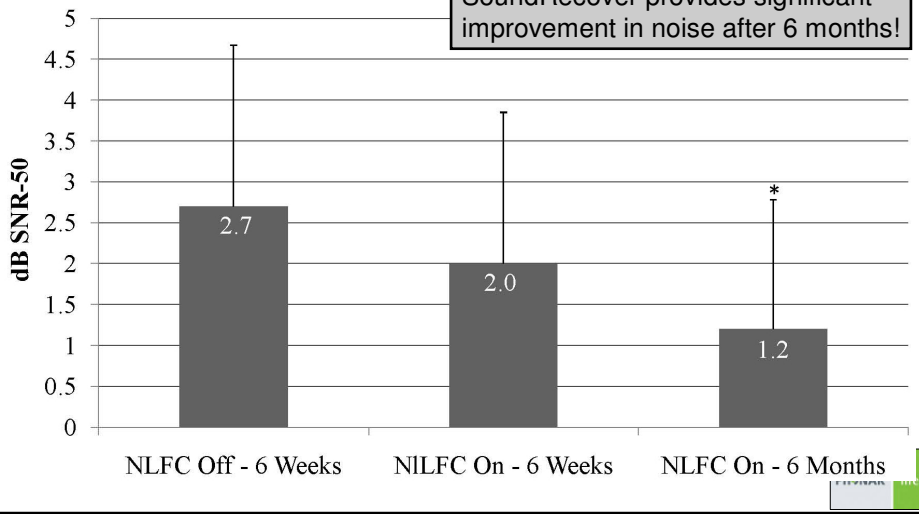
Logatome Thresholds

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

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Ears prefer SoundRecover

Proven in 20 + publications

- Bagatto M., Scollie S., Glista D., Pasa V., Seewald R. 2008. Case study outcomes of hearing impaired listeners using nonlinear frequency compression technology. Audiology Online, March
- Bohnert A., Nyffeler M., Keilmann A., 2010. Advantages of a non-linear frequency compression algorithm in noise. Europ Arch Otolaryngology
- Boretzki M., Kegel A. 2009. The Benefits of Nonlinear Frequency Compression for People with Mild Hearing Loss. Audiology Online November
- Dewald N., 2009. Experiences with a wide Application of
- Nyffeler M. 2008: Study finds that non-linear frequency compression boosts speech intelligibility. The Hearing Journal 61(12): 22- 26
- Nyffeler M. 2009: SoundRecover – Une meilleure intelligibilité vocale. Les Cahiers de l'Audition 4 : 40-43
- Simpson A., Hersbach A.A., McDermott H.J. 2005. Improvements in speech perception with an experimental nonlinear frequency compression hearing device. Int J Audiol 44(5):281-292
- Simpson A., Hersbach A.A., McDermott H.J. 2006.

www.phonakpro.com/soundrecover

of Performance in Children with Non-linear Frequency Compression Systems. Hearing Review, November, 20-24
- Kegel A., Boretzki M. 2009. Nutzen von SoundRecover für Menschen mit einer milden Hörminderung. Hörakustik August
- McDermott H.J., Glista D. 2007. SoundRecover: A breakthrough in enhancing intelligibility. Background Story, Phonak AG
- McDermott, J. 2010. The Benefits of Nonlinear Frequency Compression for a Wide Range of Hearing Losses. Audiology Online, January
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- Nyffeler M. 2008.The Naída Power Hearing Instrument Family – Field Test Results demonstrate better speech clarity – unparalleled in its class. Audiology Online, September

unparalleled in its class. Phonak AG, Field Study News, September
- Stuermann B. 2009. Audéo Yes – SoundRecover for mild to moderate Hearing Loss. Phonak AG, Field Study News, January
- Wolfe J., Caraway T., John A., Schafer E., & Nyffeler M. 2009. Initial experiences with nonlinear frequency compression for children with mild to moderately severe hearing loss. The Hearing Journal 62(9): 32-35
- Wolfe J., Caraway T., John A., Schafer E., & Nyffeler M. 2009. Verbesserung beim Erkennen und Erlernen hochfrequenter Signale. Hörakustik Oktober

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