WIDEX UNIQUE™

BREAKING THE SOUND BARRIER

SPEAKER DISCLOSURE
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Relevant Financial Relationships:
• Is an employee of Widex USA and receive financial compensation.

Relevant Nonfinancial Relationships:
• There are no nonfinancial relationships.
TODAY’S AGENDA

- After this course learners will be able to list the advantages of Audibility Extender.

- After this course learners will be able to explain the differences between linear frequency transposition and frequency compression.

- After this course learners will be able to explain to patients the benefits of Widex’s Audibility Extender.

- After this course learners will be able to describe the fitting process of Widex’s Audibility Extender.

WHY USE FREQUENCY LOWERING?
DIFFICULTIES FITTING PRECIPITOUS HIGH FREQUENCY HEARING LOSS

- Insufficient gain
- Poor resolution – dead regions
- Occlusion effect
- Over amplification of low frequencies

FUNDAMENTALS OF AUDIBILITY EXTENDER
OBJECTIVES

- MAKE HIGH FREQUENCY SOUNDS AUDIBLE
- UTILIZE AVAILABLE RESIDUAL HEARING
- MINIMIZE FREQUENCY ALTERATION OF ORIGINAL SIGNAL
- RETAIN ‘NATURAL’ SOUND QUALITY

FREQUENCY LOWERING TECHNIQUES

- 2 WAYS TO LOWER FREQUENCY
  - FREQUENCY COMPRESSION
    - NOT used by Widex
  - LINEAR FREQUENCY TRANSPOSITION
    - USED by Widex
FREQUENCY LOWERING TECHNIQUES

COMPRESSION

FREQUENCY LOWERING TECHNIQUES

LINEAR FREQUENCY TRANSPOSITION
GOOD HEARING, GOOD RESOLUTION

POORER HEARING, POORER RESOLUTION

Dead region
COMPRESSION

LINEAR FREQUENCY TRANSPOSITION
HOW DOES WIDEX AUDIBILITY EXTENDER WORK?

LINEAR FREQUENCY TRANSPOSITION:
- Analyse spectrum
- Find sound
- Set target
- Transpose sound
- Filter sound
- Overlay sound

Preserves the harmonic relationships of the transposed sounds to the original sounds

HOW DOES THE AUDIBILITY EXTENDER IMPROVE AUDIBILITY?
- Inaudible high frequency sounds are made audible
- Detection of environmental sounds
- Identification of high frequency speech sounds
AUDIBILITY EXTENDER

- The Audibility Extender uses linear transposition to move high frequency information downward in frequency to a region where it is audible to the user taking the individual hearing loss into account.

- The Audibility Extender automatically selects the most significant sound as the dominant signal from within the lost audible frequency region.
AUDIBILITY EXTENDER

THE AUDIBILITY EXTENDER IS FUNDAMENTALLY DIFFERENT FROM OTHER FREQUENCY COMPRESSION SCHEMES IN SEVERAL ASPECTS:

• It is active for the high frequency signals regardless of their voicing characteristics, i.e., voiced or voiceless. Systems that are active only for voiceless signals may miss high frequency tonal signals including music and birdsong.

• Typically only one octave of high frequency sounds is transposed to a lower octave. Frequencies higher and lower than the transposed region are filtered. This limits the amount of masking and avoids the need for compression.

• It preserves the harmonic relationship of the transposed signal and original signal. All transition cues are preserved as well. This minimizes the perception of click-like artifacts.

• The transposed signal is mixed with the original signal to give a richer, more “natural” sound perception. Systems that do not overlap the transposed sounds would risk “exaggerating” any unnaturality of the transposed sounds.

FITTING AUDIBILITY EXTENDER
AUDIBILITY EXTENDER
FITTING RANGE – PRIMARY CANDIDATES

- Precipitous high frequency hearing loss
- High frequency dead regions
- Hearing loss at 2000 Hz of 70 dB or poorer

NOT an Audibility Extender candidate
AUDIBILITY EXTENDER FITTING RANGE

Try Audibility Extender

AUDIBILITY EXTENDER FITTING RANGE – SECONDARY CANDIDATES

- Severe to profound hearing loss
AUDIBILITY EXTENDER
FITTING RANGE – SECONDARY CANDIDATES

Try Audibility Extender

AUDIBILITY EXTENDER FITTING OPTIONS
AVAILABLE IN ALL STYLES
- RIC
  - Fusion
  - Passion
- BTE
  - Fashion
- Custom
  - CIC
  - ITE
FITTING AUDIBILITY EXTENDER
DEFAULT FREQUENCY

Default Start Frequency determined by:

- Hearing loss
- Intersection of the sensogram and the average level of the aided speech spectrum
- Available gain
WHEN SHOULD AUDIBILITY EXTENDER BE USED?

AN EASY TEST:
CHECK FOR AUDIBILITY OF THE \( /s/ \) SOUND

- IS \( /s/ \) AUDIBLE IN MASTER PROGRAM without AE?
  - YES
    - STOP
    - NO NEED FOR AUDIBILITY EXTENDER
  - NO
    - TRY FITTING AUDIBILITY EXTENDER

Keep in mind Acclimatization level of Master program when testing.

HOW TO USE SOUNDTRACKER FOR FEMALE \( /s/ \)

- Display SoundTracker
- Adjust volume so that unaided \( /s/ \) sound peaks at 30 dB HL
IS SOFT /S/ IS AUDIBLE IN MASTER PROGRAM WITHOUT AE?

IF /S/ IS NOT AUDIBLE, GO TO AE AND DETERMINE IF TRANSPPOSED /S/ IS AUDIBLE

- Choose default start frequency, or 1 or 2 steps higher than default start frequency
ADJUST START FREQUENCY AND AE GAIN SO /S/ IS AUDIBLE WITHOUT DISTORTION

- GOAL: Highest start frequency with lowest AE gain to achieve audibility and acceptability of soft /s/

Remember: /s/ may not be audible for everyone - even with AE

FITTING AUDIBILITY EXTENDER SUMMARY

Is soft /s/ audible in Master program without AE?

- YES
  - STOP
  - AE not necessary

- NO
  - Try AE
  - Pick a Start Frequency

GOAL:
Highest Start Frequency and Lowest AE gain where audibility and acceptability are achieved
Fitting Audibility Extender
Other Fitting Tools

Periodic Bird Song
PERIODIC BIRD SONG

BIRD SONG WITHOUT AE

BIRD SONG WITH AE

FEMALE /SH/ SOUND
EVERYDAY SOUNDS

- **Home Sounds**
  - Silverware
  - Soda fizzing
  - Chairs scraping
  - Faucets running
  - Refrigerators humming
- **Car Sounds**
  - Turn signals
  - Tires screeching
  - Keys jangling
- **Outdoor Sounds**
  - Dogs barking
  - Leaves rustling
  - Birds chirping
  - Cars
- **Work Sounds**
  - Keyboard buttons
  - Phone ringing
  - Elevator chimes
  - Paper rustling
MORE SUGGESTIONS

/s/  /sh/

Do /s/ and /sh/ sound different? If not, try decreasing AE Gain “She sells seashells by the seashore”

FITTING SUMMARY

- Use AE only when necessary
- Find highest Start Frequency with Lowest AE Gain for audibility of /s/
- Fine tune with Start Frequency, AE Gain, and Basic/Expanded
- Use additional tools as needed
CASE STUDIES

CASE STUDY
SEVERE-PROFOUND HEARING LOSS

“It couldn’t be better. I love it.”

“I can now hear /s/, where previously /s/ in conversation was just a gap that I had to fill in by myself. Couldn’t hear them properly, couldn’t hear them at all.”

“Now when people are talking, I can hear all their different /s/. I think people have a lot of different ways of saying /s/”

“Initially, it sounded like two people talking.”

“I feel that my brain has now integrated the two soft /∫/-sounds to the point where if it’s turned off it sounds like there’s something missing. And if it’s there it sounds normal”
CASE STUDY
DOWNSHIFTING FOR BETTER AUDIBILITY

- 80 year old male
- Wore competitor RICs for 5 years
- Trouble in restaurants, TV
- Fit with 440 Fusions, tulip domes
- AE Start Frequency 3200 Hz

"Got a call from my mom last night so they decided to go out to the noisiest restaurant in Concord, NH to celebrate the new hearing aids – both of them were thrilled with how well he heard. They had a great conversation over dinner, which is something they would not have been able to do with his previous hearing aids! Also, he is using the AE program all the time – definitely prefers it!"

"They are now going out to dinner so often, they are now concerned about weight gain! But seriously, they are both thrilled with results - he is bragging to friends about his improved ability to function in the most difficult situations. My mom says the new hearing aids are saving their marriage. She is loving the return of conversation over dinner and while out in social situations plus less day to day stress associated with miscommunication.”
AUDIBILITY EXTENDER PUBLICATIONS


WHAT WE HAVE LEARNED
DIFFERENTIAL EFFECTIVENESS

- The simpler the stimuli, the stronger and the earlier the preference
- Simple stimuli (e.g. bird chirp) have potential to differentiate among algorithms
- Rate of acclimatization varies among individuals and tasks
WHAT WE HAVE LEARNED
IMPROVEMENT IN SPEECH PERCEPTION
- Perception of consonant sounds improved 5% to 20% in adults at soft input levels

![Graph showing improvement in speech perception](image)

Adult data at 30 dB HL

WHAT WE HAVE LEARNED
AUDIBILITY OF SOFT SOUNDS IMPROVED

![Graphs showing improvement in audibility of soft sounds](image)

50 dB HL input

30 dB HL input
WHAT WE HAVE LEARNED

VOICELESS FRICATIVES BENEFIT MOST

WHAT WE HAVE LEARNED

BENEFITS WERE SEEN IN NOISE
WHAT WE HAVE LEARNED

MOST BENEFIT IN WORD FINAL POSITION

WHAT WE HAVE LEARNED

OMISSIONS REDUCED OVER TIME
SUMMARY OF AE RESEARCH STUDIES

- The noise reduction and directional microphone algorithms improve speech listening comfort (and intelligibility) in noise while preserving audibility cues.
- Frequency transposition improves the perception of simple (e.g., birds) and complex sounds.
- The voiceless fricatives and stops are most affected by the use of AE. Improvements on fricatives can be immediate, and about 5-20%, both in quiet and in noise.
- Speech production may also be improved with the use of AE.
- Severe loss (in lows and mids) also experienced the same benefits as milder loss.
- The AE was most effective on omissions errors.
- Training AND AE cues together are needed for optimal benefits from AE.
- Majority of wearers with moderate hearing loss in the highs (<65 dB HL at 4kHz) preferred to use a broadband hearing aid.

SUMMARY

- Audibility Extender is a proven solution for individuals with high frequency hearing loss.
- Widex provides you with the tools to make fitting Audibility Extender easy and quick.
- The fitting process is user-friendly with Dream hearing aids and Compass GPS software.
WIDEX AUDIBILITY EXTENDER
DOWNSHIFT FOR BETTER AUDIBILITY

Thank you!
For additional questions, please email AOInquiry@widex.com