Optimizing outcomes with hearing aid verification

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Who am I?

- Director of the Research
- Director of the Audibility, Perception, and Cognition Laboratory
Three components of auditory experience

- Language input
- Audibility
- Hearing aid use

= Auditory exposure
Cumulative Auditory Experience
GOAL

• To provide early and appropriate amplification to support communication development
  – Make speech information audible
  – Support parents and caregivers
    • Information
    • Emotional support
Audibility

• How well we can hear a specific sound
• Children can only develop what they hear
• Determined by:
  – Hearing thresholds
  – **Level** and **location**
  – Noise
  – Device (if present)
SPL-o-gram SII Snapshot

For each band – Audibility x FIW = weighted audibility

SII = Sum of weighted audibility of all frequency bands
Audibility

- Aided
  - Hearing aid fitting outcome

- Unaided
  - Hearing aid candidacy
Audiogram

SOFT

X – Left ear
O – Right ear

Intensity

LOUD
SPL-o-gram

Intensity
Average speech spectrum
Hearing Thresholds

- Hearing loss results in loss of audibility for speech and other important sounds.
- Greater hearing loss = more limited audibility
Audibility with Mild Hearing Loss
Audibility with Severe Hearing Loss
Candidate for amplification?

- 6 year-old
  - 100% PBK in quiet
  - BKB-SIN + 2 dB SRT

- No difficulties in classroom or parent concerns
Unaided audibility
Hearing aid candidacy

- Audiogram method
Hearing aid candidacy

• Audibility method – 3 month-old
Hearing aid candidacy

- Audibility method – 10 year-old
Hearing aid candidacy

- Audibility
  How does ear canal acoustics influence diagnostic assessment?

  How does the hearing loss impact audibility?
Goals of Pediatric Amplification

- Promote speech and language development
- Ensure **audibility** of speech
- Provide early intervention
- Minimize error
  - Not eliminate
How do we fit hearing aids for children?

• Verification
  – Measuring the output of the hearing aid in the child’s ear to estimate audibility for speech.

• Prescriptive formulae
  – Desired Sensation Level (DSL; Scollie et al.)
  – Developed to maximize audibility regardless of hearing loss
  – Provides frequency-specific targets for speech based on degree of hearing loss
Desired Sensation Level

DSL has targets for multiple input speech levels

Soft – 50/55 dB SPL
Average – 60/65 dB SPL
Loud – 70/75 dB SPL

Maximum Power Output (MPO) - Safety - 90 dB
Is matching prescriptive targets enough?

- Goal is audibility
- What about the speech intelligibility index (SII)?
  - SII objective measure of speech audibility
  - Number between 0 and 1 or percentage/proportion
How do we interpret SII?

• More is obviously better!
• What number is the goal?
• What do we do when we don’t have a good SII?
Example Patient

Threshold in SPL

Amplified speech
Audibility?

![Graph showing the relationship between SII and % Correct for continuous discourse and nonsense syllables.](image)
Adjustments?
Actual Hearing aid fit quality

Take home message:
Hearing aids are not appropriately fit for all children
Summary SII

- SII is a useful tool:
  - May predict outcomes (e.g. Stiles et al. 2012)
- Use normative SII range from PedAMP
- Predictions of speech recognition for kids
  - Model using low context materials (nonsense syllables)
  - Measure empirically
    - Lots of variability
Verification Master Class

• Basic verification of audibility
• Advanced Verification
  – Frequency lowering (Sound Recover 2)
  – Directional microphones
  – Digital Noise Reduction
Thank you!