1

Learning Objectives

After completing this course, attendees will be able to…

- describe the importance of the RECD measurement at assessment and for the hearing aid fitting.
- describe how DSL targets inform our hearing aid fittings for children.
- describe the benefits and limitations of open fit hearing instruments for children and teens.

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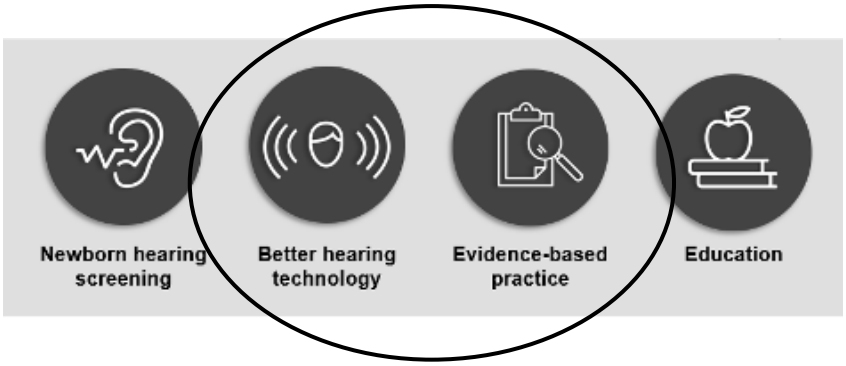
The Lives of Children with Hearing Loss



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What is the Real-Ear-to-Coupler Difference (RECD)?

Difference between the SPL measured in the patient's own ear (real-ear) and in a 2cc coupler produced by a transducer producing the same signal

Composed of 2 measurements:

- 1. 2cc coupler measurement
- 2. Real-ear probe tube measurement

4

Why is Real Ear to Coupler Difference (RECD) Important for Children?

5

- The RECD data is entered into the hearing aid software and into the verification system to generate fitting targets.
- Fitting hearing aids to targets for gain and output is a good starting point to best provide good speech information.
- RECD should be completed every time a child gets a new ear mold. A new ear mold indicates a change in ear canal size.

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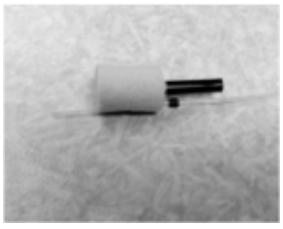
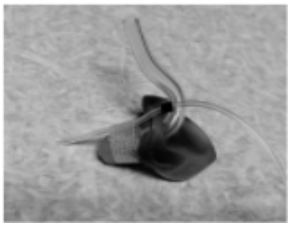
Strategies for Probe Tube Insertion RECD and REM





Premeasured probe tube attached with surgical tape is a fantastic way to keep probe tube straight, and to prevent it from moving in the child's ear!

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Use of the RECD to Correct the HL Audiogram Individualizing the Assessment

- The same threshold in dB HL as a function of frequency will result in different dB SPL thresholds as a function of frequency depending on the ear acoustics of the individual being tested.
- In other words, measuring the RECD will provide you with an accurate representation of the child's hearing level.

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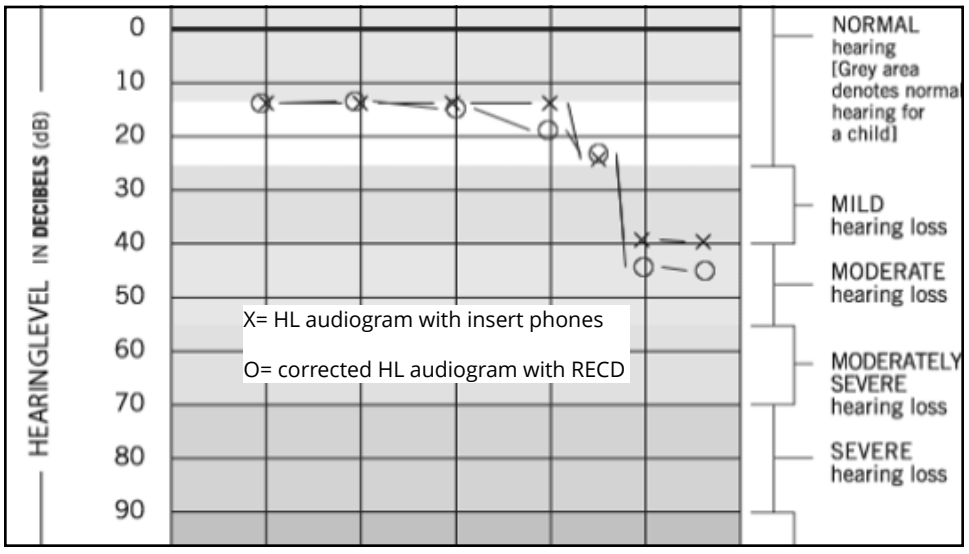

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Fitting Hearing Aids to Minimal and Mild Hearing Loss

- Data from Walker et al., (2015) suggests children with mild hearing loss who wear hearing aids demonstrate higher scores on vocabulary and grammar than non-users.
- However, convincing families on their need can be challenging.
- "We notice he hears well at home; my family doctor thinks it may be best to wait and see how he progresses in school."

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Fitting Hearing Aids to Minimal and Mild Hearing Loss

Clinical Tools

- SHARP from Boystown National Research Hospital – uses the speech intelligibility index (Sii) to show changes as distance increases between speaker and listener.
- RECD – correct the HL audiogram, provide an accurate representation of hearing.
- Validated questionnaires – parent, teacher, student, friend – ratings of listening abilities.

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Listening Inventory for Education (revised) LIFE-R

A tool to evaluate classroom listening. How are the acoustics?

Helps identify need for RMS, priorities for accommodations, teaching strategies and assessing improvements in listening.

Student self-report and teacher report versions.

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Functional Listening Evaluation (FLE)

HOW WELL CAN THE STUDENT WITH HEARING LOSS ACCESS VERBAL INSTRUCTIONS?

EFFECT OF NOISE AND DISTANCE.

WORDS, PHRASES AND NON-SENSE WORDS.

LIVE VOICE OR RECORDED VERSION FOR USE ON PHONE, IPAD OR LAPTOP.

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For Minimal and Mild HL, Offer "Flexibility" for Hearing Aid Use

- Recognize that if families are not concerned about hearing at home, the goal may be to first simply address classroom listening.
- Important listening environment where hearing and understanding are linked to academic success.
- Reduce "auditory squinting" (Eileen Rall)

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Big Tips for Little Impressions

Bagatto, 2020

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Explain the Procedure

This is new to the family and the baby

- Don't be afraid to say ear impressions feel weird
- Show them all the equipment

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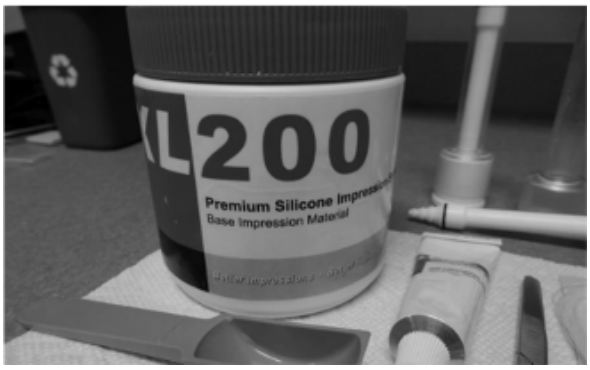
Choose the Material

- Medium-bodied that cures quickly



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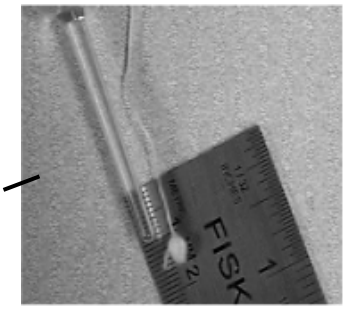
Choose the right size

- Small cotton oto-blocks work best
  - Mark oto-light for about 10mm insertion depth
  - Ensure clear ear canal free of debris



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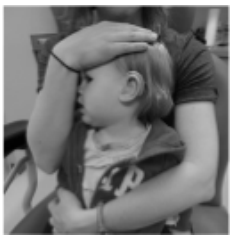
Ask for Help

- Caregivers can assist with the procedure
  - Babies often move when impression material applied
  - Cradle just for that portion



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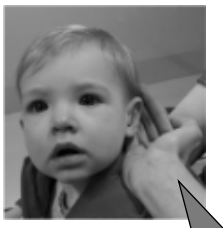
Wait, Carefully

- Use your hand as protection while curing
  - Infant's shoulder could come up
  - Infant could cuddle against caregiver



Both could squash the impression and change the shape

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Small Ears, Small Earmolds

- Silicone material is best for soft ears
  - Good for reducing feedback
  - More comfortable fit

- #13 hard wall tubes
  - Pediatric Tube lock
  - Step down to #16 tube if necessary

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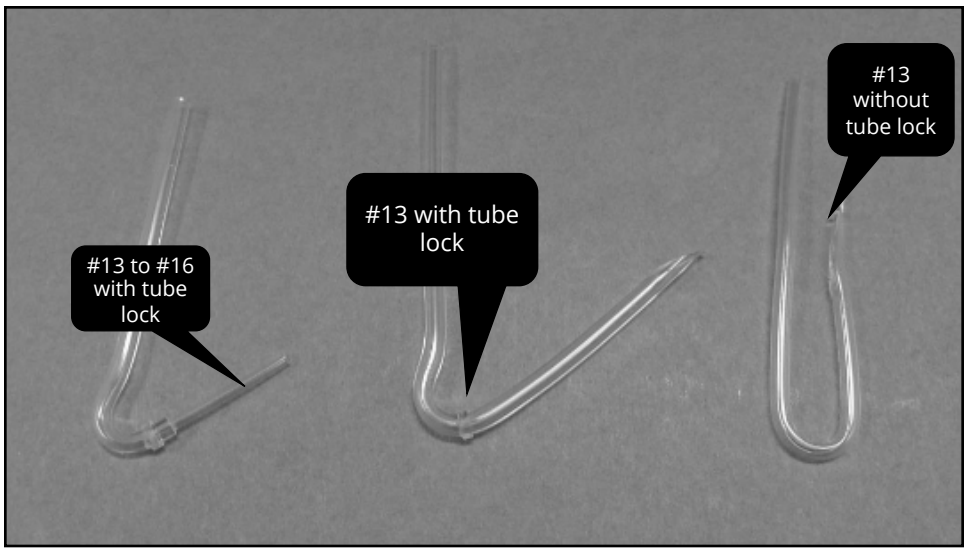

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Remote Microphone Use at Home: What Age Should it be Recommended?

- When children become ambulatory and we see the distance between speaker and listener increase.
- Access to 42% more words per day.
- Improve access within daily difficult listening environments (e.g. car rides.
- Cost conscious RMS exist (e.g. EduMic)

22 | Benitez-Barrera, Angley, and Tharpe, 2017

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Prescriptive Methods
When do I Use DSL Child or DSL Adult?

- DSL child developed for children with congenital or early onset hearing loss.
- DSL adult developed for adults with acquired hearing loss.
- Study documented performance versus listening preference. (Trends in Amplification)

Western UNIVERSITY · CANADA

Scollie, Seewald, Cornelisse, Moodie, Bagatto, Laurnagaray, Beaulac (2005)

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Procedure

Subjects (n=72)	24 children who were full-time hearing aid users 24 adults with experience wearing hearing aids 24 adults who were new hearing aid users
Prescriptive targets DSL[i/o] 4.1	
Participants had a variety of nonlinear hearing instruments	
New users provided with 15 to 20 day period of hearing instrument use	

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Procedure

- Volume control wheel set to minimum
- Speech (RMS 60 dB SPL) via a loudspeaker in sound field
- Participant set VCW until talker sounded the best (repeated measure)

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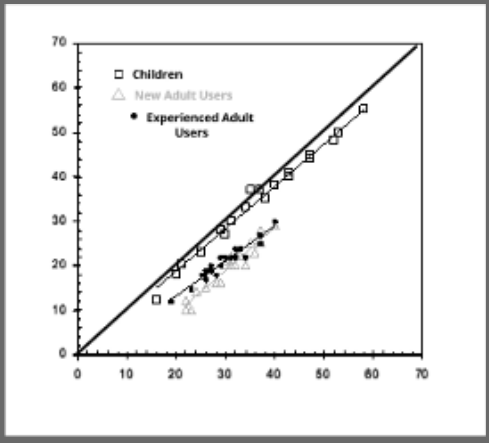
Personal Listening Levels



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When meeting DSL targets, what is most important?

Richard Seewald

"DSL targets for MPO are very important, we do not want to have an ear that is over amplified or uncomfortably loud."

Oticon event, Niagara Fall Oticon event, Niagara Falls 2007

Marlene Bagatto,

"Matching targets for moderate speech and MPO are most important. Do not compromise the fit to target for either of these to get a better match to targets at soft or loud inputs. This is because the goal of pediatric fittings is to support communication development in a safe way"

Bagatto, Marlene,2014; Seewald, 2007

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Factors that may prevent us from meeting all targets

Type, degree and shape of a hearing loss can affect our ability to meet targets.

- severe hearing losses
- sharp drops in hearing between frequencies
- notches
- pathologies that alter the performance of the auditory structure

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Are we comparing "apple-to-apples"?

- Age
- Transducer
- Prescriptive Strategy
- Earmold Acoustics
- RECD's

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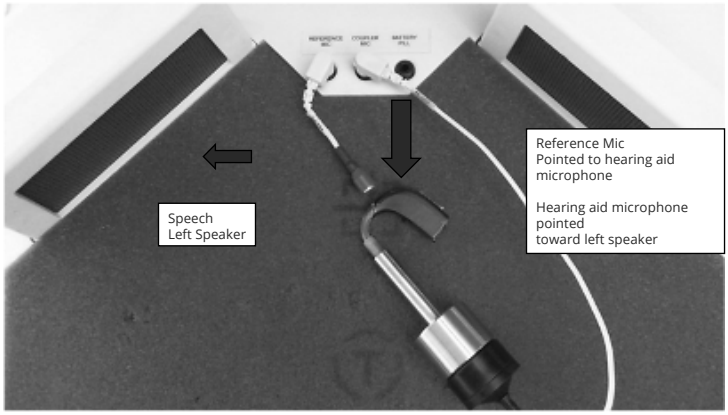
Proper placement in the Verifit 1 test box



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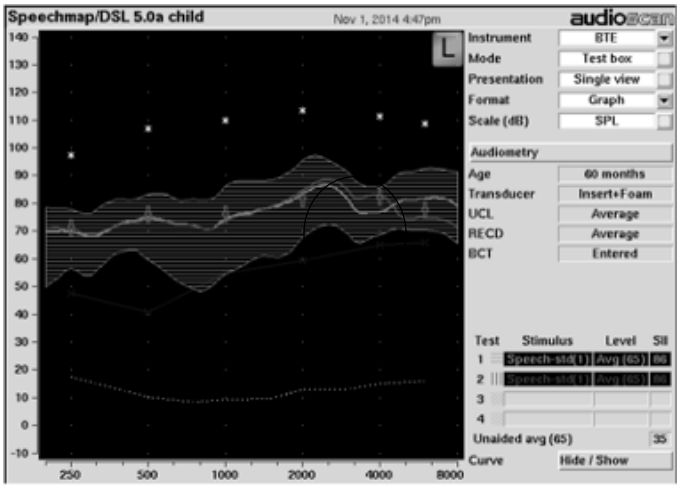

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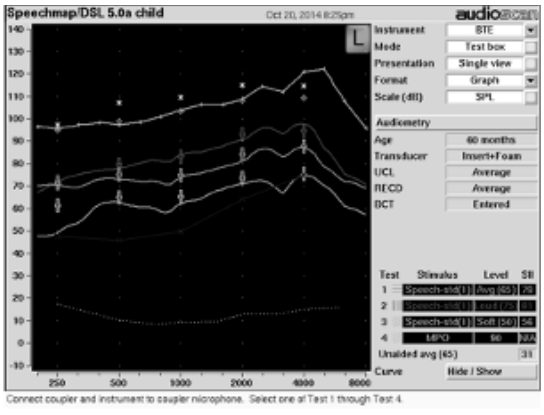
MPO Peaks – Why do we see them?



Verifit MPO peak example

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MPO Peaks – What do they mean?

The MPO peaks can occur by adding the BTE coupler tubing to our earmold + tube calculation.

MPO peak will disappear when we remove BTE coupler effect.

Confirmed when doing REAL EAR measurements or by using HA-1 coupler (which has no tube).

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Why don't we see this in all models of hearing aids and/or in different hearing aid manufacturers?

- Manufacturers have a number of options when building hearing aids to clean up the signals delivered to the ear.
- One of those options are filters. Filters can be managed internally and externally.
- Internal filters, are inside the hearing aid, external filters are in the earhook.
- Both function to smooth out peaks at different frequencies

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What are the Clinical Considerations when Fitting Open Fit Hearing Aids on Children and Teens?

- Research studies
- Candidacy
- Fitting Considerations
- Benefits and Limitations

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What is an Open Fit Hearing Aid

- A style of hearing aid characterized by its mold/coupling and its minimal occlusion of the ear canal.
- Referred to as “Thin Tube” “RIC (Receiver in the Canal) and “RITE (Receiver in the Ear)
- Can also be coupled to custom ear mold.

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Hearing Aid Selection and Teens: Perspectives from Hearing Care Professionals

- Web-based survey
- Sent out to approximately 500 clinicians in Canada and the United States
- 113 participants responded, who identified themselves as clinicians working with tweens and teens with hearing loss.
- Objective was to understand the challenges clinicians face with hearing device use when working with tweens and teens.

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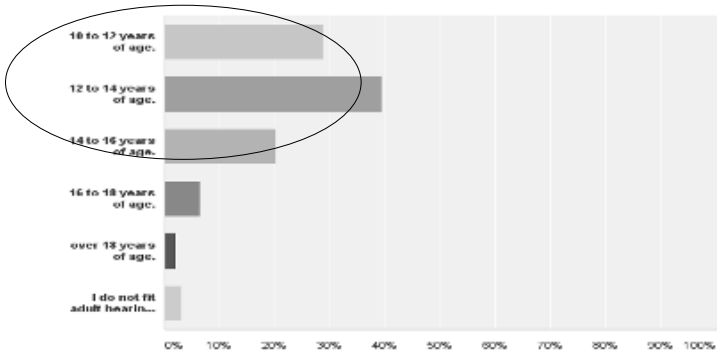
At what age do you consider selecting an adult hearing device for a teen? (Ex. thin tube receiver-in-the-ear hearing aid)



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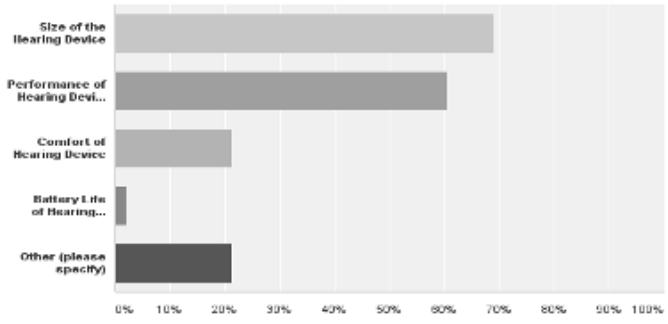
When teens talk to you about their hearing device, their biggest complaints are: (select all the applies)



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When Children and Teens talk to you about their Hearing Device, their Biggest Complaints are: (Comments)

- Sound quality for music
- How hearing aids make them look different
- A hearing device that will seamless connect to all electronic devices without the need of an interface.
- Hearing device reliability when active in sports etc. moisture/sweat
- Loud and very noisy environments.

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Benefits of Open Fit Instruments

Minimizing the Occlusion Effect

- With closed mould fittings, adult ears act like an amplifier for low frequency sounds. Adult patients describe their voice like "listening with their head in a barrel." The use of venting may not adequately address the occlusion difficulties.
- Can these effects be translated to children? Children rarely indicate problems with occlusion effect. Do they have the capacity to articulate these effects? Is it part of the paediatric clinician's assessment to make these inquiries?
- Johnstone, et al. (2016) found that 17/18 children noted an improvement in their own voice quality with open fit instruments compared to their closed fit (ear mould) instrument.

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Sound Localization and High Frequencies

- High frequency sounds play an important role in spatial awareness and localization. A traditional ear moulds reduces sound localization accuracy in adult listeners (Noble et al., 1998).
- Open fittings in adults seem to better preserve the high frequencies, maintaining interaural level differences and interaural timing differences associated with sound localization (Makous and Middlebrooks,1990).

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Sound Localization and High Frequencies

- For children, hearing aid fittings focus on providing audibility and comfort for speech sounds and do not include measurements of sound localization (Johnstone, 2016).
- Johnstone et al. (2016) noted that children with open fit hearing aids have lower localization errors than when using closed fit mould hearing aids.
- We lack clinically feasible equipment to measure sound localization abilities.

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Limitations of Open Fittings

- These devices are optimized for high frequency hearing losses, providing no little low frequency gain.
- When increasing gain, we may run into feedback for more severe hearing losses.
- Require an ear canal, large enough to support ear piece.

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Candidacy for Open Fit Hearing Devices for Children and Teens

- **Degree of Hearing Loss:** Does the hearing loss fall within the fitting range of the open fit hearing device? Do they only require amplification above 1000 Hz? Can the open fit hearing aid be used in the child-sized ear without feedback?

- **Age of Child:** Can they manage correct insertion of the open fit mould into their ear? Can they troubleshoot device should it stop working? (e.g. cerumen, moisture). Does the use of the open fit device present an increased risk for their personal safety (choking hazard).

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Candidacy for Open Fit Hearing Devices Considerations

- **Lifestyle of Child:** Is there appropriate retention of the open fit; proper dome and tube length that will keep device in place while participating in activities? Is excessive moisture/sweat an issue making a receiver-in-the-ear device problematic?

- **Remote Microphone Technology:** Is this technology essential to their learning/listening? May be limited to these type of technologies with open fit hearing aids.

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Is it Truly an Open Fitting?

- Using your probe microphone, run an On-ear measure with speech, your Real Ear Unaided Response measure (REUR).
- Then with probe microphone still in place, insert Open Fit hearing aid and run a second curve with speech, your Real Ear Occluded Response (REOR).
- Compare these curves by superimposing them onto one another. If they are the same, it means that the placement of the hearing instrument dome/receiver has not changed the characteristics, or openness of the ear canal.
- Occlusion Effect Tests also available on some verification test systems.

47 | *Audiology Online REM Courses oticon

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Suggested Method for Fitting Open Fit Hearing Aids

- Measure the child's RECD: Still important to obtain this measure so we may accurately convert our HL thresholds from the sound booth into SPL thresholds. Enter the RECDs into your verification system software to correct your HL audiogram (insert foam tip for audiometry and insert foam tip for RECD).
- Program open fit hearing device using available rationale in the manufacturer software.
- No ability to accurately do coupler-based verification, therefore child should be of age to complete Real Ear Measurements.

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The Importance of Outcome Measures

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- REM/Verification gives us our best starting point for a hearing aid fitting. The next, equally important step is validation/outcome measures.
- Outcome/validation measures give us an important snapshot about "real world" functional performance of the child/teen in quiet and complex listening environments with their hearing aids.
- These tests may also provide evidence to justify the need for advanced features (i.e. noise reduction and directionality) and for remote microphones.

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Do you have a Favorite Clinical Tip for Hearing Aid Fittings in Children?

davg@oticon.com

Thank you!

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