Fitting Infants using DSL® in the Audioscan Verifit® System

1. Measuring the Real Ear to Coupler Difference (RECD)
2. Setting a hearing aid to DSL prescriptive targets using the Coupler Approach to verification
3. Reference materials
Measuring the Real Ear to Coupler Difference (RECD)

**Power up:** Make sure the system is on. Choose “Test”, and “Test box measures”. Then select Speechmap. This will allow you to verify the hearing aid in the coupler.

**Mark:** Mark the probe tube insertion depth by sliding the black ring along the tube to the following depths:
- **a.** 5 mm past the end of the earmold (if you have one).
- **b.** The following distance from the end of the tube (the probe mic can be used as a guide, as shown to the right):
  - Adults: men: 31 mm, women: 28 mm
  - Children: 15-25 mm (5 mm past mold)
  - Infants: 10-15 mm (2 mm past tip or mold)
- **b.** If you wish, tape the earmold & tube together using thin, non-adhesive tape.

**Set Up:** Switch to the right ear by pressing the Left/Right key on the keypad. Using the mouse, select “Audiometry” to enter the client’s assessment data, and settings (see box at right). If you wish to use the bone conduction correction, change the option in the box to “enter”.

**Starting the fitting:**
Choose “Continue”. This will move you to the Threshold Entry screen. Assume you have the following nHL thresholds from tone ABR:

<table>
<thead>
<tr>
<th>Frequency</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>85</td>
<td>90</td>
<td>90</td>
<td></td>
</tr>
</tbody>
</table>

Estimate the baby’s HL thresholds using the following ABR-to-HL correction (Note: the specific correction may vary with the calibration of the ABR system.)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-20</td>
<td>-15</td>
<td>-10</td>
<td>-5</td>
</tr>
</tbody>
</table>

**Threshold:** _____ _____ _____ _____ (you calculate these.)

**Measure the Coupler Portion of the RECD:**
Press “Continue”. This will move you to the Measure RECD screen. Choose “Measure Coupler”. The on-screen instructions will tell you to connect the RECD transducer to the BTE coupler, as shown on the right. Press “Continue” to play a broadband noise into the coupler. Look at the measurement on screen. Press “Continue” when it has stabilized.

Measure the Real Ear Portion of the RECD:

Place the REM microphone set on the client’s ear. The blue cord loops around the pinna and tightens up to the earlobe.

Option A: Look in the ear with an otoscope. Carefully insert the probe tube into the client’s ear, until the black marker is at the intertragal notch, making sure that the eardrum is not touched. Place the earmold on the end of the transducer, lubricate it, and insert it into the ear. Watch the black mark and keep it at the intertragal notch.

Option B: Carefully insert the earmold/probe tube combination (if you taped them together) into the infant’s ear.

Press “Measure Real Ear”, and “Continue” to play the signal into the ear. Look at the measurement. When it is stabilized and you feel there is no error, press “Continue” to accept the measurement. Your measured RECD will be shown as a solid line in the lower portion of the graph.

Press “Continue” to return to the main Speechmap/DSL screen.
Setting a hearing aid to targets using the Coupler Approach and speech measures

Go back to the “Audiometry” module, and change the “RECD” to “Enter”. We will use this mode to enter a typical RECD for a 6 month old (below):

250: 6  
500: 10  
750: 12  
1000: 14  
1500: 16  
2000: 15  
3000: 16  
4000: 16  
6000: 19  
750: 12  
3000: 16

1. You are now in the SPLogram display. Learn to read the Unaided SPLogram by finding these items:
   - Thresholds (-o or -x-)
   - Upper Limits of Comfort (**)
   - Targets for 65 dB Long Term Average Speech Spectrum (LTASS) (++)

2. Click the “hide/show” button, and set “unaided” to SHOW and press “continue” to display the unaided levels of speech on the SPLogram (also at 65 dB SPL). Determine the following:
   - What is the Real Ear Aided Speech target at 1000 Hz? ______
   - What is the Maximum Real Ear output level? ______ What frequency is it at? ______
   - How much speech can be heard without a hearing aid? _______________

3. Set up for testing in the coupler.
• At top right-hand side of screen, set the hearing “Instrument” type to “BTE”.

• Set the “Mode” to “Test box”. (This means simulated real ear measurement – you will use RECD-corrected coupler measurements to predict real ear levels).

• Connect the hearing aid to the hearing aid programming cable.

• Connect the hearing aid to the coupler (and to the battery pill, if you are using one) and place it in the “+” marker in the test box, with the black reference mic near the hearing aid mic. Shut the lid.

4. Fit the hearing aid to targets:

• Below “Test”, choose “1” to start a test. In stimulus, choose “Speech-std(1)” and level 65 dB. Press “Continue” to measure the Long Term Average Speech Spectrum.

• Look at the curve. Do the RMS levels of speech meet the large “+” targets? Adjust the aid’s volume and/or mid-level shaping controls to fine tune, remeasuring as needed. (Remember that you are measuring at 65 dB SPL input here. If you use any low or high level controls, you will also be changing the compression characteristics of the aid, and may not see the changes on a 65 dB test. Be careful not to create unwanted compression characteristics).

• Check the MPO: Choose “2” to start a new test, and change “Stimulus” to “MPO”. Press “continue”. Compare the small “+” to the * symbols. Do they match? For infants, we typically use a conservative MPO fitting (within +3 dB of target). Adjust the output limiting as needed, and remeasure at final settings.

• If you adjusted the MPO, remeasure the “Speech standard” at average. (Sometimes, MPO changes will affect the frequency response for speech).

5. View your fit to targets on an SPLogram. It should look like the screen shown at the beginning of this activity. At the final settings, measure all of the following, and determine the following:

• What frequency range of average speech is audible?

• What range of speech speech is audible?

• How does that compare to the Unaided assessment?

• Is the MPO set appropriately?
6. **Assess how well the hearing aid amplifies Soft speech:** Choose “3” to start a new test. Change “Level” to “55 dB”. Press “Continue” to measure the aided Long Term Average Speech Spectrum for Soft speech. This test is helpful in assessing low-level gain, compression threshold, or compression ratio.

7. **Assess how the hearing aid responds to different talkers**, including you!! Change “Stimulus” to “Speech-live” and talk into the hearing aid. This is a great counseling tool to show parents how their child’s hearing aid processes their speech. If you want to take a detailed measurement, give mom or dad a passage to read (about 15 seconds long) and click “continue” to take an aided LTASS of their voice.

8. **Use the headphones (provided) to listen to the hearing aid at a comfortable volume for you.** The headphone jack (right side, front) of the system lets you listen to the coupler microphone or the real ear microphone, whichever you are currently using. This is a great way to listen for sound quality, to let parents listen, or to diagnose odd sounds that you patients report. You can listen while you set the aid.
The DSL Protocol for Prescribing and fitting hearing aids for infants and children:

1) Measure Thresholds with insert earphones. If you will fit a BTE, connect the insert phones to the ear using the child’s own earmold.

2) If the thresholds are from electrophysiology, make sure that they have been corrected to HL from nHL prior to hearing aid fitting using the earmold for BTE fittings.

3) Measure the Real Ear to Coupler Difference (RECD), also using the earmold for BTE fittings.

4) Use the data from 1 & 2 to calculate DSL targets, setting the hearing aid style and circuit type in the DSL software or electroacoustic test system. Print out a set of targets for the 2cc coupler, including user gain, full on gain, and maximum output.

5) Using manufacturer’s specifications, choose a new hearing aid that has enough power and flexibility to meet targets and provide compatibility with FM systems, telephones, and/or whatever other listening devices will be used.

6) Order the hearing aid.

7) When the aid is received, measure it, and adjust it to meet targets using fitting protocols that are appropriate for your measurement system. Coupler-based verification is recommended for children, especially if the RECD has been measured. Speech-weighted test signals are best for the 55-75 dB range of input level. For MPO, only narrow-band high-level signals should be used.

8) FM systems are often used, for home and/or school. Coupling the FM to the hearing aid (via DAI or Telecoil) lets the combined FM/HA system use the hearing aid’s frequency response shaping. The AAA 2008 FM protocol is helpful in verifying that this has been done correctly.

9) Document your final settings and verification data. Provide the recommended Volume Control setting to the parents. The use of volume control locks/covers and battery locks/covers are often considered to protect against excessive listening levels and ingestion of batteries.
10) If a behavioural evaluation of the fitting is desired, test aided thresholds and compare to DSL targets for aided thresholds, in dB HL.

11) Follow children regularly. Retesting of thresholds and RECD is recommended at least as often as earmold changes are made. When the RECD is remeasured, the aid should be readjusted to new targets. Remember that the RECD is affected by middle ear status: perforations or PE tubes will have a large effect on the RECD, and therefore on the fitting as well.