Case Studies and Critical Thinking

Jason Smalley
The most important bit about testing newborns is that no one test gives you ever answer.

Remember a few golden rules and you can start to critically think to put the picture together.

1) Post term infants with present TE-OAEs, should have an ABR present to normal levels - if they don’t, its either a technical fault or ANSD.

2) Presence of OAEs means the middle ear is clear (you don’t need tympanometry). Their absence means nothing.

3) Children with AC ABR thresholds over 70eHL are not going to have a purely conductive hearing loss in that ear.
4) High frequency tympanometry can be misleading - always go off the bone conduction

Coming up are a series of anonymised real life cases

We’re going to use the principles of today to discuss each one but there’s no right or wrong answers with these, some are straightforward, some are ‘once in a blue moon’ kind of cases!
Case 1

Unilateral referral from NHSP - NCR Right

Well baby, now 3 weeks corrected age, no significant history

“Arrived asleep but was disturbed by electrode fitting, fell back to sleep but EEG was initially noisy”

What shall we do first?
OAE

Clear Response Right 2.8 and 4kHz

Clear Response Left 2.8 and 4kHz
4kHz air conduction using Headphones - nHL to eHL correction is -5

What next?
Case 2
Bilateral referral from NHSP

Well baby, now 2 weeks corrected age, no significant history
**Test details**

**Left ear**

- **Test type:** TE
- **Ear:** Left
- **Date/Time of test:** 09/03/2022 10:32:25
- **Data file name:** DF9W3930.DTA
- **Result:** Too noisy
- **Decision:** Retest

**Right ear**

- **Test type:** TE
- **Ear:** Right
- **Date/Time of test:** 09/03/2022 10:39:19
- **Data file name:** DF9W3931.DTA
- **Result:** Too noisy
- **Decision:** Retest
4kHz air conduction using Headphones - nHL to eHL correction is -5

What next?
4kHz bone conduction- nHL to eHL correction is +5

What next?
Case 3

Bilateral referral from NHSP

NICU baby, born 36 weeks GA now 3 weeks corrected age, on NICU as small birth weight

No significant medical history, family is known to Social Services and on a Child in Need plan
**Left ear**

- **Stimulus (Pa/μs)**
- **Response Waveform (mPa/μs)**
  - Hdw = UsbOae

- **OAE response**
  - Frequency (kHz): 1.0, 1.4, 2.0, 2.8, 4.0, NSL = 260, NH = 379, Stim = 84.0 dB

- **Half Octave Band Power**
  - Frequency (kHz): 1.0, 1.4, 2.0, 2.8, 4.0, SNR = -3.0/-2.5 dB, Sig/Noise = -5.5/-2.5 dB

---

**Right ear**

- **Stimulus (Pa/μs)**
- **Response Waveform (mPa/μs)**
  - Hdw = UsbOae

- **OAE response**
  - Frequency (kHz): 1.0, 1.4, 2.0, 2.8, 4.0, NSL = 125, NH = 114, Stim = 82.5 dB

- **Half Octave Band Power**
  - Frequency (kHz): 1.0, 1.4, 2.0, 2.8, 4.0, SNR = -8.8/-7.4 dB, Sig/Noise = -7.4/-1.4 dB

---

**Test details**

- **Test type**: TE
- **Ear**: Left
- **Tester ID**: 2
- **Date/Time of test**: 08/03/2022 13:33:22
- **Data file name**: DF9W3832.DTA

- **Result**: Re-test required
- **Decision**: Retest

---

**Test details**

- **Test type**: TE
- **Ear**: Right
- **Tester ID**: 2
- **Date/Time of test**: 08/03/2022 13:35:20
- **Data file name**: DF9W3833.DTA

- **Result**: Re-test required
- **Decision**: Retest
4kHz air conduction using Headphones - nHL to eHL correction is -5

What next?
4kHz bone conduction - nHL to eHL correction is +5

Baby wakes up, won’t sleep again - what we telling parents? Next steps?
Case 4

Please could you see this 5 week old baby who has recently recovered from bacterial meningitis. Mum has no concerns over his hearing at this time and he passed his newborn hearing screen prior to the meningitis.
**Left ear**

Stimulus (Pa/ms) | Response Waveform (mPa/ms) | Hw = UsbOae
--- | --- | ---

**Right ear**

Stimulus (Pa/ms) | Response Waveform (mPa/ms) | Hw = UsbOae
--- | --- | ---

**OAE response**

**Half Octave Band Power**

<table>
<thead>
<tr>
<th>Freq</th>
<th>SNR</th>
<th>Sig/Noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0kHz</td>
<td>-10.5dB</td>
<td>0.6/11.3dB</td>
</tr>
<tr>
<td>1.4kHz</td>
<td>-4.6dB</td>
<td>1.6/6.3dB</td>
</tr>
<tr>
<td>2.0kHz</td>
<td>-7.3dB</td>
<td>-12.2/-4.9dB</td>
</tr>
<tr>
<td>2.8kHz</td>
<td>-6.0dB</td>
<td>-14.2/-8.2dB</td>
</tr>
<tr>
<td>4.0kHz</td>
<td>-3.3dB</td>
<td>-13.6/-10.3dB</td>
</tr>
</tbody>
</table>

NLo=109  
NHii=1207  
Stim=81.2dB

**Test details**

Test type: TE  
Ear: Left  
Tester ID: 2

Date/Time of test: 09/03/2022 10:32:25

Data file name: DF9W3930.DTA

**Result**  
Too noisy  
**Decision**  
Retest

**Test details**

Test type: TE  
Ear: Right  
Tester ID: 2

Date/Time of test: 09/03/2022 10:39:19

Data file name: DF9W3931.DTA

**Result**  
Too noisy  
**Decision**  
Retest
4kHz air conduction using Headphones - nHL to eHL correction is -10

What next?
1kHz air conduction using Headphones - nHL to eHL correction is -15

Child has woken up, what we telling parents?
Case 5

Please could you see this 3 week old baby who has bi-passed newborn hearing screening due to being diagnosed with cCMV

Mum has no concerns and is developing well
OAE

Clear Response Left, all bands

Response Absent Right, all bands
4kHz air conduction using Headphones - nHL to eHL correction is -10

Child has woken up, but is looking sleepy, we’ve got another 2 hours left, what we doing next?
1kHz air conduction left using Headphones - nHL to eHL correction is -15

“This ear has an OAE, I should get normal and I want to ensure that the left ear is good, at worst then, I’ve got a unilateral PCHI and I know where I am for masking (if I need it)”

What next?
Going straight to BC, I need to know is this loss on the right conductive or sensory.

Correction at this age is +5 at 1kHz and 0 at 4kHz

What next? What am I telling parents?
Case 6

Please could you see this 3 week old well baby who has referred NHSP screening bilaterally

There is no significant history
4kHz air conduction using Headphones - nHL to eHL correction is -10

What next?
4kHz bone conduction - correction is 0

What next?
1kHz air conduction - correction is -15

What next?
1kHz bone conduction - correction is +5

What next? Management?
Case 7

Please could you see this 4 week old unilateral well baby referral from NHSP for more testing

There is no significant history

Your colleague has seen this baby and hands you this set of results, saying they’re not sure what they are looking at
4kHz air conduction using Headphones - nHL to eHL correction is -5

What do we think?
### 1k AC Chirp

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>100 L</td>
<td>80%</td>
<td>4000 [±40] ±9.0</td>
<td>83 dB SPL</td>
<td>99%</td>
<td>39.1</td>
<td>1.5 kHz</td>
<td>None</td>
<td>13nV</td>
<td>NB CE-Chirp</td>
<td>L3</td>
<td>1000 Hz</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>100 L2</td>
<td>80%</td>
<td>4000 [±40] ±9.0</td>
<td>83 dB SPL</td>
<td>99%</td>
<td>39.1</td>
<td>1.5 kHz</td>
<td>None</td>
<td>16nV</td>
<td>NB CE-Chirp</td>
<td>L3</td>
<td>1000 Hz</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>100 L3</td>
<td>80%</td>
<td>4000 [±40] ±9.0</td>
<td>83 dB SPL</td>
<td>60%</td>
<td>39.1</td>
<td>1.5 kHz</td>
<td>None</td>
<td>21nV</td>
<td>NB CE-Chirp</td>
<td>L3</td>
<td>1000 Hz</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>90 L</td>
<td>80%</td>
<td>4000 [±40] ±9.0</td>
<td>70 dB SPL</td>
<td>99%</td>
<td>39.1</td>
<td>1.5 kHz</td>
<td>None</td>
<td>14nV</td>
<td>NB CE-Chirp</td>
<td>L3</td>
<td>1000 Hz</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

[Graph showing various curves and data points]
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>40b L</td>
<td>4000 26%</td>
<td>±9.8</td>
<td>90 dB SPL</td>
<td>97 %</td>
<td>49.1</td>
<td>1.5kHz</td>
<td>None</td>
<td>—</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>40b L</td>
<td>4000 4%</td>
<td>±9.8</td>
<td>90 dB SPL</td>
<td>99 %</td>
<td>49.1</td>
<td>1.5kHz</td>
<td>None</td>
<td>—</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>350b L</td>
<td>4000 7%</td>
<td>±9.8</td>
<td>75 dB SPL</td>
<td>99 %</td>
<td>49.1</td>
<td>1.5kHz</td>
<td>None</td>
<td>—</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>350b L</td>
<td>6000 6%</td>
<td>±9.8</td>
<td>75 dB SPL</td>
<td>99 %</td>
<td>49.1</td>
<td>1.5kHz</td>
<td>None</td>
<td>—</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

4k BC Chirp

![4k BC Chirp graph](image-url)
<table>
<thead>
<tr>
<th>Curve</th>
<th>Recorded</th>
<th>Reject.</th>
<th>Masking</th>
<th>Wave</th>
<th>Stimuli</th>
<th>Display</th>
<th>Ratio</th>
<th>Polarity</th>
<th>Window</th>
<th>Freq.</th>
<th>Sine</th>
<th>Rise/</th>
<th>Plateau</th>
</tr>
</thead>
<tbody>
<tr>
<td>85 L4</td>
<td>17%</td>
<td>4000</td>
<td>1%</td>
<td>87%</td>
<td>49.1</td>
<td>1.5kHz</td>
<td>None</td>
<td>--</td>
<td>Alter.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>85 L3</td>
<td>18%</td>
<td>4000</td>
<td>1%</td>
<td>84%</td>
<td>49.1</td>
<td>1.5kHz</td>
<td>None</td>
<td>--</td>
<td>Alter.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>85 L2</td>
<td>25%</td>
<td>4000</td>
<td>1%</td>
<td>66%</td>
<td>49.1</td>
<td>1.5kHz</td>
<td>None</td>
<td>--</td>
<td>Alter.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>85 L1</td>
<td>17%</td>
<td>4000</td>
<td>1%</td>
<td>89%</td>
<td>49.1</td>
<td>1.5kHz</td>
<td>None</td>
<td>--</td>
<td>Alter.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>85a L4</td>
<td>21%</td>
<td>8000</td>
<td>1%</td>
<td>79%</td>
<td>49.1</td>
<td>1.5kHz</td>
<td>None</td>
<td>--</td>
<td>Alter.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>85a L3</td>
<td>17%</td>
<td>8000</td>
<td>1%</td>
<td>91%</td>
<td>49.1</td>
<td>1.5kHz</td>
<td>None</td>
<td>--</td>
<td>Alter.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Comments: not masked

Click AC (No masking)
Case 8

• Born 26 weeks gestation

• Very small, some breathing issues and ?? Sepsis in the early days

• Initial Screen at 39 weeks GA -
  Right - CR OAE NCR AABR
  Left - CR OAE NCR AABR

First thoughts?
4k AC HP TP
ABR performed under natural sleep (8 weeks corrected age)

1k AC HP TP
What do we think?
Case 9

Please could you see this 26 week old who has been extremely unwell since birth - they have not been seen for screening

No syndrome has yet been fully identified through genetics, however he has a ‘cobbled appearance brainstem’ on MRI consistent with Walker-Warberg syndrome. He is not regulating his own body temperature however has recently come off ventilation. The head MRI notes that there is a common IAM cavity on the right, with no cochlear or SCC and no apparent auditory, vestibular, facial or visual nerves. The left appears normal. They are able now to come down to your department and sleep most of the day

First thoughts?
EEG very noisy even though child appears settled - 4kHz AC HP (-10 correction)

Thoughts? Next?
Ok, lets go off piste - slow the rate down to see if we get a better response
4kHz -10, 1kHz -15     Thoughts?  Next?
1kHz BC and 4kHz BC (at this age, both -10 correction)

What we telling parents? Management?