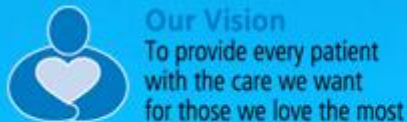


Bone Conduction Auditory Brainstem Response Testing (BC-ABR) - performance and interpretation.

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NHS Foundation Trust



Aims

- Equipment Calibration & Set Up
- When and how to perform BC ABR
- Maximizing recording conditions
- Masking
- Interpreting Waveforms

Transducer Calibration

- Transducer:

Radioear Type B-71 Bone Vibrator (check impedance is correct for equipment)

Able to deliver stimulus to 60dBnHL at 4kHz (without distortion).

Calibrate to BSEN ISO 389-6:2007

Acoustics – Reference Zero for the calibration of audiometric equipment – Part 6: Reference threshold of hearing for test signals of short duration.

Equipment Set Up

Parameter	4kHz or 2kHz Tone Pip (2:1:2 cycles)	1kHz or 500Hz Tone Pip (2:1:2 cycles)
Stimulus Rate	45.1 – 49.1 /s (17.1 – 19.2 for wave 1 with BC)	35.1 – 39.1 /s
Amplifier Filters	30 – 1500 Hz	30 – 1500Hz
Amplifier Reject Level	$\pm 5\mu\text{V}$ ($\pm 3\mu\text{V}$ to $\pm 10\mu\text{V}$)	$\pm 5\mu\text{V}$ ($\pm 3\mu\text{V}$ to $\pm 10\mu\text{V}$)
Window Length	20ms	25ms
Display Scales	25 – 100nV \equiv 1ms	25 – 100nV \equiv 1ms

Performing BC Testing

- When do you perform BC?
 - After raised AC thresholds
- How many averages?
 - 2000 - 3000
- To what level do you test down to?
- - test to 15dBeHL or lower.

Applying the Transducer

- Placement
- Force



Allowing For Age (correction from nHL to eHL)

Corrected age (weeks)	0.5 kHz	1 kHz	2 kHz	4 kHz
≤12 weeks (≤ 84 days)	5	5	-5	0
>12– 24 weeks (85 – 168 days)	0	0	-10	-5
>24 weeks – 2 years (169 – 730 days)	-5	-5	-10	-10
➤ 2 years (>730 days)	-20	-15	-10	-10

E.g. 4kHz test stimulus

Baby at 4 weeks: 30dB dial threshold = 30dBeHL

Baby at 16 weeks: 30dB dial threshold -5 = 25dBeHL.

Order of testing

- Raised AC at 4kHz
 - perform BC testing.
- Test to 15dBnHL. If NCR at 15dB consider masking.
- Then test the other ear
- Then consider 1kHz, 2kHz 500Hz.

What if levels are elevated?

- Is masking needed?

The Masking Calculator

Guy Lightfoot 2013b

(www.abrpeerreview.co.uk)

ABR Masking Noise Calculator 2013

Instructions:
Click in pale yellow cells to enter options and appropriate levels then press Enter / Return
Result is the dB "dial" level of noise for the selected system, stimulus type, transducer, corrected age & stimulus level
Offset is an alternative way of specifying noise level: it is the dB noise level relative to the stimulus level

ABR System:	Biologic Nav Pro	
Stimulus Transducer:	BC	
Noise Transducer:	TDH	
Stimulus type:	4k pip	
Patient corrected age (weeks):	6 to 8	
Test ear air-bone gap, dB:	0	
Non-test ear air-bone gap, dB:	0	
dBeHL non-test BC ABR threshold:	0	
dBnHL Stimulus Level:	15	15 dBeHL

No need to mask

Equation:	Stim(dBnHL)	+dBage	+RML	+ABGnt	-IA	-Nt	-Nc	Result	Offset
$dB_{noise} =$	15	10	28	0	20	0	21	10	-5

Variables for the current settings (dB):

Nt = 10	RML _{lower} = 13
Nc = 21	RML _{upper} = 28
BC age correction = 10	ABGnt = 0
Stimulus dBeHL = 15	IAS = 0
Stimulus dBeHLnt = -5	IAn = 42
	IAa = 20
	Max noise SPL crossing to test cochlea = -31

Risk of cross-hearing without masking

Risk of cross-masking if masking is used

ABR Masking Noise Calculator 2013

Instructions:
Click in pale yellow cells to enter options and appropriate levels then press Enter / Return
Result is the dB "dial" level of noise for the selected system, stimulus type, transducer, corrected age & stimulus level
Offset is an alternative way of specifying noise level: it is the dB noise level relative to the stimulus level

ABR System:	Biologic Nav Pro	
Stimulus Transducer:	BC	
Noise Transducer:	TDH	
Stimulus type:	4k pip	
Patient corrected age (weeks):	6 to 8	
Test ear air-bone gap, dB:	0	
Non-test ear air-bone gap, dB:	0	
dBeHL non-test BC ABR threshold:	0	
dBnHL Stimulus Level:	40	40 dBeHL

Masking Needed

Equation:	Stim(dBnHL)	+dBage	+RML	+ABGnt	-IA	-Nt	-Nc	Result	Offset
$dB_{noise} =$	40	10	28	0	20	0	21	35	-5

Variables for the current settings (dB):

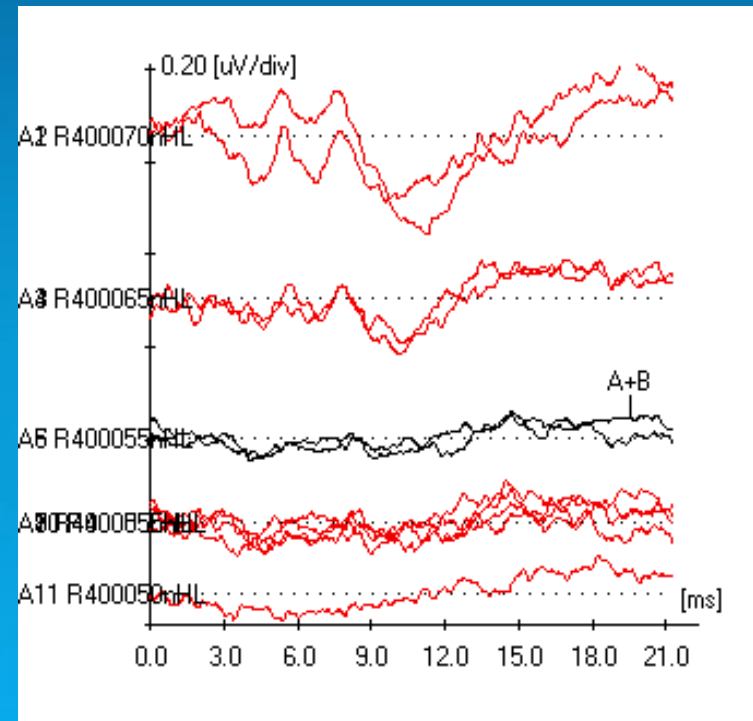
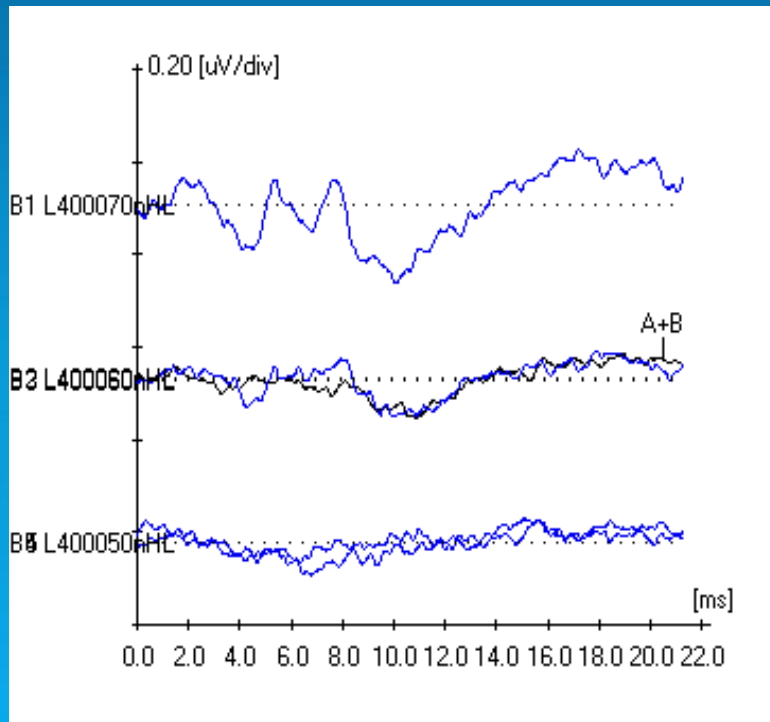
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Nc = 21	RML _{upper} = 28
BC age correction = 10	ABGnt = 0
Stimulus dBeHL = 40	IAS = 0
Stimulus dBeHLnt = 20	IAn = 42
	IAa = 20
	Max noise SPL crossing to test cochlea = -6

Risk of cross-hearing without masking

Risk of cross-masking if masking is used

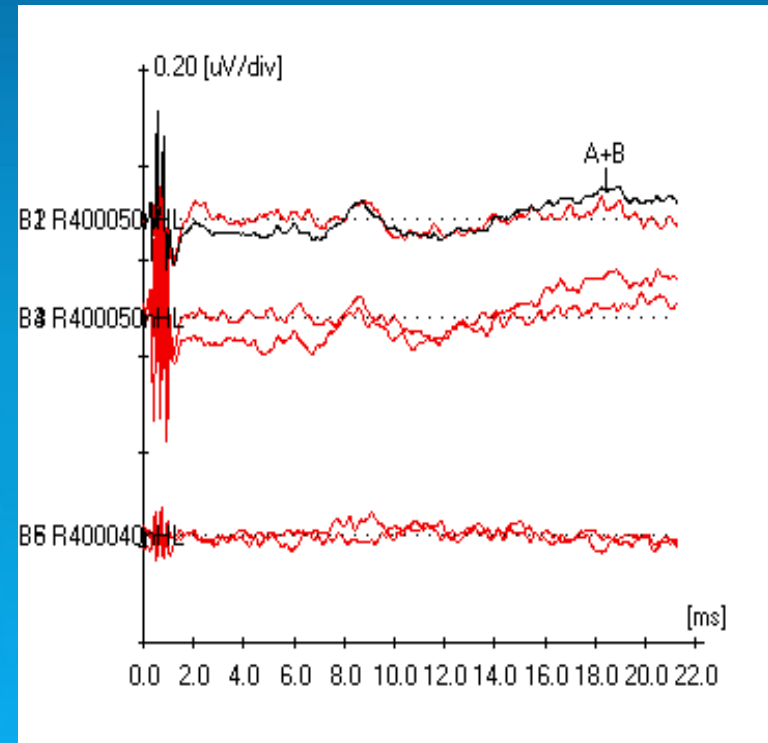
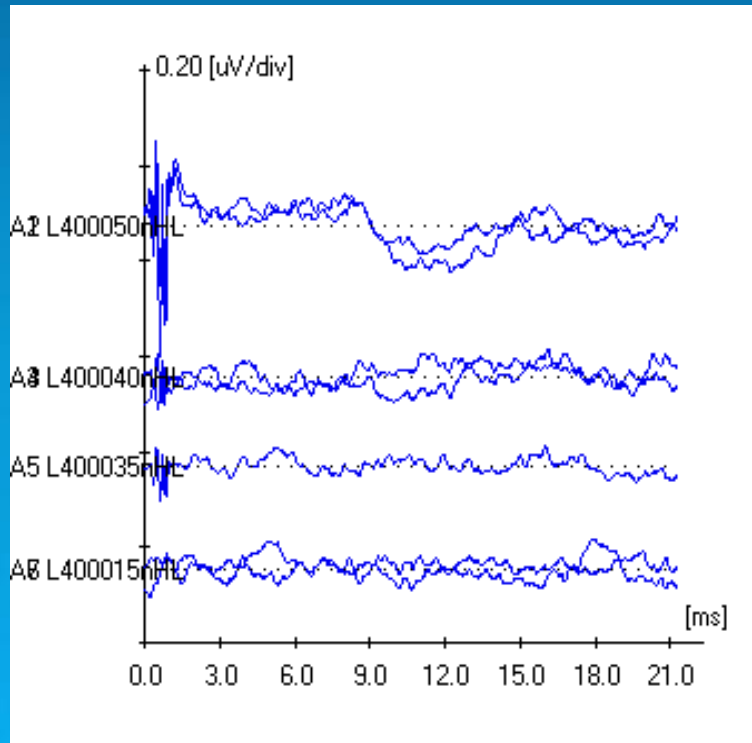
Interpreting Waveforms – Case 1

4kHz AC Headphones



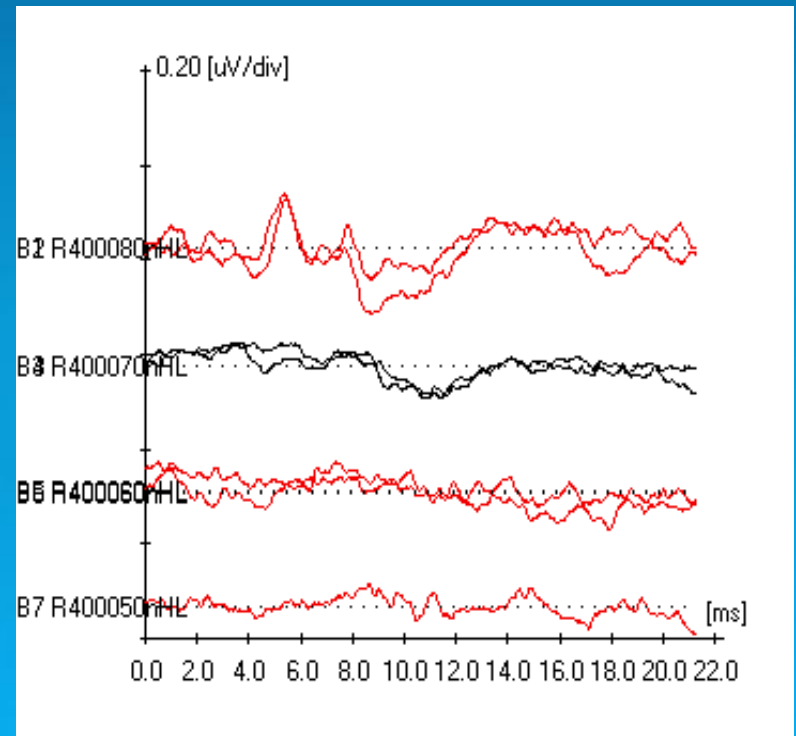
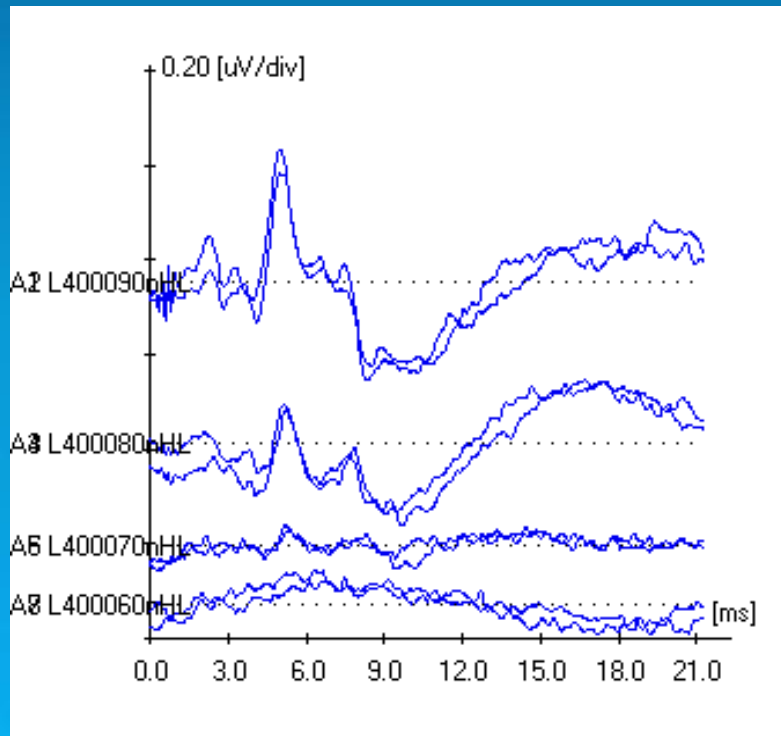
Interpreting Waveforms – Case 1

- 4kHz BC



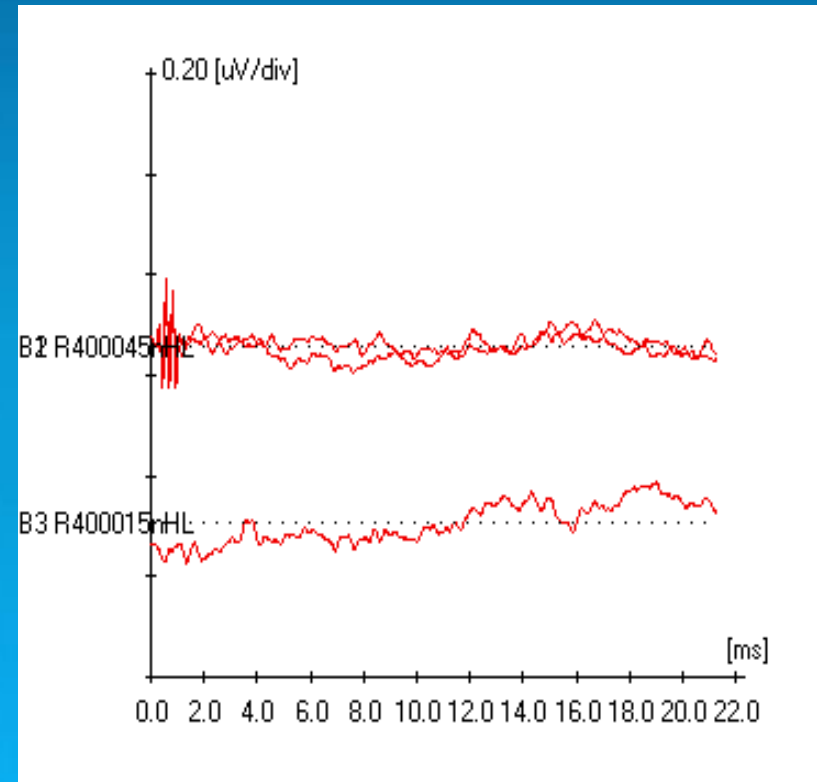
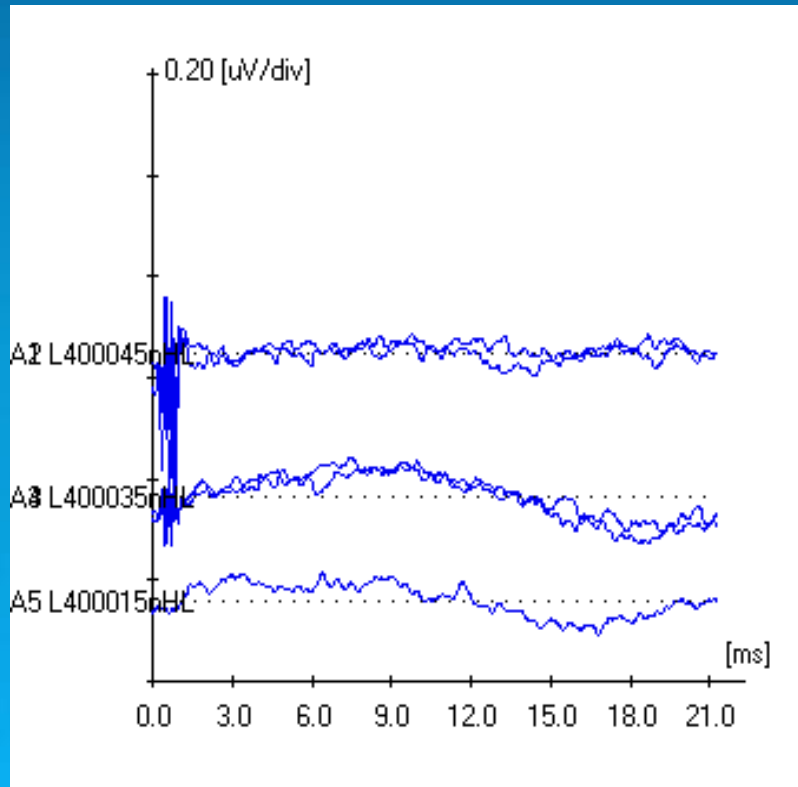
Interpreting Waveforms – Case 2

- 4kHz AC Headphones



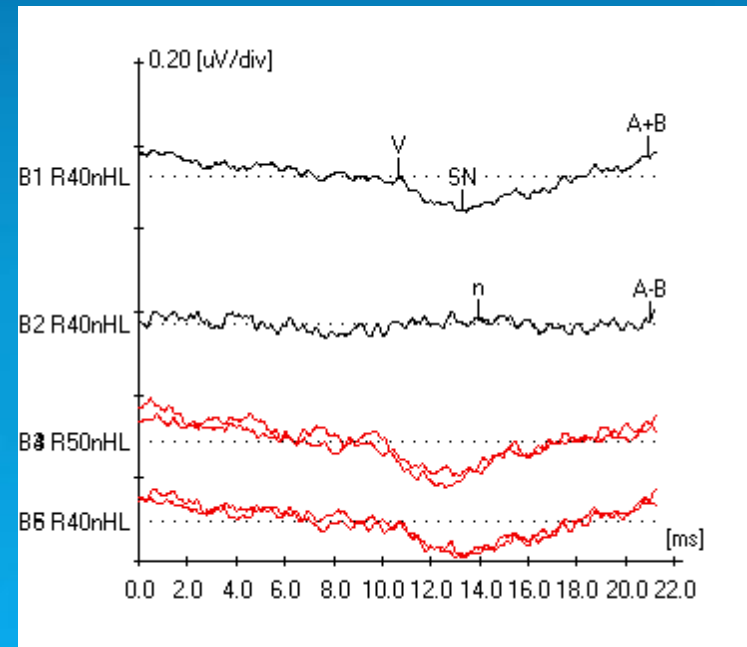
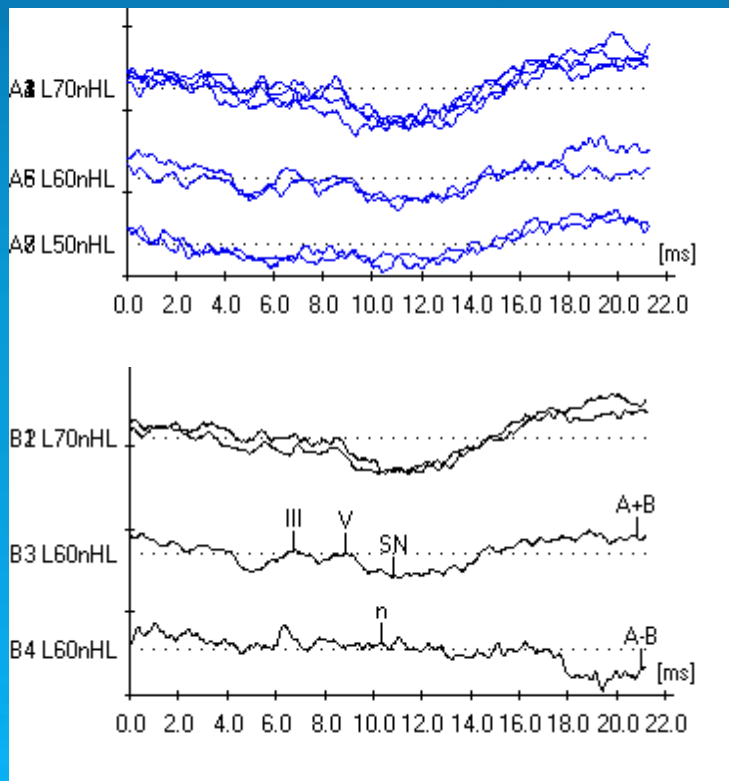
Interpreting Waveforms – Case 2

- 4kHz BC



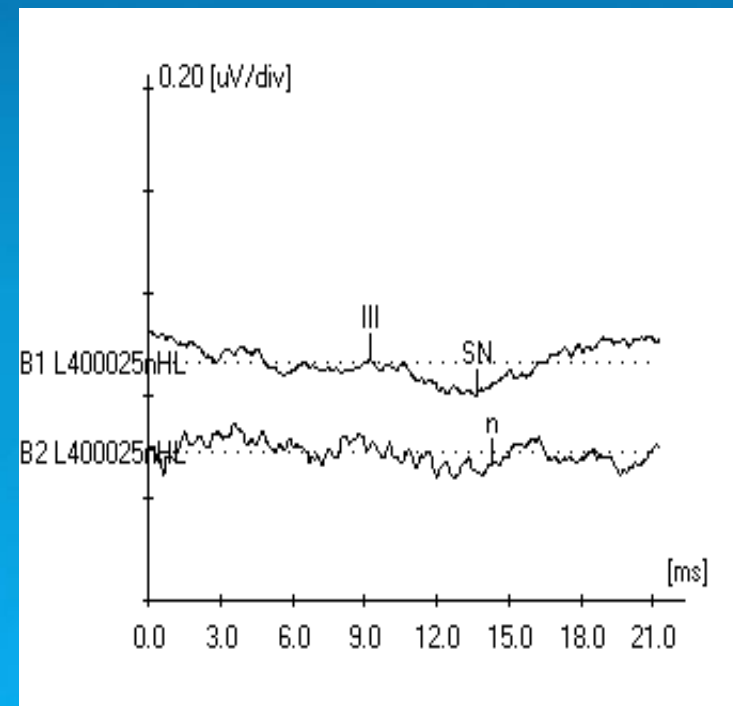
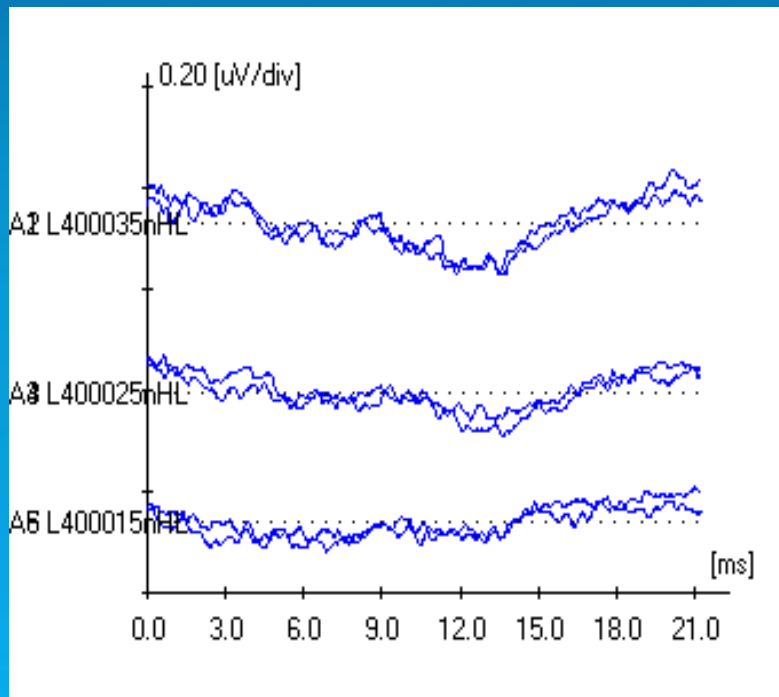
Interpreting Waveforms – Case 3

- 4kHz AC Headphones



Interpreting Waveforms – Case 3

- 4kHz BC



How Much Masking?


ABR System:	Biologic Nav Pro	
Stimulus Transducer:	BC	
Noise Transducer:	TDH	
Stimulus type:	4k pip	
Patient corrected age (weeks):	6 to 8	
Test ear air-bone gap, dB:	40	
Non-test ear air-bone gap, dB:	0	
dBeHL non-test BC ABR threshold:	0	
dBnHL Stimulus Level:	35	35 dBeHL


Masking Needed

Equation:	Stim(dBnHL)	+dBage	+RML	+ABGnt	-IA	-Nt	-Nc	Result	Offset
$dB_{noise} =$	35	10	28	0	20	0	21	30	-5

Variables for the current settings (dB):

Nt = 10	RML _{lower} = 13
Nc = 21	RML _{upper} = 28
BC age correction = 10	ABGnt = 0
Stimulus dBeHL = 35	IAS = 0
Stimulus dBeHLnt = 15	IA _n = 42
	IA _a = 20

Risk of cross-hearing without masking: 

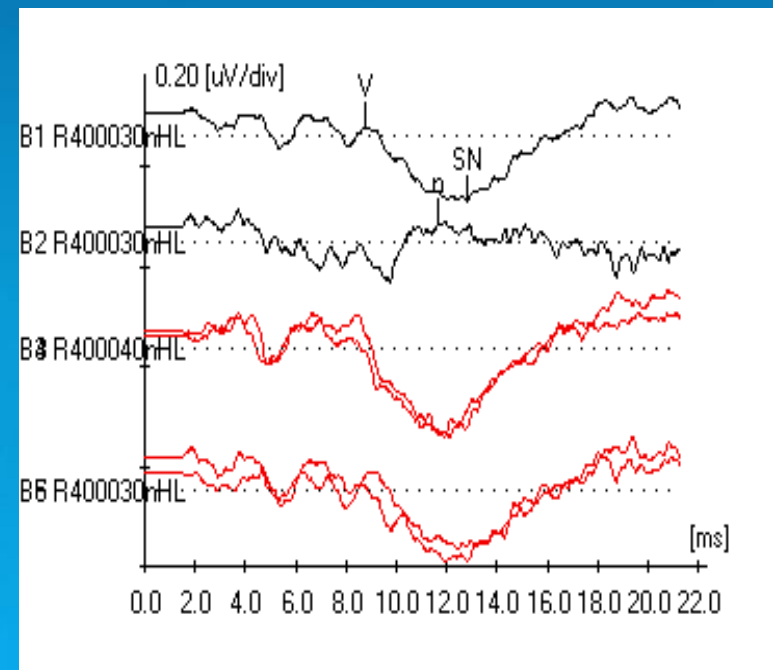
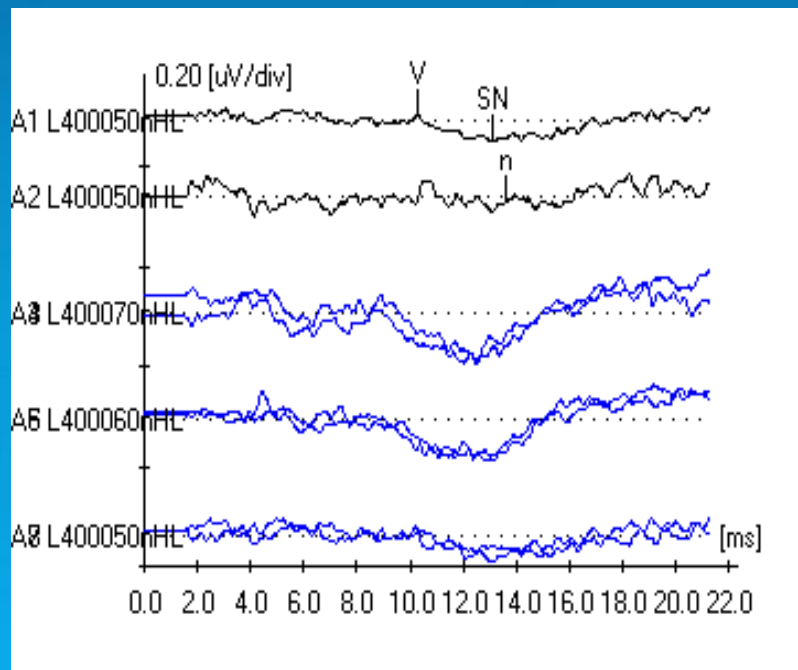
Risk of cross-masking if masking is used: 

Stimulus Parameters

Label Index	Intensity	Ear	Transducer	Polarity	Type	Frequency	Ramp	Rise/Fall	Plateau	Masking level
A1	35dB nHL	Left	Bone Oscillator	Alternating	Tone Burst	4000	Blackman	0.50	0.25	30dB HL
A2	35dB nHL	Left	Bone Oscillator	Alternating	Tone Burst	4000	Blackman	0.50	0.25	30dB HL
A3	25dB nHL	Left	Bone Oscillator	Alternating	Tone Burst	4000	Blackman	0.50	0.25	20dB HL
A4	25dB nHL	Left	Bone Oscillator	Alternating	Tone Burst	4000	Blackman	0.50	0.25	20dB HL
A5	15dB nHL	Left	Bone Oscillator	Alternating	Tone Burst	4000	Blackman	0.50	0.25	10dB HL
A6	15dB nHL	Left	Bone Oscillator	Alternating	Tone Burst	4000	Blackman	0.50	0.25	10dB HL
B1	25dB nHL	Left	Bone Oscillator	Alternating	Tone Burst	4000	Blackman	0.50	0.25	20dB HL
B2	25dB nHL	Left	Bone Oscillator	Alternating	Tone Burst	4000	Blackman	0.50	0.25	20dB HL

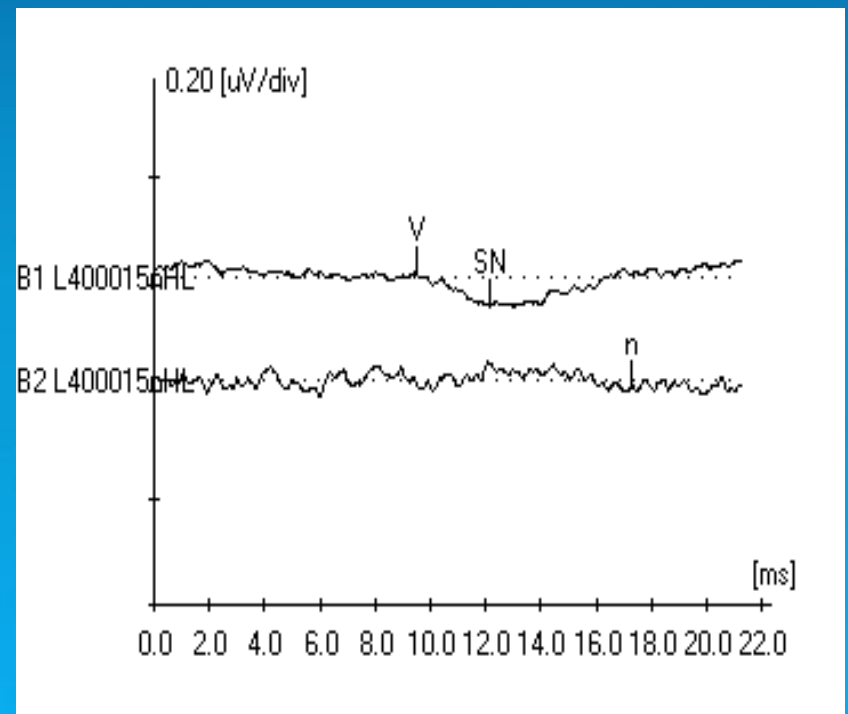
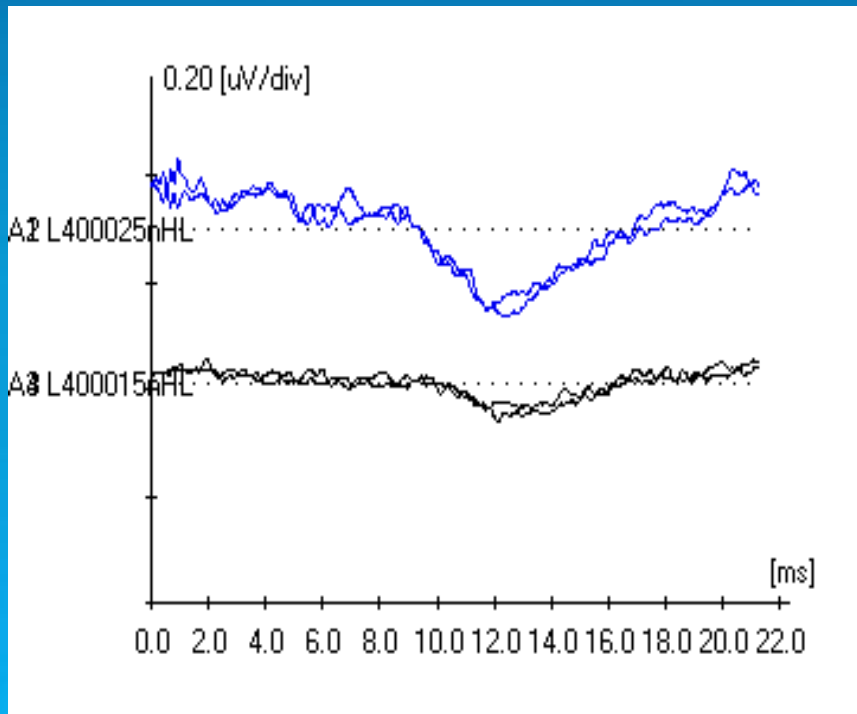
Interpreting Waveforms – Case 4

- 4kHz AC Headphones



Interpreting Waveforms – Case 4

- 4kHz BC



Summary

- Ensure appropriate calibration and set up – refer to British Society of Audiology website. www.thebsa.org.uk/resources)
- Performing BC testing at 15dB avoids the need for masking.
- Use the masking calculator if necessary

References

- Guidelines for the early audiological assessment and management of babies referred from the Newborn Hearing Screening Programme Version 3.1 July 2013 NHSP Clinical Group Co-Editors: John Stevens¹, Graham Sutton², Sally Wood. Contributors: Rachel Feirn³, Guy Lightfoot⁴, Rhys Meredith⁵, Sally Minchom⁶, Glynnis Parker⁷, Siobhan Brennan⁸, Rachel Booth. British Society of Audiology (www.thebsa.org.uk/resources/).
- Guidance for Auditory Brainstem Response testing in babies Version 2.1 March 2013 NHSP Clinical Group. Graham Sutton, Guy Lightfoot (Co-editors) Contributors: John Stevens, Rachel Booth, Siobhan Brennan, Rachel Feirn, Rhys Meredith. British Society of Audiology (www.thebsa.org.uk/resources/).



COFFEE BREAK- 15.00

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