

**Pros and Cons:
Including High Frequency
(1000 Hz) Ipsilateral Acoustic
Stapedial Reflexes in UNHS**

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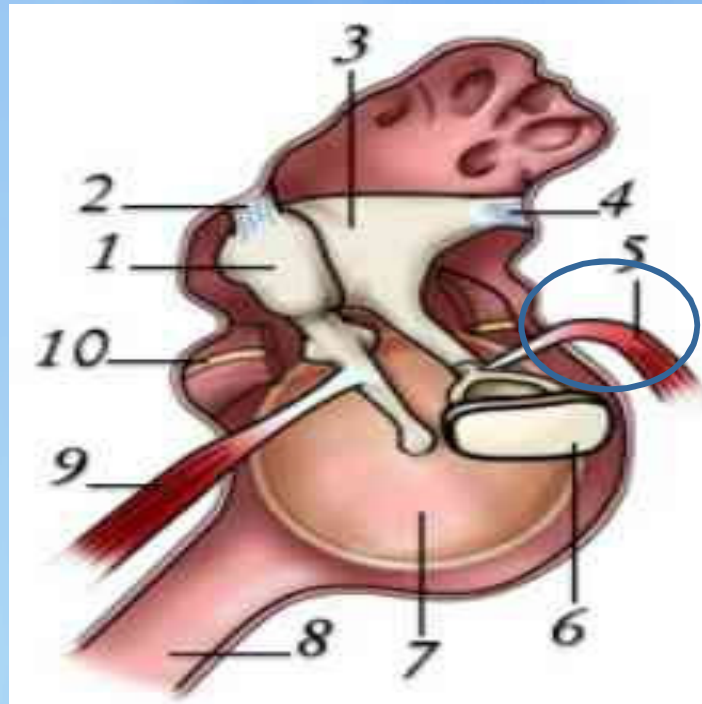
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Overview

- Acoustic Stapedial Reflexes
- Diagnostic Importance
- Previous Research
- Research Goals
- Methodology
- Results/Discussion
- Implications for UNHS
 - Pros
 - Cons

Acoustic Stapedial Reflexes

- Acoustic Stapedial Reflexes:
 - Contractions of the stapedius muscle to loud stimuli
 - Nature's purpose: protection & perceptual theories



Diagnostic Importance

- Differential diagnostic test
- Diagnosis of conductive pathology hearing loss
- Confirmation of nonorganic hearing loss
- Objective measure for:
 - central pathology
 - cochlear pathology
 - loudness recruitment
 - neuronal pathology

Previous Research

- Indicated low frequency probe-tones are not valid in the neonatal population
- Confirmed that the presence of acoustic reflexes increased with increase in probe-tone frequency
- Hallmark Studies:
 - Weatherby & Bennett, 1980
 - McMillan, Bennett et al., 1985
 - Sprague et al., 1985
 - Swanepoel et al., 2007

Mature vs Neonatal Ears

- Mature ears
 - 226 Hz probe-tone
 - Stiffness-driven system
- Neonate ears
 - Higher frequency probe-tone (i.e. 1000 Hz)
 - Mass-driven system
 - Smaller ECV
 - More compliant
 - Debris/mesenchyme

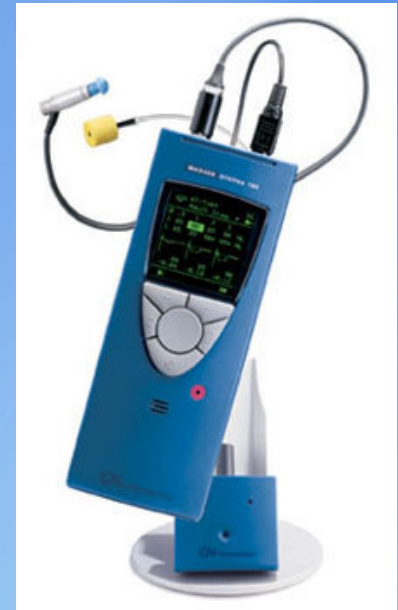
Research Goal

- To establish normative data for 1000 Hz probe-tone ipsilateral acoustic stapedial reflexes for neonatal ears using elicitor tones 500, 1000, 2000 Hz and broadband noise (BBN)
 - Means
 - Standard Deviations
 - 90th percentile ranges



Methodology

- Demographic Criteria
 - 12-60 hours old
 - 2500+ grams
 - 5-minute Apgar of 7+
 - State of arousal ≤ 2 (Bench, 1976)
- Inclusion Criteria
 - Pass of the TEOAE screening
 - Normal (peaked) 1000 Hz Tympanometry
- 138 neonates were included in initial study
 - 266 ears
- Acoustic reflexes obtained on 102 neonates
 - 175 ears



Methodology

- 1000 Hz tympanometry
 - ≥ 0.39 from the positive tail (Kei et al., 2003)
 - ≥ 0.6 mmho from the negative tail (Margolis et al., 2003)
- 1000 Hz ipsilateral acoustic stapedial reflexes
 - Elicitor Stimuli:
 - 500 Hz; 1000 Hz; 2000 Hz; BBN
 - Minimal compliance change: 0.04 mmho
 - Randomized order of elicitor and ear
 - Started measurement at 50 dB HL; ascended in 10 dB steps; bracketing technique in 5 dB increments for threshold

Results: Descriptive Statistics

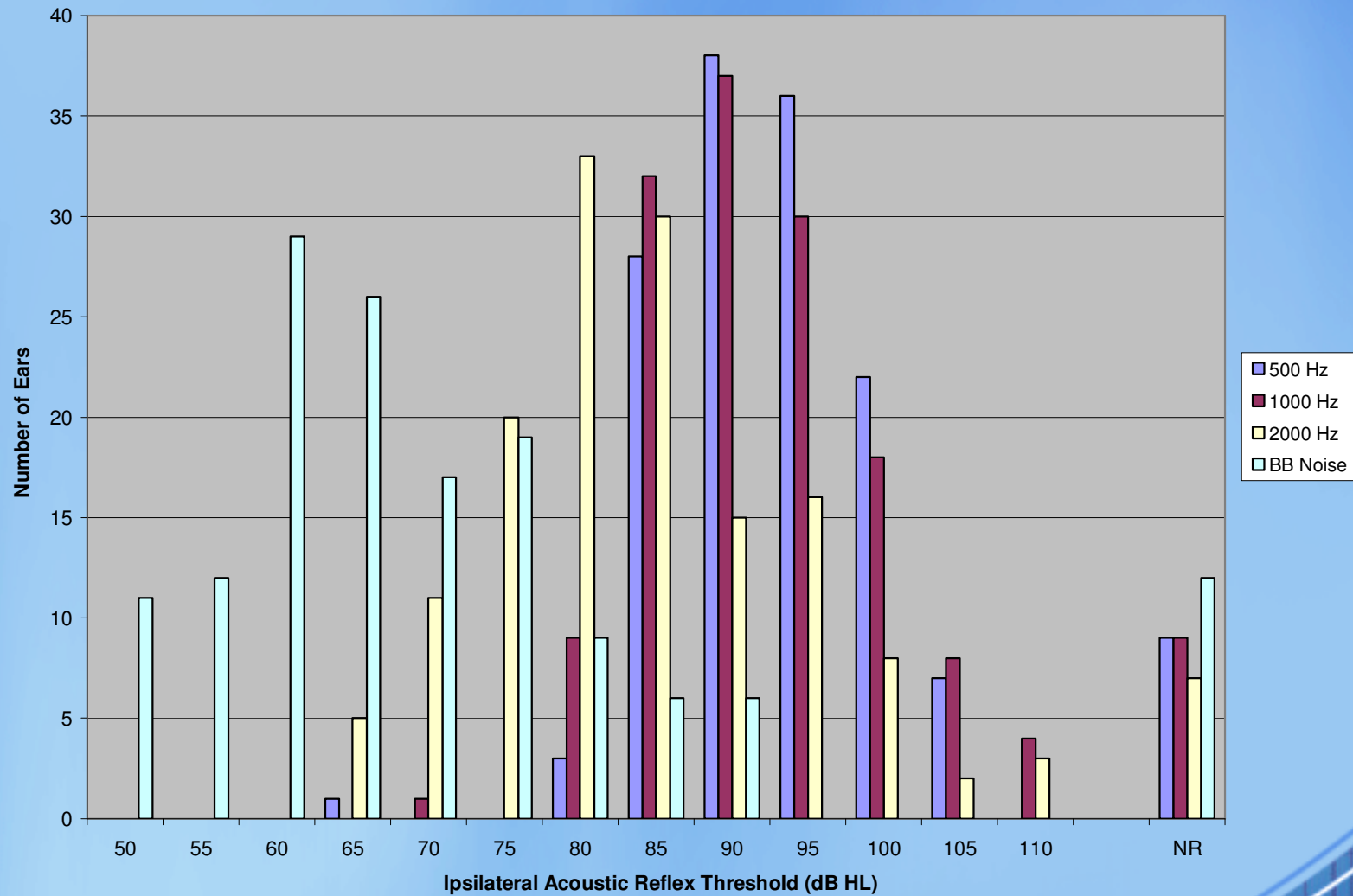
- 97% of the ears had present acoustic reflexes for at least one elicitor stimuli
 - Absent for 3% of the ears tested
- 87% of the ears had present reflexes for all elicitor stimuli
- 91-94% presence across elicitor stimuli
- Positive/Negative Deviations
 - Negative= 145 ears (83%)
 - Positive=14 ears (8%)
 - Both= 10 ears (6%)

Results: Acoustic Reflex Thresholds*

| | Elicitor Stimulus | | | |
|-----------------------------|-------------------|---------|---------|-------|
| | 500 Hz | 1000 Hz | 2000 Hz | BBN |
| N | 139 | 142 | 147 | 138 |
| Mean (dB HL) | 92.46 | 91.40 | 83.90 | 66.97 |
| SD | 5.96 | 7.04 | 9.40 | 10.37 |
| Min | 80 | 80 | 65 | 50 |
| Max | 105 | 110 | 110 | 90 |
| 5 th Percentile | 85 | 80 | 65 | 50 |
| 50 th Percentile | 90 | 90 | 80 | 65 |
| 95 th percentile | 100 | 105 | 100 | 85 |

(*Negative deviation only)

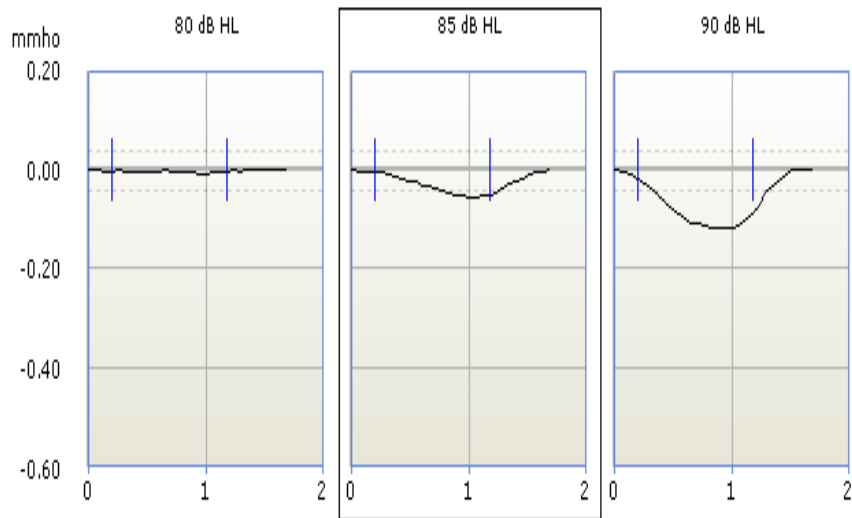
Distribution of AR Thresholds Across Elicitor Stimuli*



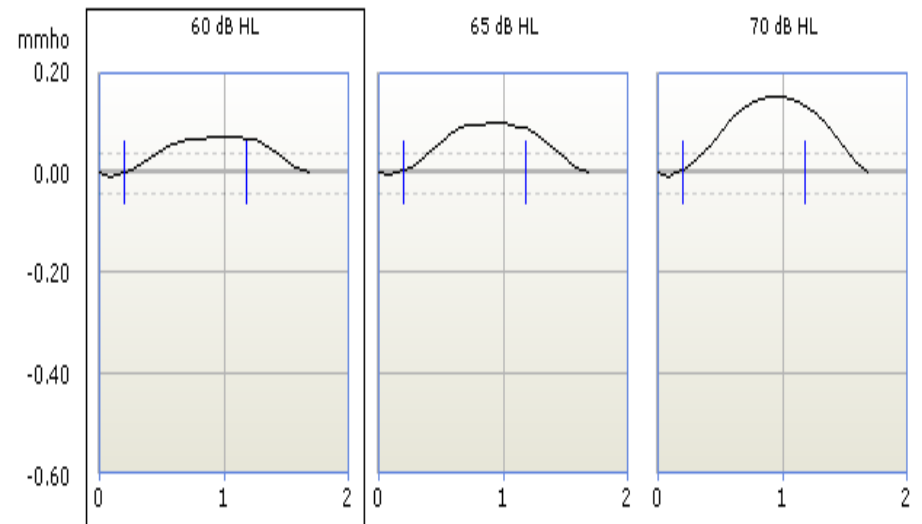
(*Negative deviation only)

Positive/Negative Deviations

Deflection, Ipsi 1000 Hz



Deflection, Ipsi 2000 Hz



Results Summary

- Tonal Elicitors: mean thresholds 80-90 dB HL
- BBN Elicitor: mean threshold 65 dB HL
- Compared to 226 Hz probe-tone norms*:
 - 13.5 dB & 9.5 dB higher mean thresholds
 - 2.3 dB lower for 2000 Hz
- Other studies
 - Similar to Swanepoel et al. (2007)
 - Some differences with Mazlan et al. (2008)
- Positive/negative deviations

*Wiley, Oviatt, & Block, 1987

Results Summary

- Time of testing
 - 12-18 hours old higher TEOAE refer rate & flat tymps
 - Especially for Cesarean Section
 - Tympanometry:
 - 12-18 hours old: 35% passed
 - 19-24 hours old: 65% passed
 - 25-60 hours old: 90% passed
- Suggests immittance testing after 24 hours for more effective test results

Conclusions

- Based on the high prevalence of high frequency ipsilateral 1000 Hz acoustic reflexes in neonates 12-60 hours old, clinical use is recommended
- Careful interpretation of immittance results is needed for neonates less than 24 hours old
- The use of automated acoustic reflex measurements is not recommended at this time due to unknown significance of reflexes in the positive direction

Acoustic Reflexes in UNHS

- Pros
 - Specific and time-sensitive diagnoses
 - Auditory Neuropathy
 - OAE-based programs
 - Reduced parent anxiety
 - Informed parent counseling
 - Decreased percentage of false-positives
 - Misses for auditory neuropathy
 - Improved follow-up process



Acoustic Reflexes in UNHS

- Cons
 - Personnel resources
 - Time
 - Tester Error
 - Expertise/Training
 - Expense



Future Clinical Needs

- Assess clinical effectiveness of implementation
 - Trial by error
- Further Research:
 - positive vs. negative deviations
 - Screening protocols
 - high frequency acoustic reflexes in NICU and premature neonates
 - Obtain normative data on contralateral high frequency acoustic reflexes



Take Home Message

- Ipsilateral high frequency acoustic stapedial reflexes in neonates at least 12 hours old
 - Reliable & accurate
 - Auditory Neuropathy: ↓ miss/late ID
 - Improved parent counseling
 - Effective management



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Thank you!!

Questions or comments

