An Investigation of the Relationship of ABR Wave V to Na-Pa of the MLR

Erin Wierzbinski, B.A., Krista Davison, B.S.

Jennifer Gonzalez, B.A., Frank Musiek, Ph.D.

Introduction

This study aimed to investigate the relationship between simultaneously recorded auditory brainstem response (ABR) wave V and middle latency response (MLR) Na-Pa complex, develop normative data, and make quantitative comparisons.

Background

- Auditory Brainstem Response (ABR) provides valuable diagnostic information about the auditory system from the auditory nerve to the level of the pons.
- The middle latency response (MLR) is believed to be generated by the midbrain and the thalamocortical pathway into Heschl's Gyrus (Kraus, Kileny, and Mcgee, 1994)
- The amplitude of the MLR wave Pa is typically larger than that of ABR wave V due to the increased amount of neural substrate at the level of the cortex.
- MLR is often compromised in patients with central auditory lesions or central auditory processing disorders
- The simultaneous recording of ABR and MLR could allow clinicians to gather information about the central auditory system more efficiently, which could have important implications for the diagnosis of disordered populations (Musiek et al., 1999)

Materials and Methods

Participants

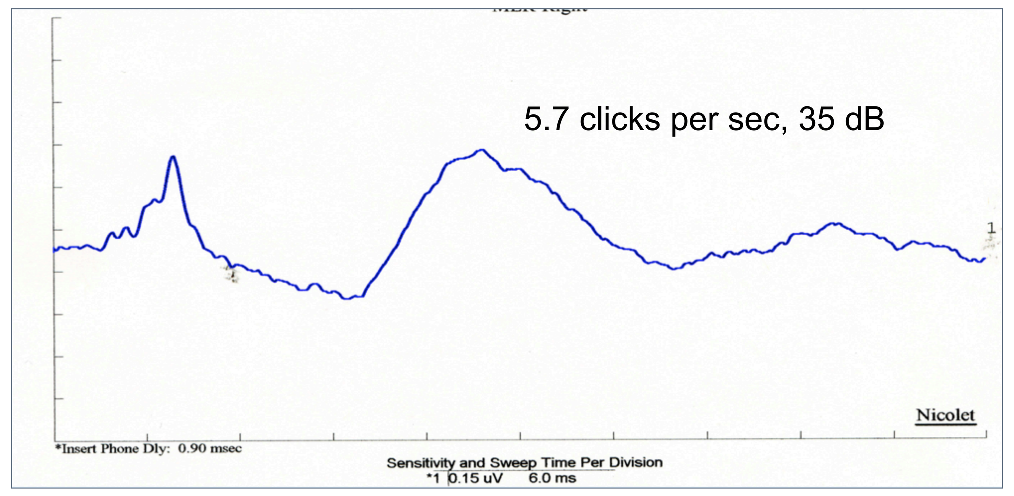
- 16 adults with:
  - normal peripheral hearing bilaterally for the octave frequencies 250 Hz through 8 kHz
  - no history of neurological or otological problems, central auditory processing disorders or learning disability
  - Normal Type A tympanograms (Jerger, 1970) bilaterally on the day of testing
  - Present otoacoustic emissions in the test ear

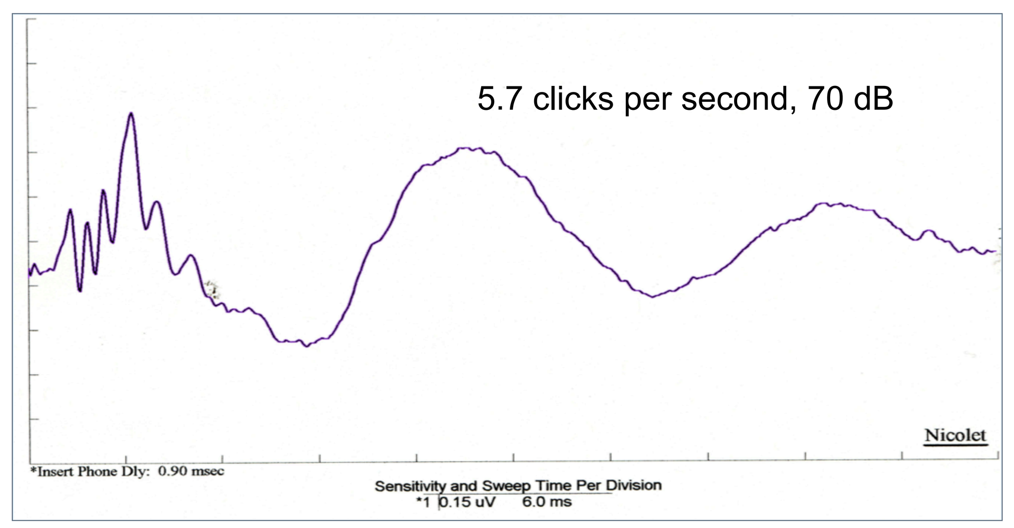
Procedures

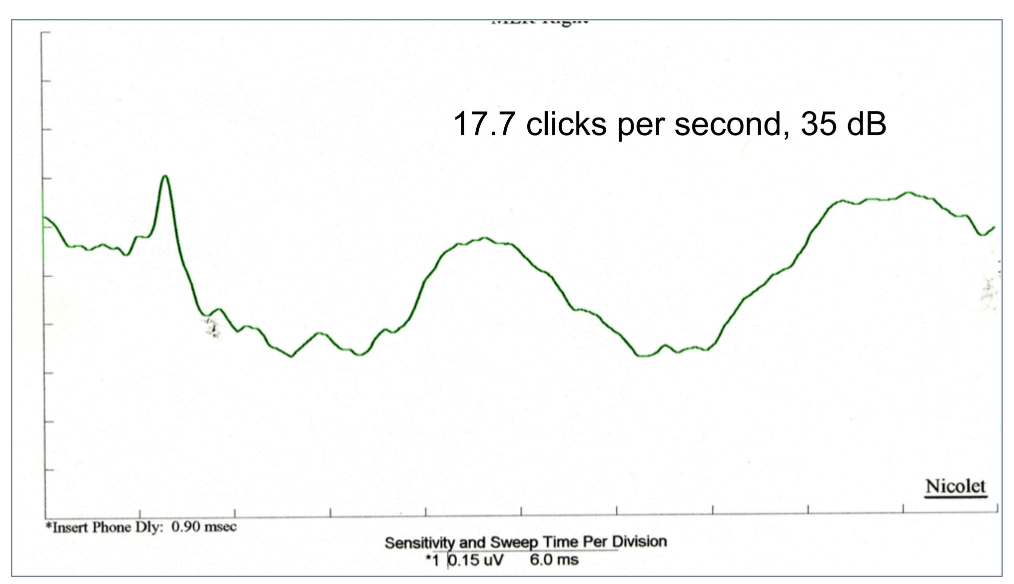
- Waveforms were recorded using a Nicolet Spirit 2000 Averager
- Ear of presentation was randomized across participants
- Electrodes at Cz, A1, and A2
- A 100 microsecond rarefaction click was used
- 1000 accepted sweeps
- Time window of 60 msec
- Stimuli were presented at two repetition rates, 5.7 and 17. clicks per second, and two intensities, 35 dB n HL and 70 dB n HL, yielding four recording conditions
- Responses were filtered online at 20-1500Hz

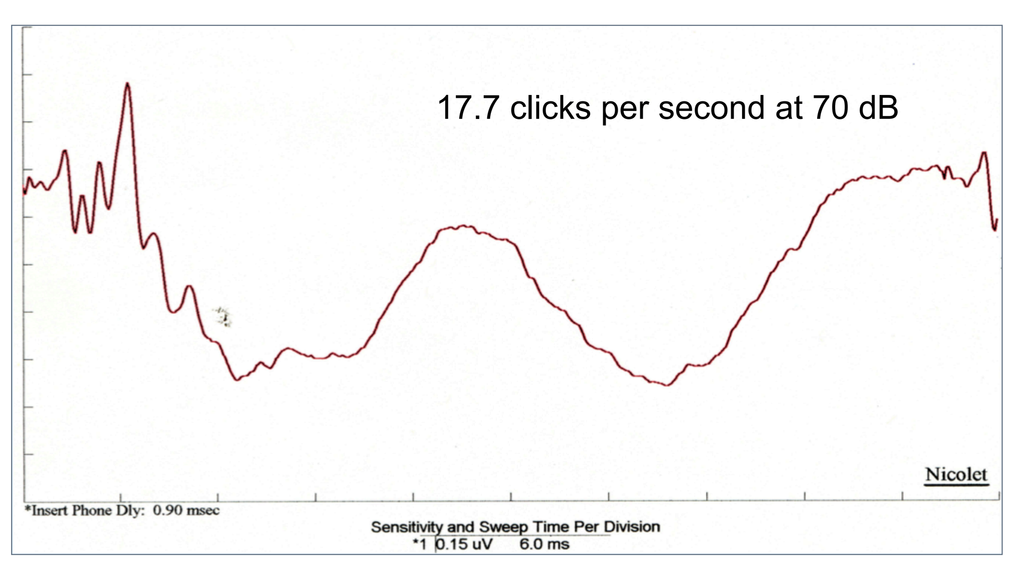
Results

Representative Waveforms of four recording conditions:





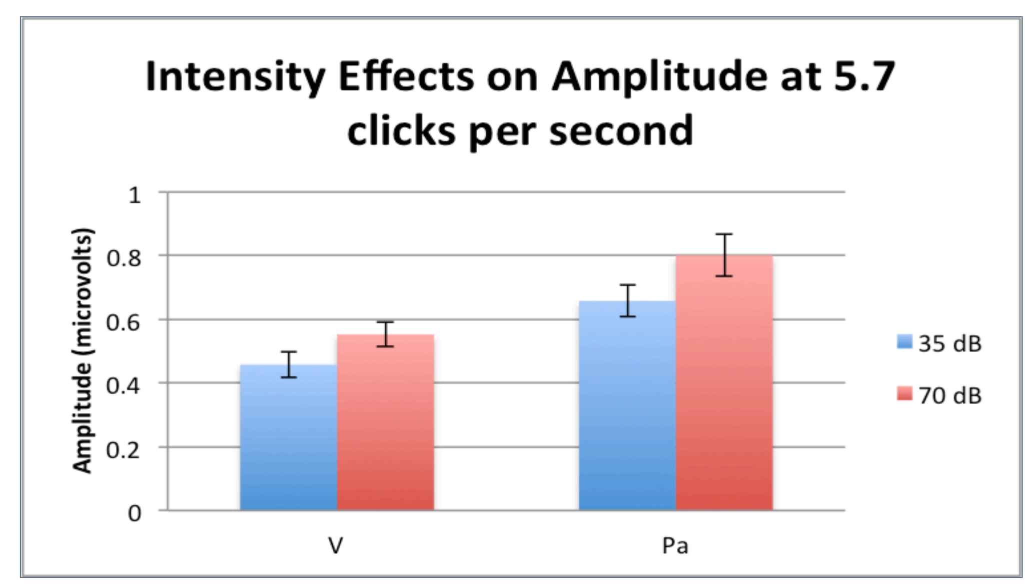


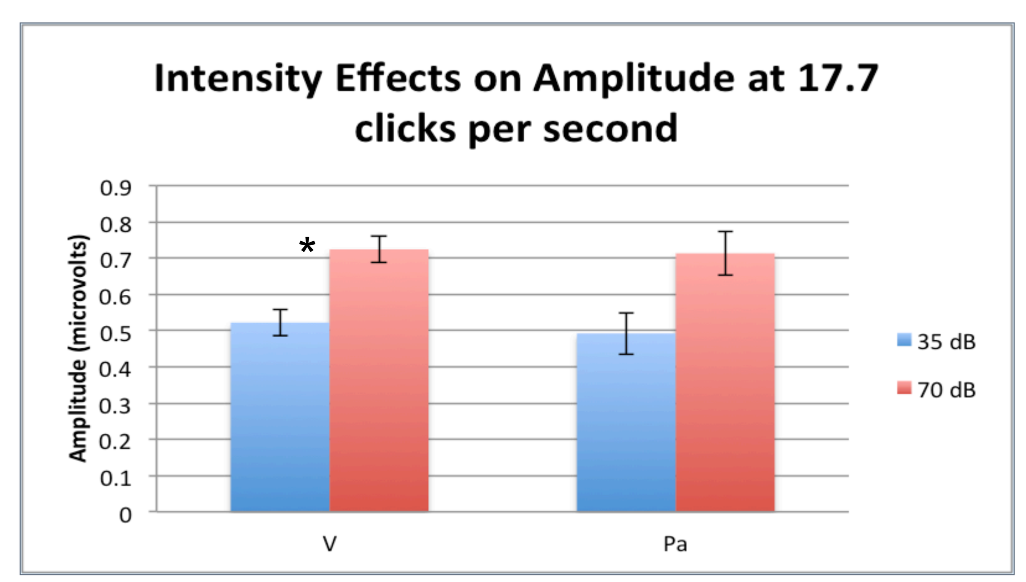


Results

Latency Measures of Wave V and NaPa (means and standard deviations)

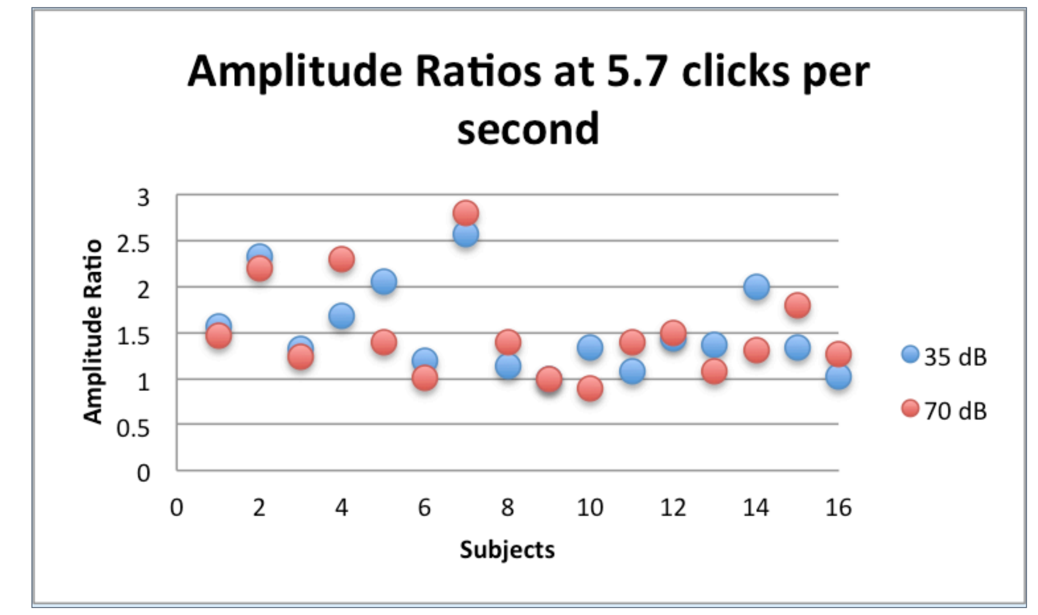
	Wave V Latency	Na Wave Latency	Pa Wave Latency	Interwave Latencies
5.7 clicks at 35 dB	6.95 (.36)	17.89(1.23)	26.00 (1.96)	19.00 (1.88)
17.7clicks at 35 dB	6.98 (.32)	18.59 (1.86)	26.92 (1.69)	19.94 (1.65)
5.7 clicks at 70 dB	5.71 (.16)	16.88 (1.34)	25.70 (1.80)	19.99 (1.74)
17.7 clicks at 70 dB	5.73 (.14)	17.00 (2.62)	25.83 (1.01)	20.17 (1.00)

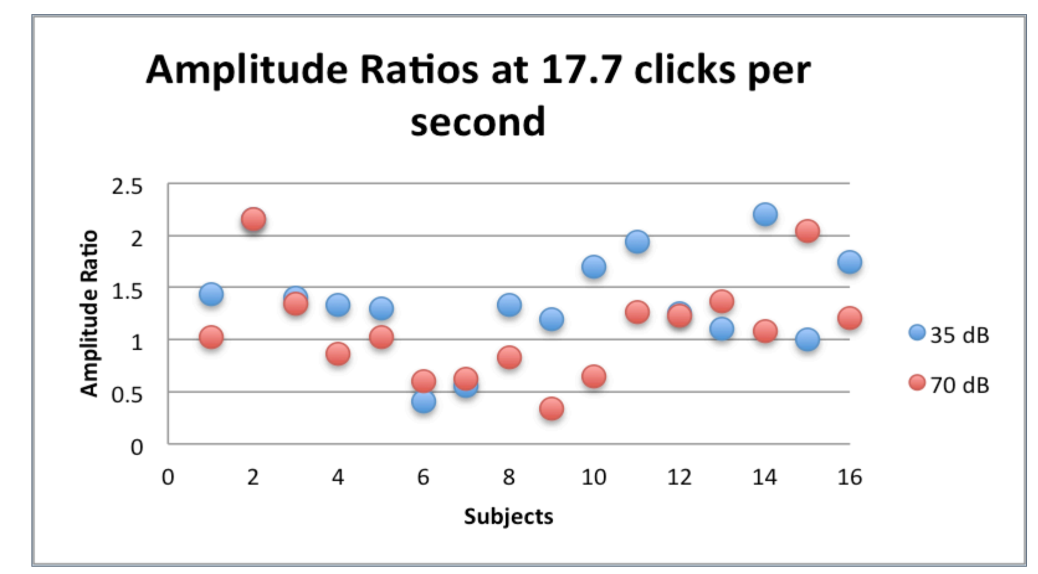


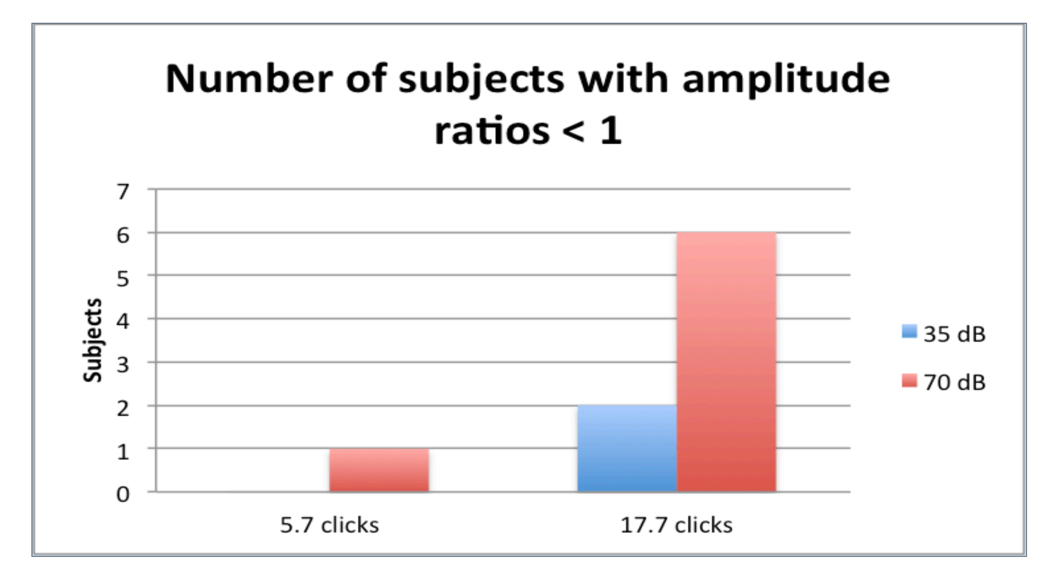


Results

Effect of repetition rate on amplitude ratio:







Results

- No significant changes were noted in the latency or amplitude of ABR or MLR as a result of repetition rate.
- Wave V latency was significantly decreased for high intensities at 5.7 clicks per second. Although not statistically significant, the latencies of NA and PA also decreased at high intensities.
- The latency of Wave V and Na were significantly affected by changes in intensity at 17.7 clicks per second.
- Interwave latencies remained approximately the same across all recording conditions
- No significant change in amplitude due to intensity was noted in any of the waves at 5.7 clicks per second. However, there was a trend toward higher amplitudes at higher intensities for all of the waves.
- The amplitude of Wave V was increased significantly at high intensities at 17.7 clicks per second
- All but one subject had a Pa/Wave V amplitude ratio greater than one in the 5.7 clicks per second recording condition
- Eight subjects exhibited Pa/Wave v amplitude ratios less than one at the 17.7 clicks per second recording condition

Discussion and Conclusion

The amplitude ratio between wave V and the Na-Pa complex appeared to be the most sensitive index to changes in stimulus. At 35 and 70 dB n HL, significant effects were noted in the amplitude of wave V, but not in the amplitude of Na-Pa. As expected, the amplitude of Na-Pa was greater than that of ABR wave V at low repetition rates. However, this was not true at high repetition rates, where the amplitude of Na-Pa was significantly reduced while wave V remained relatively stable, creating a marked change in amplitude ratio.

The effects of repetition rate on the amplitude ratios of the ABR and MLR could have important implications for the understanding of refractoriness of the generator sites of the ABR and MLR. Additionally, based on previous reports in the literature (Musiek et al. 1997), findings suggest that with the development of normative data, the amplitude ratios of simultaneously run ABR-MLRs could be diagnostically useful in patients with neurological impairment. The present data indicates that, at low repetition rates, a Wave V amplitude that exceeds that of the Na-Pa wave could have diagnostic implications.

References

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