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# **(Central) Auditory Processing Disorder**

**An Evidence-Based Review for  
Using Electrophysiological Measures  
for Diagnosing (C)APD**

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# Overview



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- Definition- Auditory Processing
- Testing Recommendations
- Electrophysiological Measures
- Recommendations

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# (Central) Auditory Processing Disorder



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Purpose: Provide evidence based review to encourage use of available Electrophysiological tools in the Assessment (C)APD Patients



# What is Auditory Processing?



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- What the brain does with what the ears hear (Katz, 1994)
- American Speech-Language Hearing Association
  - Sound localization and lateralization
  - Auditory discrimination
  - Auditory pattern recognition
  - Temporal aspects of audition, including temporal resolution, temporal masking, temporal integration, and temporal ordering
  - Auditory performance decrements with competing acoustic signals
  - Auditory performance decrements with degraded acoustic signals



# Common Characteristics



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- Attention problems, recalling information presented orally & carrying out multi-step directions
- Poor listening skills & low academic performance
- Need more time to process information
- Behavior problems
- Have language difficulty (e.g., they confuse syllable sequences and have problems developing vocabulary and understanding language)
- Difficulty with reading, comprehension, spelling, and vocabulary



# (C)APD Assessment



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## ASHA Recommendations (Subjective & Objective)

- Auditory discrimination tests
- Auditory temporal processing and patterning tests
- Dichotic speech tests
- Monaural low-redundancy speech tests
- Binaural interaction tests
- Electroacoustic measures
- Electrophysiologic measures



# Reliability?



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## Subjective measures

- Attention
- Motivation
- Memory
- Variability
- Lack of understanding of task
- Cognition



# Electrophysiological Measures



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## Clinical AEPs used for assessing (C)APD

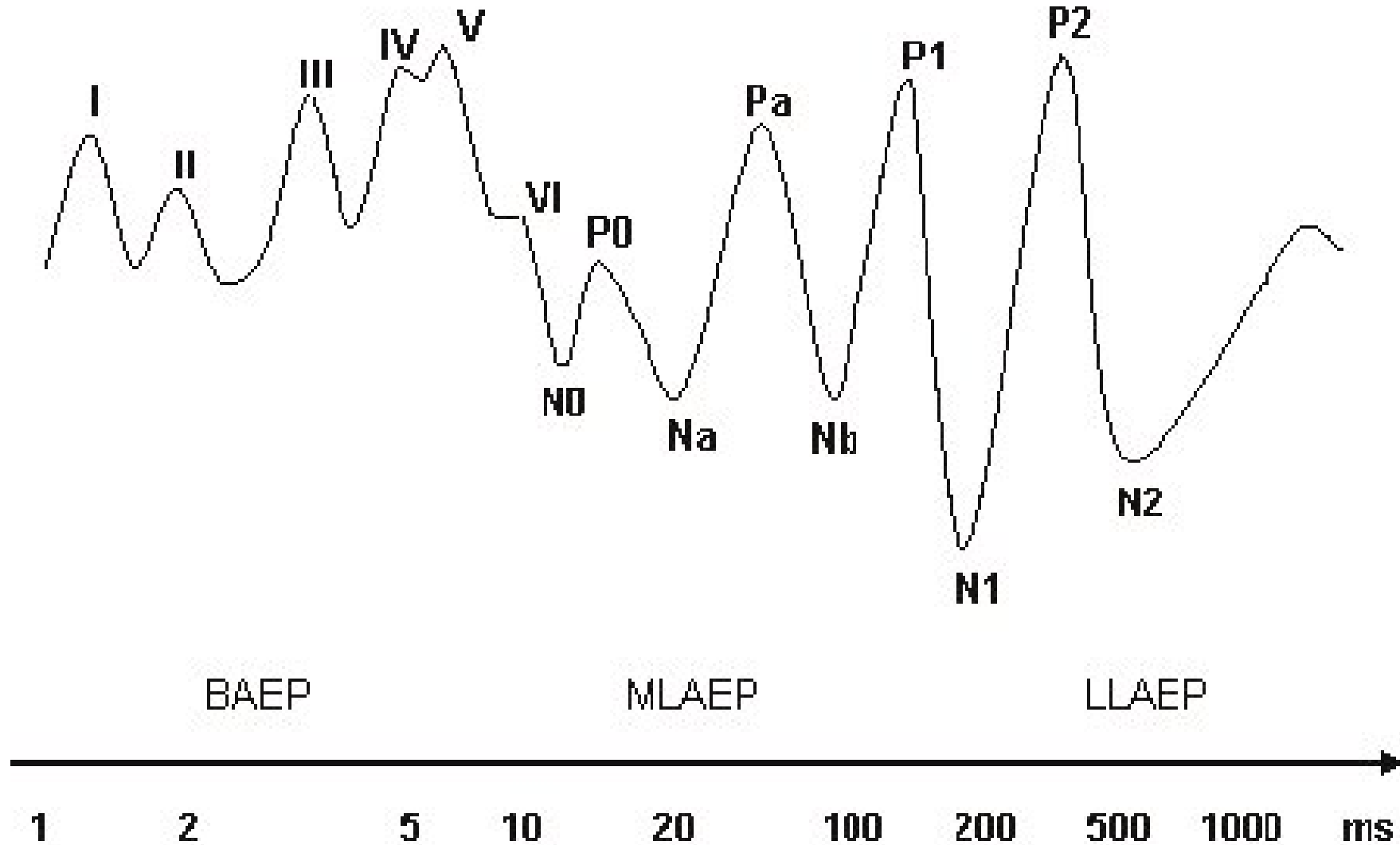
- Auditory Brainstem Response (ABR)
- Middle Latency Response (MLR)
- Mismatch Negativity (MMN)
- P300



# Electrophysiological Measures



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# Auditory Brainstem Response



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Wible et al (2005) speech AEP to investigate brainstem & cortical responses to the speech sounds /da/ & /ga/ in 20 children

- Abnormal encoding of speech sounds on both brainstem & cortical processing measures in Language Impaired group

Banai et al. (2007) reviewed studies on the relationship between speech-ABR & click-ABR & their relationship with APD

- Abnormal Speech-ABR in 40% of children with LD based on wave V-Va latencies greater than 1.5-2 SD



# Middle Latency Response



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Arehole et al. (1995) 22 subjects, 11 with learning disabilities (LD)

- Minimal amplitude differences between groups
- Latencies for Pa significantly longer in LD group
- Asymmetric latencies in contralateral recordings for LD group

Purdy et al. (2002) 10 children with learning disabilities and 10 children with no reported learning disabilities.

- MLR latency & amplitudes significantly different between tgroups



# Mismatch Negativity



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Kraus et al. (1996) 91 children with learning disabilities  
to 90 normal hearing children with no reported  
learning disabilities

- Small or absent in 40% in LD group
- Small or absent in 10-15% Control group



# P300



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Clontz and Jirsa (1990) found children with (C)APD had significant differences compared to control group

Jirsa (1992) 20 children diagnosed with (C)APD compared to 20 normal children

- Significantly longer latencies and smaller amplitudes



# Discussion



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Currently electrophysiologic measures are not able to replace the behavioral test battery for auditory processing disorders

However, current research has shown electrophysiological measures provide useful information about the physiology and integrity of the auditory system



# Recommendation



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Electrophysiological results have been able to distinguish between those children who exhibit the behavioral characteristics of an auditory processing disorder and those who do not exhibit such behaviors (Kraus et al. 1996)

Changes in the neurophysiology have been shown between pre-and-post listening intervention data, thereby giving an objective way to monitor progress (Kraus et al. 1996)



# Conclusion



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Given the potential effects of (C)APD on communication, learning, school and job performance, and social functioning, it is imperative that audiologists assess the integrity of the central auditory nervous system (CANS) in patients with TBI to fully document the scope of system deficits and to maximize treatment efficacy in rebuilding the patients' lives (Musiek and Chermak. 2008)