Auditory Processing Disorder

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Auditory processing is not only what we hear, it is how we process and use the information that we hear.

Auditory Processing Disorder (APD) occurs when a listener does not effectively process auditory information.

Hearing

Central Auditory System

Auditory processing involves the following:
- Sound localization and lateralization
- Auditory discrimination
- Auditory pattern recognition
- Temporal (timing) aspects of audition
  - Temporal resolution
  - Temporal masking
  - Temporal integration
  - Temporal ordering
- Auditory performance with competing acoustic signals
- Auditory performance with degraded acoustic signals

Characteristics of APD

- difficulty understanding speech in background noise
- misunderstanding messages
- responding inconsistently or inappropriately
- frequently asking that information be repeated
- difficulty attending and avoiding distraction
- difficulty following complex auditory directions
- difficulty with sound localization
- reading, spelling and learning problems
- reduced musical and singing skills

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Categories of APD

- **Decoding** - ability to quickly and accurately process speech
- **Tolerance Fading Memory** - understanding speech in noise and short-term auditory memory
- **Organization** - maintaining proper sequence of information
- **Integration** - bringing information together, across modalities and processing centers

Decoding

- Definition
- Associated Communication and Academic Problems
  - Delayed responses
  - Word finding
  - Developing clear speech
  - Understanding what is said, receptive language
  - Phonics, spelling, oral reading / word accuracy
  - Grammatical morphemes
  - Articulation

Tolerance – Fading Memory

- Definition
- Associated Communication and Academic Problems
  - Understanding when noise or competing signals are present
    - Anxiety
    - Easily distracted
  - Reading comprehension difficulties
  - Expressive language
  - Short term auditory memory difficulties

Organization

- Definition
- Associated Communication and Academic Problems
  - Reversals
  - Messy, regularly lose things
  - Reduced spelling skills
  - Difficulty organizing ideas or thoughts

Integration

- Definition
- Associated Communication and Academic Problems
  - Auditory - Visual Integration problems
  - Extremely long delays
  - Dyslexia
  - Severe reading and spelling difficulties

4 Categories of APD
APD Categories

• Why should we use categories?
  - To understand how APD is relating to listener's issues
  - To explain APD more easily to parents, teachers and therapists
  - To develop a therapy program
  - To suggest appropriate environmental modifications

How APD is diagnosed

• Referral
• Case History / Medical History
  - Degenerative processes such as multiple sclerosis
  - Seizure disorders
  - Head trauma
  - Cerebrovascular accidents
  - Metabolic disorders
  - Cerebromorphological abnormalities
  - Neuro-maturational Delays, often secondary to auditory deprivation
  - Age related changes in CANS function
  - Family History

Hearing Evaluation

• Diagnostic Audiological Evaluation
  - Immittance
  - Air, Bone, Speech in quiet, Speech in noise
  - Otoacoustic Emissions

APD Test Batteries require the following types of tests:

• Auditory Discrimination Tests
  - Assess ability to discriminate stimuli that differ in frequency, intensity and/or temporal characteristics

• Auditory Pattern Recognition Tests

• Dichotic Tests
  - Assess ability to separate or integrate differing auditory stimuli presented to each ear simultaneously

• Monaural low-redundancy speech Tests
  - Assess recognition of degraded speech stimuli presented to one ear at a time

MEI’s APD Evaluation (age 7+)

• Buffalo Model Questionnaire
• Staggered Spondaic Word (SSW) Test
• Phonemic Synthesis Test
• SCAN 3 (adult or child version)

Buffalo Model Questionnaire

• Questionnaire completed by parents and/or teachers, therapists or caregivers

• 48 questions that may be indicators of APD
  - Each indicator is suggestive of an APD category

• Useful to compare history and test findings, to explain the potential role of APD and to show improvement with therapy
SSW Staggered Spondaic Word (SSW) Test

• Binaural test with different words going to each ear

• Administration:
  - 40 items
  - Approximately 7.5 minutes to complete
  - Norms for ages 6 to 60
  - Counterbalanced

• Normative data is available for total errors, response bias and qualifiers

Phonemic Synthesis Test

• Sound Blending Test

• Administration:
  - 25 test items

• Norms for quantitative and qualitative scores for each age group

SCAN - 3

• SCAN-3 (Child and Adult versions)
  - Filtered Words
  - Auditory Figure Ground
  - Competing Words
  - Competing Sentences
  - Time Compressed Sentences
  - Random Gap Detection
  - Ear Advantage

Behavioral / Qualitative Errors

• Delay
• Extreme Delay
• Perseveration
• Quiet Rehearsal
• Smush
• Quick

Other Evaluations

• Medical Evaluation

• Speech / Language Evaluation

• Psycho-Educational Evaluation
  - Cognitive and IQ testing

APD Evaluation

(4-7 years old)

• Auditory Skills Assessment
  - 3 main sections

• SCAN 3 C - screening

• SSW - Half list
Results → Therapy

• Diagnosis is made

• Specific APD deficits are determined

Current Research supporting APD Therapy

• Alonso et al. (2009)
  - Recorded behavioral and electrophysiological (P300) responses pre and post therapy
  - Results: 72.4% had normal APD tests after auditory training

• Hayes et al. (2003)
  - Assessed plasticity of perception and neural encoding of speech sounds in learning disabled children using speech evoked ABR’s
  - Results: Improved cortical representation of speech in quiet and in noise after training

Treatment of APD

• Direct Auditory Training
  - Purpose: to maximize neuroplasticity and improve auditory performance by changing the way the brain processes auditory information

• Environmental Modifications
  - Purpose: to improve access to information that is presented auditorily

• Compensation Strategies
  - Purpose: to strengthen central resources (language, attention, etc) and teach responsibility for active listening participation

Auditory Training Therapy

• Wide variety of activities that can be computer based, home based or involve direct therapy with a therapist

• Overview of MEI’s program:
  - Approx 14 – 50 minute sessions
  - Followed by retest
  - Can be billed to some insurance companies

Tenets of Buffalo Model Therapy

• Working from easy to a little bit harder
• Vary the tasks during a session and to avoid too much work in one session
• Remediate the basic issues first to more easily remediate the associated issues
• Parents/Partners are invited to sit in on therapy

Therapy – Decoding (DEC)

• Phonemic Training Program (PTP)
  - Teach the sounds of English individually

• Phonemic Synthesis (PS)
  - Sound blending program

• Other:
  - Sound Check
  - Same vs. Different
Therapy – Tolerance Fading Memory (TFM)

- Words in Noise Training (WINT)
  - Speech in noise training

- Short-Term Auditory Memory (STAM)
  - Short-term memory training for digits, words & working memory

Therapy – Organization

- Sequencing
  - Follows the same procedures as STAM but focusing on sequencing

- Auditory Directive Training

Therapy - Integration

- Dichotic Offset Training (DOT)
  - Gradually increasing overlap of right and left competing words

Other Therapies

- Localization Training
- Earobics
- Hearbuilders
- Rhyming Games
- Auditory Vigilance Training
- Prosodic pattern training

More Therapies!

- Apps
  - Sound Match
  - Voices
  - ABC Pocket Phonics
- Brain Fitness Programs
  - Posit Science
  - Lumosity

- Games
  - Marco Polo
  - Simon Says
  - Twister
  - Bopit
  - Simon
  - Pictionary
  - Video games

Outcomes of Buffalo Model Therapy

- Therapy – are skills maintained?
- Phonemic Synthesis
  - Quantitative errors decrease to 4 at retest from 11 at initial evaluation
- Speech in Noise
  - Ear difference initially results in equal performance after therapy
- STAM
  - Consistent improvements for digits, words and working memory
Results - Speech in noise

Typical pattern of progress on various speech-in-noise programs for children seen for therapy at Auditory Processing Service over the past 6 years.
(n= 60, ages 5-16 years with a mean of 8.8 years)

Environmental modifications

- Get attention before speaking
- Use slow and clear speech
- Use gestures
- Look and Listen
- Preferential seating, reduction in classroom noise
- FM system
- Pre-teach new concepts and vocabulary
- Written notes given before lecture
- Written instructions
- Ask for verification
- Please show an example of the 'finished product' if there is a new task to do

Compensation Strategies

- Strengthen central resources such as language, problem-solving, memory, attention and other cognitive skills
  - Chunking, mnemonics, paraphrasing
  - Deriving word meaning from context
  - Inferential reasoning, critical thinking
- Teach responsibility for active listening and problem solving techniques
- Self Advocacy Training

Keep in mind...

- Therapy can be completed with patients with hearing loss
- ADD, Autism and Low IQ are not contra-indications to therapy
- Age and general cognitive decline can play a big part in auditory processing

Cases

- AC
- KM
- BB

Questions?

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References