Information for Parents and Educators re: Auditory Processing Disorder Diagnosis and Treatment

Auditory Processing

Central auditory processing (CAP)—also seen in the literature as (central) auditory processing or auditory processing—is the perceptual processing of auditory information in the central auditory nervous system (CANS) and the neurobiological activity that underlies that processing and gives rise to electrophysiologic auditory potentials (American Speech-Language-Hearing Association [ASHA], 2005). Very concisely stated, central auditory processing may be explained as "**what the brain does with what the ears hear**" (Katz, 1994). Auditory processing consists of mechanisms that preserve, refine, analyze, modify, organize, and interpret information from the auditory periphery and include auditory discrimination (e.g., auditory closure), temporal processing (e.g., temporal resolution, temporal ordering, and sequencing, temporal masking, temporal integration) and binaural processing (e.g., binaural interaction, localization, lateralization, dichotic listening).

Auditory Processing Disorder (APD)

An auditory processing disorder is an information or sensory input problem. Terms used to describe a processing disorder may vary based on the perspective of the professional describing the problem. Terms include, but are not limited to, "auditory processing disorder," "(central) auditory processing disorder," "language processing disorder," and "auditory information processing disorder." A student with auditory processing disorder has normal hearing sensitivity but has difficulty with the reception and interpretation of auditory information. The student with auditory processing disorder has trouble making sense out of what is heard. Although the sounds are loud enough, the student has difficulty understanding the message, therefore often acting like someone with a hearing loss or attention deficit. ASHA and AAA use the term Central Auditory Processing Disorder (CAPD) to refer to deficits in the neural processing of auditory information in the CANS not due to higher-order language or cognition, as demonstrated by poor performance in one or more of the skills listed above (ASHA, 2005; AAA, 2010).

Comprehensive Test Battery

Auditory processing disorders are diagnosed by the pattern of the overall scores of the test battery, as well as by the primary behaviors observed by the parents and/or other professionals. The test battery is administered to assess various levels of auditory processing ability and may include the subjective questionnaires and objective tests listed below:

Questionnaires

- Auditory Processing Domains Questionnaire (APDQ) is a differential screening tool for children's listening and learning which looks at the relative strength of a student's auditory processing, attention, and language skills. Using this questionnaire, parents and/or teachers of 7 to 18-year-olds rate a student's skills on 50 key items which can be readily observed in daily life. A REPORT is then made outlining the student's relative risk profile for Hearing-Auditory Processing, Attention, and Language-Learning disorders. REPORT findings have been very useful in guiding clinical referrals, with screening accuracy reported in the 70 to 85% range.
- Modified Amsterdam Inventory for Auditory Disability and Handicap Inventory is a self-assessment questionnaire that consists of 30 questions covering all the relevant factors of disability in individual hearing functioning in daily life.
- Vanderbilt Fatigue Scales (VFS) is a suite of self- and proxy-report scales specifically designed to identify significant listening-related fatigue in individuals with hearing loss and other communication-based difficulties.

Diagnostic Tests

Auditory Process	Description	Tests used to assess
Dichotic processing	a different speech stimulus is simultaneously presented to each ear and the patient repeats back one or both stimuli	Dichotic digits test, competing sentences test, staggered spondaic words test
Temporal processing	a broad category that includes skills related to processing changes to the auditory signal over time	Frequency pattern test, duration pattern test, gaps in noise test, random gap detection test
Auditory closure	monaurally presented speech is degraded through filtering, the addition of noise or reverberation, and/or time compression	QuickSIN, BKB-SIN, Filtered speech test, Compressed speech test
Binaural interaction	complimentary inputs that differ in time, intensity, or spectral characteristics of otherwise identical stimuli are combined across the ears to support the perception of an auditory signal's spatial location	Masking level difference test, LiSN test

Intervention Components

The major components of a comprehensive, multidisciplinary intervention approach are segmented into bottom-up and top-down treatments (Chermak & Musiek, 2007).

- Bottom-up (i.e., stimulus-driven) intervention approaches include:
  - auditory (and multimodal) training (i.e., direct auditory) skills remediation to strengthen the auditory brain
  - environmental modifications (i.e., approaches that increase clarity of signal and/or improve the listening environment, including remote microphone hearing assistive listening systems, improved room acoustics, etc.)
- Top-down (i.e., strategy-driven) intervention approaches build listening skills and strategies, promote efficient allocation of perceptual and higher-order resources (e.g., language, memory, attention), and provide compensatory methods to minimize functional listening deficits. These include:
  - central resources training (i.e., language strategies, cognitive strategies, and metacognitive strategies)
  - educational interventions (i.e., instructional modifications and learning strategies)

Auditory Training

Auditory training (AT) is an important component of rehabilitation for patients with central auditory processing disorder (CAPD). Four broad types of auditory processes are measured by the tests included in the diagnostic CAPD battery. A typical AT intervention addresses one or more of these auditory processes and underlying skills. Both the results of the CAPD diagnostic battery and the functional deficits presented by the patient drive which areas are selected for training.

Dichotic Processing deficits-

- Dichotic Interaural Intensity Difference (DIID) Training - https://auditec.com/tag/dichotic-interaural-intensity-difference/
- CAP-DOTS - https://capdots.com/
- ARIA (Auditory Rehabilitation for Interaural Asymmetry) Training - https://www.dichoticsinc.com
- Zoo Caper Skyscraper - https://acousticpioneer.com/auditorytraininggames.html

Temporal Processing deficits-

- Classic Simon Board Game or app - https://apps.apple.com/us/app/the-simon-game/id1530976352
- Insane Earplane - https://acousticpioneer.com/auditorytraininggames.html
- Auditory Pattern Training app
- Hear Beyond app – Sound Match, Volume Steps, Frequency Stack, Melodic Memory

Auditory Closure deficits-

- Listening and Communication Enhancement (LACE) - https://laceauditorytraining.com/
- BrainHQ - https://www.brainhq.com/
- Hear Beyond – Speech in Noise
- Auditory Training Lessons - https://auditec.com/2015/09/21/auditory-training-lessons/
- Miller-Gildea Vocabulary Building
- Hearoes app
- Story in Noise (StiNT) app

Binaural interaction deficits-

- Hear Beyond – Localizer in Noise, Localizer 360

Training Schedule: Auditory training should be intensive and usually is conducted three to four times per week for 20 to 30 minutes for six to eight weeks, or as prescribed by the specific training program. Booster sessions are beneficial for maintaining performance.