Auditory Processing Disorders and How the SLP Can Help

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The Neurology

• Ear – Peripheral Nervous System
• Outer, middle and inner ear
• Hearing acuity – ability to detect the acoustic signal
• APD diagnosis = normal hearing acuity

Central Auditory Nervous System

• 8th cranial nerve/ cochlear nerve leaves the ear
• Travels through the brainstem
• Terminates in the temporal lobe of the cortex at Herschel's gyrus

More complex

• Ascending and descending pathways
• Begins to cross over at the brainstem level
• Bilateral pathways
• The pathway that crosses over is dominant
• CAPD tests both ears, often a difference
• Corpus Callosum – connects right and left hemisphere: Integration deficit

Left and Right Hemisphere

• Left hemisphere- dominant for language, oriented to details
• Right Hemisphere -dominant for visual and spatial processing, gestalt processing, concepts and main ideas, thinking outside the box, imagination
• Treatment strategies
• Student strengths
Lobes and Zones

- Three sensory lobes:
  - Temporal – auditory
  - Parietal – tactile
  - Occipital – visual input

- There are three zones in each lobe of the cortex:
  - Primary – receives the signal
  - Secondary – attaches meaning to the signal, interprets the signal, and associates with previous input
  - Tertiary – integrates information from each lobe with the other lobes, respond to stimuli, expression

CAPD vs. Language Processing Deficit

- Central Auditory Processing Deficit
  - The acoustic signal is not transmitted well via the 8th cranial nerve and the central auditory nervous system pathway
  - The acoustic signal is not intact when it reaches the primary zone of the temporal lobe, it is hard to interpret and attach meaning in the secondary zone
  - Wait! What?

- Language Processing Disorder
  - The acoustic signal reaches the primary zone intact
  - Difficulty processing the meaning of what was said.
  - The acoustic signal has to be analyzed for language components
  - I understood what you said but I don’t know what it means – Huh?

- Brain is complex.

CAPD, (C)APD, APD

- What do we call it?
- In 2005, ASHA committee - (C)APD.
- American Academy of Audiology, Clinical Practice Guidelines – 2010 – (C)APD
- Many audiologists and SLP’s - CAPD.
- APD - auditory and language processing deficit
- APD - auditory processing deficits not officially diagnosed by an audiologist.

Common Symptoms of CAPD

- Difficulty understanding speech in noise or reverberant acoustic environments
- Difficulty localizing sound
- Difficulty hearing on the phone, PA systems
- Difficulty answering questions appropriately
- Difficulty following rapid speech
- Frequent requests for repetition/rephrasing
- Hyperacusis
- Speech sound production errors
**Auditory Processes - ASHA**

- **Auditory Discrimination**: The ability to notice, compare and distinguish the distinct and separate sounds in words.
- **Auditory Figure-Ground Discrimination**: The ability to pick out important sounds from a noisy background.
- **Auditory Memory**: The ability to remember something one has heard very recently as well as recall something one has heard a long time ago.
- **Auditory Sequencing**: The ability to understand and recall the order.

**Audistolgist CAPD Testing**

- Tax the auditory nerve pathway with speech and non-verbal stimuli.
- Sound localization and lateralization.
- Auditory discrimination.
- Auditory temporal processing.
- Auditory pattern processing.
- Dichotic listening.
- Competing acoustic signals.
- Degraded acoustic signals.

**CAPD Test Results**

- 5 major types of specific central auditory processing deficits.
- Neurologic correlates.
- SLP friendly.

**Auditory Decoding Deficit**

- Hat or Cat?
- Primary (left) Temporal lobe – primary zone.
- Analyze and detect fine acoustic differences in speech, analyze the sound or word.
- Fought a cat? Or bought a hat?
- Weak spelling, reading decoding, understanding speech.
- Noise of any kind makes much harder to discriminate.
- Always have to work harder to process speech.
- Difficulty with phonological semantics because hard to discriminate; tenses, plurals, subject-verb agreement, etc.
- Fatigue, overload, harder to process more complex language.
- Working so hard to understand which words are being said, that can lose the meaning.

**Prosodic Deficit**

- How you say it has meaning.
- Right temporal lobe and association areas.
- Prosodic elements change the meaning of what is being said without changing the words.
- Stress. Duration, rate, pitch.
- Weak Gap detection = periods, comma's, ideas.
- Conversational turn-taking.

**Integration Deficit**

- Huh?
- Corpus Callosum - Inter-hemispheric communication.
- Trouble integrating new and previously learned content.
- Difficulty understanding the big picture and how things are related.
- Difficulty learning symbols, weak visual memory for spelling and reading.
- Weak visual-motor, hard to watch, listen, and take notes at same time; hard to listen and read at the same time.
Auditory Associative Deficit
What does that mean?
- Left temporal lobe secondary zone and association areas
- Attaching meaning to auditory signal, rules of language
- Weak vocabulary, dictionary definitions difficult
- Receptive and expressive language deficits, understanding complex sentences, embedded sentences, negatives, complex language
- Word finding deficits with semantic errors
- Poor understanding of multiple meanings, idioms, sarcasm
- Poor reading comprehension, difficulty discerning the main idea, too literal
- Poor math application and story problems

Output/Organization Deficit
“Uh, well, mmm…”
- Left Temporal Lobe, secondary and tertiary zones, descending pathways
- Word finding deficits: vague and imprecise
- Difficulty discerning importance or relevance of an idea
- Oral and written expression deficits, incomplete thoughts, vague descriptions, missing details
- Traffic jam
- Trouble following directions
- Weak auditory memory, poor recall
- Poor sequencing and organization of thoughts and ideas, can’t explain things or give directions

Extra Challenges with CAPD
- Cell phone, voicemail
- PA systems, announcements, speakers
- TV
- Accents and dialects
- Lunchroom, playground
- TV and music at home, in car
- Gymnasium, auditorium, museum
- Understanding lyrics in music

Challenges continued
- Listening to coaches
- Slumber parties
- Restaurants
- Relationship issues
- Getting the joke
- Keeping up with group conversation
- Rules of games

ADD/ADHD
- CAPD and ADD/ADHD have some similar characteristics that can lead to confusion
- ADD/ADHD is far more commonly known, and far more commonly diagnosed
- ADD diagnosis: correct, incorrect, incomplete
- High rate of comorbidity – up to 50%
- Appropriate testing leads to differential diagnosis
- Treatment is very different!

ADD/ADHD Characteristics
- Inattentive, Hyperactive, Impulsive
- Type depends on which characteristics predominate
- ADD – inattentive type, quiet, zoned out
- ADHD – hyperactive type
- ADHD – inattentive and hyperactive
- Difficulty following directions, tuning out, underperforming in school
- Sound familiar?
Remember the Reticular Formation?
- Reticular formation is in the brainstem
- Tells upper cortex (prefrontal cortex) which signals to pay attention to. – Hey! Wake up! Pay attention! The teacher is still talking
- or which signals to ignore - Relax! don’t pay attention to the kids in the hall.
- ADD/ADHD: the reticular formation does not work properly

ADD and/or CAPD
- Both disorders involve the reticular formation in the brain stem
- Both disorders can make it difficult to process incoming auditory stimuli
- Both disorders can result in difficulty following directions, following conversations, following classroom instruction, organizing

Differential Diagnosis
- Characteristics Checklist
- Takes a team – psychologist, psychiatrist, audiologist, speech and language pathologist, physician/pediatrician.
- Specific testing for ADD/ADHD- questionnaires, computer based, rating scales
- CAPD testing with an audiologist
- Language processing testing
- Bottom up treatment is different – improving functioning of the nerve vs. medication

Bottom-up
Top-down
Evidenced based
Neurologically based
Suggestions for Teachers
Technology
IEP Accommodations

TREATMENT
- Understand the deficit
- Know what you are treating
- Understand the impact of the deficit. How does it affect this student?
- Is your treatment helping the student in the classroom, with social situations, with homework, with life?
- I do it, we do it, you do it

Strengths
- Understand and use the student’s strengths
- Their strength will use a different part of the brain that works very well
- Learning and using strengths helps build confidence and leads to success
Young children
- The Central Auditory Nervous System does not fully develop until the ages of 7-8 years old.
- A diagnosis of CAPD cannot be made prior to that time
- Symptoms of auditory discrimination deficit would be most apparent at an earlier age.
- Phonological processing skills should be emphasized if young children are showing early signs of poor discrimination
- Dr. Seuss!

Bottom-up: Using Computer Based Programs
- Controversy surrounding computer based programs; disagreement amongst researchers
- Earobics, Fast ForWord
- What is the deficit? What are you treating? What does the program target? What age group?
- Know the computer requirements
- Can be a great tool if used correctly

Assistive Listening Device
- Recommended by the audiologist
- Depends on type of auditory processing deficit
- Student wears ALD, teacher wears amplifier
- Filters out the extraneous background noise
- Reduces the strain and fatigue of listening to speech
- Stigma about wearing “hearing aids” must be overcome

Bottom-up Approach
- Auditory Discrimination Deficit
- Train the nerve pathway to discriminate speech sounds in isolation and in words
- Teach discrimination, spelling and reading at the same time
- What sounds can/can’t the student discriminate?
- How many sounds can they discriminate at once?
- Those tricky vowels

Feel the sounds – say the sounds
- Learn to feel the sounds
- The SLP advantage – we know how all of the sounds are produced!
- Associate the feeling with the sound with the letter

Now start building
- Two sounds – two letters
  - Say it and feel it:  am
  - Segment the sounds: a m
  - Spell it/Write it as you say it: a m
  - Read it
  - Go through big variety of CV and VC combinations until it is easy to say, segment, spell and read at this level
Three-sounds/three letters
- CVC, VCC combinations
- Say it, feel it: pan
- Segment it: p a n
- Spell it/write it as you say each sound: p a n
- Read it
- Start creating phrases and sentences with only two and three letter words (no sight words)
- Fat cat, big red dog, tip top, hot red sun

Four sounds, four letters
- CCVC, CVCC
- Say it, feel it: lump, fast, sand
- Segment: l u m p
- Spell it/write it as they say it: l u m p
- Read it: lump
- Read phrases and sentences with 2, 3, and 4 letters and four sounds
- Jump fast in the sand.

Five sounds, Five letters
- CCVCC, CCCVC, CVCCC
- Say it, feel it: grasp
- Segment it: g r a s p
- Say it: grasp
- Spell it as you say each sound: g r a s p
- Read it: grasp
- Read phrases and sentences with 2-5 letters and sounds

Multiple Syllables
- Two syllable compound words with regular spelling:
  - Hotdog
- Now say and segment the syllables: hot dog
- Use both hands to help segment the syllables: motor component, bilateral allows for greater segmentation, NOT CLAPPING

Multiple Syllables
- Say the word (may not be able to say it without segmenting it first)
- Segment the word by syllable – use hands
- Spell each syllable as they say each syllable
- Requires discrimination, sequencing, memory

Reading Multiple Syllables
- Looping understand
- Separate syllables: un der stand
- Color and separate: un der stand
- Color only: understand
- Segment and say with hands
- Repetition
- Don’t worry about perfect syllable segmentation
Prefixes and Suffixes

- Direct instruction in meaning
- Loads of examples for each one
- http://itools.subhashbose.com/wordfind
- Rewards: Reading Excellence: Word Attack & Rate Development Strategies, Multisyllabic Word Reading Strategies by Anita Archer, Mary Gleason, Vicky Vachon

Word Families

- Discrimination, semantics, sequencing, visual processing
- Hear it, say it, read it, understand it, spell it, use it
- Under
- Understand
- Understanding
- Understandable
- Misunderstand
- misunderstanding
- misunderstandable

No Guessing!!!

Reading Processing Strategies

- Isolation
- Repeated isolation
- Context
- Repeated Readings – one minute
- Preview new and difficult words

Typical Spelling Books are Hard

- Very difficult for those with deficits in sound discrimination, auditory memory, visual memory, sequencing, semantics, language learning
- Kids with CAPD need to learn to spell and read in a logical, predictable way
- Need direct instruction in rules, irregularities, meaning, morphological endings

Now it gets harder American English

- 10% of American English is spelled irregularly, i.e. not a sound to letter correlation
- Almost no dyslexia in Italian speakers – no irregular spellings, no vowel distortions
- American accent makes it much harder to spell and read
- Much higher rate of dyslexia with American English than British English
American English examples

- About – the dreaded schwa!
- 10 ways to spell the long e sound
- t/d – literally
- Voiced/voiceless – common to voice a voiceless consonant in American English –
- Picture: ture vs. cher
- Facial, glacial
- If it applies, say with British accent!

Other Irregularities in English

- Irregular spelling – Can’t count on the sound to match the symbol
- English influenced by many languages, so less consistent and predictable rules
- Digraphs, r-controlled vowels, long vowels, the letter y, -ng, vowel variations
- Sight words - do not spell them how we say them
- Homonyms, homophones

Irregular spelling

- Challenges visual memory, auditory memory
- Very hard to learn with CAPD
- Accents
- GET CLOSE ENOUGH
- Technology

Help!

- For digraphs, r-controlled vowels, long vowels, vowel digraphs, consonant digraphs, and some early rules of spelling:
  Phonics Pathways, 9th edition, Clear Steps to Easy Reading and Perfect Spelling by Dolores G. Hiskes

Lipreading

- Severity of auditory decoding deficit
- Severity of noise
- motivation

For spelling rules of and irregular spellings with consonants: Learn to Spell 500 Words a Day, Book 6: The Consonants by Camilia Sadik
The author’s premise does not apply to children with CAPD or language processing deficits, however she covers many spelling rules and provides many examples of each
Prosody
• How it is said changes the meaning
• Gap detection
• Stress, duration, rate, pitch
• Requires discrimination practice, direct semantic instruction, listening practice, and expression
• Major impact in understanding conversation, humor, sarcasm, jokes, teasing
• Understanding turn taking behaviors, periods, commas

Prosody
• Bob took Kim to the movies?
• What does it mean with different words stressed, gaps, duration, pitch?
• Listen and process
• Say it with different stress, gaps, duration pitch
• Write it with different stress, gaps, duration pitch (bold, underline, spacing, color)

Listening in Noise
• Different noise types in background
• Soft, medium, loud
• Increasing length and complexity of speech signal
• Differential Processing Training Program by Kerry Winget – Acoustic Tasks
• Hearbuilder
• LACE – Neurotone

What was that about?
• Listening for the gist
• Strategy that has to be practiced
• Summarize without detail (names, new words)
• Single sentence to multiple paragraphs
• Names, new vocabulary can be given ahead (teacher recommendation also)

Reading for the gist
• Teach to read for main ideas, or gist, FIRST
• Don’t annotate first time through
  — Don’t circle new vocabulary
  — Don’t underline
• Different approach
• Names, words always there
• Freedom

Visualize
• Uses the occipital lobe
• The first of many ways to use visualization
• Create a picture in your mind, image it happening
• Takes practice and intention
• Directions, stories, social studies, science, news
• While listening and reading
• What did you see?
• Single sentence to paragraphs
Sequencing
- Auditory memory, discrimination, association, output/organization
- Where is the breakdown?
  - At the word level?
  - At the single sentence level?
  - Following multistep directions?
  - Understanding order of events?
- For use in listening and reading tasks
- The essential piece is being able to hang onto the signal long enough to attach meaning, and then manipulate and order the content when it is not in sequence.

Sequencing - importance
- more important, more importantly, most important, most importantly, least important, least importantly, least, last but not least, of primary importance, of least importance, of secondary importance, second, better, best, first, last

Sequencing
- SIGNAL / TRANSITION WORDS FOR RECOGNIZING SEQUENCE
  - first, second, third, etc, at the beginning, finally, prior to, afterwards, shortly, thereafter, while, subsequently, soon, next simultaneously, at the same time, then, following that, when, later, now, soon, during, at (in) the end, the first/next/last thing, before, Last

Sequencing
- Start at the point of breakdown
- Process sequence within a single sentence
- Building length and complexity within a sentence
- Build to multiple steps or sentences
- Applies to listening to directions from teacher, coach, parent; math story problems; novels; science experiments; history and social studies events

Sequencing
- Add visual and motor components to help as well
- Understand sequence, follow a sequence, create a sequence
  - Speak or write sentences, directions, story problems that include sequence words
  - Still working on changing how the brain is processing information, building associations, integrating with right hemisphere, occipital and parietal lobes

Vocabulary
- Decoding/Discrimination, auditory memory, word finding, association, integration, output
- Many reasons why understanding, learning, and using new vocabulary can break down within CAPD
  - Tier I, Tier II, Tier III
- Classroom, novel, text
- Vocabulary learning strategies will help with word finding difficulties as well
Vocabulary

- “Shouldn’t the classroom teacher be teaching vocabulary?”
- “Absolutely! But our students do not learn vocabulary in the same way.”

Vocabulary

- Say it, read it, understand it, use it
- Dictionary definitions, textbook definitions
- What on earth does that mean? Meaningless
- Student friendly dictionaries
- Longman English Dictionary Online:
  - www.ldoceonline.com/(also in book form)
  - www.wordsmyth.net
  - American Heritage Student Dictionary

Vocabulary

- 
  - Scoundrel: what does it mean?
  - Dictionary definition
    - A disreputable person
  - Student friendly definition
    - A mean or wicked person, villain
  - Scrape:
    - Dictionary definition
      - To make a surface smooth or clean with strokes of an edged instrument or an abrasive
    - Student friendly definition
      - To clean or smooth by rubbing

Vocabulary

- Discrimination – segment, hands, color, space
- What does it mean in STUDENT’S own words
- What it is like – synonym or description
- Make it personal – examples
- What it does not mean
- Draw it, pictures, google search images
- Use it in at least 2-3 different sentences of their own

Vocabulary

- Learning from context
- What is the gist?
- Give 2 choices
- Generate possibilities

Word Finding Problems

- Where is the breakdown?
- Decoding/Discrimination – hard to discriminate, hard to store, hard to retrieve
  - Phonological errors, phonemic substitutions, original words, “I don’t know what it is called.” “It is something like, crayon, cranium, cranium
  - Intervention will focus on segmenting syllables, same-sound syllable cues, rehearsal (with hands and visuals)
Word Finding Problems

- Auditory Association Deficit—
  - Slow and inaccurate retrieval
  - Semantic errors
  - Misuse of words
- Intervention will focus on semantic strategies, mnemonics, gestures, key features

CAPD and Word Finding

- May have multiple error types, need multiple interventions
- Understand the breakdown, build back up

*Word- Finding Intervention Program, Second Edition (WFIP 2) by Diane J. German*

Oral and Written Expression

- Output/Organization Deficit
- Distinguish from Language Processing Deficit
- CAPD
  - Vague expression of ideas
  - Incomplete thoughts
  - Poor sequencing
  - Missing details
- Hard to hang on to an idea (language) long enough to express it. The traffic jam. Oral expression easier than written expression.

Expression - Segmenting Ideas

- Graphic Organizers can be overwhelming to these students – may cause them to freeze
- So, modify
- Brainstorm their ideas
  - Get all the ideas out in any order
  - A Few words – not whole sentences- for each idea
  - Review all ideas, check for any more
  - Number ideas to sequence
  - Expand the ideas into full sentences in order
  - Do it together at first, build independence

Expression – Segmenting Ideas

- First: student dictate to therapist
- Dictate one sentence at a time
- Say Period!
- When student types/writes, they should say their whole sentence out loud first, then write and say Period!
- Dragon dictate
- Keyboarding

Abstract Language

- Auditory decoding, association, integration, prosody, output
- Working too hard to process signal
- Jokes
- Idioms
- Sarcasm
- Inference
- Multiple meanings
- Academic and social implications
### Abstract Language

- Direct Instruction
- ALWAYS IN CONTEXT
- Literal interpretation
- Differentiate
- Provide choice of 2 or 3 options
- Generate options

### Abstract Language

- Create your own
- Apply to own life
- Act it out
- Facial expression
- Gestures

### Top Down Strategies

- Modify the environment
- Teach the student compensatory strategies
- Provide modification and differentiation strategies to the teachers
- Technology
- IEP, 504, OHI Accommodations

### Reduce the Language Load

- Auditory decoding, memory, association, integration,
- Listening and reading
- Includes processing sequential information
- Primary principal, many manifestations
- Provide for student
- Teach student independence
- Provide instruction for teachers, parents, coaches

### Reduce the Language Load - Listening

- Alert/Headline
- Rephrase, fewer words
- Sequence in order
- Student repeats back in own words
- Rehearse, use gestures, visualize
- Write it down

### Teacher directions spoken aloud to the class:

- “Grab your frog and look at the fore and hind legs, comparing length and structure. Observe the membrane of the eyes and determine name. Open mouth and locate vomerine teeth behind and between the nostrils. Touch the tympanic membranes located behind the eyes. Find the eustachian tubes. Once all done, start dissecting.”

### Reduced:

- First - front and back legs. What do they look like?
- Next - eyes What is covering them?
- Third – locate teeth up near the nose
- Fourth - go into the ears and find the tubes
- Last- start dissecting.
**Reduce the Language Load - Listening**
- Provide new vocabulary, names, places, dates, etc. **before** classroom lecture or discussion
- Provide class notes
- Note taking technology

**Reduce the Language Load – Reading Non-fiction**
- Taking notes
  - Key words, phrases
  - Outline, diagram
  - Arrows, pictures, color
  - Tell it back

**Reduce the Language Load – Reading Novels**
- Character charts
- Timeline
- Key places
- Problems
- Themes
- Pictures, color, arrows, diagrams
- Cliff notes

**Visualization**
- A picture is worth a thousand words
- Textbooks – LOOK
- Google images
- Google videos
- You-tube
- Kahn Academy
- Math – pictures, diagrams, manipulatives, visual representations

**Visualization**
- Draw it
- Diagram it
Word Banks

- Decoding deficits, word finding deficits, auditory memory deficits, output/organization
- Tests
- Pre-teaching
- Class lectures, discussions
- Assignments
- Decoding strategies if needed

Technology

- Mac
- NO SPELL CHECK
- Control click
- Auto-correction box
- Highlight text to speech
- Speech to text – microphone
- System Preferences– Universal Access -Voice over
  - White on black screen - Zoom

Technology

- Kurzweil
- Cowriter
- Smart pen
- Note taking apps
- Dragon dictate
- Siri
- TEXTING!!

Accommodations – IEP, OHI

- Preferential seating – auditory and visual
- Class notes
- Teacher edition of text
- Word banks for tests
- Say aloud spelling words
- Rephrasing of directions, student repeats
- Study guides, summaries, cliff notes
- Listening breaks

Accommodations – IEP, OHI

- Access to technology
- Large print
- Modified tests
- Modified assignments
- Extra set of textbooks
- Class assignments written down
- Reduce extraneous noise

Test Accommodations – IEP, OHI

- Extended time – standardized tests, class tests
- Readers for standardized tests and classroom tests
- Ask questions for standardized tests and classroom tests
- Dictate on standardized tests and classroom
- Quiet environment
Last but not least

• Teaching others about CAPD
  — Student
  — Parents
  — Teachers
  — Coaches
  — Family and Friends