SSW * * * REPORTS

UNILATERAL CONDUCTIVE LOSS & CAPD

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CAPD Testing: Bilateral (Asymmetrical) Conductive Hearing Loss

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A 13 year old girl, Rebeccca, was referred to our clinic by a neuropsychologist who was testing her for possible learning disabilities.

Medical History:

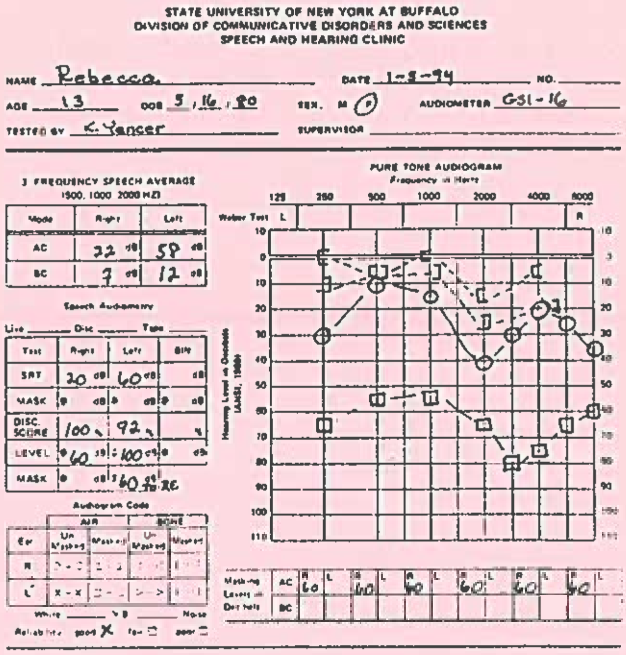
Rebecca has a history of chronic middle ear problems that were first diagnosed at 1 1/2 years of age and that have persisted since that time. She also has a history of cholesteotoma in the right ear and recurring cholesteotoma in the left ear. Extensive mastoid surgery was performed one year previous to Rebecca's CAP evaluation to remove the recurring cholesteotoma in the left ear. All three ossicles and the tympanic membrane were permanently removed from the left ear. For the right ear, a perforation remains in the drum following removal of a tympanostomy tube one year earlier. Rebecca's longstanding middle ear problems were deemed to be the result of chronic eustachian tube dysfunction, a condition which prevents her ears from "drying out" and maintains the persistant cholesteotomas and middle ear problems. Left middle ear reconstruction is not being considered at this time.

Academic/Communication History:

Rebecca's mother recounted the considerable difficulty her daughter had with phonics in the first grade. Rebecca was not able to recognize phonemes (and match them to letters) without the use of visual cues. Her mother had asked if Rebecca should use a hearing aid to compensate for her frequent bouts of hearing loss in the left ear. Unfortunately, she was discouraged at that time by her ENT who told Rebecca's mother that "she has one good ear that she can use". Use of an FM system was not offered by her school system until a medical professional, in disbelief that no amplification had been provided to Rebecca, made personal contact with her school. Once an FM unit was provided, Rebecca seemed to do much better in school. When Rebecca was in second grade, her parents took the initiative and had her fit with a BTE hearing aid in the left ear. She marvelled at the sense of "surround-sound", as

she now calls it. Rebecca is now in the 7th grade and has not been using an FM system; she is suddenly not doing well in school again! Therefore, an evaluation for learning disabilities was initiated.

Rebecca described the following difficulties at school: She has trouble sounding out words when reading and, quickly, forgets what she has just read or material that was read the night before. When asked how she did at spelling, she replied "Don't even ask!", from which I inferred, "not good at all". In addition, Rebecca explained that she has difficulty understanding what her teacher is saying at times and frequently misses homework assignments. "People mumble and I try to figure out what was said by substituting", according to Rebecca. Difficulty hearing when in large groups or when background noise is present was also mentioned.



Standard CAP Battery:

Rebecca's audiogram is shown in figure 1. SRTs were 20 dB, right ear and 60 dB, left ear, consistent with her puretone thresholds. Discrimination scores, at 40 SL, were 100%, right and 92%, left. This was considered important information indicating that when adequate amplification is provided, Rebecca's performance for discrimination of single syllable words is similar to a normal listener's (not surprising because Rebecca's hearing loss is conductive).

SSW presentation levels were set to be comfortably loud and of equal loudness between ears, 75 dB, right ear and 110 dB, left ear. As usual, practice items were presented. For the third practice item, "north west stair way", Rebecca responded "your list stair way" and offered the same response for each of three repetitions. The fact that she missed this item, even though she had "breezed" through single word discrimination testing, revealed the added challenge to Rebecca when a series of words must be repeated rather than single monosyllabic words. The two words she missed were presented to the right ear, her better hearing side. So, it did not appear that she was missing the words because of peripheral hearing loss. Overall, Rebecca scored within normal limits on the RNC, RC, LC, LNC conditions. Qualitatively, she evidenced an ear effect "low-high". This result suggested

tolerance-fading memory and was consistent with Rebecca's statement that she easily forgets what she has just read and with her difficulty listening in noisy environments.

On the Phonemic Synthesis Test, presentation levels of 75 dB, right, and 110 dB, left were employed so that it was unlikely that Rebecca did not "hear" the sounds at the peripheral level. Rebecca correctly responded to 19 out of the 25 items. By extrapolation, this places her slightly above the 5th grade normal limit of 18 correct and below the high school normal limit of 22 correct. Taking into consideration that Rebecca is in the 7th grade, her ability appears to be at least somewhat below normal limits on this test. The nature of several of her responses, "sturdidoke" for the sounds "m - i - l - k", "space" for "p - a - p - er" suggest a central impairment, many of the sounds of her responses were entirely different than those presented. This test result suggests a phonemic decoding problem and could explain Rebecca's difficulty sounding out words when reading and her poor spelling abilities.

Speech-in-noise results, for W-22 words with an ipsilateral speech spectrum noise (S/N +10), were 64% right ear, 60% left ear. The 36% decrease for her right ear and the 32% decrease for her left ear from quiet discrimination scores suggests she has mild to moderately depressed speech-in-noise skills.

<u>Additional Testing-Sound Field:</u>

Aided sound field testing of puretones thresholds revealed hearing levels in the normal range except from 2000 through 4000 Hz where Rebecca's hearing thresholds were in the mild hearing loss range. A sound field SRT was determined to be 10 dB HL, better than her better ear score (RE 20 HL) under headphones. Therefore, a binaural advantage due to the benefit of amplification was suggested.

High and low predictability SPIN sentences were administered with SPIN 12 speaker babble as background noise. This would assess Rebecca's ability to listen in a sound field situation that might simulate conditions in the classroom. Sentence tests are considered to be more realistic speech materials that may more adequately predict ability in natural communication situations compared to monosyllabic word tests. Rebecca was asked to repeat back the last word of each sentence.

It is my opinion that the low predictability sentences may represent listening situations in which new or unfamiliar information (e.g., new words, ideas, concepts) is presented and the listener cannot readily use contextual cues to figure out all the words. This is the type of listening situation in which individuals with CAPD are known to have their greatest listening difficulty. For example, for the test item "Peter should speak about the

mugs", the listener has to rely heavily on auditory processing of the sounds in "mugs". The high-predictability sentences, in contrast, may primarily test the ability to use contextual cues. For the item "The car drove off the steep cliff", the listener does not have to decode all of the auditory information if adequate use of contextual cues can be made.

Nabelek and Pickett (1974) reported that binaural listeners can repeat monosyllabic words with approximately 85% accuracy in a background of 8 speaker babble at a 0 dB signal-to-noise (S/N) ratio. This percentage undoubtedly improves with a positive S/N ratio. When a +5 S/N ratio was employed in the present testing, Rebecca, who is a binaural listener when using her aid, was expected to have a fairly good score on the low-predictability sentences if her speech-in-noise skills were good; The low-predictability sentences are deemed to be slightly easier to discriminate than monosyllabic words based on their minimal contextual cues- e.g., sentence structure dictates that the last word will be a noun.

Rebecca's percent correct for the two types of sentences are shown in the following table:

	Predictability: High	Low
Quiet	94%	100%
Noise	90%	60%
Difference	4%	40%

The high-predictability sentence results suggest that Rebecca does very well, even in the presence of distracting background noise, when ample contextual cues are available. When in an ideal (quiet) listening situation, she also has little difficulty with the low-predictability sentences. Her performance is similar to scores that might be expected of normal, binaural listeners. When most contextual cues were gone and Rebecca had to rely on accurate decoding of the sounds in the presence of noise, she missed 40% of the items. This may reflect how she would perform in a noisy classroom, using her hearing aid, when listening to new, abstract or unpredictable information.

DOES REBECCA'S HEARING LOSS NULLIFY THE CAPD RESULTS?

Research is scant on the effects of peripheral hearing loss on CAP tests. Miltenberger et al. (1978) examined 70 subjects with sensorineural hearing loss of various severities and slopes finding depressed scores on dichotic sentence tests and several other tests (no baseline CAP evaluations were carried out). Roeser et al. (1976) found that individual ear preference increased as the degree of sensorineural hearing loss increased. These results could not be assumed to apply when sensorineural hearing is normal. In fact, norms for CAP testing in individuals with conductive hearing loss who have no reported learning or listening difficulties are much needed.

What about Rebecca's absent acoustic reflex due to extensive surgery for the left ear? Colletti et al. (1992) measured word discrimination in ipsilateral masking noise for adults with stapedectomy with stapedius tendon section. For a S/N of +10 at levels of 20 SL and 50 SL (re: 100% discrimination level) listeners scores were 92% and 80% correct, respectively. Although conditions may not be directly comparable, Rebecca's scores at 40 SL (re: three speech frequency average) were considerably lower than would be expected due to absence of the stapedial reflex alone. This suggests that something other than the acoustic reflex is at the root of her decreased scores (efferent system- olivocochlear bundle, or a higher dysfunction?).

Rebecca is a young woman whose central auditory pathways were intermittently deprived of normal sound stimulation during her younger years. This period extended from about 1 1/2 years of age, when she first was seen by an ENT for middle ear problems, to age 7 when she first used a hearing aid. She is below grade level in phonemic decoding and sound-blending. In addition, her ability to listen in noise is depressed for monosyllabic words in the monaural condition, under headphones and also in the sound-field binaural listening condition when the material is unpredictable. Therefore, she appears to have central auditory processing weaknesses even when adequate levels and successful amplification are employed.

Rebecca's school does not agree that she has central auditory processing weaknesses nor that she needs an FM system (or a hearing aid, for that matter). However, the school has no explanation for her academic difficulties. Rebecca's inability to remember what she has read, difficulty sounding out words, poor spelling and considerable listening errors in noise all point to central auditory processing as indicated by test results. It is hypothesized that Rebecca's persistantly fluctuating hearing levels during her critical early years may have prevented her system from developing sufficiently for efficient processing of auditory information.

References:

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Roeser, R, Johns, D, & Price, L (1976). Dichotic listening in adults with sensorineural hearing losses. J. Amer Audit Soc, 2, 19-22.

PLEASE HELP! PLEASE HELP! PLEASE HELP! PLEASE HELP!

We are now working on the next issue of SSW REPORTS and need <u>your</u> help badly. I would very much appreciate it if you would contribute one or two cases with a diagnosis of Attention Deficit Disorder (ADD) or Attention Deficit Hyperactive Disorder (ADHD), and a control case for each.

If you have seen such a case (or 2) over the past few years for a Central Auditory Processing (CAP) evaluation, please see if you can find the person so we can put together a most informative issue on ADD/ADHD and the SSW test. We will need about 20 experimental and 20 control cases. The only restrictions are that the individuals must be 6 years or older and have had the entire 40 item SSW test.

It is of no consequence whether the person did well or poorly, was cooperative or not (but if the person was known to be on medication for the disorder, this would be useful information). To avoid bias in choosing the control subject, please choose the CAP case that you evaluated just prior to the ADD/ADHD case (again, without consideration for how good/bad the performance was).

If you are willing to help (I hope you are), please check for the following:

	Experimental	Control
age ≥ 6 years	+	+
40 item SSW	+	+
Dx: ADD/ADHD	+	-

We need:

(a) a copy of the three page SSW form (name not needed),

plus the person's

(b) age,
(c) sex,
(d) diagnosis (ADD/ADHD or control), and
(f) if ADD/ADHD, who made the diagnosis, if known

Please send as soon as possible. I appreciate your help!

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