SSW REPORTS.....

Attention & Quartile Analysis

CAP D H D

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SSW and Attention Factor

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"Are you ready?"

Attention all clinicians: are you familiar with this carrier phrase? What do you do when the client interrupts this famous carrier phrase, with the classic response, "Yes, I am ready". Do you re-instruct your client not to respond until all of the target words are heard? What do you do when the client responds in a quick manner, thus unable to properly hear all of the presented stimuli? Do you mark the possible responses as errors, when indeed the client may have provided the proper response if re-instructed to listen to all of the words before responding?

The above examples are classic responses seen when testing individuals with Attention Deficit Hyperactivity Disorder (ADHD). These individuals exhibit impulsivity and may respond before the complete set of stimuli is presented, thus causing more errors. Reliable/valid evaluation of this population requires control of attention and fatigue. This article will: 1) review ways to control for these factors when administering auditory processing tests, 2) investigate the attention factor by SSW quartile-analysis with two groups of children that exhibit both ADHD as well as CAPD, and 3) study the quartile-analysis of a group of children with only CAPD.

CONTROLLING FOR ATTENTION

ASHA (1995) provided a definition of CAPD suggesting that CAPD could possibly stem from inattention factors. This could result in the mis-diagnosis of CAPD, when because of poor attention, the client misses more of the stimuli, simply because of inattention and not an auditory deficit. Of course, those with inherent attention deficits, like ADHD, would be at risk for not paying attention to the incoming stimuli.

Tillery, Katz and Keller (2000) found 50-80% of children with ADHD to also manifest a CAPD. These findings have been replicated in other studies. Based on this discussion, you might wonder: Were these children diagnosed with CAPD in a reliable/valid manner? How was their poor inherent attention ability managed?

The first author has tested hundreds of individuals with ADHD using a strict administration procedures to ensure that the auditory processing evaluations are provided in a proper manner.

- All CAPD evaluations are administered in the morning, never after school hours, as the child may be fatigued from the day's activities.
- Breaks are provided between all tests, even when the client states that a break isn't necessary.
- Instructions are provided two times to the client and the client must repeat the instructions.
- Any form of hyperactive behavior is discouraged. When the client moves the earphone wires, plucks the microphone in front of him or wiggles his lower extremities to the tune of the taped stimuli, he is immediately told to stop such behavior.
- The taped words are repeated if the client vocally interrupts the stimuli.
- The client receives consistent positive reinforcement during the peripheral and central testing. The clinician provides consistent feedback of nodding her head affirmatively, giving a thumbs-up sign, and voicing how well the child is working. These measures are used regardless of a correct or incorrect response.
- The client is told when there are only 'five' more stimuli before completion of the test. This encouragement is given for each of the central tests.
- Individuals who are diagnosed with ADHD and receive central nervous stimulant (CNS) medication are told to arrive to the appointment while under the influence of their CNS medication.

Jerger & Musiek (2000): An Old Issue Returns

When ADHD came on the scene, hot and heavy in the 90s, there was concern that CAP tests were contaminated by poor attention. Some suggested that there was no such thing as CAPD, that it was simply ADHD or that poor attention produced the errors on the CAP tests.

Well, we weathered that confusion, as we have Norma Reese and colleagues who claimed that CAPD was a myth to hide the fact that these were simply language disorders. Now we have a new-old problem to deal with. A 'consensus statement' on CAPD that indicates that we should be testing children with ABR, MLR and OAEs in a CAPD test battery (Jerger & Musiek, 2000).

Because audiologists are actually following these 'consensus' guidelines it is important to let people know that the statement is not written in stone and should receive a serious critique. This relates especially to their rationale for using physiological tests:

> Other types of childhood disorders may exhibit similar behaviors. Examples are attention deficit hyperactivity disorder (ADHD), language impairment, reading disability, autistic spectrum disorders, and reduced intellectual functioning. (p. 468)

Thus it appears that their purpose for testing is to identify CAPD and to rule out other factors such as ADHD, and mental retardation. They are concerned about the over referral because of contamination by attention and cognitive deficits. However, no supporting literature was cited for these critical concerns.

Audiologists who often see adults and older children (who have suffered for years without being identified as having

CAPD), must disagree that there is over referral. We feel a team approach (psychologist, speech pathologist, audiologist) is the best avenue for differential diagnosis of ADHD and CAPD. The Jerger & Musiek (2000) consensus statement makes it timely to look once again at attention and the SSW test.

Background

The hallmark of ADHD is that novel stimuli command the individuals' attention, but as the information continues, attention wanes. In time it deteriorates completely. Therefore, we should expect children with ADHD to give their best performance at the beginning of a test and show deterioration over time.

Katz (cited by Katz & Levenson, 1994) divided the SSW test errors into the four quarters, 10 items in each (40 words). In a large group of normal control cases the means were fairly consistent quartile to quartile. When the cases were studied individually, it was noted that the first quartile score (Q-1) vs. Q-3 represented the most stable comparison. Q-1 vs. Q-4 was not as stable because many children who had consistent performance for Q-1 through Q-3, dropped down on Q-4. Others (more likely adults) showed improvement on Q-4. In the vast majority of cases the Q-3 score was ±3 errors of Q-1. Therefore, if Q-3 did not differ by more than 3 points from Q-1 it was considered a ***contant*** (C) pattern. If it was poorer by 4 or more, then it was considered an ***attention*** (A) pattern, and if it was better by 4 or more that was considered a ***learning*** (L) pattern.

Katz & Levenson (1994) used this system to evaluate 110 unselected cases. Nineteen met the criteria for hyperactive/distractible and/or diagnosed as ADHD. When compared to the remaining 91 with no evidence of these characteristics, no pattern differences were found using Chi-square analysis. Note in this study the use of medication (e.g., Ritalin) was not controlled. Approximately 80% of both groups *had Consistent* patterns, and *Attention* and *Learning* patterns had about 10% each.

Katz & Stecker (1994) obtained cases that were diagnosed by a pediatrician or psychologist as having ADHD and a previously seen case for CAP evaluation was used as the control. As in the previous study the number and patterns of errors across the quartiles were very similar for the two groups.

This study supported Katz's notion from a previous study: that attention is not a major influence on SSW performance whether the person has ADHD or not, if the clinician is experienced. Katz & Stecker state,

> "...audiologists 'get the goods' whether the patient is hyper- or hypo-active, whether highly distractible or listening too hard. We crack jokes, get tough, take the child for a drink, use operant conditioning, or whatever it takes." (p. 4)

Effects of Ritalin on Auditory and Attention Test Performance

The ADHD-CAPD children in Tillery et al.'s study were 7 to 14 years of age. The results showed no significant medication affect on auditory processing performance for the SSW, Phonemic Synthesis and Speech-in-noise tests. However, there was a significant medication affect on the Auditory Continuous Performance Test (ACPT, Keith, 1994), which tests for auditory impulsivity and inattention.

These results helped to show medication significantly improves inattention in the children with ADHD, but doesn't improve their auditory processing. The authors recommended that children seen for CAP testing should be evaluated while properly medicated to control for attention.

Quartile-Analyses of the SSW Test

The Quartile-Analysis is used to study the effect of attention on the SSW test (Katz & Levenson). But, because it was important not to overlook potential attention problems that might not be identified by Q-1 vs. Q-3 comparisons Q-1 vs. Q-4 and Q-2 vs. Q-4 were also studied.

Groups 1 & 2: Quartile Analysis for Children with ADHD and CAPD.

The error scores on the SSW test were analyzed for Tillery et al.'s subjects. The measures discussed to control for fatigue and attention were used in all cases, however initially they were not tested while under the influence of their Ritalin medication. Because we didn't know if Ritalin would affect test performance, subjects were tested non-medicated first. Table 1 shows the means and standard deviations (S.D.) for two groups of subjects with both ADHD and CAPD, unmedicated. Groups 1 and 2 later received different medication conditions. Paired t-test statistical analyses were utilized to compare quartiles (see Table 2).

Table 1. Total score for quarters of SSW test for 2 groups with ADHD-CAPD. Test-#1 (all in non-medicated condition).

Quartile Errors	Group 1 (n=16)		Group 2 (n=16)	
	Mean	S.D.	Mean	S.D.
1	**5.3**	3.9	**6.0**	3.5
2	**6.2**	3.5	**7.1**	3.1
3	**6.1**	3.5	**6.4**	3.6
4	**6.6**	3.8	**7.9**	4.2

Table 2 shows a significant difference of SSW quartile errors for Group 2, when comparing Q-1 and Q-4. All other comparisons were not significant. Group differences might accounted for this single significant finding.

Table 2. Paired t–tests of total errors for SSW quartiles (see Table 1).

Comparing Quarters of SSW Test	Group 1	Group 2
1 & 3	p=0.379	p=0.379
2& 4	p=0.387	p=0.330
1 & 4	p=0.119	***p=0.003****

*significant at the .05 level

Table 3 shows means and standard deviations for the groups under *different test conditions* (for SSW quartiles). Group 1 (Ritalin) and Group 2 (placebo) differed most for the first and fourth quarters of the SSW test.

Table 3. Mean quartile SSW errors. Test-2 Group 1 on Ritalin, Group 2 placebo.

Errors Quartile Anal.	Group 1 (n=16) Ritalin		Group 2 (n=16) Placebo	
	Mean	S.D.	Mean	S.D.
1	**3.2**	2.7	**3.9**	2.9
2	**4.6**	2.9	**6.1**	3.4
3	**3.9**	2.8	**5.3**	4.1
4	**4.3**	2.7	**7.3**	5.0

Although Tillery et al. showed no statistical significance in the medication condition between groups. Table 4 shows a significant difference between the first and fourth quarters of the SSW test in both the placebo and Ritalin conditions. This may be due to the fatigue/boredom factor that was noted by Katz, as it was the same for both medication and placebo conditions.

Table 4. Paired t–tests of total errors for SSW quartiles Test 2 (see Table 3).

Comparing Quarters of SSW Test	Group 1 Ritalin (n=16)	Group 2 Placebo (n=16)
1 & 3	p=0.14	p=1.00
2 & 4	p=0.62	p=0.12
1 & 4	***p=0.01****	***p=0.00****

*significant at the .05 level

Table 5 shows the means and SDs for the third SSW test. Table 6 indicates a significant finding in *both* groups for Q-1 vs. Q-4. In addition, Group 2 (Ritalin) had a significant difference between Q-1 & Q-3. Again there was no difference to indicate any special benefit in taking Ritalin (as was true in the previous studies and in the two previous administrations of the SSW).

Table 5. Total error score for quarters of SSW. Test-3, Group 1 on placebo, Group 2 Ritalin.

Quart-Ile Errors	Group 1 Placebo		Group 2 Ritalin	
	Mean	S.D.	Mean	S.D.
1	**2.4**	2.2	**2.6**	2.7
2	**3.4**	2.7	**4.6**	2.4
3	**3.9**	3.6	**4.8**	3.9
4	**4.0**	2.9	**5.0**	4.2

Quarter Errors in CAPD-Only Group

Because of our interest in the influence of attention, we also studied a group of children with only CAPD (no ADHD). An ideal group was available to compare with the ADHD and CAPD cases. When children are seen by neuropsychologists or pediatricians and <u>not</u> found to have ADHD, they are often referred for CAP evaluations. Therefore, the first 16 of these children diagnosed with <u>only</u> CAPD in the files of the first author were chosen.

Table 7 shows the means and standard deviations for quartiles of the SSW test.

Table 6. Paired t–tests of total errors for SSW quartiles Test 3 (see Table 5).

Comparing Quarters of SSW Test	Group 1 Ritalin	Group 2 Placebo
1 & 3	p=0.53	***p=0.00****
2& 4	p=0.20	p=0.55
1 & 4	***p=0.00****	***p=0.00****

Table 8 provides the statistical analyses. There were significant differences for Q-1 vs. Q3 and Q-1 vs. Q-4 for these children with CAPD only.

Table 7. Total error score for quarters of SSW. Test-1 for Group 3 - no medication.

Quart-iles	Group 3 (n=16) CAP-Only No Medication	
	Mean	S.D.
1	**2.9**	1.8
2	**4.6**	1.8
3	**4.4**	1.7
4	**4.9**	2.0

Table 8. Paired t–tests of total errors for SSW quartiles CAPD-only (see Table 7).

Comparing Quarters of SSW Test	Group 3 CAPD-Only
1 & 3	***p=0.01****
2& 4	p=0.55
1 & 4	***p=0.00****

*significant at the .05 level

Discussion

If attention deteriorates over time in children who have ADHD, as we are given to believe, then we found no support for the notion that inattention adversely effects performance on the SSW test in any of the ADHD groups studied. This agrees with the previous studies cited. However, steps were taken to minimize problems of inattention and fatigue. It should be pointed out that this study looked at the problem statistically and did not look at the clinical patterns

(C, A, & L) that were considered in the earlier studies. Although statistically significant differences were found between quartiles for those with CAPD-ADHD as well as those with just CAPD, there is little practical importance to any of the differences. For example, our 2 CAPD-ADHD groups combined Q-3 mean increase in errors of a paltry .6 than Q-1, a far cry from the 4 point criterion for individual significance. The CAPD-only group had .9 errors more for Q-3, no different than the CAPD-ADHD group. So those with ADHD performed like the CAPD group whether they were not medicated, took Ritalin, or a placebo.

Clinically, we must control for fatigue and attention when administering auditory processing tests. If the client isn't paying sufficient attention, they may not process the information in an efficient manner. It is reassuring that we found attention can be controlled and not affect test performance. For this reason we see no necessity to use the elaborate measures proposed by Jerger & Musiek to control for attention.

The present study helps to support the use of the Q-1 vs. Q-3 quartile analysis. The inclusion of Q-1 vs. Q-4 did not add useful information. Rather it reflected a pattern previously seen in normal control children (but not adults). This Q-4 effect may be a result of fatigue, boredom, or lack of sufficient frustration tolerance.

Despite these findings a question remains in our minds why in each study the hyperactive children had generally poorer scores than CAPD-only groups. For Katz & Levenson the difference was 6.5 errors, for Katz & Stecker it was 5 and in the present study it was 8.8 errors. Because attention appears to play a small role in most ADHD cases, it is not likely that the differences are due to attention. We think it more likely that the ADHD children generally have more widespread central problems that could account for the differences seen in Figure 1. However, this question deserves further research.

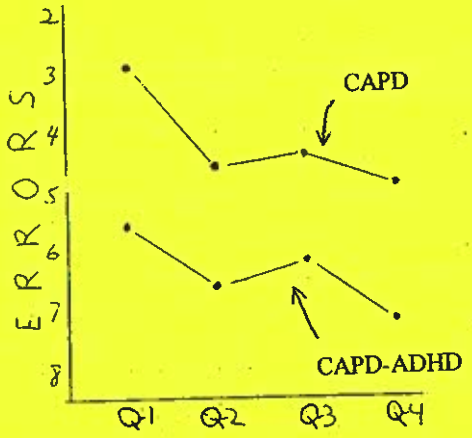

Figure 1. Mean errors, SSW Quartiles for CAPD and CAPD-ADHD groups

Summary and Conclusions

This study, and the two previously cited studies all point to the stability of SSW scores in the populations with CAPD and even in those with ADHD. However, we feel that experience in dealing with hyperactive children and employing techniques that increase the likelihood of success are important, in addition to the use of appropriate medication. Medication is not essential, but it makes the test situation much more satisfying for both the client and clinician, by helping to control adverse behaviors.

The take-home message is, attention is not a major factor in SSW test results, whether the person has ADHD or not, if the clinician is experienced and uses appropriate techniques that encourage accurate results.