SSW Reports

• What Electrophysiological Measures Tell Us About APD
• Auditory Skills Assessment (ASA)

Vol. 32 No. 3 **August 2011**

What Do Electrophysiological Measures of the Central Auditory Pathways Tell Us about APD?

Jay Lucker

Some professionals involved in auditory processing and its disorders (APD) state that the "appropriate" assessment for children with APD is primarily through the use of electrophysiological measures such as ABR. The question arises as to what do these electrophysiological measures actually tell us about how a child is processing what he/she hears?

A recent case seen by the author sheds light on this question. The following is a discussion of the case along with information regarding what is revealed for this child by electrophysiological measures versus this author's applied APD behavioral measures. The reason for sharing this information is that the author feels that the problems noted tell us a great deal about the need for audiologists to push for the use of behavioral measures for assessment of APD.

The Case for Electrophysiological Measures

It appears that the push for using electrophysiological measures involves a desire to have a clean, medical-based approach in diagnosing the presence or absence of APD. In general, the conclusion drawn from electrophysiological measures is that a child who demonstrates abnormalities has APD. In the present case, not only is the child identified as having APD purely based on electrophysiological measures, but the medical doctor completing the assessment relates the findings to deficits in processing speech, and describes this as an auditory temporal processing deficit.

The Case for Behavioral Measures

What we have been doing for years as audiologists, especially those who follow the Buffalo model or similar methods for diagnosing APD, is looking at what the behavioral measures of auditory processing indicate. The various categories in the Buffalo model are based on behavioral measures. This is also true for Lucker's system integrative model which has many similarities to the Buffalo model, but expands on it.

The rationale behind using pure behavioral measures is that these children come to us with behavioral symptoms, not with neurological complaints. The usual use of our reports is not for medical doctors, but for educators to establish appropriate educational plans (IEPs). Thus, measuring behavioral problems by assessing behavior is appropriate.

The Case in Point

The present case is of a male Kindergarten student (5.6 years of age) who was referred for APD testing. Along with the standard measures that encompass the Buffalo Model,

a number of other APD assessments are included in Lucker's approach. Additionally, some measures of language processing were completed. The boy presented with numerous problems in "listening and inattention." He had been seen by the early intervention team (at three years of age) and was labeled as having a "speech-language impairment" and provided with speech-language therapy. Recently, the team wanted to discharge him from speech-language services stating that he no longer needed them.

The parents did not agree with the dismissal suggestion and took their son to a facility that "specializes" in assessment of auditory processing using only electrophysiological measures. The boy underwent an EEG, Auditory Evoked Potentials (AEP), and Frequency Modulated Auditory Evoked Response (FMAER) measures. He was seen by two medical professionals: a neurologist and a medical technician who applied the electrophysiological measures.

Electrophysiological Measures

The EEGs were overall normal for both awake and sleep measures. The AEP to clicks indicated normal findings. However, the FMAER indicated significant deficits. The deficits were "bilaterally distorted with no clear temporo-central 4Hz following response." These results led to the following conclusions: the abnormal FMAER are "consistent with a central auditory pathology that would lead to diagnosis of central auditory processing disorder. Furthermore, these abnormal findings are consistent with deficits in speech perception due to auditory processing difficulties."

Behavioral Measures

The report was given to the parents who were devastated by what they interpreted to mean that their son was brain damaged. They shared the report with the school, and the team leader asked if the parents wanted the child reclassified as neurologically impaired. This was **not** the parents' desire. Thus, they eventually had a speech-language evaluation completed.

Results of the CELF-4 indicated normal findings in all areas. Subtests ranged from standards scores of 9 (37^{th} percentile) to 13 (84^{th} percentile). Vocabulary scores for both receptive and expressive tests were above 100 (above the 50^{th} percentile). The speech-language pathologist then referred the child for APD testing which is how this author got involved.

Because the parents stated that the doctors who completed the FMAER indicated that the APD problems would be in temporal processing, this author decided to administer a test of auditory temporal processing using linguistic material (Time Compressed Sentence Test (TCST). Although the norms for that test start at age six, the boy, diagnosed with auditory temporal processing deficits and "speech perception" problems scored within the age norms for six year olds. Thus, this child does **not** have an auditory temporal processing deficit.

Normal results were also found on the Auditory Figure Ground on the SCAN. Phonemic Synthesis (with 1^{st} grade norms) score was found to be normal as were all of the other auditory phonological processing subtests of the Comprehensive Test of Phonological Processing (CTOPP). Results of the SCAN-C indicated the only abnormal findings were for the CW and the ear difference on the CW for LEF. SSW findings support a conclusion that the boy has auditory integration processing problems: only the LC, Ear L/H, and, most

importantly, the Type A measures were abnormal.

Language based test results were normal: the Token Test for Children (TTFC) (original version) and TTFC-2 were found to be normal as were the two language processing subtests of the TAPS-3.

Conclusions and Discussion

This male client was diagnosed with APD. However, his APD has nothing to do with single ear processing of auditory information as would be interpreted from the FMAER results done on each individual ear.

No electrophysiological measures were completed using interhemispheric/corpus callosum neurological processing. Yet, the electrophysiological measures were abnormal. What do they tell us?

My only response to this question when the parents asked me was, "I don't know!" and I really do **not** know. I know from the behavioral evidence that this boy does have problems with auditory integration and sound-symbol association integrative processing. He may have no problems with language processing at age five, but problems could occur once the language he has to process and integrate becomes more advanced. Additionally, we may find him having problems with reading, decoding, and spelling once these tasks become more advanced. My recommendation was for interventions that would address auditory sound-symbol association integrative processing. For the purposes of this paper, these recommendations are not discussed.

The focus of this case study was to investigate what electrophysiological measures indicate about APD when a child is found to have abnormal electrophysiol-ogical findings. The 'behavioral' information regarding auditory sound-symbol association integrative processing is not seen in the electrophysiological measures. It is only through the behavioral measures that we find the real APD deficits and are able to provide appropriate explanations of how these deficits could be affecting the child in school. We need to support the continued use of behavioral measures of APD and keep the electrophysiological measures for research and medical diagnostic purposes.

For information please contact Dr. Jay Lucker at at 301-254-8583 and apddrj@verizon.net.

* * * * *

Auditory Skills Assessment
Donna Geffner

In the *Auditory Skills Assessment (ASA) Manual* there is an acknowledgment to "Dr. Jack Katz for his expertise, for his belief in the need to test and identify children with problems early and for his numerous invaluable contributions to the field of auditory processing. His review and support of the ASA were immeasurable."

We are grateful to Dr. Katz for lending his knowledge of testing and his strong commitment for early identification to aid us in the development of this instrument. It was our intention to create a measure that would find those children at risk for auditory processing problems early so that intervention and auditory stimulation could be administered in the hopes of warding off more serious deficits in later years. Fortunately, I had the input from expert test

author Ron Goldman and the support of Pearson, the largest publisher in the world with their incredible team of scientists, psychometricians and a project director (Tina Eichstadt) to support us.
Let me tell you why the test was created. It was the intent to identify children early who are at risk for auditory skill deficits and who would be good candidates for in-depth evaluations and early intervention. The instrument could serve as a screening measure on a larger scale for pre-schools and early intervention programs where youngsters are often singled out as having difficulty developing speech and language skills. It provides a way to investigate young children, ages 3.6-6.11, never before tested, for auditory skills. Further, it allows for progress monitoring in that re-administration of the ASA could be used to check a child's progress to determine if a program of intervention is working, and what skills need yet to be developed. It is an instrument that can be used by professionals in the fields of speech-language pathology, audiology, school psychology, remedial reading and learning disabilities.

ASA is not a test of hearing acuity or a definitive test of auditory processing. At this time it is more difficult to diagnose very young children (e.g., under the age of 5). In those cases they can be considered "at risk." Katz (personal communication) suggests that one can form a "working hypothesis" so that it is not necessary to lose precious time in remediating the problems. As clinicians, we can surmise which children are having difficulty with auditory stimuli, which children cannot follow directions, mishear, have trouble in noise, and are easily distracted by extraneous stimuli. These are the children who may have problems recognizing the sounds of letters, or blending sounds to form words, or rhyming words, or telling two sounds apart from one another. These are the children who need to be scrutinized for later identification. In some cases, the child may outgrow some of these issues; in other cases, the child will become a person with an auditory processing disorder. The task of the ASA is to help in the screening process. The specificity of the test is high at the .68 level which is typical of many tests that are used for diagnosis. Further, it only takes 5-15 minutes to administer, which is the time needed to gather the necessary information without exhausting the young child's attention.

The screener is a criterion referenced indicator based on data from a nationwide sample of 475 children ages 3 years 6 months through 6 years, 11 months. There were several reiterations of the test that involved 875 children. Many original subtests and test items were reduced or eliminated to create a quick screener. There is a sample overall cut score and an indicator of performance in major domains such as high, average, low to pinpoint further assessment or intervention needs. One can give the test without headphones or specialized equipment, except for a CD player. The complete ASA kit consists of a manual, a stimulus CD, a stimulus book and 25 record forms. The test is individually administered using auditory stimuli presented via the stimulus CD. There are training items and pictures of words that the child must know prior to taking the test. There are three trials to allow the child to learn and identify the correct picture of the word. Children ages 3.6 months through 4.11 months take two sections of the ASA for 5 minutes, while children ages 5.0 through 6.11 take all six sections, for a total time of 15 minutes.

ASA: Six sections organized within three domains of related auditory skills

Speech Discrimination Domain

In this section **speech discrimination in noise** is the subtest that evaluates the child's ability to distinguish speech sounds in a typical school setting (cafeteria). The signal to noise ratio is +6dB. In the second part, **Mimicry**, the child is asked to repeat a nonsense word that follows typical English sound patterns.

Phonological Awareness
Within this domain **Sound Blending** is the subtest that measures the child's ability to recognize parts of a word and blend them together to form a word. In the next section, **Rhyming,** the child hears a pair of words that rhyme and is asked if they rhyme (yes/no). Some training may be necessary here.

Non Speech Processing
Within this domain there is a **Tonal Discrimination** task whereby the child is asked to distinguish the difference between nonlinguistic auditory stimuli. A pair of two distinctively different musical instrument sounds –an oboe and a piano, are presented. The child is asked if the two sound alike (yes/no) response. The child is trained to hear the difference and then is asked to answer either yes or no when pairs are presented.

Tonal Patterning, the 2nd subtest involves having the child tell which musical instrument is heard last. The child hears a pair of successive auditory stimuli- a single note played on an oboe and a single note played on a piano and is asked to point to the picture of the instrument that played last.

The Manual describes how the subtests are scored in order to arrive at a cut off score to determine whether the child falls within the criterion for his/her age. The overall sensitivity and specificity of the ASA cut off scores reported in the Manual's Appendix are .77 and .68 respectively. That is 77% of the children in the clinical sample scored at or below the cut score and 68% of the matched nonclinical sample scored above the cut score. In setting the cut scores, preference was given to attaining a high sensitivity because of the importance of flagging children who truly have poor auditory skills. These sensitivity and specificity values indicate that the ASA functions well as a screening test for auditory skill deficits in young children.

The rationale for the sections are based on the knowledge that auditory skills play a significant role in the development of speech and language and in the acquisition of reading, writing and spelling skills. What a child learns depends on his or her ability to receive, extract, and attribute meaning to what is heard through the auditory channel. Auditory skills critical to accurate listening includes discrimination of sounds and phonemes, knowledge of phonological structure and auditory memory. Studies have shown that auditory discrimination is closely tied to performance on receptive and expressive language subtests. Reading acquisition data show that auditory processes play a major role in the mastery of learning to read. Translating a printed message to a spoken one involves grapheme recognition and phonemic association. Printed words become spoken words and vice versa. If a child can't perceive phonemes clearly, remember their sequence, and organize them into linguistic symbols, then the child is likely to have difficulties learning to read.

Research indicates that identifying young children at risk for auditory skill deficits as early as possible leads to intervention and support that can prevent later language, learning, and reading disorders. The ASA was developed to measure a broad range of

auditory skills in young children who have not yet been formally tested in these areas and at these ages, yet would benefit most from early intervention. Isn't that a good idea? Contact Dr. Geffner for more information at geffner@sprynet.com

Reference

Geffner, D., and Goldman, R. (2010). *Auditory Skills Assessment*. MN. Pearson Assessments.

Dear Ackie

Q: Dear Ackie:

I felt badly that no one has asked you a question in a long time. Rumor has it that the August issue of *SSW Reports* will have two distinguished contributors. Because Donna Geffener (and Ron Goldman) have contributed the excellent ASA test for children as young as 3-6 years-of-age, and Jay Lucker has been a strong voice for testing young children, I thought this would be a good time to ask the following question:

Is there any reason… ANY reason that we should hesitate to test children under seven-years-of-age for APD?

Frustrated but Need Assurance

Dear Frustrated,

I understand exactly how you feel. WHAT ON EARTH is going on in their minds? Doctors take an oath to do no harm. We may not be able to help everyone but we must avoid harming the people who come to us for help. Everyone … EVERYONE knows that early intervention is critical. Surely every audiologist knows the importance of identifying and training young deaf children, the younger the better. Why? Because they benefit so much from early intervention. Soon after the ASHA (2005) *Technical Report* on APD came out re: testing APD at age 7 and up, despite the outcry from audiologists that this was a harmful recommendation; there were two successive issues of *SSW Reports* (one by Jay Lucker) dealing with this dangerous position. Fortunately, ASHA in their wisdom, downgraded that document from Guidelines (suggesting a professional standard) to a Technical Report that does not hold the weight of guidelines.

When I was in college we were ignorant about a lot of things that we should be smart about in the 21st century. My professor said that we should not try to test a deaf child until they are 10 years old because at that age they are not so wild. If this is the case then the child will lose so many years that can never be regained. Of course, this goes for APD as well as a hearing loss. If we weren't so successful in testing these children and changing their lives with training we might believe those *experts* that say, "Don't test until the central auditory nervous system is more fully mature."

That's exactly the point! We want to get the child when their CANSs are the most plastic. In time they would develop poor auditory skills, develop bad habits and auditory errors will be built in early and strongly.

Is APD the only disorder known to humankind that we don't want to know the problem as soon as possible? Of course, we need to identify APD AS SOON AS POSSIBLE, counsel the parents and develop a program to improve the skills as soon as possible! We are continually gratified in working with young children and now *Auditory Skills Assessment* (ASA) gives us another tool.