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Characterizing and Predicting Outcomes of Communication Delays in Infants and Toddlers: Implications for Clinical Practice

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Clinical Forum

Epilogue

The Role of the Speech-Language Pathologist in Identifying and Treating Children With Auditory Processing Disorder

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Purpose: A summary of issues regarding auditory processing disorder (APD) is presented, including some of the remaining questions and challenges raised by the articles included in the clinical forum.

Method: Evolution of APD as a diagnostic entity within audiology and speech-language pathology is reviewed. A summary of treatment efficacy results and issues is provided, as well as the continuing dilemma for speech-language pathologists (SLPs) charged with providing treatment for referred APD clients.

Conclusion: The role of the SLP in diagnosing and treating APD remains under discussion, despite lack of efficacy data supporting auditory intervention and questions regarding the clinical relevance and validity of APD.

Key Words: auditory processing disorder, speech-language pathologists, treatment efficacy

Auditory processing is “a deficit in the neural processing of auditory stimuli that is not due to higher-order language, cognitive, or related factors” but that can lead to problems in those areas (Chermak & Musiek, 2007b, p. ix). The comorbidity of auditory processing with language and learning has contributed to ongoing debate of the specific characteristics that constitute an auditory processing disorder (APD). The focus of the controversy in the past revolved around the nature of processing as an auditory phenomenon (Katz, 1978; Keith, 1981; Tallal, Stark, Kallman, & Mellits, 1981), a language-based phenomenon (Gerber & Bryen, 1981; Kamhi, 1981; Rice, 1983), or a phenomenon consisting of both auditory and language aspects (Butler, 1981; Rees, 1973). The controversy of

the present has evolved to a critical examination of evidence to support or refute the efficacy of treatment options for APD. The author perspectives included in this clinic forum illustrate the continuing diversity represented among professionals in how to define and treat APD.

Evolution of “Auditory Processing”

Massaro (1975) defined auditory processing as the ability to abstract meaning from an acoustic stimulus. The dilemma that continues to stymie speech-language pathologists (SLPs) in regard to processing is, “What kind of meaning?” Individual authors and researchers have offered personal perspectives on how they define the type of meaning abstracted from an auditory stimulus, ranging from acoustic characteristics as small as the individual phoneme (Hirsh, 1966) or syllable (Abbs & Sussman, 1971) to those as large as a major clause component of a sentence (Lieberman, Cooper, Shankweiler, & Studdert-Kennedy, 1967).

Audiologists approach auditory processing from the perspective of emphasizing the measurable acoustic characteristics of the signal (Chermak & Musiek, 2007a; Tremblay, Kraus, Carrell, & McGee, 1997). In the late 1970s, the term gravitated to *central auditory processing*, very specifically

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pinpointing the neurophysiological transference of the acoustic stimulus through the central auditory nervous system (CANS; Weisberg & Katz, 1978). However, audiologists working in conjunction with SLPs in educational settings began to advocate that auditory processing went beyond the pure transference of the acoustic signal from the external environment into the auditory cortex of the brain (Bellis, 2003). The ability to discriminate aspects of the signal entered the discussion, such as low and high pitch patterns, filtered frequencies, phoneme differences, and listening in the presence of background noise.

Myklebust (1954) was among the first researchers to introduce the concept of a psychoeducational model into auditory processing. His audiological evaluations on a number of children were showing normal peripheral hearing despite evidencing significant problems processing auditory information (Jerger, 2009). The suggested correlation between a learning disability and auditory processing led to the development of psycholinguistic skills assessment using Osgood's (1957) model of communication. The Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, & Kirk, 1968) was based on the premise that discrete auditory perceptual skills could be evaluated and could subsequently provide specific targets to remediate deficit communication skills necessary for learning.

Kirk's premise (Kirk et al., 1968) seemed to substantiate that the auditory perceptual skills involved in differentiating features of the acoustic signal were critical for developing the foundation for speaking, spelling, reading, and writing using a linguistically coded system of language. Consequently, an expansion of APD parameters began to overlap into phonetic acquisition and phonemic discrimination, further involving the SLP, as preliteracy skills were encompassed within the definition of APD (Geffner & Ross-Swain, 2007; Tallal, Merzenich, Miller, & Jenkins, 1998).

As a result, the delineation between auditory processing and language became blurred for some SLPs and audiologists. The discrete acoustic reception and transference of auditory information were evaluated by the audiologist; however, the applied language and academic skills that children acquire using auditory information were evaluated and treated by SLPs. This overlap resulted in a confusion of terms based on who evaluated the child first—the audiologist or the SLP (Richard, 2007b). For example, if a child had difficulty discriminating the difference between two phonemes, the audiologist would diagnose APD, and the SLP would diagnose a phonemic discrimination problem. Both diagnostic labels could be accurate, but professionals often fail to further explore if the child's problem might be difficulty in discriminating acoustic boundaries that distinguish phoneme features (auditory) or the perceptual skills to discriminate minimal pairs (language). Locke (1980a, 1980b) and Stackhouse and Wells (1993) are among researchers who have written about the stages of processing and the importance of determining if the focus of treatment goals should be auditory or linguistic.

The continued evolution of the term into the SLP's vocabulary reverted back to Massaro's (1975) original definition—abstraction of meaning. SLPs were clinically treating children who could accurately hear and repeat auditory information without comprehending the linguistically embedded message; the problems were related to interpreting the overall meaning conveyed within the spoken utterance. Semantic and metacognitive influences re-entered the auditory processing discussion (McAleer Hamaguchi, 2003; Richard, 2007a).

So is auditory processing a unique and identifiable clinical entity? Some audiologists would argue that it is a distinct and definitive disorder (e.g., Bellis, 2003; Chermak & Musiek, 2007a; Keith, 1981); some SLPs would argue that it is not. That is exactly the case postulated by Kamhi (2011). After an eloquent walk through the history of APD, he dissects many of the problems in diagnosis and definition, concluding that the evidence does not support auditory processing as a distinct clinical entity. Can it be separated from language, phonology, and literacy? It would depend on how the term is defined. Why is it so difficult to reach professional consensus on a definition for APD? Because audiologists and SLPs are viewing the characteristics of the disorder from different perspectives. Does it sound like the argument is going in circles? Yes, because it is!

Disagreement among audiologists continues to escalate in regard to the definition, assessment procedures, and treatment approaches for APD. Some researchers feel strongly that electrophysiological and electroacoustical measures should be the primary diagnostic indicators (Banai & Kraus, 2009; Chermak & Musiek, 2007a); others argue strongly against those measures (Katz et al., 2002), citing little evidence to support the diagnostic value of these expensive evaluations in APD. Cacace and McFarland (2009) presented a series of differing perspectives among audiologists in their book, *Controversies in Central Auditory Processing Disorder*. The authors suggest that, although all of the viewpoints are relevant, the diversity of opinion substantiates the lack of a uniform definition.

Treatment Efficacy

Interpretation of efficacy data has been plagued by the lack of agreement on diagnostic parameters for APD. Although the 2005 American Speech-Language-Hearing Association (ASHA) Working Group on Auditory Processing Disorders (ASHA, 2005) attempted to address this issue, the clinical reality is that various professionals apply their own evaluation criteria that results in the diagnosis of APD. Consequently, the task of conducting a systematic review to substantiate intervention efficacy in APD was challenging (Fey et al., 2011).

The 1996 ASHA Task Force on Central Auditory Processing Consensus Development reached consensus on four

major issues regarding central auditory processing disorder (CAPD; Richard, 2011). Although agreement was attained on the primary questions, the task force acknowledged problems with empirical support for their conclusions. The 2007 ASHA Ad Hoc Committee on the Role of the Speech-Language Pathologist in Identifying and Treating Children With Auditory Processing Disorders conducted a systematic review of the current research to decrease the gap between scientific evidence and clinical practice. Results yielded a paucity of controlled studies and subsequently failed to clearly demonstrate the specific effects of auditory treatments on children's language, reading, or even more peripheral auditory outcomes (Fey et al., 2011).

There was discussion within the 2007 ad hoc committee regarding study weaknesses that might have compromised the results of the systematic review. The major concern focused on two factors that led to heterogeneity in study samples of children with APD. The first is the historic lack of agreement regarding the disorder's definition by audiologists and SLPs. This motivated extensive debate among the committee members regarding diagnostic categories of subjects meeting the inclusion criteria in the systematic review parameters. For example, the diagnosis of reading disorder was excluded because it would introduce a large and diverse subject population that might not be related to auditory processing issues. Yet there was acknowledgement that some reading disorders could be attributed to poor sound processing skills.

Some members of the 2007 ad hoc committee believed that the stringent criteria imposed in the systematic review's critical appraisal process resulted in elimination of many legitimate and important research studies that demonstrate benefits of various auditory training programs. Others believed that the heterogeneity was not an inherent problem. Ultimately, the committee decided that studies with children of undefined diagnoses should not be included, and language-focused intervention (e.g., Earobics [Cognitive Concepts, 1997]) would not be considered; the intervention had to primarily emphasize auditory skills on subjects whose auditory processing or oral language skills were the main complaint.

The second factor was the comorbidity of APD with numerous other disorders (e.g., phonology, literacy, language, hearing, learning disabilities). The relationship between poor auditory processing and language-learning problems has been suggested behaviorally (Bellis, 2003; Geffner & Ross-Swain, 2007; Richard, 2001) and electrophysiologically (Moncrieff & Musiek, 2002; Wible, Nicol, & Kraus, 2005). Tallal and Merzenich (1997) concluded that many language problems are the result of auditory perceptual impairment, which led to development of the original FastForWord (Scientific Learning Corporation, 1998) program.

Do problems in accurately processing an acoustic signal always lead to language-learning difficulties? No. Can problems in accurately processing an acoustic signal lead

to language-learning difficulties? Yes. The 2007 ad hoc committee members were in agreement that APD as a clinical entity probably served no purpose if educational or life functions were not negatively impacted. Individuals with diagnosed APD might compensate well, resulting in no experienced deficits or academic problems.

The issue addressed in this clinical forum focused on the theoretical foundation of APD that guides intervention decisions. When a child shows symptoms of APD, Kamhi (2011) and Wallach (2011) believe you should focus on the actual academic weakness, such as phonemic awareness, reading, spelling, and language competence. Their articles adamantly advocate interpreting auditory processing by the functional deficits. Medwetsky (2011) believes that the auditory transmission of the speech stimulus cannot be minimized. He has developed a model that acknowledges the integration of auditory, cognitive, and language mechanisms in processing spoken language, but maintains that assessment should focus on subcomponent auditory skills, such as auditory memory, discrimination, and attention. It comes back to the classic bottom-up audiology philosophy for intervention versus the top-down speech-language pathology philosophy to a treatment approach (Duchan & Katz, 1983).

Research continues to question the efficacy of treatment on low-level nonmeaningful auditory skills to improve higher level language competency. Strehlow et al. (2006) demonstrated marked improvement in temporal processing as a result of specific training, but no transfer effect to reading and spelling. Similar results have been realized by others (Schaffler, Sonntag, Hartnegg, & Fischer, 2004), including studies published subsequent to completion of the systematic review (McArthur, Ellis, Atkinson, & Coltheart, 2008), which substantiate minimal positive gain from isolated auditory intervention. There appears to be little rationale to support highly specific auditory training (and nonlinguistic) methods to remediate specific language skills in reading, spelling, and writing.

The Role of the SLP in APD

The 2005 ASHA Working Group on Auditory Processing Disorders attempted to define the role of the audiologist in assessment procedures and basic intervention for APD (ASHA, 2005). The role of the SLP was never addressed, even though most individuals presenting with a diagnosis of APD will be referred to an SLP for treatment. According to DeBonis and Moncrieff (2008), "Speech-language pathologists (SLPs) are affected by this current state of uncertainty because their professional responsibilities include screening for APD, making appropriate referrals, and providing intervention services" (p. 4).

In a 2004 ASHA caseload survey (ASHA, 2004), 67% of SLPs working in the schools reported serving children who had been diagnosed with APD. An assessment battery

that focuses only on semantic, morphologic, and syntactic aspects of language may not be sensitive to the auditory–linguistic aspects of evaluating auditory perceptual skills. Several states have already adopted guidelines in conjunction with their education departments to address the gap in providing recommendations to school SLPs who are responsible for intervention with this population (Colorado Department of Education, 2008; Virginia Department of Education, 2005).

The systematic review failed to provide support for the use of auditory interventions as an efficacious treatment option (Fey et al., 2011). Positive trends were noted in some of the studies; others showed minimal to negative gains as a result of treatment. However, the lack of evidence has not decreased the large number of referrals from psychologists, physicians, audiologists, and teachers to treat children with APD. For this reason, some committee members believe it is critical for ASHA to establish an APD-focused assessment battery for SLPs as well as treatment guidelines to achieve better consistency in APD intervention among SLPs, similar to what was accomplished for audiologists by the 2005 working group.

At present, professionals are not able to cite strong rationale to justify the various auditory skill-based treatments provided to children with APD. Clinical decisions must be guided by existing evidence, which at present is minimal in supporting auditory interventions for APD. The weak database fails to provide direction for practicing professionals who treat this population. The limitations need to be acknowledged by SLPs providing services and explained to parents and consumers requesting remediation.

Wallach (2011) provides a compromise solution: Peel back the layers of the APD to discover the realized language deficits and treat those within an applied curricular approach. Wallach states that “we do not process auditory, we process language” (p. 282). If an APD does not cause any academic or language deficits, does it merit intervention? Kamhi (2011) and Wallach would say absolutely not.

Conclusion

The complexity of APD fails to lend itself to a simple definition. The debate began in the early years of our professions, with strong voices in the early 1980s (e.g., Butler, 1981; Katz, 1978; Keith, 1981; Massaro, 1975). Auditory processing has experienced resurgence into the forefront in the past 20 years (e.g., Bellis, 2003; Chermak & Musiek, 2007a; Geffner & Ross-Swain, 2007). Despite more than 50 years of research and clinical practice, definitive diagnosis and treatment have not emerged from evidence-based systematic reviews. The inadequate research base in APD suggests that we should stop using the term and evaluate parameters of language performance that are deficient (Kamhi, 2011; Wallach, 2011). Medwetsky (2011) asserts that the source of the deficits (i.e., auditory processing) needs to be

identified and acknowledged. In reality, there is not enough good research to determine which position has more validity. The profession continues to struggle with how to answer questions regarding APD and its clinical relevance.

Following the systematic review, Fey et al. (2011) generated several suggestions that might facilitate research studies to resolve some of the questions. First, subjects in studies need to be “evaluated using a comprehensive battery of conventional tests of APD as well as more sophisticated neurophysiological indices” (p. 253). This would bring a uniformity to prestudy auditory and language abilities that could be measured poststudy. Second, “the language characteristics of children in APD study samples are unknown” (Fey et al., 2011, p. 253), confounding the ability to interpret treatment-related gains. Third, small case studies need to be replicated in “larger, well-controlled and hypothesis-driven experimental trials that compare their efficacy with that of other auditory and language interventions” (Fey et al., 2011, p. 253).

Research studies need to be designed to tease apart the effects of auditory intervention tasks that are within the boundaries defined by the 2005 ASHA working group. Can research show that intervention to improve perception of pitch and tone (i.e., low, high), which is a nonmeaningful, nonlinguistic task, results in benefits to language interpretation at a metalinguistic level? Does drill on auditory memory or discrimination produce or encourage a difference in language or literacy performance?

Perhaps the best solution to the problems associated with APD is to acknowledge that the processing of auditory–verbal signals encompasses a variety of different skills, both acoustic and linguistic in nature. Therefore, audiologists and SLPs need to collaborate and use each other’s expertise. Many skills are included within the concept of auditory processing—one subset is served by audiology and another by speech-language pathology. Each discipline, audiology and speech-language pathology, needs to be consistent in defining the tasks encompassed within APD and empirically evaluate their clinical relevance.

Returning once more to Massaro’s (1975) definition, an individual needs to acquire the ability to abstract meaning from auditory stimuli that carries a linguistically encoded message. That skill will involve the peripheral auditory system to receive the acoustic stimulus, the central auditory system to transfer the acoustic stimulus to the auditory cortex, the phonemic linguistic code to recognize words as units, and a lexical semantic knowledge to comprehend the meaning. It requires a continuum of abilities involving auditory, phonemic, and linguistic competence (Richard, 2007b). The professional charged with providing assessment or treatment should use evaluation tasks that identify competency in discrete auditory and language skills. Realized deficits should be addressed while keeping efficacy data to document the functional outcomes of treatment.

And the debate will continue!

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