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USE OF FAST FORWORD IN REMEDIATION OF CENTRAL AUDITORY PROCESSING DISORDERS

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ABSTRACT

This article reports data from two independent audiology clinics on the use of Fast ForWord in remediation of central auditory processing disorders (CAPD). The data include a retrospective investigation of 15 randomly selected children from a private clinic in Bromall, Pennsylvania and six case studies from a clinic in Houston, Texas. The results are discussed relative to recent controversies about the nature of CAPD and its independence from other higher level cognitive impairments in children.

In 1996 an ASHA task force defined central auditory processing as "the auditory system mechanisms and processes responsible for the following behavioral phenomena: sound localization and lateralization; auditory discrimination; auditory pattern recognition; temporal aspects of audition including temporal resolution, temporal masking, temporal integration, and temporal ordering; auditory performance with competing acoustic signals; and, auditory performance with degraded acoustic signals." (ASHA, 1996, p. 41) Despite general agreement with this definition among audiologists and other hearing scientists, controversy remains about the nature and management of central auditory processing disorders (CAPD). Specifically, some authorities have questioned whether CAPD is causally linked to developmental language disorders, attention deficit disorders (ADHD) and/or other learning disabilities. (See especially, Chermack and Musiek [1997] for a thorough discussion of this issue.)

Tallal and her colleagues (Tallal and Piercy, 1973; Tallal and Stark, 1982) have explored an experimental paradigm to clarify the causal connection between central auditory processing deficits and language impairments in otherwise normally developing children. They developed a non-linguistic task that requires only the sequential ordering of two sweep tones separated by variable interstimulus intervals. They reported that on this task children with and without language impairments could perform the task with a high degree of accuracy as long as the interstimulus interval was over 350 milliseconds. However, as soon as the interval between the two sweep tones decreased below the 350 ms threshold, the language-impaired children were unable to accurately sequence the two tones. Since this experimental paradigm required no linguistic interpretation or response, the researchers concluded that a temporal auditory processing deficit might underlie speech sound discrimination problems, thereby leading to language learning delays in otherwise normally developing children. Corroboration of this hypothesis came from later research with Merzenich, et al., (Tallal, et al., 1996; Merzenich, et al., 1996) in which language impaired children were trained on the two-tone temporal processing tasks while simultaneously receiving intensive language treatment with acoustically modified speech signals (prolonged and amplified rapidly occurring acoustic elements). Post-test to pre-test language comparisons of the experimental group of children who received the acoustically modified speech were significantly superior to post-test changes in the control group who underwent the same intensive treatment without the modified speech.

The current study was conducted in an attempt to shed further light on the relationship between CAPD, language disorders, and temporal processing. Whereas the original Tallal and Merzenich, et al. (1996) study did show increases in language skills after short-term intensive training using acoustically modified presentations of speech stimuli, some audiologists questioned whether children diagnosed with CAPD might also benefit from the program. Furthermore, since many children who exhibit CAPD also exhibit varying degrees of language impairment, a second question raised was whether children with both CAPD and language disorders would show gains in both language and auditory processing or one area of disturbance but not the other. If temporal processing differences account for some language disturbances, one would expect that remediation of a temporal processing deficit would result in increased language performance, but that might not necessarily transfer to other central auditory processing tasks. On the other hand, if language disturbances are causally linked with a range of central auditory processing tasks in which temporal processing and speech discrimination are closely and fundamentally linked, one might expect concurrent gains in both areas across a spectrum of tasks.

In the present study, 15 clinical cases were randomly selected from a group of over 50 children who had participated in the *Fast ForWord* computer-based intensive language and temporal processing program subsequent to audiological diagnosis of CAPD. In all cases, the audiologist/speech language pathologist who administered the *Fast ForWord* program was the same professional who had initially diagnosed CAPD. In most cases the children had been referred for audiological testing because of academic and/or reading difficulties. Seven of the children, also diagnosed with language disorders, were analyzed for changes in language scores. Since the investigation was preliminary in nature, the authors opted for a retrospective study to determine whether further, more experimentally controlled investigation of CAPD and temporal processing/language training would be warranted.

The fifteen children are described below.

- 15 children between the ages of 5-11
- all exhibited CAPD as determined by administration of the SCAN (Screening Test for Auditory Processing Disorders) and other CAP testing - only the SCAN data are presented here
- seven had other language or psychological diagnoses as well as CAPD
- all had been referred specifically for audiological testing

All audiometric puretone, speech reception, speech discrimination and CAPD assessments were performed on a Grason-Stradler GSI-61 clinical audiometer, ANSI 3.6, 1989, Type 1. The SCAN was administered at 15 dB+ PTA. Headphones used were Telephonics TDH-50P. The audiometric chamber used was Acoustic Systems

Model 143 Delta. Tympanometry was conducted on a Grason-Stradler GSI 38, ANSI S 3.6/ISO 389.

All of the children had normal puretone thresholds except subject 002 Female SB who had a recurrent Otitis Media with effusion since her 1st year of life - PTA 22dB, SRT 20 dB (air-bone gap not greater than 10 dB). One child, subject 014 CP, a female, had a 92% word discrimination score for the left ear and 88% word discrimination score for the right ear on initial testing but was re-tested two days later and received 100% bilaterally. That child had been diagnosed as "mildly aphasic".

Portions of the *Test of Language Development* (TOLD) were administered to those children for whom language testing was deemed appropriate. All seven language impaired children received three subtests of the TOLD that will be reported here: oral vocabulary, grammatical understanding, and sentence imitation. Several CAPD batteries were administered but the one used consistently with all fifteen children was the SCAN, *A Screening Test for Auditory Processing Disorders* (Keith, 1986), so those data will be reported here. Because the reliability of the SCAN has been questioned (Amos and Humes, 1998), especially when administered through a tape recorder, administration was conducted using only the aforementioned calibrated audiometric equipment. Further, all test/re-test data are presented in standard score format with a comparison made between the scores obtained after *Fast ForWord* and the re-test changes noted by Amos and Humes.

Data from the SCAN pre- and post-testing are provided in standard score format, and t-test statistical comparisons were conducted for each of the subtests. Language pre- and post- test standard scores on three subtests of the TOLD are provided on the seven children for whom language testing was administered. No statistical comparisons were performed because of the small *n*.

RESULTS

Figure 1 provides the mean standard score SCAN changes observed on the 15 subjects after six to eight weeks of *Fast ForWord*. As can be observed from Figure 1, the children averaged over a five point standard score increase on the Filtered Words subtest, $t = 7.375$, $p < .0005$. By comparison, the children in the Amos and Humes (1998) study, both first and third grade children, averaged less than two standard score point increases on re-test after seven weeks. On the Auditory Figure Ground subtest, the 15 children in this study made an average four and one-half standard score increase after *Fast ForWord*, $t = 5.315$, $p < .0005$, whereas the Amos and Humes data showed no standard score increase on re-test. Finally, on the Competing Words subtest, the 15 subjects in this study made almost a four standard score point increase after *Fast ForWord*, $t = 4.375$, $p < .0005$, compared with an average two standard point increase noted after seven weeks by Amos and Humes.

Language post-test scores also showed large increases on the seven children for whom TOLD testing was conducted. Figure 1 shows these changes reported as standard scores. On the Oral Vocabulary subtest of the TOLD the children averaged over a four standard score increase. On the Grammatical Understanding the children showed an average three standard score increase. Finally, on the Sentence Imitation subtest the children averaged slightly over a two standard score increase.

Summary of Study 1 The findings of this preliminary retrospective study of fifteen children diagnosed as CAPD suggest that an intensive computer program designed to increase temporal processing speed as well as enhance overall language skills results in improvements in both language and central auditory measures. Despite the small number of children studied, the t-test comparisons on all three SCAN subtests were highly significant. Since these results were obtained retrospectively, results await corroboration through a prospective study, using a control group if possible. Because SCAN and TOLD test data made similar increases in all children for whom language test data were available, these data show a correspondence between language and CAPD test results and changes. However, the data are inadequate to infer a causal connection.

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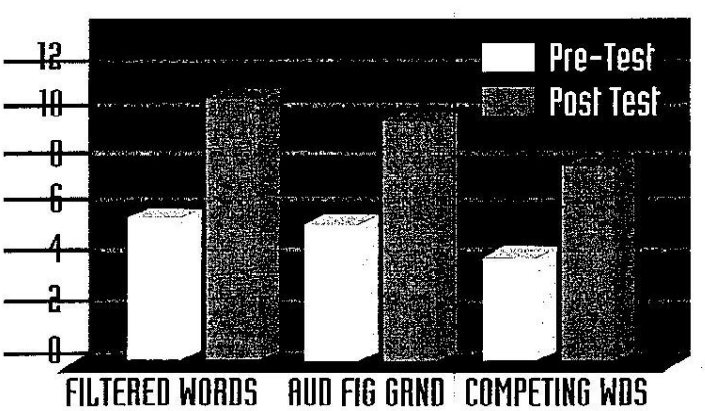

Figure 1. SCAN pre- and post- Fast ForWord standard score composites for 15 children.

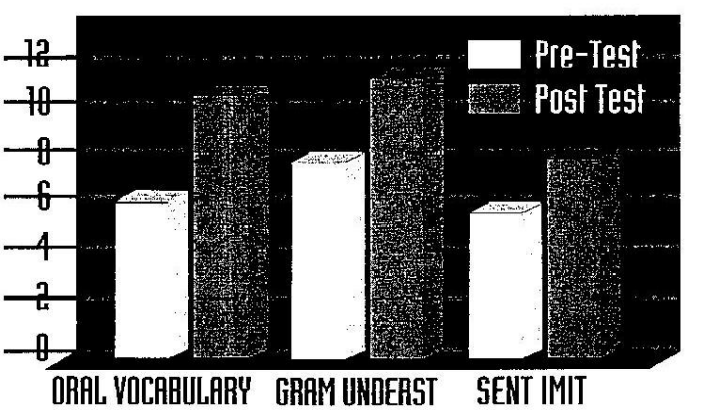

Figure 2. TOLD pre- and post- Fast ForWord individual test scores for 15 children diagnosed as exhibiting central auditory processing disorders.

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