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The reassessment of central auditory processing disorders in children 7 to 12 years of age

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Independent Study Project

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THE REASSESSMENT OF CENTRAL AUDITORY PROCESSING ABILITIES IN CHILDREN 7-12 YEARS OF AGE.

INTRODUCTION

Children with central auditory processing disorders (CAPD) are part of an often undiagnosed or mislabeled group of children with communication disorders who may experience learning, behavioral, and emotional problems in school. Unfortunately many children go undiagnosed or are given ineffective or inappropriate treatment (Katz et al. 1993; Keith 1986). Successful diagnosis and effective remediation of CAPD prove a challenge to all involved (Katz et al. 1992).

Ferry (1981) states that interest in central auditory processing has grown dramatically over the past ten years with the increased survival rates of low birth weight and other "high-risk" infants. These infants were either born prematurely or have other factors in their history that may contribute to developmental problems. One reason for the increased interest is that the identification of children allows modification of language and learning styles to facilitate academic progress. Other reasons stem from establishment of evaluation teams, federal legislation mandating special education programs, improved remediation techniques, and the increase in our knowledge about basic brain development (Keith 1981).

Numerous authors have attempted to define CAPD however the term is still in great dispute (Musiek et al 1990). Many researchers believe CAPD is a global term that describes a diverse set of symptoms such as neurological, psychological and educational problems (Zarrella 1995). Factors that may contribute to CAPD include (Keith 1986):

* academic problems
* attention deficit disorder
* family adjustment problems
* genetic traits
* learned helplessness
* language disorder (oral and/or reading)
* middle ear effusion
* neurological disorder
* perceptual motor disorder
* poor self image
* social emotional problems

CAPD has been defined by Keith (1986) as:

> ... the impaired ability to attend to, discriminate, recognize, remember, or comprehend information presented auditorily, even though the person has normal intelligence and hearing sensitivity. These difficulties are more pronounced when listening to low redundancy (distorted) speech, when there are competing sounds, or when there is a poor acoustic environment. (page 3).

In other words, CAPD is any breakdown in a child's auditory abilities that results in diminished learning through hearing, provided peripheral auditory sensitivity and intellectual function is normal. When auditory processing abilities are disrupted because of a lesion somewhere in the auditory pathways to the brain, a series of "problems" can occur (Keith 1986). Children with CAPD may have academic difficulty and appear to have "hearing problems" yet have normal audiograms (Musiek et al. 1990; Trace 1995; Musiek et al.1994). Either these children do not have the neurological and sensory potential necessary to develop and organize language normally or the development may occur at a slower rate. Some of these children have difficulty perceiving speech when

there is a poor signal presented to the them due to a delay or deficit in the development of the auditory pathways to the brain. The more severe the CAPD the greater the effect on language (Keith 1986). Katz et al. (1992) lists the following "at risk" behaviors for CAPD:

> Easily distracted
> Exhibits behavior problems
> Gives inconsistent responses to auditory stimuli
> Gives slow or delayed response to verbal stimuli
> Has difficulty following oral instructions
> Has difficulty listening in the presence of background noise
> Has difficulty with phonics and speech sound discrimination
> Has poor auditory memory (span and sequence)
> Has poor receptive and expressive language
> Has reading, spelling, and other academic problems
> Learns poorly through the auditory channel
> Often misunderstands what is said
> Poor auditory attention
> Requests information to be repeated
> Says "huh" or "what" frequently (page 111)

Katz et al. (1993) developed four categories that represent the characteristics of individuals with CAPD:

1. Decoding problems-- at the phonemic level, often associated with slow or delayed responses to verbal stimuli. Problems are related to poor phonics, poor reading, word-accuracy, and poor spelling.

2. Tolerance, Fading memory-- difficulty with fading memory, inattention and processing speech in a noisy background despite normal hearing ability. Less of

an academic problem is observed, however child may have difficulty with reading comprehension and expressive difficulties.

3. Integration problems-- inability to coordinate two or more functions (i.e. visual and auditory stimuli). More severe academic difficulties are present. Integration problems share many of the same characteristics as decoding or tolerance/fading memory problems.

4. Organization problems-- sequencing difficulties or delays, often existing with a learning disorder. (Katz et al. 1993, page 192; Zarrella 1995).

There is a correlation between CAPD and a high incidence of otologic disorders, learning disabilities, and attention deficit disorder (ADD) (Musiek et al.1994; King et al. 1992; Keith et al. 1989; Jerger et al. 1987; Pinheiro et al. 1985; Pinheiro 1977). Some authors believe that the link between CAPD and otologic disorders (particularly otitis media) stems from the relationship between language learning and persistent middle ear infections (Katz et al. 1992). Fluctuating hearing loss up to 40dB is associated with otitis media. Hearing loss associated with persistent infections can cause language learning difficulties. In particular, the low intensity and linguistically complex speech sounds at the ends of words and in multisyllabic words; are difficult to hear, especially in noisy environments (Katz et al. 1992). Children with language learning difficulties may be classified as learning disabled (LD) due to the physiological effects of numerous middle ear infections early in life, or because of a neurologic defect that is not allowing auditory information to be properly integrated to the brain (Northern et al. 1992). Children with a

learning disability often appear to have difficulty paying attention in the classroom, and/or have behavioral problems (Gascon et al. 1986). An attentional problem can be symptomatic of a number of etiologies including Attention Deficit Disorder (ADD), Attention Deficit Hyperactivity Disorder (ADHD), and CAPD (Keith 1994). Symptoms of ADD and ADHD are short attention spans, distractibility, hyperactivity, and impulsivity. These symptoms are the same as those reported for children with CAPD (Gascon et al. 1986; Zarrella 1995). Many articles dispute that CAP, ADD and ADHD are separate entities; however, others believe CAP is a "subset" of ADD and ADHD (Gascon et al. 1986). Many of the symptoms seen in LD, ADD and ADHD can cause poor performance on CAP tests (Musiek et al.1994; Sloan 1992).

TESTS

Many CAP tests have been prepared to evaluate a variety of processing skills/abilities (see appendix A for a partial list of CAP tests). The tests listed in appendix A have been used in identifying maturational and auditory processing disorders that may contribute to a child's poor performance in communicating and functioning in the school setting (Keith 1986). However, many of these tests lack normative data. Tests with published norms are signified by "*N*" in appendix A.

This study focused on the tests used by audiologists at St. Louis Children's hospital which are the SCAN: a Screening Test for Auditory Processing Disorders, the TAPS: Test of Auditory Processing Skills, and the G-F-W Auditory Selection test. The

SCAN, TAPS, and G-F-W all have normative data which facilitates accurate interpretation of results.

Robert Keith, Ph.D. (1986) developed the SCAN to assess performance with filtered words, figure ground, and competing words in children from 3 to 12 years of age. Keith suggests that the SCAN is sensitive to the presence of ADD and to maturational factors, both of which may result in an overall decrease in all subtests. The Auditory Figure Ground and Filtered Words subtests are said to investigate performance in noise and listening skills. The Competing Words subtest analyzes the development of the child's auditory system (Keith 1986). In addition the filtered words and auditory figure ground tests relate well to real life problems. For example filtered words is similar to classroom lectures where the teacher may have his/her back to the class. All of the auditory signal may not completely heard and the child must "fill in" the rest of the signal in order to understand. The auditory figure ground subtest is similar to situations in the classroom, the gym, the cafeteria, etc. where a child's ability to understand speech stimuli is challenged with other people talking in the background. Furthermore, the SCAN is minimally affected by short term memory and language ability. The child is required to repeat one or two words at a time and the vocabulary is at the elementary age level.

The TAPS is designed to assess six areas of auditory skills (see Table #1) and short term memory of children 4 to 12 years of age. Each subtest measures specific areas of expressive language function, and it is helpful when used with other tests to determine learning problems. Gardner (1985) states that the purpose of the TAPS is to measure a

child's auditory perception in various areas. Poor performance on one or more subtests is associated with learning problems for reading and spelling. In addition, information about the child's response time, articulation, and language can be informally assessed by the examiner. See Figure #1 for the TAPS subtests (Gardner 1985):

The G-F-W: Auditory Selection test provides a more in-depth look at auditory figure ground ability. It is designed to provide a thorough assessment of the ability to attend under increasingly difficult listening conditions; in quiet, with fan-like noise, with cafeteria noise, and with voices in the background (Goldman et al. 1974).

REMEDIATION

Similar to recommendations for hearing impaired individuals, the remediation for CAPD often consists of recommendations to improve the child's listening environment (Katz et al. 1993). Children may present with a "maturational delay" or with an auditory processing problem. "Maturational delays" require remediation focused on classroom management, counseling for the parent, teacher, and/or child, and tutoring. Often children with maturational delays catch up by 9 or 10 years of age (Katz et al. 1992). For suspected permanent disorders, recommendations may include counseling teachers and parents to understand the child's abilities, management of the child's listening environment, direct intervention in therapy, or special education (Keith 1986). At the time of diagnosis, the audiologist may make recommendations that include preferential seating in the classroom, educational interventions, using an FM auditory trainer, or

retesting at a later time (Keith 1986; Peck et al. 1991; Zarrella 1995; Katz et al. 1992). See Appendix B for other listings of recommendations. It is important for parents, teachers, and children to utilize the recommendations given to aid the child in learning. However it is most important that the child recognize his/her own abilities and take responsibility in their own remediation (Keith 1986).

Between the years of 1990-1994, 55 children were identified with a CAPD in the audiology unit at St. Louis Children's Hospital. The aim of this study was to reevaluate these children and survey parents to determine which recommendations have been found to be useful for parents. We were also interested in determining whether test scores have changed over the course of 2-6 years time.

METHOD

Subjects

Fifty-five children (11 female and 44 male) between 7 years to 12 years of age at the time of the study who had been diagnosed with central auditory processing disorders between 1990-1994, were asked to participate in the study. The parents of each child were contacted via telephone and informed of the purpose of the study, benefits to their child, and procedures involved. They were asked to participate in this study in one of two ways: 1. Fill out a questionnaire (see appendix C) and return it in the self addressed stamped envelope. 2. Fill out and return a parent questionnaire in the self addressed stamped envelope and bring their child in to St. Louis Children's hospital for a free retest

of central auditory processing abilities, repeating those tests used at the time of initial diagnosis.

Of the initial 55 potential subjects, 20 returned the parent questionnaire. Of these 20, 9 returned the parent questionnaire and brought their child in for retesting. One child was retested by his school district and the parents sent in the test scores. Of the subjects that did not participate, 13 were unreachable (8 had an incorrect address and/or no address listed and 5 had an incorrect phone number or no phone number listed in the child's medical charts). Twenty parents stated that they would consider participating in the study but did not respond. Two parents were not interested in participating and felt their child did not have a problem. The subjects participating ranged in age from 8-12 years at the time of the study with 17/20 (85%) males and 3/20 (15%) females.

Apparatus/Equipment

The hearing screening, SCAN, and G-F-W were performed in a double-walled sound proof booth using a Grasen-Stadler GSI10 2-channel audiometer with TDH-39 headphones. A tape deck was used for administration of the SCAN Test and G-F-W Auditory Selective Attention Test. Both tests were administered according to procedures described in the tests manuals. The Test of Auditory Perceptual Skills Test (TAPS) was performed in the sound booth with the examiner and the child in face-to-face positions.

Test Materials and Procedures

An air-conduction hearing screening was administered at 20dBHL for 500Hz, 1000Hz, 2000Hz, and 4000Hz (Keith 1986). Provided the subject passed the screening, he/she was reevaluated using the same central auditory processing (CAP) tests administered at the time of the initial evaluation. Tests included combinations of the SCAN, TAPS, and G-F-W. Six children received the SCAN and the TAPS, two children received the GFW and SCAN, and one child received the SCAN only. Tests were administered according to directions in the test manuals. Periodic breaks were taken if the subject became fatigued during testing.

The **TAPS test** consists of six subtests as described below:

1. Auditory number memory-- digits forward and digits reversed.

Forward- assesses use of rote memory of nonlinguistic matter.

Reversed-assesses concentration and mental control.

The child was asked to repeat a list of numbers given by the examiner forwards or in the same order as the examiner says them, and then in reversed order for as long as he/she is able.

2. Auditory sentence memory---assesses ability to recall auditory information in sequence. The child was asked to remember and repeat back in sequence the sentence given to him/her by the examiner.

3. Auditory word memory---assesses recall and speech pronunciation ability.

The child was asked to repeat back strings of one-syllable words, two-syllable words, and compound words as the sequence became progressively difficult.

4. Auditory interpretation of directions---assesses auditory memory, sequencing, and understanding. The child was asked to understand and interpret what he or she perceived by ear in order to derive an appropriate answer as to what he or she would do.

5. Auditory word discrimination---assesses phonemic discrimination ability. The child was asked to determine if the pair of words told to him or her by the examiner are "the same" or "different".

6. Auditory processing (thinking and reasoning)---assesses thinking and reasoning abilities.

The child was asked to give answers to questions told to him or her by the examiner. These questions required the child to listen and think before he or she responded.

Administration time for the TAPS test was approximately 15-30 minutes depending upon the age of the child and his/her cooperation.

The **SCAN test** contains three subtests:

1. Filtered words-- tests auditory closure skills. This subtest contains two lists of 20 monosyllable words each low-pass filtered at 1000Hz with a filter roll-off of 32dB/octave; 20 words presented to the right ear and 20 words presented to the left ear. The child was asked to repeat the words that he or she heard.

2. Auditory figure ground-- tests the ability to identify a primary signal or message in the presence of competing sounds. This subtest contains two lists of 20 undistorted monosyllabic words recorded in the presence of multi-talker speech babble noise at +8dB signal to noise ratio. Noise was presented in the same ear that the stimulus word was presented; 20 words were presented to the right ear and 20 words were presented to the left ear. The child is asked to repeat the words he or she heard while ignoring the noise.

3. Competing words-- tests the maturational development of the child's auditory system. This subtest is made up of two lists of 25 monosyllabic word pairs that are presented to the right and left ears with simultaneous onset times. For the first 25 words, the child is asked to repeat back both words starting with the word presented in the right ear first. For the second part of the test, the child is asked to repeat back both words starting with the word presented in the left ear first.

Administration time for the entire SCAN test was approximately 20-30 minutes.

The **G-F-W auditory selective attention test**-- contains three sections.

The purpose of this test is to evaluate listening abilities with increasingly difficult background noises-- in quiet, with fan-like noise, with cafeteria noise, and with voices as a background. The examiner and the child are seated face-to-face with a test booklet between them on a table. The stimulus is presented via a cassette recording through earphones at a "comfortably loud" level (about 50dB). The G-F-W is a picture pointing

test in which the child is asked to choose from four pictures illustrating the test word. Administration time for the G-F-W was approximately 20 minutes.

Results

Parent questionnaire

The parents of the 20 subjects participating in this study completed a parent questionnaire. This questionnaire asked 14 specific questions with respect to CAPD about the child and the parents opinion regarding the child (see Appendix C for questionnaire).

Results of answers to Yes/No/Not sure questions are depicted in Table #1.

Question #3- How many ear infections has your child had during the past year?

Seventy-five percent of the children in the study have not had any ear infections within the past year. See Table #2 for results.

Question #5- In what grade is your child?

Children were in grades 2 to 6. Of the 20 children in this study, 14 (70%) children were in age appropriate grades in school according to public school regulations. Therefore 6 (30%) were not in age appropriate grades. Of the six, four children were one grade behind and two children were two grades behind.

Question #6- What educational diagnosis, if any, has been given to your child? (i.e., learning disability, hyperactivity, language impairment, mentally challenged, physically challenged....etc.)

An educational diagnoses had been given to 12/20 (60%) of the children. Diagnosis included CAPD, learning disabled, attention deficit disorder, attention deficit hyperactivity disorder, psychological, and/or speech/language impaired. See Table #3 for a breakdown of the results.

Question #8- If you answered YES to Question #7 [Does your child receive any special services in school and/or outside of school hours? (i.e. special education, tutoring, speech language therapy, psychological consultations, etc.)] , please describe in detail the services your child receives, and approximately how many hours a week are dedicated to each.

Special services either in school or outside school are offered to 16/20 (80%) of the children; 7/16 receive more than one type of service listed. Services being received by these children (n=16) are found in Table #3.

Question #9- How long has your child been receiving these services?

The average number of years of all the children receiving a specific service is listed in Table #5.

Question #10- Do you feel these special services have helped your child?
If YES, in what areas have you noticed improvement?

For all 16 of these children (100%), the parents stated in the questionnaire that they believe that the special services have greatly helped their child. The areas where parents have noticed improvement include the following:

*Accepts limits better
*More tolerant of what he/she can/can not do
*Able to think things through
*Less impulsive
*Improved focus
*Improvement in speech/language abilities
*Improvement in expressive language
*Improved mobility
*Improved reading, spelling, and English grammar
*Improved behavior
*He/she is better able to follow complex instructions
*Improved academic performance

Question #11- Is your child currently on medication for attentional, hyperactivity, or seizure disorders? If YES, please list the medications:

Of the 20 subjects, 6/20 (30%) are on medication for attentional, hyperactivity, or seizure disorders. See Table #6 for a breakdown of the types of medications these children are on.

Question #12- According to our records, the following recommendations were given for your child. Please place a check mark next to those which: you attempted, were helpful, you use regularly.

Parents were asked to select and rate recommendations suggested to them at the time of diagnosis as to which of the recommendations they have or have not tried and found helpful. The 12 recommendations listed on the questionnaire in Appendix C were listed and the parents were to select if:

1. They <u>attempted</u> the recommendation, but did not pursue it further.

2. They found the recommendation <u>helpful</u> and used it, but they do not use it regularly.

3. They use the recommendation on a <u>regular</u> basis with their child.

The overall results of the 20 respondents are as follows:

	You attempted.	Were helpful.	You use regularly.
1. Control child's environment by obtaining quiet.	30%	20%	45%
2. Use simple language when talking with your child.	0%	35%	50%
3. Obtain your child's attention before speaking.	10%	10%	75%
4. Have child give feedback or repeat instructions given.	10%	25%	55%
5. Avoid conversation in areas where there are competing noises.	20%	25%	45%
6. Allow child to move to an optimal listening environment.	15%	30%	40%
7. Use visual aids to reinforce auditory cues.	10%	20%	45%
8. Psychological consultation	20%	10%	15%
9. Speech & Language Evaluation	10%	50%	20%
10. Neurological evaluation	20%	10%	5%
11. Assistive listening devices (such as FM devices)	0%	0%	10%
12. Retesting for Central Auditory Processing Abilities in 1-2 years.	15%	10%	5%

Question #13- Are there any strategies that your child uses that were not necessarily recommended, but have proven beneficial to him/her? (Please explain in detail).

Strategies not necessarily recommended, but that parents report to have been beneficial to the child include:

1. Child asks for repetition if he/she does not understand.
2. Child asks speaker to talk slower.
3. Child asks speaker to look at him when speaking.
4. Child uses closed caption while watching TV.
5. Child uses assistive listening device at the movie theater.

Question #14- If your child uses an FM system in school for more than half of the academic day, please answer the following questions:

a. Do you feel the FM system helps your child?
b. Does your child like to use the FM in school?
c. What does he/she like about the system?
d. What doesn't he/she like about the FM system?
e. Has the FM system been technologically reliable? (i.e. Does it or doesn't it break often?)
f. What feedback have the teachers given to you regarding the use of this equipment?

In this study only 2/20 children used an FM system regularly in school (subjects #1 and #6). Both parents responded that the FM system helps their child. Subject #1 has reported to like the FM at school and subject #6 liked it "sometimes". Subject #1 finds the system to be essential in understanding in the classroom, and realizes how much it helps her. The primary complaints from these two children regarding the FM system include:

1. Headset of FM system is uncomfortable. (subject #1 & #6)

2. Child does not like how the system looks (vanity). (subject #1)

3. System picks up other close radio frequencies. (subject #6)

Technological reliability of the FM is very good for subject #6 and poor for subject #1; however, the parent states that the device is dropped often. Teacher feedback regarding the device is very positive for subject #1 and no feedback is reported for the subject #6.

Retesting

Nine subjects returned to St. Louis Children's hospital for retesting of central auditory processing (CAP) abilities using the same tests given at the time of initial diagnosis. All subjects passed the hearing screening test. Of those children who came in for CAP retesting (n=9), 6 parents agreed their child had a CAP disorder, 2 were unsure, and one did not feel their child had a problem.

Six children were retested with the TAPS and the SCAN, two children were given the G-F-W and the SCAN, and one child was retested with the SCAN test only.

Significant changes in individual performance were based on the 80% confidence interval for the SCAN, and the 95% confidence interval (+/- 2 SD) for the TAPS. Group mean scores were considered significant if test/retest scores did not fall with in +/-1 standard deviation. CAP test scores were considered within the normal range if they were greater or equal to the 25th percentile.

On the SCAN, 4/9 children improved their performance on the filtered words subtest, and the group mean performance was also significantly better. The Auditory figure ground subtest showed one child with improved performance and one child with decreased performance. The group performance did not change significantly. On the competing words subtest, three children performed significantly better and four children performed significantly worse with no significant changes in the group mean performance.

On the TAPS, only the auditory sentence memory subtest, the auditory word memory subtest, and the interpretation of directions subtest showed significant changes. On the auditory sentence memory subtest, one child (#4) showed improved performance and one child (#9) showed decreased performance. Subject #5 showed decreased performance on the auditory word memory and the interpretation of directions subtest, and subject #3 also showed decreased performance on the interpretation of directions subtest. No significant changes were noted for group performance.

Significant changes on the G-F-W occurred in subject #1 on the voice paradigm. Group performance also significantly improved. See Table #8, 9, & 10 for each subjects results, the standard deviations of each subtest, and the group mean performance scores at initial diagnosis and at the time of retesting.

Discussion

The original subject population of 55 children supports Keith's (1981) findings that CAP disorders are more prevalent in males versus females by a 4:1 ratio. Of the 55 subjects with CAPD at initial diagnosis, 44 were male and 11 were female.

The parent questionnaire revealed many interesting findings (see Appendix C). Parents were asked if they believed their child had a central auditory processing (CAPD) disorder. All 20 of the subjects in the analysis had been diagnosed with CAPD, 2 to 6 years ago, 13 parents stated they believed their child had a CAP disorder, six parents were unsure, and one parent did not feel their child had a CAP disorder.

One characteristic that is closely related to CAP disorder is a positive history of middle ear problems, predominately otitis media early in life which often results in placement of T-tubes (King et al. 1992). Early otits media has been related to communicative problems and decreased auditory skills (Katz et al. 1992). In this study, 85% (17/20) of the children in the study group had a positive history of middle ear disease. However at the time of retesting no child had T-tubes, and only 5/20 (25%) children had one or more ear infections in the past year.

Sixty percent (12/20) of the study population had received an educational diagnosis from his/her school at the time of the study. The diagnoses included no reported problems to learning disabled (LD), attention deficit disorder (ADD), attention deficit hyperactivity disorder (ADHD), psychological, speech/language impaired, etc. Nine of the 12 children who have received an educational diagnosis, had more than one diagnosis (e.g. LD and ADD). A breakdown of the educational diagnosis is given in Table #3.

Of the six parents that stated that they were unsure that their child had a CAP disorder 4 children had not received an educational diagnosis at the time of the study, and the other 2 children were diagnosed with attention deficit disorder.

Sixteen of the 20 subjects receive special services. Speech therapy, tutoring, and special education are the three most common services for these children. Parents of these children all claim that these services have greatly helped their child. With these statements from parents about how special services have aided in their child's

remediation, future recommendations for remediation may be to include tutoring, speech therapy, or special help in classes where the child may need it.

In the parent questionnaire, parents were asked to select and rate recommendations suggested to them at the time of diagnosis as to which of the recommendations they have or have not tried and found helpful. The recommendations used in the questionnaire are listed in Table #10. The three recommendations used regularly by most of the parents are also the easiest to utilize in the home environment. These recommendations are:

1. obtaining the child's attention before speaking,
2. have child give feedback or repeat instructions given,
3. use simple language when talking with the child.

Although the recommendations listed above have been found to be the most widely used by parents in this study, they are certainly not the only recommendations used. All parents stated that they use at least one or more of the listed recommendations regularly with their child, and many parents stated that they have found recommendations helpful in the past that were no longer needed at the time of this study. Parents also stated that some of the children have learned to utilize strategies that were not necessarily recommended at the time of diagnosis.

Of the seven children in the study who received an educational diagnosis as ADD or ADHD, five are on medication. Gascon et al. (1986) concluded that children with

ADD/ADHD on prescribed medication improve in their CAP test performance. Possible reasons are:

1. Medications improved the attentional deficit component and what is left is the true CAP ability of the child.

2. ADD is only partially treatable with medications and the best to expect is improvement in these children; not necessarily return to "normal".

This study retested two children with ADD or ADHD who are on medication. One child (subject #6) was retested using the SCAN and scored significantly better on all subtests. This child also uses an FM system regularly in the classroom. The other child (subject #7) was retested using the SCAN and the G-F-W. There were no significant changes in test/retest scores except on the competing words subtest of the SCAN in which scores were significantly worse at retesting than at the time of diagnosis. One child (subject #5) diagnosed with ADD who is not on medication was retested using the SCAN and TAPS. Performance significantly increased for the filtered word subtest of the SCAN (16% to 50%), but significantly decreased for the competing word subtest of the SCAN (37% to 2%). The auditory word memory (99% to 2%) and auditory interpretation of directions subtests (75% to 9%) of the TAPS both decreased (see Table #8). However a larger test population is needed to further investigate this issue.

Keith et al. (1989) states that children with histories of ADD or ADHD have a greater decrease in SCAN scores particularly for the auditory figure ground and filter word subtests as compared to children with no history of attentional problems. However

Gascon et al. (1986) suggests that children sensitive to attentional problems have more difficulty and poorer scores on CAP tests using a competing stimulus paradigm (i.e. competing words subtest of the SCAN). Findings of this study tend to support Gascon et al. (1986). Of the three children with ADD or ADHD who were retested using the SCAN, two children had significant decreases in their scores on the competing words subtest (CW) at the time of retesting compared to initial diagnosis scores (subjects #5 and #7). The other child (subject #6) retested had an improvement in scores on the CW subtest, and all three children either significantly improved or had no significant changes on the filtered words (FW) and auditory figure ground (AFG) subtests of the SCAN. Since there were only a small number of children retested with ADD or ADHD and the relationship between CAPD, ADD, and ADHD is not known, further research is needed in this area to determine which subtests of the SCAN are actually affected most by ADD and ADHD.

Keith (1986) states that the SCAN is sensitive to both the presence of attentional deficits and to maturity of the auditory system. This may be identified by an overall increase in subtest scores when comparing test/retest results. Of the 9 children retested, only one child (subject #6) had an over all significant increase in subtest scores.

Using a +/- 1 standard deviation for all subtests, the group mean test/retest scores did not significantly change on either the SCAN, the TAPS, or the G-F-W tests except on the filtered word subtest of the SCAN and the voice paradigm of the G-F-W. For the filtered word subtest, the mean group score improved from 26.8% to 51.6% (SD =

23.5%). Improved scores on this subtest may indicate that the group as a whole has improved listening skills (Keith 1986). With respect to the two subjects who were tested with the voice paradigm of the G-F-W, subject #1 performed at a significantly depressed level at initial diagnosis (1%), but retested at a level that is considered well with in the normal range (42%). This subject also utilizes an FM system in the classroom. The other subject's (subject #7) performance did not change.

From Table #7 it can be seen that the two subjects (#1 and #6) who use the FM system in the classroom have significantly better scores on the SCAN test than they did at the time of initial diagnosis. This would suggest that the FM system may provide more than environmental assistance. The FM may be therapeutic for some children diagnosed with CAPD who have difficulty in noise.

As a pilot study, many areas are in need of further research to aid in determining what the best recommendation and remediation possibilities are for children with CAPD. Areas that could have been studied more in depth or in addition to those explored include:

1. The history of middle ear disease and the relationship to t-tubes in children diagnosed with CAPD.
2. Educational services rendered.
3. More in-depth parental education of CAPD at the time of initial diagnosis (i.e. pamphlets about what CAP is and its characteristics, etc.).
4. A teacher survey in regards to child's performance and remediations utilized at school.
5. A larger population of children diagnosed with CAPD surveyed and retested to determine if any of the findings of this study are significant.

Summary

1. Many children diagnosed with CAPD have a positive history of otologic disorders, learning disability, and/or attention deficit disorder.

2. CAPD occurs more in males than in females by about a 4:1 ratio.

3. Many children diagnosed as having a CAP disorder have received an educational diagnosis from his/her school. Of those who have not received a diagnosis, parents suspect there might be problems.

4. Of the children receiving special services, all parents state that the services have greatly aided in helping their child with tutoring and speech therapy as the two most sought after and successful services.

5. SCAN test/retest scores show a variety of significant increases and decreases in scores for individual children on the competing word subtest, but no significant change in group mean scores for competing word and auditory figure ground subtests. However the filtered word subtest does show a significant increase in group mean scores.

6. TAPS test/retest scores show little significant changes for individual subjects and for all group mean scores.

7. G-F-W test/retest scores show no significant changes in test performance except for an increased performance on the voice paradigm for one subject (#1) who utilizes an FM system regularly in the classroom. Significant group mean performance was also noted for the voice paradigm.

8. The management of CAPD involves a wide range of procedures from special services to environmental modifications to the use of assistive listening devices (FM systems). This then involves many different professionals in helping children who have been diagnosed with a CAP disorder, e.g. school teachers, tutors, the audiologist, speech-language-pathologists, neurologists, psychologists, parents.

Conclusion

This study reassessed the central auditory processing abilities of 7 to 12 year olds by retesting CAP abilities in children and through a parent questionnaire. In the questionnaire parents provided useful feedback on how the child is performing and what remediation strategies are used. A questionnaire similar to the one used in this study could be utilized to obtain information to modify recommendations when children return for retesting. Children with CAPD are a group of individuals with a wide variety of characteristics and educational diagnoses. Some areas of weakness may improve overtime or with special services, and areas of strength may decline if no remediation is enacted. Many different professionals are involved in helping children who have been diagnosed with a central auditory processing disorder, e.g. school teachers, tutors, the audiologist, speech-language-pathologists, neurologists, psychologists, and parents in order to obtain the best care and services.

Appendix A

SOME COMMON TESTS OF CENTRAL AUDITORY PROCESSING

For Adults and/or Children

#Auditory Continuous Performance Test (ACPT)--(Keith 1994)

#Binaural Fusion--(Martin et al. 1977; Farrer et al. 1981)

#Competing Environmental Sounds (CES)--(Johnson et al. 1980)

#Competing Sentences

#Dichotic Sentences--(Fifer et al. 1983)

Dichotic Digits--(Musiek 1983)

#*Goldman-Fristoe-Woodcock: Auditory Selective Attention Test (GFW)--(Goldman et al. 1974)

Low-Pass/High Pass Filtered Speech--(Palva et al. 1975)

#Pediatric Speech Intelligibility (PSI)--(Jerger et al. 1984)

Pitch Pattern Sequence Test--(Musiek et al. 1987)

#*SCAN: A Screening Test for Auditory Processing Disorders--(Keith 1986)

#SCAN-A: A Screening Test of Auditory Processing Disorders for Adolescence and Adults--(Keith 1994)

#Selective Auditory Attention Test (SAAT)--(Cherry 1980)

Speech Intelligibility in Noise (SPIN)--(Bilger et al. 1983)

#Staggered Spondaic Word Test (SSW)--(Arnst et al. 1982; Amerman et al. 1980; Johnson et al. 1980; Katz 1968)

Synthetic Sentence Identification (SSI)--(Decker et al. 1981)

#*Test of Auditory Perceptual Skills (TAPS)--(Garner 1985)

#The Willeford Battery--(White 1977; Willeford 1977)

#Time Compressed Speech (30%, 60%)--(DeChicchis et al. 1981; Beattie 1986)

* = tests used in the current study
# = norms available

Appendix B

Suggested Interventions for Remediation of CAP

Lasky and Cox (1983)

1. Seek classroom placement to avoid settings that are noisy or reverberant and avoid open classroom placements.
2. Provide the child preferential seating near the place where the teacher spends most of his/her time giving auditory instructions, and away from distracting auditory and visual "noise".
3. Teach children to use visual information (look and listen).
4. Encourage teachers to gain the child's attention before giving auditory instruction.
5. Check the child's comprehension of auditory information.
6. Rephrase and restate important information to provide auditory redundancy.
7. Counsel teachers and parents regarding the child's auditory needs.
8. Use FM systems to enhance the speech to noise ratio for the child.
9. Teach compensatory strategies.
10. Teach listening skills, including when to listen for meaning rather than exact repetition. Teach a child to wait until instructions are completed before the child begins a task.
11. Give the child time to think and to respond to auditory instructions or questions.
12. Use attention devices such as calling the child's name, saying "listen" and "are you ready" before giving assignments.
13. Limit the amount of information in each instruction.
14. Provide in-services to help teachers and parents understand auditory processing problems.
15. Allow a "buddy system" that the child can use to check on homework assignments or other instructions.

Levine (1984)

1. Describe the problem in terminology that makes sense to parents with subsequent "demystification" of what is going on.
2. Teach bypass strategies to help a child circumvent weak areas.
3. Attempt to strengthen areas of weakness with special help outside the classroom.
4. Give parents advice on what they can do to help their child organize and develop.
5. Provide psychological counseling for children who may be depressed or otherwise disturbed.
6. Provide stimulant dedication for children with attention deficits.
7. Act as the child's advocate within the school system.

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Classroom Suggestions for Children With Auditory Processing Problems

1. Avoid space with a free flow of sound.

   Acoustic competition or noise (other conversations, fans, music, etc.) can degrade the acoustic signal so that listening difficulties may actively interfere with comprehension. Competition for attention of these children should be minimized. They may have to "find" the source of every sound visually as they may not be able to do it by hearing alone. Teach important concepts when the fewest auditory distractions are present.

2. Provide a quiet corner for independent work.

3. Use carpet and drapes to help absorb sounds.

4. Make sure instructional areas are well lit. Visual cues are essential for children who cannot depend on their hearing.

5. Allow the child to move to the most advantageous position for seeing and hearing. This position has been found to vary according to the child's needs. Although, sitting in the front of the class might be most logical, some children perform better several rows from the front. Nevertheless, he should be seated in close proximity to the teacher and away from noise sources.

6. Give clear, concise directions.

   Since processing complex messages may be difficult, they may perform better with instructions presented in the simplest terms possible. One might consider presenting complex instructions in several steps, waiting until one action is completed prior to directing the next. Reduce motor activities required during the communication process, such as the number of written responses while he is listening to you. Use the students name often to help hold his attention. Gradual movement into new areas of material by reviewing known material first may help the child to experience success.

7. Use visual aids to reinforce auditory features of sound and to facilitate memory.

8. Provide visual drill and reinforcement of new vocabulary.

9. Assign a "buddy" to help with directions, assignments, etc.

   Adolescents might like to use a tape recorder. Lessons and assignments might be recorded so that the student could take notes from the recorder, allowing him as much repetition and time as he requires.

10. Make sure the seat work is thoroughly understood prior to leaving the student to work independently.

    Repeat instructions on an individual basis after class whenever possible. Seeking periodic feedback to see how he follows directions may enhance his listening habits.

11. Try to carry these concepts to all areas of school including playground activities and physical education class.

12. Most importantly praise successes or accomplishments representing improvement. Structure activities to provide successes not failures.

    Please do not hesitate to contact us at St. Louis Children's Hospital (314) 454-6171 should you have any questions or concerns.

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314-454-6000

PEDIATRIC
AUDIOLOGY

Suggestions for Parents of Children With Auditory Processing Problems

1. Control the child's environment by obtaining quiet through any means available to you.

   Take him to a quiet room for conversations. Turn off the T.V. or radio.

   If you can't control the environment, wait until you can to hold an important conversation.

2. When talking to your child, use simple language.

   Don't use long words when short will do. Use short sentence, describing one idea at a time. Rephrase sentences using the same basic idea. Pronounce words carefully.

3. Avoid conversations when you and your child are in separate rooms.

4. Obtain your child's full attention before speaking to each other.

   Either call his name or touch him to let him know that you are talking.

5. Have your child give feedback or repeat instructions after they are given.

6. Most importantly, try to place your child in the best listening situations possible so that he may achieve successes through listening.

Please do not hesitate to call us at St. Louis Children's Hospital (314-454-6171) should you have any questions or concerns.

Appendix C

Subject # _____
Date sent _____
Date returned _____
Age _____

PARENTS SURVEY

1. Do you feel your child has a central auditory processing disorder? _____
2. Does your child have a history of middle ear disease (infections, etc.)? _____
3. How many ear infections has your child had during the past year? _____
4. Does your child currently have tubes in his/her ears? _____
5. In what grade is your child? _____
6. What educational diagnosis, if any, has been given to your child? (i.e., learning disability, hyperactivity, language impairment, mentally challenged, physically challenged....etc.) _____
7. Does your child receive any special services in school and/or outside of school hours? (i.e. special education, tutoring, speech language therapy, psychological consultations, etc.) _____

8. If you answered YES to #7, please describe in detail the services your child receives, and approximately how many hours a week are dedicated to each. _____

_____

_____

_____

_____

_____

_____

_____

_____

9. How long has your child been receiving these services? _____

_____

_____

_____

10. Do you feel these special services have helped your child? _____
If YES, in what areas have you noticed improvement? _____

_____

_____

_____

_____

11. Is your child currently on medication for attentional, hyperactivity, or seizure disorders? _____ If YES, please list the medications: _____

_____

_____

_____

12. According to our records, the following recommendations were given for your child. Please place a check mark next to those which:

	A. You attempted.	B. Were helpful.	C. You use regularly.
1. Control child's environment by obtaining quiet.	☐	☐	☐
2. Use simple language when talking with your child.	☐	☐	☐
3. Obtain your child's attention before speaking.	☐	☐	☐
4. Have child give feedback or repeat instructions given.	☐	☐	☐
5. Avoid conversation in areas where there are competing noises.	☐	☐	☐
6. Allow child to move to an optimal listening environment.	☐	☐	☐
7. Use visual aids to reinforce auditory cues.	☐	☐	☐
8. Psychological consultation	☐	☐	☐
9. Speech & Language Evaluation	☐	☐	☐
10. Neurological evaluation	☐	☐	☐
11. Assistive listening devices (such as FM devices)	☐	☐	☐
12. Retesting for Central Auditory Processing Abilities in 1-2 years.	☐	☐	☐

13. Are there any strategies that your child uses that were not necessarily recommended, but have proven beneficial to him/her? (Please explain in detail). _____

_____

_____

_____

_____

14. If your child uses an FM system in school for more than half of the academic day, please answer the following questions:

a. Do you feel the FM system helps your child? _____

b. Does your child like to use the FM in school? _____

c. What does he/she like about the system? _____

_____

_____

d. What doesn't he/she like about the FM system? _____

_____

_____

_____

e. Has the FM system been technologically reliable? (i.e. Does it or doesn't it break often?) _____

f. What feedback have the teachers given to you regarding the use of this equipment? _____

_____

_____

_____

_____

_____

Thank you very much for taking the time to fill out this survey. The input you give will help us improve our evaluation and recommendations for children with auditory processing problems.

FIGURE # 1---TAPS SUBTESTS

1. *Auditory number memory*
    a. *Forward*
    b. *Reversed*
2. *Auditory sentence memory*
3. *Auditory word memory*
4. *Auditory interpretation of directions*
5. *Auditory word discrimination*
6. *Auditory processing*

Table #1-- Results of "Yes/no/ not sure" questions (N=20)

Question	yes	no	not sure
1. Do you feel your child has a central auditory processing disorder?	13 65%	1 5%	6 30%
2. Does your child have a history of middle ear disease (infections, etc.)?	17 85%	3 15%	
**4. Does your child currently have tubes in his/her ears?	0 0%	20 100%	
7. Does your child receive any special services in school and/or outside of school hours? (i.e. special education, tutoring, speech language therapy, psychological consultations, etc.)	15 75%	5 25%	

**NOTE- question #4 regarding tubes does not provide past history of tubes.

Table #2-- Number of ear infections in the past year (N=20)

# of infections	ratio	percentage
0	15	75%
1	3	15%
2	1	5%
4	1	5%

Table #3-- Breakdown of the Educational Diagnosis

No diagnosis =	8/20	40%		
Diagnosis =	12/20	60%		
	*Central Auditory Processing Disorder		2/12	17%***
	*Learning Disabled		8/12	67%
	*Attention Deficit Disorder		5/12	42%
	*Attention Deficit Hyperavtivity Disorder		2/12	17%
	*Psychological		1/12	8%
	*Speech/Language Impaired		3/12	25%

***NOTE--Percentages of the educational diagnosis adds to more than 100% because 9/12 children have received more than one diagnosis.

Table #4-- Special Services Rendered

Service	Number	Average # of Hours per week
Speech Therapy	9/16	1.8 hours
Tutoring	7/16	2.5 hours
Special Education***	7/16	
*math	2/7	3.75 hours
*reading	2/7	3.75 hours
*spelling	1/7	3.0 hours
*english	1/7	3.75 hours
*unspecified	2/7	4.0 hours
Psychological consult**	4/16	0.75 hours
Special school	3/16	30 hours (full time)
Occupational therapy	2/16	1.0 hour
Physical therapy	1/16	1.0 hour

*Specified special education class.

**Psychological consultation includes social service counseling.

***Some children are in more than one special education class.

Table #5-- Average number of years using special services

Service	Average # of Years
Speech therapy	3.1 years
Tutoring	1.5 years
Special education	3.2 years
Psychological consult	2.7 years
Special School	2.8 years

Table #6-- Types of Medication Subjects Receive

Subject	Medications
1	ritalin, imipramine
2	zoloft, dexedrine, trazodone, orap
3	ritalin
4	depakote
5	ritalin
6	ritalin

Table #7-- Test/ Retest Score Significance

SCAN

Subjects	Ed Diagnosis	Filtered words		Aud Figure Ground		Competing Word	
		initial dx	retest	initial dx	retest	initial dx	retest
1	LD, FM	1	50*	5	16	5	50*
2	LD	75	84	37	16	25	25
3	none	37	50	25	50	16	63*
4	none	50	63	98	16**	50	2**
5	ADD	16	50*	16	16	37	2**
6	LD, ADHD on med,FM	1	37*	2	63*	2	50*
7	LD,ADD,lang on med	16	5	25	25	50	2**
8	none	9	75*	16	16	16	9
9	Speech, memory	37	50	75	37	37	9**
Group mean score		26.80%	51.6%*	33.20%	28.30%	26.40%	23.60%
Standard deviation		23.5%		30.70%		17.00%	

* = retest scores are significantly better from scores at initial testing
** = retest scores are significantly worse from scores at initial testing

Table #8-- Test/Retest Score Significance

TAPS

Subject	Aud #Mem-F		Aud #Mem-R		Aud Sent Memory		Aud Word Memory	
	initial dx	retest	initial dx	retest	initial dx	retest	initial dx	retest
1								
2	2	2	9	9	25	25	5	16
3	37	37	0	16	25	50	25	25
4	9	16	50	37	16	75*	9	25
5	91	84	16	2	84	95	99	2**
6								
7								
8	63	84	16	2	75	50	37	91
9	16	16	37	25	50	16**	5	5
Mean group score	36.30%	39.80%	21.30%	15.20%	45.80%	52%	30%	27.30%
Standard	31.70%		16.98%		26.08%		32.98%	

* = retest scores are significantly better from scores at initial testing
** = retest scores are significantly worse from scores at initial testing

Table #8 (continued)

TAPS (cont.)

Subject	Interp of Dir		Auditory Discrim		Auditory Processing	
	initial dx	retest	initial dx	retest	initial dx	retest
1						
2	50	16	75	75	75	75
3	25	5**	50	50	37	25
4	75	50	84	84	50	84
5	75	9**	50	50	63	37
6						
7						
8	25	9	63	37	1	16
9	5	25	91	63	91	91
Mean group score	42.50%	19.00%	68.80%	59.80%	52.80%	54.70%
Standard deviation	26.40%		15.80%		28.86%	

* = retest scores are significantly better from scores at initial testing
** = retest scores are significantly worse from scores at initial testing

Table #9-- Test/Retest Score Significance

G-F-W

	Quiet		Fan-like noise		Cafeteria noise		Voice	
Subject	initial	retest	initial	retest	initial	retest	initial	retest
1	100%	100%	68%	69%	28%	17%	1%	42%
7	99%	100%	1%	15%	1%	1%	1%	1%
Mean group score	99.50%	100%	34.50%	42%	14.50%	9%	1%	21.5%*
Standard deviation	0.50%		33.50%		13.50%		0%	

Table #10-- Recommendations

1. Control child's environment by obtaining quiet.
2. Use simple language when talking with your child.
3. Obtain your child's attention before speaking.
4. Have child give feedback or repeat instructions given.
5. Avoid conversation in areas where there are competing noises.
6. Allow child to move to an optimal listening environment.
7. Use visual aids to reinforce auditory cues.
8. Psychological consultation
9. Speech & Language Evaluation
10. Neurological evaluation
11. Assistive listening devices (such as FM devices)
12. Retesting for Central Auditory Processing Abilities in 1-2 years.

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St. Louis Children's Hospital

One Children's Place
St. Louis, Missouri 63110-1077
314-454-6000

Dear _____,

You are invited to participate in a research study conducted at St. Louis Children's Hospital on Central Auditory Processing Disorders. Our records indicate that your child _____ was diagnosed with a central auditory processing disorder on _____ at St. Louis Children's Hospital.

Central Auditory Processing (CAP) is often described as "what we do with what we hear." Little is known about the remediation for CAP, therefore this study is being conducted to investigate the assessment and the recommended interventions of CAP disorders.

Participation in this study would include one of two options:

1. Fill out the enclosed parent questionaire and consent form and return them in the self addressed stamped envelope.

-or-

2. Fill out and return the parent questionaire and enclosed consent form in the self addressed stamped envelope and bring your child in to St. Louis Children's hospital for a free retest of central auditory processing abilities, repeating those tests previously used at the time of diagnosis. (Dawn will call to schedule times.)

Please read the enclosed consent form carefully. Dawn will be calling you to inform you of the purpose of this study, background information, and to answer any questions regarding the study. You may call Dawn at home (618-257-8075) or on her CID voice mail (314-977-0201 x 485#) if that is more convenient for you. Please consider participation in one of the two above mentioned means. Thank you for your time.

Sincerely,

Roanne Karzon, Ph.D., CCC-A/SLP
Manager of Audiology

Pam Koprowski, M.S., CCC-A
Audiologist

Dawn Siekmann-Carpenter
Central Institute for the Deaf
Audiology Graduate Student

Washington
WASHINGTON UNIVERSITY IN ST. LOUIS

Form #3 10/93
HUMAN STUDIES COMMITTEE
Box 8089
(314) 362-3244
Fax 367-3041

PEDIATRIC
INFORMED CONSENT FOR PARTICIPATION IN RESEARCH ACTIVITIES

Participant _____ HSC Approval Number

Principal Investigator Rodney P. Lusk, M.D. 95-0888

Title of Project: Reassessment of Central Auditory Processing abilities in children between 7 and 12 years of age.

1. You are (Your child is) invited to participate in a research study conducted by Dr. Rodney Lusk and/or colleagues. The overall purpose of this research is:

To investigate the efficacy of the assessment and the recommended interventions for central auditory processing disorders by comparing scores of your child at the time of his/her evaluation and diagnosis to those scores he would obtain now which is one to four years post diagnosis. In addition you will be asked to complete a parent survey that will be used to judge efficacy of any interventions that were used.

2. Your (Your child's) participation will involve:

Participation in the study will include one of two options:

1. Fill out a questionnaire and return it in the self addressed stamped envelope enclosed with the questionnaire.

-or-

2. Fill out and return the parent questionnaire in the self addressed stamped envelope and bring your child in to St. Louis Children's hospital for a free retest of central auditory processing abilities, repeating those tests previously used at the time of diagnosis. Testing will include a pure tone hearing screening by placement of headphone on his/her ears, and a response to tones perceived by raising his/her hand. During the central auditory processing test the child will be asked to respond to verbal stimuli according to directions given prior to testing.

3. There are certain risks and discomforts that may be associated with this research. They include:

There are no known risks for the subjects selected. Periodic breaks will be taken if the child becomes fatigued during testing.

4. The possible benefits to you (your child) and society from this research are:

Child will obtain a free reassessment of central auditory processing abilities using the same test as those used for the initial diagnosis. Parents will be notified of any significant changes in performance. Those children who demonstrate significantly decreased performance will be offered a brief (10-15 minute) counseling session to review the findings and make any additional recommendations. Group results will lead to more efficacious recommendations for future patients.

5. You (Your child) may choose not to participate in this research study or withdrawn your (your childs) consent. Your (Your child's) choice will not at any time affect the commitment of health care providers to administer care and there will be no penalty or loss of benefits to which you (your child) are otherwise entitled. Other than non-participation in the research, available alternatives include:

Continue to follow the recommendations as stated in the report of the initial assessment of auditory processing abilities.

6. The University will take all reasonable measures to protect the confidentiality of your (your child's) records and your (your child's) identity will not be revealed in any publication that may result from this study. The confidentiality of all study related records will be maintained in accordance with State and Federal laws. There is a possibility that your (your child's) medical record, including identifying information, may be inspected and photocopied by officials of the Food and Drug Administration or other Federal or State government agencies. If this study is sponsored, a representative of the Sponsor, _____, may inspect these research records.

7. If you have (your child has) any questions or concerns regarding this study, or if any problems arise, you (your child) may call the Principal Investigator at 454-6171--Dr. Karzon. You may also ask questions or state concerns regarding your (your child's) rights as a research subject to Dr. Philip Ludbrook, Chairman of the University's Human Studies Committee, at (314) 362-3244 or (800) 438-0445.

8. Washington University recognizes the importance of your contribution to research efforts intended to improve medical care. The University makes every effort to minimize any health and safety risks to people participating in such research activities. Washington University reserves the right to make all decisions concerning payment for medical treatment for injuries solely and directly relating to your participation in biomedical or behavioral research. If you believe you have been injured as a result of your participation in a research study, please contact the chairman of the Human Studies Committee or principal investigator as stated above in Item 8.

9. You (Your child) will be informed of any significant new findings developed during the course of participation in this research that may have a bearing on your (your child's) willingness to continue in the study. The investigator may withdraw you (your child) from this research if circumstances arise which warrant doing so.

I have read this consent form and have been given the opportunity to ask questions. I will also be given a signed copy of this consent form for my records. I hereby consent to my (my child's) participation in the research described above.

(When Applicable)
Parent or legal guardian's signature on participant's behalf if participant is less than 18 years of age or not legally competent. (Blood drawing only: Less than 17 years of age.)

Participant's Signature

Date

Relationship to Child

Witness' Signature, if Present

I have explained the research to the parents or guardians and when appropriate to the participant.

Investigator's Signature

Date

REGARDING CHILDREN WHOSE SIGNATURE IS NOT DOCUMENTED ABOVE

In our best judgment, we believe that requiring the signature of the subject is not appropriate in this particular instance. He/she understands the procedures and/or therapy and its potential risks and benefits, in our opinion, in a manner appropriate to his/her age.

Physician

Parent/Guardian

This form is valid only if the Human Studies Committee current stamp of approval is shown below. Approval is for one year unless otherwise stated.

APPROVED BY
THE HUMAN STUDIES COMMITTEE (IRB)
JAN 12 1996
VOID ONE YEAR FROM ABOVE DATE