October 14, 2016

[redacted]

RE:

ELECTROPHYSIOLOGY AND ELECTROACOUSTICAL EVALUATION

HISTORY:

:, a 12 year old male, was seen at for Children Audiology Department on 09/26/2016 for an audiological battery using audiometric testing, behavioral speech-in-noise testing, a Cortical Auditory Evoked Potential (CAEP), and Otoacoustic Emission (OAE) Suppression testing. was accompanied by his mother, Ms. , who acted as the primary informant. was referred for this evaluation due to concerns for 's auditory abilities following a right anatomical hemispherectomy.

was initially referred for a full diagnostic central auditory processing evaluation; however, due to the comorbid diagnosis of "moderate intellectual disability" as a result of his extensive brain surgery, could not proceed with the language-based behavioral central auditory processing evaluation. Since the traditional auditory processing test battery was heavily language based (i.e. listening to and repeating words and sentences) and required appropriate attention, memory, and higher executive function, any deficit in these areas would potentially confound any significant behavioral test findings. Therefore, an objective non-linguistic based test was instead recommended to evaluate s auditory function. A Cortical Auditory Evoked Potential and Otoacoustic Emissions Suppression Test were recommended to evaluate the higher auditory pathways of the central nervous system for ability to detect speech segments within varying quiet and noise conditions.

Pre and perinatal history was significant for born at 40 weeks gestation, and he passed his newborn hearing screening in both ears per parental report. Otologic history was significant for occasional ear infection with no recent bouts noted. There has not been a known family history of hearing loss in childhood reported. Medical history was remarkable for intractable seizure disorder, hemiplegia, hemianopsia, and Pervasive Developmental Delay (PDD). has a history of two extensive brain surgeries to manage the severe seizure disorder. Per a report from Institute, first surgery in 2007 involved a "craniotomy of the right temporal and parietal structures with preservation of his right motor strip and posterior regions"; however, surgery had to be stopped as a result of increased seizure activity during the procedure. A second surgery in 2009 was noted to be a callostomy (i.e. Resection of the corpus callosum) and a right anatomical hemispherectomy with the rest of the right cerebral hemisphere removed all the way to the occipital lobe as reported by the mother. Follow up scans "revealed lesions within the left hemisphere, which were attributed to some potential blood loss." 's mother reported that is right-hand dominant, and there has been a noted history of developmental delays in motor coordination skills and speech since the surgeries.

attends the sixth grade at School. His mother reports a class size of approximately 15-20 students. parents and teachers have observed that " has difficulty reading, stringing sounds together, [and] recognizing words in various environments." The parents rate 's academic and reading performances as "below average-poor" and "poor" respectively. There are diagnosed "mixed receptive, expressive, pragmatic language disorder" and dysarthria. A speech language evaluation on 10/28/2015 through the I indicates scores in the "severely-impaired" and "below average" ranges on the Clinical Evaluation of Language Function, fifth edition (CELF-5). His evaluating speech-language pathologist notes that "These results show that will have trouble understanding language across environments, particularly when he does not have visual support and when information is lengthy and/or out of context." He does have an Individualized Education Plan (IEP) through school, which includes accommodations such as Life skills classroom, therapy services (physical, occupational, and speech), reminder cues and prompts, adapted seat and desk, verbal and visual prompts, feedback, extra time to answer, choices, and structured peer interaction. He does not receive tutoring in addition to school accommodations. 's favorite subject is math. He reportedly enjoys bowling, soccer, and boy scouts. His mother notes that he does get adequate sleep and nutrition but may not be getting enough exercise.

has had comprehensive testing through the He has been qualified as having "moderate intellectual disabilities" although his mother observes that he is functionally more able than some of his testing would denote. His scoring on the Stanford Binet Intelligence Scales, third edition (SBIS-III) show a nonverbal IQ score of 73 and a verbal IQ score of 57. He has had a more recent neuropsychological evaluation on 10/23/2015 at KKI. His scores on the Differential Ability Scales, second edition (DAS-II) are in the "Impaired" range for all subtests, which include Verbal skills, Nonverbal Reasoning, Spatial skills, and General Conceptual Ability. One of his examiners writes "Evaluation results across domains indicate a profile in the borderline to impaired range, with some superimposed strengths (i.e. Average range). Overall verbal and nonverbal cognitive skills were well below the expected level for his age... On tasks measuring attention and processing speed, performance was consistently impaired... Receptively, he was able to follow simple two step instructions. Expressively, his overall output and ability to generate information to cues was impaired." The report continues to note that "verbal memory skills were stronger

than visual memory skills."

The following characteristics and behaviors of concern were noted on Auditory Processing and Associated Diagnoses Questionnaire (APAD-Q):

0 = Does not exhibit; 1 = Exhibits occasionally;
2 = Exhibits regularly; 3 = Interferes with everyday function

Daydreams/"zones out" frequently (2 - Exhibits regularly)
Impulsive or hyperactive (2 - Exhibits regularly)
Short attention span in most situations (2 - Exhibits regularly)
Restless, cannot sit still (2 - Exhibits regularly)
Forgetful in many situations (3 - Interferes with everyday function)
Does not complete assignments (2 - Exhibits regularly)
Often fatigued (2 - Exhibits regularly)
Tires easily (3 - Interferes with everyday function)
Temper tantrums more than once a week (0 - Does not exhibit)
Seeks attention (1 - Exhibits occasionally)
Irritable (1 - Exhibits occasionally)
Lacks self-confidence (1 - Exhibits occasionally)
Shy (1 - Exhibits occasionally)
Fakes illnesses (0 - Does not exhibit)
Expresses dislike of or anxiety about school (0 - Does not exhibit)
Disobedient (1 - Exhibits occasionally)
Lacks motivation in regard to completion of tasks (2 - Exhibits regularly)
Difficulty with phonics, spelling, or writing (3 - Interferes with everyday function)
Difficulty following written directions (3 - Interferes with everyday function)
Difficulty following television programs (1 - Exhibits occasionally)
Difficulty with vision/visual stimuli (Answer not provided)
Reverses written numbers or letters (2 - Exhibits regularly)
Says "huh" or "what" frequently (2 - Exhibits regularly)
Asks for repetition of verbal information often (2 - Exhibits regularly)
Sensitivity to loud sounds (2 - Exhibits regularly)
Appears confused in noisy places (2 - Exhibits regularly)
Distracted by background sounds (3 - Interferes with everyday function)
Inattentive to auditory stimuli (1 - Exhibits occasionally)
Difficulty following a verbal sequence (1 - Exhibits occasionally)
Difficulty following verbal directions (1 - Exhibits occasionally)
Difficulty following multi-step directions (2 - Exhibits regularly)
Does opposite of what is requested (0 - Does not exhibit)
Easily upset by new situations (1 - Exhibits occasionally)
Displays anxiety/stress frequently (1 - Exhibits occasionally)
Prefers to play with younger children (2 - Exhibits regularly)
Prefers to play with older children (0 - Does not exhibit)
Prefers solitary activities (1 - Exhibits occasionally)
Clumsy (1 - Exhibits occasionally)

Pain assessment was performed today with a 0 rating (nonpainful) using the 10 Point Scale.
No contraindications to testing were reported today.

AUDIOLOGICAL EVALUATION RESULTS:

Otoscopic Examination:
Right- unobstructed.
Left - unobstructed.

Tympanometry:
Right - Type A, normal middle ear system compliance and pressure, normal ear canal volume.
Left - Type C, normal middle ear system compliance with negative pressure at -120 daPa, normal ear canal volume.

Distortion Product Otoacoustic Emissions (DPOAE):
Right - Present at 2-5 kHz.
Left - Present at 2-5 kHz.

OAE testing is not a direct test of hearing. When OAEs are present, the responses support normal outer hair cell function within the cochlea for the frequency range tested. The absence of OAEs can correlate with cochlear hair cell loss and subsequent hearing loss as a result; however, this finding should be judged with caution as these emissions are also adversely affected by outer and middle ear obstructions such as ear wax, small ear canals, and middle ear fluid.

Middle Ear Muscle Reflexes (Acoustic Reflexes):
Ipsilateral and contralateral acoustic reflex thresholds were evaluated at 500 through 4000 Hz bilaterally. Reflex thresholds were as follows:

Ipsilateral Right (probe and stimulus in the right ear):
500 Hz: 85 dB; 1000 Hz: 80 dB; 2000 Hz: 85 dB; 4000 Hz: 85 dB

Contralateral Right (stimulus in the right ear and probe in the left ear):
500 Hz: 100 dB; 1000 Hz: 100 dB; 2000 Hz: 90 dB; 4000 Hz: 100 dB

Ipsilateral Left (probe and stimulus in the left ear):
500 Hz: 85 dB; 1000 Hz: 80 dB; 2000 Hz: 85 dB; 4000 Hz: 90 dB

Contralateral Left (stimulus in the left ear and probe in the right ear):
500 Hz: 100 dB; 1000 Hz: 100 dB; 2000 Hz: 95 dB; 4000 Hz: 85 dB

Please note: The reflex thresholds are recorded by the stimulus ear.

Normal middle ear muscle reflex thresholds indicate synchrony throughout the middle ear acoustic reflex arc. This response usually rules out the possibility of Auditory Neuropathy Spectrum Disorder (ANSD).

Audiogram Results:
Test Mode: conditioned play audiometry, supra aural earphones
Test reliability: good. was cooperative for the evaluation.

The audiometric results revealed normal pure tone thresholds from 250 through 8000 Hz including mid-high frequency interoctaves. Speech recognition thresholds (SRT) were obtained

at 10 dB HL in the right ear and at 10 dB HL in the left ear. Speech discrimination abilities in quiet were 100% in both ears. SRT did corroborate the pure tone average bilaterally.

The **Bamford-Kowal-Bench Speech In Noise (BKB-SIN)** test attempts to identify difficulties in the perception of speech in the presence of background noise that more closely mimics noise in the classroom setting. ' is asked to listen to and repeat two sets of ten sentences in each ear that are presented in background multi-talker babble, which increases in loudness until sentence ten is reached. *Although not specifically a test of auditory processing ability, this test helps identify whether a better signal-to-noise ratio (SNR) is needed for a child to successfully listen in the classroom.*

Ears	's average SNR-50	Correction Value	's SNR Loss	Criterion Range	Performance
Binaural	2.0	-0.9	2.9	0 - 3.0	Normal

's performance for understanding speech in the presence of multi-talker babble is normal for the binaural (i.e. Both ears) listening conditions. The individual ear conditions could not be evaluated today due to 's fatigue to the extensive behavioral audiometric testing today.

Cortical Auditory Evoked Potential Testing:
Cortical Auditory Evoked Potentials (CAEP) were obtained while was awake and in a state of calm repose while watching a silenced video screen. A 4-electrode, dual channel montage was used with insert earphones to present a short speech stimulus /da/ in quiet and various noise paradigms. This evaluates higher auditory pathways at the level of the brain (i.e. Auditory Cortex) for the efficiency of that pathway to detect speech. CAEP results reflect processes within the same side pathways only, and crossover pathway function at the level of the corpus callosum cannot be determined by today's testing; therefore, dichotic listening skills cannot be evaluated with this test.

Quiet Test Condition:
This condition presents the speech segment /da/ repeatedly to each individual ear in a quiet setting. ***Present and robust P1/N1 and P2/N2 responses were observed within normal latencies in the right ear using adult and site-specific norms. P1/P2 complex (with a small questionably emerging P1/N1) and N2 responses were observed within normal latencies in the left ear using adult and site-specific norms.***

Ipsilateral Noise Test Condition:
The speech stimulus /da/ was presented with ipsilateral (i.e. same ear) background noise at a +5 dB signal-to-noise ratio to investigate 's cortical auditory pathway speech detection abilities in the presence of a challenging background noise setting. ***Present and robust P1/N1 and P2/N2 responses were observed within normal latencies in the right ear using adult and site-specific norms. P1/P2 complex and N2 responses were observed within normal latencies in the left ear using adult and site-specific norms.***

Contralateral Noise Test Condition:
The speech stimulus /da/ was then presented with contralateral (e.g. opposite ear) background noise at a +5 dB signal-to-noise ratio to investigate 's cortical auditory pathway speech

detection abilities in the presence of slightly less challenging background noise setting. ***Present and robust P1/N1 and P2/N2 responses were observed essentially within normal latencies in the right ear using adult and site-specific norms. P1/P2 complex (with a small questionably emerging P1/N1) and N2 responses were also observed essentially within normal latencies in the left ear using adult and site-specific norms.***

Binaural Noise Test Condition:
The speech stimulus /da/ was then presented with binaural (i.e. both ears) background noise at a +5 dB signal-to-noise ratio to investigate 's cortical auditory pathway speech detection abilities in the presence of the most challenging background noise setting. ***Present and robust P1/N1 and P2/N2 responses were observed within normal latencies in the right ear using adult and site-specific norms. P1/P2 complex and N2 responses were observed within normal latencies in the left ear using adult and site-specific norms.***

Minimal electrical/myogenic interference was observed in any of the four test conditions. This was deemed to not have an adverse effect on this test condition's reliability and morphology. Morphology and repeatability were considered very good for all test conditions. No significant asymmetry in latencies was observed consistently throughout testing.

Behavioral Observations:
was cooperative for all of today's testing. Per his mother's suggestions, was given prompts and time limits so that he could maximize his task compliance. He was friendly, often demonstrating humor, and was very receptive to verbal prompting and reinstruction. On behavioral testing, he showed very slow response time, which would be anticipated given his medical history and its adverse impact on overall executive function. maintained a quiet, calm demeanor throughout the electrophysiological portion of testing. He remained engaged in the video activity for the entirety of the CAEP testing and, although he became slightly fidgety toward the end, minimal myogenic interference was observed.

Impressions:
s auditory sensitivity on behavioral testing is normal in both ears. This is an indication of subjective sound detection but does not assess the brain's processing of sounds such as speech. Tympanometric results reveal normal/borderline normal middle ear system function bilaterally (slight negative pressure in the left ear). Middle Ear Muscle Reflex (MEMR) testing shows present reflexes within the efferent system from the level of the brainstem to the middle ear. This supports a finding of normal neural synchrony within the peripheral auditory pathway in both ears and rules out Auditory Neuropathy Spectrum Disorder (ANSD) bilaterally. Distortion product otoacoustic emissions are present in both ears, indicating normal outer hair cell function within the cochlea bilaterally. Transient-evoked otacoustic emission (TEOAE) suppression was attempted at today's appointment; however, TEOAE findings are not robust enough for suppression testing to be performed in both ears.

Additionally, behavioral testing of speech discrimination in the presence of increasing background noise has been performed using the Bamford-Kowal-Bench Speech In Noise (BKB-SIN) Test. Although the BKB-SIN test is not a test of central auditory processing, it attempts to identify the point at which a person is no longer able to effectively filter out background babble (i.e. speech noise). Depending on this level, one can determine whether an

individual needs a better signal-to-noise ratio (louder speech signal in comparison to the background noise) to function appropriately. As the background speech noise increases, appears to be to able to adequately detect the speech signal of interest in the binaural listening condition (i.e. Both ears listening together). Although does not demonstrate significant difficulty in the binaural listening condition, his performance on the individual ear listening conditions of the BKB-SIN can not be determined due to patient fatigue at the time of testing. As a result, SNR loss in the individual ears cannot be ruled out at this time. An SNR loss means that the child may hear almost as well as his normal hearing peers in quiet; however, the presence of background noise may adversely impact his speech understanding and he may need the signal (e.g. the teacher's voice) to be louder than the background noise to listen appropriately. In a real-life listening situation, will be listening with both ears together thus any SNR loss demonstrated may not be consistently indicative of his performance in the presence of background noise in a real-world listening situation. This does not mean the does not have difficulty listening with both ears but that he may have varying levels of difficulty based on the classroom acoustics, reverberation, and speech projection. Optimal classroom acoustics and good communication strategies are critical components in 's ability to understand speech in the presence of background noise. Additionally, attentional components and auditory distractibility can be other extenuating factors to be considered in optimizing the communication setting for given that the BKB-SIN is performed in an optimal listening situation with minimal external auditory and visual distractors.

The CAEP test is an objective measure of the neuromaturation of the higher auditory pathway and its ability to detect speech stimuli in quiet and a varying noise conditions. While this test cannot give a diagnosis of central auditory processing disorder, it does diagnose whether the ipsilateral central auditory nervous system (CANS) is functioning appropriately. Present CAEP recordings indicate that sounds are being detected and rudimentarily processed at the primary level of the auditory cortex in a variety of noise conditions. Today's results suggest that has appropriate function of the ipsilateral (i.e. Same side) peripheral and cortical auditory pathways bilaterally. This testing, however, does not evaluate the higher auditory pathway that crosses over the corpus callosum, which is responsible for the interhemispheric transfer of all sensory and higher executive function information. Major central auditory processing skill areas that are known to be adversely affected as a result of damage to this pathway are Dichotic Listening skills. Dichotic Listening skills are those skills utilized when meaningful auditory information is presented to the two ears at the same time. These skills are dependent on the ability of the two hemispheres of the brain to communicate with one another when information is presented to the two ears. This is done by the signal crossing over a band of neural fibers that connects the two brain hemispheres, called the corpus callosum. Although behavioral testing of Dichotic Listening skills could not be performed today due to coinciding diagnoses affecting higher executive functions, Dichotic Listening skills are documented to be adversely impacted when the corpus callosum is either absent, irreparably damaged, or surgically resected. As a result of his right anatomical hemispherectomy and the complete resection of the corpus callosum, has a likely atypical right ear advantage when information is presented to both ears at the same time. This means that he has an easier time perceiving information presented to the right ear than to the left ear on dichotic listening tasks. "A general right ear-advantage (REA) for verbal information and a left ear advantage (LEA) for non-linguistic stimuli have been demonstrated in healthy individuals...The ear advantage is attributed to the dominance of the contralateral cerebral hemisphere for processing the stimuli (deBode et al., 2007)." A general right ear advantage is typical and most notable in children given that certain connections in the corpus callosum in the brain are still developing through early adolescence. The typical listening pathway to engage verbal language areas is dependent upon which ear receives the signal. In the majority of the population, the areas of

the brain responsible for receiving and comprehending language are located in the left hemisphere. When listening to a speech signal in the right ear, the signal travels through the peripheral auditory pathway, crosses over to the opposite side through the brainstem, and arrives at the left hemispheric language center for immediate processing. If the speech signal begins in the left ear, the signal travels in the same way but crosses the brainstem to the right side. The signal must go one extra step further and cross the corpus callosum to the left hemisphere for processing of language. In younger children, this pathway is less developed and, therefore, is slower and less efficient. This produces a lagtime effect, in which the child does not perceive as readily the speech signal presented simultaneously to the left side. It is only when the corpus callosum is fully developed in early adolescence that the speech signal can cross to the language center with almost the same timing regardless of the ear presentation. If the corpus callosum has been irreparably damaged or, as in the case with , has been completely severed, there is no ability for this neuromaturation to occur and there is a breakdown in this "linguistic neural bridge". This creates a permanent atypical right ear advantage (in other words left ear deficit), which extremely limits 's ability to accurately detect and coordinate competing, meaningful messages. Also, factoring in slow processing speed, attentional concerns as well as language and memory deficits, and 's ability to efficiently access linguistic information becomes greatly taxed.

shows good subjective detection of sound in quiet and background noise as well as detection of speech segments within the ipsilateral pathway in both ears. Given that his anatomical right hemispherectomy has included the right temporal lobe and, presumably the right auditory cortex, the presence of robust right CAEP responses indicates the likelihood that there is some functional remnant of the auditory cortex on that side. This should be considered as a strength as does not have complete irradication of auditory abilities, even in the background noise. His hemispherectomy, however, does have clear implications on severely reduced Dichotic Listening skills. Challenging listening environments may still adversely impact 's performance in the classroom, particularly when doing seat work in the presence of background noise/competing messages, in receiving unfamiliar verbal instruction, or in listening to information in less than optimal communication settings. High noise levels can affect the ability to understand speech, decrease attention, affect reading ability, reduce on-task behavior, decrease achievement, and affect psychosocial behaviors (Crandell &Smaldino, 2000). Additionally, children with extensive cerebral involvement present with executive functioning deficits, which impact their ability to plan, organize, and self-monitor. Behavioral treatment and appropriate academic supports and accommodations are essential.

Recommendations:

The following recommendations are offered to assist at home and at school. Due to 's deficits when listening to competing speech, the recommendations listed for the classroom environment should be discussed with 's educational audiologist and proactively incorporated into an IEP or 504 plan to aid in 's academic success.

1. All educators and therapists who are directly involved with are strongly encouraged to reference The Brain Recovery Project's "Education after Hemispherectomy: An Introductory Guide for the Educational Team" and "School Assessments, Aids, Services, and Instruction Methods After Hemispherectomy" located at www.thebrainrecoveryproject.org.

2. should continue to be enrolled in his speech and language therapy program at the discretion of his managing speech-language pathologist.

additional 20 minutes from a chapter book that is one or two grade levels above the child's current reading level. The child should be asked brief questions to ensure that he comprehends the reading subject. Additionally, a journal is suggested be kept during the reading to jot down key words or unfamiliar vocabulary.

8. Considering he has intact ipsilateral auditory pathways, listening to an audiobook to augment any visual reading assignments is recommended to further increase 's reading comprehension but to also exercise his listening skills and auditory memory. This task may be challenging for however, the key to this exercise is consistent daily practice. A family member should be directly involved with this task in order to have answer basic questions about the excerpt and summarize the chapter. Learningally.com and Bookshare.org are educational websites that are designed to provide educational reading materials in both the written and verbal language modalities. Other audiobook resources are attached at the end of this report for further reference.

9. Due to likely issues with Dichotic Listening skills, may be a candidate for assistive listening technology to improve the signal-to-noise ratio within the classroom when he is not receiving small group instruction. This can be provided for the child through one of several options including classroom amplification, a "totable" FM system, infrared system, or a personal FM system worn at the ear level. A Frequency Modulated (FM) system allows the child to hear direct sound from a microphone transmitter worn by a parent or teacher. The receiver is worn on the child's ears or is received at a desk level speaker. The FM system allows the child to discriminate important speech information clearly while reducing competing speech and distracting background noise (also known as increasing the signal-to-noise ratio). Either an IEP or Section 504 of the Rehabilitation Act of 1973 should be implemented so that is provided with this technology. *Based on the current research literature and evidence-based practice, amplification in the form of assistive listening devices may be recommended if a diagnosis of Central Auditory Processing Disorder (CAPD) is given. Based on limited success rate, Audiology Department policy will no longer include fitting hearing aids on children who have normal peripheral hearing with a diagnosis of either CAPD or central hearing loss. If families are interested in this management methodology, they are encouraged to pursue this option with a qualified audiologist in this specialty at an outside facility.*

10. Due to 's affected higher executive functions such as attention and potential for heightened auditory distractibility, a reduction of classroom ambient reverberation and visual distractions is advised. This can be done through physical modifications in the classroom environment such as carpet on the floor, latex-free stoppers on chair legs, curtains on windows, corkboard bulletin boards on walls. Also, a self-contained classroom setting (i.e. permanent wall structures that reach to the ceiling, closing doors) is strongly recommended instead of an open, unstructured learning environment, which may increase ambient noise and unwanted visual distractions. An example of this open classroom environment would be classrooms that are held in a larger community room with multiple grades present and teaching simultaneously. Additionally, it may be beneficial for to do seat work in a quiet area, such as a study carrel, during independent work sessions and study halls.

11. Strategic/preferential seating is strongly advised to reduce auditory and visual distractions. This also assists with increasing meaningful visual (such as visual aids, models, assignments on the chalkboard, etc.) to augment the more meaningful auditory signals (e.g. Teacher's speech) as well as auditory memory and organization. 's most beneficial seating arrangement may be in the front center of the classroom. This recommendation assumes that

the teacher's placement is also at the front of the classroom and should be adjusted for the teacher's position accordingly.

12. would benefit from "pre-teaching" of new information, particularly new subject vocabulary, as he would be able to familiarize to new words. An example of this is providing with a list of homework assignments/new vocabulary and a written study guide (when possible) for the week. This would increase his recognition of sounds and words in a noisier classroom environment.

13. Combined verbal and visual examples to augment the verbal are also advised when possible. Complement new concepts and information with visual aids, including projection overheads, computers, and smartboard/blackboard examples. Explain verbally while showing visually, e.g. give directions both speaking and in written form. If these are directions for chores, track on a written chore schedule at home.

14. Attempts to obtain attention (cuing) prior to giving directions is advised for both school and home settings. This can be accomplished by saying name while obtaining eye contact, using an assigned visual cue, or gently touching his shoulder to gain his attention just prior to the initiation of the instruction.

15. Instruction should be short, simple, and repeated as necessary. The understanding of verbal information for the average child is approximately 124 words a minute. Given that the average adult speaks using over 200 words a minute, a child often needs a slower rate of speech, with deliberate pauses, and a clear voice. If a child has hearing loss, poorer language skills, or is listening as a non-native speaker, speech may need even further adjustments to allow the child time to access the speech information. Reducing the instructional information to smaller units and presenting with a slower rate of speech will increase ability to effectively listen to and follow verbal instruction. Instructors and therapists should be made aware that faster rates speech may cause more difficulty for to accurately follow new instructions and unfamiliar topics.

16. Because of the concerns for slower processing speed and demonstration of slow response time throughout today's behavioral testing, extra time for oral testing and in participating in activities with verbal instructions is strongly suggested.

17. reportedly has difficulty following multistep directions. He may benefit from play with electronic applications such as "Splingo's Language Universe", which works with a child's varying abilities to work with multiple step directions. Other language and educational games are also available through sites like www.superduperinc.com, which has online games as well as iPad/smartphone applications.

18. Due to expressed concerns regarding difficulty following written, verbal, and/or multi-step instructions as well as issues with abstract thinking about future actions, is encouraged to actively participate in games that develop the ability to think several steps ahead, which facilitates improved organization, memory, abstract thinking, and problem-solving skills. Examples of these games include chess, backgammon, checkers,and blokus.

19. Continued use of metacognitive techniques designed to strengthen memory and aid in item recall may be useful during classroom instruction and specialized therapy. Suggested tasks may include verbal rehearsal, chunking (breaking sentences in two or three parts with pauses

in between the phrases), tag words (e.g. "first we start with", "second step is", "before you do", "next we", "after you"), and organizational aids.

20. may benefit from memory games and exercises such as Simon or Bop-It electronic games (purchased on-line or in toy stores), the card game "Concentration", video games like "Brain Age" and "Mind Games", and online resources targeted toward developing working memory like junglememory.com and Lumosity.com. parents may also want to play "the picnic" game. This game consists of a family member saying "I'm going on a picnic, and I'm bringing an A for Apple", and the next participant says "I'm going on a picnic and I'm bringing A Apple and B banana" and so forth. The key goal for this game is to keep listing items while trying to recall the previous picnic list, which helps utilize cues while targeting memory.

21. Incorporating checklists and schedules in daily tasks are suggested to assist working with organization and memory skills.

22. Develop and maintain routines and use consistent vocabulary and formats. This will also assist with organization as well as memory skills.

23. Hearing protection in loud noise (greater than or equal to 85 dBA). Noise protection devices (earmuffs or foam earplugs) can be purchased at local hardware stores and pharmacies. The Noise Reduction Rating (NRR) on the hearing protection package is recommended to be equal to or greater than 25 dBA for effective hearing protection. Those participating in impact noise activities such as hammering devices or firearm shooting should wear double hearing protection.

24. Conservative volume use for personal listening devices (i.e. IPODs, MP3 players). Volume levels should be between minimum volume and the halfway point to maximum. To exceed these levels may cause permanent damage to the sensory hearing organs.

Test results and recommendations were discussed with mother and understanding was indicated. If there are further questions or concerns, please contact the Audiology Department at

Pediatric Audiologist
Hospital for Children

Copy to:
Parent(s)
Pediatrician

The Brain Recovery Project

READING RESOURCES FOR CHILDREN WITH LEARNING DIFFERENCES:

Learning Ally

Online audiobooks resource specially aimed at children diagnosed with dyslexia and other reading disorders
Membership subscription sign up required
www.learningally.org
app version available

Bookshare
Audiobooks resource for patients of all ages with print disabilities
Membership subscription sign up required; however, U.S. Students and schools can qualify for free membership with participating schools
Please note: CAPD is not a recognized diagnosis by Bookshare for free membership
www.bookshare.org

LibriVox
Free public domain audiobooks, classic novels used in middle and high school curriculum are often included
Free access
www.libriVox.org
App version available

Audible
Online audiobooks resource for the general public
Free membership subscription, books are paid by single item purchase
www.audible.com
app version available

Reading Rockets
On-line articles discussing resources for parents with children struggling with reading
www.readingrockets.org

Starfall
Online resource to assist with phonics and mathematics for younger children
www.starfall.com

Tumble books
Public school online library resource for ebooks. There is a menu for different age groups and needs. Some of the resources are free but there is a subscription cost associated with total access. Please read fine print carefully!
www.tumblebooks.com

Preschool printables
Resources for the development of skills for preschool children working toward development of kindergarten skills
www.preschoolprintables.com

Behavioral Desensitisation of Anxiety about Sound Exposure

"1. When the child becomes distressed by exposure to sound, move the child away from the sound source if possible and then comfort and reassure him/her.

2. Try to explain the source of the sound to the child.

3. The child's fear reaction will often diminish if s/he can exercise some control over the sounds. So encourage the child to clap his own hands, to play with noisemakers or to start and stop the vacuum cleaner at home.

4. Repeated gentle exposure to the noise may help the child to reduce anxiety and desensitise the auditory aspect of the sensitivity. You could tape-record one or more of the problem sounds (e.g. Laughter, clapping, thunder, sirens, machine-noise) and help him to switch the tape recorder to a very low volume. Gradually over a period of days or weeks the volume can be increased. **(See also the "Selective Listening Exercises" below to be incorporated with this step.)** Practice with the sounds under play conditions that the child can control, to help break the association of that sound with fear. This is not the same as unexpected exposure to the same sound, as people with hyperacusis do say that they can cope better if they are warned that a sound is about to occur, but it is helpful.

5. Children should not be forced to stay in a situation that is causing them obvious distress (for example during singing in assembly). This may compound their apprehension and make them associate that situation (e.g. The assembly hall) with pain. If fear of a specific situation has become established, it is important to gradually desensitise the child, with time and care...

The use of ear plugs, muffs or defenders should be avoided except in extreme or short-term, unavoidable situations (e.g. During a journey). ***Exposure to normal and tolerable sound is crucial if the ear and brain are to establish normal sensitivity.***"

Josephine Marriage, Ph.D. "Management Approaches to Hyperacusis in Children: Framework of Symptom Management". www.hyperacusis.net.

General directions for Selective Listening Exercises/Noise Desensitization

Materials:
Recording of background sounds containing approximately 3 minutes of each of the following kinds of sounds:

Level I – Nonverbal constant noise (ex. Fan, dishwasher, vacuum cleaner, hair dryer)
Level II – Nonverbal variable noises (ex. Washing dishes, crowd noise, recess)
Level III – Nonverbal music (ex. Classical, jazz)
Level IV – Verbal music (ex. Folk songs)
Level V- Verbal, nonmeaningful conversation (ex. Foreign language, philosophical readings)

Directions:
Place the sound source so that the sounds reach ; ears equally. The volume should not be louder than a speaking voice.

Complete simple exercises first. should be able to complete each task with at least 80% accuracy without the background noise. Once he can complete the tasks the volume of the sounds should be increased.

As he masters the simple exercises move into harder tasks at the same sound level, but beginning at the lowest volume.

Once has mastered exercises with Level I sounds, it is appropriate to proceed to the level II sounds. Repeat exercises.

It is important to remember that this is slow process. may or may not be able to fully focus when there are verbal stimuli present. It is also very important to listen and let him tell you if he believes that he is ready to proceed.

Hall, J.W. & Mueller, H.G. (1997). *Audiologist's Desk Reference Volume I.* Singular Publishing, San Diego, pp.558-559.

Attachment: AEP waveforms

MRN #

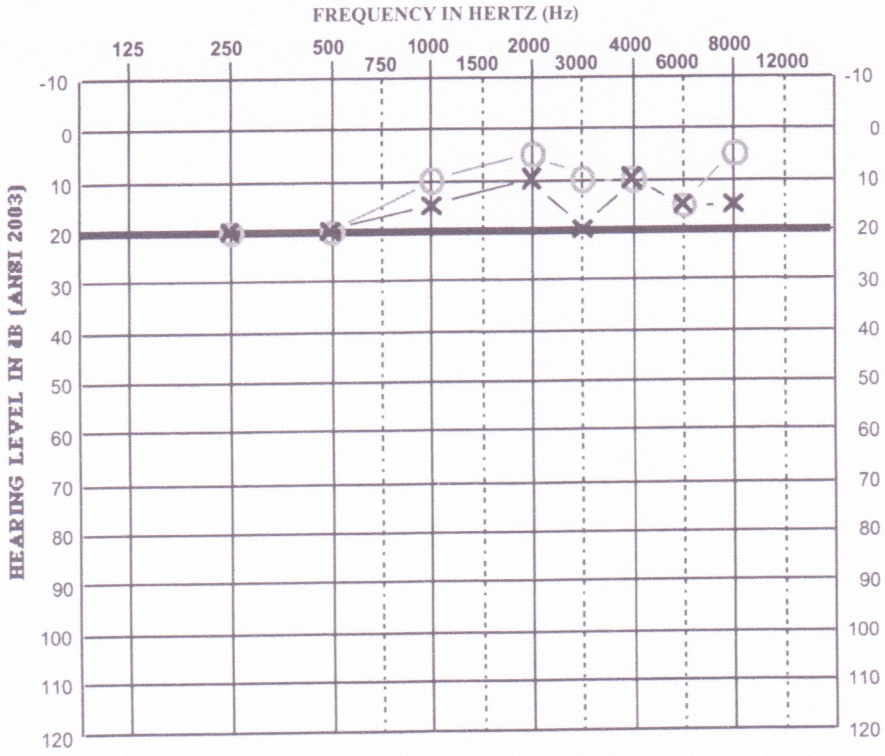
NAME

D.O.B.

Referring Physician

MEDICAL RECORD ——— AUDIOLOGICAL REPORT

Audiologist:



	Right	Left
Air Conduction		
Unmasked	○	×
Masked	△	□
Bone Conduction		
Unmasked	<	>
Masked	[	]
Sound Field		
Unaided - Aided	S	A
Comfort Level		
Maximum	MC	MC
Uncomfortable	UC	UC
Reflexes		
Contra	–	–
Ipsi	⊣	⊢
Commented	C / P / V N / FM / M	

Test Reliability

	GOOD	FAIR	POOR
AIR	X		
BONE			
SPEECH	X		
LOCAL-IZATION			

Otoscopy

RIGHT		LEFT
■	Unobstructed	■
☐	Non-occluding cerumen	☐
☐	Occluding cerumen	☐
☐	PE Tube	☐
☐	Abnormal	☐
☐	Did Not Evaluate	☐
☐	Uncooperative	☐

Audiometer:
GSI 61

Transducer:
TDH-50

Method: Play Audiometry (pegs)

☐ Crying ☐ False Positives
☐ Fearful of VRA Stimuli ☐ Uncooperative
☐ Inattentive to task ☐ Vocalizing
☐ Inconsistent
☐ Could not condition

* = Masked ☐ Currently Uses Amplification/CI

	Stimulus	LEFT	RIGHT	BONE	SF Unaided	SF Aided	List
SAT							
SRT	MLV	10 dB	10 dB				Spondees
Discrim In Quiet (1)	MLV	100% at * 50 dB	100% at * 50 dB				CID W-22
Discrim In Quiet (2)							
Discrim In Noise							

■ Hearing is within normal limits --- ☐ Right ☐ Left ■ Both ☐ Better Ear (SF)
☐ Currently hearing loss is present --- ☐ Right ☐ Left ☐ Both ☐ SF ☐ See Notes
☐ Minimum response levels are age/developmentally appropriate

☐ Stable ☐ Improved ☐ Poorer ☐ See Notes

Contraindications: No
Pain Reported: No
Rating: 0
Scale: 10 Point

MLV-Monitored Live Voice
REC- Recorded Voice
N- Narrow Band Noise
CI- Cochlear Implant
V- Vibrotactile
P- Pressure

AUDIOLOGIST SIGNATU

Date 09/26/2016

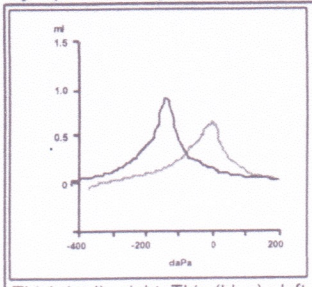
MRN #

NAME

D.O.B.

Referring Physician

Tympanometry



Thick (red) - right, Thin (blue) - left

Tympanogram Diagnostic

	Right	Left
Probe Tone (Hz)	226	226
Ear Canal Volume	1.30	1.10
Peak Admittance (ml)	0.60	0.90
Peak pressure (daPa)	20	-120
Curve Type	A	C

09/26/2016

		Acoustic Reflexes				Reflex Decay	
Stim	Meas	500	1000	2000	4000	500	1000
Right	Contra	100	100	90	100		
	Ipsi	85	80	85	85		
Left	Contra	100	100	95	85		
	Ipsi	85	80	85	90		

Abs- Absent CNT- Could Not Test UdB- Undefined decibel level

OAE RESULTS

RIGHT

Test Protocol: PASS

LEFT

Test Protocol: PASS

	1 KHz	2 KHz	3 KHz	4 KHz	5 KHz	6 KHz	8 KHz	1 KHz	2 KHz	3 KHz	4 KHz	5 KHz	6 KHz	8 KHz
RESULT		Pass	Pass	Pass	Pass				Pass	Pass	Pass	Pass		
DP		0	1	-2	-3				-7	-7	1	-4		
NF		-11	-15	-20	-20				-17	-18	-20	-20		
SNR		11	16	18	17				10	11	21	16		

RESULT: P=Pass, R=Refer, CNT= Excessive Artifact, DNT=Abnormal Tympanogram

Recommendations

- [ ] Medical Evaluation/Mangement
- [ ] Speech/Language Evaluation
- [x] Continued Speech/Language Therapy
- [ ] Developmental Evaluation
- [ ] Central Auditory Processing Evaluation
- [ ] Consider Amplification/CI upon Clearance
- [ ] Consider Classroom Amplification/FM System
- [ ] Preferrential Classroom Seating
- [ ] Hearing Protection in Excessive Noise
- [ ] Continue Monitoring Speech Development
- [x] SEE NOTES:

- [x] Retest
  - [ ] PRN
  - [ ] Post Medical Management
  - [ ] In conjunction with Otologic Care
  - [ ] Per Hematology/Oncology Protocol
  - [x] With ABR/OAE
  - [ ] In Conjunction w/ Cleft Palate Clinic
  - [ ] Ear Specific Testing Around Age 3
- [ ] F/U with Managing Audiologist for Hearing Aid/CI Care
- [ ] Continued use of amplification/CI as previously recommended
- [ ] Primary care physician follow-up in 6 months or as needed
- [ ] Otolaryngologic follow-up in 12 months or as needed
- [ ] Practice Play Audiometry Techniques
- [ ] Two Tester Hearing Evaluation
- [ ] Return in _____ to confirm findings/monitor hearing

AUDIOLOGIST SIGNATURE

Date 09/26/2016

MRN #

NAME

D.O.B.

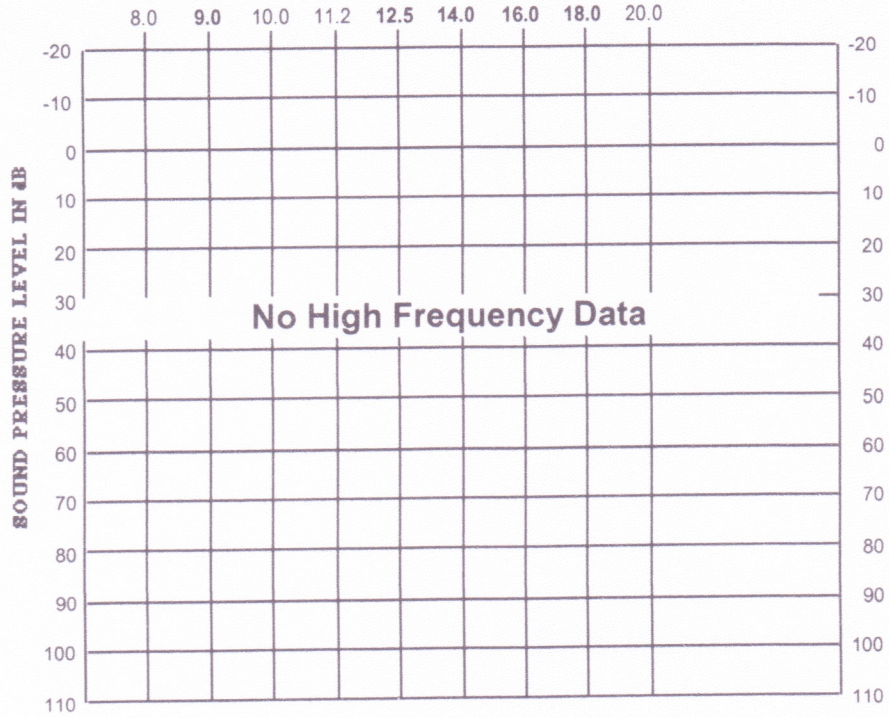
Referring Physician

MEDICAL RECORD ——— AUDIOLOGICAL REPORT

Audiologist:

High Frequency Audiogram

FREQUENCY IN HERTZ (kHz)



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Notes

Intake with CAEP and OAE Suppression

Patient has a history of anatomical right hemispherectomy with listening and learning concerns.

See full report for a comprehensive list of recommendations and accommodations.

AUDIOLOGIST SIGNATU

Date 09/26/2016