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Understanding a Child's Aided Hearing Characteristics

And How the Desired Sensation Level (DSL) Approach Can Help (Part 1)

By Pamela D. Millett, Ph.D.

Whatever happened to the aided audiogram? Teachers and parents, accustomed to using the aided audiogram as an assessment, counseling and programming tool, often wonder why these test results are rarely seen. Most clinical audiologists have replaced aided audiograms, which indicate the child's hearing thresholds after hearing aid amplification, with real ear measurement technology, but teachers and parents/caregivers may not have learned to interpret and apply these results to everyday life. The first part of this article will describe why aided audiograms are no longer considered the measurement tool of choice by clinical audiologists, and the second part will describe how parents/caregivers and teachers can interpret a different kind of graph, the SPLogram, to obtain the same information.

An aided audiogram is obtained in essentially the same way as a standard audiogram. Sounds are presented in the sound suite or booth, and the child's responses to increasingly softer sounds are recorded; the main difference is that the sounds are presented through speakers because the child is wearing his or her amplification. For infants and young children, these responses might be a head turn towards the source of the sound; for older children, these responses might be putting a block in a bucket or raising a hand when sounds are presented. Obtaining a complete aided audiogram requires a significant amount of time during which the child needs to be paying close attention. Real ear measurement technology, on the other hand, allows the audiologist to measure the characteristics of the hearing aid in the child's ear canal very quickly and accurately. One of the most commonly used software programs for real ear measurement technology,

called the Desired Sensation Level (DSL) program, produces a different type of audiogram. This "SPLogram" looks a little different than a traditional audiogram, and with a little practice parents and teachers can use SPLograms to understand what a child can be predicted to hear with his or her hearing aids.

How do clinical audiologists measure how well a hearing aid is working without an aided audiogram or SPLogram? One way is an electroacoustical evaluation where the hearing aid is connected to a metal container (called a 2 cc coupler), placed in a small, sound proofed chamber and measured. This is often referred to as an "ANSI" test, meaning that the procedures and the measurements have been standardized by the American National Standards Institute (ANSI, 1996). These results can be compared to specification sheets from the manufacturers that provide expected values for each hearing aid. The measurement is typically done by clinical audiologists to

ensure that the electronic components are working; however, it cannot be used as an indication of how a child will perform with this hearing aid.

Why not? The values obtained when measuring the hearing aid coupled to a small metal chamber and the values obtained when the same hearing aid is placed in a child's ear are quite different. Sound behaves very differently in a metal chamber than in an ear canal made of skin, cartilage and bone. Therefore, the "ANSI" measurement may overestimate or, more typically,

aid. If the way in which each individual's ear shapes sound is unique, a better and more individualized hearing aid fitting can be obtained when this data is incorporated into the fitting.

Using real ear measurement, the hearing aid can be measured directly on the child's ear and the ear canal resonance characteristics will automatically be incorporated. Alternatively, the audiologist can do one quick measurement of the child's ear canal characteristics without a hearing aid, ask the computer to compare the child's ear to a 2 cc metal

- Measure the maximum sound output of the hearing aid (very important to ensure that the hearing aid cannot damage the child's residual hearing).
- Incorporate the child's ear canal resonance into the hearing aid fitting, particularly important because this measurement will change as the child's ear grows in size and changes in shape.
- Measure the performance of the hearing aid using different sound levels, since many hearing aids respond differently to soft, medium and loud level sounds as well as to different kinds of sounds.

From the clinical audiologist's perspective, the prescription and evaluation of a hearing aid must be done using the most accurate and reliable procedure, preferably one that can be done quickly given the attention spans of children and the realities of clinic schedules. Aided audiograms are still used by clinical audiologists, most commonly to evaluate results with a cochlear implant or bone conduction device or as a crosscheck of the real ear measurement results. However, in general, aided audiograms do not give as much "bang for the buck" for hearing aid evaluation.

If aided audiograms are not provided, how can we know what to expect from a child's hearing aids? It is important for parents and teachers to know how a child can be predicted to hear with his or her hearing aid, and interpreting test results is not as daunting as it appears. The second part of this article will discuss the DSL program, a hearing aid prescription and verification software widely used to evaluate hearing aid benefit for children (Bagatto, Scollie, Hyde & Seewald, 2010; Seewald, Cornelisse, Ramji, Sinclair, Moodie, & Jamieson, 1997). The DSL program was developed by Richard Seewald and colleagues at the University of Western Ontario in London, Ontario, specifically for children to provide a more accurate way of evaluating hearing aid characteristics. It is widely used across North America and internationally, allowing an audiologist to input the child's unaided audiogram into the software program, measure the characteristics of that child's individual ear canals, generate targets for each frequency for soft, average and loud sounds, assess a variety of hearing aids

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underestimate the sound levels the child receives. Aided audiograms, on the other hand, do test hearing aid performance on the child's ears. However, they are time consuming, tiring for children and yield information about only a few frequencies. With the introduction of real ear measurement systems in the late 1980s, a more accurate way to measure hearing aid benefit was possible.

Real ear measurement systems provide a direct measure of sound at an individual's eardrum. Our ear canals actually shape sound as it passes through them to the eardrum. A phenomenon called "resonance" causes certain frequencies in the speech signal to be enhanced or amplified by the ear canal. The amount of enhancement and the frequency range at which it occurs varies from child to adult, and even from age to age (Kruger, 1987; Seewald & Scollie, 1999). This resonance can be measured using real ear measurement equipment and the resulting graph is referred to as the Real Ear Unaided Response. This simply means that it shows what happens to sound in an individual's ear canal without a hearing

coupler and save the resulting converted values. This is called the Real Ear to Coupler Difference. Once this value is entered, the audiologist does not need to have the child present to test a variety of hearing aids since the child's "virtual ear" is saved in the program.

Real ear measurement is also crucial because the performance of the same hearing aid will differ for different sized ears. For example, we might measure a particular hearing aid on an adult and find that the maximum sound output of the hearing aid is 120 dB. When the same hearing aid at the same settings is placed on a child's ear, the maximum output of that same hearing aid might be closer to 130 dB because the child's ear canal is much smaller than the adult.

For the clinical audiologist, real ear measurements are the clear choice for hearing aid prescription and evaluation based on accuracy, completeness of information provided and speed. Real ear measurements allow the audiologist to:

- Obtain information regarding the hearing aid characteristics for many individual frequencies.

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to select the most appropriate model for the child, and verify the characteristics of a child's existing hearing aids to ensure that they are providing the most appropriate amplification. All of these activities can be done more quickly and accurately

using real ear measurement equipment in combination with the DSL program than by measuring aided audiograms. The end result is a more accurate hearing aid fit, ensuring the child the best opportunity to develop listening and spoken language. ♪

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