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The Art and Science of a Good First Fit

By Leanne Powers, AuD

Why did we choose ears instead of eyes? In my 16 years of clinical experience working with the hearing impaired I've often pondered this question. After all, compared to our industry, the eye care professional field can't be all that different, right?

Take for example the process of getting new eyeglasses or contact lenses. An appointment is set up, a test is given to determine the prescription, new frames or lenses are picked out, and then voila—you're fit with new glasses or contacts. So far that doesn't sound too different from a patient getting a new pair of hearing aids. Broken down into its most basic steps, the process is virtually the same. It's the many factors that go into fitting hearing instruments, and the various potential patient outcomes that make fitting ears so different from fitting eyes. For example, a new pair of glasses can "correct" your vision but hearing instruments can only "aid" a hearing loss. After you're fit with new glasses, your vision can be restored to 20/20. If only it worked that way with hearing instruments!

So this begs the question—how can hearing care professionals get closer to achieving the patient results that eye care professionals, in particular optometrists, attain? Clearly we have a very long way to go before we can even think about using terms like "correcting" or "restoring" hearing. But it doesn't mean that we can't get pretty darn close to it—or even provide a benefit that may not be available to people with "normal" hearing. For example, wirelessly streaming music into both ears while swimming underwater. Now, when was the last time you heard a pair of glasses do that?

First-Fit Goals: Spontaneous Acceptance and Long-Term Patient Satisfaction

Regardless of the patient's intentions and goals, the goals of hearing care professionals are always the same: spontaneous acceptance and long-term patient satisfaction. And it all starts with a proper first fit.

So what exactly is a first fit? Generally speaking, the term *first fit* describes the act of or result of initially programming a hearing instrument to achieve the most optimal settings according to the patient's needs. A *first fitting* appointment occurs when the patient is initially fit with hearing instruments that have already been *first-fit*. Simple enough, right?

Spontaneous acceptance is the primary goal of the first fitting for a hearing instrument. Until recently, this goal was a lot more difficult to accomplish than it is now. In the past, the first fitting appointment consisted of two main things:

1. Managing patient expectations
2. Perfecting your "you'll get used to it" speech

Although some may consider this a bit “glass half empty,” the reality is that until recently, hearing instruments still struggled to produce the rich, natural sound quality found in today’s devices. Of course, hearing aid technology has been steadily improving for the past 50 years, yielding smaller, smarter, more stylish, and more powerful instruments. For example, in the mid-90’s the first wearable behind-the-ear (BTE) digital hearing instruments were introduced. Wireless e2e technology debuted in 2004, and for the first time binaural hearing aids could stay in sync and “talk” to each other. However in the past 5-10 years, the balance of speech recognition AND comfort became a major focal point for manufacturers, in addition to looks and capabilities.

Modern Digital Hearing Instruments Sound Much More Natural

Today, hearing instruments are much closer to mimicking the natural sound patients expect. The usual feedback from wearers that the instruments sound “tinny” or “artificial” are slowly changing to comments like “natural” and “that’s how it’s supposed to sound.” Newer, faster processing chips offer the promise of a new horizon where patients fit with hearing aids have less disappointment and higher levels of spontaneous acceptance.

What Makes a Good First-Fit Experience?

Fitting hearing aids is both an art and a science. These two aspects are intertwined throughout the first-fit process and are largely dependent on one another. Let’s take a look at the artistic and scientific factors that influence a good first-fit experience.

The Right Questions

Of course a good case history or intake form is a crucial part of the first-fit assessment as hearing loss is a medical condition which has co-morbidity with many other health issues. It is our job as the gatekeepers of a hearing impairment diagnosis to recognize when a patient needs to be referred to other health care professionals. There are specific closed-ended questions that can be used to aid in the diagnosis and referral process, such as, “Do you have ringing in your ears?” etc. But even in the case history, the *art* of fitting plays a role. In addition to objective, closed-ended questions, it’s important to ask open-ended questions that tap into the emotional and experiential aspects of how hearing loss is impacting a patient’s life.

Testing, 1-2-3...

While asking the right questions in a case history is somewhat of an art, validating the patients’ responses is science. Usually, testing provides confirmation of the issues raised in the patient’s case history. Sometimes, however, testing can reveal a medical issue unknown to the patient. The point is that a thorough battery of testing gives the professional real insight into the patient’s current situation, while providing potential clues into the past. Testing complements the case study—the results of which are essential in calculating the best first-fit formula for the specific patient. At a minimum, the following tests should occur with each patient:

- Audiogram to measure the scope of the hearing impairment and the hearing threshold

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- Speech recognition testing
 - Loudness discomfort levels (LDLs) testing

Based on the case history, other tests may need to be considered, including:

- Bone conduction testing
- Tympanometry testing
- Otoacoustic emissions testing
- Acoustic reflexes testing

The Art of Consultation

Once the testing is complete, the consultation period begins. Many professionals cling to the scientific aspect of fitting and feel a thorough explanation of the test results is necessary to ensure a positive hearing rehabilitation experience. Others, however, feel a more direct approach with minimal explanation and a stronger focus on addressing what patient's need (to purchase) to overcome their impairment is the way to go. So, in this area we can say that the art of fitting takes over again.

There is no single correct way to complete a consultation that will ensure a patient chooses to purchase a hearing instrument when the test results confirm the need. Again, I am reminded of my visit to the eye doctor. My optometrist never asks if I want to correct my vision—a successful

“There is no single correct way to complete a consultation that will ensure a patient chooses to purchase a hearing instrument when the test results confirm the need.”

fitting with glasses is assumed prior to my appointment. He simply asked *how* I want to correct it, with contacts, glasses, or surgery. There is no debate or negotiation at this point. He proceeds to write me a prescription that I will get filled.

Hearing impairment is different though. Remember the difference between *correcting* and *aiding*? Unlike corrective vision, future success with hearing aid wearers cannot be assumed based on past successes. Most of our patients know at least one person that has tried hearing aids and did not adopt them. Our patients need to be convinced that beginning this journey is the right thing to do and hearing care professionals go about that in a variety of ways.

Adding more complication to this process is that these tiny sophisticated electronic devices we call hearing instruments carry what is seen as a significant price tag for most individuals—a price tag, which (unlike eye ware) is not normally covered by insurance. That's why hearing aid technology comes in a variety of performance levels from value to premium. The features available within the instruments and the level of processing need to be considered to make sure we fit patients with the technology that best matches their lifestyle, expectations, and budget. There is no scientific formula available to help you guide patients in this decision process and, therefore, I consider this portion of the consultation part an art.

The Demo Approach

One avenue that some professionals utilize is to demonstrate hearing instruments during the consultation. In most cases, the hearing care professional programs a set of hearing aids for the patient to try in the office and sometimes out in the real world. The hope is that a successful demo convinces patients they can be helped by allowing the hearing instruments to essentially “sell themselves.” Let’s briefly return back to the eye doctor analogy. When you sit in the exam chair the optometrist uses a machine with interchangeable lenses called a phoropter to evaluate how well you read words projected on the wall. You would never agree to purchase glasses or contacts if the optometrist was unable to make your vision clear enough to read the letters. It’s not that different with a demo hearing instrument experience. If the demo sounds bad, the patient won’t be confident in a hearing instrument’s ability and will likely not purchase.

While the demo approach itself can be categorized as an art, a successful hearing instrument demonstration draws us back to the science of a first fit. Hearing aids cannot be simply pulled off the shelf and slipped on like a pair of slippers. They need to be fit. It’s the job of our profession to determine these settings based on the degree of hearing loss and then feed this information into the fitting software. The software then applies a fitting formula to the information received, creating a first fit target. Of course, the formula’s accuracy is dependent on the accuracy and amount of data provided. An inaccurate first fit can be detrimental to the patient’s overall fitting experience.

The Art and Science of First-Fit Formulas

First fit formulas alone are based on science. Knowing when and how to make the best use of them can be considered an art. So where do the fitting formulas come from? There are several researched fitting formulas in use in today. Some are considered industry standards while others are proprietary to a certain manufacturer.

Formulas 101

The most commonly used fitting formula is NAL-NL2. Developed by the National Acoustic Laboratory in Australia, NAL-NL2 has two primary objectives:

1. Make speech intelligible
2. Make loud sounds comfortable.

The second most popular fitting formula available is Desired Sensation Level (DSL). Often DSL is considered the formula of choice for fitting children, but in recent years both formulas NAL-NL2 and DSL have relied more on age dependent factors in determining sound level targets.

The information assessed by a fitting formula includes:

- The pure tone air and bone conduction thresholds

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- Loudness discomfort levels (LDLs)
 - The age of the patient
 - The experience level of the patient with amplification
 - The type of language the patient speaks (tonal: Chinese, Korean, Thai; or non-tonal: English, French, German)
 - The acoustic coupling method applied (i.e., how the sound is delivered to the ear).

The Science of Formulas: What to Look for

Have you ever heard the saying “first impressions matter most?” Of course you have, because it’s true! Without a good first impression you may never get to the next step of the fitting process, and even if you do, you have to fight an uphill battle. The reality is this: HCPs are already selling something that nobody wants-to-need, let alone purchase. Fortunately, technological advances in hearing aids have not only improved and increased the features available in these instruments, but they have also improved the accuracy of the first-fit algorithms. Let’s take a look at some of these features:

- **Digital Noise Reduction Filters**

Digital noise reduction filters are applied to separate speech signals from other sounds in the environment. This helps patients focus and provides optimal audibility. Remember, unlike fitting glasses for a vision impairment, we can’t “correct” hearing loss. With hearing, we still need to send the amplified sound through the damaged inner ear to be processed by the auditory system. This can affect a patient’s ability to sort through the environmental sounds and process the signal of interest (usually speech). Similar to gain, the accuracy of noise-reducing filters is improved by having more channels.

- **Compression Algorithms**

Modern hearing instruments have multiple channels for processing sound and applying frequency compression. So, what exactly is compression? We talked about how the goal of NAL-NL2 is to make speech audible while making loud sounds comfortable. To achieve this goal, softer sounds that are no longer naturally audible (due to the patients hearing loss) need to be amplified. At some point the patient perception of loudness returns to a normal level and therefore less gain needs to be applied to louder inputs. They may already be audible to the patient even without amplification.

Having multiple channels means that the compression can be applied in different amounts for different pitches or frequencies. And, since hearing loss usually affects different frequencies at variable levels, multiple channels ensure the proper amounts of amplification can be applied at each individual frequency. The more channels you have, the more precise you can be when applying gain. Some modern hearing aids also allow for multiple compression kneepoints which further refine the gain application process.

Now, imagine you are driving a car. The process of making sounds audible is similar to pressing the gas pedal to accelerate. Prior to reaching your destination you need to slow down rather

than stop abruptly. The point where you remove your foot from the accelerator—just before you press the brake—is like the compression point. This is when you change from linear amplification (a one-to-one input-to-output relationship) to a state of compression. How hard you step on the brake determines the compression ratio, or the rate at which this one-to-one relationship is changed.

So, utilizing compression allows us to:

- apply the necessary amount of gain to soft sounds to make them audible
- apply less gain to average sounds to restore the natural balance of loudness but ensure they are also audible;
- apply minimal, if any, gain to loud sounds that were already audible to maintain comfort

The Art of Formulas: Personalization

Do you ever feel like the one thing all patients seem to have in common is that they all want to hear differently? So, in the world of hearing aid fitting, the target formula is just a starting point. The reality is most hearing instrument fittings require some minor adjustment to satisfy the patient's preferences—and possibly personal reasons for how patients think they should hear.

“Hearing care professionals need to ask the right questions and read between the lines of their patients’ complaints and comments about their experience.”

Determining what to adjust to achieve a successful fit is the art of fitting. Patient feedback is just as important here as it is during the initial case history/assessment. Hearing care professionals need to ask the right questions and read between the lines of their patients' complaints and comments about their experience. The more accurate the first fit, the less adjustment is needed, resulting in less stress on the fitting professional. A great first fit will also lessen the time needed in the fitting software and give more time for counseling and aural rehab.

In the demo model for hearing aid consultations, it is not productive or cost effective to spend time making fine tuning adjustments for each hearing instrument demonstration. Therefore, the first fit configuration must show patients that they can achieve audibility in a comfortable and pleasing manner. Most hearing instrument manufacturers modify the target fitting formulas in their software to work optimally with their products. These modified formulas are renamed for branding purposes.

The Real World: First Fit Success & Beyond

Let's examine one example of advanced hearing instrument technology in the real world. Siemens' micon processing platform was introduced in November 2012. Siemens recognized the goal of a great first fit experience is not just to ease the job of the fitting professional, but also to improve patient acceptance right from the beginning. The micon platform provides directional speech enhancement and noise reduction in 48 channels up to 12 kHz of bandwidth, and advanced frequency compression.

To weave together the processing power with the knowledge about the hearing instrument wearer's experiences with amplification, Siemens adapted the NAL-NL2 formula into a proprietary formula. Psychoacoustic models for effective audibility and sound comfort are applied to the NAL-NL2 formula base. The result is a first fit that provides a proven balance of sound comfort and audibility right from the start with virtually no adjustments needed.¹

Little to no adjustments is always a bonus for both the patient and the hearing care professional. But it doesn't mean the first fit experience is necessarily over. Once the hearing instruments are agreed upon, the delivery process begins. During the delivery process, the first fit algorithm is utilized again to customize the purchased hearing aids to meet the patient's needs. Verification measures are typically performed to ensure that the optimal settings are programmed into the hearing aids. Once the patient has experienced real-world listening environments, questionnaires can be administered to validate the fitting.

One way to verify a fitting is Probe Microphone measures, otherwise known as Real Ear Measures (REM). This is often done manually and can take upward of 30 minutes. However, certain tools are available to help automate this process, improve workflow, and save patients and hearing care professionals time. Siemens' AutoFit is one example of these tools. AutoFit is an optional feature that automatically provides the professional with an optimized real-ear insertion gain setting during the first fit. This significantly reduces the time it takes to verify the fitting as the individual ear characteristics and ear coupling differences are delivered directly to the fitting software, eliminating the need for manual adjustments. The AutoFit feature is compatible with the following REM systems: Unity™2, MedRX AVANT REM, and MedRX AVANT REM+. Optimally, this feature would be part of the fitting software; its integration is currently being evaluated.

Conclusion: Successful First Fits Change Lives

Perhaps one day our fitting process will be more like that of optometrists, where we no longer need to convince wearers that they need help. Can you imagine a world when we can simply test, consult, determine a need, prescribe a solution, and fit it according to the patient's degree of hearing loss, lifestyle and personal preferences?

Until then, a successful first fit will continue to remain a decisive factor in educating your patients on the many benefits of amplification. No pressure, right? The good news is that steady advances in hearing aid technology, along with improved algorithms are improving the odds of a successful first fit each day. Still, technology alone is not enough. Thorough case histories, asking the right questions, and the art and science of consultations and demo approaches are equally important to achieving the initial goal of spontaneous acceptance. Once acceptance is achieved, the secondary goal of long-term listening satisfaction begins.

It's in the quest to achieve this secondary goal that I personally am most reminded why I chose ears over eyes. When patients go home with new hearing aids, aural rehabilitation begins and lives are changed. It's seeing tears of joy when a grandmother is able to hear her granddaughter's voice again. It's the relief in a businessman's face when he reports that he can now hear what is said in a meeting and he no

longer has to pretend to hear at work. It's the sincere gratitude of a significant other for "giving them back the spouse they remember." These are just a few reasons why we chose ears instead of eyes.

1. Powers, Thomas and Beilin, Joel. *True Advances in Hearing Aid Technology: What are they and where's the proof?* *The Hearing Review*. January 2013



Leanne Powers, AuD, received her undergraduate degree from Northern Illinois University, her graduate degree from RUSH University in Chicago, and her Doctorate from A.T. Still University of Health Sciences in Arizona. Powers practiced in a variety of hearing healthcare settings for 16 years including the operation of two hearing aid offices in the Chicago land area prior to joining the Siemens Training Team. She currently serves as an Education Specialist for customers as well as Siemens staff on products and services.

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1. **Improvements in hearing aid technology have yielded:**
 - a) smaller, smarter, more stylish & powerful instruments
 - b) nothing, hearing aids haven't changed
 - c) eye glass hearing aids
 - d) rechargeable in-the-ear hearing aids
2. **What types of questions should you ask the patient to receive a good first fit?**
 - a) close-ended questions
 - b) open-ended questions
 - c) open-ended questions that tap into the emotional aspects of hearing loss
 - d) all of the above
3. **How does testing compliment a patient's case history?**
 - a) can reveal a medical issue unknown to the patient
 - b) compliments the case study
 - c) a & b
 - d) one test can provide all the answers
4. **What are the minimum tests that should occur with each patient?**
 - a) audiogram
 - b) speech recognition testing
 - c) loudness discomfort levels (LDLs)
 - d) all of the above
5. **What is the benefit of multiple channels in hearing aids?**
 - a) to process sound & apply compression
 - b) to ensure the proper amounts of amplification can be applied at each individual frequency
 - c) To improve accuracy of noise-reducing filters
 - d) All of the above
6. **What are two key goals of a hearing care professional for a fitting?**
 - a) having a successful practice
 - b) long-term patient satisfaction
 - c) spontaneous acceptance
 - d) b and c
7. **A demonstration of the hearing aids using a quick first fit with the patient's own test results is a good approach to add to a consultation.**
 - a) true
 - b) false
8. **The two common first fit formulas used during today's fittings are**
 - a) NAL-NL2 and DSL
 - b) NAI-NII and DLS
 - c) NAL-NL2 and NDA
 - d) ND-LNL2 and DAL
9. **The primary goal of the first fit settings for a hearing instrument are:**
 - a) the patient's spontaneous acceptance
 - b) to make as much money as possible
 - c) to restore normal hearing to the patient
 - d) none of the above
10. **Three things that a traditional fitting formula includes are loudness discomfort levels (LDLs), age, and size of the ear canal.**
 - a) true
 - b) false

For continuing education credit, complete this test and send the answer section at the bottom of the page to:

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The Art and Science of a Good First Fit

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