Beyond the Fitting Target: Verifying Advanced Hearing Aid Features

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There was a time, in the not so distant past, when the only thing a hearing care professional (HCP) needed to worry about when fitting a hearing aid was the audibility and comfort of the signal. This was done in a variety of ways, from asking, "How does that sound?" to reading a list of single-syllable words in quiet and then comparing the score to the unaided results. In the early 1980s, prescriptive fitting methods became popular. Along with the widespread use of prescriptive fitting methods, probe microphone measures became the standard in which they were verified. Although not routinely conducted by HCPs today,[1] they are still the best method for verifying that a hearing instrument is approximating a prescriptive gain target.[2]

Currently, probe microphone measures are not just for verifying prescriptive gain targets. Most modern hearing aids utilize many advanced features such as digital noise reduction, directional microphone technology, and adaptive feedback cancellation. Believe it or not, probe microphone measures can be used to show the patient how these advanced features work. Considering that patients are paying a lot of money to reap the benefits of these advanced features, all of us should agree that showing the patient how they actually work in the ear before they walk out the door with their purchase is a very good thing.

Showing the Patient that Advanced Features Work

The best way to demonstrate the functionality of the advanced features on a user's hearing instrument is probe microphone measures. Two of the most common advanced features are detailed below with a step-by-step guide for using probe microphone measures during the hearing aid fitting. If you are currently using probe microphone measures, the addition of these two procedures will add only a couple of minutes to your fitting. More importantly, your patient can walk out the door knowing how these advanced features actually work.

Digital Noise Reduction

Digital Noise Reduction (DNR) is one of the most common advanced features available in hearing instruments. Although originally developed to increase speech understanding in noise, there has been a lack of real-world evidence supporting this claim.[3] However, there is a small body of research that indicates that DNR increases comfort in noise.[4] It is for this reason DNR is beneficial for the majority of hearing aid users.

Using any probe microphone equipment you can verify the DNR on a given hearing instrument following these four steps:

1. enable the DNR in the hearing aid memory you will be measuring;
2. run a modulated, speech-like signal at 70 dB for a minimum of 30 seconds;
3. run a continuous, noise-like signal at 70 dB for a minimum of 30 seconds;
4. compare the two curves.

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As you can see in Figure 1, the curve for the non-speech signal is greatly reduced in comparison to the curve for the speech-like signal. It is important to remember that every hearing aid manufacturer has a proprietary method for enacting DNR. This means that the timing and amount of reduction will vary between manufacturers. There is little evidence supporting one method over another.

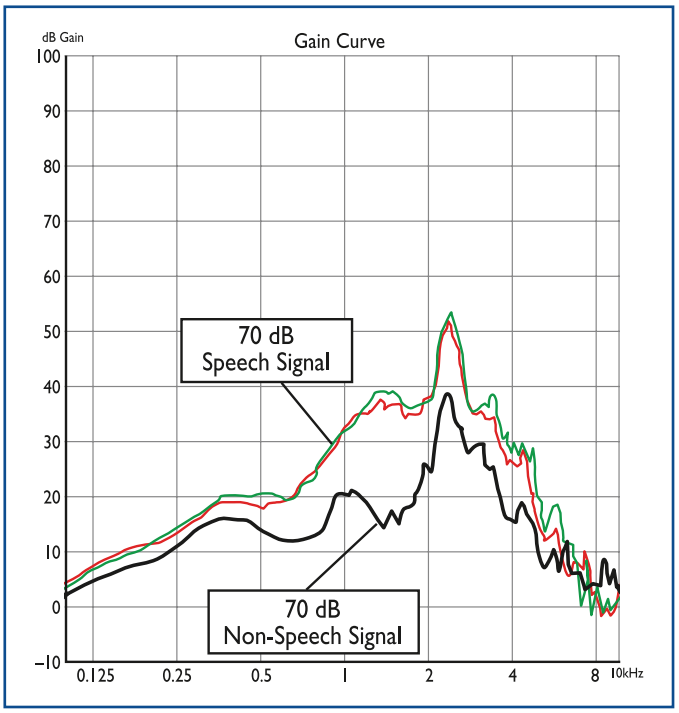

Figure 1. Comparison of speech and non-speech signal in an advanced digital hearing instrument with DNR.

Directional Microphone Technology

It is conventional wisdom that directional microphones are one of the few proven methods to improve speech understanding in background noise. As we know, the number one complaint of people with hearing loss is the inability to understand speech in background noise.[5] It is for this reason we have seen a surge in the number of hearing instruments with directional microphones fit in the last several years.

Using any probe microphone equipment you can easily verify any hearing instrument with directional microphones using a front-to-back measurement.

1. enable the directional microphone feature in the memory you will be measuring;
2. face your patient towards the speaker;
3. run a non-speech signal at 70 dB;
4. turn your patient around so their back is to the speaker (make sure you know where the null point of the directional microphone is located);
5. run a non-speech signal at 70 dB;
6. compare the two curves.

As you can see in Figure 2, the curve run from the front is much greater than the curve from the back. There are a few caveats when doing a front-to-back measurement. First, you must know where the null point is located. Second, every hearing aid manufacturer has a proprietary method for automatically switching to a directional microphone, so you may need to increase the level of your signal. Lastly, it is easiest to verify the directional microphones in a manual fixed directional mode.

Seeing is Believing

The digital age has brought a tremendous amount of improvement to hearing aid technology. Today's hearing instruments are far superior to the trimmer-controlled, linear analog technology available just 10 years ago. However, along with these improvements come side effects. Our patients are savvier and have much higher expectations of their hearing aids and our services. They want to see that the investment they are making is worth the price. As the old adage says, "seeing is believing," or, in this case hearing is believing. The more we can demonstrate the functionality of hearing instruments the more our patients are aware of their complexity. *THP*

References:

1. Lindley G. (2006) Current hearing aid fitting protocols: Results from an on-line survey. *Audiology Today* 18:13–20.
2. Mueller HG. (2005) Fitting hearing aids to adults using prescriptive methods: An evidence-based review of effectiveness. *Journal of the American Academy of Audiology* 16:448–460.
3. Bentler RA. (2005) Effectiveness of directional microphones and noise reduction schemes in hearing aids: A systemic review of the evidence. *Journal of the American Academy of Audiology* 16:477–488.
4. Palmer C, Bentler R and Mueller, HG. (2006) Amplification and the perception of annoying and aversive sounds. *Trends in Amplification* 10:95–104.
5. Kochkin S. (2002) MarkeTrak VI: Consumer rate improvements sought in hearing instruments. *The Hearing Review* 9:18–22.

Chart courtesy Frye Electronics

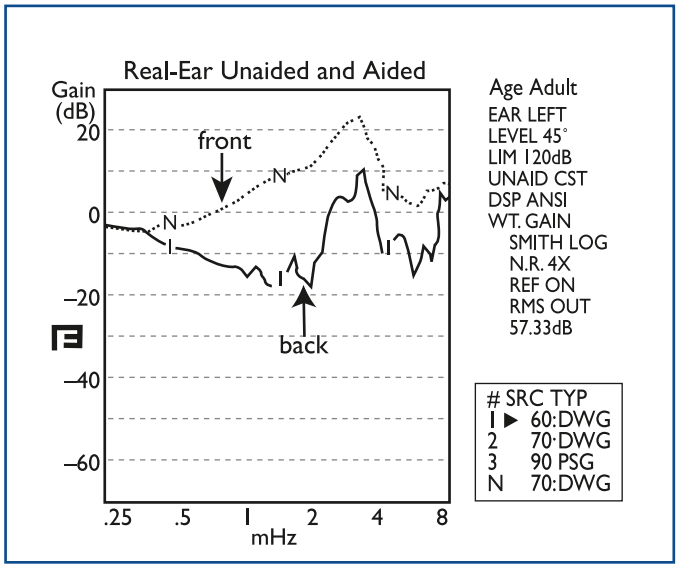

Figure 2. Comparison of a 70 dB signal with the user facing the speaker versus turned 120˚ to the left.

IIHIS Continuing Education Test:
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1. **Prescriptive fitting methods became popular in which decade?**
   a. 1970s
   b. 1980s
   c. 1950s
   d. 1960s
   e. none of the above

2. **This is the best method for verifying that a hearing instrument is approximating a prescriptive gain target:**
   a. probe microphone measures
   b. aided word recognition scores
   c. functional gain
   d. "how does that sound" method
   e. front-to-back measurements

3. **There is a small body of research that indicates this advanced feature increases comfort in noise:**
   a. directional microphones
   b. feedback cancellation
   c. digital noise reduction
   d. data logging
   e. none of the above

4. **Originally, digital noise reduction was developed for this purpose:**
   a. improve speech understanding in quiet
   b. improve speech understanding in noise
   c. improve comfort in noise
   d. improve comfort in quiet
   e. increase comfort for loud sounds

5. **When running curves to verify DNR, which of the following is not included in the step-by-step procedure?**
   a. enable the DNR in the hearing aid memory you will be measuring
   b. run a modulated, speech-like signal at 70 dB for a minimum of 30 seconds
   c. turn your patient around so their back is to the speaker
   d. run a continuous, noise-like signal at 70 dB for a minimum of 30 seconds
   e. none of the above

6. **When comparing the two curves ran to verify DNR you will want to see which of the following?**
   a. the curve for the non-speech signal is less than the curve for the speech-like signal
   b. the curve for the non-speech signal is greater than the curve for the speech-like signal
   c. the curves should be the same
   d. all of the above
   e. none of the above

7. **According to Kochkin 2002, this is the number one complaint of people with hearing loss:**
   a. cannot hear soft sounds
   b. cannot understand speech in background noise
   c. cannot understand speech in quiet
   d. loud sounds are uncomfortable
   e. cannot understand in church

8. **When running curves to verify directional microphone technology, which of the following is not included in the step-by-step procedure?**
   a. face your patient toward the speaker
   b. run a non-speech signal at 70 dB
   c. turn you patient around so their back is to the speaker
   d. run a non-speech signal at 70 dB
   e. none of the above

9. **When comparing the two curves ran to verify directional microphones you will want to see which of the following?**
   a. the back curve is greater than the front curve
   b. the curves are the same
   c. the front curve is greater than the back curve
   d. all of the above
   e. none of the above

10. **What should you be aware of when doing a front-to-back measurement?**
    a. the null point
    b. the manufacturer's proprietary method for automatically switching to directional microphone
    c. it is easier to verify directional microphone technology in a manual fixed directional mode
    d. a and b
    e. a, b, and c

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ANSWER SECTION

(Circle the correct response from the test questions above.)

1.	a	b	c	d	e	6.	a	b	c	d	e
2.	a	b	c	d	e	7.	a	b	c	d	e
3.	a	b	c	d	e	8.	a	b	c	d	e
4.	a	b	c	d	e	9.	a	b	c	d	e
5.	a	b	c	d	e	10.	a	b	c	d	e