Day-To-Day Hearing Aid Fittings: Clinical Nuggets From Recent Research

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Where Gus hangs out when he is in Nashville

Today's talk, however, is not from the Music City, but is coming to you from:
"North Dakota's Largest Island"

And, while island life is enchanting, islands do tend to draw unusual inhabitants!

And most every summer day along the shore you see this guy!

Did you know:

- Not all, but many articles in the audiology literature on hearing aids report findings that have direct clinical applications.
- Keeping up with all these articles is not easy—there sometimes are 200 or more hearing aid articles published in a single year.
- Even if you read the articles, the take-home clinical point is not always obvious, as it may not have been the purpose of the study.

What we're going to do today:

- I've selected a dozen (or so) articles published in the last couple years that I think have a clinical nugget or two.
- I'll summarize the article (briefly) and then present what I think is the take home message for those of you selecting and fitting hearing aids on a daily basis.

In general, we'll talk about four important components of fitting hearing aids:

- Pre-fitting considerations
- Selection of technology
- Verification of the fitting
- Post-fitting follow-up and counseling

Before we begin . . .

Acknowledgement: For the past 12 years Catherine Palmer, Bob Turner and I have conducted a session at the annual Academy of Audiology meeting, where we review recent hearing aid articles. Some of the content today includes material from these presentations.

In general, we'll talk about four important components of fitting hearing aids:

- Pre-fitting considerations
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Just wondering . . .

Have you ever had the patient who, on the surface, was the ideal candidate for a bilateral fitting, but she's thinking she probably could get by with only using one?

This leaves you with some possible options:

- Amp up your counseling, and convince her she really needs to walk out the door with two.
- Suggest that you fit her with one today (so she can get used to it) and then fit the second aid in a few weeks.
- Tell her that that's her choice, it's just fine to only use one, and whenever she's ready for a second aid to let you know.

Better together: Reduced compliance after sequential vs. simultaneous bilateral hearing aid fitting

Lavie, Banai, Attais, & Karni
AJA, Oct, 2013

What they asked . . .

- What are the long term effects of fitting bilateral amplification simultaneously (both aids on Day #1) versus sequentially (the second aid a month later)?

What they did...

- Thirty-six subjects ages 64-88; mean age 76 years.
- All had bilateral symmetrical hearing loss and speech recognition scores.
- All were new users

What they did . . .

- Twelve were fitted simultaneously
- Twenty-four were fitted sequentially—they used one hearing aid for a month before being fitted with the second.
- Patients returned to the clinic every 10 days for interview, at which point a compliance score was assigned (either good, fair or poor)
- Data logging of hearing aid use also was recorded at the clinic visits

What is a compliance score?

- The compliance score was based on four factors:
  - Use of hearing aid (s)
  - Patient report of “good hearing”
  - Patient report of “comfortable with hearing aid(s)”
  - Patient report of “satisfaction”

What they found . . .

- After first month, compliance for both groups were the same--~75% with high compliance ratings.
- No change for simultaneous group after the second month
- But for the sequential group:
  - 17 of the 24 had reduced compliance in the second month
  - Only 25% had high compliance

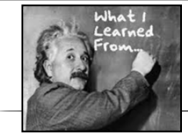
What they found (Data Logging) . . .

- Simultaneous group: Same for both ears for both months. Same overall use for both months (mean ~5.3 hours/day).
- Sequential group: In second month, reduced use for ear originally fitted: 7.6 versus 6.4 hours/day; lower use for second ear fitted: 4.5 hours/day.

Why the difference? The authors suggest . . .

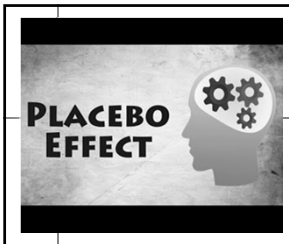
- Several of the participants were disappointed in the benefit provided by the second aid after using only one.
- Perhaps the sequential group had auditory deprivation for the non-fitted ear after using only one hearing aid for a month *(Note: would this really happen after only one month?).*

Gus is wondering . . . Could the findings be related to our research of 25 years ago?



Clinical Tip From This Article?

If a patient appears to be a good (or even reasonable) candidate for bilateral hearing aid use, start them off with a bilateral fitting on Day One.



How does the placebo effect relate to fitting hearing aids?

Dawes et al (2013) Placebo effects in hearing-aid trials are reliable. *IJA* 52(7): 472-477

What they did . . .

Purpose: To determine if there was a placebo effect in unblinded behavioral testing associated with hearing aid clinical trials.

Design: Individuals tested with two different identical pairs of hearing aids, but told that one pair was "new." Testing included speech recognition and overall preference.

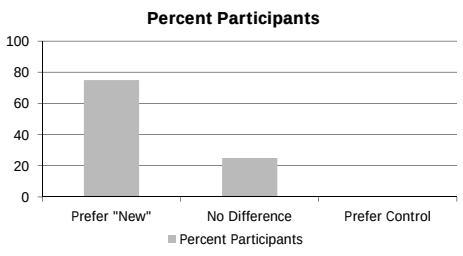
General findings of the study:

Speech recognition: Mean performance was 4% higher for the "new" hearing aid, with 75% showing better performance with these instruments.

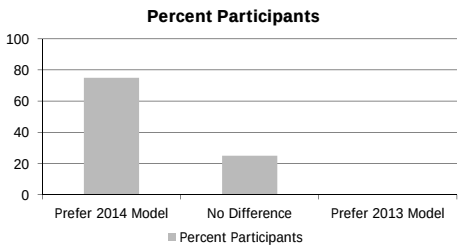
Quality ratings: Mean ratings were 8.2 (10 point scale) for the "new" hearing aids, compared to 7.3 for the control hearing aids.

Overall preference: The "new" hearing aids were preferred by 75% of the participants, 25% said no difference. No one preferred the control hearing aids.

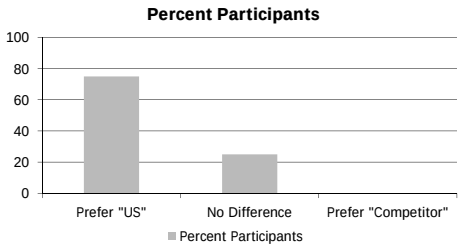
Preference data from study:

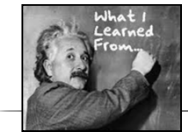


But what if:



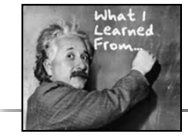
Or, how about this?





Clinical Tip From This Article?

For any time of casual listening comparison you might make in your clinic, if you really want an honest answer from your patients, you have to be very careful that the placebo effect doesn't influence their response.



Clinical Tip From This Article?

And . . . When reading about comparative clinical testing of products or features (especially in non-peer-reviewed articles), question if the placebo effect could have been a factor.

In general, we'll talk about four important components of fitting hearing aids:

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- Verification of the fitting
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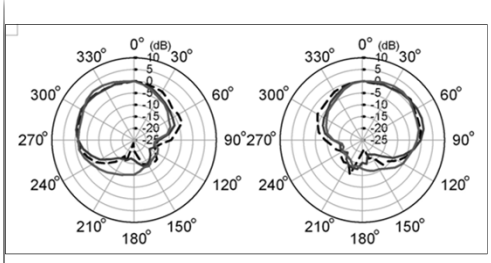
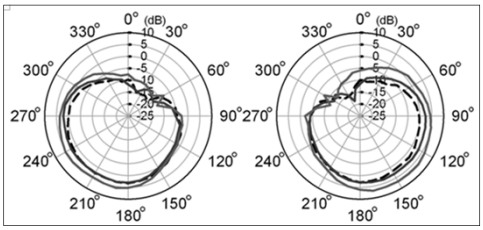
You're no doubt familiar with traditional directional processing



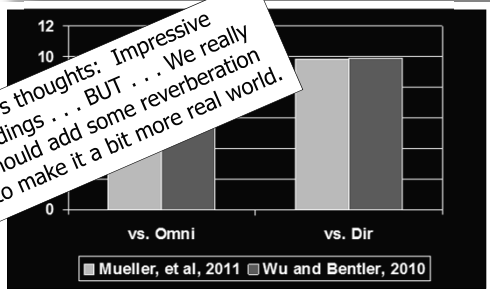
Recent advances have allowed for anti-cardioid processing, which operates automatically



Lab study for Speech@180; Noise@0 (Mueller et al, *IJA,* 2011)

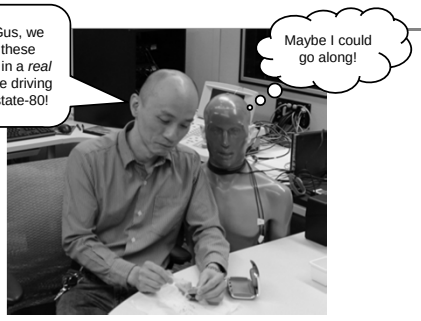
- HINT sentences presented from behind (adaptively); HINT noise presented from the front (72 dB SPL)
- Tested in three conditions:
  - Omnidirectional
  - Automatic traditional directional
  - Automatic directional with anti-cardioid algorithm option
- Replication study using same design and instruments conducted at University of Iowa

Benefit of anti-cardioid algorithm (in SNR)



Gus's thoughts: Impressive findings . . . BUT . . . We really should add some reverberation to make it a bit more real world.

BUT WU HAD AN EVEN BETTER IDEA!



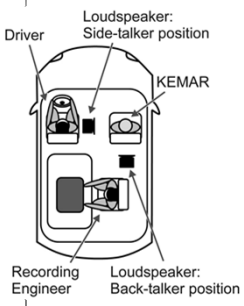
In case you were wondering—the World's Largest Truck Stop is at Exit 284

The Effect of Hearing Aid Technologies on Listening in an Automobile
Wu Y-H, Stangl E, Bentler R A, Stanziola R W

American Journal of Audiology 2013 24(6)

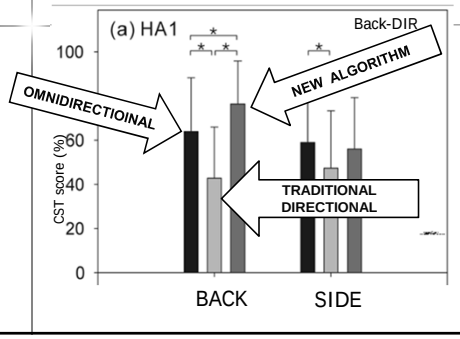
Most important passenger!

"WU ON THE ROAD"

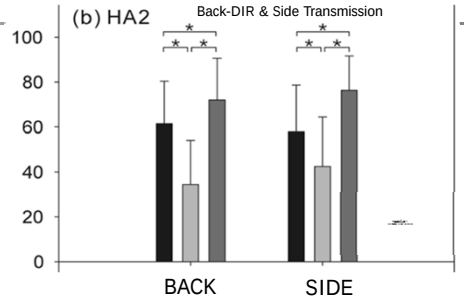


- CST sentences were presented from the side and back of the hearing aids, which were placed on the ears of a manikin
- The recorded stimuli were presented to listeners via earphones in a sound-treated booth to assess speech recognition performance and preference

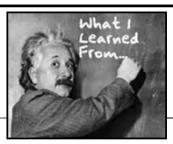
Speech recognition for HA1



Speech recognition for HA2



Clinical Tip From This Article?



The signal classification system seems to work pretty well for these hearing aids, and they provide significant benefit in real world situations.

Good? Better? Best? Have you ever wondered . . .

Do PSAPs really work?

Are Premier hearing aids better than Entry-Level?

Are hearing aids better than PSAPs?

Thought-provoking article by Robyn Cox from AudiologyOnline's "20Q with Gus" (April, 2014)

20Q: Hearing Aid Provision and the Challenge of Change

Robyn Cox

1. In the few years I've been practicing, I've noticed that a lot of what my professors taught about hearing aid fitting isn't actually done in the "real world". I'm okay using the fitting practices I've learned in my current job, and think I can make a decent living doing them. Why change?

Whether or not they fit hearing aids using accepted best-practice, I bet we could agree that many audiologists focus on selling as many high-cost premium hearing aids as possible in order to make a living. This focus needs to change because there are forces at work that oppose the status quo. To meet the coming challenges, audiologists of the future will have to change the way they do things if our profession is going to prosper rather than fade away.

2. Sure, I've heard other people saying that sort of scary stuff, but I think it's just the same old gloom and doom. Exactly what kind of forces do you mean?

Pressures are rising because both consumers and research funders are asking for proof to justify the high costs of hearing aids.

Our baby boomer patients are more tech-savvy than their parents were. They have computers and smart phones and they access the Internet for information. They look at reviews, hearing aid websites, etc. Access to information – right or wrong – about hearing aids is greater than it used to be. These patients are value-conscious and increasingly aware of the different options they have in hearing devices, which we can talk about later. They believe that traditional hearing aids are expensive and they wonder if they're worth it. Also, I assume you know about the Consumer Reports article in 2009 that reported on the journeys of several patients as they shopped for hearing aids. CR reported that the patients encountered "high prices . . . mediocre fittings . . . and lack of information." Whether you agree with the report or not, it gave hearing aid practitioners, both audiologists and hearing instrument specialists, a black eye.

What they did . . .

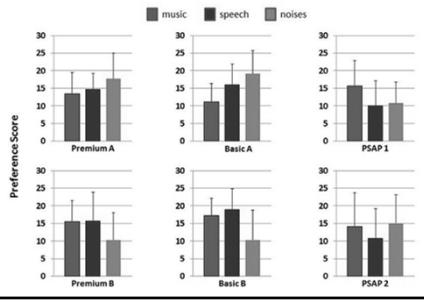
- Compared examples of premium hearing aids, basic hearing aids, and high quality PSAPs. Measured 6 devices, two in each category.
- Each device was fit on KEMAR to match the NAL-NL2 targets for an average mild to moderate hearing loss.
- Three types of everyday sounds were used as test stimuli: speech, noise, and music. Each of the three sounds was recorded through each hearing device on KEMAR.

.

What they did (testing) . . .

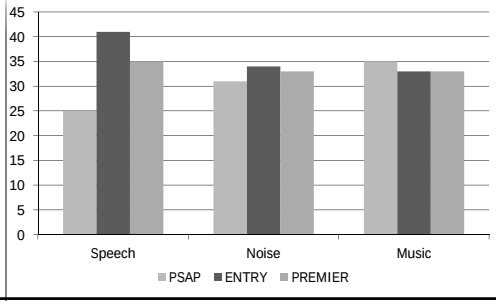
- Twenty adult listeners with mild to moderate sensorineural hearing loss listened monaurally using an ER-2 insert earphone.
- A double round-robin paired-comparison tournament was performed using the 6 recordings of each sound. During each tournament, the 6 different hearing device conditions were paired against each other twice.

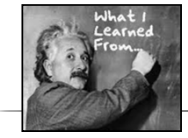
Results of the comparative testing:



Cox data: Average ratings for both sets of instruments for each category

(percent preference for each condition)





Clinical Tip From This Article?

The differences among PSAPs, Entry Level and Premier hearing aids may not be as large as some people believe.

Caveat 1: They were all fitted to NL2 targets.

Caveat 2: These were laboratory measures.

Let's talk about "trainable"

Data obtained with 3rd generation trainable hearing aids.

(Palmer, AudiologyOnline, 2012)

One of the purposes of the study was to examine the effects of the "start time" of the training. All participants were new hearing aid users (fitted to NAL-NL1):

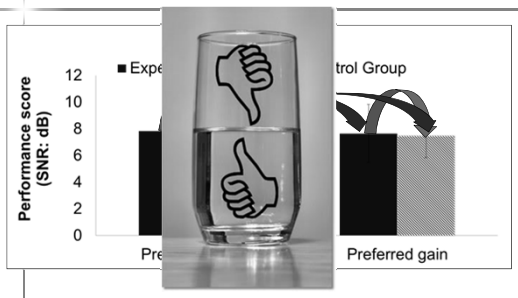
- Control group (n=18) = training was off and then turned on at the second visit
- Experimental group (n=18) = training was on from the beginning

Following training, comparisons made to the original NAL fitting, and comparative speech testing

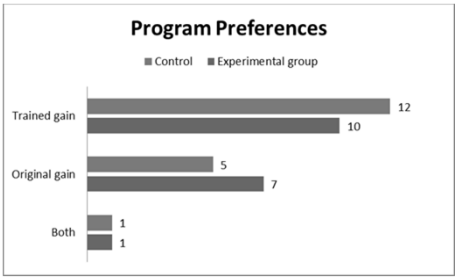
General findings regarding trained gain and real world loudness judgments

- Gain for soft was reduced slightly for both groups, but somewhat more for the group who had trained from the beginning:
  - Control: SII for soft speech reduced ~2%
  - Experimental: SII for soft speech reduced ~4%
- Real-world loudness judgments (PAL ratings):
  - No difference from programmed to trained gain.
  - No difference between groups.

Training had no positive or negative effect on overall HINT performance for either group



Preferences for trained gain versus original programmed gain
(65% selected the trained gain;)



More research with trainable hearing aids (Research from the NAL)

Real-life efficacy and reliability of training a hearing aid

Keidser G, & Alamudi K

Ear & Hearing, 2013, 34(5)

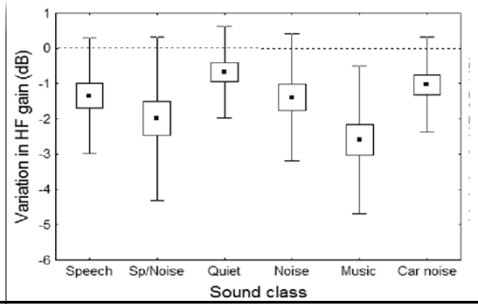
What they did . . .

- Test devices enabled training of the compression characteristics in four frequency bands and in six sound classes
- Participants wore the devices programmed to NAL-NL2 for 3 weeks and trained the devices from the prescribed response for three weeks

What they did . . .

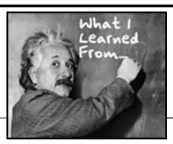
- They compared their trained response with the prescription (NAL-NL2)
- The devices were reset to the prescription, and 19 participants repeated the training and comparison trials
- During the comparison trial, participants made daily diary ratings of satisfaction with the programs, and a structured interview was completed

What they found . . .



What they found . . .

- About half made insufficient changes and could not distinguish between the prescribed and trained responses
- For those who made sufficient changes, training was effective for 75 to 80% and tended to result in higher overall satisfaction with the devices

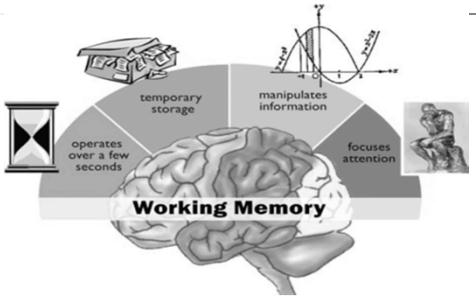


Clinical Tip From These Articles?

Not everyone is a good candidate for trainable hearing aids, but for those who are . . . Training appears to improve the overall fitting for the majority, and does not have any downside.

Note: A peripheral finding (and clinical gold nugget) is that the NAL-NL2 is a pretty darn good starting point.

Working memory and hearing aid benefit: A direct relationship?



Effects of noise and working memory processing of speech for hearing aid users
Ng et al (2013) *IJA*, 52:433-441.

Purpose: To evaluate the relationship between the benefits of noise reduction and individual's working memory.

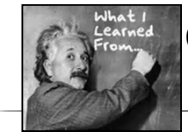
Design: A sentence-final word identification and recall test was conducted in two noise backgrounds with and without noise reduction as well as in quiet. Working memory capacity was measured using a reading span test.

General findings of study:

Noise impaired recall performance.

For late list items the disruptive effect of the competing speech background was virtually cancelled out by noise reduction for persons with high working memory capacity.

Conclusion: Noise reduction can reduce the adverse effect of noise on memory for speech, but only for persons with good working memory capacity.



Clinical Tips From This Article?

- The benefit of different hearing aid noise reduction features may be impacted by your patient's working memory.
- Research data supporting feature benefit is probably from people with good working memory (participants screened as part of research protocol)

In general, we'll talk about four important components of fitting hearing aids:

- Pre-fitting considerations
- Selection of technology
- Verification of the fitting
- Post-fitting follow-up and counseling


The importance of audibility in successful amplification of hearing loss

Ron Leavitt and Carol Flexer
Hearing Review, December, 2012

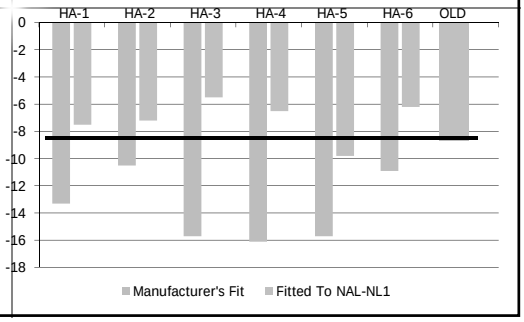
What they did . . .

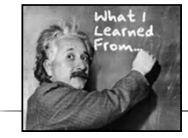
- Selected the premier product from each of the "Big Six," and programmed these hearing aids to each manufacturer's recommended fitting. All special features were activated.
- For benchmarking purposes, they added a 7th hearing aid—a circa 2002 single-channel analog instrument, which they programmed to NAL-NL1.

What they did . . .

- The subjects were all experienced hearing aid users with typical downward sloping hearing losses.
- The subjects, fitted bilaterally, were tested with all seven sets of instruments. The speech recognition test was the QuickSIN, presented at 57 dB SPL.
- Following the initial testing, all hearing aids were re-programmed to NAL-NL1 and QuickSIN testing was repeated

Performance for the aided QuickSIN presented soundfield at 57 dB SPL. Bars indicate "SNR-Loss": The average SNR *disadvantage* compared to individuals with normal hearing





Clinical Tip From This Article?

If you want to help your patients understand speech in background noise, it is very risky to use the manufacturer's proprietary fitting.

So what if you just push the "NAL Easy Button" in the fitting software? Will you then obtain a NAL fitting in the real ear?

The Accuracy of Matching Target Insertion Gains with Open-Fit Hearing Aids

Aazh, H., Moore, B., Prasher, D.

American Journal of Audiology, 2012, 21, 175-180

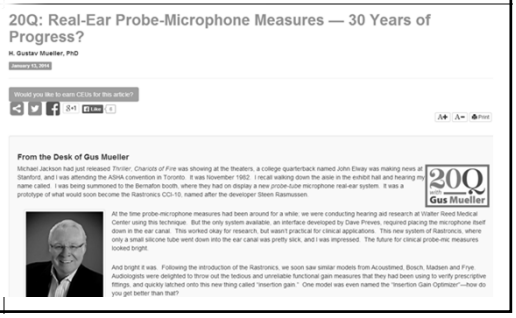
What they did . . .

- 30 people; 51 ears
- All open fittings
- NAL-NL1 selected in fitting software

What they found . . .

- 71% of fittings had a >10 dB mismatch from target at one or more frequency through 4000 Hz.
- After adjustment, 82% met target (majority could be met through 2000 Hz)

A 20Q article from earlier this year . . .



20Q: Real-Ear Probe-Microphone Measures — 30 Years of Progress?

H. Gustav Mueller, PhD

From the Desk of Gus Mueller

Michael Jackson had just released *Thriller*, *Chariots of Fire* was showing at the theaters, a college quarterback named John Elway was making news at Stanford, and I was attending the ASHA convention in Toronto. It was November 1982. I recall walking down the aisle in the exhibit hall and hearing my name called. I was being summoned to the Bernafon booth, where they had on display a new *probe-tube* microphone real-ear system. It was a prototype of what would soon become the Rastronics CCI-10, named after the developer Steen Rasmussen.

20Q with Gus Mueller

At the time probe-microphone measures had been around for a while, we were conducting hearing aid research at Walter Reed Medical Center using this technique. But the only system available, an interface developed by Dave Preves, required placing the microphone itself down in the ear canal. This worked okay for research, but wasn't practical for clinical applications. This new system of Rastronics, where only a small silicone tube went down into the ear canal was pretty slick, and I was impressed. The future for clinical probe-mic measures looked bright.

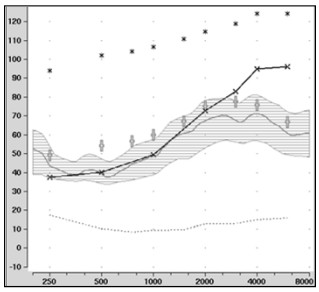
And bright it was. Following the introduction of the Rastronics, we soon saw similar models from Acoustimed, Bosch, Madsen and Frye. Audiologists were delighted to throw out the tedious and unreliable functional gain measures that they had been using to verify prescriptive fittings, and quickly latched onto this new thing called "insertion gain." One model was even named the "Insertion Gain Optimizer"—how do you get better than that?

Maybe things have gotten better? Or the problem is only with one or two manufacturers?

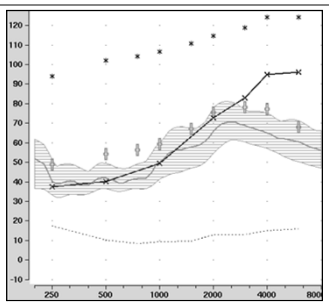
<u>Data collected a few months ago:</u>

- Selected the premier hearing aid from three of the leading manufacturers.
- Selected "NAL-NL2" fit in the manufacturer's software; programmed for typical downward sloping hearing loss
- Matched all fitting and patient characteristics between software and probe-mic equipment.
- Conducted verification using speech mapping (male passage from the Verifit)

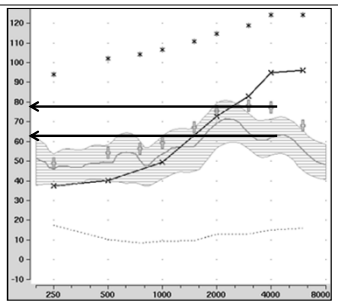
Results for Manufacturer A

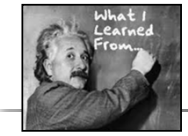


Results for Manufacturer B



Results for Manufacturer C





Clinical Tip From These Articles?

If you believe that fitting to prescriptive target is a good thing, it is very risky to use the manufacturer's fitting algorithm without real-ear verification.

While targets aren't so good for Hal, what about hearing aid fittings?

Initial-Fit Approach Versus Verified Prescription: Comparing Self-Perceived Hearing Aid Benefit

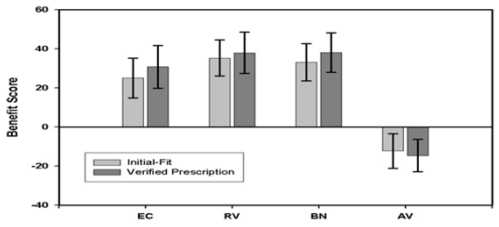
Abrams, H., Chisolm, T., McManus, M., McArdle, R.

Journal of the American Academy of Audiology, 23(10), 768-778

What they did . . .

- 22 experienced hearing aid users
- Crossover design with two intervention groups: ½ were first fitted with hearing aids via the manufacturer's first fit
- Second group were first fitted with hearing aids verified with probe-mic (REAR) to NAL-NL1 prescription
- After real-world use (4-6 weeks), all then "crossed-over" to other fitting

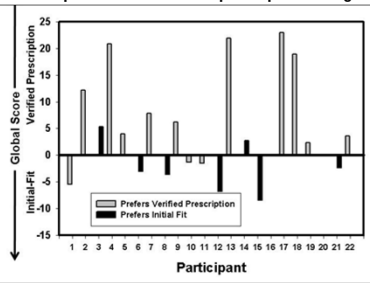
APHAB benefit scores for the two conditions

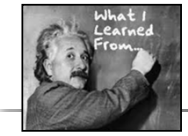


Preference for "initial" versus "verified prescriptive" fitting plotted as a function of difference in APHAB Global score.

APHAB scores significantly better for those fitted to the NAL

15/22 preferred the verified prescription fitting





Clinical Tip From This Article?

Yes, fitting to target does matter. And yes, the only way you will know if you've fit to target is to verify with probe-mic measures!

In general, we'll talk about four important components of fitting hearing aids:

- Pre-fitting considerations
- Selection of technology
- Verification of the fitting
- Post-fitting follow-up and counseling

The effects of hearing aid use on ~~listening effort and mental fatigue~~ associated with sustained speech processing demands

Ben Hornsby (a Vandy guy)
Ear and Hearing, 2013, 34 (5), 523-534

What the research was all about . . .

Quantify the impact of hearing aid use and advanced signal processing on measures of listening effort and auditory mental fatigue

What he did . . .

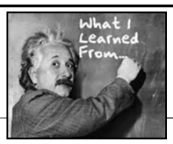
- 16 adults (47-69 years); Mild to severe sloping SNHL
- Dual-task paradigm
  - Word recognition
  - Word Recall
  - Visual Reaction Time (RTs)

What he did . . .

- Fitted with hearing aids; Used in real world 2 weeks prior to each test condition
- Subjective ratings of listening effort during the day
- Ratings of fatigue and attentiveness immediately before and after the dual-task

What he found. . .

- Word recall was better and RTs were faster in aided compared to unaided
- Word recognition and recall were resistant to mental fatigue
- Subjective and objective measures of listening effort and fatigue weren't correlated
- Age and degree of hearing loss weren't predictive



Clinical Tip From This Article?

We sometimes forget some of the more subtle benefits of hearing aid use, such as improved dual tasking—in this case word recall and reaction time.

And finally . . . How about some really "current" research findings--Last week's meeting at Lake Tahoe!

Have you ever wondered: How large does an SNR advantage need to be before it's meaningful to a patient?

On a meaningful increase in signal-to-noise ratio

McShefferty D., Whitmer W., Akeroyd M. (verbally; 7 days ago)

In the clinic, the JND for an SNR change?

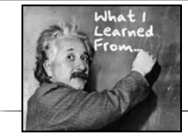
3 dB

But what if the judgments were not just about JNDs, but . . .

- Would you be willing to go see an audiologist for this increase in SNR?
- Would you be willing to swap devices for this increase in SNR?

What SNR then became meaningful?

6 dB



Clinical Tip From This Article?

If your patient is a previous hearing aid user, it's pretty unlikely that the new hearing aids will provide a 3 dB advantage to what they were already wearing. A 6 dB advantage? Only with a remote microphone!

Day-To-Day Hearing Aid Fittings: Clinical Nuggets From Recent Research

H. Gustav Mueller

Professor, Vanderbilt University, Nashville, TN.
Consultant, Siemens Hearing Instruments
Contributing Editor, *AudiologyOnline*