Vanderbilt Audiology's Journal Club: Hearing Aid Features and Benefits - Research Evidence

Todd A. Ricketts, Ph.D.

Brought to you by
AudiologyOnline

Real-Life Efficacy and Reliability of Training a Hearing Aid

Gitte Keidser and Karima Alamudi
2013 Ear and Hearing, 34 (5), 619–629

What they asked . . .

- Do patients reliably train away from a verified and validated prescriptive method (NAL-NL2).
- Does the listening environment effect the reliability of training.
- For those that train reliably, do they exhibit a preference for the "trained" gain via journals kept during real world experiences.

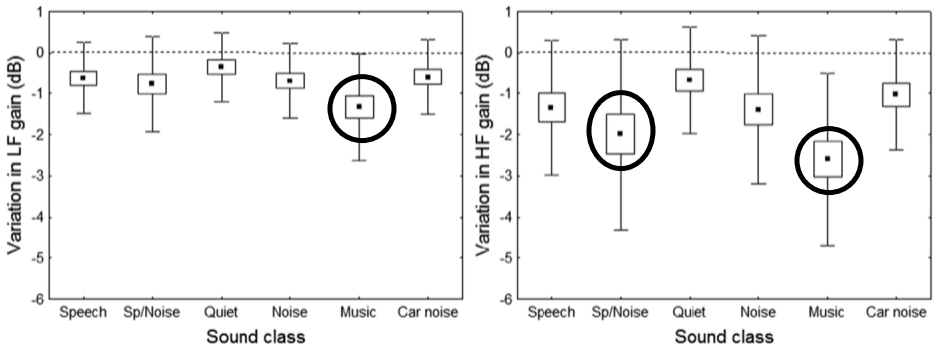
Why it matters. . .

- If patients, or some subset of patients, can reliably train to an individually preferred gain – this technology may be particularly useful once appropriate clinical guidelines for it's use are established.

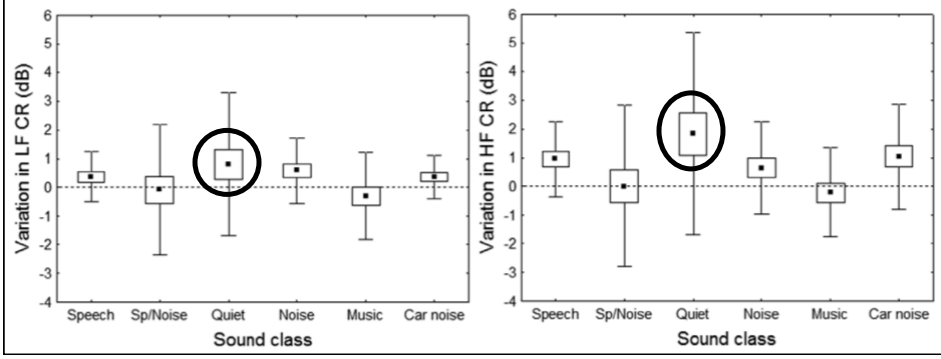
What they did . . .

- 26 (25) experienced hearing-impaired patients (median age 79) were fitted with commercial, multimemory, prototype devices that enabled training of the compression characteristics (syllabic compression) in four frequency bands and in six sound classes.
- Wore NAL-NL2 (clinically modified) for 3 weeks - then trained the devices for 3 weeks – then compared the trained response to the NAL-NL2 for 2 weeks (alternating days).
  - Participants made daily diary satisfaction ratings and completed a structured interview after the comparison trial.
- 19 participants repeated the training/comparison trials.

What they found. . . Average gain change by environment

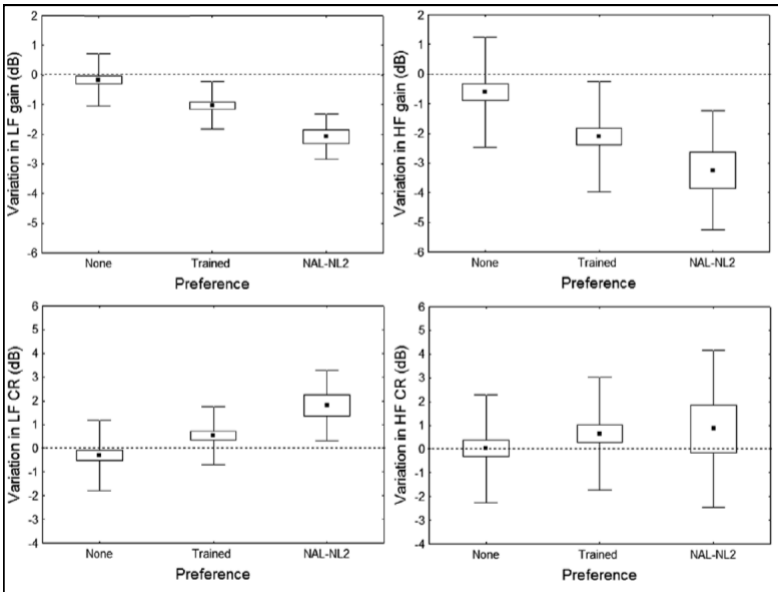


What they found. . . Average CR change by environment



What do Individuals Prefer?

- Only 20 of 25 participants adhered to the protocol and were evaluated.
- Two of these 20 did not train the hearing aids (made very few adjustments).
- Of the remaining 18, 8 exhibited no preference, 8 preferred trained and two preferred NAL-NL2.
  - Greater percentage of "no preference" compared to past studies related to smaller/fewer adjustments?
  - Interestingly the two that preferred NAL-NL2 actually made greater changes during training than those that did not!



Concern? For some small sub-set that train the farthest away, they may actually train to a less preferred setting!

Can Individuals Complete Training Reliably (N = 19)?

- Training occurred for only 46% of potential cases in the first training period and 32% of potential cases in the second training period.
  - Less training in the second period
- 12 of 19 individuals exhibited significant correlation between their first and second training period (training was reliable and the effect was significant).
- 4 of nineteen were unreliable (not significantly correlated)
- 3 of 19 did not show significant training (not significantly correlated)

Can Individuals Complete Training Reliably (N = 19)?

- Ten individuals produced valid preferences after both comparison trials.
  - Of these, 6 had consistent preferences (4 no preferences, 1 trained response, and 1 NAL-NL2 response).
  - Three participants changed from preferring the trained response to having no preference
  - One participant changed preference from NALNL2 to the trained response.

Why is this important?…

- Smaller changes compared to past studies may be related to NAL-NL2 being a more well liked starting place (compared to NAL-NL2 for example).
  - Individuals who train more often and train in more environments were more likely to prefer the trained response.
  - Individuals who are generally happy with their fit may train less.
    - Training is not for everyone.

Clinical recommendations from the authors?…

- Avoid training in those without interest…
- A satisfied patient who has trained significantly large changes should continue wearing the trained devices as-is.
- A satisfied patient who has little or no trained changes are assumed to be happy with the prescription- deactivate training to avoid inadvertent changes.
- An unsatisfied patient who has little or no trained changes should be encouraged to continue training the devices for longer
- An unsatisfied patient who has trained significantly large changes should be re-set to the prescription and the reason for dissatifaction explored.

Hearing-aid users' voices: A factor that could affect directional benefit

Yu-Hsiang Wu, Elizabeth Stangl & Ruth A. Bentler

International Journal of Audiology 2013; Early Online: 1–6

What they asked . . .

Can hearing-aid users' own voices affect the directional benefit for a backward-facing directional processing (Back-DIR) algorithm that uses an anti-cardioid directivity pattern to enhance speech arriving from behind the listener.

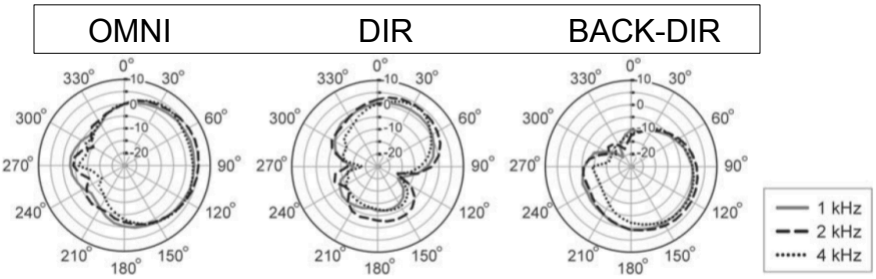
Why it matters. . .

- The magnitude of directional benefit has been shown to be effected by a large number of environmental and physical factors.
- If the magnitude of directional benefit can be effected by the presence of a listeners own voice, the magnitude of benefit demonstrated in the laboratory may over- or under- estimate the benefit achieved in specific real world listening situations.

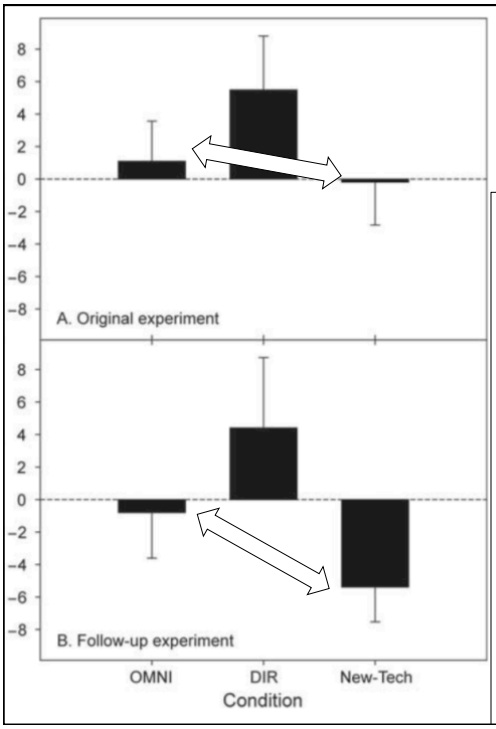
What they did . . .

- Speech recognition performance for fifteen listeners with sensorineural hearing loss was measured in a speech-180°/noise-0° configuration, with aids programmed to Back-DIR or omnidirectional across two experiments.
  - Noise was presented continuously.
- In the first experiment, listeners repeated sentences from the standard hearing-in-noise test (HINT).
- In the second experiment, the HINT was modified so that a carrier phrase (speech-180°) was presented before each sentence in order to prime the processing after the patient finished repeating the sentence.

What the technology does. . .



Back-DIR was an automatic/ adaptive feature: The omni pattern was activated when the noise level was low. When the overall sound level is higher than 65 dB SPL and the stimuli consisted of speech and noise, the device would select DIR when speech was from the front and Back-DIR when speech was from behind.



What they found. . .

- Adaptive/automatic adaptation time was approximately 1-2 seconds.
- HINT Sentences are about 2-3 seconds.
- Listener responses (speech in quiet (would return the hearing aid to omnidirectional mode).
- For Exp#1 it would not get switched back until 1/2 – 2/3 of the way through the HINT sentence.
- By playing a carrier sentence in noise prior to the HINT sentence, switching occurred prior to presentation of the test HINT sentence in Exp#2

Why is this important?…

- In some real world conversations, a listeners own voice may act to reduce speech recognition in noise performance for some automatic/adaptive directional technologies, particularly for the first few seconds.
- The magnitude of benefit in the laboratory is only representative of real world listening situations that are nearly identical.

Speech recognition in noise using bilateral open-fit hearing aids: The limited benefit of directional microphones and noise reduction

Lennart Magnusson, Ann Claesson, Maria Persson & Tomas Tengstrand

International Journal of Audiology 2013; 52: 29–36

What they asked . . .

1. Do directional microphones improve speech recognition in noise in comparison with omnidirectional microphones for open-fit HAs?
2. To what extent might an open fitting reduce the benefit of directional microphones and NR algorithms in comparison with closed fittings?
3. How do subjective HA outcomes of typical open-fit HA recipients compare to outcomes of the average HA user?

Why it matters. . .

- Open fitted hearing aids are quite popular for a number of very good reasons.
- If open fittings significantly reduce the effectiveness of some types of processing such as directional microphones, this should be considered clinically, particularly for patients who struggle in noise.
- If there is a reduction, it is important to know if the open fitting still leads to positive outcomes.

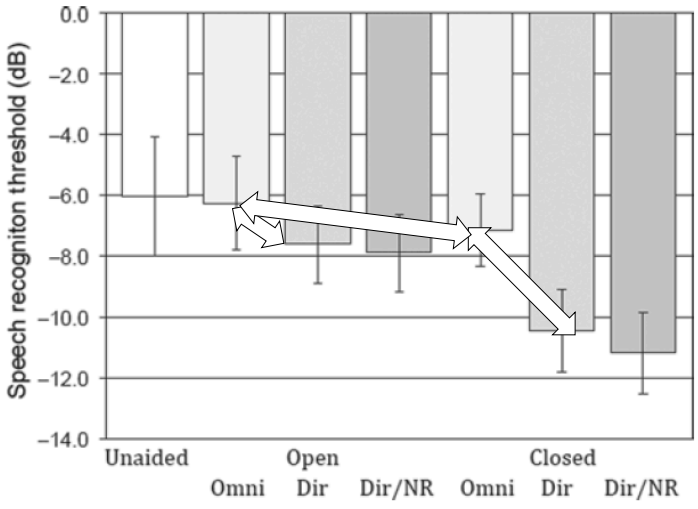
What they did . . .

- 20 adults with symmetric mild sloping to moderate sensorineural hearing loss without prior experience with hearing aids served as participants.
- All were fitted bilaterally with the same model of hearing aids.
- Speech recognition in noise was evaluated for unaided, omnidirectional with and without NR, as well as directional with and without noise reduction conditions for both open and closed fittings.
  - "moderate" NR and fixed directional was applied.
- All fittings were manufacturer first fit default fittings without any real ear verification.

What they did . . .

- Speech recognition testing was completed using an adaptive SNR task (Hagerman, 1982) with the speech level fixed at 65 dB (presented from in front of the listener), and uncorrelated noise presented from four loudspeakers surrounding the listener.
- The international outcome inventory for hearing aids (IOI-HA) was administered four to six weeks after completing the experimental part of the study, to assess the outcomes with the open-fit HAs.

What they found. . .



What they found. . .

- Trend (0.9 dB) of poorer performance for Open than Closed when in Omni.
- Directional benefit increased from 1.4 dB in Open to 3.3 dB in Closed.
- A small benefit for NR (0.8 dB) was found only in closed, but difficult to interpret because it is unclear whether a consistent amount of gain was provided across all programs.
- IOI-HA results were very similar to normative values other than a higher score for "impact on others" for Open.

Why is this important?…

- Although there was greater benefit for closed, 17 of 20 kept the open instruments after a 4 - 6 week trial (no trial with closed was offered) – and had expected IOI-HA scores.

- If laboratory results are due only (or at least mainly) to differences in coupling (and not differences in gain) – these results suggest that we may consider a less open fitting for those listeners who exhibit particularly poor speech recognition in noise.

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

Harvey B. Abrams, Theresa H. Chisolm, Megan McManus, Rachel McArdle

Journal of the American Academy of Audiology 2012; 23:768–778

What they asked . . .

1. Despite evidence suggesting inaccuracy in the default fittings provided by hearing aid manufacturers, the use of probe-microphone measures for the verification of fitting accuracy is routinely used by fewer than half of practicing audiologists.
2. Does self-perception of hearing aid benefit (APHAB), differ between manufacturer's initial-fit approach versus a verified prescription (NAL-NL1), with adjustments based on participant request.

Why it matters. . .

- Verification of a validated prescriptive method requires clinical time and resources. Evidence is needed to support applying these resources consistent with evidence based practice procedures.
- If evidence exists supporting this practice it may be adopted by a greater percentage of practicing audiologists.

What they did . . .

- 22 experienced hearing aid users completed the study
- Half of the participants were fit with new hearing aids via the manufacturer's initial fit while the second half were fit to NAL-NL1 using probe-mic measurement.
- After a wear period of 4–6 wk, the participants' hearing aids were refit via the alternate method and worn for an additional 4–6 wk.
- Participants were blinded by utilizing probe-mic measures with both approaches.
- The APHAB was administered at baseline and at the end of each intervention trial.
- At the end participants identified the "preferred" fit.

Hearing Aids Used

- Microtech Radius 12 (n = 30),
- Microtech Radius 16 (n = 2),
- Phonak Eleva 11 (n = 2),
- Phonak Eleva 211 (n = 4),
- Starkey Destiny 1200 (n = 4),
- Siemens Prisma (n = 1)
- Siemens Artis (n = 1).

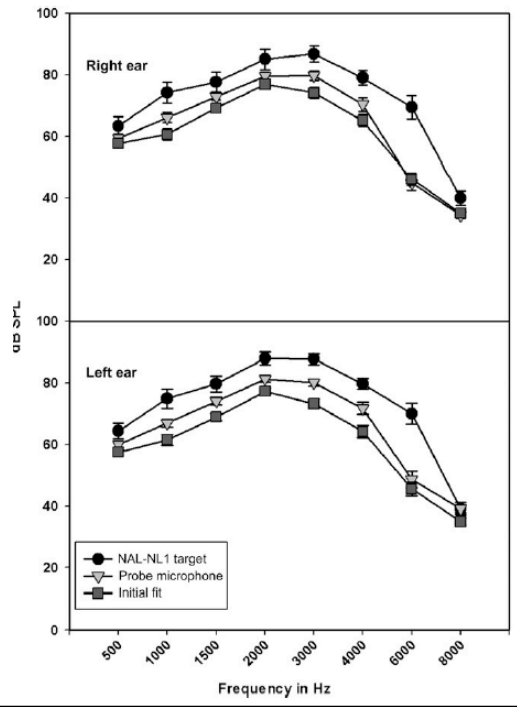
- BTE; n = 6
- canal n = 2,
- CIC; n = 6
- half-shell n = 22
- ITC; n = 2
- ITE; n = 6

What they found. . .

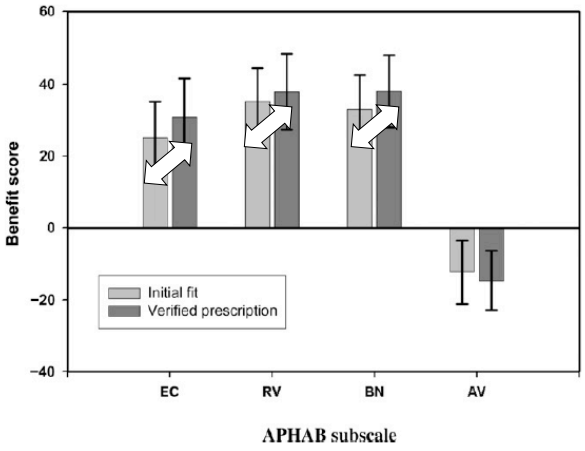
9 of 44 were modified for the NAL-NL1 fit

5 of 44 were modified for the initial fit

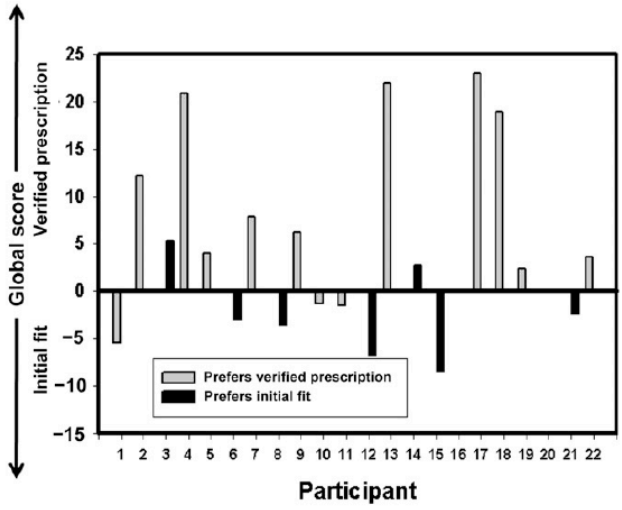
Modifications resulted in a change from average gain across all participants of no more than 1.1 dB.



What they found. . .



What they found. . .



What they found. . .

- For the Ease of Communication, Reverberation, and Background Noise subscales, scores obtained with the verified prescription were significantly higher than those for the initial-fit approach, indicating greater benefit.
- Of the 22 participants, 7 preferred their hearing aids programmed to initial-fit settings and 15 preferred their hearing aids programmed to the verified prescription.

Why is this important?…

- These data add to and more specifically support the use of verification of validated prescriptive fitting methods.
- They provide additional evidence based support of the need for well trained practitioners for the optimal fitting hearing aids and support for us as evidenced based practitioners.
- These data also provide some indirect support for NAL-NL2

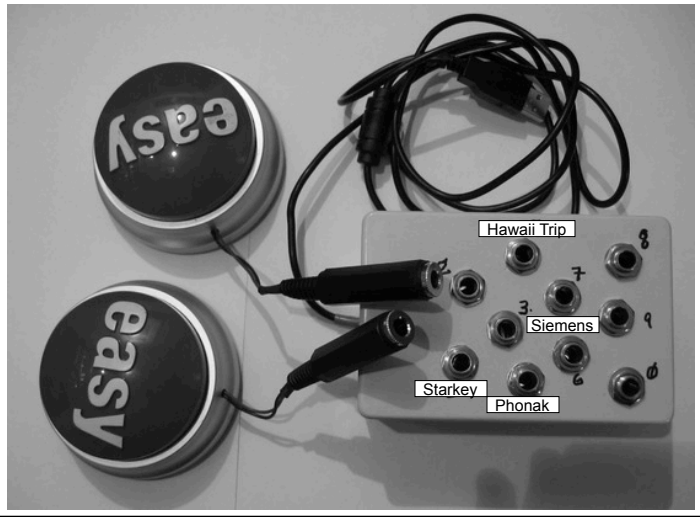
A couple things to add about "verification":

Findings from a Mueller (2007) survey of audiologists:

- When asked if they used a validated prescription method (either the NAL or the DSL) 78% said yes.
- But . . . Of that 78%, only 44% reported routinely using probe-mic measures.

Question of the day: How did the other 56% know *what* they were using?

PUSHING THE EASY BUTTON JUST DOESN'T WORK!



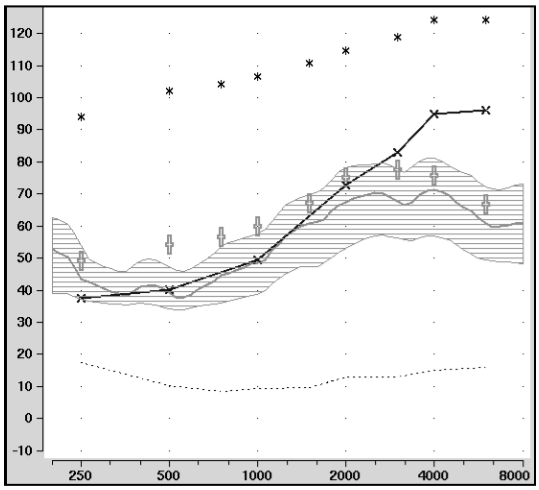
Probability of NAL fit when selecting "NAL" in the fitting software:

- Aazh and Moore (2007): Programmed to the manufacturer's NAL using four different types of hearing aids on 42 ears. Only 36% of fittings were within +/-10 dB of NAL targets. After re-programming, 83% were within +/-10 dB (100% for hearing aids with four or more channels).
- Aazh et al (2012): Of 51 fittings, after programming to the manufacturer's NAL, 71% failed to match NAL-NL1 targets within 10 dB; after re-programming, a match was obtained for 82% of the fittings.

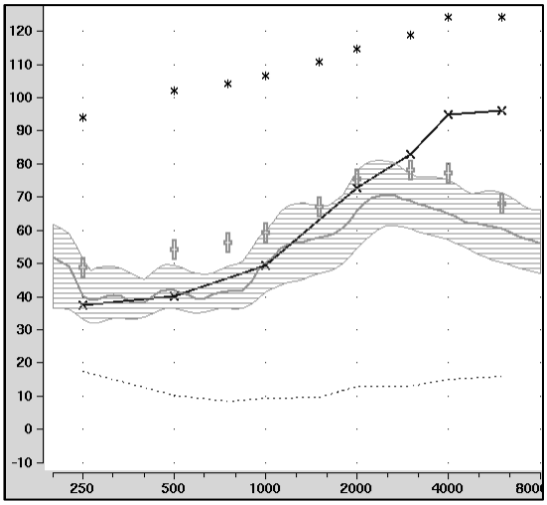
So do you think things have changed? Here are data from last week!

- 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

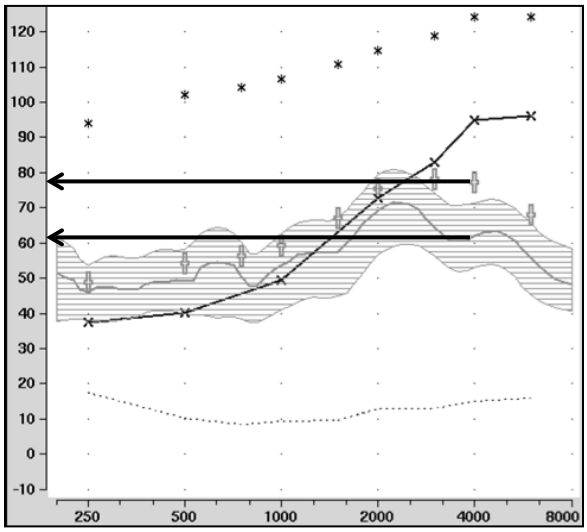
Results for Manufacturer A



Results for Manufacturer B



Results for Manufacturer C



VANDERBILT AUDIOLOGY JOURNAL CLUB

Hosted by Gus Mueller

Clinical Tidbits: Some interesting research findings

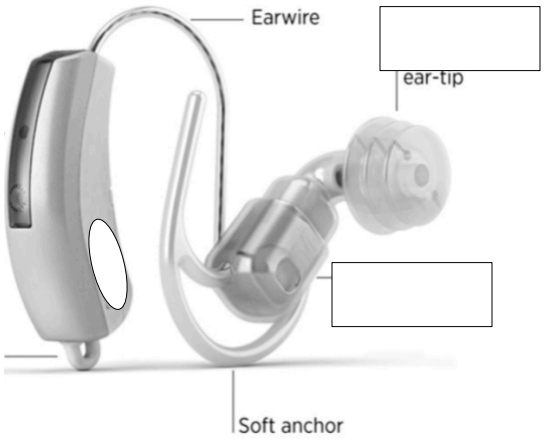
Brought to you by AudiologyOnline

RITE hearing aids may be reasonable for use in Infants due to their smaller size and weight

- 18 infants with mild to moderate/severe hearing loss fitted with RITE (16 were prior BTE users)
- The infants used the device for a period of 2–5 mo.
- Audiologists and parents completed questionnaires
- At the end of the study, 11 of the 16 children were using the instant ear-tip, 5 were fitted with the receiver mounted in a custom earmold.
- The audiologists rated the RITE solution to provide a safe, stable, and secure fit.

Caporali; Schmidt; Eriksson, Skold; Popecki; Larsson; Auriemmo (2013). Evaluating the Physical Fit of Receiver-in-the-Ear Hearing Aids in Infants. J Am Acad Audiol 24:174–91

Anchor modification for a pediatric focused product



Placebo effects in hearing-aid trials are reliable

- 16 Participants compared two devices that were acoustically identical, except one was described as “ new ” and the other as “ conventional ” . Participants completed a speech-in-noise test, sound quality ratings, and rated overall personal preference for both hearing aids.
- Significantly better mean speech-in-noise performance (70.9% versus 66.8%), and sound quality ratings for the “new” hearing aid
- 75% expressed an overall preference for the “ new ” hearing aid - double-blind methodology is optimal.

Piers Dawes , Rachel Hopkins & Kevin J. Munro. Placebo effects in hearing-aid trials are reliable. International Journal of Audiology 2013; 52: 472–477