Self-Adjustment Versus Prescriptive Fitting:

How Much of a Difference Really Makes a Difference

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BACKGROUND: INTRODUCTION and METHODS

Many contemporary hearing aids have self-adjustment algorithms as an integral part of their technology. Several studies have shown promising results for self-adjusted hearing aid fittings[1-3]; however, questions remain about end users' ability to fit gain profiles appropriately to achieve satisfactory outcomes and clinical efficacy.

One such device is Eargo's hearing aid that allows end users to program devices by performing in-situ hearing screening and self-adjustments using Eargo's smartphone application called **Sound Match**. We are recruiting adults aged 18 to 85 with mild-to-moderate sensorineural hearing loss to test Eargo's hearing aids in a single-blind crossover field trial.

- Two fitting conditions: A) **prescriptive** fit based on the participant's clinical audiogram and fit to NAL-NL2 real-ear aided response targets; B) **self-adjusted** by participants using Eargo's Sound Match in-situ hearing screening and self-adjustment controls.
- Participants wore each fitting for 2-3 weeks; condition order was randomized.
- For each fitting condition, the following main outcomes were collected:
  - Real-ear aided response (REAR)
  - Abbreviated Profile of Hearing Aid Benefit (APHAB)
  - Subjective sound quality ratings
  - Speech recognition in noise (AzBio sentences in speech-shaped noise, +5 SNR, 65/60 dB SPL)

PARTICIPANTS

- 12 participants completed to date

Table 1: Participant Demographics

Characteristic	Value
Age (years)	
Mean (SD)	71.5 (13.97)
Median	74
Range	24 - 83
Gender, n (%)	
Female	7 (50%)
Male	7 (50%)
Hearing aid experience, n (%)	
New user	4 (28.6%)
Experienced user	10 (71.4%)
Pure Tone Average (0.5, 1, 2 kHz), (Hz)	
Mean (SD)	31.9 (8.48)
Median	30
Range	13.33 - 48.33
High Frequency Pure Tone Average (1, 2, 3, 4 kHz), (Hz)	
Mean (SD)	41.27 (9.57)
Median	41.5
Range	23 - 53.75

Table 1: Participant demographics (n= 12)

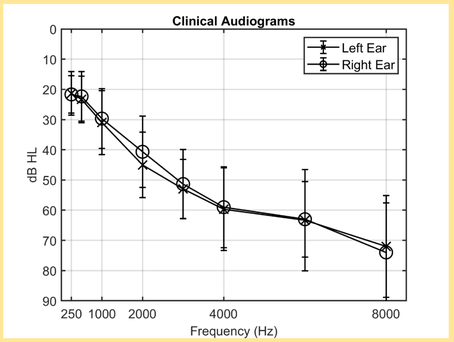

Figure 1: Mean audiometric thresholds. (n= 15)

SOUND MATCH OUTCOMES

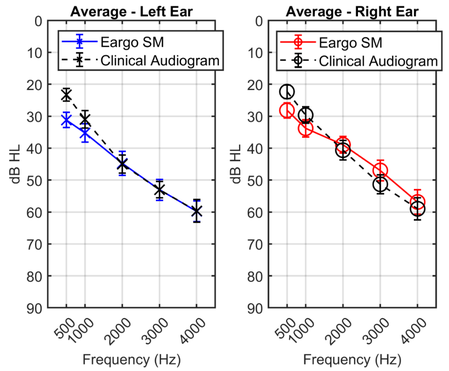

Figure 2: Comparison of average Sound Match thresholds to average audiometric thresholds (n= 15)

REAL EAR AIDED RESPONSE

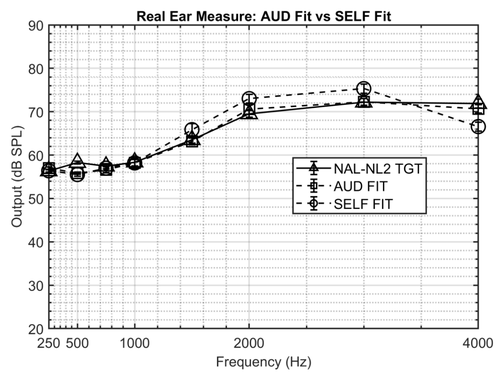

Figure 3: Comparison of average self-adjusted and audiologist-fit REAR for a 65-dB SPL male talker (n= 12)

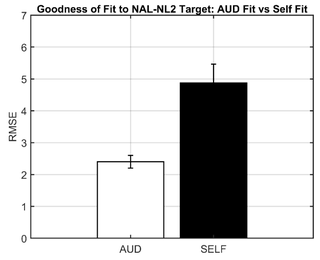

Figure 4: Proximity to NAL-NL2 targets: Mean ± 1 standard deviation (error bars) RMSE from NAL-NL2 targets for self-adjusted and audiologist-fit hearing aids (n= 12)

TRIAL OUTCOMES

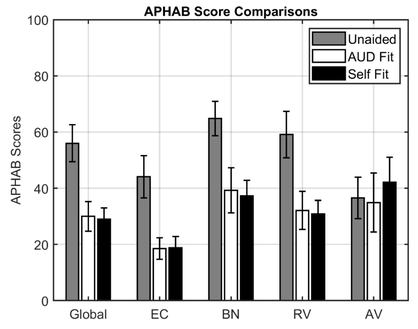

Figure 5: APHAB scores (n= 12)

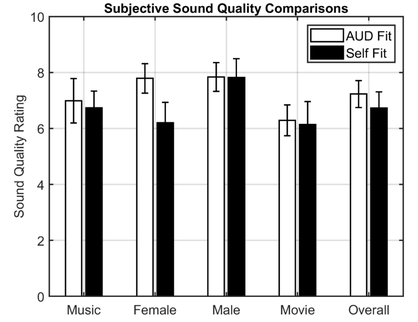

Figure 6: Sound Quality ratings (n= 12)

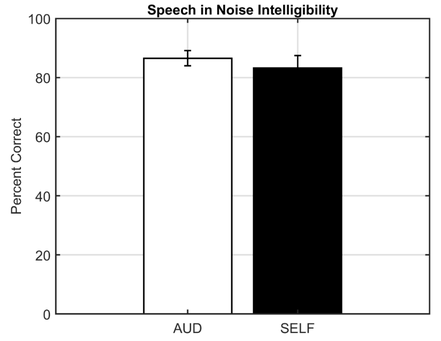

Figure 7: AzBio scores in noise (n= 12)

FUTURE DIRECTIONS

- Determine the magnitude of deviation from NAL-NL2 prescriptive targets that makes a difference in meaningful, real-world outcome.
- Goal is to answer the question: how close does a self-adjusted programming need to be to an audiologist-fit frequency response to produce comparable outcomes that matter to end users?

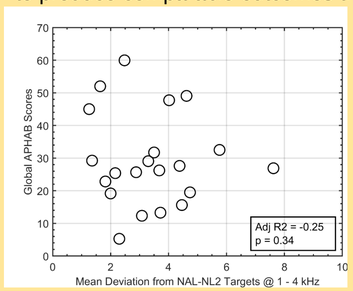

Figure 8: Correlation plot of mean deviation from NAL-NL2 targets 1-4 kHz and global APHAB score. Deviation was calculated by finding the mean of the absolute value deviation of each 1/12th octave band from 1-4 kHz (n= 12)

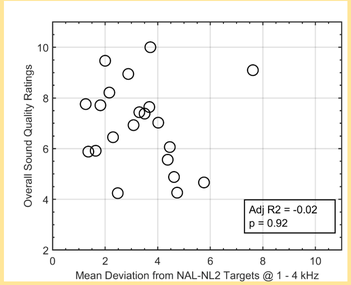

Figure 9: Correlation plot of mean deviation from NAL-NL2 targets 1-4 kHz and subjective sound quality rating (n=12)

Take-Home Messages

- In our sample, the Eargo Sound Match system produces output that closely matches an audiologist-fit hearing aid.
- For both self-adjusted and audiologist-fit programmings, RMSE from NAL-NL2 targets were less than 5 dB SPL.
  - The closeness/deviations from NAL-NL2 targets were not predictive of real-world and lab-based outcome measures.
- Thus far, the self-adjusted and audiologist-fit programmings are showing comparable results for APHAB, subjective sound quality ratings, and AzBio speech in noise recognition.

REFERENCES:

1. Nelson, P. B., Perry, T. T., Gregan, M., & VanTasell, D. (2018). Self-adjusted amplification parameters produce large between-subject variability and preserve speech intelligibility. *Trends in Hearing, 22.*
2. Boothroyd, A., Mackersie, C. (2017). A "Goldilocks" approach to hearing-aid self-fitting: User interactions. American Journal of Audiology, 26(3S), 430–435.
3. Sabin, A. T., Van Tasell, D. J., Rabinowitz, B., & Dhar, S. (2020). Validation of a self-fitting method for over-the-counter hearing aids. *Trends in Hearing, 24.*

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