

UNILATERAL AND BILATERAL SPEECH RECOGNITION AND PREFERENCE FOR BILATERAL FITTING

Kathryn L. Shaughnessy

Mentor: Robyn Cox

Hearing Aid Research Laboratory, University of Memphis, Memphis, TN

Presented at the American Auditory Society Convention, Scottsdale, AZ, March 2008

INTRODUCTION

Rationale

For many years, the trend in amplification has been to fit bilateral hearing losses with bilateral amplification. In 2005, Walden and Walden reported that for subjects with bilateral hearing loss, listening to speech from 0° azimuth with bilateral amplification is not always better than listening with unilateral amplification. This finding was surprising for much of the audiological community. Walden and Walden's finding goes against conventional wisdom that people with bilateral hearing loss do best, or at the very least no worse, with bilateral amplification. Walden and Walden found that in some subjects, unilateral amplification produced better results than bilateral amplification. Based on these findings, bilateral amplification may not be optimal for all people with bilateral hearing loss.

Two potential limitations of the Walden and Walden (W&W) study were the lack of acclimatization to hearing aids and the use of a single relatively high presentation level. The purpose of our study was to further explore the conditions studied by W&W, using an acclimatization period and an additional stimulus level.

Research Questions

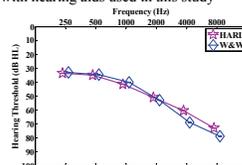
- Are the W&W data comparing bilateral, better, and poorer ear performance replicated in subjects after an acclimatization period with the hearing aids?
- Does the pattern of data change at a lower presentation level?
- Could clinically obtained QSN scores allow audiologists to determine in advance whether a patient will prefer one or two hearing aids?

METHODS

Subjects

- 37 subjects with symmetric hearing loss
- Mean age: 70 yrs, Range: 57 – 81 yrs
- Three months experience with hearing aids used in this study

Figure 1. Mean audiogram for our subjects (HARL) and Walden and Walden subjects (W&W).



Interview

After 12 weeks of HA use an interview was conducted to determine preference for one or two hearing aids.

Speech Test

Stimuli: QSN Test Lists

Conditions: Bilateral aided, Right aid only, Left aid only (Non-test ear remained open)

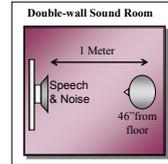
Stimulus levels: 70 dBHL and 50 dBHL.

Hearing Aids

Testing conducted with BTE, digital, non-linear hearing aids in omni-directional mode. VC set at subject's preferred programmed volume for the bilateral fitting.

PROCEDURE

Test Set-Up



Administration

- Listening conditions, list pairs, and order of test levels were controlled to minimize learning and fatigue effects.
- 2 QSN lists per condition
- Scoring was computed by averaging number of words correct on two lists
- Practice: 1 list per level

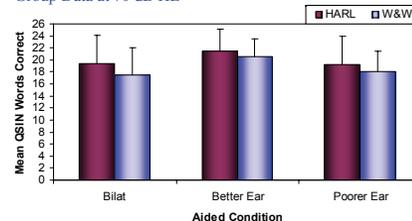
Analysis

- Scores were analyzed according to performance difference between bilateral amplification and unilateral amplification in the better and poorer ears.
- SPSS GLM within-subject design was used to explore the relationship between bilateral, better unilateral and poorer unilateral scores at each level.
- In some cases the difference between better and poorer ear was as small as one word. (For four subjects there was no difference between the right and left ear.)

RESULTS

- Are the W&W data replicated in subjects after an acclimatization period? **YES**

Group Data at 70 dB HL



- Better ear scores were significantly higher (2.03 words) than scores from the bilateral condition ($p < .001$).
- Poorer ear and bilateral scores were not significantly different from each other ($p = .598$).
- These results replicated those found in the W&W study.
- Similar results were also found between the two studies when analyzing individual data.

Individual Subject Data at 70 dB HL

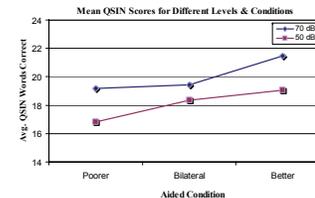
Comparison	HARL	W&W
Better Unilateral Superior to Bilateral	78.4%	82.1%

- Does the pattern of data change at a lower presentation level? **YES**

At 70 dB HL it is possible that the hearing aids went into saturation, thus distorting the sound. When unilaterally aided, one ear remained open to receive an undistorted signal.

The stimulus was lowered to 50 dB HL to see if the better ear score was still significantly higher than the bilateral score when the possibility of saturation was removed.

- At 70 dB HL, bilateral scores were not significantly different from poorer ear scores.
- At 50 dB HL, bilateral scores were not significantly different from better ear scores.



- Better ear scores were .716 words higher than scores in the bilateral condition, not a statistically significant difference ($p = .072$).
- Scores in the bilateral condition were significantly higher (1.51 words) than scores from the poorer ear ($p < .05$).
- These results are different from those obtained with the 70 dB HL stimuli.

- Correlation Between Age & Bilateral/Better Ear Difference Score

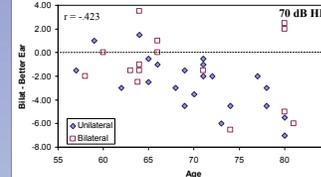


Figure 2. Correlation between age and difference score at 70 (above) and 50 dB HL (right). Data are shown for hearing aid preferences of unilateral or bilateral fitting.

70 dB HL Stimulus

- As subjects aged, there was a greater tendency for better ear score to exceed bilateral score, consistent with W&W results ($r = -.423, p < .01$)

50 dB HL Stimulus

- No correlation between age and difference score ($r = .063, p = .710$)

- Could clinically obtained QSN scores allow audiologists to determine in advance whether a patient will prefer one or two hearing aids? **NO**

- Interview results indicated that 15 subjects (41%) preferred bilateral over unilateral amplification in the real world.
- As demonstrated in Figure 2, QSN scores show no pattern of separation between the filled (unilateral preference) and unfilled (bilateral preference) symbols.
- Although many subjects preferred to wear one hearing aid, aided QSN scores were not predictive of this preference.
- Therefore, prior to hearing aid fitting, audiologists cannot predict user preference based on aided QSN scores.

CONCLUSIONS

- It was found that the W&W results (unilateral scores greater than bilateral scores for 70 dB input) are replicated when subjects have worn HAs long enough to be acclimatized to them. The associated effect size was .49.
- At a lower intensity level (50 dB HL) there was no binaural advantage, which is consistent with our hypothesis that hearing aid saturation occurred at high intensity levels.
- Our study results are consistent with the recommendation of W&W to remove one hearing aid in noisy situations.
- W&W suggested removing the left hearing aid, however our study found that the right ear and left ear occurred equally as the better unilateral ear.
- Some previous research on subjects listening with hearing aids in the sound field with speech and noise presented at 0° azimuth showed a significant binaural advantage (eg. Laurence, Moore, & Glasberg, 1983).
- However, our study did not show a binaural advantage at either 50 or 70 dB HL presentation levels with speech and noise presented at 0° azimuth.
- The absence of a binaural advantage in our study might be explained by the fact that the non-test ear was left open whereas in previous studies, the non-test ear was plugged in unilateral tests.

REFERENCES

- Laurence, R., Moore, B., and Glasberg, B. (1983). A Comparison of Behind-the-Ear High-Fidelity Linear Hearing Aids and Two-Channel Compression Aids, in the Laboratory and in Everyday Life. *British Journal of Audiology* 17: 31-48.
- Etymotic Research. (2001). *QuickSIN Speech-in-Noise Test Manual*. Elk Grove Village, IL: Etymotic Research.
- Walden, T., and Walden, B. (2005). Unilateral versus Bilateral Amplification for Adults with Impaired Hearing. *JAAA* 16: 574-584.

ACKNOWLEDGEMENTS

Supported by NICDD.

Jennifer Goshorn assisted with this study.

Please contact kshg@nss@memphis.edu for further information. PDF-versions of this poster can be obtained at <http://www.ausp.memphis.edu/harl/>

