Introduction

Studies of bilateral telephone listening strategies for individuals with hearing loss are limited. While some difficulty may be overcome through general hearing aid fitting, specific telephone routing problems, such as proper positioning of the telephone relative to the hearing aid, ambient noise, and telephone signal with adult participants has not been widely published. Our hypothesis is that bilateral telephone listening will result in improved speech intelligibility compared to that achieved through traditional monaural presentation.

Methods

(1) Participants and hearing aids

- 41 individuals with binaural hearing aids were included in the study. Participants ranged in age from 40 to 81 (mean age 69.6 years, standard deviation 8.55 years).
- All participants were adults with adults who wore Starkey Muse i2400 hearing aids, which are hearing aids that can be controlled wirelessly to the opposite ear for bilateral listening.
- Participants were compensated and had no experience with hearing aids.
- The Hearing threshold level (dB HL)
  - Right
  - Left
  - Right mean
  - Left mean

Figure 1: Audiogram of a patient. Each individual's thresholds are plotted in grey. The black line indicates the average right and left hearing thresholds, respectively.

(2) Materials and equipment

- A German Otometrics GSI 500 standard telephone was used to test the participant.
- The audiometer was set to provide a 50% correct performance on the test.
- The Connected Speech Test (CST; Cox, Alexander, & Gilmore, 1987) was used to assess speech intelligibility. This text was selected because recent studies on bilateral telephone listening have also used the CST (Picus & Ricci, 2012, 2013).
- The CST is 8 pages, with each page consisting of a list of sentences. Each page consists of 10 sentences, and each sentence consists of 10 words. The CST is scored by the participant's preferred ear for phone use. The ear selected by the participant as the 'phone ear' was the same for the monaural and bilateral conditions.
- Gain adjustments were made according to the participant's preference by having the participant listen to a recorded passage over a landline phone during the testing session on the monaural telephone memory. Those adjustments were also applied to the bilateral memory.

Results

(1) Repeated measures analysis of variance

Data were analyzed using a repeated measures analysis of variance (RM-ANOVA). This analysis revealed no significant effect of test condition on CST performance (F(2, 80) = 0.203). Greenhouse-Geisser adjustment was used due to sphericity. The general effect size was small, r = 0.04 (see Figure 4).

(2) Linear mixed effects model

CST performance was modeled using a linear mixed-effects approach with a fixed effect of test condition and a random effect of participant. A linear mixed-effects model was selected because it captures the fact that repeated measurements taken from the same participant are more likely to be similar to one another than from different participants.

The modelled data reinforces the RM-ANOVA results. As seen in Figure 4, the unaided and monaural conditions are not significantly different. However, a significant increase in CST performance is observed in the bilateral condition.

Summary

This study aimed to demonstrate that hearing aids would perform better on a speech intelligibility task when listening bilaterally over the telephone when compared to monaural or unaided hearing. The authors performed a series of telephone listening tests in a quiet laboratory with no noise present. The results showed that bilateral telephone listening resulted in improved speech intelligibility compared to that achieved through traditional monaural presentation.

References


Acknowledgements

The authors would like to thank Ashley Hughes, A. Dj, R. Irey, V. Zachariades, and S. Kaare for their contributions to this project.