Benefits of Wireless Technology for Persons with Normal Hearing

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INTRODUCTION

Speech understanding in conditions with poor signal-to-noise ratio can be challenging even for normal-hearing individuals. Such individuals often encounter listening difficulties in restaurants, sporting events or entertainment venues. Poor signal-to-noise ratio (SNR) can be a result of reverberant environments, increasing distances from the speaker of interest or increased background noise.

The Phonak ear-level Roger Focus receivers can pair with wireless microphone technology such as a Roger Pen to improve speech recognition in background noise. The benefit of this technology in individuals with unilateral hearing loss, autism spectrum disorders and auditory processing disorders has been well established when used with a single talker (Rance et al., 2017; "Roger Focus for school children,"2014).The purpose of this study was to verify the benefits of Roger Focus receivers in individuals with normal hearing when listening to a group of speakers.

PURPOSE

1. Evaluate the electroacoustic performance of 20 Roger Focus receivers coupled to a Roger Pen transmitter.
2. Evaluate speech recognition performance in different SNRs for adults with normal-hearing sensitivity using Roger Focus receivers

METHODS: ELECTROACOUSTIC ANALYSIS

Data were collected for 20 Roger Focus receivers using the FONIX 8000 hearing aid test system following the American National Standards Institute/ Acoustical Society of America S3.47: Specification of Performance Measurement of Hearing Assistance Devices/Systems (Thibodeau & working group S3/81, 2014). The arrangement included a Roger Focus receiver attached to a 2cc acoustic coupler placed outside the test box and a Roger Pen set to omni-directional mode and placed inside the test box.

FONIX 8000 HEARING AID ANALYZER

ROGER FOCUS RECEIVER

ROGER PEN

Figure 1. Equipment used for electroacoustic measurement.

METHODS: SPEECH RECOGNITION TEST

Speech recognition-in-noise was measured for 10 normal hearing adults in the age range of 18-40 years who were attending a week-long auditory rehabilitation conference. The Hearing In Noise Test sentences (Nillson et al.,1994) were presented in restaurant noise at 0, -5, and -10 dB SNR. Simulating a dining experience, the participant faced 5 speakers (Fostex 6302 B3E) spaced equally around a four-foot circular table. The stimuli were presented from a laptop (Toshiba) and a sound board (Focusrite Scarlett 18i20) using Cubase software. Restaurant noise was presented via a Toshiba netbook through two speakers (HDMX Jam) on either side of the participant. Participants were fit with bilateral Roger Focus receivers and allowed to select the optimal gain setting. A practice list of 10 sentences were completed prior to the start of the test. The participant wore a Roger Pen connected to a Roger Mylink receiver worn by the examiner to facilitate scoring responses in the background noise. Speech recognition was measured with and without the Roger Focus receivers.

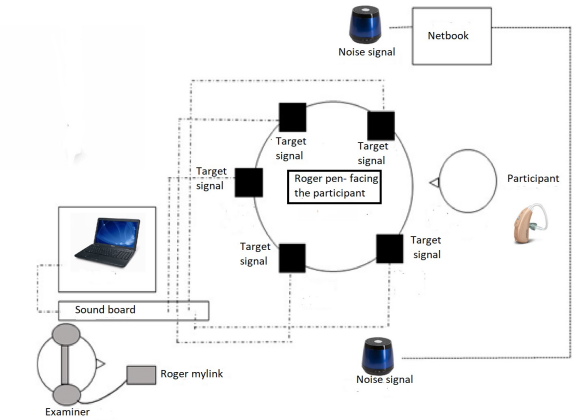

Figure 2. A diagram representing the test arrangement used for speech-recognition testing.
Note. Adapted from Land &Thibodeau (2017).

RESULTS: ELECTROACOUSTIC ANALYSIS

The average values for the Electroacoustic analysis are shown in Table 1. The variability across devices was within acceptable clinical expectations.

	MEAN
Maximum OSPL90 (dBSPL)	104.19
HFA-OSPL90 (dBSPL)	94.74
HFA-OSPL60 (dBSPL)	24.99
Frequency Range(Hz)	F1-255
	F2- 6649
Measured Gain (dB)	16.98
Equivalent Input Noise (dBSPL)	26.46
Total Harmonic Distortion (%)	500Hz- 0.46
	800Hz- 0.37
	1600Hz-0.51

Table 1. Mean values from the electroacoustic measurements of 20 Roger Focus receivers.
Note. HFA=High Frequency Average; OSPL=Output Sound Pressure Level.

RESULTS: SPEECH RECOGNITION TEST

The improvement in scores when using Roger Focus compared to no technology at 0, -5, and -10 dB SNR was 8.79%, 13.40%, and 14.15%, respectively. Following arc sin transformation to account for unequal variance in percent correct data (Sherbecoe & Studebaker, 2014), a two-factor repeated measures ANOVA was performed for the scores from three SNR conditions with and without technology. There was a significant effect of SNR condition (df=2; p< 0.05) and technology (df=1; p<0.05), but no significant interaction effect (df=2; p>0.05). Follow-up t-tests revealed that performance at all three SNRs was significantly different from each other (p<0.05).

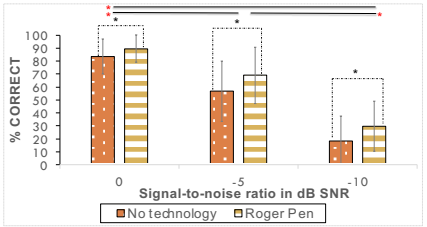

Figure 4: Average speech-recognition scores obtained at different SNR levels with and without technology. Error bars marked on the graph indicate standard deviations for each test condition.
Note. SNR=Signal-to-Noise Ratio; *p< 0.05

dB SNR	Improvement in scores
0	8.79%
-5	13.40%
-10	14.15%

Table 2: Improvement in scores across different SNR conditions
Note. SNR=Signal-to-Noise Ratio

CONCLUSION

It was concluded that the use of Roger Focus by adults with normal hearing can provide significant benefits in noisy situations. They might be motivated to use the Roger Focus as bilateral ear-level receivers for phone calls, listening to music, or for better speech understanding in background noise. Knowledge of the benefits received with this technology in noisy group settings would help audiologists provide recommendations those with normal hearing who seek solutions for communication in noise. Future research can focus on the effect of age of participant and their performance in speech in noise.

LIMITATIONS

- Limited sample size
- Variability in gain provided by each receiver due to user-control of gain settings.
- Participants in the study were selected based on convenience sampling

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ACKNOWLEDGMENTS

This study was part of a larger research study on the benefits of wireless technology. Gratitude is expressed to Phonak for providing the equipment and to all the participants of the study.