Field Study News

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Improved speech recognition in meetings with the Roger Table Mic™

Assistive listening devices help listeners with hearing loss function better in everyday challenging communication situations. The Roger Table Mic from Phonak aims to provide better speech recognition at meetings. The use and benefits of the Roger Table Mic in the meeting setting was tested in a research study conducted at the Ear Institute in Pretoria, South Africa. The results of the study show significant improvement in speech recognition at 3.0 and 4.5 meters, when performance using hearing aids only is compared with performance using the Roger Table Mic and Roger receivers together with hearing aids. The majority of participants reported less listening effort and rated the sound quality of the Roger system to be good.

Introduction

People with hearing loss require a more favorable signal-to-noise ratio (SNR) than their normal hearing peers in order to communicate effectively in complex listening situations. Research has indicated that people with severe-to-profound hearing loss require an average SNR of 15-25 dB in order to achieve the same level of understanding as a person with normal hearing (Baquis, 2014). Personal amplification devices, such as hearing aids and cochlear implants, allow people with hearing loss to hear and understand speech better. There are, however, situations where the use of a personal amplification device is not sufficient to maintain speech understanding. Historically, analog FM systems and wireless microphones have improved speech intelligibility in situations involving speech over distance and background noise. Today, wireless microphones are operating in the 2.4 GHz band and are available for use with hearing aids. Additional microphones can further help listeners function better in everyday communication situations and acquire greater confidence in their communication skills (Johnson & Seaton, 2011).

Assistive listening devices (ALDs) support people with hearing loss by reducing the background noise, lessening the effects of distance between the speaker and the listener and reducing the negative effects associated with reverberation (Johnson & Seaton, 2011). The latest ALD developed by Phonak uses their new wireless technology standard, called Roger. Roger is an adaptive digital wireless transmission technology running on the 2.4 GHz band. Roger allows for low-delay and reliable broadband audio broadcast towards miniature low-power receivers or a neckloop receiver, that can be connected to hearing aids or cochlear implant sound processors. Roger uses sophisticated adaptive algorithms, depending on the different noise levels, to enhance listening in noise. In a study conducted by Dr. Linda Thibodeau, participants with a hearing loss showed better speech recognition in clinical and real-word settings when using adaptive digital technology (Roger) compared to other wireless technologies. Subjective ratings showed that the majority of participants preferred the use of adaptive digital technology. The greatest benefit was obtained when the highest noise levels were used (Thibodeau 2014).

The latest microphone-transmitter that is part of the Roger portfolio is called Roger Table Mic. The Roger Table Mic is a microphone tailored to working adults with a hearing loss who participate in small and large meetings. For larger meetings, it is possible to use several Roger Table Mics. The aim of the Roger Table Mic is to provide better speech recognition in complex listening environments, including listening environments with speech at a distance and in rooms with poor acoustics. The use and benefit associated with the use of the Roger Table Mic for people with hearing loss was tested in a research study conducted at the Ear Institute in Pretoria, South Africa.

Methodology

Participants

Eighteen hearing instrument users, 10 female and 8 male, ranging in age from 28 to 66 years (average of 55 years), participated in

the study. The degree of hearing loss ranged from moderate to profound. Sixteen of the participants had a bilateral sensorineural hearing loss and two had a sensorineural hearing loss in one ear and a mixed hearing loss in the opposite ear. The average pure tone threshold of the participants is shown in Figure 1.

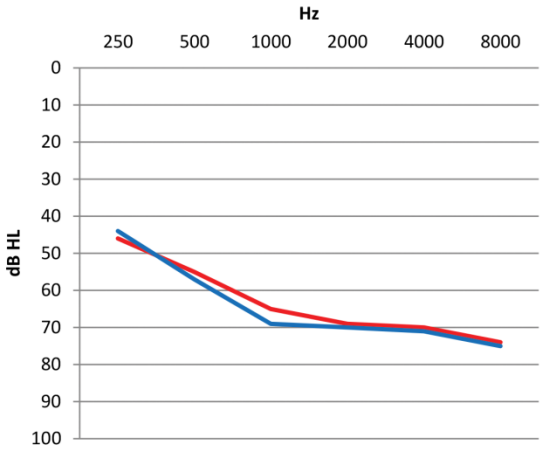

Figure 1: Average pure tone air conduction audiogram of participants

All participants wore two Phonak hearing aids of different technological levels, which were fitted through the use of verification. All hearing aids were compatible with Roger wireless technology through either the use of design integrated receivers or through the use of a universal receiver and ComPilot. An additional program was added to the hearing instrument settings to accommodate the use of the Roger system. The default setting, as prescribed by the fitting software, was selected and used during testing.

Test setup

Tests were conducted in a room used for office meetings. The size of the room is estimated to be 30 square meters. Inside the room was a boardroom table and five loudspeakers. The participants were positioned on one side of a boardroom table. A loudspeaker, through which the primary speech signal was delivered, was positioned in front of the participants (at 0 degrees). Tests were conducted with the loudspeaker positioned at approximately 1.5, 3.0 and 4.5 meters away from the participants. The speech level remained fixed throughout testing. Four loudspeakers, through which white noise was delivered, were positioned in each corner of the room. The speakers were pointed away from the test subjects in order to provide a diffuse sound field. The noise level was adjusted according to the test protocol. Figure 2 provides an overview of the test setup. It also shows the level of speech as measured at ear level of the test subject at the different loudspeaker locations.

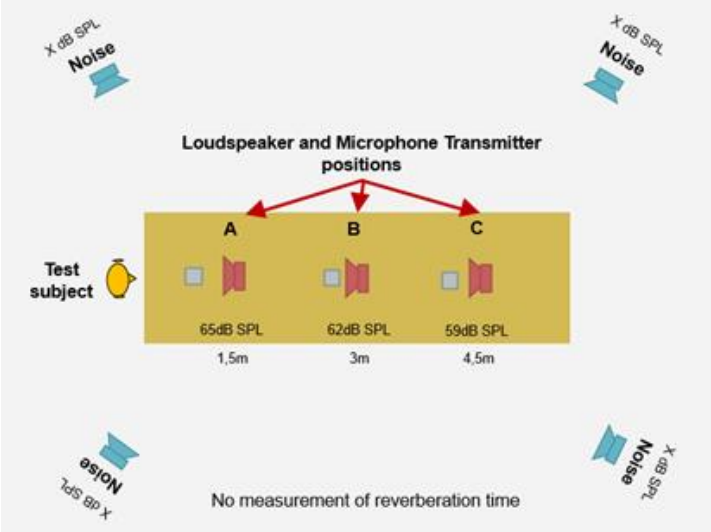

Figure 2: The loudspeakers on the table were placed 80 cm from the floor and loadspeakers in the corners were placed 110 cm from the floor.

Test protocol

Speech recognition scores (% words correct) were determined using the Hearing-In-Noise-Test (Nilsson, Soli, & Sullivan, 1994). These scores were determined in two listening conditions, one with hearing aids only and the other with the hearing aids connected to the Roger Table Mic and Roger receivers. The first part (Phase 1) of the test was conducted with hearing aids only. The signal-to-noise ratio (SNR) at which the participant was able to obtain a speech recognition score of 50% was determined with the loudspeaker positioned closest (at 1.5 meters) from the participant. The SNR was determined by keeping the speech signal fixed at 65 dB SPL and adjusting the noise levels of the four surrounding loudspeakers. Once the SNR, at which the participant was able to obtain 50% correct speech recognition, was determined, the test was repeated with the loudspeaker positioned at 3.0 and 4.5 meters. The same noise levels, as determined by the first position (at 1.5 meters) were used. Upon completion of this test, the second part of the test (Phase 2) was conducted with the hearing aids connected to the Roger Table Mic and Roger receivers. Speech recognition scores were calculated at the different loudspeaker positions (at 1.5, 3.0 and 4.5 meters) using the same SNR as during the first part of the test. During each test, the microphone transmitter was positioned between the participant and the loudspeaker, 75 centimeters from the loudspeaker.

In addition to the test protocol, a subjective measurement was included. Participants were asked to comment on the listening effort required to obtain correct speech recognition, as well as comment on the sound quality of the Roger system. Listening effort was determined through the use of a rating scale. Figure 3 shows the rating scale used during Phase 1 and Phase 2, as well as the rating scale used to rate the sound quality of the Roger system.

Listening effort rating scale (Phase 1)				
1. Very difficult	2.Difficult	3.Neutral	4.Easy	5. Very easy
Listening effort rating scale (Phase 2)				
1. Very difficult	2.Difficult	3.Neutral	4.Easy	5. Very easy
Sound quality of Roger Table Mic and Roger receivers				
1. Very poor	2. Poor	3. Neutral	4. Good	5. Very good

Figure 3: Rating scales used as part of the subjective measurement

Results

During Phase 1, testing was conducted with hearing aids only. Testing during Phase 2 was conducted with the hearing aids connected to the Roger Table Mic and Roger receivers. Figure 4 shows the average speech recognition scores obtained by participants in the different test conditions. Results indicate significant improvement in speech recognition scores when Roger Table Mic and Roger receivers are used with hearing aids.

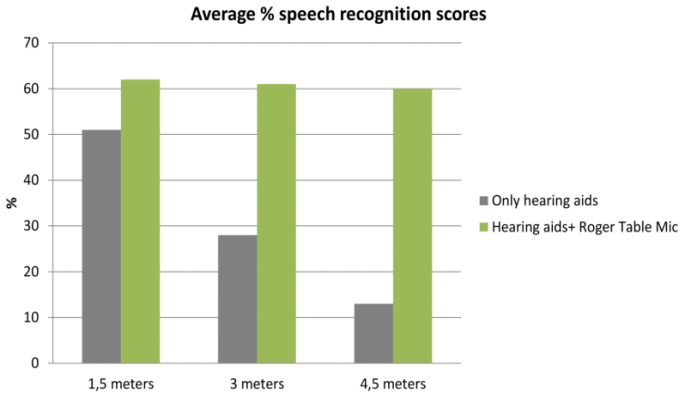

Figure 4: Average correct speech recognition scored obtained during testing with HINT sentences (N=18)

Subjective measurements relating to listening effort associated with Phase 1 and Phase 2 of testing were collected. Figure 5 shows the participants' responses to the different listening conditions. The subjective responses of the participants supports the improvement in speech recognition scores obtained during testing.

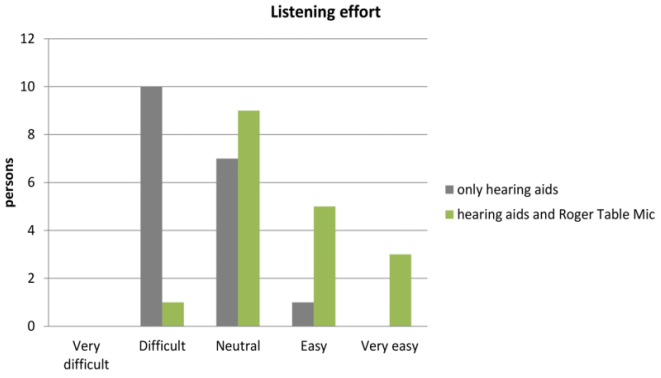

Figure 5: Participant responses relating to listening effort during Phase 1 and Phase 2 of testing (N=18)

Subjective measurements relating to the sound quality of the Roger system associated with Phase 2 of testing were also collected. Figure 6 illustrates the participants' responses. The subjective responses of the participants supports the improvement in speech recognition scores obtained during testing.

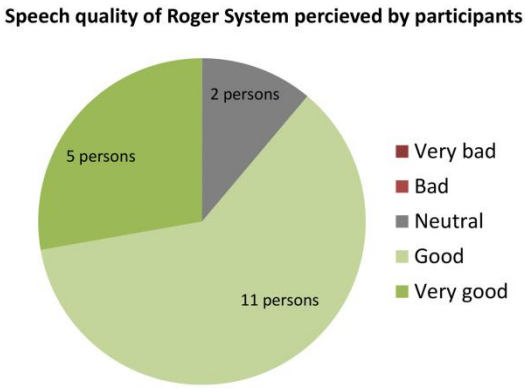

Figure 6: Participant responses relating to the sound quality of the Roger system during Phase 2 of testing (N=18)

Conclusion

The results of the study show an significant improvement ($p < .0.005$) in the speech recognition abilities of the participants when performance using hearing aids only was compared to performance using the Roger Table Mic and Roger receivers at 3.0 and 4.5 meters. The improvements were not only observed within the clinical test environment, but also experienced by the participants as evidenced by the subjective rating scales. The majority of participants reported less listening effort and rated the sound quality of the Roger system to be good.

References

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Authors

Elmé Selesho received her Bachelor's degree in Audiology from the University of Pretoria, South Africa, in 2006. She worked as audiologist and head of the training department at one of the largest private hearing health care networks in South Africa. In 2014, she joined the Eduplex Training Institute as programme coordinator where she writes, develops and manages online learning programs with the specific mention of the Hearing Aid Acoustician Programme.

Gené Zwarts obtained a Speech-Language Therapy and Audiology degree in 2007 and a Master's degree in Augmentative and Alternative Communication in 2009. She has been working as an audiologist since 2008 and joined the Ear Institute in 2009. She is a senior audiologist working with adults and pediatrics whose duties include diagnostic hearing evaluation, hearing aid dispensing, hearing aid fitting and verification, hearing aid service and practice management.