

BEYOND HEARING AIDS: TECHNOLOGIES TO IMPROVE HEARING ACCESSIBILITY FOR OLDER ADULTS WITH HEARING LOSS

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1 Presentation

Hearing impaired older adults can experience significant difficulties accessing auditory information using their hearing aids alone. Listening in noisy environments, in poor acoustics and from a distance can present challenges even with advanced adaptive directional microphones and the signal processing strategies found in today's hearing aids. In addition, difficulties hearing on their telephone, cellphone, listening to TV broadcasts, computers, etc., can increase the frustration levels of many older adults, impacting quality of life and overall hearing health.

Each individual presents with a unique set of hearing needs and challenges. Factors such as the degree and configuration of their hearing loss, speech understanding and central processing capabilities, cognitive state and other factors contribute to the individual's communicative condition. Unless the clinician fully understands the auditory abilities and communication needs of the older adult, the recommendations for hearing assistive technologies could be inappropriate or at best only partially resolve the challenges facing the individual.

It is beyond the scope of this presentation to discuss in detail the various components that make up an auditory needs assessment; however, some key measures would include assessing hearing thresholds, speech understanding in noise (SIN), cognitive screening, a measurement of manual dexterity, and a detailed understanding of the communication needs and hearing goals of the individual.

Only after a complete picture of the individual's needs and challenges has been determined can the clinician then present appropriate technology options from an ever increasing array of devices. As noted by Sergei Kochkin (2007), a hearing aid user's satisfaction is directly related to the number of listening environments they can successfully participate in. This so called "multiple environmental listening utility" or MELU is a key focus for the hearing aid industry in designing products that will be well received by the market.

Rather than focusing on traditional technologies, such as induction loops, FM and infrared systems which have been available for many years, this presentation will look at newer technologies and devices offered by hearing aid manufacturers to enhance the overall performance of their hearing aids. These devices are relatively new to the market having been released in the past few years. They offer improved access to speech in challenging situations as well as better access to telephones, televisions, audio from computers and other like devices.

2 Recent developments in hearing aid accessibility technologies

Major manufacturers of hearing aids have in the past five to six years developed technologies to enhance the connections of their hearing aids to cellphones, televisions, music players, computers, and Bluetooth transmitting devices. These devices stream audio signals to the hearing aids using transmission signals like Bluetooth, 900 MHz or 2.4 GHz to connect the user's hearing aids wirelessly. GN Resound, Oticon, Phonak, Siemens, Starkey, Unitron, Widex and others may take different approaches, but all share the same goal, to provide better connectivity for the individual who is hard of hearing to modern communication devices and to gain better access to sources of entertainment.

2.1 Streamers

A number of manufactures have developed streaming devices to enhance the connection of the individual's hearing aids to cellphones. Based on a Bluetooth connection these streamers use various approaches to bring the caller's voice to the hearing aids wirelessly. This is done either through an induction loop or by streaming directly to the circuitry of the hearing instrument.



Phonak ComPilot Streamer with RemoteMic

The streamers all provide wireless "hands free" connectivity to cellphones using the protocols employed in Bluetooth ear pieces worn by the general public. The streamers provide binaural access to the caller's voice. This binaural access has the potential to greatly improve the user's speech understanding. In a study of hearing aid users in seven different telephone listening conditions Picou and Ricketts (2011) identified that when subjects had binaural access to a phone message the highest levels of understanding were observed, improvements of up to 35% over the monaural condition were noted.

Manufactures GN Resound and Starkey, working with Apple Inc., have developed apps that can directly connect iPhones to their hearing aids eliminating the need for an intermediary streaming device.

Streamers also have the ability to stream music and audio using A2DP Bluetooth protocols. They also act as a remote control for the individual's hearing aids. For individuals with dexterity and/or vision issues, or who purchase hearing aids without onboard controls, this can provide easier access to volume adjustments and program

changes thus increasing the opportunity to make use of special listening programs available in their hearing aids.

2.2 Remote microphones

All of the manufacturers mentioned above have developed small remote microphones that either work with a streamer or have the ability to connect directly to the hearing aids. These remote microphones can be used to reduce the impact of distance and low levels of background noise. A good application for the remote microphone is in the car or in a social situation at a dining table. These low cost microphones have limited signal processing, with the majority using omni directional microphones. Due to limited signal to noise ratio (SNR) improvement for high levels of noise or transmission over extended distances the use of a personal FM or Roger system would be preferable.

2.3 TV and computer/tablet access

These same manufacturers have developed a number of devices to provide enhanced access to audio signals from TVs, computers, music players, tablets, etc. as mentioned previously these devices can stream directly or in conjunction with a streamer, the audio signal from the source to the hearing aids. For example Oticon, Phonak and Siemens all have TV devices that work with their streamers to deliver the TV audio to the users hearing aids.



Phonak TVLink with ComPilot

Manufactures GN Resound, Starkey and Widex have TV devices that can stream the TV audio directly to their compatible hearing aids. Most systems stream in stereo which can further enhance listening enjoyment. These devices can also be used to connect to other audio sources such as a computer, music player or tablet and transmit the audio signal of interest.

2.4 Landline phones

Phonak and Widex have launched cordless phones that will automatically connect their compatible hearing aids binaurally to the caller’s voice as soon as the phone is held in close proximity to the head. As mentioned previously the binaural connection can greatly improve speech understanding. This type of phone also allows for greater freedom of phone placement. The older adult does not have to achieve or maintain a particular position of the phone relative to the hearing aids in order to maintain a connection.

2.5 Roger

A newer technology has been launched by Phonak called Roger (aviation term meaning “message received and understood”) which features adaptive, wireless remote microphone transmission on the 2.4 GHz band. Roger audio signals are digitized and packaged into very short digital bursts of code that are broadcast several times using

different channels between 2.4000 and 2.4835 GHz. Frequency-hopping between channels, in combination with these repeated broadcasts creates a robust transmission and avoids interference issues that can occur with personal FM system.



Phonak Roger Pen transmitter w/ charging/audio input stand

In a recent study of hearing aid users Linda Thibodeau (2014) compared Roger to traditional FM and adaptive FM systems. She found improvements in speech understanding of 54% and 35% respectively in high levels of noise (figure 1).

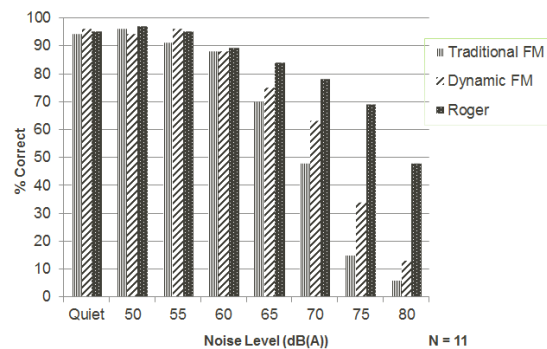


Figure 1: HINT percent correct scores for total words correct as a function of noise level for Traditional FM, Dynamic FM and Roger (adapted from Thibodeau).

3 Conclusion

Newer hearing aid assistive technologies available from hearing aid manufacturers illustrate the growing enhancement of hearing accessibility now being afforded older adults. Not all devices perform at the same level or are appropriate for all individuals. Careful assessment of auditory needs along with adequate training and support are critical to the successful implementation of these technologies.

Acknowledgments

Photos courtesy of Phonak

References

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