Phone communication made easy with ReSound hearing aids

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ABSTRACT

ReSound hearing aids are designed according to our Organic Hearing philosophy, which is inspired by the natural ways we listen and how we connect with people. One way virtually everyone makes connections with others is by using the phone. ReSound has taken special care to ensure that hearing aid users have multiple ways to use the phone that are convenient and make it easier to overcome challenges. Although new technical phone solutions have become available, traditional phone use is still important. A study where people fit with ReSound ONE™ Receiver-In-Ear hearing aids shows how the unique M&RIE (Microphone-&-Receiver-In-Ear) receiver can support conventional phone use. Additionally, as the leader in wireless connectivity, ReSound adds the convenience of hands-free direct streaming of Phone and FaceTime calls from iPhone and iPad*, beginning with the ReSound ONE generation of hearing aids.

The phone is an everyday communication tool across the globe, with virtually everyone having need to use it. Listening on the phone can be difficult for those with hearing loss, and an inability to communicate on the phone has been linked to a perceived reduction in quality of life.[1] Reduced audibility is an obvious factor that interferes with phone usage, but absence of visual cues and the presence of background noise can make hearing on the phone even more of a struggle. Satisfaction with phone usage for hearing aid users is nevertheless positive at 69% for traditional landline phones and 73% for cell phones.[2] However, there is room for improvement for many.

People with hearing loss who use hearing aids have more options to help them hear on the phone than ever before. Satisfaction with phone use might easily be improved with increased awareness and adoption of technology for phone use. Driven by our Organic Hearing philosophy, ReSound offers solutions that can adapt to users' lives and the way they want to interact with everyday technology, like phones. In this paper, we review the many options for using the phone with ReSound hearing aids, including new evidence showing how the benefits of the unique M&RIE receiver extend to phone usage.

TRADITIONAL PHONE USE WITH HEARING AIDS

One way to use the phone with hearing aids is to hold the handset near the hearing aid microphone. In this way, the acoustic signal from the phone receiver can be picked up and amplified by the hearing aids. Depending on the style of hearing aids worn, it can be somewhat difficult to place and maintain the handset in relation to the hearing aid microphones. With custom in-the-ear styles, the phone can be held up to the ear in the conventional way because the hearing aid microphone is in or at the ear canal entrance. However, with behind-the-ear (BTE) and receiver-in-ear (RIE) styles, people often hold the phone in a less natural position above and behind the pinna where the device is worn. Those with open fit hearing aids have the option of holding the phone up to their ear canal because direct sound can easily enter around the open dome/earmold, but they lose any benefit of the hearing aid amplification that compensates for their hearing loss. Despite the practical difficulties there can be in using the phone in a conventional manner, many hearing aid users likely need to do so at least occasionally. Cell phone and smartphone ownership is high across age groups but use of streaming capabilities remains low,[2] which supports the need for adequate performance with conventionally used phones.

For all hearing aids, acoustic feedback may be an issue with phone use. Placing a phone near the hearing aid microphones alters the feedback path and can dramatically affect the occurrence of feedback. Depending on hearing aid style, the feedback path may vary 10 to 20 dB.[3,4] Feedback management systems in hearing aids mitigate feedback but may not be effective enough to allow for adequate gain for effective phone use. The most common complaints of hearing aid users regarding phone use is that the other person's voice is not loud or clear enough.[2]

* ReSound ONE hands-free calls are compatible with iPhone 11 or later, iPad Pro 12.9-inch (5th generation), iPad Pro 11-inch (3rd generation), iPad Air (4th generation), and iPad mini (6th generation), with software updates iOS 15.3 and iPadOS 15.3 or later.

The ReSound DFS feedback cancellation has been shown to allow additional gain when using the phone, increasing average speech recognition by 22 percentage points compared to not using DFS.[5] The most recent version of the ReSound system, DFS Ultra III, improves performance with up to 18 dB of added stable gain, and includes a predictive feature that can stabilize gain to prescribed levels in dynamic situations. In addition, it has a third feedback cancellation channel to account for the canal microphone in the M&RIE receiver module.

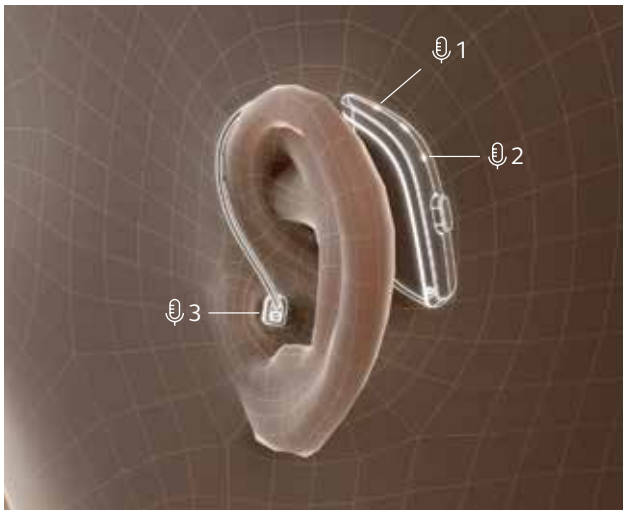

Figure 1. The M&RIE receiver module features a microphone in the ear canal. This allows it to collect sound that preserves individual acoustic cues from pinna, head and torso that help with localization and spatial hearing.[6] The device microphones can provide added SNR benefit in challenging listening conditions.

M&RIE has the potential to make conventional phone use easier. First of all, the ear canal microphone location means that the phone can be held up to the ear in the usual way. This is obviously easier than trying to locate and maintain the "sweet spot" for sound pickup with the device microphone location on RIE hearing aids. In addition, the phone signal could be clearer due to the gain allowed by DFS Ultra III and the fact that the entire bandwidth of the signal can reach the ear canal either via the microphone or directly via venting. Anecdotal reports from people fitted with ReSound ONE with M&RIE receivers suggested that using a phone in the conventional way is an advantage relative to an RIE with a standard receiver. Therefore, we set up a study to systematically examine this potential benefit.

Methods

The objective of the study was to examine the subjective experience of telephone listening with the ReSound ONE fit with M&RIE receivers and standard receivers. 20 experienced hearing aid users who currently wear RIE hearing aids participated. Their ages ranged from 59 to 88 years (Age: M=70.5; SD=8.01; 8 females, 12 males). Their audiograms showed symmetrical sensorineural hearing losses with severity ranging from mild to severe (Figure 2).

Participants were fitted with ReSound ONE RIE hearing aids with standard medium power (MP) receivers and M&RIE receivers for the study. The hearing aids were programmed to the ReSound proprietary Audiogram+ fitting targets using ReSound Smart Fit™ 1.8, calibration of DFS Ultra III was performed, and gain adjustments were made to individual preference. The default All Access Directionality program was used for this test.

The study protocol consisted of one visit. During the appointment participants were initially asked a series of 6 questions on their general telephone use. Participants were fitted binaurally in counterbalanced order with either the standard MP receiver or the M&RIE receiver. They were asked to call into a local weather hotline number and listen to the recorded message twice: once using the standard receiver and once using the M&RIE receiver. After the listening experiences, participants were given a second questionnaire that was specific to which receiver they were fitted with and asked about their experience in the telephone listening test.

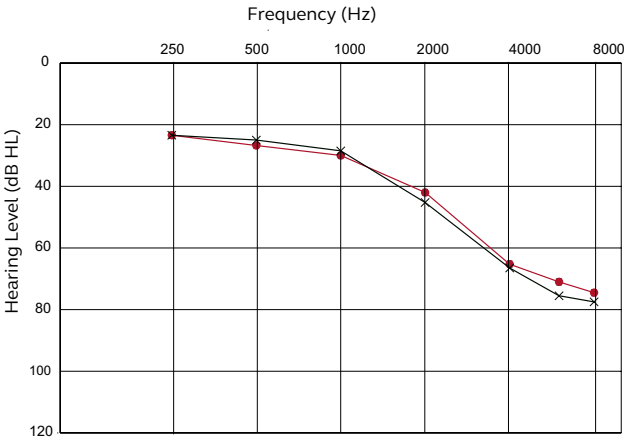

Figure 2. Mean air-conduction right and left hearing thresholds for participants.

Results

General phone use

Out of the 20 participants, 55% reported using smartphones, 30% using landline telephones and 15% using both types. Similar to other reports,[2] 75% of the participants said they never use direct streaming and none of the participants use a telephone accessory for assistance. When asked about using speaker phone as a means of easing phone conversations, 55% reported doing so. 70% of the participants reported that they hold the phone up to their ear canal in the conventional manner when using the phone, while the remaining 30% stated that they hold the phone up to the hearing aid microphones.

Listening test

No differences were noted in the participants' ratings of their experiences with the landline phone versus the mobile telephones. Therefore, the results for the landline condition are reported. Participants indicated in their ratings that they were able to hear the recorded message clearly 100% of the time regardless of which hearing aid receiver was used. None experienced feedback during the experiment with either of the receivers used. Participants also rated how much effort they experienced in placing the phone to best hear the message. When fitted with the M&RIE receivers, 95% of participants reported "very little effort", or "no effort" in finding the placement of the tel-

ephone on the ear that allowed them to hear best. When using the standard receivers, 80% reported "very little effort" or "no effort" in finding the optimal telephone placement. Participants using both M&RIE and standard receivers were satisfied with the performance of the ReSound ONE while using the telephone. All 20 participants would recommend the ReSound ONE with M&RIE to another individual for conventional phone use while 18 of 20 would also recommend the ReSound ONE with a standard receiver for this application.

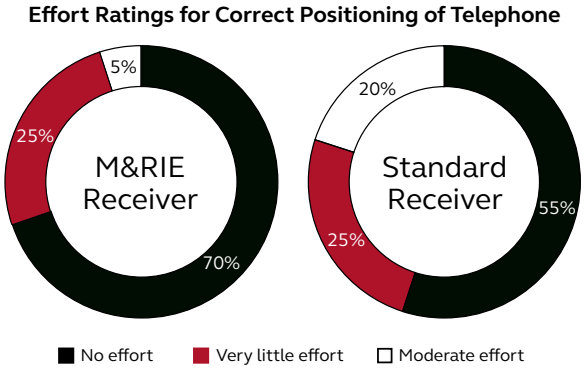

Figure 3. Participants rated both receivers highly for conventional phone use. With the M&RIE, 95% of participants rated conventional phone use as requiring either no effort or very little effort.

Finally, when asked to indicate a preference for conventional telephone use with one receiver or the other, half of the participants had no preference. Of those who expressed a preference, 60% preferred the M&RIE and 40% preferred the standard receiver.

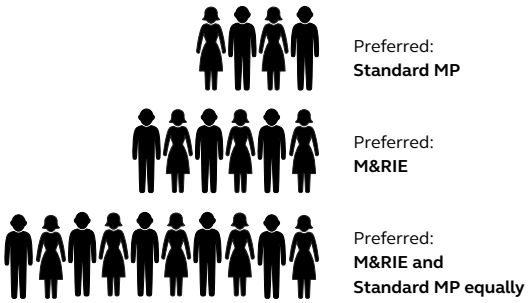

Figure 4. Half of the participants indicated an equal preference for the two receivers when using the phone. For the remainder, slightly more users stated a preference for M&RIE.

Conclusion

Ensuring adequate conditions for using the phone in a conventional manner remains an important need to be met with hearing aids. This test demonstrated that the M&RIE receiver is easy-to-use for conventional phone listening, and that individuals may prefer the M&RIE for phone use. Regardless of which receiver is used, the DFS Ultra III is likely to provide sufficient feedback-free gain for good telephone listening.

USING THE TELECOIL

Many ReSound hearing aid models feature a telecoil. Users who wear hearing aids with a telecoil can activate it to pick up and amplify the stray magnetic field from a phone handset. This improves the signal-to-noise ratio (SNR) for the phone signal. The telecoils in ReSound hearing aids are activated in a dedicated program that can be fine-tuned to match prescriptive targets and individual preferences. It has been shown that speech recognition when using a telecoil to receive the phone signal yields better performance than when using the hearing aid microphones,[7] and that performance can be optimized by customizing the telecoil response.[8] The hearing aid microphones can be muted or reduced in volume when the telecoil is active, which eliminates risk of acoustic feedback when the phone is held near the hearing aid. Aside from phone use, telecoils integrated in hearing aids can also be used to achieve a better signal-to-noise ratio in public areas that are equipped with looping technology, such as theaters.

PhoneNow

Because the signal from a phone is often limited in bandwidth, it can make sense for an individual to be fit with a dedicated phone program that enhances the phone frequency region. PhoneNow is a feature that makes it faster and easier to access a phone program by automatically switching the hearing aid to this program. The phone program can use either a telecoil or the hearing aid microphone as the input depending on whether the hearing aid has a telecoil and what the user's preference is. PhoneNow is activated through a small magnet that is attached to the phone receiver. When the phone with the magnet attached is brought next to the hearing aid, PhoneNow will cause the hearing aid to switch to the telephone program. When speaking on the phone in noisy environments, hearing aid users may experience amplified ambient noise in the non-phone ear. The room noise picked up by the non-phone ear can make listening on the phone a more difficult task. For ReSound hearing aids that have wireless communication between the two hearing aids in a binaural fitting, PhoneNow can identify the "phone ear" and the "non-phone ear", turning down the gain on the non-phone ear by 6 dB while the phone is being used. This is intended to reduce the disturbance caused by the amplification of sounds and background noise in the listening environment, and by extension, to reduce the listening effort required in this situation. When the user ends the phone conversation, both hearing aids automatically return to their previous microphone program and volume setting.

WIRELESS STREAMING OPTIONS

The phone solutions that have been discussed so far present the phone signal monaurally. This is the natural mode of using the phone, that unaided listeners use as well. With today's wireless streaming technology, hearing aid users can also receive the phone signal binaurally. Binaural listening affords several benefits, which importantly include improved speech recognition relative to monaural presentation.[7,9]

Streaming via a wireless phone accessory

The ReSound Phone Clip+ is a small wireless accessory that links a Bluetooth-enabled® mobile or landline phone to the hearing aids. It is small and can be worn clipped to the user's clothing or on a lanyard. This is important, as the accessory contains a microphone to pick up the hearing aid wearer's voice and transmit it to the phone, thereby allowing hands-free use of the phone. The phone signal alone can be transmitted to both ears simultaneously, resulting in improved speech intelligibility in both quiet and noisy surroundings. As with the telecoil, it is possible to add hearing aid microphone input to the streamed signal, and the amount of microphone versus streamed signal can be adjusted both by the Hearing Care Professional at the fitting, and by the user with a remote control or smartphone app. The sound received in the hearing aids for the streamed and/or microphone input is amplified as programmed for the individual user, accounting for the specific frequency response needed for their hearing loss.

Streaming directly

Another way to receive the phone signal in both hearing aids of a binaurally fit pair is to stream audio directly from an iPhone, iPad or Android™ smartphone. ReSound worked with Apple as the first to bring this functionality to hearing aids. A special streaming protocol based on Bluetooth Low Energy made it possible to stream high quality audio from iPhone and iPad with less battery consumption than is required for standard Bluetooth streaming. This is critical for hearing aids, as batteries are expected to last much longer than in consumer products based on Bluetooth. Similarly, direct streaming to hearing aids from many Android smartphones is also possible today based on a cooperation with Google. This Bluetooth Low Energy application is called Audio Streaming for Hearing Aids (ASHA). A significant additional advantage of direct audio streaming to hearing aids is that video chat apps also can be used. These apps add the possibility to augment the binaural audio sound with visual cues to make communication even easier for hearing aid users. Being able to see the person you are speaking to contributes importantly to understanding regardless of hearing status, as demonstrated by Jespersen & Kirkwood.[9] They tested people with normal hearing and varying hearing loss severities, and found that all groups showed an average benefit of at least 23% when listening to a video call versus an audio only call.

HANDS-FREE CALL

A downside of direct streaming to hearing aids has been that it is necessary to have the phone itself held or positioned so that it could pick up the hearing aid wearer's voice. This is because the Bluetooth Low Energy streaming features were one-way, meaning that sound could be sent from the phone to the hearing aids, but not vice-versa. Beginning with the ReSound ONE generation of hearing aids, users can have convenient conversations with outstanding sound quality even when they can't hold their iPhone, such as when driving, cooking, carrying groceries, or when their iPhone is out of reach. The microphones on the hearing aids pick up the user's voice and transmit it to the phone and the far-end caller. Therefore, when using a compatible iPhone or iPad, it is no longer necessary to use a separate Bluetooth phone accessory to use the phone hands-free.

ReSound has been able to utilise Apple's latest software update, with support for bidirectional hearing aids.

SUMMARY

Virtually everyone, including those who wear hearing aids, has a need to use the phone. ReSound hearing aids offer multiple solutions for hearing better on different types of phones. Holding the phone to the ear in a conventional manner remains an important mode of phone use, especially for those with mild-to-moderate hearing losses. In a study where participants compared ReSound ONE hearing aids fit with standard and M&RIE receivers when listening to a phone call in the conventional manner, it was shown that 95% could hear the call with little-to-no effort when using M&RIE, and all would recommend this solution to others. ReSound hearing aids offer additional ways to use the phone, including telecoils and direct audio streaming solutions. Both have been shown to provide better understanding on the phone than listening without hearing aids, and many hearing aid users benefit even more than when listening via the acoustic microphones. For added convenience, people who wear ReSound ONE or newer generation hearing aids can make hands-free calls without a separate Bluetooth phone accessory when using a compatible iPhone or iPad.

*ReSound ONE hands-free calls are compatible with iPhone 11 or newer, iPad Pro 12.9-inch (5th generation), iPad Pro 11-inch (3rd generation), iPad Air (4th generation), and iPad mini (6th generation) with iOS 15.3 or newer.

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