

# wireless

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# connectivity

## for hearing aids

**T**he role of amplification in the life of the patient with hearing loss is to improve access to sound. Normally we interpret this scenario as a live, face-to-face conversation, but there are many other ways that important sounds reach us as listeners. Along with the recent technical improvements in wireless transmission of sound have come new opportunities to bring important sounds to the hearing aid user. The hearing industry has jumped on these opportunities and has created impressive solutions for those with hearing loss over the past few years.

In the past, connectivity in hearing aids was seen as an accessory. Although FM use for children in schools is widespread and now considered a necessity, the use of connectivity for adults was limited primarily to the use of T-coils for telephones and, in some cases, looped spaces.

The primary limitation to the growth of connectivity and hearing aids for adults was that the solutions were not particularly elegant. External sound sources either had to be hardwired into the hearing aid or had to make use of analog T-coils where sound quality was often an issue.

The strength and quality of the magnetic signal coming from telephones has been a problem in the past, and the number of private and public spaces that offer a looped magnetic signal has been limited.

The explosion of audio signals transmitted via Bluetooth® wireless technology has driven the hearing aid industry to re-examine options for getting external audio signals into hearing aids. Effective solutions have now been developed to the point that connectivity should be considered as a possibility for all patients who wear hearing aids, and a discussion about connectivity needs and potential solutions should be a part of every hearing aid counseling session.

### The New Era of Connectivity

For several decades, external signals entered hearing aids either via direct audio input or by making use of analog T-coils. Few everyday



consumer electronic devices broadcasted wireless signals, so connectivity in hearing aids always was managed by devices specifically developed for those with hearing loss. The development of wireless headsets for cell phones dramatically changed the landscape of wireless technology in everyday use.

The primary wireless technology now used in cell phones and other electronics is Bluetooth. Despite its widespread use in cell phones, Bluetooth wireless transmission poses a particular problem for the hearing aid industry because the size of the transmitters and receivers is relatively large compared to the typical components in hearing aids.<sup>1</sup> More importantly, the power requirements for Bluetooth transmission and reception are too high to realistically be driven off the batteries used in hearing aids, especially the smaller 312 and 10A sizes.<sup>1</sup> However, the popularity of this format made it such that the hearing aid industry had to find a way to get Bluetooth wireless signals into hearing aids.

One option that was tried was to use a Bluetooth adapter connected to the body of behind-the-ear hearing aids. That application

met with limited success and is not used as the primary method of getting Bluetooth transmitted signals into hearing aids. The more common solution that has now been adopted by several hearing aid companies is to use a body-worn gateway device (**Figure 1**). These gateways will accept input signals from various formats including Bluetooth, direct audio input and, in some cases, FM. The input signal is converted into a digital magnetic signal. The hearing aids have a digital magnetic receiver integrated within the electronics of the device. This onboard receiver will pick up the wireless signal being emitted from the gateway device.

Digital magnetic transmission has several important advantages that made it a natural choice for the hearing aid industry. First, the electronics required are small, a fraction of the size of Bluetooth electronics, and thus easily can fit within the body of nearly all models of hearing aids. Second, the power requirements are also a fraction of that of Bluetooth. Therefore, digital magnetic reception can occur in hearing aids without a significant increase in overall drain on the hearing aid battery. Third, the digital magnetic signal being emitted from the gateway device is security-coded, so only the registered hearing aids paired with that gateway will pick up the signal.

The size of digital magnetic electronics is such that not only is there a receiver incorporated within the electronics of the hearing aid but, in many cases, there also is a transmitter. This transmitter is used to communicate with the other hearing aid that the patient is wearing, allowing for a variety of binaural processing schemes. Although not the focus of this paper, the professional can expect significant new developments in the hearing aid field over the next several years based on the ability of two hearing aids to send data to each other. We have seen the beginning of true binaural processing over the last few years,<sup>2</sup> but new and exciting applications are coming.

Although it is desirable to have full wireless reception directly in the body of the hearing aid without the need for a gateway device, that is unlikely to occur for a number of years. For fully-integrated wireless reception within hearing aids to occur, a newer wireless technique would have to emerge to replace Bluetooth as we currently know it. That development does not appear to be imminent and the professional should expect that the use of gateways to bring wireless signals into hearing aids will be the norm for the immediate future.

The hearing aid industry also has begun to develop important accessory devices to get audio signals into the gateways (**Figure 2**). Cell phones that emit a Bluetooth signal can communicate directly with gateways. However there are the other electronic devices in our lives that create sound to which patients with hearing loss deserve better access. Specific focus has been placed on developing adapters to create a Bluetooth signal from landline phones and from televisions. Since, under certain circumstances, a Bluetooth signal can be delayed when transmitted using standard protocols, television viewing with off-the-shelf Bluetooth transmitters can create a situation where the visual signal is seen by the viewer before the audio signal arrives. Because improved television viewing is important to patients with hearing loss,<sup>3</sup> the hearing aid industry has had to develop dedicated Bluetooth applications that minimize the transmission delay so that television viewing can occur without a perceptible mismatch between the audio and visual signal.

## Benefits of Connectivity

For many years, the only connectivity for most adult hearing aid

users was to use the T-coil when speaking on the telephone. Now that there has been significant development in wireless transmission of audio signal to hearing aids, many professionals are in a position where they need to rethink the way they discuss the need for connectivity with patients. In some cases, there is a natural tendency not to bring up the topic of connectivity when fitting advanced-technology hearing aids because the professional may assume that the patient assumes that the hearing aid will solve all communication issues. Of course, this is not the case, and the significant benefits of connectivity that many, many patients have experienced over the last few years should inspire professionals to broach the topic of connectivity with most patients being fit with hearing aids.

One approach to help frame the discussion of connectivity is to describe the benefits that the patient should experience. These include:

**Higher-quality, more intelligible speech signal**—When listening over the telephone or when listening to speech from televisions, the connectivity solutions that have been developed have been demonstrated to improve speech understanding.<sup>4</sup> Since many patients continue to experience difficulties in the perception of these transmitted signals even when wearing high-quality hearing aids, connectivity can be offered as a solution to those residual communication issues.

**Less trouble when using phones and televisions**—As discussed above, the connectivity solutions that were developed in the past tended to not be particularly elegant. Oftentimes, connectivity meant a direct-wired connection to the electronic device that was producing the audio signal. The availability of wireless connectivity, along with the very smart design of the gateways that are now available, has made connection to these consumer electronics much more seamless. In fact, this seamless integration with consumer electronics can be used to highlight the sophistication of modern advanced-technology hearing aids.

**Easier shared use**—It is quite common for family members to complain that the television needs to be played at excessively high volume when the hearing-impaired loved one is in the room. Wireless connectivity to hearing aids allows the hearing aid user to have independent control over the sound level of the television signal, allowing the rest of the family to listen at an appropriate and comfortable level.

**Decreased mobility concerns**—Some patients have physical limitations on how easy it is to move around their living space. When the phone rings, sometimes it is not a trivial matter to get up and answer. The phone connectivity solutions that have been developed make access to a telephone more direct for many of these patients. The gateways that are currently available make answering calls, ending calls and the adjustment of volume easier.

**Volume control adjustment**—An added benefit of body-worn gateway devices is that they can function as a binaural volume



**Figure 1:** A body-worn gateway device that transmits audio signals to a pair of hearing aids using digital magnetic transmission.

control for the hearing aids. Again, for some patients with mobility or dexterity issues, this can be a simple yet highly useful benefit.

## Candidates for Connectivity

It is important to discuss the best candidates for connectivity. The simple answer is that any patient with hearing loss probably runs into situations where their hearing aid fitting could be augmented by the use of connectivity. However, for those with less hearing loss or with fewer demands on their hearing, it is possible that the frequency of such difficulties is low. Perhaps a strategy for such patients is to mention the possibility of connectivity at the time of the original hearing aid selection but to defer the actual decision about the use of connectivity to a later date.

Another strategy is to wait until follow-up questioning has unveiled difficulties that could be addressed with connectivity technology. The potential difficulty with this approach is that, unless



**Figure 2:** Adaptors designed to send landline phone (right) and television (left) audio signals to a gateway device.

the patient is aware of the possibility of connectivity, he or she may never bring up the issue unless specifically asked. Given that the price of connectivity technology has been kept modest compared to the overall price of advanced-technology hearing aids, it is legitimate to suggest that connectivity should be discussed with all patients who use hearing aids. It is not up to the professional to decide who can and cannot afford hearing aids and now connectivity technology. It is the professional's responsibility to present recommendations on the very best way to solve the hearing difficulties faced by the patient.

When the new era of connectivity started a few years back, the classic target patient was one who spent a considerable amount of time on the cell phone. The mating of hearing aids and cell phones had been problematic for a number of years, and the opportunity to use wireless approaches to improve satisfaction with cell phone use for those with hearing aids was a natural first goal. Many professionals had an image of a busy working adult who spent a considerable amount of time conducting business on the cell phone. Another early target audience was younger patients—teenagers and young adults—who want to mate MP3 players with their hearing aids. Although both of these groups were very legitimate target audiences, the benefits of connectivity have now been reinterpreted in terms of the more classic hearing aid user: the older adult.

Aging carries with it a natural tendency for the person to become increasingly detached from the people, activities and places that have defined that person's development over the years. Physical, economic, social, and occupational changes all conspire to create a large gulf between the older person and the world they knew for so many years.

There is a well-known concept called "successful aging." This term describes the process by which an older person adapts successfully to the inevitable physical and social changes that accompany the aging process. The body changes over the years. Occupational,

family and other social changes are going to happen also. These are facts that cannot be denied. The key question is: How well does a person handle these challenges? Those who are not successful at the aging process are those for whom life changes threaten well-being and physical and mental health may become compromised.

Rowe and Kahn (1998) described the three markers of successful aging:

- Maintaining good physical health;
- Maintaining good cognitive health; and
- Maintaining active engagement with other people and essential activities.

Importantly, it has been observed that physical health, cognitive health and engagement are linked, but perhaps in a negative way. As the person's health begins to fail, they may have less opportunity to engage with others. The combination of health struggles and isolation can lead to depression. As the depression deepens, the patients may be less motivated to care for themselves. Health fails even more, isolation increases and cognitive health continues to decline. A dramatic, downward spiral becomes a great risk.

Clearly, hearing professionals play a vital role in the third factor. We can help break the chain of events that can threaten the well-being of the older patient. Of course, it is not just physical or social changes that lead to isolation; declines in sensory function also play a roll. The communication challenge brought on by hearing loss may lead older individuals and those with whom they come in contact slowly to begin to avoid these difficult interactions. The change in social pattern may be insidious, but it is real.

As older patients become more and more removed from those individuals and life activities that enrich their lives, the role of electronic media increases in importance. The miles between the patient and family and friends can be bridged with the telephone. Access to what is going on in the world can be gained through the television. Importantly, the role of these devices changes as the user gets older. Research indicates that the elderly watch television specifically to maintain a sense of involvement in the world<sup>5,6</sup> and turn toward telephone technology in order to lead a "more social, active, meaningful, and independent life."<sup>7</sup>

## Our Important Role

The professional's job is to decrease the impact of hearing loss in all aspects of a patient's life. Wireless technologies have opened up new possibilities for us to address long-standing concerns that our patients present to us. The hearing aid industry has paid particular attention to designing connectivity technology that is intuitive and effective for our patients. The professional plays a vital role in learning how these technologies can be incorporated into a patient's life. The older patient is at particular risk for becoming detached from ongoing society. We all play an important role in keeping our patients as active and involved in the modern world as possible. **\$**

References available online at [www.advancetech.com/aud](http://www.advancetech.com/aud). Access "Magazine" in the red menu bar, then "References."

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