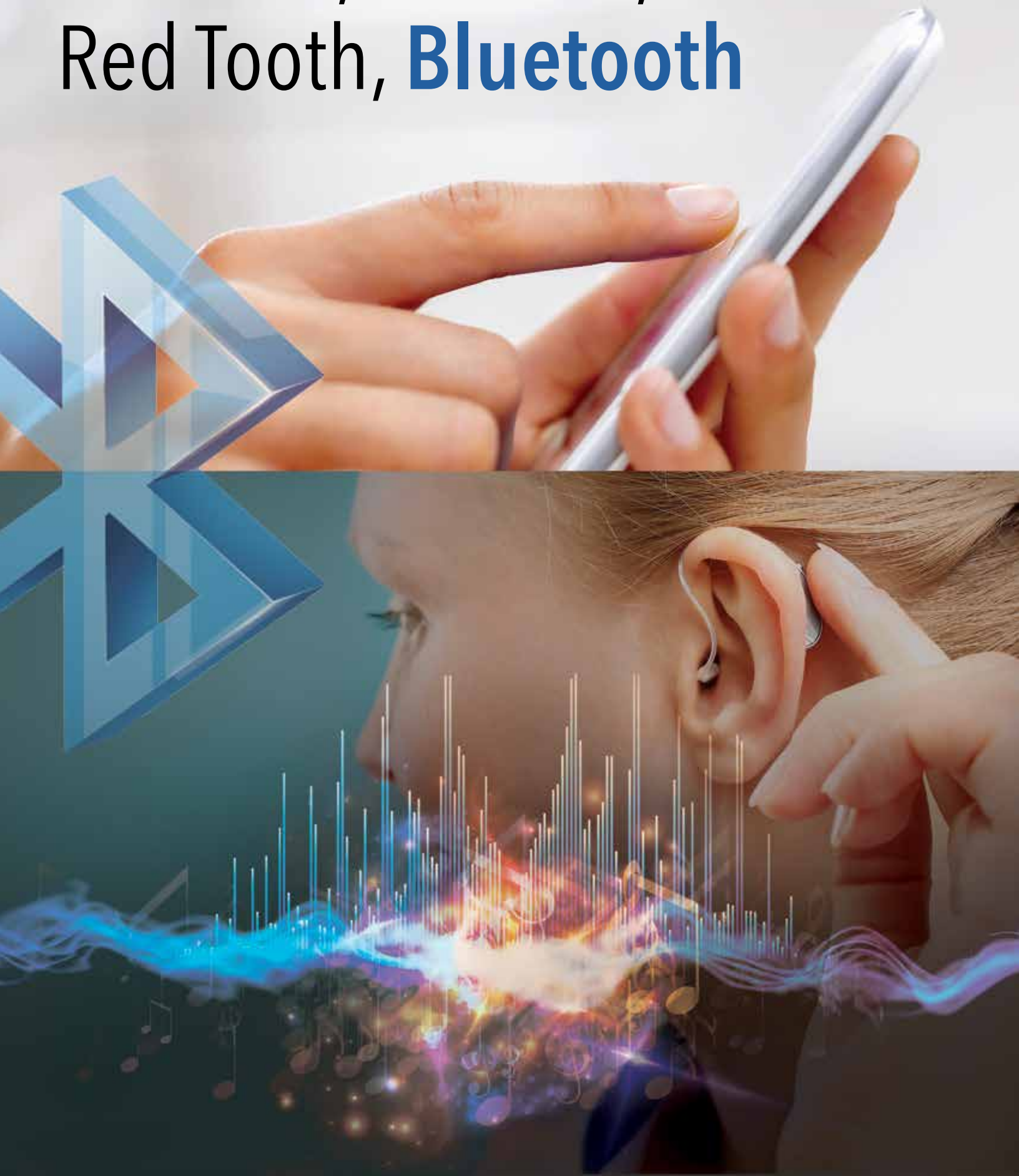
One Fish, Two Fish, Red Tooth, **Bluetooth**

BY AMY BERNSTEIN



If terms like Bluetooth, streaming or apps intimidate you or you just want to learn more about how modern hearing aids take advantage of these technologies, you have come to the right place. These terms can be overwhelming at first, but fear not–they can be broken down in a way that is easy to comprehend.

Understanding Bluetooth Basics

Bluetooth is a low-power radio wave that creates a private connection. Think of it as a personal radio station. FM radio stations operate on the frequencies between 88 and 108 MHz (*FM Radio*, 2015); Bluetooth uses a higher frequency range, 2400 to 2483.5 MHz (Bluetooth Special Interest Group, n.d.-b). The devices, such as your phone and Bluetooth hearing aids, must be initially paired, or programmed to communicate, so that Bluetooth can create a secure, personal station that will allow the devices to recognize each other in the future.

To keep the connection secure between the Bluetooth devices, the devices do not pick just one frequency station; rather, they automatically hop between many stations thousands of times per second (Bluetooth Special Interest Group, n.d.-a). Imagine having a conversation with your friend using walkie-talkies. To ensure the connection is secure and nobody intrudes on your frequency, both of you automatically switch to a new channel each second. As you talk, each channel transmits only part of what you're saying. Even if someone were to overhear you at one station, they would only hear part of a word. It would be nearly impossible to guess what station you might both choose next over and over again. That is what makes Bluetooth's hopping so secure, especially since Bluetooth seamlessly changes stations thousands of times per second.

Bluetooth can carry the playback of sound from a paired device to an audio device such as a person's hearing aids. This is known as streaming. Examples of audio that can be streamed are phone calls, voicemails, music, podcasts and audio from videos. It also allows commands like volume control to be sent from one device to the other.

How Are Bluetooth Hearing Aids Better?

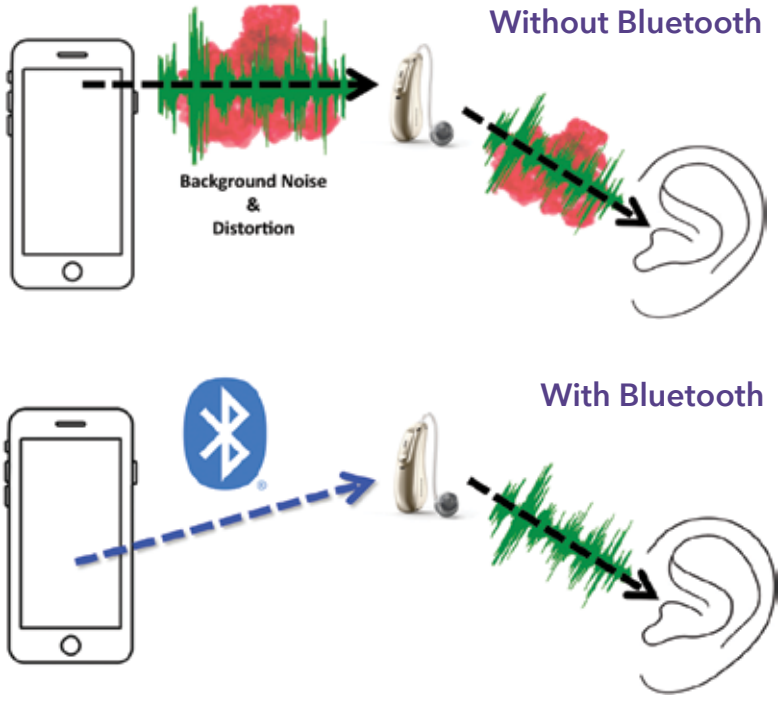
Bluetooth streaming provides better sound quality, less noise interference and better speech understanding compared to hearing aids without Bluetooth streaming (Kim et al., 2014; Nesgaard Pedersen & Kirkwood, 2014; Picou & Ricketts, 2011; Tchorz & Schulte, 2005). Phone calls and media audio play directly into both ears for a clearer signal while reducing interference from background sounds (Picou & Ricketts, 2011; Picou & Ricketts, 2013).

Without Bluetooth, sound emitted by the phone's speaker is picked up by the hearing aid's microphones, processed by the hearing aid and then sent to the hearing aid's speaker, whereupon it finally travels to the ear. However, when sound is streamed via Bluetooth, it can skip the middleman and go directly from the device to the hearing aid's speaker. This eliminates the limitations of a phone's speaker and hearing aid's microphones, as well as the distance that an acoustic signal would normally need to travel through space between the two. That is good, because distance causes sound to be lower in volume and allows background sounds to interfere, which distorts the sound.

If the user wears hearing aids in both ears, the user will hear the sound in both ears. This provides an additional benefit of hearing phone calls in both ears instead of the typical single ear, making it easier to understand speech on a cellphone (Picou & Ricketts, 2011; Picou & Ricketts, 2013).

Bluetooth-enabled Smartphone Apps Are Smarter

Bluetooth can also enable one's smartphone to act as a remote control for hearing aids when the appropriate application, or "app," is downloaded to the smartphone. These free apps are unique to each brand and model.



It is much easier to precisely make changes to settings, such as increasing the volume by three steps, when they are displayed on a phone, rather than by using the buttons on hearing aids and listening for tones.

Most apps have equalizer settings in which the hearing aid user can modify bass and treble pitches. (See illustration at right.) The audiologist should already have customized the hearing aid settings to accommodate each individual's hearing loss, but equalizer settings can be used to make further preference changes. The table below lists words that are often associated with bass, middle and treble pitches.

Changes are optional, and if no changes are made, the hearing aids will remain where the audiologist programmed the settings based on the user's hearing loss.

Limitations of Bluetooth Streaming and Apps

There are limitations to which smartphones can use Bluetooth streaming and apps. In general, most generation 5 or newer iPhones are compatible with most hearing aid models. Top-of-the-line, new smartphones are more likely to be compatible with hearing aids than older or budget smartphones. There are some exceptions, however. Some basic flip phones have Bluetooth for streaming that works with certain hearing aid models, but no app control. Be sure to tell your audiologist the make and model of your phone and ask about compatibility. Finally, take comfort in the fact that a patient, compassionate audiologist who is willing to walk through each step of the process will make it a breeze to take advantage of Bluetooth's exciting functionality. HL

Equalizer Settings

Bass	Middle	Treble
Background sounds Boominess Echo Fullness Loudness Roundness	Roundness Speech sounds	Clarity Sharpness Tinny

Common changes that can be made using the equalizer:

Goal	Action
For increased speech clarity	Increase middle and treble; and decrease bass a little
For bass boost in music	Increase bass and decrease treble
For treble boost in music	Increase treble and decrease bass
To reduce echo	Decrease bass
To reduce the clanking of dishes or keys	Decrease treble a little

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