INNOVATE YOUR WORLD

with the Halo and TruLink Experience

Amanda Wolfe, Au.D.

Wearable wireless technology such as the health-tracking Fitbit®, smart watches and Google® Glass™ have flooded gadget-centric markets worldwide with the promise to revolutionize the health, wellness and lifestyle of the tech consumer. To some degree, devices such as cell phones, computers and tablets have found their way into the lives of individuals of all ages. With this seemingly "perfect storm" of everyday convenience combined with technologically advanced devices, it should come as no surprise that 58 percent of American adults own a smartphone and 42 percent own a tablet (Pew Research Internet Project, 2014).

As technology continues to advance, both younger and older generations continue to invest in products meant to improve their everyday lives; the integration of hearing aid and mobile technology was a natural progression in this effort. The collaboration between Starkey Hearing Technologies and Apple® introduces an innovative hearing solution that meets the needs of people with hearing loss across different generations.The flexibility and personalization allowed by the fully featured Halo™ hearing aids and the TruLink™ mobile app provide hearing aid wearers with a truly customizable listening experience that redefines the traditional hearing aid.

CLINICAL VALIDATION

To ensure that participants would find value and convenience in controlling their hearing aids with the use of iPhone®, as well as to validate the usability and functionality of the system as whole, a comprehensive clinical trial was completed to evaluate the treatment provided by Starkey Hearing Technologies' 2.4 GHz wireless technology, the Halo receiver-in-the-canal (RIC) device, iPhone and the TruLink mobile app. Twenty-one individuals, six females and 15 males —18 of who were experienced hearing aid users — participated in this study. The mean age of all participants was 56 years, with a range of 20 to 75 years. The study consisted of four visits over six to eight weeks, during which objective and subjective data were collected and analyzed. Mean audiometric data, as well as group minimum and maximum thresholds, are shown in Figure 1. The trial focused on each patient's experience with the Halo hearing devices and iPhone 5, 5C or 5S models. A majority of participants were current smartphones users with varying degrees of technical skills.

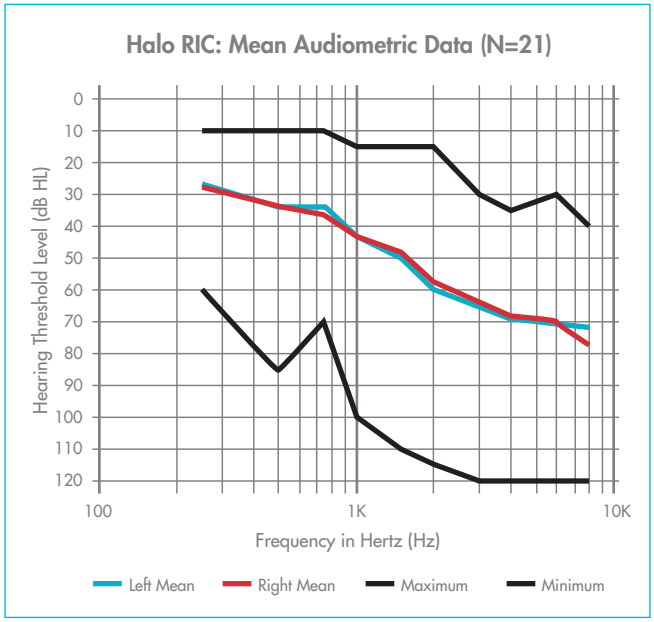

Figure 1: The mean audiometric data of all 21 participants are displayed. The red line indicates mean thresholds of right ears, and the blue line indicates mean thresholds of left ears. The black lines indicate minimum and maximum thresholds.

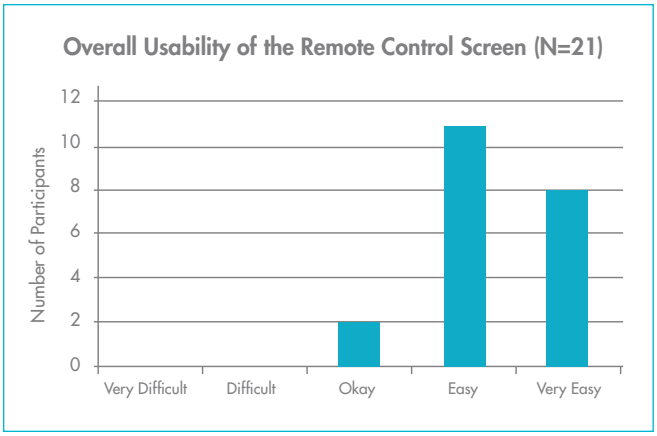

Figure 2: Participant rating of the overall usability of the Remote Control screen.

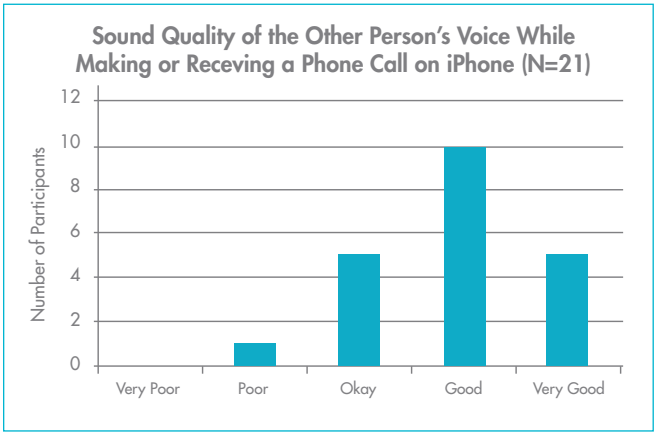

Figure 3: Participant rating of sound quality of the other person's voice while making or receiving a phone call on iPhone.

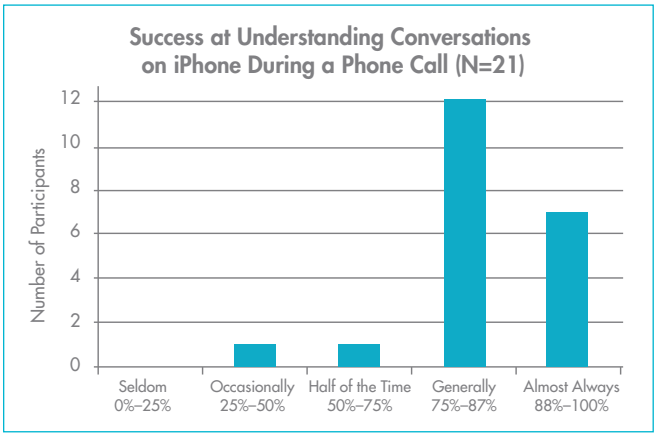

Figure 4: Participant rating of success at understanding conversations during a phone call on iPhone.

Participants were fit bilaterally with Halo hearing aids using 50-gain, 60-gain or 70-gain Absolute Power receivers, as appropriate for their hearing loss. At the first session, all the hearing aids were Best Fit to Starkey Hearing Technologies' proprietary fitting rationale, e-STAT (Scheller & Rosenthal, 2012).

All hearing aid fittings were verified through measurement of the real-ear aided response using an Audioscan Verifit with the loudspeaker placed at 0° azimuth and a 28-millimeter probe tube insertion depth. The test stimulus used was the International Speech Test Signal (ISTS), presented at the levels of 50, 65 and 75dB SPL along with an 85dB SPL pure-tone sweep (Holube, Fredelake, Vlaming & Kollmeier, 2010). Per each participant's preference for sound quality and loudness, the hearing aid gain and frequency response were adjusted as needed during the initial session and throughout the entirety of the study. Measurement of the front-to-back ratio was performed to verify the Halo dual-omni microphone directional system. Once the hearing aids were programmed appropriately for each participant, they were paired to the participant's iPhone. At the time of fitting, participants were oriented to the use of the hearing aid, iOS and the TruLink app.

Data collected from the first field trial focused on the ease of use and functionality of Halo and the Trulink app, as well as the integration of both with the iOS operating system. Participants were encouraged to use the system as they desired with an emphasis on use of the TruLink app, including remote control functionality, making/receiving phone calls and streaming audio from music and videos. Figures 2 through 6 show participant ratings of their experience using Halo and TruLink in real-world environments. The majority of participants found the TruLink Remote Control easy or very easy to use when changing memories, adjusting volume or muting the hearing aids (Figure 2). The ability to wirelessly stream bilateral phone calls and music to the Halo hearing aids was a focal feature that many participants used extensively during the clinical trial. Most participants judged sound quality and speech understanding to be good or very good while making or receiving a phone call (Figures 3 and 4). As the study progressed, participants' level of understanding and comfort improved as they gained experience with iPhone, Halo and the TruLink app.

During the second field trial, participants were encouraged to create at least four custom memories using the TruLink SoundSpace feature. They were also asked to use the TruLink Remote Microphone feature to stream audio from a

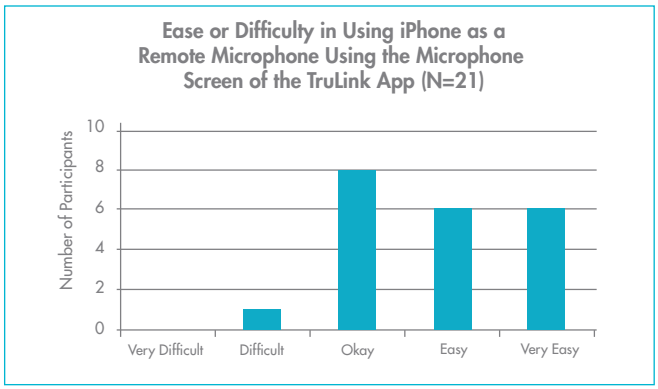

Figure 5: Participant rating of the ease or difficulty in using iPhone as a remote microphone while using the microphone screen of the TruLink App.

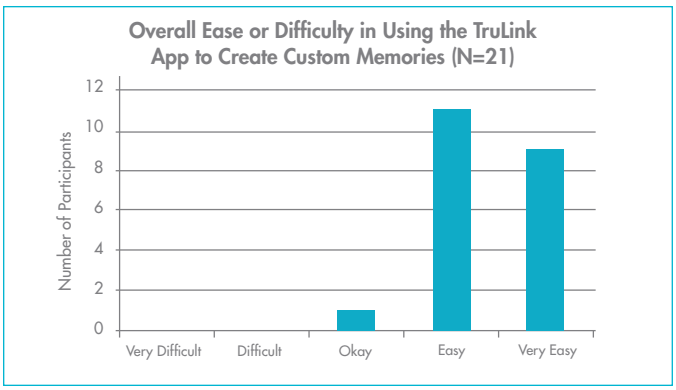

Figure 6: Participant rating of the ease or difficulty in using TruLink to create custom memories.

remote talker; this exercise included recording and emailing the audio recordings. Figure 5 displays participant ratings of ease of use for the TruLink remote microphone; some participants found the remote microphone feature useful, while others reported that the feature would be used infrequently. The TruLink SoundSpace feature allowed participants to tailor the hearing aid frequency response to their preference. Once they found a preferred sound quality, these settings were assigned to a custom hearing aid memory that could be geotagged to the GPS coordinates of any location. Once a TruLink custom memory was created, it would activate automatically when the participant visited the geotagged location. Although the description of this TruLink feature sounds advanced, participants found the experience of creating custom memories simple, rating the process as easy or very easy (Figure 6).

At the final session, participants were asked to reflect on their entire experience and impression of Halo and TruLink. Figures 7, 8 and 9 show that participants were satisfied with both the Halo hearing aids and the TruLink app. As a result, they were highly likely to recommend this new technology to friends or family who would benefit from hearing aids.

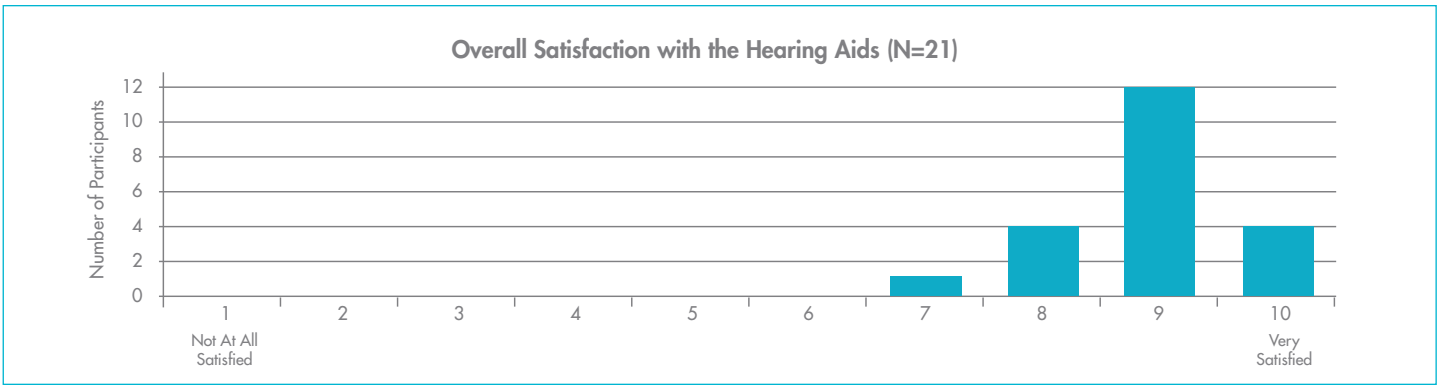

Figure 7: Participant ratings of overall satisfaction with the hearing aids.

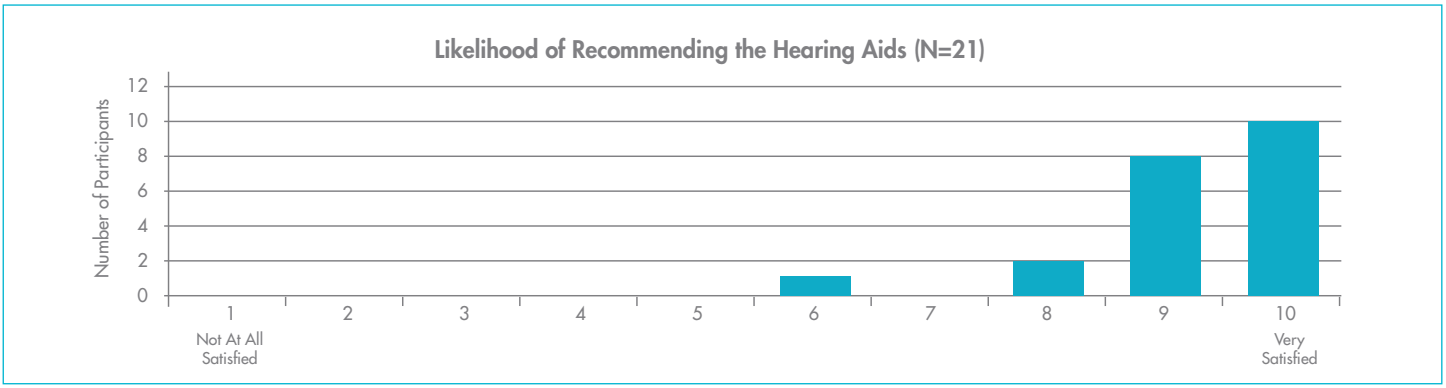

Figure 8: Participant ratings of likelihood of recommending the hearing aids.

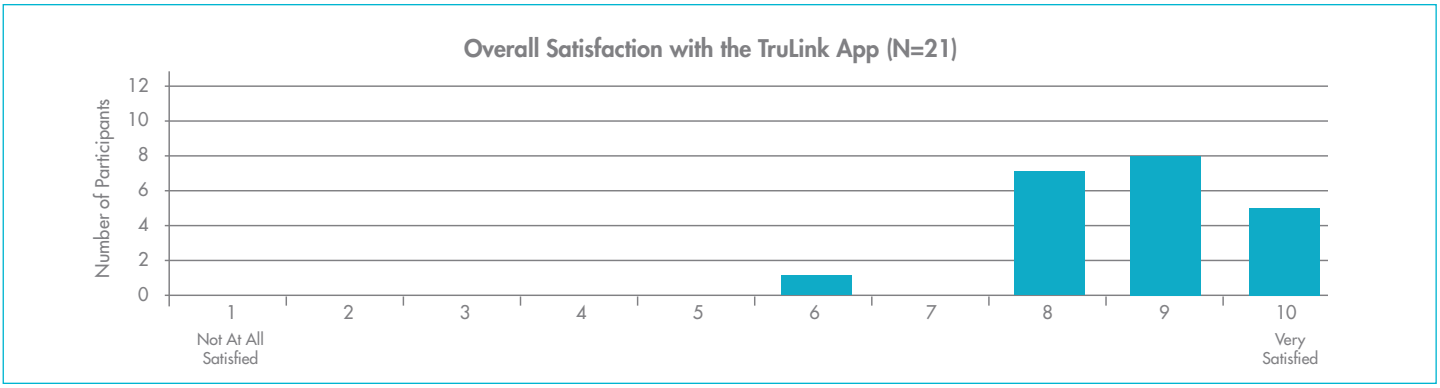

Figure 9: *Participant rating of overall satisfaction with the TruLink app.*

The data figures show some responses indicating that a small portion of the participants did not perform as well, and did not appreciate the technology as much as others in the study. This underscores the importance of carefully selecting candidates for any hearing aid technology to make sure there is a good match of the patient's capabilities and preferences with the technology offered.

A final illustration of the participant experience is shown in Figure 10; everyone was asked to select three to five words from a closed-set list that best described Halo and the TruLink app or how using the system made him or her feel. The most commonly selected words were valuable, high quality and easy to use.

CONCLUSION

The Halo hearing aids and TruLink mobile application are the first Made for iPhone (MFi) hearing aids developed by Starkey Hearing Technologies. Results from this clinical trial clearly show that participants found both Halo and TruLink easy to use with very good sound quality. For the clinical audiologist, the concept of an MFi hearing aid may seem too complex for many traditional patients; however, this trial showed that participants quickly learned to use the TruLink mobile app. This observation reaffirms the thought that many hearing aid wearers are ready to take control of their listening environments and social interactions. The combination of TruLink features and the leading technology of Halo hearing aids offers a unique experience, providing hearing aid wearers with the flexibility, personalization and convenience they desire.

REFERENCES

Holube, I., Fredelake, S., Vlaming, M., & Kollmeier, B. (2010). Development and analysis of an International Speech Test Signal (ISTS). *International Journal of Audiology, 49*(12), 891-903.

Pew Research Internet Project. (2014). Device Ownership Over Time. Pew Research Center, Washington, D.C. Retrieved from http://www.pewinternet.org/data-trend/mobile/device-ownership/

Scheller, T. & Rosenthal, J. (2012). Starkey Hearing Technologies' eSTAT Fitting Formula: The rationale behind the rationale. *Innovations, 2*(2), 41-45.