FM for Adults

Chapter 9

Real World Success Stories

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Introduction

Individuals with hearing loss have increased difficulty understanding speech in a background of noise, which is often referred to as a signal-to-noise ratio loss, or SNR loss. Numerous studies have examined the relationship between SNR loss and other audiological variables such as pure-tone sensitivity and speech recognition in quiet measures (see Wilson and McArdle, 2005). The overarching conclusion has been that SNR loss cannot be predicted from other more common audiometric testing. Thus, in order to establish SNR loss for an individual, it must be directly measured (Killion, 2002).

The information gained from a speech-recognition-in-noise task can be used to devise a treatment plan for an individual with hearing loss. An individual with normal hearing on average demonstrates an SNR loss of approximately 2 dB (Killion et al, 2004). For individuals with hearing loss, SNR loss on average is around 12 dB but can vary depending on materials used for testing, hearing levels of the individual, and the amount of distortion in the auditory system of an individual (Wilson and McArdle, 2005). Current hearing aid technology, such as directional microphones, can improve the signal-to-noise ratio of an environment about 3-5 dB (Ricketts, 1999). For individuals with minimal amounts of SNR loss, appropriate use of directional microphones may be sufficient for improving their ability to communicate in noisy situations. For individuals with a more severe SNR loss, a greater improvement in SNR is necessary to improve their ability to communicate in noisy environments (Hawkins, 1984).

Frequency modulated (FM) technology has been shown to greatly improve the communication ability of individuals with severe SNR loss in noisy environments. An FM system consists of receivers that couple to the personal hearing aids of the listener and a transmitter which functions as a microphone. The transmitter is utilized to broadcast the signal of interest over and above the background noise to the ear-level receivers. In essence, this process improves the signal-to-noise ratio by 15-25 dB in most listening environments (Hawkins, 1984; Crandell and Smaldino, 2000).

Bay Pines VAHCS FM program

At the Bay Pines VA Healthcare System, we have been fitting FM systems for the last 5 years. Initially, potential FM users were scheduled into the Severe Hearing Loss Clinic and treated by an audiologist who specialized in FM technology. A specialized clinic was critical for success due to the complexity level of fitting FM systems on analog hearing aids. As technology has continued to improve and become increasingly digital, the need for a specialized clinic has declined. Although a specialty clinic is no longer utilized at Bay Pines VA HCS, we still follow the basic protocol for fitting and follow up as was previously established.

Frequency modulated (FM) technology has been shown to greatly improve the communication ability of individuals with severe SNR loss in noisy environments.

Our “best” candidates tend to be individuals recently fit with hearing aids who present to their follow-up appointment with continued complaints of difficulty hearing in situations for which an FM system can be utilized. We have also found FM technology to be beneficial in treating patients who are seen repeatedly in our repair clinics for difficulty understanding speech in numerous situations. Once a potential FM can-

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didate is identified, the Client Oriented Scale of Improvement (COSI) (Dillon et al, 1997) is used to identify individualized treatment goals. These treatment goals become the focus of the counseling and coaching involved with the FM fitting. Once the FM system has been fit, the patient is seen back for a follow-up appointment and treatment outcomes are established. If the patient needs further training with the FM system, additional follow-up appointments are scheduled.

FM Case Reports

At Bay Pines VAHCS we have fit over 100 FM systems to all types of patients. Below are several case studies that highlight how FM systems can be used successfully with a variety of patients.

Case 1:

An 86 year old male with long-standing asymmetric hearing loss. Pure tone thresholds for the right ear showed hearing to be within normal limits through 2000 Hz then steeply sloping to profound sensorineural hearing loss at 4000 Hz and above. Pure tone thresholds for the left ear showed a mild to moderate sensorineural hearing loss from 250 to 1500 Hz steeply sloping to a profound hearing loss at 3000 Hz and above. Retrocochlear pathology was ruled out. This patient had worn multiple sets of private purchased hearing aids without success. He reported he was told by a private practice audiologist that he has an auditory processing disorder. He was seen in our clinic 17 times within 2.5 years complaining of severe difficulty communicating in background noise (2003–2005).

In 2005 he was fit with Phonak Perseo 111 behind the ear (BTE) hearing aids with a soundpilot remote, bilateral ML8S receivers and a TX3 handymic. At his FM follow-up his previously established treatment goals were reviewed. He reported that with the FM system he was hearing much better almost all the time (95 %). Specifically, he reported that he could finally hear his wife while traveling in the car and while dining in the residential dining hall. He also reported being able to hear and communicate at cocktail parties and that he felt less isolated and more involved socially. Since his FM follow up in November of 2005 he has only had 2 return visits to our clinic for earmold maintenance.

FM technology has continued to develop over the last few years. Although the hearing loss for this patient did not warrant BTE hearing aids, at the time it was necessary to access the FM system. If this patient was seen today he could be fit with in-the-ear (ITE) hearing aids, a MyLink receiver, and a Zoomlink transmitter.

Case 2:

A 54 year-old male with long-standing bilateral sensorineural hearing loss. Pure-tone thresholds revealed a moderate-severe sensorineural hearing loss from 250 to 4000 Hz sloping to a profound hearing loss above 4000 Hz for the right ear. The left ear had no measurable hearing at any frequency. This patient reported to the clinic for an updated hearing evaluation and consideration for new amplification. He had been a previous BICROS user with some success but continued to express difficulty hearing in noise. Our plan was to fit the patient with a BICROS system using a Phonak Savia BTE and a Croslink kit with consideration for an FM system.

The patient returned for his follow-up reporting improvement in many listening situations but continued difficulty understanding speech in noise. Given the complaint, an FM system was fit to the CrosLink kit. At his next FM follow up, he reported that the Croslink+FM system had changed his life. He reported that he could participate more in social activities and in his VA medical setting.

His COSI responses indicated that he heard much better in noise (95 % of the time).

Case 3:

A 72 year-old male with bilateral profound sensorineural hearing loss. This male was fit with Phonak Supero 413 BTE hearing aids. At his hearing aid follow up he continued to report difficulty communicating in background noise, understanding the television, and communicating on the

telephone. In order to improve in these areas, MLx receivers were coupled to his hearing aids and he was issued a Smartlink transmitter. The following COSI goals were established for the FM trial: (1) improve understanding of his wife at home, and (2) improve ability to hear passengers better in the car. Following a two-week trial with his FM system, he reported that his ability to understand his wife at home was much better and that he could understand what she was saying about half the time. He also reported that his ability to understand passengers in the car was slightly better and again he could understand the passengers about half the time. Although these outcomes seem unimpressive, he reported significant improvements in his quality-of-life given that his hearing loss was so severe.

Case 4:

An 80 year-old male with bilateral profound sensorineural hearing loss. This gentleman reported to the clinic to complete preliminary testing to determine cochlear implant candidacy. He was currently wearing Oticon 380Ps. Given our past success with FM systems and patients with severe to profound hearing loss, this patient was fit with an FM system. Bilateral MLx receivers were coupled to the patient's current hearing aids and he was issued a TX3 handymic to use as his transmitter. Following a four week trial period with the FM system, the patient reported that he was very satisfied with the FM system. He stated that the additional microphone provided comfort and reassurance in difficult listening situations. He also reported that the FM system worked great with the television and improved his ability to communicate with his wife. He also stated that he felt he was doing extremely well with his hearing aids and FM system and that he was no longer interested in a cochlear implant.

Case 5:

An 83 year-old male who was legally blind. This male reported to the clinic because he was unsatisfied with his current ITE hearing aids. This patient had a bilateral mild to profound sensorineural hearing loss. He reported that he lived alone but was socially active in the community. He was having continued difficulty understanding speech in noisy situations, watching television, and communicating at his weekly dinner club meetings with his current hearing aids.

Given his complaints, this patient was fit with his first FM system in 2003. He was fit with Phonak Claro 311 hearing aids bilaterally coupled to bilateral ML8 receivers. He was also issued a TX3 handymic for his transmitter. Following his 4 week FM trial, he reported the following outcomes: (1) able to understand speaker at weekly dinner club meetings 75 % of the time; (2) able to understand one-on-one conversations in noise 95 % of the time, and (3) able to understand television 50 % of the time. Over the last 4 years this legally blind patient reported using his FM system mostly for listening to audio books and portable radio on an everyday basis. He reported that the FM was his best companion and that he would not be willing to give it up.

In 2007 this patient was fit with new Savia Art 311 BTEs and ML9S receivers. He continued to use his TX3 handymic transmitter. The Savia products simplify FM use with the EasyFM option that automatically switches the hearing aids to FM+M mode when the transmitter is turned on. If the patient prefers a stronger FM signal as compared to the hearing aid microphone, the microphone can be attenuated in the software. Following his trial period with the new hearing aids, this patient reported to the clinic with a main complaint that he was unable to deactivate FM with the hearing aid push button or his remote control. After troubleshooting the complaint, the problem was resolved by deactivating the EasyFM function in the fitting software. As previously mentioned the patient used his FM system frequently to listen to books on tape and radio. With his older hearing aids and FM system he was used to keeping his portable radio continually attached to the transmitter via a direct audio input cable. With the new system, specifically the Easy FM function, using the direct audio input cable activated the EasyFM function on his hearing aids, which kept the hearing aids in FM+M unless the portable radio was unplugged from transmitter.

Case 6:

A 66 year-old male who had been wearing hearing aids for 20 years. This gentleman was seen for an FM fitting due to continued communication difficulties. When this patient was seen for his FM follow up he was so impressed with how well the FM system worked in noisy listening environments that he asked if he could use the device to improve is ability to hear and understand conversations over the telephone. He reported that he had avoided using the telephone for many years and that he had imposed on his wife to do all the telephone business. In addition, all family information had to be relayed to him later by his wife because he was not able to understand his children and grandchildren via the telephone.

This patient was wearing Phonak Savia 211 hearing aids with ML9s receivers bilaterally along with using a TX6 Smartlink transmitter. Given his request to improve communication on the telephone, he was ordered a TX4 TelCom transmitter to use for telephone communication. The Telcom connects to both the telephone and any other audio equipment (e.g., television, stereo, computer). The way the Telcom works is that when the telephone rings, the Telcom automatically mutes the audio signal from the television or stereo and transmits the caller's voice clearly and crisply once the telephone handset is removed. When the telephone handset is replaced, the audio signal transmitted to the hearing instruments is returned back to the previous setting. If the telephone call is for another member of the household, the FM user pushes on the top of the TelCom which re-engages the audio signal transmitted from the television or other audio device and the other person can talk on the phone in private. During his follow up for the Telcom system this patient made the following remarks:

"Telephone conversations are better than they have been in 25 years."

"Equipment has improved the quality of my life significantly"

"I had business with a contractor on the phone and was able to use the phone easily. A great improvement!"

"I spent some time today and this evening on the telephone. What a treat it is to actually hear the person on the other end clearly."

"Started the day making some phone calls to family. The TelCom is really effective with the telephone."

"I spent some time today and this evening on the telephone. What a treat it is to actually hear the person on the other end clearly."

Conclusions

In summary, many different types of patients can benefit from FM use. We have found that the communication needs of the patient are better predictors of success than the hearing thresholds. There may be patients with a little or a lot of hearing loss that may do quite well with an FM system. Each individual case may require a different treatment plan, different FM equipment, or different instructions, however, most of the time significant benefit is obtained by all.

Over the last few years we have learned a few tricks of the trade. Below are a few common problems we have encountered in dispensing FM systems as well as some suggestions for resolution:

(1) **Problem:** Avid Smartlink users frequently complain about the battery life, especially if using the Bluetooth option.
Solution: order a car charger or consider a TelCom for home use to give the Smartlink time to charge.

(2) **Problem:** Moving linear users to newer Phonak products prior to FM fitting.
Solution: We have found the Phonak Eleva 411 to be the most pleasing to Phonak Sonoforte or Phonak Powerzoom users. We have also used probe microphone measures to set the programming for the new hearing aid to match the older hearing aid response.

(3) **Problem:** Not all patients can handle the Smartlink transmitter.
Solution: Fit patients who are unable to utilize the Bluetooth function or the remote control options with a Zoomlink transmitter. The simpler transmitter makes using the FM system easier for patients who become overwhelmed quickly by the technology.

(4) **Problem:** FM and FM+M are difficult concepts for patients to understand.
Solution: Give instructions detailing specific listening situations for when to use FM and FM+M. Another option is to attenuate +M for users with EasyFM who fail to grasp the concept so that when the FM system is activated they don't receive as much stimulation from the hearing aid microphone.

(5) **Problem:** As discussed in one of the cases above, EasyFM is not for everyone.
Solution: At follow-up de-activate EasyFM for patients with complaints.

(6) **Problem:** Once you get a large base of FM patients wearing EasyFM, you may have interference between a patient waiting to be seen in the lobby and a patient being seen in the clinic.
Solution: We're still working on this one ...

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