FM Technology Use in Adults with Significant Hearing Loss Part II: Outcomes

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Introduction

Individuals with adult-onset hearing loss benefit from the use of FM systems. Improvements over hearing aid use alone are reported for objective measures of speech understanding in noise (Jerger, Chmiel, Florin, Pirozzolo, and Wilson, 1996; Lewis, Crandall, Valente, Enrietto, and Kreisman, 2001; Boothroyd, in press), subjective measures of hearing handicap (Jerger, et al., 1996) and self-perceived benefit (Boothroyd, in press; Sanford and Kierkhaefer, 2002). While 20 of 28 of the participants in the Sanford & Kierkhaefer (2002) study elected to purchase their FM systems, less than 3% of 180 participants in the Jerger et al (1996) study and none of the 12 participants in the Boothroyd (2003) study indicated that they would use FM systems beyond the study protocol. Indeed, clinical experience and manufacturer report (Ermann, 2003) indicate there is little use of FM systems in the adult population.

There are several possible reasons for minimal use of FM systems by adults. These include: ease of device use (Jerger, et al., 1996), cost of devices (Ermann, 2003), lack of clear cut criteria for determining device candidacy (Ermann, 2003), and lack of "considerable counseling, instruction, and coaching" regarding FM use (Boothroyd, in press). The purpose of this project was to examine the latter two issues, while controlling for device cost by examining the veteran population.[1] Several important considerations for determining FM candidacy in the adult population are described in our companion paper in these proceedings (Noe, McArdle, Chisolm et al., 2004). Preliminary outcomes from a trial period of FM use which included systematic and considerable counseling, instruction, and coaching are presented here.

Methods

Participants

A total of 38 veterans had begun a trial period of FM use with 31 completing the protocol by the date preliminary data analysis was initiated (9/30/03). All participants exhibited at least a moderate to severe hearing loss bilaterally and no physiological or psychological problems that might preclude successful FM use. In addition, all participants had indicated that they experienced a lack of satisfaction with hearing aid use in at *least* one communication situation where FM device use could be beneficial. Detailed information about the participants can be found in Noe et al. (2004).

FM Systems

All veterans were fit binaurally with Phonak MLX or ML8 receivers and utilized a Phonak TX2, TX3, or TX4 transmitter.

Outcomes

Outcomes were measured through the use of three standardized instruments: (1) *Communication Profile for the Hearing Impaired* (*CPHI*; Demorest and Erdman, 1986); (2) *MarkeTrak* survey (Kochkin, 1990); and, (3) *Client Oriented Scale of Improvement* (*COSI;* Dillon, James and Ginis, 1997). The *gold standard* outcome was the decision to keep and use

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[1] Veterans who are eligible for hearing aids through the VHA can receive FM systems at no charge.

the FM systems after the trial period. In addition, to obtain an estimate of the perceived value of the FM system, each veteran was asked how much he would be *willing-to-pay* for the FM device. Willingness-to-pay is a method used by health economists for preference assessment which has been applied to hearing aid intervention (e.g., Chisolm and Abrams, 2001).

Protocol

Veterans were seen in five individual sessions over a 7-week period of time. In the first session adequate functioning of hearing aids was determined and any necessary adjustments were made. Baseline outcome measures were obtained and individualized goals for FM use were determined through the use of the COSI procedure. A minimum of one and a maximum of three goals were obtained for each participant. The second session occurred one week later. In this session the FM device was fit and the veteran was instructed on its use. For each veteran, individualized instructions were provided verbally, in writing, and with picture support describing how the FM system should be used to achieve the first goal. The veteran returned two weeks later for the third session to discuss progress and receive instruction on meeting the next goal. If there was not a second goal then the first goal was reinforced. The fourth session occurred two weeks later. In this session the last goal was introduced if needed and previous goal(s) were reinforced. After two additional weeks of FM use the veteran returned for the final session in which outcome measures were obtained.

Results

Communication Profile for the Hearing Impaired

Eighteen items from the CPHI were utilized to assess self-perception of communication performance in different communication situations. For each item, respondents indicate whether or not they can communicate effectively using a 5-point Likert scale with 1 indicating "rarely, almost never" and 5 indicating "usually, almost always". Responses from the 31 participants who completed the protocol to date are summarized using the five scale scores shown on the horizontal axis in figure 1. Mean responses (+/– 2 standard errors) are shown on the vertical axis. The open bars show mean report of self-perceived communication performance with hearing aid use alone and the shaded bars show the outcomes of the FM trial. It can be seen that scores for all scales increased with the use of the FM system. Indeed, the results of a repeated measures analysis of variance (ANOVA) revealed a significant main effect of device [F (1,30) = 22.60, p = 0.00005, MSE = 78.00]. Collapsed across scales, the mean score for hearing aids alone was 2.44, indicating that that the participants believed they could communicate effectively "about half the time" to "occasionally, sometimes". With the FM system this score rose to 3.44 indicating the participants believed their ability to communicate effectively was now somewhere between "frequently, often" and "about half the time."

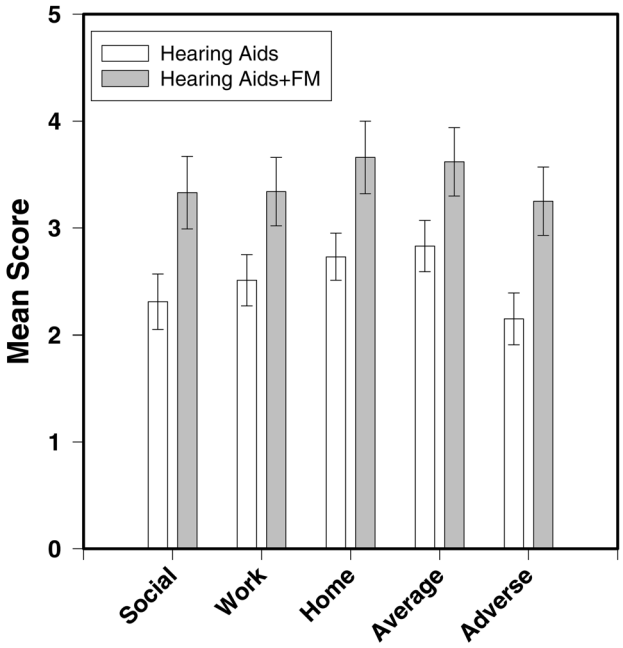

Figure 1. Mean (+/– 2 standard errors) CPHI scale scores.

MarkeTrak Survey

Items were selected from the MarkeTrak survey to assess both *satisfaction with devices in specific listening situations* and *satisfaction with device features*. With regard to *specific listening situations*, participants were asked to rate their level of satisfaction with their devices using a 5-point Likert scale with 1 indicating "very dissatisfied" and 5 indicating "very satisfied" for listening in 12 situations: one-on-one, small groups, large groups, outdoors, concerts,

worship, T.V., music, leisure activities, restaurants, cars, and telephones. Initially data were obtained for satisfaction using hearing aids alone. The proportions of satisfied and dissatisfied participants in each listening situation were compared to the proportions reported in the MarkeTrak VI survey (Kochkin, 2002) using chi-square analyses with alpha set to .05 and Bonferroni corrections for multiple comparisons. Results reveled statistically significant differences in the proportions of satisfied to dissatisfied participants between the two groups for seven of the listening situations: small groups ($\chi^2 = 35.13$, $p = .000$); worship ($\chi^2 = 25.33$, $p = .000$); T.V. ($\chi^2 = 15.44$, $p = .001$); music ($\chi^2 = 19.54$, $p = .000$); restaurants ($\chi^2 = 8.92$, $p = .003$); cars ($\chi^2 = 16.06$, $p = .000$); and telephones ($\chi^2 = 8.86$, $p = .003$).

The proportional data from the participants using hearing aids alone are illustrated in figure 2. The light gray bars show the proportion of participants satisfied and the open bars show the proportion of participants dissatisfied with hearing aid use in each listening situation. The proportion of participants satisfied in each listening situation with FM use is shown by the medium gray bars, while the proportion dissatisfied is shown by the dark gray bars. It can be seen that for all listening situations, the proportion of satisfied participants increased and the proportion dissatisfied decreased when an FM system was coupled to the hearing aids. In all listening situations, except music, the change in the proportions of satisfied to dissatisfied participants that occurred with hearing aid alone to that which occurred with FM use was statistically significant: small groups ($\chi^2 = 17.08$, $p = .000$); worship ($\chi^2 = 12.18$, $p = .005$); T.V. ($\chi^2 = 13.54$, $p = .002$); restaurants ($\chi^2 = 13.89$, $p = .002$); cars ($\chi^2 = 15.76$, $p = .001$); and telephones ($\chi^2 = 18.12$, $p = .000$). For these six listening situations, the satisfaction data for FM use were compared to the data reported in MarkeTrak VI. There was only one listening situation for which there was a statistically significant difference in the proportions of satisfied/dissatisfied individuals between the present participants with FM devices and the MarkeTrak VI respondents with hearing aids. This was for telephone use ($\chi^2 = 8.57$, $p = .003$). While 41% of the MarkeTrak VI respondents were satisfied with telephone use, 68% of the participants in this study were satisfied with telephone use when using their FM devices. We believe this finding is related to the fact that all of the participants who indicated satisfaction with telephone use were utilizing the Phonak TelCom transmitter. The TelCom is specifically designed to route a telephone signal to an FM receiver.

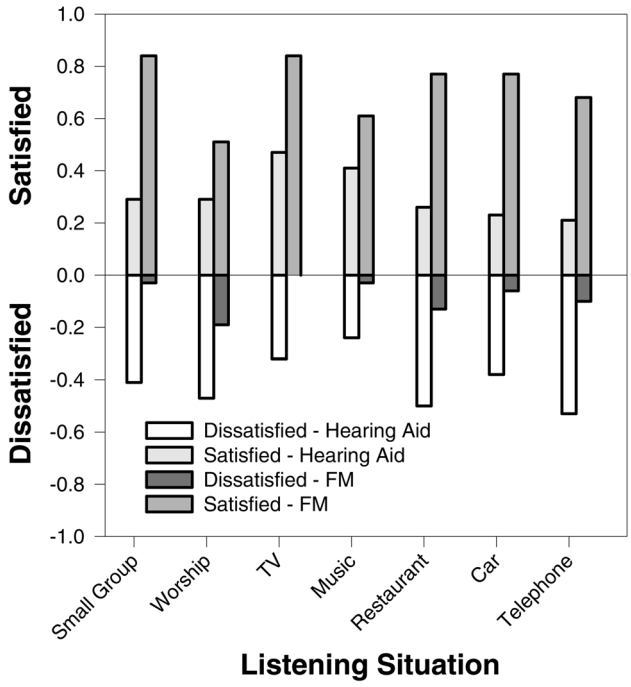

Figure 2. Proportions of participants satisfied and dissatisfied with device use in specific listening situations.

Seven items from the MarkeTrak survey instrument were used to assess satisfaction with the device features by rating satisfaction using a 5-point Likert scale. A rating of 1 indicated "very unsatisfied" and 5 indicated "very satisfied". The device features and percentages indicating satisfaction were as follows: visibility to others (90%), clearness of tone and sound (77%), reliability (74%), improves your hearing (87%), use in noisy situations (48%), sound of your voice (81%), and ability to hear soft sounds (68%). The only feature for which a majority of participants did not indicate satisfaction was for use in noisy situations. While only 48% of the participations indicated they were satisfied with the FM device in noisy situations, only 26% of these participants were satisfied with their hearing aids in noisy situations. Indeed, the MarkeTrak VI data indicate that only 30% of hearing aid users are satisfied with hearing aids in noisy situations (30%).

In addition to assessing satisfaction in specific listening situations and satisfaction with device features, participants were also asked to respond to an

additional item from the MarkeTrak survey. This item asked, "How often do you find yourself embarrassed, ridiculed, or rejected because you wear an FM system?" The majority of participants (90%) indicated that they never found themselves embarrassed, ridiculed or rejected while a much smaller percentage (10%) indicated this sometimes occurred. Perhaps most interesting was that none of the participants indicated that this occurred most of the time or all of the time.

Client Oriented Scale of Improvement (COSI)

The COSI was initially utilized to set a minimum of 1 and a maximum of 3 individualized goals for FM use . At the end of the FM trial period each participant was asked to rate how much better (or worse) he could hear with regard to each goal identified using a 5-point Likert scale with 1 indicating "worse" and 5 indicating "much better". To summarize data across participants, COSI allows for each of the individual goals to be assigned to one of 16 "general categories". All of the goals of the participants fell into the categories of: conversation with 1 or 2 in quiet; conversation with 1 or 2 in noise; conversation with a group in quiet; conversation with a group in noise; TV/Radio at a normal volume; familiar speaker on the phone; and church or meeting. The percentage of participants reporting "better" or "much better" functioning with the FM system as compared to hearing aid use alone for the goal categories was: conversation with 1 or 2 in quiet (83%); conversation with 1 or 2 in noise (94%); conversation with a group in quiet (100%); conversation with a group in noise (71%); TV/Radio at a normal volume (90%); familiar speaker on the phone (83%); and church or meeting (88%).

Decision to Keep FM Systems

To determine if the careful identification of adult candidates for an FM system combined with systematic counseling, instruction, and coaching would increase the uptake rate of FM use in the adult population, we asked each participant if he wanted to continue using the device. Our intent was to examine differences in characteristics and outcomes between those who wanted to continue using the FM systems and those who did not. To date, 31 of the 31 participants who completed the FM trial period chose to continue using the FM devices! Thus we could not examine any factors amongst these participants which might influence the decision process.

Willingness-to-pay for FM Systems

An important consideration in the present study was that participants did not need to purchase the FM systems. The decision to continue use of FM systems after the trial period may have been different had participants been asked to purchase devices. We did, however, ask the participants how much they would be *willing-to-pay* (WTP) for their FM systems. To provide an anchor, the participants were told that the hearing aids they had cost about $4,000 a pair. The range of WTP responses was from $150.00 to $8000.00, with a mean value equaling $2323.10. While this value is somewhat lower than the manufacturer's suggested retail price for two receivers and the transmitters used in this study (approximately $3250.00), about 1/4 of the participants (n = 8) provided WTP values equal to or higher than the manufacturer's suggested retail price.

Summary

The data presented here demonstrate positive outcomes from FM use in terms of improvements in self-perception of communication performance, improved satisfaction with listening in several specific situations, and success in reaching individualized goals. In addition, the majority of participants indicated satisfaction with FM device features and indicated that they were not embarrassed, ridiculed, or rejected because they used an FM system. Although the potential of device cost on the decision to utilize FM systems is in need of further investigation, the data presented provide a strong indication that with the utilization of appropriate criteria for device candidacy (Noe et al., 2004) and a systematic approach to intervention, adults will elect to use FM devices beyond a trial period.

Acknowledgments

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