FM Amplification for Enhancement of Conversational Discourse Skills: Case Study

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Abstract

The purpose of this single-subject pilot study was to examine the efficacy of FM amplification for enhancing the discourse skills of a 4-year-old girl with a history of speech-language impairments, otitis media with effusion (OME), and motoric delays. Over a period of several weeks, language treatment sessions were conducted with and without FM amplification, in a classroom setting. Sessions were videotaped and analyzed for the appropriateness and effectiveness of the subject’s conversational turns during sessions with amplification and with no amplification. Although the number of sessions was small, more appropriate and effective conversational turns occurred during sessions with amplification.

Key Words: FM amplification, otitis media, language

FM amplification for children other than those with sensorineural hearing impairments has been reported as a therapeutic tool in school and clinical settings for preschool and school-aged children (Loose, 1984; Stach et al., 1987; Flexer et al., 1990; ASHA, 1991; Blake et al., 1991; Flexer and Savage, 1993). FM amplification has been shown to increase attending behaviors in children with language-learning disabilities and auditory processing difficulties (Loose, 1984; Blake et al., 1991; Flexer and Savage, 1993) and to enhance awareness of acoustic stimuli for children with language delays and histories of OME (Flexer et al., 1990). Others have advocated and used soundfield amplification and other amplification devices during phonologic intervention (Hodson and Paden, 1991; Gordon-Brannan et al., 1992), and FM amplification has been recommended for children with histories of recurrent otitis media (Ross et al., 1991). Despite these recommendations, few data-based studies have explored the efficacy of FM amplification for children experiencing language impairment.

Otitis media with effusion (OME), one of the most common illnesses of early childhood (Teel et al., 1989), and the hearing loss associated with OME have been linked to language and learning difficulties (Menyuk, 1988). Some studies have shown that children with chronic OME perform more poorly on narrative tasks, have less advanced language skills, and have more difficulties attending than do children without histories of OME (Silva et al., 1982; Roberts et al., 1989; Friel-Patti and Finitzo, 1990). Other studies, however, have not supported this relationship (Wright et al., 1988; Roberts et al., 1991). Psychophysical and electrophysiologic evidence of abnormalities in binaural hearing and brainstem-level auditory processing have also been linked to significant OME history in early childhood (Chambers, 1989; Pillsbury et al., 1991; Hall and Grose, 1993); however, the functional implications of these findings are unknown.

Because FM amplification can help to provide a relatively constant speech signal and improved signal-to-noise ratio, children with histories of OME and associated language difficulties may benefit from the use of these systems. Although gains in academic achievement have been reported for school-aged children using soundfield amplification (Bess, 1987; Flexer et al., 1990), and increased attending has been observed...
in children with OME during language testing using FM amplification (Flexer and Savage, 1993), few studies have examined the advantages of FM amplification for children with histories of OME and language impairments.

One area of language development that affects communicative competence in conversation is pragmatic ability, or the appropriateness with which speech and language are used in varied contexts. Bishop and Adams (1989) identified particular pragmatic and linguistic characteristics of children who have been identified as being pragmatically or conversationally impaired. Characteristics include a tendency to give too much or too little information to listeners, use of contextually inappropriate information, use of unestablished reference items, poor topic maintenance and relevance during conversation, problems with responding to or understanding question forms, and difficulty producing and comprehending extended periods of conversation. The purpose of this single-subject case study was to investigate the use of FM amplification as a means of enhancing appropriate and effective conversational turns for a child with impaired pragmatic ability, a history of OME, and normal hearing sensitivity at the time of the study.

**METHOD**

**Subject**

SB, a 5-year-old female attending a research child care center, participated in the study. She was the product of a full-term pregnancy complicated by mild gestational diabetes. By the age of 14 months, hypotonia, some joint hypermobility, and dyspraxia for gross motor skills motoric delays were noted. Surgery was performed to correct exotropia at the age of 4 years. At the child care center, she received physical therapy and occupational therapy.

At the age of 3 weeks, SB was diagnosed with her first episode of OME and antibiotics were prescribed. At the age of 18 months, tympanostomy tubes were inserted bilaterally. One tube expelled naturally at the age of 27 months and the other was removed surgically. Between 27 and 42 months, SB experienced persistent OME. At the age of 4 years, 9 months, adenoids were removed, tympanostomy tubes inserted, and OME resolved. In total, SB was seen eight times to determine hearing status (four screenings and four threshold assessments). She presented four times with normal tympanograms and normal hearing bilaterally. On other occasions, her hearing sensitivity was characterized by a slight to mild decrease in the presence of flat tympanograms (three visits) and a slight decrease in the presence of negative pressure (one visit). Hearing tests performed at study entry and 3 weeks into the study indicated normal hearing sensitivity.

Prior to the study, central auditory processing was assessed using the speech-in-noise subtest of the SCAN (Keith, 1986) and the ipsilateral and contralateral sentence tests of the Pediatric Speech Intelligibility Test (Jerger, 1984). Performance on both measures was within normal limits. Annual assessment of receptive and expressive communication using the Sequenced Inventory of Communication Development–Revised (SICD-R) between 2 and 4 years revealed age-appropriate scores in receptive and expressive language. At 4 years of age, a mild delay was evident in receptive and expressive communication.

Additionally, at 3 years of age, SB’s pragmatic skills, particularly as they related to discourse, were observed to be functionally impaired in the classroom. SB often required repetitions of questions and directions within the classroom setting before responding appropriately. During classroom discourse, she often did not respond appropriately during conversation with both peers and adults and had difficulty participating in play with peers. Additionally, SB used inappropriate conversational skills such as repeated requests for information that she herself could provide when asked, failure to provide referents, abrupt topic shifts, and inappropriate pauses. SB received speech-language therapy in the classroom at her child care center. For the 1½ years prior to the study, a therapy goal focused on enhancing SB’s conversational appropriateness and effectiveness.

**Classroom Setting**

The classroom was typical of most preschool environments. The floor area was linoleum, three wall surfaces were a hard, plaster-like material, and the fourth wall consisted entirely of windows. There were three teachers in SB’s classroom, and 16 children ranging in age from 2 to 5 years.

SB was seen for language therapy twice weekly for sessions of 20 to 25 minutes. During therapy, the speech-language pathologist (SLP) provided numerous opportunities for a variety of communicative behaviors (e.g., requesting, responding, informing) to be produced by SB.
within a conversational context. To do this, a combination of a milieu (Kaiser et al, 1992) language intervention approach and a responsive teaching approach was employed as the child participated in classroom activities. In milieu therapy, the environment is designed to elicit initiations from the child and all verbal attempts by the child are reinforced and expanded. In responsive teaching, therapy focuses on adapting adult responses to a child's initiations with the purpose of supporting the meaning of the child's initiation while redirecting the manner in which the child expresses intent.

**Treatment Procedure**

Over the 3-month treatment period, a research assistant videotaped 10 minutes of one weekly therapy session using a Panasonic AG 190 camera equipped with an external microphone and time monitor. During the first three sessions, baseline data were collected and no amplification was provided. Over the next eight therapy sessions, FM amplification was alternated, one session on and one session off. The child wore the FM units only when they were activated and this occurred only in the designated therapy sessions.

Acoustic amplification was provided via binaural ear-level FM hearing aids (Sonovation Model LRR 200) fitted to soft, nonoccluding earmolds. To reduce the output to a level appropriate for a child with normal hearing sensitivity, a pair of 4700-ohm earhooks replaced the standard earhooks supplied by the manufacturer. The transmitter/hearing aids were then adjusted to provide a real-ear insertion gain of 7 to 9 dB and a real-ear saturation response of approximately 97 dB SPL. Both the environmental microphones and FM were activated at all times. The amplified signal was consistent with the instrument's typical ratio of FM to environmental input, which resulted in an FM signal approximately 4 to 6 dB higher than that provided by the environmental microphones.

The ear-level FM instruments are larger than the behind-the-ear hearing aids typically used with young children, but they were readily accepted by the subject and there were no problems with retention of the devices. The hearing aid and transmitter were carefully monitored to ensure that the instruments were working properly and that appropriate settings were maintained. Daily listening checks were carried out and electroacoustic analysis was periodically conducted during the investigation.

**Coding and Reliability**

Three speech-language pathology graduate students who were blind to the purpose of the study coded the interactions during therapy. All were familiar with clinical intervention procedures and had previously participated in supervised clinical practicum for children with language disorders. The first author served as the coder-trainer and conducted reliability checks during the experiment. During minutes 1 through 5 of each tape, the coders first identified each conversational turn directed toward SB by the SLP, a teacher, or a peer (e.g., "SB, What is this?"). This turn was transcribed and its function determined to be a request for information (RI), information sharing (IS), or rhetorical (RH).

RIs were defined as questions seeking information (e.g., "Do you want this?", "Tell me about this") and requests for clarification (e.g., "I couldn't hear you"; "You'll have to tell me again"). IS provided information about a person or event (e.g., "That's Tommy's chair"; "I like red play-dough") and included explanations and clarifications (e.g., "No, I need a red crayon not blue"; "I didn't understand you") and information about tasks (e.g., "Let's go get some white paper"; "I wouldn't put that in your mouth"). The RH category was defined as a question or statement that required no verbal or nonverbal response by SB (e.g., repetition of child's turns).

The appropriateness/effectiveness of responses to requests for information was judged based on whether or not SB attempted to provide the requested information and thus whether she completed a successful interaction (Brinton and Fujiki, 1984). Responses were deemed inappropriate/ineffective when SB abruptly shifted topics, did not respond verbally or nonverbally, and when gestures or nonverbal behaviors were unrelated to the requested information. In addition, repetitions of the speaker's question by SB without further request for information were coded as inappropriate/ineffective. The appropriateness/effectiveness of SB's responses to information sharing was based on her ability to maintain a topic of conversation that was established by the previous speaker (e.g., SLP, teacher, peer) (Foster, 1985). Responses were judged inappropriate/ineffective when the focal child did not appropriately monitor possible transition points in conversation for interruption or topic shifts, did not respond verbally or nonverbally to shared information, or used gestures or nonverbal behaviors unrelated to the shared information.
Reliability checks were conducted on the first 2 minutes of each tape on 40 percent of the coded data. Agreement was defined as complete correspondence of each coded category between the observer and the investigator. Mean interobserver agreement was as follows: identity of the speaker/listener (99%), function of the turn by the speaker addressing SB (92%), and judgment of the appropriateness/effectiveness of SB's conversational turns (74%). Verbatim transcription of the previous conversational turn (93%) and of SB's response (85%) were also computed.

RESULTS

Figure 1 shows means for the appropriate/effective conversational turns by session. For these analyses, a total number of possible appropriate/effective turns taken by SB was calculated and a total number of appropriate/effective and inappropriate/ineffective were tallied, and from these a percentage of appropriate/effective turns was computed. The means were computed for preamplification baseline sessions (47%, 64%, 47%), no amplification sessions (41%, 48%, 46%, 68%), and amplification sessions (83%, 68%, 67%, 75%). Overall, more appropriate/effective conversational turns were evidenced during amplification (73%) as compared to no amplification (51%) sessions.

DISCUSSION

Results of this preliminary pilot study suggest that FM amplification may have enhanced appropriate and effective discourse for a child with language impairments and a history of OME. This child was better able to respond and maintain a topic when using FM amplification as compared to the nonamplified condition. Increasing the level of the signal relative to the ambient noise levels may have helped this child follow conversations more effectively.

Our findings are consistent with those of some previous investigators in supporting the effectiveness of FM amplification (Blake et al, 1991; Flexer and Savage, 1993); however, these results should be interpreted carefully for several reasons. First, generalization of results from a single-subject study are inherently limited. Second, there were a total of only eight sessions that alternated between the amplified and nonamplified conditions. The child's conversational turns might have been different had the period of amplification been extended over several consecutive sessions. Third, the child wore the FM system only when the amplification was on so the presence of the FM system may have affected the results. Although it could be argued that the FM system affected others with whom the child interacted or that the coders were biased by seeing it on the child, it is important to emphasize that the coders were unaware of the purpose of the study.

Despite the limited number of data points and the design limitations discussed, the results of this preliminary single-subject study lend some support for the use of FM amplification as a means of enhancing discourse skills—in particular, the appropriateness and effectiveness of conversational turns. Further studies with larger numbers of children over a longer period of time are warranted.

REFERENCES


