



Finding Aspects of Effective Spoken Language Interventions for Children with Cochlear Implants and/or Hearing Aids: An Editorial of Emerging Works

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Abstract

While there is a strong evidence base in the extant literature showing children with hearing loss need intervention in certain linguistic areas, there is limited empirical evidence exposing the actual teaching practices that facilitate efficient learning. As a result, children may not be reaching optimal spoken language outcomes. The principal purpose of this editorial is to present some recent and emerging features of intervention that may improve the spoken language performance of children with cochlear implants and/or hearing aids. In particular, the preliminary effects of using child-performance data to manage outcomes, dual language learning intervention, various components of vocabulary instruction and certain aspects of phonological awareness training are reviewed.

Keywords: Cochlear implants; Hearing aids; Interventions

Introduction

Listening and spoken language programs for children with hearing loss emphasize the development of spoken language by assuring maximum access to sound through hearing aids (HAs) and cochlear implants (CIs), regular exposure to a rich, linguistic environment and encouraging parents to be partners in their child's learning [1]. While many children with significant hearing loss who receive cochlear implants and hearing aids have demonstrated the ability to acquire age-appropriate spoken language skills, the majority of these children also require specialized and individualized teaching by qualified professionals [2-4]. Even with such efforts, there continues to be a language gap at the group level between children with hearing loss and their normal-hearing peers [5-7]. If the goal for children with hearing loss, particularly those developing spoken language, is to develop proficiency that is equivalent to peers with normal hearing, then these children must learn at a rate that is faster than would be expected of children with normal hearing. It is imperative; therefore, that research defines which instructional practices lead to the fastest rates of learning in children with hearing loss. While there is existing evidence in the literature for certain variables of intervention (i.e. early identification, early amplification) and positive prognostic factors (i.e., no other medical issues, educated parents, etc.) that predict future success with hearing technology, many instructional practices are guided by a set of principles established by the Alexander Graham Bell Association for the Deaf and Hard of Hearing and informed by typical development [8]. There is also a strong evidence base showing children with hearing loss need intervention in certain linguistic areas, however; there is limited empirical evidence exposing the teaching practices that are actual active ingredients for efficient learning to occur (E.g. vocabulary, syntax, phonological awareness, dual language, etc). As a result, children may not be reaching optimal spoken language outcomes. While such intervention studies are sparse, there has been a recent emergence in the number of examinations evaluating the effectiveness of intervention strategies and instructional practices which lead to improved outcomes for children with hearing loss. Exploring processes that maximize individualized instruction is important because of the variability in outcomes that can occur in this population. Deaf educators and listening and spoken language specialists need effective and efficient methods that allow them to scaffold and differentiate instruction for this dynamic group of children. The purpose of this article is to bring attention some recent literature, completed by the current author and his colleagues, that exposes some suspected features of intervention that may have the potential to improve the spoken language success of children with cochlear implants and/or hearing aids. In particular, the preliminary effects of using child-performance data to manage outcomes, dual language learning intervention, various components of vocabulary instruction and

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certain aspects of phonological awareness training will be reviewed.

Using Child-Performance Data (Data-Driven Instruction)

In general, it has been the consensus for decades that the most effective interventions for students with disabilities-whether in special education or general education settings-have employed intensive and reasonably individualized instruction, combined with careful, frequent monitoring of student progress [9]. Until recently, there has been no mention in the literature on the effects of such data-driven instruction (DDI) for children with hearing loss compared to those who do not receive DDI in spoken language programs [9]. To study this, in a two year retrospective study, compared 11 matched pairs of children with cochlear implants who attended the same spoken language preschool. One group received DDI and the other did not. Groups were matched with no statistically significant differences for age of hearing device fitting, time in the program, degree of pre-device fitting hearing loss, gender and age at testing.

For the DDI group, daily informal language samples were collected and analyzed over a two-year period, per preschool protocol. Annual informal and formal spoken language assessments in articulation, vocabulary and omnibus language were administered at the end of 3 time intervals: baseline, end of year one, and end of year two. Utilizing a partnership approach, classroom coaches worked with the deaf education teachers who participated in the study for two years to analyze data, develop activities, and implement lesson plans that would help the child meet the selected spoken language objective(s). Teachers also had the opportunity to discuss student learning and design intervention on a regular basis in their shared office spaces and during bi-monthly staff meetings scheduled throughout each school year.

The primary outcome measures of the DDI group were total raw score performance of spontaneous utterance sentence types and syntax element use as measured by the Teacher Assessment of Spoken Language (TASL) [10]. In addition, standardized assessments (the Clinical Evaluation of Language Fundamentals – Preschool Version 2 (CELF-P2) [11], the Expressive One-Word Picture Vocabulary Test (EOWPVT) [12], the Receptive One-Word Picture Vocabulary Test (ROWPVT) and the Goldman-Fristoe Test of Articulation 2 [13] were also administered and compared with the control group.

Results indicated that the data-driven instruction group demonstrated significantly higher raw scores on the TASL each year of the study and significantly higher scores for total language on the CELF-P and expressive vocabulary on the EOWPVT compared to the control group, but not for articulation or receptive vocabulary. Post-hoc assessment revealed that 78% of the students in the DDI group achieved scores in the average range compared to 59% in the control group.

Overall, data-driven instruction is a system of teaching and outcomes management that strives to provide more detailed information about students into the hands of LSL professionals. This type of instruction may not only be effective, but an important “ingredient” to the improved spoken language success of children with cochlear implants and/or hearing aids [9].

Developing Dual Language Capabilities

There are an increasing number of individuals with HL who use CIs and HAs who speak two languages with considerable

differences in agreement in both the research literature and clinical practice regarding recommendations on which spoken language to support in bilingual children with HL who use CIs and HAs [14-19]. Some researchers have found evidence for supporting both spoken languages in bilingual children who have HL and use CIs and HAs [14,16], while other sources are more cautious or even refrain from recommending support of the home language for this population [15,18]. The lack of agreement regarding best practices coupled with the limited amount of research on speech and language skills of bilingual children with HL who use CIs and HAs have prompted studies addressing the issue of whether or not supporting the home language can have beneficial results not only for the language spoken at home but also for the language of the majority culture [14,16].

In particular, [14] conducted a study comparing the language skills of bilingual Spanish- and English-speaking children (from non-English speaking homes) to those of their monolingual English-speaking peers, all of whom had hearing loss and used CIs and/or HAs. The bilingual children in the [14] study all received dual language support, and the authors found that the language skills of the bilingual and the monolingual participants were commensurate. Furthermore, when comparing the Spanish and English language skills of the bilingual participants, the skills were found to be not only comparable, but also highly correlated. The authors concluded that supporting the language spoken at home (in this case, Spanish) for bilingual children who used CIs and/or HAs did not hinder the children’s ability to acquire English.

More recently, in a retrospective study [20], compared the language skills of two groups of bilingual children who used CIs and HAs and received different types of support. One group received support in both of their languages (Spanish and English) while the other group received support in English only. Both groups were from non-English-speaking homes (the home language was Spanish in both groups). The English scores of the children in the dual language support group, as measured by the PLS-5, exceeded those of their peers who received English only support [20]. Concluded that, quality dual language support by qualified and trained professionals has the potential to accelerate majority language learning for children from non-English speaking homes.

Overall, research findings in support of dual language learning suggest that quality language support in both languages early in life is not detrimental to language development in bilingual children with HL who use CIs and HAs. On the contrary, early dual language support for bilingual children may accelerate expressive and total language skills because children with HL learning spoken languages need more rather than less, language input.

In both research studies the bilingual participants with dual language support experienced intervention that was designed to make improvements in both languages. Effective components of this instruction have been described as a coordination of services where bilingual SLPs work with the child and family on their home language on a weekly basis, while deaf educators work with these children on a daily basis in English on parallel lesson plans [21].

Components of Effective Vocabulary Instruction

Despite poor vocabulary outcomes for children with hearing loss, few studies have evaluated the effectiveness of specific vocabulary-teaching methodologies on vocabulary learning for this group. In an

effort to address this paucity in the research [22], investigated how semantic richness of instruction interacts with individual child profiles to influence word learning. A single subject adapted alternating treatments design measured the effects of three semantic richness conditions—Semantically Sparse, Semantically Rich, and Semantically Super Rich—on expressive vocabulary learning at the end of the school week. Across participants, the two most semantically rich conditions (the Semantically Rich and Semantically Super-Rich conditions) related to superior expressive labeling outcomes as compared to the Semantically Sparse condition. This study indicated that inclusion of semantically rich information during instruction, such as linking the new word to other words a child might know, may improve word-learning outcomes. The participating children seemed to learn words more easily if they had additional information that allowed them to evoke imagery, semantic features, or a memory of bodily experience with the new word. Analysis of overall performance, demonstrated that expressive labeling performance was lowest for those children with delayed scores on norm-referenced articulation measures and highest for those with low omnibus language in the super-semantically rich condition. Overall, the authors concluded that the semantic richness of instruction differentially affects the expressive vocabulary learning of children with hearing loss depending on individual child characteristics (e.g. low omnibus language, poor articulation).

Additionally, according to the authors, asking teachers to provide varying levels of semantic information also altered the teachers' word repetition. Post-hoc analysis of the intervention fidelity videos revealed that the teachers produced new words an average of 6.3 times in the Semantically Sparse condition, 9.7 times in the Semantically Rich condition and 10.4 times in the Semantically Super-Rich condition. It was concluded that providing more word repetitions for these children was automatic for teachers when they were instructed to elaborate on new words for children with hearing loss. Overall, the provision of learning opportunities that include physical interactions with a new word paired with increased opportunities for the children to hear the word many times in meaningful contexts appeared to be particularly important for the children in the study; especially for those with low vocabulary knowledge and/or limited listening experience.

Dovetailing on the above study, [22] evaluated a few of the many intervention strategies (increased repetition, increased environmental exposure) promoted to teach vocabulary to children with hearing loss, particularly preschool-aged children [22-24], by comparing three vocabulary instruction conditions: (a) explicit, direct instruction, (b) follow-in labeling, and (c) incidental exposure using an adapted alternating treatments single-subject experimental design. Visual analysis of the results of the data indicated that all 9 participants learned the most words in the explicit, direct instruction condition and the fewest words in the incidental exposure condition. These results were not consistent with some recommendations currently made to educators, however, the authors implications for practice, including emphasis on direct instruction, were discussed and for children with hearing loss, it was concluded that the way in which words are taught matters [25]. The authors recommended that the discouragement of explicit instruction using drill in favor of only incidental teaching experiences may not be the most effective way to rapidly increase the vocabulary knowledge of a child with hearing loss. Instead, explicit instruction paired with opportunities for incidental use of new words throughout the day may better facilitate word learning for children with hearing loss than a one-time-only

incidental input. In this study, direct instruction was demonstrated to be an appropriate way to supplement the learning opportunities of children with hearing loss, particularly if those children are unlikely to learn words through incidental exposure. Although this study provided preliminary evidence that direct instruction is superior to focused, follow-in or incidental input alone, visual analysis of all three forms of input compared in this study indicated that each were likely useful to varying degrees and perhaps necessary for learning and generalizing vocabulary knowledge. The authors suggested utilizing these different approaches of vocabulary intervention when scaffolding instruction versus choosing one over the other; starting with the most effective as demonstrated in this study and moving to incidental approaches perhaps as a form of review and/or reinforcement.

Overall, these two studies find the following aspects of intervention to matter: semantic richness, explicit instruction and scaffolding that allows for increasingly meaningful use of the target words throughout the child's day. Children with hearing loss may be able to learn words more easily if they have additional information that allows a child to evoke imagery, semantic features, or a memory of bodily experience with the new word. Explicit instruction paired with opportunities for naturalistic use of new words throughout the day may better facilitate word learning for children with hearing loss than only naturalistic input (Lund & Douglas, in press).

Phonological Awareness Training

Even though cochlear implants and digital hearing aids have provided increased access to sound for children with hearing loss over the past several decades, their median reading levels by 18-years of age have not increased since the 1970s [26,27]. Literacy outcomes for children with hearing loss (CHL) have been reported to continue to plateau at a median third- to fourth-grade reading level [27]. Clearly, increased access to sound has not led to gains in literacy performance on its own. There is a great need, therefore, to develop effective and efficient literacy interventions for CHL.

In a case report of 9 preschool children, [28] aimed to find features of phonological awareness intervention for preschoolers with hearing loss that could facilitate mastery of PA skills comparable to children without hearing loss. In particular, the authors highlighted issues related to skills that are transferable to mainstream settings (i.e., typical hierarchy of phonological awareness skills trained through spoken language), intervention modifications suspected to be important for CHL (i.e., contrasting continuants vs. stops in the initial position of CV words) and treatment intensity (i.e. short 15 minute lessons vs. 20-30 minute lessons). In this study, authors utilized an evidenced-based intervention that was considered to be transferable to the mainstream setting in that it utilized an existing method demonstrated to be effective for school-aged children with reading delays, in general education settings, who did not have hearing loss. This study also provided additional evidence that modifying PA intervention in a way that offers clarity through maximal contrasting stimuli (i.e. discriminating between two initial sounds, voiceless bilabial stop and voiceless alveolar continuant) can be effective in improving PA outcomes for CHL as opposed to implementing a curriculum without the use of modifications. Lastly, considering fatigue related to hearing loss and a preschooler's capacity for withstanding a lesson longer than 15 minutes, the PA intervention was designed to include 2 five-minute PA activities preceded by a five-minute letter knowledge activity. In just 15 minutes per day, 4 days per week, substantial

gains in PA skills were made across the prekindergarten school year resulting in age-appropriate PA skills, as well as age-appropriate letter and letter-sound knowledge for almost all of the participants across as indicated by the Phonological Awareness Literacy Screening– Pre K.

Overall, it appears, based on this preliminary research, that when designing PA intervention, aspects of effective intervention for preschool children may include the teaching of skills that are relevant to a general education classroom, differentiated in a way that is facilitative to the unique auditory abilities of children with hearing loss and completed in short, 15 minute daily lessons.

Conclusion

Given the performance gap that continues to exist at the group level between children with hearing loss and their normal-hearing person language learning and later reading and writing development, it is vital that effective early interventions be developed and utilized [22]. While more evidence is mounting in the literature, this article has presented a review of some emerging, preliminary evidence aiming to expose the active “ingredients” of effective intervention.

Overall, preliminary results of the literature mentioned in this article indicate possible aspects of effective spoken language intervention to include instruction that is purposefully data-driven, explicit and semantically rich [22,26]. When designing intervention for the population of children with hearing loss who are dual language learners, instruction must be in the languages the child needs to be successful in his/her life. This can be done through a coordination of services implemented by a team of professionals, including the family, who take particular roles in developing each language [20]. Features of PA intervention for preschoolers with hearing loss that could facilitate mastery of PA skills comparable to children without hearing loss appear to include skills that are transferable to mainstream settings, use of modifications suspected to be important for CHL and daily treatment that is short (15 minutes) and spread out throughout the school year [28].

With the goal of developing spoken language proficiency that is equivalent to peers with normal hearing, future directions in research should be aimed at developing recommendations consistent with practices that accelerate learning. A next step in this line of research is to generalize these findings prospectively to larger groups of children with hearing loss using more group-design and possibly multi-center studies. Concerning vocabulary instruction, the finding that articulation related to word-learning outcomes should be further explored [22]. If children with many articulation errors tend to be poorer word learners than other children with hearing loss, individualized instruction may need to reflect that difference. For phonological awareness training, studies are needed that include CHL who are delayed, late-identified and whose PA delays persist, despite evidence-based intervention [28]. Other possible aspects of effective intervention to explore could be the effects of group size and impact of instructional coaches on student learning [25].

Otolaryngologists who consider the information in this paper may be able to enrich their meaningful discussions with interventionists and with families who are in the process of choosing therapeutic and/or educational environments for their children with cochlear implants and/or hearing aids. It is the hope of the author that the certain intervention “ingredients” documented in these studies will, at a minimum, serve as a set of considerations for deaf educators, speech-language pathologists and auditory-verbal practitioners

as they work to design effective spoken language and pre-literacy intervention for preschool children with hearing loss.

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