Critical Review:
Exploring Language Development of Bilingual Children with Cochlear Implants

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This critical review examines the existing literature regarding bilingual language development of children with cochlear implants. Six articles were included in this review. Research designs included four retrospective studies and two prospective studies. Overall, the studies provide suggestive evidence that bilingual children with cochlear implants can acquire age-appropriate language skills and that second language exposure may not impede primary language skills. More comprehensive research for higher quality evidence is needed in this area. Recommendations for clinical practice and future research are discussed.

Introduction

A cochlear implant (CI) is an electronic medical device that can facilitate the provision of a sense of sound to children who have severe-to-profound sensorineural hearing loss bilaterally and they can be implanted in children as young as 12 months. Although the expected primary benefit of receiving CIs is improvement in audition, many secondary benefits such as the ability to acquire speech and language skills are attributed to them (ASHA, 2008). In fact, many profoundly deaf children who have received CIs at a young age have gone on to acquire age-appropriate speech and language skills, commensurate with their normal-hearing (NH) peers (Thomas et al., 2008). Research indicates that achieving these skills often requires some sort of therapeutic intervention, which is often offered by a Speech-Language Pathologists (SLP) and/or Auditory Verbal Therapists (Geers et al., 2011).

Understanding how to teach spoken language to a child with CIs is important and may become more complicated when a child is bilingual (BL). The majority of the existing literature regarding speech and language development of children with CIs and guidelines for clinical practice focus on monolingual (ML) children however, there is an increasing number of bilingual (BL) children with hearing loss (HL) who use a listening device. Clearly, there is a need to further investigate outcomes related to CIs with this population (Bunta et al., 2016).

Currently, the existing literature reports mixed evidence regarding BL language development of children with CIs and guidelines for best practice (Bunta et al., 2016). One prevalent opinion amongst clinicians and educators of the hearing impaired is that exposure to a second oral language might confuse deaf babies (whose auditory and language learning systems were already compromised) and would precipitate further delay in oral language acquisition of the primary language. However, other research suggests that increasing exposure to more than one language may increase the quality and quantity of language input for children with CIs, which may result in beneficial long-term language outcomes (Bunta et al., 2016). Differing opinions also exist regarding which spoken language should be encouraged in the home of BL children with CIs. For this reason, parents often receive conflicting recommendations regarding the language they should support and the best way to do so. (Thomas et al., 2008). Consequently, it is beneficial to investigate BL language development of children post cochlear implantation in order to inform intervention planning and guide clinical practice so that BL children with CIs receive the most beneficial treatment.

Objectives

To review and critically evaluate the existing literature regarding language development of bilingual children with cochlear implants and to determine whether second language exposure influences primary language development.

Methods

Search Strategy

A variety of online computerized databases such as Scopus, CINAHL and PubMed were used to search for journal articles. Search terms included [Cochlear] AND [Implants] AND [Bilingual]. Articles were chosen from search results if they met the criteria for study inclusion.

Reference lists of previously searched articles were also used to obtain other relevant studies.

Selection Criteria

Research studies that investigated bilingual language

development and its associated factors on children with cochlear implants were included in this study. Participants must have had cochlear implantation at age 6 or younger. No limits were set on the study design, demographics, or primary and secondary languages spoken by participants.

Data Collection

The results of the literature search yielded six studies that met study inclusion criteria. This included three retrospective designs, one between-groups case-control study and one single group repeated measures design.

Results

Waltzman et al. (2003) conducted a single group, retrospective examination of oral language development of 18 congenitally profoundly hearing impaired, oral BL children (primary language: 16 English, 2 Yiddish), who had a cochlear implantation at age 5 or younger.

Outcome measures included English standardized tests of speech perception, receptive and expressive language, and a commonly employed informal rating scale of receptive and expressive second language skills, completed by the examiner. It was unknown whether the examiner who rated participants' second language skills was fluent in their second language. Intervention was cochlear implantation at age 5 or younger and preoperative scores were compared to postoperative scores on all measures (3). Results indicated a statistically significant difference on English language scores on all measures. The authors argued that test score comparisons indicated that the majority of paediatric CI recipients showed age appropriate receptive and/or expressive language abilities in their first language when compared to their normal-hearing peers and the ability of some CI recipients to develop second language proficiency in addition to their primary language.

Limitations of the study included the lack of a control group, small sample size, lack of objective data on second language skills and lack of control for variables such as intensity of second language exposure, parental involvement and motivation, multiple disabilities, school setting and language intervention. As well, statistical analyses were not reported in any detail such that tests completed could not be determined. Overall, this study provides somewhat suggestive evidence that BL children with CIs can acquire oral age-appropriate language skills and can acquire varying degrees of second language competency. To the extent that some of these children had age appropriate skills in their primary language and proficient skills in their second language, these results indicate some possibility that learning a second language may not impede primary language development.

Robbins et al. (2005) conducted a single group, repeated measures examination of oral language skills of 12 congenitally, profoundly deaf children, who received CIs at age 3 or younger, across 2 years. Characteristics of participants were reported in detail. Three participants were lost to follow up for unspecified reasons.

Outcome measures included standardized tests of English expressive and receptive language skills and a commonly employed informal rating scale of second language skills completed by the examiner. It was unknown whether the examiner was fluent in the participants' second language. Raw scores were converted to standard scores with norms comparing the child's language skills to those of NH peers. The number of children scoring in the average range on English measures increased over the two years with only one child presenting with impaired language skills at study end. Also, participants' second language skills improved across both years.

Limitations of the study included the lack of a control group, small sample size, lack of objective data on second language skills and lack of statistical analyses to interpret results. It is noteworthy to mention that participants came from high-income families with participants receiving intensive auditory-oral therapy before and after the study, received implantation at an early age and had parents fluent in English, all of which may have allowed a high likelihood to succeed on language measures. Overall, the study provides somewhat suggestive evidence that BL children with CIs can acquire age-appropriate language skills and the ability to acquire continuing second language skills. To the extent that some of these children had age appropriate skills in their primary language and advancing second language skills, these results indicate some possibility that learning a second language may not impede primary language development.

Thomas et al. (2008) conducted a between groups, case control study of oral language development of 24 children who had a cochlear implantation at age 6 or younger (primary language: English). Twelve ML children were matched with twelve BL children on age, age at implantation (+/- 1 year), cochlear anatomy, educational setting and device type. All variables were equivalent amongst matched pairs.

Outcome measures included standardized tests in English, of speech perception, receptive and expressive language skills and an informal rating scale to evaluate English proficiency (completed by examiner) and second language proficiency (completed by participants' parents). Scores were obtained at 6, 12, 24, and 36

months post activation of CIs and were compared between both the ML and BL group, on all measures and across all time frames. Appropriate matched-pairs *t* tests and matched-pairs mixed-model analyses revealed no statistically significant difference between English test scores of the ML and BL group, on all measures and across all time intervals. Also, results from the informal rating scale indicated that most children were in early phases of second language development.

This study had a somewhat larger sample size (n= 24) and an appropriate control group (ML children). Limitations of the study included a lack of standardized measures to obtain objective data on second language skills and a lack of control for background variables that are known to influence language development such as socioeconomic status (SES), intensity of second language exposure and education level of parents. Considering the strengths and weaknesses, the study provides suggestive evidence that children with CIs can acquire knowledge of more than one language and that second language exposure may not impede primary language development (English).

Bunta & Douglas (2013) conducted a mixed, retrospective examination of dual language support versus English only support on oral language skills of 20 BL (Spanish and English) and 20 ML (English) children with HL who had CIs and/or hearing aids (HAs) implanted at age 5 or younger (primary language: English). Participants were individually matched as closely as possible between both groups (ML and BL) on chronological age, type/length of device use and type/duration of intervention. The speech and language intervention that participants received for a year or more were reported in detail, and support provided in English was commensurate between both groups. Participants' English and Spanish language skills before receiving intervention were not reported on.

Outcomes measures included standardized tests in English and Spanish of total, receptive and expressive language skills. Raw scores of all measures were compared between both groups and within the BL group. An appropriate MANOVA analyses revealed no statistically significant difference of English raw scores between groups on all three measures. Comparison of Spanish and English total language raw scores in the BL sample revealed no statistically significant difference and a positive correlation across both language scores.

One strength of this study was the use of standardized tests to measure both languages in the BL group. A major limitation was the study design being retrospective in nature, which hindered the consideration of certain variables (e.g., intensity of language input and details on language use of the participants) and matching for background variables such as maternal education and SES. It is noteworthy to mention that despite having higher maternal education levels in the ML group there were no statistically significant differences found in the language scores between the two groups. Considering the strengths and limitations, this study provides highly suggestive evidence that both languages of BL children with HL can be supported without having adverse affects on the language development of children that use a listening device. To the extent that BL children showed comparable scores across their home language and language of the majority and showed language skills commensurate to their ML English speaking peers, these results indicate a possibility that BL children can acquire second language skills without hindering primary language development.

Bunta et al. (2016) conducted a mixed, retrospective examination of English language skills in 20 BL (English and Spanish) children with HL who had CIs implanted and/or wore HAs at age 5 or younger. The purpose was to examine the effect of receiving English-only support (group 1) or dual language support (group 2) on language outcomes. This study was an extension of the previous mentioned study by Bunta et al., 2013 and used a subgroup from it (BL group receiving dual language support). Both groups were matched on various background variables and received speech and language intervention for a year or more in either English (37.2 months) or English and Spanish (29.8 months). A statistical analysis comparing both groups on background variables revealed no significant group differences and language skills before receiving intervention were not reported on.

Outcome measures included standardized tests in English to measure total, expressive and receptive language skills. The authors did not report on participants' Spanish language skills. Raw scores and converted language age scores of all measures were used to interpret the data which the authors argued was appropriate because the BL group was not considered to be representative of the standard sample (normed on a sample of ML, normal hearing English-speaking children). Non-parametric tests on both raw and language age scores revealed that BL children that received dual language support outperformed their BL peers that received English-only support on total and expressive language but not receptive language.

One strength of this study was that variables such as second language spoken (Spanish only) and maternal education were controlled for and a narrowly defined age range for participants was used. Limitations of the study included the study design being retrospective in nature

and using a small sample size (20 participants). Overall, this study provides highly suggestive evidence that dual language support may be beneficial for BL children with CIs and that it is possible for these children to develop oral proficiency in a second language without impairing primary language development.

Teschendorf et al. (2011) conducted retrospective examination of oral language skills in 93 profoundly hearing impaired children (41 ML and 52 BL) that had cochlear implantation at age 6 or younger. Primary language of all participants was German and for those who were BL, second language was the native language of their parents. Inclusion and exclusion criteria were reported in detail.

Outcomes measures included standardized tests in German of speech perception, expressive and receptive language skills. Tests were administered before implantation and at 6, 12, 18, 24, and 36 months' post implantation. Second language skills were measured using an informal rating scale, which was completed by the parents. The scores of both groups across all time intervals were compared using an appropriate unpaired *t* test and results revealed a statistically significant difference of auditory perception (12, 24, 36 months), receptive language (all time intervals) and expressive language scores (6, 12, 24, 36 months) between both groups. All groups were divided into four groups based on how much intensity of the second language they were exposed to however there were no statistically significant results shown between the 4 groups on all language measures.

This study used a large sample size however, factors that may have influenced the language development of participants were not controlled for such as, SES of the parents, educational status, intensity of exposure to both languages, and English skills of the parents. Furthermore, second language skills and degree of exposure to second language were not objectively measured. From the BL group, 14 children were reported to be exposed to their native language rarely (>25%), which lowers validity of the BL sample. Overall, this study provides somewhat suggestive evidence that BL children with CIs may develop age appropriate language skills, and that second language exposure may impede primary language development.

Discussion

The objective of this review was to critically evaluate the existing literature regarding language development of BL children with cochlear implants and to determine whether second language exposure influences primary language development. Two studies reported that BL children with CIs showed age appropriate receptive and/or expressive language skills and an ability to develop second language skills. Three studies reported that second language exposure is not detrimental to primary language acquisition. One retrospective study found that BL children with HL and CIs did not perform as well as their ML peers with HL and CIs, on all measures of spoken language, suggesting possible detriment.

Despite the highly consistent findings across the majority of studies, the results of one retrospective study by Teschendorf et al. (2011) suggested that it may be detrimental to support two languages, as they found that children growing up in BL homes underperformed when compared to their ML German speaking peers on expressive and receptive language tests. However, this may have been due to several methodological discrepancies of the BL group such as lack of control for background variables known to influence language development such as, SES of the family, degree of second language exposure, living environment, motivation of the parents, integration of parents, compliance to rehabilitation and educational differences. It is also noteworthy to mention some parents of the participants had been counselled to speak solely in German (language of the majority culture) with their child, although it wasn't the parents' first language. This may have been a possible explanation for the BL group's poorer results on German speech and language skills and lower ratings for second language skills. Overall, results were inconclusive in regards to whether the difference in scores was because of the children being bilingual or lack of control for certain background variables.

There were inconsistencies found between the studies, which may have been a result of various factors. Several studies were retrospective designs (4/6), which limits the ability to consider desired variables. Many of the studies also lacked control for background variables that are known to influence language development such as home environment, intensity of language exposure, education level of the parents, degree of intervention and SES. Five of the studies used a small sample size limiting the generalizability of findings. Also, inconsistencies may have been due to general discrepancies between participants as studies had children coming from a special population subject to variability in hearing. Participants often had wide age ranges and came from varying environments that spoke a variety of first and second languages. Some variability may have also have been due to differences in methodological approaches. Various types of standardized tests were used and most studies used an informal rating scale to evaluate participants' second language skills. Also, participants were often compared to NH peers, which may not be an

appropriate comparison. Findings of overall language skills were often drawn from primary language skills instead of total language skills (considering first and second language skills). Out of the six studies one lacked use of appropriate statistical analyses and another study did not report on the type of statistical tests that were run.

Previous studies have indicated the benefits of BL language development. For example, research suggests that it might be socially, economically, professionally, and personally harmful to deprive a child of the benefits of learning the second language to which they have been exposed to since birth (Genesee, 2003). Other studies have also indicated that bilingualism has been found to have a positive effect on a child's ability to judge grammar, substitute symbols, and increase their metalinguistic awareness (Teschendorf et al., 2011). Furthermore, if parents are not fluent in the primary language of the culture then speaking in their home language may provide a language rich environment, which is crucial for language development in the early years of a child's life, especially for children with CIs who may already be delayed. This may be important to consider as clinicians instructing parents who are not fluent in the language of the majority culture to only speak that language may cause parents to limit language use with their children and may deprive the child of opportunities to grow his or her language skills (Bunta et al., 2013). By supporting both languages clinicians can facilitate the ability of children to communicate across linguistic environments, avoiding certain social and personal costs (Genessee, 2008). Furthermore, valuing and supporting a child's home language may reduce caregiver stress, facilitate continuance of the family-child bond, and encourage richer language exposure (Rhoades & Chisolm, 2000). Outcomes can be beneficial when both the home language and the language of the majority culture are supported as Bunta et al. (2013) demonstrated in their study. Overall, there was no conclusive evidence suggesting that second language acquisition is detrimental to primary language acquisition and most evidence is suggestive that children with CIs have the ability to acquire varying degrees of second language skills in addition to primary language skills. This is consistent with BL, NH children (Waltzman et al., 2003). Lastly, a common theme considered by all researchers of reviewed studies was that the proficiency levels of both languages are contingent on the degree of intensity of intervention in both languages, importance to the parents, living environment, integration of the family, compliance with rehabilitation program, and length of implant experience.

Future research considerations:

Future research is highly recommended to further understand bilingual language development of children with cochlear implants and to strengthen the current evidence. This will benefit confidence levels to apply research findings to clinical practice. The following recommendations should be considered in future studies to strengthen the level of evidence:

- Study designs that offer a stronger level of evidence (e.g., prospective experimental designs)
- Use of more control groups and control for background variables in order to come up to conclusive evidence.
- Use of larger sample sizes in order to increase generalization
- Following the participants longitudinally in order to investigate how their speech and language skills develop over time.
- Use of standardized measures to evaluate second language development
- Investigating specific elements of speech and language skills (e.g., phonological skills, morphology, syntax)
- Comparing findings to samples that are normed on children with hearing loss

Clinical Implications

Given that the evidence is suggestive clinicians should be cautious when implementing the results into their clinical practice. Nevertheless, current evidence would lead clinicians to refrain from recommendations that limit parent's intentions to provide a bilingual exposure for children with CIs.

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