Speech production in Spanish-English bilingual children with cochlear implants

Speech acquisition is crucially hinges upon the quality and quantity of environmental input (Barnes, Gutfreund, Satterly, & Wells 1983; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Shneidman, & Goldin-Meadow, 2012). Being exposed to two different languages limit the total amount of input as well as the quality of input that children receive for each language (see a review in Flege, 2012). Severe hearing impairment corrected by implanting artificial cochlear also inevitably and profoundly affects the quality of input (Friesen, Shannon, Baskent, & Wang, 2001; Sarant et el., 2001). In the present study, we investigated the combined effect of bilingualism and cochlear implants (CI) in Spanish-English bilingual children with CI. More specifically, we compared the speech of 12 Spanish-English bilingual children with CI, 12 monolingual English-speaking peers with CI, and 20 bilingual normal-hearing (NH) peers to determine how bilingualism and CI impact children's speech production differently. We focus on fricative and affricate productions as there exists shared sounds between the two languages and these sounds are also error-prone and late-acquired even for monolingual normal-developing children. Three acoustic parameters were examined, which characterize the fricative and affricate distinctions between /s/ and /ʃ/ in English, and between /s/ and /tʃ/ in English and Spanish. These acoustic parameters are duration, rise time, and centroid frequency of the frication noise. Overall, monolingual and bilingual children with CIs produce well-contrasted fricatives and affricates in both languages in a way similar to normal hearing children. These findings indicate the effectiveness of the artificial procedure in satisfactorily restoring the language-learning capacity and enabling bilingual children to function in both languages approaching to their normal hearing peers. However, bilingual children with CIs are less able to maintain two separate language systems and experience more cross-language interference when comparing with their normal hearing peers. For instance, bilingual children with normal hearing produce /s/ with longer duration and longer rise time in English than in Spanish, whereas bilingual CI children do not demonstrate such a language-specific pattern in their production. In addition, we also noted a more robust Spanish /s/-/tʃ/ distinction in duration and rise time for CI children than NH children. We speculate that the larger acoustic distance between these two sounds in CI children may be related to the greater English exposure they receive during the rehabilitation therapy. In summary, our study contributes significantly to the current knowledge base of CI children's speech ability and in particular unveils the complex interplay between bilingualism and cochlear implant and further highlight the constraint of input on language acquisition.

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