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Cochlear Implants, Hearing, Speech, and Language

Ching, T., Cupples, L. & Zhang, V. (2022). Predicting 9-Year language ability from preschool speech recognition in noise in children using cochlear implants. Trends in Hearing (Volume 26 – January-December) https://journals.sagepub.com/doi/full/10.1177/23312165221090395

The importance of speech perception in early language development is well established and as such, it is not surprising that children with hearing loss perform below their typically hearing peers on assessments of spoken language. However, what is missing from the literature is clear evidence for a longitudinal relationship between early speech perception abilities and later language skills in deaf children. To address this gap, Ching et al. examined the impact of both early speech perception on later language ability, and of early language on later speech perception in children using cochlear implants. They drew on data from 56 children with CIs, collected as part of the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study, using the data collected at 5 years of age for predicting outcomes at 9 years of age.

Findings indicate that preschool speech perception in noise is a significant predictor of language ability at school age, after controlling for the effect of early language. This longitudinal relationship between pre-school and school age children aligns with theoretical models of native language acquisition emphasizing the critical role of speech perception in early language acquisition. The authors suggest that children who have hearing-in-noise deficits from their early years, experience difficulties in language development partly because they receive impoverished language input in typically noisy, everyday situations, and partly because they are less proficient in acquiring language through incidental hearing- a difficulty exacerbated in noisy classroom environments.

Key Insights: Given the demonstrated relationship between early speech perception in noise and later language abilities, the authors note that the focus in early intervention should not be limited to developing good language skills, but also on enhancing auditory abilities for listening to speech in noise. They suggest that "these findings lend support to the use of noise-reduction technology and remote microphones not only at school age in formal schooling environments, but also at a young age in early childhood centres and at home."

The complete article can be accessed at:
https://journals.sagepub.com/doi/full/10.1177/23312165221090395

2. Cochlear Implants and Literacy Development

Wang, Y., Sibaii, F., Lee, K., Gill, M. J., & Hatch, J. L. (2021). Meta-analytic findings on reading in children with cochlear implants. *Journal of Deaf Studies and Deaf Education, 26*(3), 336-350. https://doi.org/10.1093/deafed/enab010

Wang et al. conducted a meta-analysis with data from 47 published articles to examine the difference in reading achievement between deaf students with cochlear implants and their typically hearing peers, as well as between cochlear implant and hearing aid users. Specifically, comparisons between students with cochlear implants and their hearing peers were based on data from 43 independent samples that represented approximately 900 cochlear implant users and nearly 2,500 hearing peers. Analyses comparing cochlear implant and hearing aid users were based on data from 19 independent samples and represented essentially equal numbers of students, with over 400 participants in each group.

Comparisons conducted as part of the meta-analysis included phonological awareness, decoding, fluency, vocabulary and reading comprehension. Findings indicated that students with cochlear implants scored statistically significantly lower than their typically hearing peers in all areas except fluency. There were no statistically significant differences in scores between cochlear implant and hearing aid users apart from phonological awareness where implant users had lower achievement. However, it must be underscored that although the cochlear implant users performed below their hearing peers, *their scores still indicated achievement in the average range*. As such, the authors note that the findings from this study confirm a positive shift in literacy outcomes for deaf students with cochlear implants.

Key Insights: Although as a group, deaf students with cochlear implants evidence reading outcomes statistically lower than their hearing peers, they are achieving in the average range (i.e., age-appropriate performance). This is a profound improvement from the outcomes historically reported for this population. However, more research is needed not only to document how these students are doing, but to identify the factors that influence outcomes and the nature of the pedagogical attention required to best support them in learning to read and maintaining this performance over time.

The complete article can be accessed at:

https://academic.oup.com/jdsde/article/26/3/336/6276256

3. Cochlear Implants and Social-Emotional Development

Krysztofiak, M. & Pluta, A. (2021). Theory of mind development in deaf children with cochlear implants: Literature review. Journal of Hearing Science 11(2), 9-18.
https://doi.org/10.17430/JHS.2021.11.2.1

Theory of Mind (ToM) is typically defined as the ability to attribute mental states (e.g., thinking, knowing, feeling) to oneself and others. By recognizing that others have beliefs, thoughts, and emotions that may differ from our own, we can begin to understand and appreciate the actions of others and the possible reasons for their behaviours. ToM must also be recognized as a multidimensional concept characterized by a developmental progression over time with the foundational skills laid down in early life and becoming more advanced during the school years. It is by about four years of age that children can pass false belief tasks – the most commonly-used measure for explicitly assessing ToM.
Given the established link between language and ToM, it has been suggested that delays in language development account for reported delays in ToM development in deaf children. In this review, Krysztofiak and Pluta summarize existing research on the development of ToM in deaf children with cochlear implants who use spoken language with an emphasis on describing the influence of language (vocabulary and syntax). An additional aim is to consider the environmental factors that impact development.

In summarizing their review, they note that although results of studies are mixed, the majority report delayed performance on ToM tasks relative to typically hearing peers. Factors impacting performance included age at implantation, language skills, access to conversations about mental states, family correlates and executive functions. These are discussed in detail in the paper. They conclude by positing suggestions for supporting and facilitating the development of ToM such as conversations targeting mental state terms, book sharing, role play, and thought and speech bubbles.

Key Insights: The findings from this review underscore the critical role that language and early access to language play in the development of ToM for deaf children with cochlear implants. An important take-away message is that parents, clinicians and educators implement strategies to support the development of ToM. As the authors note, "It is not deafness per se, but rather delayed spoken language development and restricted early access to abstract mind-related discourse, that are the key factors explaining ToM delays."

The complete article can be accessed at

https://doi.org/10.17430/JHS.2021.11.2.1