ABSTRACT

This study is an investigation of the early development of speech-language and executive-organizational skills in preschool users of cochlear implants over a 1-year period. Nineteen children aged 3-5 years who were deaf at birth and received cochlear implants prior to age 3 completed measures of speech perception, receptive vocabulary, and executive-organizational skills at two visits separated by one year. Several correlations with medium or larger effect sizes were found between executive functioning and speech-language skills over the 1-year period. Receptive vocabulary at baseline predicted attention skills one year later, and parent-rated working memory behavior at baseline predicted later receptive vocabulary skills. Speech perception skills at baseline predicted visual-motor integration skills one year later. Results demonstrate longitudinal associations between executive functioning and spoken language skills in deaf children with cochlear implants.

BACKGROUND

Coehlear implantation restores some attributes of hearing and spoken language to many children with profound hearing loss. However, early auditory deprivation and language delays have downstream neurocognitive effects on sequential processing, representational specificity, and functionalized language, ultimately affecting executive functioning (Pisoni et al., 2010). Conversely, executive functioning is critically important for the development of spoken language skills, which are significantly delayed in children with cochlear implants. Executive functioning abilities may therefore account for some of the enormous variability observed in spoken language outcomes in children with CIs, offering the possibility for better understanding of individual differences in spoken language development and motivation for the development of novel interventions (Pisoni et al., 2010). Long-term users of CIs score lower than normal-hearing (NH) children in three areas of executive functioning: verbal working memory, inhibition-concentration, and facility-speed (Kronenberger et al., 2010), and these deficits are present as early as preschool ages (Bier et al., in press). In this study, we sought to investigate the relationships between executive-organizational functioning and speech language development over a 1-year longitudinal period in a sample of preschool-aged children with CIs.

REFERENCES


METHOD

Participants: N=19 children with cochlear implants
Mean age=3.9 years (SD=0.8); 6 female, 13 male; age at implant 10-36 months (mean=18.0, SD=7.6)
All deaf at birth, best ear pre-implant PTA mean=102.7 dB HL (SD=11.7), range=82-118
Procedure
• Tested first at age 3 (N=14), 4 (N=2), or 5 (N=3) years and then one year later
• Average years between testing=1.03 (SD=0.19)
• Measures
• Speech-Language: Receptive Vocabulary: Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4; Dunn & Dunn, 2007)
• Speech Perception: Lexical Neighborhood Test (LNT; Kirk et al., 1995)
• Executive Functioning/Memory
• Visual Memory: NEPSY-2 Memory for Designs (MD; Korkman et al., 2007)
• Controlled Attention/Concentration: Leiter-R Attention Sustained (AS; Rodi & Miller, 1997)
• Visual-Motor Organization-Integration: Beery Test of Visual-Motor Integration (VMI; Beery & Beery, 2010)
• Working Memory (parent-report): Behavior Rating Inventory of Executive Function Working Memory subscale (BRIEF-WM; Gioia et al., 2000)
• Statistical Analysis
• Pearson correlations between measures at same time period and across 1-year time period

RESULTS/DISCUSSION

• Results
• Baseline working memory (BRIEF) significantly predicted receptive vocabulary (PPVT) one year later
• Baseline receptive vocabulary skills (PPVT) significantly predicted attention skills (Leiter Attention Sustained) one year later
• Speech perception skills (LNT) at baseline predicted visual-motor integration skills (VMI) one year later
• Non-significant (p<0.10) correlations of moderate effect size were found between:
• Baseline visual memory and Time 2 receptive vocabulary
• Baseline receptive vocabulary and Time 2 visual memory and working memory
• Baseline speech perception and Time 2 visual memory and attention
• Discussion
• Results demonstrate longitudinal associations between executive functioning, memory, and spoken language skills in preschool-aged children with cochlear implants
• These findings are consistent with theories proposing that early executive functioning and spoken language skills have reciprocal influences on long-term outcomes following cochlear implantation
• Future research with larger sample sizes is needed to provide sufficient power to detect statistically significant moderate effect sizes and to test path models that control for baseline scores