Describing Patterns of Spoken Language in Children with Down Syndrome Following Parent-Coached AAC Intervention

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Introduction: Children diagnosed with Down Syndrome (DS) often exhibit a delayed speech profile during the first few years of life and persistent difficulties with phonological processes. These difficulties may be due to one or a combination of the following factors: common hearing loss, differences in cranial-facial anatomy, cognitive abilities, and language environment. Some of these children may use augmentative and alternative communication (AAC) to augment their language development. Speech Generating Devices (SGDs) are a type of AAC that couple picture symbols or text with digitized, or synthesized speech. When AAC in the form of an SGD is used in early intervention, it provides not only a means of communication, but also a consistent mode of production via digitized or synthetic speech. SGDs provide an acoustically consistent form of the target vocabulary, which may allow for the child to pay more attention to target vocabulary and provide opportunity for vocal imitation. Despite research evidence demonstrating the benefits of AAC for developing language and speech skills, hesitation persists for parents and professionals in using this method with the fear that spoken-verbal communication will be hindered. Accordingly, this study will investigate children with DS to 1) describe their speech-sound development after participating in parent coached AAC intervention and 2) investigate if there were differences in articulation accuracy across different intervention groups among children with DS.

Method: One-hundred and thirteen children completed the parent-coached intervention, and 49 children produced spoken target vocabulary words. Eleven of the 49 children had a primary diagnosis of Down syndrome. The current study investigates the spoken target vocabulary words of the 11 children with Down syndrome. The data for this study were gathered from two larger studies. Children were recruited to the original studies based on the following criteria: a) 24 to 36 months of age at the beginning of recruitment; b) an expressive vocabulary of less than 10 intelligible words; c) significant expressive language delay (i.e., less than 12 months on the Mullen Scales of Early Learning; d) indication of intentional communication (e.g., intentional gestures, joint attention, vocalizations, physical manipulation); e) upper extremity gross motor control to access symbols on the speech generating device (SGD); and f) primary diagnosis other than delayed speech and language skills, hearing/vision impairment, or autism. Participants were randomly assigned to one of four intervention groups: spoken communication intervention (SC-I), augmented communication output (AC-O), augmented communication input (AC-I), and a hybrid augmented communication input and output (AC-IO). We examined Systematic Analysis Language Transcripts (SALT) transcripts from session 24 to determine if each child produced spoken target words. Each spoken word was transcribed using the International Phonetic Alphabet (IPA) and analyzed for accuracy/ errors (i.e., percent of phonemes correct (PPC), final consonant deletion, substitution, cluster reduction, vocalic /r/, vowels, and other errors).

Results: Overall, children with Down syndrome produced 82 percent of phonemes in target vocabulary words accurately. Individual phoneme analysis revealed, children with DS produced more cluster reduction errors ($M = .88, SD = 1.36$) than final consonant deletion ($M = .13, SD = .35$), substitution ($M = .13, SD = .35$), vocalic /r/ errors ($M = .38, SD = .52$), and another types of errors ($M = .13, SD = .35$). We found no significant differences between intervention groups for PPC, $H(3) = 4.375, p = .22$ or any of the error types. Additionally, we examined correlations of baseline measures (i.e., receptive language, vocal imitation, and unintelligible vocalizations) and session 24 measures (i.e., percent of phonemes correct and unintelligible vocalizations). The number of unintelligible words at session 24 was significantly correlated with the PPC at session 24, $r = -.71, p = .05$. This suggests that as PPC increases, the number of unintelligible words decreased. We also compared the DS group to the larger subset of children with heterogeneous diagnoses who produced spoken target vocabulary words ($n = 38$). There were no significant differences between the groups for types of errors (e.g., Cluster reduction, $U = 98.5, p = .61$; PPC, $U = 115, p = .92$). Similarly, among the children with spoken target vocabulary output there were no significant differences between children with DS and children with other diagnoses on the baseline factors of receptive language, vocal imitation, and unintelligible utterances, $U = 171, p = .68$, $U = 214, p = .49$, and $U = 217, p = .44$ respectively.

Discussion: Overall, this study suggested that there were limited articulation errors made across all intervention groups at the conclusion of intervention. Additionally, the majority of speech sound difficulties were age appropriate (i.e., cluster reduction). These results confirm prior research that young children with developmental disorders beginning to speak produce developmentally appropriate speech-sound errors. Comparisons among children who produced spoken target vocabulary words suggest that although children with different etiologies may develop different speech profiles, early in speech development they have similar speech sound errors. Lastly, these findings support that children with DS who participated in AAC interventions did not exhibit significantly more errors than children in the SCI group in which speech was the focus of the

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intervention. Thus, intervention specifically targeting spoken language may not yield better accuracy of spoken target vocabulary words compared to AAC interventions. This adds to the literature that supports AAC as a means of early intervention, and disputes the idea that AAC may cause some detrimental effects to speech-sounds development.

References/Citations: