

Impact of Speech treatment and Auditory Feedback training with Forbrain for Children with Speech Sound Disorder.

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Five to eight percent of all children in the United States have a speech sound disorder (SSD). Children with SSD have difficulty producing sounds of their target language system. Some of these children also have difficulty perceiving and categorizing speech sounds. It is presently unknown what underlying mechanisms might account for the communication problems children with SSD encounter. One possible explanation is that children with SSD cannot produce speech sounds correctly because they have poorly specified phonological representations, which are the result of inaccurate speech sound perception. Thus, speech sound production errors may stem from imprecise speech perception and its resulting sparse phonological representations.

We propose to use electrophysiological measures (event-related potentials, ERPs) to examine how phonological representations and their associated auditory sensory responses change in conjunction with two traditional speech treatment approaches: one that does and one that does not involve auditory feedback with Forbrain®. A better understanding of phonological representations and the auditory sensory system in children with SSD will inform how speech evaluations and treatment are best conducted by speech-language pathologists.

Our major objective is to characterize how traditional speech treatment (with and without auditory feedback with Forbrain®) alters the auditory neural responses to sounds targeted in treatment. Since SSD has a relatively high incidence, a good understanding of its underlying nature can inform its clinical management, which could ultimately improve the lives of the affected children and their families. Specifically, children who receive treatment for their SSD have better long-term social, academic, and communicative prognoses than those who do not receive treatment. Here, we propose to use ERP measures to assess auditory sensory processing of speech syllables in children with SSD.

Aim: To assess how ERP auditory sensory responses evoked by English syllables change over time. This will allow for a better understanding of how the neural mechanisms associated with speech perception in SSD change after a period of traditional speech treatment, or intervention that combines traditional treatment and auditory feedback. *It is predicted that the speech treatment program that includes auditory feedback with Forbrain® will enhance the phonological representations of children with SSD above and beyond what occurs with traditional treatment alone, resulting in ERP amplitude and latency waveform changes.*

Treatment:

Speech sound treatment for children with SSD. Treatment will follow proven Evidence-Based Practice (EBP) methods of previous treatment studies of children with SSD (Cummings & Barlow, 2011; Gierut et al., 1996; Gierut & Morrisette, 2010; Morrisette & Gierut, 2002). A single-subject staggered multiple baseline design will be used in this treatment program, as it has been shown to be useful in the study of treatment of communicative disorders (Connell & Thompson, 1986; McReynolds & Kearns, 1983; McReynolds & Thompson, 1986). Following procedures for this design, the children with SSD will be randomly assigned to one of two treatment conditions: traditional speech treatment alone (Tx) or traditional speech treatment with auditory feedback training via Forbrain® (AFTx). Every child will be evaluated in a baseline period in which no treatment was provided, followed by speech treatment.

Consistent with efficient and effective Evidence-Based Practice procedures used previously by the PI (Cummings & Barlow, 2011) and others (Gierut et al., 1996; Gierut & Morrisette, 2010; Gierut & Neumann, 1992; Gierut, 1992; Morrisette & Gierut, 2002), treatment will be delivered in two phases: Imitation and Spontaneous Production. Treatment will be provided two times weekly in 1-hour sessions, for up to 14 sessions. Each treatment sound will be targeted through the production of five words that will be initially introduced to the child using a storybook reading format. During the Imitation phase of treatment, each child will be shown a picture of the target word and will be asked to repeat the clinician's verbal model until achieving either a pre-established performance- or time-based criterion, whichever comes first. Specifically, imitation treatment will continue until a child maintains 75% accurate production of the treated phoneme over two consecutive sessions (i.e. performance-based criterion) or until seven consecutive sessions are completed (i.e. time-based criterion) (Gierut et al., 1996). During the Spontaneous Production phase, each child will produce the treated phoneme without a model. In other words, the words targeted in treatment will be elicited by having the children name pictures, label objects, retell stories, and so on. This phase of treatment will continue until the child maintains either a performance-based criterion of 90% accurate production of the treated phoneme over three consecutive sessions, or a time-based criterion of seven consecutive sessions, whichever comes first (Gierut et al., 1996). It is expected that children will spend approximately 3 months in treatment.

Auditory feedback training for children with SSD. Half of the children with SSD will receive auditory feedback via Forbrain® during their twice-weekly speech treatment sessions. Each child will wear the Forbrain® device for 20 minutes during each treatment session. Specifically, the child will put on the Forbrain® device immediately after the reading of the treatment story and then wear it continually for the subsequent 20 minutes of treatment. This selected period of time in treatment sessions typically involves the shaping/elicitation of the treatment sound in isolation, as well as the production of the treatment words in drill play activities. Once the Forbrain® wear-time is complete, the child will remove the device for the remainder of the treatment session.