Critical Review:
Effectiveness of LSVT LOUD in Children with Dysarthria Secondary to Cerebral Palsy

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Approximately 80% of individuals with cerebral palsy have an accompanying motor speech disorder, such as dysarthria, which greatly affects the clarity, audibility, and intelligibility of their speech (Reed et al., 2017). This critical review examines the current evidence base regarding the effectiveness of Lee Silverman Voice Treatment (LSVT) LOUD in children with dysarthria secondary to cerebral palsy (CP). Studies include single-subject, between group, and mixed-group designs, examining both the therapeutic effects and physiological brain changes found immediately after, and several weeks following treatment. The evidence gathered from this review is both suggestive and promising. Recommendations for future

Data Collection

Results of the literature search yielded five articles which included the above selection criteria. One study used a single-subject design, two included a between-group design, and two articles used different measures to analyze results from the same mixed non-randomized clinical trial.

Results

Single-Subject Design

Single-subject designs are an appropriate starting point for testing hypotheses interested in examining possible treatment effects. It is also considered appropriate as the population size of children with spastic CP and dysarthria is relatively small. Caution should be taken when interpreting results due to the small sample sizes.

Boliek and Fox (2012) conducted a phase 1 treatment study using a nonconcurrent multiple baseline single-subject design with replication across subjects in order to examine the therapeutic effects of LSVT LOUD in children with spastic CP and dysarthria. Four children between 5 and 7 years of age with a medical diagnosis of spastic CP underwent a full dose of the LSVT LOUD protocol, consisting of 4 one-hour sessions a week for 4 consecutive weeks, for a total of 16 treatment sessions. Outcome measures on parent rating forms, listening, voice, and speech tasks, were taken over at least 4 baseline recordings (BASE), as well as 1-week following treatment (POST), and again 6-weeks following treatment (FUP). Results indicated listener preference for POST over BASE data for all participants, as well as improved parent ratings from BASE to POST. All participants also demonstrated gain in at least one acoustic measure. Maintenance of gains at FUP varied across participants.

Despite large heterogeneity in this population, the authors attempted to control for age, sex, ability to follow directions, vocal fold pathology, medication stability, velo-pharyngeal incompetence, structural disturbances of the speech mechanism, concomitant speech disorders, and maturational changes during the study period. This does limit their participant pool as it reduces the participants to those with CP and dysarthria without additional factors or disabilities which may affect treatment outcomes and that many children with CP and dysarthria may not have. As such, this also helps with generalizability of findings, as many of the varying factors in this participant population have been controlled for. To account for these factors, the researchers included an age- and sex- matched control group of typically developing children, as well as one untreated child with CP. All participants with CP also presented with a similar dysarthria severity level, making generalizability of findings specific to moderate severity, however the authors did not state this. Moreover, Boliek and Fox (2012) outlined their treatment protocols, outcome measures, and analysis procedures clearly and thoroughly, so they are easily replicable for future studies. The researchers' established an appropriate baseline by including a minimum of 4 data points for each participant. The treatment phase of the study was equal to or longer than each of the baseline conditions, which is also considered appropriate. Including multiple baseline conditions strengthens the single-subject design overall, as opposed to a basic or experimental design only. Moreover, the researchers included a control group for comparison, which is not required in phase 1 studies and provides greater statistical power.

The outlined research methods were thorough and adequate, including a

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Between-Group Design

Between-group designs are appropriate for comparing outcomes between different treatment approaches or determining possible treatment effects of one approach. However, more participants and data points from each condition are required to achieve adequate statistical power than for single-subject designs.

Levy, Ramig, and Camarata (2012) conducted a phase 1 study using a small group pre-post intervention design to explore the effects of a more "traditional" subsystems intervention approach versus the single-focus LSVT LOUD intervention in three children with dysarthria secondary to CP. Two children received a full dose (4 one-hour sessions per week for 4 consecutive weeks) of LSVT LOUD following the established protocol, while the third child received traditional therapy for 50 minutes twice per week for four weeks. Outcome measures included a functional impact questionnaire for caregivers, a standardized articulation assessment, and

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validity of the outcome measure itself. As such, the findings of this study are somewhat suggestive, and do provide the first preliminary neuroanatomical evidence for neuroplasticity changes following LSVT LOUD in this patient population.

Bakhtiari, Cummine, Reed, Fox, Chouinard, Cribben, and Boliek (2017) tested the same 8 children and used the same general design as the previous study, but this time aimed to examine potential neural changes using fMRI to demonstrate post-treatment connectivity changes using graphical models. 16 bilateral brain regions of interest based on previous speech, language, and neuroanatomical literature were selected for examination. Results demonstrated reduced neural activity in regions associated with decreased motor system effort, and increased activity in a region associated with contribution to decision making processes for the CP group. Post-treatment changes in connectivity between areas related to the motor speech feedback system suggests greater recruitment of this system and less reliance on the feedforward control system, which is a desired outcome for this kind of neuroplasticity treatment.

The authors of this study clearly defined their methods, outcome measures, data collection, and analysis procedures for replication. Similar research has also been conducted on Parkinson's patients following LSVT LOUD, so this type of outcome measure allows for a more direct comparison to the original treatment population. Moreover, the authors provided a rationale for looking at both sides of the brain based on recent research findings of a more bilateral language network in children compared to adult

LSVT LOUD approach is based may be important principles for SLPs to include in their therapy toolkit when serving this patient population.

Future Research Considerations

While it may not necessarily be realistic for this rare of a population,