The effects of two speech interventions on functional intelligibility in pediatric dysarthria
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Introduction
Reduced functional speech intelligibility is a primary disability in children with cerebral palsy (CP) who have the motor speech disorder of dysarthria (Kennes et al., 2002). Interventions for pediatric dysarthria with evidence of efficacy are greatly needed (Pennington, Miller, & Robson, 2000). The present exploratory study examined the effects of two intervention methods on children with CP: 1) TRADITIONAL intervention, representing "treatment as usual," consisting of instruction on breath control, positioning, articulation, and other behaviors (Pennington, Miller, & Steen, 2010), 2) Lee Silverman Voice Treatment (LSVT LOUD), an intensive intervention protocol that increases intelligibility and vowel space in adults with dysarthria due to Parkinson Disease (e.g., Sapir, Spielman, Ramig, Story, & Fox, 2007), and has recent evidence suggesting effectiveness for children with CP (Fox & Bolek, 2012). Descriptive results are presented.

Testing
1. Questionnaires on functional impact completed by caregivers.
2. Children were recorded:
   a. Numbing pictures in Arizona Articulation Proficiency Scale (AAPS, Fudala, 2001)
   b. Naming photographs of contrastive words (contrasting in vowels)*meat-mitt-knot-nut-soap-soup-pan-pan chip-ship* (Levy et al., 2010; see Ansel & Kent, 1992)
   c. Producing spontaneous speech.

SPL Analysis
Actual SPL was determined for each stimulus. For children who received LSVT LOUD intervention, at post-test, SPL had increased overall for contrastive words, although baselines were not stable. For P3, increase took place at word level, but did not carry over to spontaneous speech. For P4, SPL increase was greater in spontaneous speech. SPL of child receiving TRADITIONAL intervention did not increase.

Question
Do TRADITIONAL and LSVT LOUD interventions increase functional intelligibility of children with dysarthria due to CP, as judged by:
1. Caretakers’ responses regarding functional impact?
2. (Arizona) Articulation score (pre- and post-intervention)?
3. Blinded listener preference (pre- and post-intervention) of words and spontaneous speech?

Results
1. Functional impact as reported on questionnaires:
   Caregivers reported positive functional impact for all children. E.g., for "Speaks so others can understand," ratings increased median of 1 points (P4), 2.5 points (P3), 1.5 points (P2), where 1 = never, 9 = always. Comments included: "More eager to engage other children."

2. Arizona Articulation Proficiency Scale (Fudala, 2001)
   A speech-language pathologist and a master’s student scored coded sound files.
   Articulatory proficiency score increased post-intervention for all children, indicating increased intelligibility. Voice-onset-time errors, in particular, decreased.

3. Blinded Listener Preference
   Ten naïve listeners were presented with pre- and post-intervention stimuli in contrastive-words and spontaneous speech and indicated overall preference. Half of the pre-intervention stimuli presented were from Baseline 1, the other half from Baseline 2. Immediate post-test was preferred for all children and both conditions, especially for spontaneous speech.

Method
Participants
Three native American-English speaking females with spastic dysarthria:
P3: 8;0 year-old, mild dysarthria
P4: 5;3 year-old, moderate dysarthria
P2: 9;7 year-old, moderate dysarthria, severe apraxia

Pre-intervention: Children were tested twice before intervention.
Intervention: P3/P4 received LSVT LOUD, P2 received TRADITIONAL.
Post-intervention: Children were tested immediately after last intervention session.

Schedule
LSVT LOUD took place 4 times weekly 50-60 minutes, plus 10 minutes of homework and one carryover assignment daily. TRADITIONAL was twice weekly 50 minutes with homework. Both took place over four weeks.

Preliminary Summary and Discussion
2. Greater post-intervention intelligibility according to the AAPS.
4. Increased SPL for LSVT LOUD in most conditions, but not for TRADITIONAL.
5. LSVT LOUD and TRADITIONAL interventions show promise for yielding increased functional intelligibility in children with dysarthria, although success may vary across linguistic levels and children. LOUD speech led to increases not only in volume, but also in intelligibility. TRADITIONAL intervention also led to increases in intelligibility—without increasing volume. The 3-year-old child may have shown greater SPL increases and preferred speech at spontaneous-language level than at word level because her intervention addressed spontaneous productions more than word-level activities due to her young age.

Discussion
1. Analysis of performance on the specific vowel contrasts, speech in verbal sequencing, sentence repetition, reading, stimuliability for "loud" and "clear," and other listener data collected.
2. Analysis of follow-up tests and acoustic analysis.
3. Examination of adults’ perception of dysarthric speech in noise.
4. Examination of perception of American English dysarthric speech by adult listeners who are non-native speakers of English.
5. Analysis of children with dysarthria’s speech perception. In our preliminary perception study, discrimination of non-words by P2 and P3 was less accurate than of real words (99% vs. 83%). Further study of discrimination and identification by children with and without CP and their perception-production relationship (Levy & Law, 2010) is needed to determine whether perceptual intervention may be indicated.

Future Directions
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References
A&A Speech Preferred

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