The Assessment of Speech Production in Children with Cerebral Palsy Following Pharmacologic Treatment to Improve Muscle Tone and Movement

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OBJECTIVES
The present study was conducted to develop a protocol for assessment of speech production in individuals following Botulinum toxin injections for improvement in muscle tone and movement.
- Develop a task protocol to investigate the effect of Botulinum toxin A (Btx-A) on speech production, including assessment of respiratory support, speech intelligibility, and quality of parent communication.
- Develop a questionnaire to assess parents’ perception of their child’s speech production and the child’s willingness to communicate.

METHODS
Subjects:
- Two children with cerebral palsy who served as their own controls
- No injections of Btx-A in the last six months
- Both receiving speech therapy services, but no direct work on speech production for one month preceding the initial visit
- Both had the ability to cooperate and participate in speech tasks
- Both had previously been found to have hearing acuity within normal limits

RESULTS
Range of Motion:
- Subject 1 – all range of motion values at 4 and 10 weeks post-injections were greater than or equal to baseline, with the exception of the measure for the left popliteal angle
- Subject 2 – all values at 4 and 10 weeks post-injections were greater than or equal to baseline

Ashworth Scores:
- Subject 1 – all scores better than or equal to baseline
- Subject 2 – all scores better than or equal to baseline with the exception of the score for the right hamstring

Vowel Duration:
- Subject 1 – sustained vowel production for a maximum of 2.2 s for any trial with a minimum duration of 0.53 s (normal for age is 9.22 s)
- Subject 2 – sustained vowel production for a maximum of 12.44 s and a minimum of 4.02 s (normal for age is 9.22 s)
- Variability in duration was seen, but no pattern of change over vowels or sessions for both subjects

Sound Intensity:
- Subject 1 showed variable performance in sound intensity over trials and sessions
- Subject 2 showed very similar scores for maximum sound intensity in each session and increasing stability of performance over the three sessions

Table 3. Mean syllables/breath for three sentences for baseline and post-injection sessions

<table>
<thead>
<tr>
<th>Session</th>
<th>Subject 1</th>
<th>Subject 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>3.1</td>
<td>3.9</td>
</tr>
<tr>
<td>4 weeks</td>
<td>4.3</td>
<td>5.8</td>
</tr>
<tr>
<td>10 weeks</td>
<td>3.6</td>
<td>5.1</td>
</tr>
</tbody>
</table>

DISCUSSION
- For both subjects, range of motion values and Ashworth scores indicate that the Btx-A was in effect when speech samples were taken at 4 and 10-week intervals post-injection.
- Tasks that were most sensitive to change were those for maximum sound intensity, transcription of sentences for measurement of consonant production, and length of breath groups.
- The results of the Parent Questionnaire related directly to changes noted in objective measures and gave insight into performance outside the test setting.
- The perceptual assessment tasks showed very small changes for this group, perhaps because subjects were on one-on-one or group setting (weeks 4 and 10); decrease in value from baseline to weeks 4 and 10 in willingness to speak with family members.
- Subject 2: gains in intelligibility for known material (week 10), intelligibility in a noisy background (week 10), willingness to communicate with friends on a one-on-one basis (weeks 4 and 10), and willingness to communicate with friends

CONCLUSIONS
- Speech tasks were not uniform in their sensitivity to change; tasks that were most sensitive were sound intensity, consonant production, and syllables per breath.
- The parent questionnaire provide valuable observations of speech production outside the test setting (https://www.marshfieldresearch.org/crc/parents-quality-of-communication/).
- Positive changes in speech production were seen after treatment with Btx-A and these thoughts to be at least partly a result of improved respiratory support.
- Further study is indicated with a larger subject group and with provision of targeted speech therapy.