Spontaneous Vocalization Change in Infants with Severe Impairments using visiBabble

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Abstract

Children with difficulty producing speech sounds can practice sounds in play, even prosodically. visiBabble is a prototype computer-based program that responds with customized animations to targeted types of infant vocalizations. The program automatically recognizes acoustic-phonetic characteristics of the vocalizations and can selectively respond to utterances with varying levels of complexity (e.g., multi-syllable utterances). This poster reports syllable production changes of three children with physical and speech impairments, ages 1-4, in response to visiBabble reinforcement. Results include immediate effects of visiBabble reinforcement on infant vocalizations as well as long-term effects of home visiBabble practice on spontaneous sound production.

Background

• The goal of visiBabble is to encourage children with significant delays or impairments in developing speech to produce vocalizations that are more speech-like. It does this by providing visual and auditory feedback for types of babbling that are associated with later language and cognitive development.
• The program is also designed to be a clinical tool that relies on acoustic-phonetic analysis of the child's vocalizations. As a child interacts with visiBabble, the program analyzes the child's utterances to determine relative acoustic complexity so that it can respond differentially to target and non-target types of utterances.
• The purpose of the visiBabble system is to increase the vocalizations of young children, and to increase the sophistication and variety of such vocalizations by differentially reinforcing syllabic and non-syllabic productions.

Procedures

Subjects

• Subjects were three children with neurological impairments at risk for being non-speaking, mean age 20 months (range 17-26 months).

Equipment

• visiBabble was a computer program that responded to a child’s vocalizations with animated reinforcements, based on acoustic-phonetic recognition of target syllable types.
• Visual reinforcement appropriate for the child’s developmental age (e.g. fireworks, animation, uncovering puzzle pieces from a personal or age appropriate picture) was presented in response to all child vocalizations that matched the targeted sound type.
• Partial reinforcement (e.g. producing single syllables in multisyllabic mode) received a brief highlighting of reinforcer item but no animation or complete removal of item.

Results

Treatment Implementation

• Although each family was scheduled for 6 weeks of visiBabble intervention, actual intervention times could be longer because of vacations and other family delays. Average number of visiBabble weeks in the home was 10 (range 6-14), and the average number of family uses of visiBabble (recorded automatically by the computer) was 17 (range 10-28).
• There was variability in the average number of visiBabble sessions/week for the children. The child with the least vocalizations practiced the most intensively (HR averaged 5.7 family uses/week in 6 weeks), HR averaged 16.6% week in 10 weeks, and CS averaged 13.5% week in 14 weeks.
• Children varied in the percentage of the 6-minute sample in which they attended to the visiBabble screen. HR averaged 42% attendance (range 25-68%), JL averaged 14% (range 44-95%), and CS averaged 80% (range 67-94%).

Treatment Outcomes

• In post-treatment spontaneous vocal samples, HR increased in targeted complex productions (i.e., words and multiwords) and decreased in simpler productions (i.e., canonical babbling and multi-syllable babbling).
• In post-treatment spontaneous vocal samples, IL increased in the variety of both consonants and vowels produced (target was any vocalization). IL also showed a post-treatment decrease in less complex vocalizations, like vowel only and quasi-consonants, and an increase in more complex canonical syllables.
• In post-treatment spontaneous vocal samples, CS increased her number of syllable utterances, as targeted in intervention. CS decreased her overall number of words produced, but showed a greater number of different words in the post treatment sample.

Discussion

• All three subjects showed increases in the frequency and variety of vocalizations after 6-14 weeks of visiBabble intervention.
• All three subjects demonstrated increases in the vocal skill area targeted by visiBabble.
• Based on independent speech samples collected by parents before and after treatment, all subjects exhibited generalization of skills from visiBabble to spontaneous production.
• Subjects with complex motor and neurological impairments showed change in frequency and variety of vocalizations even with co-occurring cognitive impairments.
• Based on the small n and quasi-experimental design, the study should be replicated to control for outside variables and include a larger number of subjects.

Clinical Implications

• visiBabble has the potential to be an effective strategy for targeting skill production in children with a variety of motor and cognitive skills if their productions fall in the range between vowels and multi-syllabic words.
• visiBabble does not target specific sounds, but addresses the acoustic-phonetic variety and complexity of vocalizations children produce. Therefore, visiBabble should not be used in isolation, but should be combined with other forms of vocal and communicative treatment.

Acknowledgements

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Subject Developmental and Descriptive Characteristics

<table>
<thead>
<tr>
<th>Subject</th>
<th>Motor Age</th>
<th>Developmental Age</th>
<th>Chronological Age</th>
<th>Age of Baseline Assessment</th>
<th>Baseline Spontaneous Vocalization</th>
<th>Baseline VisiBabble Use</th>
<th>VisiBabble Use During Intervention</th>
<th>VisiBabble Use Post Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS</td>
<td>26 mo.</td>
<td>25 mo.</td>
<td>25 mo.</td>
<td>15 mo.</td>
<td>15.5%</td>
<td>90%</td>
<td>90%</td>
<td>80%</td>
</tr>
<tr>
<td>HR</td>
<td>23 mo.</td>
<td>22 mo.</td>
<td>22 mo.</td>
<td>16.5 mo.</td>
<td>9.5%</td>
<td>10%</td>
<td>10%</td>
<td>14%</td>
</tr>
<tr>
<td>JL</td>
<td>17 mo.</td>
<td>50 mo.</td>
<td>50 mo.</td>
<td>4 mo.</td>
<td>1%</td>
<td>20%</td>
<td>20%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Data Coding

• Children’s speech samples during the CSBS were coded as parent vocal samples and after intervention were broadly transcribed for phonemes and words produced.
• Utterances were differentially coded into categories of vocal production: vowel only, multiple vowels, long vowels, quasi-consonants, canonical syllables, multiple syllables with consonants, words, multiple words.
• Videotapes of child during the visiBabble session were coded to see if child was attending or not attending to the screen.

HM Changes in Types of Productions Before and After VisiBabble Use

CS Changes in Types of Productions Before and After VisiBabble Use

HM Changes in Types of Productions Before and After VisiBabble Use