Decreasing Drooling With Oral Motor Stimulation in Children With Multiple Disabilities

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Key Words: child development disorders • sialorrhea • single subject research

Many persons with severe and profound disabilities exhibit chronic and excessive drooling, which can have unfavorable effects on their socialization and health. Few treatments to reduce this behavior, however, have been evaluated systematically. In the present investigation, oral motor stimulation was used with 2 children who attended a residential educational facility for students who are blind and who have multiple disabilities. The treatment involved the brushing of the hard palate, the upper and lower gums, the tongue, and the inside of both cheeks at 1-hr intervals during the school day. The efficacy of this approach was demonstrated with a withdrawal experimental design. Because this treatment did not eliminate drooling, vibration was applied to the chin and neck, first in conjunction with the oral motor stimulation and then contingent on the subject’s having a dry face. Vibration did not have additional therapeutic effects. The results of this study are discussed in relation to the existing literature on modification of drooling and the difficulty of effecting change in the behavior of persons with severe and profound mental and physical disabilities.

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Over the past two decades, the therapeutic management of chronic drooling in persons with developmental and physical disabilities has received considerable attention from professionals in various fields. Drooling is a significant problem because it detracts from one’s physical appearance, inhibits others from initiating social interactions, damages clothing and instructional materials, and presents hygiene concerns (Drabman, Cordua y Cruz, Ross, & Lynd, 1979). Because drooling is associated with infantile behavior, others may underestimate the abilities of the person who drools, thereby establishing a vicious circle of low expectations and underperformance (Ray, Bundy, & Nelson, 1983). Thus, the reduction or elimination of drooling is an important treatment goal.

The three major approaches to drooling management are surgery, behavior modification, and oral motor therapy. Surgical techniques involve either the transplantation of the parotid ducts, the removal of the submandibular salivary glands, the sectioning of the chorda tympani and tympanic nerves, or a combination of these procedures (Goode & Smith, 1970). Although clinical reports are positive, more rigorous assessments have shown surgical procedures to be only partially successful (Harris & Purdy, 1987). Further, surgery is recommended only after a trial of behavioral therapy, neurodevelopmental therapy, or both (Crysdale, 1980).

Behavior modification programs have used various combinations of cuing, positive reinforcement, and overcorrection or punishment. Garber (1971) described a program in which a 14-year-old boy with choreoathetotic cerebral palsy and mild mental retardation was rewarded with pennies when he did not drool over a prescribed length of time. Trott and Maechtlen (1986) used overcorrection to decrease drooling exhibited by a young girl with severe mental retardation. In this procedure, when drooling was observed, the child was guided to clean up any saliva on her clothes, furniture, or materials and to hold a tissue to her lips for 30 sec. Thorbecke and Jackson (1982) evaluated the efficacy of a multicomponent treatment to reduce drooling in a youth with moderate mental retardation and cerebral palsy. Intervention consisted of praise for a dry chin, criticism and overcorrection for drooling, and training in self-monitoring (i.e., teaching the child to check her chin) and self-instruction (e.g., “It’s wet; I’ve been forgetting to swallow; I must wipe it 10 times”). In these and other cases, behavioral treatments were successful, and in some, results were evidenced across settings and over an extended follow-up (Barton & Madsen, 1980; Drabman et al., 1979; Dunn, Cunningham, & Backman, 1987; Thorbecke & Jackson, 1982; Trott & Maechtlen, 1986).
Perhaps the most frequently used techniques to control drooling in clinical settings are those involving sensorimotor and neurodevelopmental methods. Children with cerebral palsy have shown infrequent swallowing and an uncoordinated swallow response, compared with children who are developing normally (Soschanwskyj, Koheil, Bablich, Milnew, & Kenny, 1986). Oral motor therapies address these deficiencies by facilitating swallowing. As a result, drooling is reduced. In these approaches, the hypothesized underlying problem (i.e., inadequate swallowing) is addressed directly with methods that are thought to produce relatively permanent neural changes. A number of descriptive reports are available that outline the various techniques, including vibratory stimulation of relevant muscles (McCracken, 1978), rubbing of the gums, or both; the application of pressure to the orofacial area; and jaw support (Morris, 1978; Mueller, 1972). Two studies evaluated the efficacy of the latter treatment with subjects with mental retardation and cerebral palsy (Samelstad, 1988; Ray et al., 1985). In both cases, withdrawal single-subject experimental designs demonstrated that oral motor therapy reduced, but did not eliminate, drooling during observation sessions scheduled immediately after treatment periods. It should be noted that the use of the withdrawal design, although clearly demonstrating treatment efficacy, contradicts the supposition that oral motor therapy creates long-lasting changes in neural structures, which results in a reduction of the target behavior.

In their review of the literature, Harris and Purdy (1987) elaborated the need for additional controlled research evaluating the usefulness of programs for drooling management with clients with severe disabilities, including cerebral palsy. The purpose of the present study was to perform such an investigation with 2 students with multiple disabilities. Oral motor therapy was chosen over behavioral treatment methods due to the students' severe cognitive and motor limitations, which resulted in poor self-awareness and minimal responsiveness to cues and consequences for behaviors.

Method

Subjects

Two students with severe multiple disabilities served as subjects for this investigation. They were in the same classroom at a special school serving persons with visual impairment. Both had a long history of drooling and frequently wore linen napkins around their necks to protect their clothing. Neither responded to verbal prompts to close their mouths or to swallow. The first subject, Tess, was a 10-year-old girl who was severely mentally retarded and had visual impairment, severe spastic cerebral palsy, and seizure disorder. Tess received 100 mg of carbamazepine three times a day for seizure control. Observations of her oral motor capabilities revealed minimal lip closure and an open mouth posture while at rest. Tess demonstrated a good suck-swallow pattern when she drank from a cup, but she had difficulty maintaining lip closure on the rim and she was unable to chew solid foods. She showed no hypersensitivity to touch. The second subject, Rob, also 10 years old, was profoundly mentally retarded, deaf, and blind, and had athetoid cerebral palsy and behavioral problems (e.g., tantrums, self-stimulation). An evaluation of his oral motor functioning showed an open mouth posture at rest, a good suck-swallow pattern while drinking, and up-and-down chewing motions and lateral tongue movements while eating solid foods. Rob showed some hypersensitivity to touch in the orofacial area. Consent to participate in the study was obtained from the children's parents.

Setting and Materials

The primary setting for intervention and assessment was the classroom (7 m x 7 m), which was equipped with furniture, academic materials, and leisure activities adapted for use by children with sensory and physical disabilities. Besides Tess and Rob, five other students with multiple disabilities, aged 7 to 10 years, were present in the classroom. The teacher (the first author) and two classroom aides administered treatment to the subjects and instructed and supervised all of the students. Periodically, treatment and data collection activities were performed in other settings within the school building, including rooms designated for special therapies such as art, music, and communication. A NUK toothbrush1 and an adaptAbility versatile two-speed vibrator2 were used to provide oral stimulation. A kitchen timer and specially prepared data sheets facilitated data collection.

Procedure

The classroom staff recorded the occurrence of drooling throughout the school day (9:00 a.m. to 3:00 p.m.) using a momentary time sampling procedure. Drooling was defined as evidence of saliva on the subject's face. An egg timer was used to signal auditory cues at 10-min intervals. When the cue sounded, a designated rater checked each of the students for the presence of drool. Drooling was recorded as occurring if seen at the moment of observation. Then, any saliva that was found was wiped from the child's

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1 Manufactured by Gerber Products Company, Reliance Products Corporation, Woonsocket, RI 02895.
2 Manufactured by adaptAbility, Colchester, CT 06415.
face and from materials so that it would not interfere with subsequent observations. The wiping away of drool was a regular part of the daily activities for these children and was considered necessary to keep them clean and free from germs. A verbal cue to prepare the students and gentle touch during wiping minimized any adverse response to this procedure. Data were expressed in terms of the percentage of intervals per day in which drooling was scored.

Three staff members—the teacher and two aides—alternated in serving either as the primary data collector or as a secondary rater to assess the accuracy of observations. Generally, the primary rater recorded the target behavior for each subject. The second rater independently recorded drooling during 21% of daily observations for Tess and 16% of daily observations for Rob, equally distributed across all phases of the investigation. Interrater agreement was calculated separately for each student and session. Percentage agreement was calculated by dividing the number of agreements by the total number of agreements plus disagreements and multiplying by 100. Agreement was reached when both raters indicated the occurrence or nonoccurrence of the target response in the same interval. Interrater agreement ranged from 84% to 100%, with a mean of 95.5% for Tess and 95.2% for Rob.

**Intervention and Experimental Design**

Initially, the efficacy of oral motor stimulation for drooling management was evaluated with a withdrawal single-subject experimental design (Barlow & Hersen, 1984). The investigation began with a baseline phase, during which drooling was observed and recorded for both subjects. Intervention for drooling was then initiated. The procedures were conducted at hourly intervals throughout the school day. Before oral motor stimulation was applied, the students were calmly approached and told what was about to happen. First, the NUK device was used to stimulate the child's hard palate vertically (10 repetitions) and horizontally (10 repetitions). Then, the inside and outside of the upper and lower gums were brushed five times each. Next, the center and both sides of the tongue were massaged five times each. Finally, five strokes with the NUK device were applied to the inside of each cheek. Treatment was administered slowly and gently, allowing the child time to swallow between exercises. The entire sequence usually took 3 to 5 min to complete. After a stable level of the target behavior was observed, baseline conditions were reinstated. Oral motor stimulation was then implemented again.

Next, a vibration component was added to enhance the treatment's effectiveness. During this phase, vibration was applied to the child's chin and throat for 10 sec following oral motor stimulation. Because no additional gains were observed, a return to the previous condition to evaluate the relative efficacy of oral motor stimulation versus oral motor stimulation plus vibration was deemed unnecessary. Instead, 10 sec of vibration was applied contingent on dry checks rather than incorporated into the hourly treatment. In the contingent vibration phase, the usefulness of 10 sec of vibration as a reinforcer for having a dry chin was tested. The rationale for this modification was that the students appeared to enjoy the vibration, as indicated by smiling and laughing. A return to the oral motor stimulation plus vibration condition ended the study.

**Results**

The effects of oral motor stimulation, vibration, and contingent vibration therapies on drooling are presented in Figure 1 and Table 1. The results of the withdrawal design indicated that oral motor stimulation was effective in reducing the percentage of intervals in which drooling was observed. Drooling occurred at high levels for both students in baseline 1, decreased substantially during oral motor stimulation 1, increased when treatment was withdrawn (baseline 2), and again was controlled when intervention was resumed (oral motor stimulation 2). Thus, experimental control was demonstrated (Barlow & Hersen, 1984).

Even with oral motor stimulation, however, Tess's and Rob's drooling continued, albeit at reduced levels. Thus, the vibration component was added. No additional gains accrued with the combined treatment (vibrations 1 and 2) in either case. In the contingent vibration phase, the amount of drooling increased over that observed during other treatment conditions.

**Discussion**

This study showed that oral motor stimulation was effective in reducing, but not eliminating, drooling in 2 children with severe, multiple disabilities. These results corroborate the findings of several earlier empirical and anecdotal case reports that described similar effects of neurodevelopmentally based treatments (McCracken, 1978; Ray et al., 1983; Samelstad, 1988). The results of the withdrawal experimental designs suggest that the oral motor stimulation treatment did not change neural structures, because change in the target response varied with the introduction and removal of treatment. Instead, intervention may have had only short-term effects by serving as a cue to swallow or by affording subjects increased attention under treatment conditions. Further research should
be designed to ascertain the mechanism responsible for behavioral change.

The results of the present study indicated that the efficacy of oral motor stimulation was not enhanced with the addition of vibration. It is uncertain whether vibration alone would have been as effective as oral motor stimulation, because this variation was not evaluated. Contingent vibration, however, led to increased drooling for both students, thus partially countering the effects of oral motor stimulation.

The current investigation is unique in that it represents the first application of treatment for drooling throughout the day, in natural situations, in contrast to intervention performed during isolated sessions in a therapy room. Further, the stimulation procedures were applied by the classroom teacher and by para-professional staff. The usual format for the administration of oral motor stimulation was adapted through the use of shorter but more frequent treatment sessions. Additional research is needed to evaluate the relative efficacy of the implementation of drooling treatments throughout the day in natural situations.

Table 1
Effect of Treatment Conditions on Intervals of Drooling

<table>
<thead>
<tr>
<th>Condition</th>
<th>Tess M (%)</th>
<th>Range (%)</th>
<th>No. of Days in Condition</th>
<th>Rob M (%)</th>
<th>Range (%)</th>
<th>No. of Days in Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline 1</td>
<td>82.4</td>
<td>66-90</td>
<td>9</td>
<td>69.5</td>
<td>38-88</td>
<td>14</td>
</tr>
<tr>
<td>Oral motor stimulation 1</td>
<td>55.0</td>
<td>43-60</td>
<td>6</td>
<td>31.8</td>
<td>15-53</td>
<td>8</td>
</tr>
<tr>
<td>Baseline 2</td>
<td>71.9</td>
<td>41-89</td>
<td>13</td>
<td>76.6</td>
<td>59-95</td>
<td>5</td>
</tr>
<tr>
<td>Oral motor stimulation 2</td>
<td>44.7</td>
<td>23-68</td>
<td>16</td>
<td>51.7</td>
<td>14-53</td>
<td>10</td>
</tr>
<tr>
<td>Vibration 1</td>
<td>39.5</td>
<td>16-50</td>
<td>10</td>
<td>36.0</td>
<td>24-52</td>
<td>8</td>
</tr>
<tr>
<td>Contingent vibration</td>
<td>65.0</td>
<td>50-76</td>
<td>4</td>
<td>57.3</td>
<td>52-61</td>
<td>4</td>
</tr>
<tr>
<td>Vibration 2</td>
<td>54.5</td>
<td>28-63</td>
<td>10</td>
<td>32.8</td>
<td>19-50</td>
<td>6</td>
</tr>
</tbody>
</table>
versus the application of procedures in special therapy sessions. Similar questions have been raised recently in both special and regular education over the relative benefits of isolated versus integrated special therapies (see Sernat, Messina, Nietupski, Lyon, & Brown [1977] for a discussion of this issue as it relates to the work of occupational and physical therapists).

Several studies have shown that oral motor stimulation (with and without vibration applied to the throat and neck) reduces drooling in persons with severe disabilities, including severe cerebral palsy. Drooling has not been eliminated in any investigation, however, including the present one, in which it was still observed approximately one third of the time with the best treatment. Given that oral motor stimulation is intrusive and considered by some clients to be aversive (McCracken, 1978), one would hope that the outcome would be more positive (i.e., zero or near-zero levels of drooling). Further, it is unclear whether the decreases in drooling obtained in available studies are indeed clinically significant in terms of increased social acceptance, reduced property damage, and lessened hygiene concerns. Although more satisfactory results have been reported with behavior modification treatments, the applicability of verbal instructions, reinforcement, overcorrection, and self-instruction to drooling management with persons functioning in the lowest ranges of intellectual and physical abilities remains to be determined. Additional work in this area is warranted.

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References


