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Treatment Techniques to Encourage Lip Closure and Decrease Drooling in Cerebral Palsy

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TREATMENT TECHNIQUES TO ENCOURAGE LIP CLOSURE AND DECREASE DROOLING IN CEREBRAL PALSY

by

Kim M. Samelstad

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the requirements for the
Degree of Master of Science
Department of Occupational Therapy

Western Michigan University
Kalamazoo, Michigan
December 1987
This study was designed to test the effectiveness of oral sensorimotor techniques in decreasing drooling. A withdrawal $a_1-b-a_2$ design was used with two subjects diagnosed as having mental retardation and cerebral palsy. The baseline phase consisted of 20 minute sessions of play, followed by a 45 minute period during which the subjects wore a bib. The treatment phase was identical to the baseline phase except that the 20 minutes of play was replaced with 20 minutes of treatment. The treatment techniques that were used included the following: light touch to the midline of the lips, maintained pressure around the lips, stretch pressure, firm strokes applied on both sides of the larynx downward, and popsicle sucking. The amount of saliva collected on an absorbent bib during the 45 minute period which followed the 20 minutes was measured and recorded. Though data sessions for one subject were marked by high session-to-session variability, the treatment effectively decreased drooling in both subjects.
ACKNOWLEDGEMENTS

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Kim M. Samelstad
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INTRODUCTION

Drooling is a problem that has been associated with developmental disabilities such as cerebral palsy and mental retardation (Morris, 1977; Mueller, 1972). The patient who drools is often treated by the occupational therapist or speech therapist (McCracken, 1978; Morris, 1978; Ray, Bundy, & Nelson, 1983). Patients with oral motor dysfunction may have associated problems with feeding, speech, and drooling.

Treatment in this area is important because excessive drooling is generally assumed to be a handicapping condition which can further complicate the social acceptance of individuals with mental retardation, cerebral palsy, and other developmental disabilities (Drabman, Cordua y Cruz, Ross, & Lynd, 1979). Persistent drooling creates hygiene problems for parents, teachers, therapists, and playmates because of the constant soiling of clothes, school materials, toys, and furniture (Crysdale, 1980). Individuals who exhibit this problem receive less positive attention from teachers and aides than non-droolers due to the constant presence of saliva on the face, hands, clothing, and materials (Drabman et al., 1979; McCracken, 1978; Trott & Maechtlen, 1986). As a result, treatment which suppresses or eliminates is
Drooling in the cerebral palsied individual has been related to abnormalities in, rather than absence of, swallowing (Ekedahl, Mansson & Sandberg, 1974) and to abnormal transport of saliva to the back of the throat rather than to an increase in secretions (Crysdale, 1980; Goode, 1970). Jaw stability, mouth closure, and the ability to swallow play important roles in controlling drooling (Mueller, 1975).

The normal act of swallowing implies that the lips are closed and the jaw is stable (Gallender, 1979). One of the most common problems of the cerebral palsied is a constantly opened mouth (Mueller, 1975). The muscles involving lip closure and control are typically well developed and efficient by eighteen months of age (Gallender, 1979). However, the child with cerebral palsy often cannot adjust his/her lips to seal the sides for leaks while drinking and cannot close the jaws and/or coordinate the tongue for proper swallowing (Mueller, 1972; Ray et al., 1983). Poor mouth closure, due to abnormal muscle tone or uncoordinated jaw movements, decreases the quality of swallowing and thereby may result in excessive drooling (Morris, 1978; Scherzer & Tscharnuter, 1982). Jaw closure is also required to facilitate normal coordination of tongue movement needed
for transportation of saliva (Ray et al., 1983). In normal development the lips are slightly closed at rest. In cerebral palsied individuals the lips are often open at rest, which contributes to drooling (Gallender, 1979).

Therapy for drooling has consisted of several different methods, including surgery, behavioral techniques (overcorrection and positive reinforcement), and sensorimotor, neurodevelopmentally oriented techniques. Surgical interventions decrease the secretion of saliva rather than improve the transport of saliva to the back of the mouth. Crysdale (1980) stated, "successful management of drooling seems dependent on controlling the secretions of the submandibular gland" (p. 782) which can be done through surgery.

Results of behavioral techniques have been documented in several studies. Garber (1971) used positive reinforcement, rewarding the child with a penny for swallowing. This was a single subject study with a 14-year old male with choreoathetotic cerebral palsy. Trott and Maechtlen (1986) used overcorrection with a mentally retarded subject. They used praise for a dry face and wiped the face with a tissue when drooling was present. A study done by Drabman et al. (1979) consisted of using positive reinforcement for dryness and overcorrection for wetness.
None of the three studies reinforced the role of mouth closure in facilitating the swallowing of saliva.

The techniques most commonly used by occupational therapists, physical therapists, and speech therapists are those involving sensorimotor and neurodevelopmental methods. Through the years a set of neurophysiological techniques for the treatment of drooling, credited to Margaret Rood, has been accumulated and used by occupational therapists and others (McCracken, 1978). Loiselle (1979) presented a review and organization of Rood's principles; treatment aims and techniques that were related to pre-feeding behaviors of tongue thrust, drooling, and gag reflex hypersensitivity. According to Loiselle, the aims of treatment to decrease drooling are: (a) to facilitate swallowing, (b) to elicit mouth closure, and (c) to decrease tongue thrust. This author also identified sensory and proprioceptive techniques designed to provide the stimulation needed to meet the above aims.

Morris (1978) and Mueller (1975) advocated a neurodevelopmental approach to the problem of drooling and emphasized the normalization of muscle tone and the facilitation of appropriate movement patterns. Their techniques include placement of the client in a feeding position that inhibits abnormal postural patterns in
order to permit isolated movements of the head and oral structures (Ray et al., 1983). Mueller (1972), Morris (1977), and Farber (1982) also discussed the use of manual jaw control to facilitate mouth closure. They also advocated using tactile stimulation to the gums, because the resultant salivation should provide tactile cues for swallowing.

McCracken (1978) used neurophysiological techniques and vibration to facilitate mouth closure and decrease tongue thrust in ten adolescent mentally retarded individuals and in a 51 year old mentally retarded adult. She found that drooling may not be completely controlled, but suggested that it can be significantly decreased. Ray et al. (1983), using the techniques advocated by Morris (1975) and Mueller (1975), found that facilitating mouth closure decreased drooling in an 11-year old male with mental retardation and cerebral palsy. Ottenbacher, Scoggins, and Wayland (1981), investigated the effectiveness of a program of oral-motor therapy employing neuromotor and sensory facilitation techniques with twenty severely and profoundly retarded subjects. The program was designed to facilitate feeding patterns and to increase weight gain in the subjects. The results of the investigation revealed no statistically significant difference between the two groups (control
and treatment) in terms of the weight gained; however, two individuals in the experimental group were found to have relatively large weight gains. Ottenbacher, Hicks, Roark, and Swinea (1983) used a multiple baseline design to determine the effects of oral sensorimotor therapy in four developmentally disabled subjects. Although the results of their investigation were mixed, the design procedures employed suggested individual improvements or partial improvements in three of the subjects. Boullard (1984) attempted to test the effectiveness of oral sensorimotor techniques in reducing drooling in a counterbalanced group design consisting of ten subjects with developmental disabilities. The intervention techniques used were similar to the techniques used by Ray et al. (1983). Boullard found no statistically significant differences between treatment and control conditions; however, a descriptive review of individual data indicated that five of the ten subjects appeared to show decreased drooling following treatment.

The present study attempted to provide additional support for these routinely used treatment techniques. It was hypothesized that by facilitating mouth closure and swallowing there would be a decrease in drooling. The techniques to facilitate mouth closure and swallowing were similar to those used by Ray et al. (1983). In
addition to those, techniques advocated by Rood (Loiselle, 1979) were also used. This study used a withdrawal $a_1$-$b$-$a_2$ design with two subjects diagnosed as having mental retardation and cerebral palsy.
METHODS

Subjects

Subjects were identified as having a problem with drooling and were referred to the researcher by an occupational therapist. The subjects were students at Croyden Avenue School, Kalamazoo, Michigan; both were wheelchair bound. Informed consent forms for the participants in the study were obtained for the subjects from their parents.

Subject 1 was a 21-year old female with mental retardation and spastic cerebral palsy with quadriplegic involvement. Observations of oral-motor functions showed an open mouth position at rest with minimal lip closure. She was observed to have a good suck-swallow pattern as was demonstrated when she drank from a cup using a straw. No sensitivity to touch was noted in the oral-facial area. The subject routinely wore a bib and required frequent bib changes to keep her dry.

Subject 2 was a 14-year old female with mental retardation and spastic cerebral palsy with quadriplegic involvement. Observations of oral-motor functions showed an open mouth position at rest with minimal lip closure. She was able to close her lips with verbal and/or physical prompts. She was observed to have a good suck-
swallow pattern. She was encouraged to use a straw when drinking from a cup to facilitate this pattern. No hypersensitivity to touch was noted in the oral-facial area. This subject did not routinely wear a bib.

Settings

For Subject 1, the study was conducted in her home. For Subject 2, the study was conducted in a quiet distraction-free room in her school. For each subject, the same setting was used through all three phases of the study.

Measurement Apparatus

Drooling, the dependent variable, was measured by weighing the amount of saliva collected on an absorbent bib during the 45 minute period of free play or classroom activity, which followed the 20 minute period during baseline or intervention. The teacher, aides, and parents refrained from giving food or liquid to the subjects and from making any verbal reference to the subject's drooling during the time that saliva was being collected.

For Subject 1 the researcher and the subject's mother weighed the bib before placing it on the child. The same two people re-weighed the bib after the 45
minute period. For Subject 2 the researcher and the teacher's aide weighed the bib before placing it on the child, and the same two people re-weighed the bib after the 45 minute period. All bibs were made of the same material and were identical in size, but they varied slightly in their dry weight. An Ohaus Harvard Trip Balance scale was used to weigh the bibs. The scale was calibrated daily by balancing it out to zero. The weight of saliva was measured in grams. To measure the weight of saliva, the dry weight, measured by weighing the bib before placing it on the child, was subtracted from the bib's wet weight after the 45 minute period. This eliminated the possible effects of the slight differences in dry bib weight.

Design

A withdrawal $a_1$-b-$a_2$ design was used for each of two subjects in this study. The baseline phase ($a_1$) consisted of 20 minute sessions of play, followed by a 45 minute period during which the child was engaged in free play or classroom activity. The treatment phase (b) was identical to the baseline except that the 20 minutes of play were replaced by 20 minutes of treatment. The final baseline phase ($a_2$) was identical to the initial baseline phase.
The 45 minute free play period for Subject 1 was defined as watching her regular TV show. The mother of Subject 1 was unaware as to what phase her child was in throughout the study. Classroom activity for Subject 2 from Croyden Avenue School was defined as those activities that were regularly scheduled for that 45 minute time period. The teacher and aides were unaware of whether Subject 2 was in the baseline or treatment phase. The TV show for Subject 1 and the classroom activities for Subject 2 remained the same throughout the course of the study.

Procedure

The investigator conducted the study Monday through Friday, at approximately the same time every day. Subject 1 was seen Monday through Friday for 39 planned sessions with only two absences. Subject 2 was seen Monday through Friday for 53 planned sessions. Subject 2 had fifteen absences, including six consecutive absences due to a school vacation.

At the start of all baseline and treatment sessions, each subject was positioned in her wheelchair with (a) head in midline and not tilted backward or forward, (b) trunk supported (with spine as straight as possible), (c) 90 degrees of hip flexion with hips fully back into the
chair, and (d) ankles in neutral position with feet flat on the foot rests. Intervention techniques used in this study were similar to those used by Ray et al. (1983), but also included facilitation techniques for swallowing and lip closure as advocated by Rood (Loiselle, 1979). Treatment employed in this study included three major components: positioning, facilitating swallowing, and facilitating lip closure. The investigator then administered techniques to facilitate swallowing. These included firm strokes applied on both sides of the larynx, stretching downward in a longitudinal direction (3 times) while allowing time for the individual to swallow. Following this, the investigator applied facilitation techniques to encourage lip closure. These techniques were administered in the following order: (1) light touch to the midline of the lips (three times every five seconds), (2) maintained pressure around the lips (three times every five seconds), and (3) stretch pressure to the upper lip and downward to the lower lip using the index and middle fingers. Following these techniques, jaw control was applied by placing the middle finger under the chin, resting the index finger between the lower lip and chin, and lightly resting the thumb along the side of the face (Mueller, 1972). Jaw control was applied as the subject sucked on a popsicle. Jaw
control and lip closure were maintained for 5 minutes after popsicle sucking. During the 5 minutes, the investigator applied three firm strokes in each direction from the midline laterally to the upper gum. There was a pause between each set of three strokes to permit the subject to swallow. The purpose of this last activity was to stimulate saliva production to allow the build-up of saliva in the mouth while providing jaw and lip control. Pooled saliva is hypothesized to stimulate tactile receptors in the mouth to trigger an automatic swallow during a functional activity (Mueller, 1975).
RESULTS

Figure 1 shows the results of the study for Subject 1. The results clearly demonstrated the effectiveness of treatment. All but one session (19), of the treatment phase resulted in lower drooling scores than all the sessions of both baseline phases. During the initial baseline phase the amount of drool measured, fluctuated slightly from session to session, with one notable increase observed during the sixth session. The mean score for drooling during the initial baseline phase was 1.46 grams. The treatment started during the fourteenth session following the establishment of a countertherapeutic trend beginning during the ninth session of the baseline. Drooling decreased at the beginning of the treatment phase and was maintained at a relatively stable level with the subject showing only one notable increase during the nineteenth session. The mean score for drooling during the treatment phase decreased to 0.48 grams. During the final baseline phase the subject's drooling increased with marked fluctuations from session to session. The mean score for drooling during the final baseline phase was 2.42 grams.

Figure 2 shows the results of the study for Subject 2. The results were not as clear as they were for Subject 1,
Figure 1. Measurement of Drool for Subject one

For Subject 1, weight of saliva on a bib during 45 minute measurement period following three experimental conditions: $a_1$ = 1st baseline; $b$ = treatment; $a_2$ = 2nd baseline
Figure 2. Measurement of Drool for Subject two

For Subject 2, weight of saliva on a bib during 45 minute measurement period following three experimental conditions: $a_1 = 1$st baseline; $b = \text{treatment}; a_2 = 2$nd baseline

Data not collected due to school vacation.
primarily because of high session-to-session variability. However, the mean scores for each phase suggest a difference across phases in the hypothesized direction. During the initial baseline phase the amount of drool fluctuated from session to session, with a marked increase seen by the fourth session. The mean score for drooling during the treatment phase decreased to 2.31 grams. During the final baseline phase the subject's drooling increased, once again with marked fluctuations from session to session. The mean score for drooling during the final baseline phase was 4.51 grams.
DISCUSSION

The results supported the hypothesis that techniques to facilitate mouth closure and swallowing decrease drooling. In the study by Ray et al. (1983), the subject was an 11 year old male with a diagnosis of mental retardation and cerebral palsy. In the present study, the subjects were 14 year old and 22 year old females, also with diagnoses of mental retardation and cerebral palsy. In most ways, the present study can be thought of as a successful replication of Ray et al. (1983). However, the procedures were not exactly the same. Because of the Rood-oriented approach of this study, the researcher replaced the six ounce cup of fluid with a popsicle sucking activity.

In the study by Boullard (1984), a counterbalanced group design was used with ten developmentally disabled subjects. Boullard's results showed that the overall difference between control and treatment conditions was not statistically significant. There could be several explanations for Boullard's statistically non-significant results.

According to Hersen and Barlow (1976), pooled group data often mask individual results and cause low power. Although Boullard's overall results were not
statistically significant, a descriptive review of the individual data indicated that five of the ten subjects showed a decrease in drooling following treatment. Second, according to Cohen (1977), there is a direct relationship between sample size and power. Sample size appeared to be an important determinant of statistical power in Boullard's study. Sixteen subjects began the study and only ten finished. Due to the small group of subjects (ten), relatively little data was produced, which contributed to the low statistical power. Boullard stated that, given the means and variances obtained from her sample group, 27 subjects would have been needed to have achieved statistical significance. Third, some of the subjects in Boullard's study had low rates of drooling before treatment and, consequently, had less room for improvement.

In the present study, drooling was not completely eliminated, but it was decreased considerably. A longer treatment phase, one greater than two to four weeks, may be needed to attain more consistent lip closure and swallowing, and this may stabilize drooling at a lower level. During treatment, it was noted by the aides in the classroom that the subjects were drooling less and had dryer chins and clothing. Upon return to the final baseline, the classroom aides expressed concern because
the subjects' drooling had increased noticeably.

The original plan for this research project was to develop a multiple baseline across subjects. This researcher found that in attempting to carry out the planned design for this study (a multiple baseline across four subjects), she encountered several problems. Four subjects were initially referred to the researcher but only two were used in this study. However, the researcher discovered that two of the subjects referred did not drool enough to make a measureable weight difference of the bib when measured. Due to the time constraints of the researcher, she was not able to find two additional subjects to replace the two that were dropped. Another factor to be considered is that of time. This researcher found that in order to implement a multiple baseline across four subjects required a commitment of at least four hours a day.

This researcher believes that future investigators should be aware of some of these problems. An $a_1$-$b$-$a_2$ design is acceptable from an experimental standpoint, but it has one major undesirable feature. This feature is that the subject ends on a baseline phase. Hersen and Barlow (1976) have argued that "on an ethical and moral basis, it certainly behooves the experimenter to continue
some form of treatment, subsequent to completion of the research aspect of the study" (p. 177).

The teachers at Croyden Avenue School expressed a desire to continue treatment upon the completion of the study. The researcher demonstrated the techniques to the teachers who then will carry on the treatment. The teachers will be supervised by the occupational therapist at the school.
CONCLUSION

The present study has contributed to the existing knowledge base of occupational therapy in the area of oral sensorimotor treatment. The profession of occupational therapy needs to further study the area of oral motor dysfunction in developmental disabilities. Additional research can be conducted using various designs, including single subject A-B-A and A-B-A-B, multiple baseline across subjects, or group designs (especially those involving repeated measurement). Future studies should include replication of this study, replication of this study with other types of subjects, and the study of other variables in oral motor dysfunction.
APPENDIX

Letter of Informed Consent
Informed Consent

Participant's Name __________________________ Date ____________

The purpose of this study is to test the effectiveness of treatment techniques to encourage lip closure and decrease drooling with the cerebral palsy. These treatment techniques are accepted and widely used by occupational therapists and speech therapists with individuals who have a problem with drooling. The procedure for this research is outlined in the following paragraph.

The study consists of a baseline phase, a minimum of six days, when information will be collected on the amount of drooling that occurs without treatment. The subsequent treatment phase will include techniques to encourage lip closure and swallowing. Treatment will take 20 minutes per day followed by a 45 minute period when the child will be engaged in regularly scheduled activities. The treatment phase will last a minimum of 14 days. The amount of drooling will be measured by weighing a bib before and after it has been worn for the 45 minutes following treatment. The techniques to be used in the treatment session are as follows: stretch pressure, pressure under the jaw, popsicle sucking, and maintaining pressure around the lips.

The mouth is sensitive to touch and each individual has a different level of tolerance for stimulation. The researcher will monitor the subjects for their tolerance level and will stop treatment when the subject exhibits any negative reactions such as pulling away from the researcher.

It is expected that you will find that your child could benefit from these treatment techniques. This research will also benefit the occupational therapy profession by helping to establish the effectiveness of these treatment techniques.

If at any time you have further questions you may contact me or the research advisor, David Nelson at 383-4936.
If you choose to withdraw your child and discontinue participation in this study there will be no penalties or effects on programming for your child.

Kim M. Samelstad
100 Western Ave., C-5
Kalamazoo, MI 49008
Telephone number: 349-5230

Consent:

I have been satisfactorily informed of the purpose and procedures involved in this study. I give permission for my child's participation in this study. I have been offered a copy of this form.

Signature of Parent
BIBLIOGRAPHY


