*Original Article*

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# Effectiveness of Sensory Motor and Behavior Therapy on Drooling in Children with Cerebral Palsy

**Banumathe KR*, Sugi S.**, Guruprasad V.*****

**Abstract**

**Aim:** To determine the effectiveness of sensory motor and behavior therapy on drooling in children with cerebral palsy

**Methodology:** 20 children with drooling in cerebral palsy were selected for the study based on the screening tool. The assessment tools such as swab method, drooling quotient with activity and drooling quotient without activity were used for pre and post test scores. 10 children received conventional treatments who were control group and 10 children were given sensory motor and behavior therapy along with conventional treatment who were experimental group. Posttest was taken after 6 weeks of intervention for 10 min / session, 3 days a week and the scores were subjected to statistical analysis.

**Results:** The data were analyzed with Mann-Whitney U-test and Kruskal Wallis test using the SPSS version 16. Results showed statistical significant difference at $p<0.05$ levels of significance in post test scores of experimental when compared to control group. Constant droolers showed greater improvement than frequent droolers in swab method and drooling quotient with activity at $p<0.05$ levels of significance. The study also found that age and diagnosis do not have an effect on treatment outcome.

**Conclusion:** The study concluded that sensory motor and behavior therapy have a significant effect on reducing drooling in children with cerebral palsy.

**Key Words:** Cerebral palsy; Drooling; Sensory motor therapy; and Behavior therapy.

## Introduction

Drooling is the unintentional loss of saliva from the mouth. Many children lose control of saliva and drool when they concentrate on gross and fine motor movements. Normal children develop the ability to perform most activities without drooling around 2 years of age. Persistent drooling is most commonly associated with neuromuscular disorders such as Cerebral Palsy which is the most common physical disability in early childhood. Those children frequently have lifelong problem with oral motor control that can present as drooling, eating and drinking difficulties and /or speech problems [2].

The pathophysiology of drooling seems to be the result of problems exist in sensory awareness or organisation and children may be unable to perceive the pressure cues in the mouth that would normally serve to trigger an automatic swallow and may be aggravated by inability to close the mouth[1].

Drooling can produce significant negative effects on physical health including irritated facial skin, unpleasant odor, increased oral and perioral infections, hygiene problems,

**Author Affilation:** *MOT (Adv. OT Pediatrics), M.Sc. (Psy), Assistant Professor, Department of Occupational Therapy, Manipal College of Allied Health Sciences, Manipal University, Karnataka, **MOT (Adv. OT Pediatrics), Associate Professor, KMCH College of Occupational Therapy, Tamilnadu Dr. M.G.R Medical University, Tamilnadu. ***MOT (Neurosciences), Assistant Professor, Department Of Occupational, Therapy, Manipal College of Allied Health Sciences, Manipal University, Karnataka.

**Reprint's request: Mrs. Banumathe KR,** Assistant Professor, Department of Occupational Therapy, Manipal College of Allied Health Sciences, Manipal University, Manipal-576104, Karnataka.

Email: banumathe.kr@manipal.edu

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dehydration, social isolation and affect the Quality of Life that can result in a loss of self-esteem. Thus drooling can lead to functional, social, psychological and clinical consequences for patients, families and caregivers.

Control of drooling requires developed oral sensory awareness provided by own secretions in order to swallow in a timely manner and to facilitate frequent swallowing, where sensory therapy is necessary [2].Significant correlations have been found between jaw control ability and adequate swallowing by creating intraoral suction pressure, which implies the need for jaw control techniques[3]. However, the above techniques alone need not facilitate swallowing. Habituation and generalization of swallowing is essential to reduce drooling even when the above techniques are not in use. This can be facilitated through the use of behaviour therapy techniques like positive reinforcement, prompting, cueing, modeling, shaping and prompt fading [4].

Thus there is a need for combination of behavior treatment methods along with sensory motor therapies to increase swallowing frequency, to facilitate mouth closure and thereby reducing drooling [5].

The current study attempts to find out the effectiveness of combinations of sensory, motor and behaviour therapy techniques to reduce drooling in children with cerebral palsy.

## Methods

The study design was two group pretest-posttest quasi experimental designs in which the designed sensory motor and behavior therapy techniques were independent variable and drooling was the dependent variable. The study was conducted in KMCH Occupational therapy Department and Special schools in Coimbatore. 20 Children who have been diagnosed with Cerebral palsy, within the age group of 2 to 12 years of both genders, who were identified to have drooling based on screening tool who scored > 3 in frequency and severity, and who were not having any illness over the past week at the time of the assessment were included for the study and others who were under medications, or undergone any surgeries for drooling or having care givers with psychiatric morbidity were excluded.

Modified drooling measure form and questionnaire on drooling were used for screening, Drooling Quotient (with activity and without activity) and Swab Method used as a primary outcome tool. The drooling quotient is a validated, semi quantitative, direct observational method. The drooling is observed and the presence or absence of drooling is evaluated at every 15$^{th}$ sec interval over a 10 minutes period (40 observations) while the subject is awake and sitting erect. An episode of drooling is defined as new saliva leaving the chin. The drooling quotient expressed as

$$DQ(\%) = \frac{\text{No. of drooling episodes in 10 min}}{\text{40 observations in 10 minutes}} \times 100$$

The swab method is a highly reproducible method and can be used to evaluate salivary flow rates in drooling children in cerebral palsy during interventional studies under standardizes conditions. It was described by Rotteveel et al. after the mouth is dried with sterile gauze; the cotton roll is placed in the floor of the mouth for 2 minutes. The cotton roll should be weighed before and after the procedure using an electronic scale, which is sensitive to 0.01 gram. The increase in weight during the 2 minutes interval is calculated.

A written consent was taken from the head of the institution to conduct a study. The purpose of the study was explained and informed consent was obtained from the caregivers prior to the study. Modified drooling measure form and drooling questionnaire were given to caregivers of 23 children with cerebral palsy. Among them, 20 children were selected and 3 were excluded as they had mild, occasional drooling. The 20 children were divided into 2 groups: experimental and control, 10 in each. Pretest scores were taken using the swab method, drooling quotient without activity and drooling quotient with activities like listening to rhymes, stacking rings

and cups, and beads for both groups. The control group received conventional occupational therapy. The experimental group received conventional occupational therapy along with; Sensory stimulation by using lemon extract, jaw control techniques and behavior therapy techniques was used to facilitate mouth closure and to increase the frequency of swallowing. The behavior techniques were faded, as the child showed improvements. The intervention was given for 10 min/session for 3 days a week over a period of 6 weeks, after which the post test was done.

## Results

The data was analyzed using SPSS version 16. Non-Parametric tests such as Mann-Whitney U test and Kruskal Wallis test were used. Table 1 and 2 shows that there were no significant differences at $p>0.05$ level among experimental and control groups in age, gender, and diagnosis, which can be compared. According to Table 3, there was significant difference between experimental and control group at $p<0.05$ level, which shows the significant reduction in drooling. Table 4 and 5 shows the age and diagnosis do not have an effect on treatment outcome. The constant droolers showed significant improvement at $p<0.05$ which was showed in table 6 that frequency have an effect on treatment outcome.

## Discussion

The main implication for occupational therapists is that the assessment and treatment of drooling should address both the sensory and motor elements of oral function [7]. Hence this study attempted to find out the effectiveness of the above combinations.

Based on the screening tool, the following were also analyzed, which implies the need

**Table 1: Baseline Characteristics**

| CHARACTERISTICS | Experimental Group (N=10) | | Control Group (N=10) | | u-TEST (Z) | P |
|---|---|---|---|---|---|---|
| | MEAN | SD | MEAN | SD | | |
| AGE | 62.4 | 37.22 | 75.6 | 33 | -1.064 | .287 |
| GENDER | 1.30 | .48 | 1.40 | .51 | -.457 | .648 |
| DIAGNOSIS | 1.40 | .51 | 1.60 | .51 | -.292 | .771 |

**Table 2: Comparison of pretest data of experimental and control group**

| DROOLING ASSESSMENT | PRE TEST | | | | u-TEST (Z) | P |
|---|---|---|---|---|---|---|
| | Experimental Group (N=10) | | Control Group (N=10) | | | |
| | MEAN | SD | MEAN | SD | | |
| SWAB | 2.31 | .70 | 1.91 | .81 | -.983 | .326 |
| Drooling Quotient with activity | 45.75 | 22.67 | 42.25 | 14.74 | -.341 | .733 |
| Drooling Quotient without activity | 30.75 | 24.38 | 34.50 | 17.51 | -.682 | .495 |

**Table 3: Comparison of post test data of experimental and control group**

| DROOLING ASSESSMENT | POST TEST | | | | u-TEST (Z) | P |
|---|---|---|---|---|---|---|
| | Experimental Group (N=10) | | Control Group (N=10) | | | |
| | MEAN | SD | MEAN | SD | | |
| SWAB | 1.03 | .480 | 2.25 | .717 | -3.176 | .001* |
| Drooling Quotient with activity | 13.00 | 13.165 | 44.50 | 8.959 | -3.536 | .001* |
| Drooling Quotient without activity | 6.25 | 9.736 | 32.50 | 10.671 | -3.428 | .001* |

* significant at p<0.05 levels

**Table 4: Effect of chronological age on treatment outcome in experimental group**

| DROOLING ASSESSMENT | < 5 YEARS | | > 5 YEARS | | u-TEST (Z) | P |
|---|---|---|---|---|---|---|
| | MEAN | SD | MEAN | SD | | |
| SWAB | 1.156 | .283 | 1.460 | .949 | -1.066 | .286 |
| Drooling Quotient with activity | -26.25 | 16.336 | -31.00 | 18.389 | -.000 | 1.000 |
| Drooling Quotient without activity | -19.166 | 21.369 | -32.50 | 17.677 | -1.183 | .237 |

**Table 5: Effect of diagnosis on treatment outcome in experimental group**

| DROOLING ASSESSMENT | CP QUADRIPLEGIA | | CP DIPLEGIA | | u-TEST (Z) | P |
|---|---|---|---|---|---|---|
| | MEAN | SD | MEAN | SD | | |
| SWAB | 1.128 | .640 | 1.502 | .561 | -.853 | .394 |
| Drooling Quotient with activity | -27.916 | 15.765 | -28.500 | 19.659 | -.107 | .915 |
| Drooling Quotient without activity | -21.666 | 18.819 | -28.750 | 24.195 | -.323 | .747 |

for therapy. Parental views on drooling 90 % of them extremely worried about their child's drooling and their effects on his/her life, 85 % of them needed wiping most of the time, 75 % were frequent droolers, 25 % were constant droolers, 90 % had moderate to severe drooling and 10% had profuse drooling. Percentages of degree of drooling in the following activities were moderate to very severe. 100 % in concentrated activity like fine activities, e.g. stringing beads, putting pegs in a hole etc. 95 % in prone position, 90 % in supported sit, while playing, while crying, 85 % in unsupported sit, 75 % during ill, 50 % while watching TV.

In 1987, Morris stated that the drooling can be reduced by improving sensory awareness or through improving the ability to perceive the pressure cues in the mouth which trigger swallow [8]. The alcohol based flavors may have served to heighten intra-oral sensory awareness in these children who displayed a diminished threshold to swallow. Using lemon

extract in the current study which consisted alcohol could trigger swallow by increasing intra-oral sensory awareness, participants learned to swallow more frequently and drooling diminished over time.

Children with cerebral palsy found to have significant positive correlations between drooling and reduced ability to voluntarily control the jaw [3]. So jaw control technique has been used in the present study which has the ability to facilitate mouth closure and helps in swallowing [9]. Behavior therapy techniques such as positive reinforcement, prompting, cueing can be used to learn new behavior or to increase the frequency of desired behavior [6].Therefore, in the current study, behavior therapy techniques have been used to increase the frequency of swallowing behavior to reduce drooling.

Nunn, 2000 suggested that combination of behavior therapy method and sensory motor therapy are the treatment approaches to be adopted to reduce drooling [5]. The current study findings also supported the above statement by showing the reduction in drooling through the use of sensory motor and behavior therapy in experimental group when compared to control group in all the 3 variables such as swab method, drooling quotient with activity and drooling quotient without activity.

Erasmus et al, 2009 had done a study on salivary flow rates in cerebral palsy of different ages and sex and concluded that no age related decline or increase in distribution of salivary flow in children from 3-19 years of age; age is not an important factor when measuring salivary flow rates till adolescence [10]. Similar findings were recorded in this study.

Heyring et al, 1980 found that there was no correlation between type of cerebral palsy and the incidence of drooling [3]. Likewise, the current study showed that the type of cerebral palsy has no effect on treatment outcome.

The constant droolers have higher improvement when compared to frequent droolers in both swab method and drooling quotient with activity. Generally the children with cerebral palsy have associated movements like opening mouth while concentrating on activities and movements. This may induce drooling. Intervention adopted in this study included sensory stimulation (which would cue a child to swallow saliva), jaw control (which would facilitate appropriate swallowing), positive reinforcement, shaping, prompting (which would increases swallowing frequency). This probably could have reduced drooling during activities.

**Table 6: Effect of frequency of drooling on treatment outcome in experimental group**

| DROOLING ASSESSMENT | FREQUENT DROOLERS | | CONSTANT DROOLERS | | u-TEST (Z) | P |
|---|---|---|---|---|---|---|
| | MEAN | SD | MEAN | SD | | |
| SWAB | 1.007 | .472 | 1.910 | .371 | -2.165 | .030* |
| Drooling Quotient with activity | -25.00 | 15.275 | -35.50 | 19.640 | -.843 | .054* |
| Drooling Quotient without activity | -17.50 | 20.00 | -40.833 | 7.216 | -1.720 | .084 |

*significant at p<0.05 levels

During the study period, the investigator appreciated the following incidents.

One of the children in experimental group showed marked reduction in drooling which made the special educator to recommend the investigator to give therapy to other children as well. Another child was applauded by teachers and other children in morning assembly as his drooling was reduced.

A similar incident was noted in another child where the special educator said that

there is no need to bring hand kerchief to school as his drooling reduced gradually. Some parents also noticed the reduction in drooling and gave positive verbal feedback.

The subjects were not assigned randomly and sample size was too small to generalize the study results. Biological variations and emotional variations were not considered during the assessment. As drooling quotient method was direct observational method, chances for the investigator to miss out the drool while observing is high. If it was videotaped and assessed, it would have been more standardized. The investigator found difficulty in prompt fading and could not assess the generalization as the duration of therapy was short. Longitudinal study would be beneficial. Since this study is the preliminary study to find out the factors like age, diagnosis, frequency affecting the intervention outcome, further research in this area is recommended.

The results of this study favored the alternate hypothesis by showing a significant reduction in drooling after the intervention. The study confirm the implication of intervention should consider the combination of sensory, motor and behavior therapies and further confirm the role of Occupational therapist to intervene for subjects with drooling.

**References**

1. Palmer MM and Heyman B. The effects of sensory-based treatment of drooling in children: A preliminary study. *Physical and Occupational therapy in pediatrics* 1998; 18(3/4): 85-94.
2. Scully C, et al. Drooling-review article. *J of oral pathological medicine* 2009; 38: 321-327.
3. Heyring, Barton EJ, Madsen JJ. The use of awareness and omission training to control excessive drooling in a severely drooling in a severely retarded youth. *Child Behavior Therapy* 1980; 2(1): 55-63.
4. Vanderburg JW, Didden R, Jongerius PH, Rotteveel JJ. A descriptive analysis of studies on behavioral treatment of drooling. *Developmental medicine and child neurology* 2007; 49: 390-394.
5. Nunn JH. Drooling: review of the literature and proposals for management. *J of oral rehabilitation* 2000; 27: 735-743.
6. Wong V, et al. Pilot study of oromotor rehabilitation program for children with drooling problems. *Hong Kong J of Pediatrics* 1999; 4: 96-100.
7. Lambrou R, Tetreault S, Dudely J. The relationship between oral sensation and drooling in person with cerebral palsy. *The Am J of occupational therapy* 1989; 43(3): 155-161.
8. Dunn KW, Cunningham CE, Backman JE. Self-control and reinforcement in the management of a cerebral-palsied adolescent's drooling. *Developmental medicine and child neurology* 1987; 29(3): 305-10.
9. Iammatteo PA, Trombly C, Luecke L. The effect of mouth closure on drooling and speech. *The Am J of occupational therapy* 1990; 44(8): 686-691.
10. Erasmus CE, et al. Drooling in cerebral palsy: Hyper salivation or dysfunctional oral motor control. *Developmental medicine and child neurology* 2009; 51(6): 454-459.