

# Pilot Study of Oro-motor Habilitation Program for Children with Drooling Problem: A Pilot Observation

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## Abstract

A pilot project for children who attended the Drooling Clinic at the Children's Habilitation Institute of the Duchess of Kent Children's Hospital was conducted. The aim was to investigate the effectiveness of the Oro-motor Habilitation Program in reducing drooling. The Program consisted of oro-motor function training, behavioral modification program, motor control training, the use of oral appliances and surgical treatment. The study group consisted of 12 children with varying degrees of drooling problem, cerebral palsy and mental retardation (N=7) and mental deficiency (N=5). Visual analogue scale and Drooling Quotient (DQ) were used to measure the severity of drooling before and after the Oro-motor Habilitation Program. Improvement occurred in 75% of children after receiving the Oro-motor Rehabilitation Program for 6 months, 86 % for cerebral palsy, 60% for mental deficiency. We propose to provide a trial of Oro-motor Habilitation Program before embarking on surgical treatment of drooling.

## Key words

Oro-motor Habilitation Program; Visual Analogue Scale; Drooling Quotient; Multi-disciplinary; Children

## Introduction

Drooling is normal in infants and it will subside by the age of 18 months.<sup>1</sup> However, drooling is common in populations with mental retardation or cerebral palsy beyond this age and may even persist to adult life.<sup>2</sup>

Drooling occurs in 10-13% of children with cerebral palsy<sup>3</sup> and has also been noted in patients with other forms of neurological damage.<sup>4</sup>

Drooling remains a stigmatizing problem. It may contribute to loss of body fluid, dehydration, facial inflammations and infections. Children with drooling problems may suffer from social isolation as the caregiver tends to avoid them or exclude them from group activities.<sup>5</sup> Frequent change of clothes will increase the workload of the caregiver. In addition, saliva may cause a disagreeable odor or may damage common household items such as computers, books and worksheets.

Adequate saliva control is important to the acceptance of these children by the community. Currently, the Children's Habilitation Institute has been assessing and treating children with specific oro-motor problems such as drooling and/or feeding problems. The multidisciplinary team consists of child neurologists, developmental paediatricians, otolaryngologists, speech therapist and occupational therapists. The aim of the study was to investigate the effectiveness of the Oro-motor Habilitation Program in reducing drooling severity and frequency.

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## Subjects and Methods

The study group consisted of 12 children ( 8 boys, 4 girls) with varying degrees of drooling, currently followed

up in the Drooling Clinic of the Duchess of Kent Children's Hospital. Their age ranged from 4 to 18 years (mean age = 7.1 years.) Seven children had cerebral palsy and mental deficiency and 5 had mental deficiency.

The treatment program consisted of (1) behavioral modification program conducted by speech therapist to reinforce good lip closure, (2) motor control programs conducted by occupational therapist aiming at improving postural muscle tone control, (3) oro-motor training conducted both by speech therapist and occupational therapist including normalizing the muscle tone of lips, cheeks and tongue together with developing good lip, tongue and jaw control (4) Oral appliances such as complete lip closure detector which will facilitate sensory awareness of lip closure (5) surgical treatment by otolaryngologist.

All children were given oro-motor training and behavioral modification program for a period of 6 months on a biweekly basis. Home training was carried out by the caregivers for 5 minutes twice a day, 5 days/week.

Oro-motor training aimed to improve tongue position and mobility, lip closure, jaw position and stability. It

consisted of brushing, vibration and icing. Vibration was applied to the masseter, the anterior digastric muscles and the upper lip for two minutes in each area. Other manipulating techniques such as stroking, patting and tapping were applied on both the upper and lower lips to improve normal movement pattern.

Cerebral palsy children who drooled had more trouble in initiating swallowing than normal children or cerebral palsy who did not drool.<sup>6</sup> Drooling may be related to infrequent swallowing, inadequate lip closure and poor head posture. Our subjects were encouraged to have frequent swallowing. A mirror was used as a visual aid to give feedback to increase swallowing frequency. Different combinations of verbal cueing and positive reinforcement were also used. In order to decrease habitual open mouth posture, patients were rewarded with food when they kept the lips closed over one minute, which was gradually increased to longer period of time as the patient's ability to control drooling improved.

Positional and oro-motor functional problems predispose to drooling, thus treatment to improve body position and posture are important in the management of

**Table 1** Demographic data of 12 children with drooling problem

Case	Sex	Age	Diagnosis	Head control	Communication	Facial tone	Ability to close lip	Habitual mouth closure	Training sessions
1	M	4	CP, MR Epilepsy	Poor	Non-verbal	Hypertonic	Yes	Open	7
2	F	7	CP, MR Epilepsy	Fair	Non-verbal	Hypertonic	Yes	Open	10
3	M	7	Mild MR	Good	Verbal (sentences)	Hypotonic	Yes	Open	11
4	F	7	Moderate MR Epilepsy	Good	Verbal (single word only)	Hypotonic	Yes	Open	10
5	F	6	CP, MR	Good	Verbal (single word only)	Hypotonic	Yes	Open	9
6	M	7	CP, MR	Fair	Non-verbal	Hypertonic	Yes	Open	12
7	M	4	Severe MR Epilepsy	Good	Non-verbal	Hypotonic	Yes	Open	9
8	F	18	Severe MR Rett Syndrome	Good	Non-verbal	Hypotonic	Yes	Open	6
9	M	5	CP, MR	Fair	Non-verbal	Hypotonic	Yes	Open	7
10	M	10	Mild MR	Good	Verbal (sentences)	Hypotonic	Yes	Open	8
11	M	6	CP Epilepsy	Poor	Non-verbal	Hypotonic	Yes	Open	7
12	M	6	CP, MR Epilepsy	Poor	Non-verbal	Hypertonic	Yes	Open	8

MR - mental retardation

CP - cerebral palsy

drooling. Seven cerebral palsy children were also given motor control program. They were positioned in a way that their shoulder girdle, trunk, and pelvis were stable and the back of the neck was straight with the chin slightly tuck. Since stability is pre-requisite for mobility, oro-motor training could be further facilitated through an increase in head and trunk stability.

Only 2 children (Cases 3 and 10) with mild mental retardation had the ability to follow verbal commands. They were given oral appliance of the complete lip closure detector. This was a device that consisted of a lip electrode connected to an electronic control unit. The lip sensor was hooked onto the lower lip. When the lip seal was broken, a continuous beep was activated. It was developed as a lip seal reminder to assist the children in improving lip closure.

**Measurement of Drooling**

Drooling was measured by two validated techniques: (1) Visual Analogue Scale which is a questionnaire-based scoring system for severity of drooling and (2) Direct semi-quantitative observation (i.e. Drooling Quotient).

The Visual Analogue Scale was used to measure the severity of drooling before and after Oro-motor Habilitation Program. The scale was a 10 cm line with the marking of 'Normal' at one end, and 'Extremely wet' at the other end. The severity of drooling was assessed visually by the caretaker and represented by a mark along the visual analogue scale. The lowest score was zero which meant that the child never drooled. The highest score was 10, which meant that the child had severe drooling.



A visual analogue scale is 10 cm in length

During the reassessment after treatment, the same caretaker rated the severity of drooling without referring to the previous score. Successful treatment outcome was defined as any negative change (i.e. decrease in score) in the visual analog scale.

An objective measurement was also used to document the degree of improvement by a using the Drooling Quotient.<sup>7</sup> Drooling was observed and scored during two periods of 10 minutes separated by a 30-minutes break. The presence or absence of drooling was evaluated at every 15-seconds interval over a 10-minutes period (40 observations) while the patients were awake and sitting erect. An episode of drooling was defined as new saliva leaving the chin. The drooling quotient, expressed as a percentage, was calculated as the number of drooling

episodes in 10 minute divided by 40 (the number of observations).

During the initial assessment, drooling quotient was obtained on two occasions by the speech therapist and a mean value was calculated as a baseline measure. Treatment was provided regularly on a biweekly basis for 6 months. The patients were reassessed after treatment. Successful treatment outcome was defined as any negative change (i.e. a decrease in Drooling Quotient).

**Drooling Quotient**

$$(DQ) (\%) = \frac{\text{no.of drooling episodes}}{40 \text{ observations}} \times 100\%$$

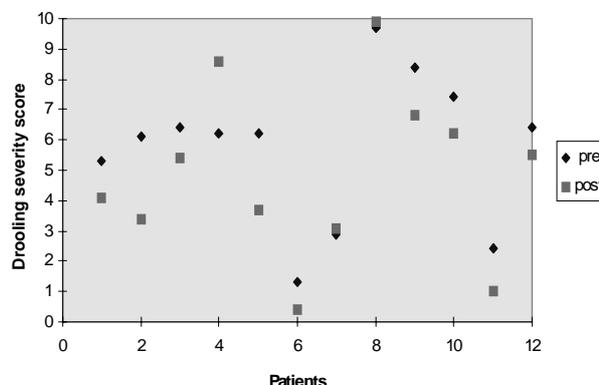
( in a 10 minute period)

**Results**

Pre- and post-treatment data were analysed using Wilcoxon matched-pairs signed-rank analysis. This showed an improvement in both the median drooling severity, from 6.3 (pre-treatment measure) to 4.8 (post-treatment) in the Visual Analogue Scale (p<0.05) (Figure 1); from 32.5% (pre-treatment assessment) to 20% (post-treatment assessment) in the Drooling Quotient (p<0.05) (Figure 2).

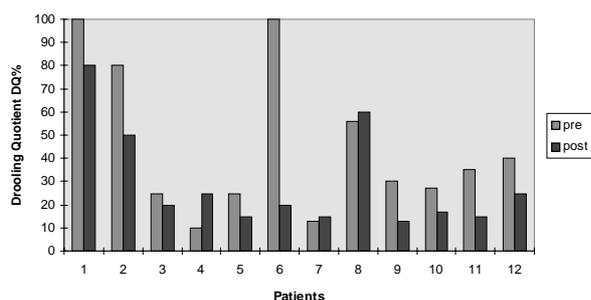
**Discussion**

The control of drooling is difficult as the problem is



Diamonds represent the pre-treatment performance and squares represent the post-treatment performance.

**Figure 1** Visual Analogue Scale. Pre- and Post-treatment Performance on Measure of Drooling Severity rated by the same care-taker using the Visual Analogue Scale.



**Figure 2** Drooling Quotient. Pre- and Post-treatment Assessment of Drooling Frequency rated by the Speech Therapist.

caused by complex interacting elements, especially for children with severe and multiple disabilities. Several factors may contribute to drooling, including poor head and trunk control, disordered oro-motor control, inadequate swallowing skills such as inadequate oral suction,<sup>8</sup> infrequent swallowing,<sup>6</sup> incomplete lip closure<sup>9</sup> and pharyngeal sensory deficit interfering with swallowing.<sup>1</sup>

Drooling in cerebral palsy children cannot be cured by application of a single treatment method. Therefore, a combination of treatment approaches may be necessary.<sup>10,11</sup> The first line therapy usually consists of behavioral modification programs, motor control programs for physical positioning and head control, tone normalization, oral sensory motor treatment, oral appliances giving bio-feedback to development of lip seal. When the above means fail, surgical treatment may be necessary.

Our study showed that Oro-motor Habilitation Program in treatment of children with drooling problem can alleviate the problem to some extent with 9 children showing improvement. Patient (6) was a child with cerebral palsy and mental retardation with severe drooling. With his mother's high motivation to be involved in the training program and 100% attendance rate after biweekly therapy of physical positioning, behavioral modification and oro-motor training for 6 months, his drooling quotient was reduced from 100% to 20%. This preliminary result suggests that drooling can be treated. The extent of the initial drooling may not limit the outcome that can be achieved.

With her parents' consent, Patient (8) aged 18, a child with Rett syndrome, was considered for bilateral submandibular duct relocation and sublingual gland excision by ENT surgeon as she was found to have persistent moderate drooling after failure of 6-months therapy.<sup>12,13</sup> One-month after surgery, her drooling quotient reduced from 55% to 15% and drooling severity was reduced from 9.8 to 1.2 in the visual analogue scale.

Patient 4 showed increased in drooling after 6-month therapy. One of the factors contributing to the increase in drooling may be related to her frequent episodes of seizure during the training period and she was put on anti-convulsion medications.

Various success rates are found in 9 children and it is not possible to conclude which method of treatment is the best. However, children's awareness of drooling and the ability to swallow on command seemed to be the factors affecting the treatment outcome of the behavioral program and the use of oral appliances. For children who were not able to follow any verbal instructions or imitate oral movement, oro-motor program seemed to work better for them.

Our results show improvement in drooling, indicating that treatment oro-motor therapy and behavioral therapy may be worth trying even in more severe cases with saliva control problems. However, children's awareness of drooling, the ability to swallow on command seemed to be other factors affecting the treatment outcome of the behavioral program.

These results are the broad brushstrokes that encourage more specific investigation into drooling in disabled children. Our study has limitations, mainly the short duration of therapy, the lack of standardization of other therapy, and the nonblind study design.

Larger sample size and grouping of patients into more homogeneous groups, as well as control studies would be necessary to evaluate the different treatment methods in different patient groups. The initial results are encouraging and may be useful in designing a long-term control study. We believe that a period of quality Oro-motor Habilitation Program is essential before contemplating surgical treatment and multidisciplinary approach can enable refinement of assessment techniques and different treatment strategies.

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