

## Research Article

### Drooling Reduction with Oral Motor Exercises Among Cerebral Palsied Children at the National Institute of Rehabilitation Medicine: A Quasi-Experimental Study

Anees Fatima<sup>1</sup>, Nazia Mumtaz<sup>2</sup>, Ghulam Saqulain<sup>3</sup>

<sup>1</sup>Speech Therapist, Institute of Medical Rehabilitation (IMR), Islamabad, Pakistan; <sup>2</sup>Head of Department of Speech Language Pathology & Hearing Sciences, Isra Institute of Rehab Sciences, Isra University, Islamabad, Pakistan; <sup>3</sup>Head of Department of Otorhinolaryngology; Capital Hospital, CDA, Islamabad, Pakistan

#### Abstract

**Background:** Cerebral palsy (CP), with a frequency of 1.22/ 1000 live births, is the commonest cause of motor deficiency and results in multiple of issues. Drooling is one highly prevalent problem occurring due to dysfunction of oral-motor mechanisms and altered intraoral sensitivity. In spite of a number of management options few including oral motor exercises (OME) have been evaluated. Insufficient evidence regarding efficacy of OME, prompted us to conduct this study.

**Objective:** To analyze the effectiveness of oral motor exercises (OME) to reduce drooling in cerebral palsied children.

**Methodology:** This Quasi experimental study with purposive sampling was conducted at Speech-Language Therapy Department of National Institute of Rehabilitation Medicine, Islamabad over a period of six months. N = 15 CP cases with drooling, of either gender, aged 4 to 15 years underwent OME for drooling control. Severity and frequency of drooling was assessed on Thomas-Stonell and Greenberg scale before intervention and post-intervention at two occasions. Statistical analysis was carried out using SPSS 21.

**Results:** A significant reduction in drooling (p value of < 0.05) occurred with reduction in the drooling severity from a mean score of 3.86 + 0.91 at start of treatment to 3.53 + 1.06 at completion of 25 sessions and 2.73 + 0.96 at completion of 50 sessions following OME. Also the drooling frequency reduced from a mean value of 3.88 + 0.43 to 3.60 + 0.50 at completion of 25 sessions and 2.28 + .54 at completion of 50 sessions.

**Conclusion:** OME results in significant decrease in drooling in CP patients.

**Received** | 15-10-2018: **Accepted** | 25-03-2019

**Corresponding Author** | Dr. Ghulam Saqulain, Head of Department of Otorhinolaryngology; Capital Hospital, CDA, Islamabad, Pakistan. **Email:** ghulam\_saqulain@yahoo.com

**Keywords** | Cerebral palsy, Drooling, Sialorrhea, Swallowing, Therapy

#### Introduction

Cerebral palsy (CP) is a neurological condition arising from damage to immature brain and characterized by childhood disorders of development with limitations of physical, mental, communicational and intellectual abilities.<sup>1</sup> According to Bax M et al, the disturbances of motor system in these

children affect other sensations, cognitive ability, perception, communication and behavior. Also comorbidities like epileptic fits and secondary musculoskeletal problems can arise.<sup>2</sup> Bax, 1964, defined CP as a postural and movement disorder due to a lesion of the immature brain. It has a frequency of 1.5 to 4.0 per 1000 live births in the United States<sup>3</sup> and 1.22 per 1000 live births in Pakistan<sup>4</sup> and is associated

with a number of issues including drooling with a high prevalence.<sup>5</sup> It is defined as “Saliva coming out beyond the lip margin”, and usually results from weak muscles with weak swallows of reduced frequency,<sup>6</sup> resulting from dysfunction of oral-motor mechanisms and altered intraoral sensitivity.<sup>5</sup> Drooling is also related to behavior, since it causes a vicious cycle of less expectations and thus more drooling,<sup>7</sup> with issues like soiled bad looking clothing, bad smell and resultant infection, ulceration of neighboring skin, communicational difficulties resulting in social rejection.

The management of drooling encompasses a number of options including: Non-invasive options like oral motor therapies and medications; and Invasive options like radio therapeutic or surgical intervention, so much so that submandibular duct relocation may also be considered.<sup>9-11</sup> Several researchers claim training to enhance sensory awareness and motor skills is most effective,<sup>5</sup> however age, mobility and involvement of oral motor mechanisms being predictors of outcome require further research.

In spite of a number of management options, few have been evaluated including oral motor exercises (OME) for sialorrhea, with not sufficient evidence to access the effects of OME on swallowing.<sup>12</sup> Also Arvedson J et al. in their study recommended further research due to dearth of studies with enough data keeping in view the stressing and socially isolating effects of drooling.<sup>12</sup>

The present study aims to analyze the effectiveness of oral motor exercises to reduce drooling in CP patients. It is hypothesized that OME results in significant decrease in drooling of CP patients after 25 sessions and after 50 sessions (post intervention). The present study has significant importance since local data is not available.

## Methods

Following ethical approval from the institutional research board, this interventional study was carried out in the department from May 2017 to October 2017. Fifteen patients were enrolled after obtaining consent for inclusion in the study, using purposive non probability sampling. All patients 4 to 15 years of age with cerebral palsy and no associated developmental anomalies or acquired disability were inclu-

ded. This study was conducted in Speech-Language Therapy Department of National Institute of Rehabilitation Medicine, Islamabad, Pakistan with the hypothesis that OME results in significant decrease in drooling of CP patients after twenty five sessions and after fifty sessions (post intervention)

During the sessions, the CP patients were seated on chairs or wheel chairs in a well-lit and ventilated speech therapy cabin. Being a rapid and accurate, the Drooling Severity Scale and Drooling Frequency Scale (DSFS) was used for assessment,<sup>8</sup> where Drooling Severity scoring is 1 (never drools), 2 (mild drooling), 3 (moderate with drool reaching lips and chin), 4 (severe with drool drips off chin) and 5 (profuse where drool drips off the body) and Drooling Frequency is scored 1 (no drooling), 2 (occasional), 3 (frequently drools) and 4 (constant drooling) and Final Drooling Score is the sum of sub-scores. Before instituting therapy, the patient's general information was collected on a demographic sheet before starting OME therapy sessions for each patient. Total 50 individual therapy sessions were conducted for each patient with 24 hour gap between two sessions and each session conducted for thirty minutes duration. In each session, participants were provided with oral motor exercises (OME) for drooling control, including techniques for sensory stimulation; face massage, tapping, stroking, brushing and icing stimulation. Drooling severity scale and frequency scale scoring and recording was done to measure drooling control before starting speech therapy sessions, after conducting 25 sessions and the end of 50 sessions and data entered.

Data collected was coded, organized and SPSS 21.0 was used for statistical analysis and tests. For gender frequency and percentage were calculated, while age was presented by Mean + SD. Also mean and standard deviation of drooling severity score and drooling frequency score were noted. Repeated measures ANOVA (RM-ANOVA) was used to find within group differences. The results were then compared with local and international literature.

## Results

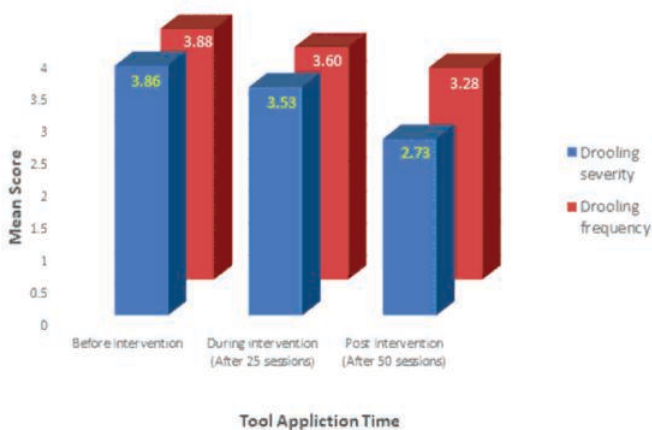
With a view to analyze the effectiveness OME to improve drooling in C.P patients, the findings of the study were statistically analyzed. Our study popula-

tion comprised of N=15 cases with no dropout, with an age range of 4 to 15 years, median age 9.00 years and IQR of 4 years including 8 (53.3%) males and 7 (46.7%) females with male female ratio of 1.14:1.

The differences within groups for drooling severity and frequency were measured by using RMANOVA (Table 1), which shows that overall there was significant decrease in drooling severity and drooling frequency at  $p < 0.05$  (Figure 1).

**Table 1:** Group Difference for Drooling Severity and Drooling Frequency. Drooling Severity and Frequency\* Mean Drooling Score. Cross Tabulation (n=15)

Scale	Tool Application Time	Drooling Score (Mean±SD)	p-value
Drooling Severity	Before intervention	3.86 ± .91	0.10
	During intervention (After 25 sessions)	3.53 ± 1.06	
	Post intervention (After 50 sessions)	2.73 ± .96	
Drooling Frequency	Before intervention	3.88 ± .43	0.001
	During intervention (After 25 sessions)	3.60 ± .50	
	Post intervention (After 50 sessions)	3.28 ± .54	



**Figure 1:** Chart Showing Improvement in Drooling Severity and Drooling Frequency Following Institution of OME at 25 Sessions and at 50 Sessions Post therapy (n=15)

## Discussion

Cerebral palsy (CP) is highlighted with impaired oral motor function, resulting in problems with swallowing mechanisms including sucking, chewing, and swallowing resulting in drooling/ sialorrhea. Droo-

ling is a major issue with an overall prevalence of 10 to 58%<sup>5</sup>, and 22.20% in admitted cases in a local study.<sup>13</sup> In a systematic review of literature, Arvedson J et al. noted mixed findings as regards results of oral motor exercises (OME) in different studies, suggesting that there was insufficient evidence to judge the impact of OME on swallowing.<sup>12</sup> Thomas and Greenberg reported that age, mobility and involvement of oral motor mechanisms, were important factors in predicting outcome, and reported improved drooling severity and frequency in 66% cases with conservative treatment strategies alone,<sup>8</sup> providing better eating and swallowing for improved quality of life.<sup>14</sup>

In this quasi-experimental study, results indicated significant decrease in drooling severity ( $P < 0.00$ ) and drooling frequency ( $P < 0.001$ ) with OME. Sensory issues may result in drooling in CP, which can affect swallowing, chewing and speaking with many researches claiming that OME techniques were effective in reducing drooling in CP patients<sup>5,10</sup> and similar results are reported in our study. According to Dias BL et al. training CP child for sensory awareness and motor skills is most effective<sup>5</sup> and benefit of oral motor stimulation by OME (brushing) has also been reported.<sup>7</sup> In a local study by Iram H et al. OME proved to be more effective than behavioral therapy in decreasing drooling.<sup>15</sup> These findings correlate with the finding of the current study.

In the present study, following institution of OME, significant reduction in drooling ( $p$  value of  $< 0.05$ ) occurred with reduction in the drooling severity from a mean of  $3.86 \pm 0.91$  at start of treatment to  $3.53 \pm 1.06$  at completion of 25 sessions and  $2.73 \pm 0.96$  at completion of 50 sessions. Also the drooling frequency reduced from a mean value of  $3.88 \pm 0.43$  to  $3.60 \pm 0.50$  at completion of 25 sessions and  $3.28 \pm 0.54$  at completion of 50 sessions (Figure 1). Similarly Kumar R et al. (16), reported in their study, that the severity of drooling improved from pretreatment value of  $2.60 \pm 0.50$  to  $1.00 \pm 0.00$  following OME and similarly frequency reduced from  $2.67 \pm 0.49$  to  $1.14 \pm 0.36$ . This was also associated with control of oral-motor structures like tongue, lip and even jaw control.<sup>16</sup> Also in a study by Clark HM, improved oral function including drooling occurred due to motor exercises along with sensory stimulation of oral-motor and respiratory muscles<sup>(17)</sup>, supporting the result of current study. In a similar study OME were successful to control frequency and severity of drooling in CP by application of facial massages and other oral-motor techniques like stretching, vibration, tapping, stroking and sensory techniques, thus



improving swallowing.<sup>17</sup> Also Pervez R, in a local study concluded that the Kinesio Taping improved drooling.<sup>18</sup> This evidence correlates with findings of present study. Behavioral therapy for drooling control is time consuming and alternative self-management strategies may help.<sup>19</sup> Failure of conservative therapies justify invasive interventions like injection botulinum toxin and surgical interventions like salivary duct ligation or relocation etc.<sup>20</sup> A survey of CP care professionals in France revealed that the commonest modality used was facial rehabilitation in 95%, followed by administration of anticholinergic drugs in 94%, injections of botulinum toxin in 66% and surgery in 34 % cases<sup>21</sup> and reduction in drooling leads to less care needs.<sup>22</sup> However according to Lawrence & Bateman, the target should be individual's needs keeping in view the comorbidities.<sup>19</sup>

Study had limitation since, the sample size was small and variations across age and types of cerebral palsy were not controlled thus there is chance of these variables to act as confounders.

## Conclusion

The present study shows that oral motor exercises are effective in reduction of both frequency and severity of drooling among cerebral palsy patients. Keeping in view the results of this study, a trial of this non-invasive technique is justified before opting for invasive strategies to treat sialorrhea in CP children.

**Ethical Approval: Given**

**Conflict of Interest: None**

**Funding Source: None**

## References

- Colver A, Fairhurst C, Pharoah PO. Cerebral palsy. *Lancet*. 2014; 383(9924):1240-49.
- Bax M, Goldstein M, Rosenbaum P, Leviton A, Paneth N, Dan B et al. Proposed definition and classification of cerebral palsy. *Dev Med Child Neurol*. 2005; 47(8):571-76.
- Tian CY, Leng LG, Tian ZM. How to deal with cerebral palsy in 21st century--a new epoch in clinic treatment. *Zhongguo Ying Yong Sheng Li Xue Za Zhi*. 2014; 30(6):511-15.
- Ahmad A, Akhtar N, Ali H. Prevalence of Cerebral Palsy In Children of District Swabi Khyber Pakhtunkhwa – Pakistan. *Khyber Med Univ J*. 2017; 9(2): 88-91
- Dias BL, Fernandes AR, Maia Filho HS. Sialorrhea in children with cerebral palsy. *J Pediatr*. 2016; 92(6):549-58.
- Bavikatte G, Sit PL, Hassoon A. Management of Drooling of saliva. *BJMP*. 2012;5(1):a507
- Furuta M, Yamashita Y. Oral Health and Swallowing Problems. *Curr Phys Med Rehabil Rep*. 2013;1(4): 216-22.
- Rashnoo P, Daniel SJ. Drooling quantification: Correlation of different techniques. *Int J Pediatr Otorhinolaryngol*. 2015; 79(8):1201-5.
- Bavikatte G, Sit PL, Hassoon A. Management of Drooling of saliva. *Br. J. Med. Pract.* 2012;5(1):5071
- Erasmus CE, van Hulst K, Rotteveel JJ, Willemsen MA, Jongerius PH. Clinical practice: swallowing problems in cerebral palsy. *Eur J Pediatr*. 2012; 171(3): 409-14.
- Walshe M, Smith M, Pennington L. Interventions for drooling in children with cerebral palsy. *Cochrane Database Syst Rev*. [Internet]. 2012 [Cited 2018 Sept.12]. Available from: <http://onlinelibrary.wiley.com/enhanced/doi/10.1002/14651858.CD008624>.
- Arvedson JI, Clark H, Lazarus C, Schooling T, Frymark T. The effects of oral-motor exercises on swallowing in children: an evidence-based systematic review. *Dev Med Child Neurol*. 2010; 52(11): 1000–13
- Ali Z, Umar S, Shah AA, Basit A, Oneeb A, Irfan HM. Frequency of Various Types of Cerebral Palsy amongst the Admitted Children at a Tertiary Care Hospital and Retrospective Etiologic analysis on the Basis of History, Examination and Laboratory Support. *PJMHS*. 2017;11(1) 75-79
- Levitt S, Addison A. Treatment of cerebral palsy and motor delay. 6th ed. United States: Wiley-Blackwell; 2018. 1-24 p.
- Iram H, Khan MSG, Maqsood M. Effectiveness of Non-Invasive Interventions in Controlling Drooling. *J Riphah Coll Rehab Sci*. 2014; 02(01):03-07.
- Kumar R, Varma A, Kumar V. Role of Oromotor Therapy in Drooling Child attending ENT Department. *IOSR J Dent Med Sci*. 2015; 14(8):9-13.
- Clark HM. Neuromuscular treatments for speech and swallowing: a tutorial. *Am J Speech Lang Pathol*. 2003; 12(4):400-15.
- Pervez R, Butt AK, Tabassum N. Effectiveness of kinesio taping therapy in drooling management among children with cerebral palsy. *J Riphah Coll Rehab Sci*. 2014; 02(01):12-17.
- de Bruijn TWP, Sohler J, van der Burg JJW. Outpatient Treatment Based on Self-Management Strategies for Chronic Drooling in Two Children. *J Dev Phys Disabil*. 2017;29(5):735-755.
- Lawrence R, Bateman N. Surgical Management of the Drooling Child. *Curr Otorhinolaryngol Rep*. 2018; 6(1):99-106.
- Chaléat-Valayer E, Porte M, Buchet-Poyau K, Roumenoff-Turcant F, D'Anjou MC, Boulay C et al. Management of drooling in children with cerebral palsy: A French survey. *Eur J Paediatr Neurol*. 2016; 20(4):524-31.
- Van der Burg JJ, Jongerius PH, Van Hulst K, Van Limbeek J, Rotteveel JJ. Drooling in children with cerebral palsy: effect of salivary flow reduction on daily life and care. *Dev Med Child Neurol*. 2006; 48(2):103-7.