



## RELATIONSHIP BETWEEN FEEDING AND ORO-MOTOR SKILLS IN CHILDREN WITH CEREBRAL PALSY

Srushti Shabnam\*

Swapna N\*\*

\*Lecturer (Audiology and Speech Therapy), Department of ENT, Swami Rama Himalayan University, Uttarakhand.

\*\*Reader in Speech Pathology, Department of Speech-Language Pathology, All India Institute of Speech and Hearing, Karnataka.

### Abstract

*Feeding and oro-motor deficits are often associated with children with cerebral palsy, but most of the studies do not depict the relationship between feeding and oro-motor problems objectively.*

**Aim:** *To investigate the feeding and oro-motor skills and to assess the relationship between two in children with cerebral palsy (CP).*

**Method:** *To assess the feeding and oro-motor skills, the physical domain of Feeding Handicap Index (FHI) (Srushti, 2014) and the Com-DEALL oro-motor assessment checklist (Archana, 2008) respectively were administered on 60 children with CP in the age range of 2-10 years.*

**Results:** *The results indicated feeding and oro-motor problems in children with cerebral palsy. There was a strong correlation between physical domain of FHI and the oro-motor scores obtained on the Com-DEALL checklist. Further, the correlation was much stronger for the dyskinetic, rather than the other types of CP. It was also seen that the feeding issues were greatest in quadriplegics.*

**Discussion:** *The findings of the present study revealed that feeding and oro-motor problems were quite common in children with CP. These findings were in consensus with several studies reported in the literature. The findings also indicate the possibility of a causal relationship between the two.*

**Conclusion:** *It can be concluded that children with CP do have oro-motor and feeding deficits and there is a relationship between the two. However future studies have to explore the relationship between feeding and oro-motor skills in depth. These findings have implications for intervention of feeding problems.*

**Key Words:** *Cerebral Palsy, Feeding Skills, Oro-Motor Skills.*

### Introduction

Cerebral palsy (CP), one of the most frequent conditions leading to developmental disability in children, is often associated with a variety of feeding problems and oro-motor dysfunction. CP is defined as a group of permanent disorders of the development of movement and posture, leading to activity limitation which is caused by disturbance in the developing fetus or infant brain. The motor deficit can co-occur with the disturbance of sensation, perception, cognition, communication and behavior (Rosenbaum, Bax, Goldstein, Leviton & Paneth, 2006). The children with cerebral palsy are at risk for feeding problems, dysphagia, gastro esophageal reflux disease and aspiration. The prevalence of feeding difficulties in CP children varies from 30-90% (Reilly, Skuse, & Poblete, 1996; Fung, Samson-Fang, Stallings, Conaway, Liptak, Henderson, et al., 2002). Research indicates that these feeding problems are prevalent in children with cerebral palsy.

A longitudinal study by Motion, Northstone, Emond, Stucke, and Golding, (2002) revealed that children with cerebral palsy exhibited weak sucking at 4 weeks of age and had greater feeding difficulties which were seen at 6 months of age. Also, feeding difficulties at 4 weeks of age was associated with the pattern of functional impairment at 4 years of age and at 8 years and with speech and swallowing difficulties at 8 years of age.

Yilmaz, Basar, and Gisell (2004) assessed functional feeding skills of patients with CP, aged 4-25 years using the Modified Functional Feeding Assessment Scale (FFAm). Mothers had expressed concern regarding drooling and reluctance in accepting solid foods. None of the mothers thought that there was a major problem with adequate ingestion. However, the study revealed that patients had disabilities in spoon feeding, biting, chewing, cup drinking, straw drinking, swallowing and clearing.

In a study done on Pakistani children with moderate to severe cerebral palsy in the age range of 3-15 years, the parents reported that their children had difficulty in getting food off spoon with lips, were taking longer time to swallow the bites of



food, liquid leaked out of corners of the mouth and had coughs when receiving liquids or pressed tongue forward while swallowing. The study suggested that 90% of parents were conscious about the feeding problem in their children with cerebral palsy (Ghayas & Sulman, 2013).

Diwan and Diwan (2013) found maximum inadequate feeding skills present in spastic quadriplegic type of CP (75.0%). Problems found were related to sucking and swallowing, inability to self-feed (48.5%), prolonged feeding time (mean feeding time was 22.42 minutes) (95%), improper feeding positions, coughing and choking during feeding (6.1%), vomiting (3.0%), recurrent chest infections, oral motor dysfunction, drooling and cry / strong extensor thrust during feeding.

The feeding problems or dysphagia encountered in children with CP could be due to the abnormal oral muscle tone and strength and general body posture (Arvedson & Brodsky, 2002). The lack of tongue lateralization, instability of the lower jaw, and phasic biting can severely limit the individual's ability to chew, position, and swallow a food bolus safely (Rogers, Arvedson, Buck, Smart, & Msall, 1994). Gangil, Patwari, Aneja, Ahuja, and Anand, (2001) also stated that the main etiology of feeding difficulties in CP children is oro-motor dysfunction (OMD), leading to inadequate chewing and swallowing, requiring longer feeding session, and causing inadequate calorie intake. The persistence of the primitive reflexes such as suckle-swallowing, rooting, gagging, biting, asymmetrical tonic neck reflex etc. can also interfere with a child's eating skills (Ottebacher, Bundy, & Short, 1983). Hypersensitivity around the oral regions, hyperactive gag reflex, and restricted temporomandibular joint can also be presumed to cause feeding problems.

Oro motor dysfunction is also frequently observed in children with neurological problems and those who are born premature (Lau & Hurst, 1999; Gisel, Alphonse, & Ramsay, 2000; Sullivan, Lambert, Ford-Adams, Griffiths, & Johnson, 2007). It is often seen in children with CP (Ramsay, Gisel, McCusker, Bellavance, & Platt, 2002; Reilly, Skuse, Wolke, & Stevenson, 1999). Oropharyngeal Dysphagia (OPD) is found to be prevalent in children with CP (Parkes, Hill, Platt, & Donnelly, 2010; Calis, Veugelers, Sheppard, Tibboel, Evenhuis, & Penning, 2008). A study by Benfer, Weir, Bell, Ware, Davies, and Boyd (2013) revealed that 85% of children with CP in the age range of 18-36 months had OPD. They found that half of the population had impaired pharyngeal phase and impaired saliva control.

Some studies have tried to investigate the oro-motor difficulties as well as the feeding problems in children with CP. A study by Reilly, Skuse and Poblete (1996) examined the oral-motor involvement, feeding history, and current feeding methods of 49 children with CP who were between the ages of 1 and 6 years. Findings indicated that feeding difficulties for children with CP were common during the first 12 months of life and that all preterm and most term babies with CP had been fed non-orally at least once. Sucking problems were seen in 57%, swallowing problems were seen in 38% of the children and 80% had been fed non-orally on at least one occasion. Further, results revealed that more than 90% of the children with CP had clinically significant oral-motor dysfunction, and 60% of the children in the study were completely dependent on caregivers for all feeding. Children with more severe gross motor involvement tended to have more severe oral motor dysfunction.

Gangil, Patwari, Aneja, Ahuja, and Anand (2001) tried to determine the magnitude and extent of feeding problems in children with cerebral palsy (CP). One hundred children (76 boys and 24 girls) with cerebral palsy of mean age 2.5 years (range 1 to 9 years) and mean developmental age of 7.6 months (range 1 to 36 months) were included in the study. Oral motor dysfunction was found in all cases and in each category. Spastic quadriplegic cerebral palsy and hypotonic patients had significantly poor feeding skill score. Children with CP exhibited prolonged feeding time and were on liquid and semisolid diet.

Sjakti, Syarif, Wahyuni, and Chair (2008) found that 76% of the children with cerebral palsy had feeding difficulties; 50% of them were spastic quadriplegia and 38% had spastic diplegia, 3 subjects had spastic hemiplegia. The most frequent complaints of feeding difficulties were swallowing difficulties, prolonged feeding time, frequent coughing and choking, difficulty in drinking and frequent vomiting. They also reported that oro-motor dysfunction (OMD) was the most frequent causative factor for feeding difficulties in 56% of the children. The oro-motor issues reported in their patients were poor lip closure, perioral hypersensitivity/hypersensitivity, tongue thrust, limited tongue movement, jaw instability, persistent bite reflex, poor respiratory coordination, poor gag reflex and inadequate lip retraction.

Similarly, a study by Wilson and Hustad (2009), examined feeding development in 37 children with CP in the age range of 1 and 5 years. 78% of the children had clinical oral motor involvement and 22% of the children appeared to have oral motor abilities within age appropriate limits. Results indicated that history of early feeding difficulties was similar in both groups of children. However, the children with CP who had oral-motor involvement continued to have feeding difficulties at a later age, along with a different progression in acquisition of more advanced feeding skills. Children with CP who did not have



oral-motor involvement were shown to have early feeding problems that did not persist through development. Clancy and Hustad (2011) carried out a longitudinal study to track the changes in feeding between 4 years to 7 years of age in children with cerebral palsy. They found that those children who had severe oro-motor involvement, had marked and pervasive feeding difficulties which showed some fluctuations with time, but were generally stable. Those children who had mild to moderate oro-motor involvement showed little to no change over time and had fewer problems in comparison to the severe group.

In sum, a review of the existing literature has revealed that feeding and oro-motor difficulties are commonly associated with CP, however the studies exploring the extent and type of these problems are limited. The existing studies portray well about co-existence of oro-motor difficulties and feeding issues in children with cerebral palsy, but most of them do not depict any relationship between feeding and oro motor problems objectively. More over such studies in the Indian context are limited. Keeping this in mind, the present study was planned with the aim of investigating the feeding and oro-motor skills in children with CP using the physical domain of Feeding Handicap Index (FHI) (Srushti, 2014) and Com-DEALL oro-motor assessment checklist (Archana, 2008) respectively and to assess the relation between the two.

## Method

### Participants

Sixty children with CP in the age range of 2-10 years diagnosed as 'Delayed speech and language with cerebral palsy' by professionals such as speech-language pathologist, pediatrician, physiotherapist and a clinical psychologist were recruited for the study. Children were selected from among those who reported to the Department of Clinical Services, All India Institute of Speech and hearing, Mysore, India and were categorized depending on the type and topographical distribution of CP. Children with CP who had associated problems such as intellectual disability and/or hearing impairment were also incorporated in the group. There were 39 children with spastic type of CP, 7 with dyskinetic CP (athetosis, chorea, choreoathetoid, & dystonia) and 14 children with other types of CP such as flaccid (n=4), ataxic (n=4) & mixed (n=6). Based on the topographical distribution, the children with CP were also divided into different groups. There were monoplegics (n=9), diplegics (n=2), paraplegics (10), quadriplegics (n=32), hemiplegics (n=6), triplegics (n=1) and double hemiplegics (n=1).

### Procedure

Initially a rapport was built with the selected participants and their parent/s. The testing was carried out in a relatively noise free environment with minimum distractions. Each child was tested individually. The oro-motor skills were evaluated using Com-DEALL Checklist for Assessment of Oro-motor skills in Toddlers (Archana, 2008). It consists of four subsections namely jaw movement (6), tongue movement (10), lip movement (8) and speech (6). Higher scores on Com-DEALL Checklist suggest better oro-motor skills and lower scores are suggestive of poor oro-motor skills. Feeding skills were assessed using physical domain of Feeding Handicap Index (FHI) (Srushti, 2014) which had 21 items. The higher the score on FHI, the poorer are the feeding skills and vice versa. Physical domain of FHI covered the dimensions like sucking, biting, chewing, finger feeding, spoon speeding, self-feeding, cup drinking, drooling, holding the food in mouth, tongue movement, rinsing and spitting, weight gain, swallowing, gagging, vomiting and choking. In addition, different food items (e.g., Biscuit, banana, water etc.) were given to child to eat and drink to permit a firsthand observation of the feeding skills. The time taken to administer the tool was approximately 30 minutes. All ethical standards were met for participant selection and their participation. Prior to testing, a written consent was obtained from the parents of the participants after explaining the purpose of the study.

### Statistical Analysis

From each participant, a total score and domain specific scores were obtained for both physical domain of FHI and Com-DEALL Checklist for Assessment of Oro-motor skills in Toddlers. The scores obtained were averaged across all participants and were fed into SPSS version 20 software for the statistical analysis. Appropriate statistical tests were used to assess the correlation between physical domain of FHI and Com-DEALL Oro Motor assessment checklist scores.

## Results

### The Results have been Presented under Different Sections Below

**I. Feeding Skill:** The results of the present study suggest that all the sixty children with cerebral palsy had feeding issues. Feeding issues such as difficulty in sucking, chewing, swallowing solid food, rinsing and spitting and restricted use of tongue movement were seen in 35-40 children with CP and difficulty in eating with fingers, difficulty in drinking using glass/cup and inadequate weight gain were seen in 15-25 children from amongst the 60 children with CP. The scores obtained from physical domain of FHI, also suggested that the feeding issues were greatest in dyskinetic type of CP compared to the other



two types of CP (Table 1). Kruskalwallis test was administered to assess whether there was a significant difference between the three groups of CP (Spastic, Dyskinetic & Others). The results revealed statistically significant difference between the three groups (Table 1).

**Table 1: Mean, Standard Deviation (SD) and Chisquare values for Different Types of CP for FHI (Physical Domain)**

Parameter	Type of CP			$\chi^2$
	Spastic (n=39)	Dyskinetic (n=7)	Others (n=14)	
FHI (Physical domain)	16.9±9.0	21.0±7.0	10.5±6.5	9.012*

The mean score and standard deviation values were also obtained for the different types of CP classified based on the topographical distribution. The mean score and standard deviation values obtained by quadriplegic, hemiplegic, monoplegic, diplegic and paraplegic CP were 26.8±13.6, 19.5±14.0, 15.1±9.7, 1.5±2.1 and 1.1±1.2 respectively. There was only one child with triplegia and one with double hemiplegia and score obtained by them were 7 and 9 respectively. Mann-whitney test revealed that there was no significant difference across the groups based on topographical distribution but based on the mean scores, it was seen that the children with quadriplegia had the maximum feeding problems.

**II. Oro-Motor Skill:** The scores obtained from Com-DEALL Checklist suggested that jaw, tongue and lip movements were affected in all the children with CP (Table 2). The children with CP had sluggish jaw movements, restricted tongue movements (lateralization and elevation) and had difficulty in lip rounding and spreading. High mean values on the total Com DEALL oro-motor scores were obtained for the third group which comprised of children with hypotonia, ataxia & mixed CP. This was followed by children with spastic and then dyskinetic CP. Kruskal Wallis test suggested that the overall oro-motor scores did not differ significantly across the three types of CP (spastic, dyskinetic and others). With respect to the subsections of Com DEALL oro-motor checklist, only the scores obtained on the jaw movement differed significantly across the different types of CP ( $p=0.039$ ). Mann Whitney test indicated that for jaw movement, there was a significant difference between spastic and others ( $z=2.38$ ,  $p=0.017$ ) and between dyskinetic and others ( $z=2.00$ ,  $p=0.045$ ). However, there was no significant difference between spastic and dyskinetic with regard to the jaw movement.

The mean score and standard deviation values obtained by quadriplegic, hemiplegic, monoplegic, diplegic and paraplegic CP were 18.9±12.2, 26.1±13.7, 35.2±11.5, 32.5±10.6 and 26.5±18.5 respectively. There was only one child with triplegia and one with double hemiplegia and score obtained by them were 50 and 25 respectively. This suggests maximum oro-motor problems were seen in patients with quadriplegia. Kruskal Wallis test suggested that the lip movement scores ( $z=16.88$ ,  $p=0.01$ ) and overall oro-motor scores ( $z=12.90$ ,  $p=0.04$ ) differed significantly across the topographical distribution.

**Table 2: Mean, Standard Deviation (SD) and Chi square Values for Oro Motor Checklist for Different Types of CP**

Parameters	Type of CP			$\chi^2$
	Spastic (n=39)	Dyskinetic (n=7)	Others (n=14)	
Com-DEALL Scores	23.1±15.1	16.1±8.0	30.8±13.13	5.969
Jaw movement	6.3±3.0	6.2±2.3	8.4±1.6	6.488*
Tongue movement	7.2±6.7	4.1±2.5	10.4±6.9	4.081
Lip movement	7.8±5.1	4.5±1.9	9.2±4.7	3.722
Speech	1.7±2.9	1.1±3.0	2.6±4.2	2.162

**III. Relationship between Feeding and Oro-Motor Skill:** There was a strong correlation between the physical domain of FHI and Com-DEALL Oro Motor assessment checklist scores (Spearman's coefficient = -0.756). It was found that scores obtained from physical domain of FHI correlated well with each subsections of Com-DEALL Oro Motor assessment checklist, i.e., jaw, tongue, lip movements and speech (Spearman's coefficient = -0.471; -0.640; -0.726 and -0.621 respectively). Pearson's correlation showed that there was a very strong correlation between physical domain of FHI and Com DEALL oro-motor scores for the dyskinetic group (-0.875), and strong correlation for spastic (-0.672) and other group (-0.623).

## Discussion

The primary objective of the study was to investigate the feeding and oro-motor skills in children with CP and to assess the relation between the two in children with CP. The study revealed several findings of interest. It was found that children with CP had feeding problems such as difficulty in sucking, chewing, swallowing solid food, rinsing and spitting, restricted use of





tongue, difficulty in eating with fingers, difficulty in drinking using glass/cup and inadequate weight gain. It was also found that the children with CP had oro-motor problems such as sluggish jaw movements, restricted tongue movements (lateralization and elevation) and difficulty in lip rounding and spreading.

The findings of the present study were in consensus with several studies reported in the literature. Several researchers have also reported of feeding problems in children with CP (Reilly et al., 1996; Gangil, et al., 2001; Fung, Samson-Fang, Stallings, Conaway, Liptak, Henderson, et al., 2002; Motion et al., 2002; Ghayas & Sulman, 2013; Diwan & Diwan 2013). Oro-motor dysfunction also has been reported by several investigators (Reilly, et al., 1996; Reilly, Skuse, Wolke, & Stevenson, 1999; Ramsay et al., 2002; Calis et al., 2008; Sjakti, et al., 2008; Wilson & Hustad, 2009; Clancy & Hustad, 2011; Parkes et al., 2010; Benfer et al., 2013). The finding that there were oro-motor problems in the participants with CP is in consensus with previous studies where they have found poor lip closure, perioral hypo sensitiveness/ hypersensitiveness, tongue thrust, limited tongue movement, jaw instability and inadequate lip retraction in children with CP (Sjakti et al., 2008; Clancy & Hustad, 2011).

In the present study, it was found that there was a relationship between oro-motor and feeding issues. The link between oro-motor and feeding problems has also been reported by several researchers. Sjakti, Syarif, Wahyuni, and Chair (2008) found that oro-motor issues were the most common cause of feeding problems seen in their 56% of the subjects. Wilson and Hustad (2009) found that children with CP who had oral-motor involvement continued to have feeding difficulties at a later age. Clancy and Hustad (2011) also found that children with CP with oro-motor issues are at risk of having feeding issues. They found that children with mild-moderate oro-motor difficulties had issues like asymmetry of oro-facial structures during movement or at rest and drooling and children with severe oro-motor difficulties had issues like extremely limited volitional control of feeding musculature along with severe drooling. In present study, similar oro-motor difficulties were found in children with CP such as inadequate lip closure, restricted tongue movement and inadequate jaw movement.

Another finding of interest was that the feeding and oro-motor issues were greatest in dyskinetic type of CP compared to the other types of CP. However Diwan and Diwan (2013) and Sjakti, et al., (2008) reported that spastic CP had the greatest feeding problems. This could be attributed to the type of motor deficits seen in dyskinetic type of children with cerebral palsy. Dyskinetics exhibit involuntary movements, in addition to the abnormalities in the tone, whereas the spastics exhibit an abnormally high tone in the muscles. Gangil et al., (2001) reported that spastic quadriplegic cerebral palsy and hypotonic patients had significantly poor feeding skill score. Selly, Parrott, Let bright, Flack, Ellis, Johnston, Mohammed, and Tripp (2001) reported that there was no significant relationship when looked at from a statistical point of view between feeding problems and the type of CP. However they also reported that quadriplegic athetoid CP (dyskinetic type) had feeding problems to a greater extent.

In addition, in the present study, the feeding and oro motor issues were frequently seen in children with quadriplegic type of CP. This could be attributed to the fact that their upper limbs were involved along with their lower limbs and the upper limbs have a significant role in feeding. This finding is in agreement with the studies by Gangil et al., (2001); Sjakti, et al., (2008); and Diwan and Diwan (2013). Children with dyskinesia and/or spastic quadriplegia are more likely to have more pronounced feeding and/or swallowing problems in comparison to those who have less motor involvement such as unilateral limb involvement (Calis et al., 2008; Erkin, Culha, Ozel, & Kirbiyik, 2010; Brooks, Day, Shavelle, & Strauss, 2011; Benfer et al., 2013; Kim, Han, Song, Oh, & Chung, 2013; Lustre, Freire, & Silvério, 2013).

## **Conclusions**

To conclude, feeding and oro-motor problems were commonly seen in children with CP and varied according to the type and severity of CP. The results of the present study highlighted that there was a relationship between feeding and oro-motor skills in children with CP. Oro-motor problems could possibly lead to most of the feeding problems seen in children with CP, however further studies and in depth statistical analysis such as regression analysis could reveal the causative relationship if any, between the two. These findings also have implications for intervention of feeding problems. Speech-language pathologists should work towards improving the oro-motor mobility and strength in children with cerebral palsy which could in turn lead to an improvement in feeding skills.

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