



Feeding and Oromotor Problems in Children with Cerebral Palsy: A Survey Report

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Abstract

The aim of the study was to identify and investigate the feeding and oromotor problems in children with cerebral palsy. Seventy four participants with cerebral palsy and associated problems in the age group of 1.2 years to 9.6 years were screened for feeding and oromotor problems using a questionnaire that was developed. The parents of these children were asked to respond to the questions in the questionnaire. The responses were documented as 'yes' or 'no' with a score of '1' and '0' respectively. When the frequency of feeding problems were analysed, it was found that overall, 63.51% of children with cerebral palsy exhibited problems in feeding skills like self feeding skills, vegetative skills, eating (semisolid & solid food items), swallowing skills, preferences towards soft/ warm food items and prolonged meal times. Oral motor skills were affected in 61.70% of children. Further analysis revealed that feeding problems were highly prevalent when cerebral palsy was associated with intellectual deficit. There was a correlation observed between oromotor skills and feeding skills. Children with oro motor deficits had greater feeding problems compared to children without oro motor deficits. To conclude, children with cerebral palsy presented inadequate feeding and oromotor skills. Hence, it is very important for speech-language pathologists to include in depth assessment and management of feeding skills as a rehabilitative goal along with communication skills.

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Introduction

Cerebral palsy (CP) is a static condition which is also known as non-progressive encephalopathy. It is primarily a motor disorder in which the development of movement and posture, balance and coordination is affected causing activity limitation. According to National Institute of Neurological Disorders and Stroke (NINDS, 2006), symptoms of CP include, increased/decreased or fluctuating muscle tone, hyperactive reflexes, impaired coordination, sudden involuntary movements, excessive drooling, difficulty in walking, eating, speaking and limited usage of hand. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, and behaviour; by epilepsy, and by secondary musculoskeletal problems (Rosenbaum, Paneth, Leviton, Goldstein, & Bax, 2006). This condition occurs during the fetal life or in the first years of life due to brain disorders or brain injury (Brouwer & Ashby, 1991). In India, according to Indian Academy of Cerebral Palsy (IACP, 2011) the incidence of CP was up to 3 cases per 1000 live births, making it the most common cause of disability. The motor disorders associated with CP vary according to the site of lesion (spasticity, flaccidity, choreo-

athetosis, ataxia and mixed forms) and to its localization to limbs (monoplegia, hemiplegia, diplegia, and tetraplegia).

Dysphagia has been frequently reported in children with CP. They mostly present with feeding and swallowing problems due to which malnutrition, dehydration and pulmonary issues are common (Aurélio, Genaro, & Macedo Filho, 2002). A study by Sjakti, Syarif, Wahyuni, and Chair (2008) shows the prevalence of undernourishment and severe malnutrition in children with spastic cerebral palsy to be 66% and 11% respectively.

The prevalence of feeding and swallowing problems in children with CP has been widely reported by several investigators (Rogers, Arvedson, Buck, Smart, & Msall, 1994; Reilly, Skuse, & Poblete, 1996; Odding, Roebroek, & Stam, 2006; Sullivan, Lambert, Rose, Ford-Adams, Johnson, & Griffiths, 2000). The prevalence of feeding disorder has been reported to be as high as 80% (Rogers et al., 1994). Reilly et al. (1996) conducted a study on prevalence of feeding and oral motor problems by incorporating interview and home based observation on 49 children with CP between 12 to 72 months of age. Oral motor deficits were predominant in 90%

of children. Non oral mode of feeding was present in at least one occasion. Sucking (57%) and swallowing (38%) difficulties were evident in first 12 months of life. According to Odding et al. (2006), feeding and swallowing disorders can be some of the first signs of involvement in as many as 60% of children diagnosed with CP.

Feeding and swallowing is mostly affected in children with severe motor impairments like spastic quadriplegia (Calis, Vengelters, Sheppard, Tibboel, Evenhuis, & Penning, 2008; Parkes, Hill, Platt, & Donnelly, 2010) when compared to children with diplegia, however mild forms of CP too present with oropharyngeal dysphagia (Benfer, Weir, Bell, Ware, Davies, & Boyd, 2013). 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 CP. They found that the 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.

Feeding problems in children with CP has been extensively studied by various researchers (Sullivan et al., 2000; Rogers et al., 1994; Waterman, Koltai, Downey, & Cacace, 1992). Sullivan et al. (2000) and Waterman et al. (1992) reported that the drooling issues were present in 28% and 78% of the children respectively. Further, Sullivan et al. (2000) reported of gastrointestinal problems like constipation (59%) and vomiting (22%) in children with CP. Self feeding was affected in 89% and choking while feeding was reported in 56% of the children. Mealtime duration was prolonged (3 hours/day) in 28% of the children studied. Additionally, 8% of children in the study were tube fed (gastrostomy tube). Rogers et al. (1994) reported reduced tongue control and delayed oral phase of swallow in 90% of the patients and silent aspiration was present in 97% of children studied. Morgan and Reilly (2006) stated that because of inadequate functioning of the oral motor structures, exaggerated oral reflexes and altered oral sensitivity, children with CP have deficits in the oral phase of the swallow. They further stated that, these limitations are due to the deficits in tongue lateralization which is necessary for chewing solid food items, excessive tongue thrusting, difficulty in bolus transit, increased oral transit time (greater than 3s) and reduced ability to clear food residue in the mouth. Poor control of the lips may result in difficulty receiving the bolus (eg, clearing off food from a spoon), difficulty sucking from a bottle or straw, anterior loss of food due to poor lip seal and excessive loss of saliva.

Reily et al. (2000) and Pohl and Cantrell

(2006) reported that the feeding problems seen could either occur in the oral, pharyngeal or in the esophageal phase in children with CP. The common oral phase problems include dis-coordinated tongue movement patterns, poor chewing, poor/absent bolus formation, poor /absent manipulation of bolus, oral pocketing of food, slow oral transit time (slow transportation of bolus), premature spill into the pharynx, hypersensitivity in and around mouth and prolonged subsistence on pureed foods. The common pharyngeal phase problems include delayed/absent swallow reflex, slow pharyngeal transit time, residue in the pharynx after a swallow (incomplete clearance), pooling of food in the valleculae or pyriform sinus, aspiration/penetration before, during or after swallow, nasal regurgitation, gagging, increased frequency of choking and coughing, respiratory distress during meals and poorly coordinated ventilatory cycle and swallowing. The common esophageal phase problems include vomiting, esophageal dysmotility, delayed gastric emptying, GERD, oesophagitis, aspiration of GERD.

Intellectual Developmental Disorder (IDD) is one of the most common associated disorders with CP. The prevalence of IDD in this population varies from 20% to 70% (Beckung & Hagberg, 2002; Pelligrino, 2007; Sigurdardottir, Indredavik, Eiriksdottir, Einardottir, Gudmundsson, & Vik, 2010). Since CP is frequently associated with IDD, some studies have reported the occurrence of feeding impairments specifically in these children. A study conducted on children with CP and IDD estimated an occurrence of dysphagia in 99% of the sampled of children (Calis et al., 2008). Rezaei, Rashedi, Gharib, and Lotfi (2011) studied prevalence of feeding problems in 144 children with IDD, of which only the 46 children had CP with IDD. Findings revealed that the most prevalent feeding problem was self feeding in children with CP with IDD. They also stated that these children required special equipment and special positioning for feeding.

In the Indian context, Gangil, Patwari, Aneja, Ahuja, and Anand (2001) studied the feeding difficulties in children with CP. They considered 100 parents of children with CP in the age range of 1 to 9 years. They were questioned for their perception regarding their child's feeding difficulties. 90% of the parents reported that their children were not able to self feed, 81% reported of chewing problems, 84% reported of inadequate/absent tongue lateralization, 63% reported of swallowing problems, 62% reported of coughing/choking during feeding, 52% reported of drooling, 33% reported of difficulty in taking solid food, 23% reported of sucking difficulties and vomiting and 14% reported of no closure of spoon around the lips.

Diwan and Diwan (2013) also studied the extent

of feeding problems in a sample of 33 children with CP in the age range of 7 to 96 months. Detailed feeding history, information with respect to oral motor skills and feeding skills were collected incorporating parent interview method and by administering the test Gisel and Patrick feeding behaviour skill. Analysis of the data revealed that feeding dysfunction was evident in children with CP. Maximum deficits were noticed in spastic quadriplegic CP with Gross Motor Function Classification System for Cerebral Palsy (GMFCS V) when compared to spastic diplegic CP, wherein normal feeding skills were present in these children. Further it was noticed that children with spastic quadriplegic CP had oral motor deficits, drooling, sucking and swallowing problems, affected self feeding skills, prolonged mealtime duration, vomiting, coughing and choking, frequent chest infections, cry and strong extensor thrust while feeding.

Srushti and Swapna (2014) studied the feeding problems in children with CP in the age range of 2 to 10 years as a part of the validation of the tool titled 'Feeding Handicap Index' (FHI) which assesses the physical, functional and emotional aspects of feeding. The sample included 28 (46.6%) children with CP with no IDD, 25 (41.6%) with mild IDD, 5 (8.3%) with moderate IDD and 2 (3.3%) with severe IDD. The oro-motor abilities were assessed by administering the Checklist for Assessment of Oro-motor skills in Toddlers (Archana & Karanth, 2008). The mean scores on FHI were calculated. The results revealed no significant difference in scores of FHI across the four groups. Amongst the group of children with CP with IDD, the children with severe IDD exhibited the maximum feeding related problems. There was also a high correlation between FHI scores and the oro motor scores.

Feeding skills play a vital role in the survival of an individual and it is also evident from the studies that children with CP exhibit feeding and nutritional deficits. The most commonly reported problems in literature include oral motor deficits, difficulties with self-feeding, chewing, sucking and swallowing (Reilly et al., 1996; Sullivan et al., 2000). Such findings are very well documented in studies conducted in Western countries. However, there is a dearth of such studies conducted to identify feeding problems among Indian children with CP.

Since CP most commonly is associated with intellectual deficits, it would be interesting to study the feeding differences, if any, between those only with CP versus those with both CP and IDD. It has been reported in the literature that around 30% of children with IDD have feeding problems (Gouge & Ekvall, 1975; Palmer, Thompson, & Linscheid, 1975). Certain other studies have reported that around 80% children with severe to profound

degree of severity have feeding problems (Perske, Clifton, McClean, & Stein 1977; Matson, Gardner, Coe, & Sovner, 1991). Very few studies have documented the influence of IDD on feeding in children with CP. In the Indian context too, the studies by Gangil et al., (2001) and Diwan and Diwan (2013) have not focussed on the influence of IDD though it is well documented that IDD can also lead to feeding problems. The study by Srushti and Swapna (2014) did focus on this issue, though they did not find any significant difference between the two groups. Since children with IDD also have been reported to exhibit feeding difficulties, it would be interesting to investigate the influence of IDD on feeding problems in children with CP and if there are any differences among both the groups of children (CP and CP with IDD) with respect to the feeding skills.

Moreover it is possible that these problems in feeding faced by the children with CP, if not identified and treated early, can have a negative impact on the life, which may in turn hinder the progress of the child during intervention and thereby affect the overall quality of life. Further, the information elicited can also help in counseling the caregivers regarding the need to tackle the feeding problems at the earliest along with speech-language intervention. Hence, a need was realized to investigate the feeding problems in children with CP. Keeping this in view, this study was planned with an aim to identify and investigate the nature of feeding and oromotor deficits in children with CP. The specific objectives of the study was to 1) identify the frequency of feeding and oromotor problems in the children with CP as a whole, 2) compare the frequency of feeding and oromotor problems in children only with cerebral palsy versus the group with cerebral palsy and intellectual developmental disorder and 3) assess the relationship between oromotor and feeding problems.

Method

The present study aimed to identify and investigate the nature of feeding and oromotor deficits in children with CP. A questionnaire was prepared to assess the feeding and oromotor problems in children with CP considered for the study. This was prepared by compiling information from the literature and the complaints concerning feeding and oromotor problems received from the caregivers of clients with CP registered in the special clinic for motor speech disorders, Department of Clinical Services, All India Institute of Speech and Hearing, Mysore. The questions were categorized under the domains of oromotor function (7 questions), drooling (1 question), eating (5) vegetative skills (5), swallowing difficulties (5), self feeding (2), meal time duration (1), preferences for food

Table 1: Demographic details of the participants

Age range	Children with CP		Children with CP and IDD		Children with CP, IDD and HI	
	Males	Females	Males	Females	Males	Females
0-2 years	2	1	0	0	0	1
2-4 years	3	1	3	3	4	1
4-6 years	8	5	9	7	2	1
6-8 years	3	3	3	3	0	0
8-10 years	3	0	5	3	0	0
Total	19	10	20	16	6	3

textures and temperature (4) resulting in a total of 30 questions. Questions pertaining to oromotor skills were compiled from Checklist for Assessment of Oro-motor skills in Toddlers (Archana & Karanth, 2008). Questions on eating, vegetative skills and swallowing difficulties were included from FHI by Srushti and Swapna (2014) and modified accordingly. Other questions like preferences towards food taste/ texture/ temperature and prolonged meal time durations were mainly the complaints/ concerns of caregivers of children with CP registered in the special clinic for Motor speech disorders. Few sample questions that were included in the questionnaire were as follows: Does the child have any difficulty in the following- eating semisolid food, eating solid food, drinking liquid from a cup independently etc. A scoring procedure was also designed in which questions with 'yes' and 'no' responses corresponded with a score of '1' and '0' respectively.

The compiled questionnaire was evaluated for relevance of the questions by three Speech-Language Pathologists (SLPs) who were experienced in working with children with feeding problems. They were asked to judge the appropriateness of the questions included. The feedback was collected using a 3 point rating scale ranging from the contents are not very valid (score 0) to all the contents are valid (score 2). They were also asked to suggest modifications, if any. Suggested modifications were incorporated in the questionnaire. Initially, there were 30 items which were reduced to 23 after the content validation. The final questionnaire included questions which were categorized under the domains of oromotor function (3 questions), drooling (1 question), eating (4) vegetative skills (5), swallowing difficulties (4), self feeding (2), meal time duration (1), preferences for food textures and temperature (3) resulting in a total of 23 questions. Inappropriate questions were deleted and some questions were rephrased. The final version of the questionnaire developed has been shown in the Appendix I.

Participants

A camp was organized for children with cerebral palsy. Different professionals such as ophthalmologists, dentists, speech-language pathologists (SLP) and a dietician carried out the necessary evaluations for the children who participated in the camp. 74 children with cerebral palsy participated in the camp. Children who were diagnosed as 'Delayed speech and language with cerebral palsy (DSL with CP)' by a qualified team of professionals including speech-language pathologist, pediatrician, physiotherapist and a clinical psychologist were allowed to participate in the camp. Amongst them 29 children had cerebral palsy (CP), 36 children had cerebral palsy associated with intellectual developmental disorder (CP and IDD) and 9 children had cerebral palsy with intellectual developmental disorder and hearing impairment (CP, IDD and HI). Amongst 74 children with CP, 45 children had IDD as an associated problem. Severity of IDD varied from mild to severe (24 children had mild IDD, 10 had moderate IDD and 6 had severe IDD). Demographic details of the participants have been shown in Table 1.

The detailed evaluations of a few participants registered at the special clinic for Motor speech disorders were reviewed for Physiotherapy/ Occupational therapy (PT/OT) evaluations to understand the extent of motor abilities. It was found that 39 children had gross motor deficits (inadequate neck control, sitting, and walking skills). 26 children were able to walk independently but exhibited fine motor deficits. Other 9 children had not undergone recent PT/ OT evaluations. In total there were 29 females and 45 males within the age range of 1.2 years to 9.6 years. All the children included in the study were enrolled in an intervention program. The parents/ caregivers of children with CP and associated problems were explained about the purpose of the study and an informed written consent was taken.

Table 2: Number and percentage of participants with feeding problems in the group as a whole

Sl. No.	Feeding skills	No. of children with problems	Percentage of children with problems
1	Eating semisolid food	26	35.13
2	Eating solid food	45	60.81
3	Need to force for feeding	27	36.48
4	Frequent vomiting after feeding	13	17.56
5	Drinking from cup independently	36	48.64
6	Sucking through straw	52	70.27
7	Biting	35	47.29
8	Chewing	52	70.27
9	Spillage while chewing	50	67.56
10	Swallowing	31	41.89
11	Nasal regurgitation of food	16	21.62
12	Cough/ choke during feeding	20	27.02
13	Retains food in the mouth	36	48.64
14	Self feeding with fingers	47	67.14
15	Self feeding with spoon	51	72.85
16	Meal time duration	22	29.72
17	Preference for food taste	22	29.72
18	Preference for food textures	17	22.97
19	Preference for food temperature	26	35.13

Procedure

As a part of the camp, two SLPs administered the final version of the developed parent reported questionnaire on 74 children with CP. The parents of children with CP were expected to respond to the questions with either a 'yes' or 'no' response. The time taken to administer the questionnaire was approximately 20 minutes.

Analysis

The responses obtained from the parents/caregivers were documented where in 'yes' responses corresponded with a score of '1' and 'no' responses were given a score of '0'. The feeding problems faced by the child were noted. The scores obtained from each participant were tallied. These scores were averaged across all the participants and fed to the computer for statistical analysis. The Statistical Package for Social Sciences (SPSS) version 18 was used to analyse the data. Frequencies of problems present and absent for all the 23 questions were identified. Further chi-square test was used to analyse differences in proportions between groups. p-values below 0.05 were considered statistically significant.

Results

The present study aimed at investigating the feeding and oromotor problems in children with cerebral palsy. The analysis revealed that out of the 74 children studied, 63.51% and 61.70% of children exhibited feeding and oromotor problems re-

spectively. The results obtained are depicted under the following sections:

Feeding skills

The feeding problems in the entire group of participants with CP were identified based on the questionnaire. The number of children exhibiting different feeding problems was estimated. The developed questionnaire had 19 questions pertaining to feeding skills which was further categorized into the following: eating, vegetative skills, swallowing, self feeding, meal time duration and preferences toward food taste/texture/temperature. Table 2 depicts the number of children with CP in the group as a whole affected on feeding skills.

From the Table 2, it can be observed that children with CP and associated problems had greater deficits in self-feeding skills with spoon (72.85%). The next most frequently found feeding problems were chewing (70.27%) and sucking through straw (70.27%). The problem that was found the least was vomiting after feeding, i.e., only 13 children (17.56%) reported to have this problem. Hence, it can be inferred that self-feeding and vegetative skills were maximally affected in these children when compared to other feeding skills. The results obtained under the six specific domains of feeding are presented below:

Eating: Amongst the 74 children, difficulty in eating semisolid food was found in 26 (35.13%) children and difficulty in eating solid food was found in 45 (60.81%) children. Parents of 27 (36.48%)

Table 3: Number and percent of children with CP affected on oro-motor skills

Oral motor skills	No. of children with problems	Percentage of children with problems
Lips	43	58.10
Tongue	54	72.97
Jaw	40	54.05
Drooling	48	64.86

children reported that they had to force feed their children. Additionally, parents reported that these children exhibited problem behaviours such as crying/throwing food/ food denial (indicated by a head nod) throughout the meal time. Frequent vomiting after feeding was reported in 13 (17.56%) of these children. On an average, it was found that 37.49% of children with CP with associated problems had difficulty with eating.

Vegetative Skills:

The analysis for questions on vegetative skills revealed that 36 children (48.64%) had difficulty drinking liquids from a cup and for 52 children (70.27%), sucking liquids through a straw was a problematic. 35 children (47.29%) exhibited biting problems and 52 children (70.27%) had chewing problems. The parents of 50 (67.56%) children reported of spillage of food items from the mouth while chewing. Overall, on an average 60.80% of the children with CP and associated problems had difficulty with vegetative skills.

Swallowing: The analysis showed that swallowing was affected in 31 children (41.89%), 16 children (21.62%) had nasal regurgitation of food items and another 20 (27.02%) of the children were found to have coughing/choking during the act of swallowing. 36 children (48.64%) retained/pocketed food for longer durations without swallowing after an act of chewing. These findings indicated that on an average swallowing was affected in 34.79% of the children with CP.

Self Feeding Abilities: Two questions to assess self feeding skills were present in the questionnaire. Children less than 2 years (i.e. 4 children) were not considered for analysing the self feeding abilities. Hence a total of 70 children were considered for analysis. The analysis of this section revealed that 23 children (32.85%) were able to self feed with fingers while 47 children (67.14%) were dependent on their mothers or any other family members for feeding. Self feeding abilities using utensils like a spoon, was also noted and it was found that 19 children (27.14%) were able to self feed using spoon while 51 children (72.85%) exhibited difficulty with the same. These findings indicated that self feeding

with spoons and fingers was difficult for more than 50% (69.99%) of the children.

Meal Time Duration: This was assessed by asking the time taken to complete a main meal. If children took more than half an hour to complete the main meal, then the same was considered as a problem in feeding. Eicher (2007) also reported that a meal lasting more than 30 minutes is considered 'prolonged'. Results for the same showed that 22 children (29.72%) took more than half an hour to complete a meal.

Preferences Towards Food Taste/ Texture/ Temperature: Preferences toward food taste, textures and temperature were assessed. Three questions were present in the questionnaire to check for the same. The analysis revealed that 22 children (29.72%) presented with specific taste preferences, where 8 children wanted salt to be added to all the food items while the other 14 children wanted sugar to be added instead. The analysis of assessment of preferences towards food textures showed that 17 children (22.97%) preferred only the semisolid food texture such as, ravaganji, cerelac, blended vegetables and smashed rice. Similarly, the analysis of preferences towards food temperature showed that 26 children (35.13%) wanted their food always in the warm temperatures. Overall, these findings indicated that only around 29.27% exhibited specific food preferences. The Figure 1 given below depicts the number of children with feeding issues on all the 19 questions in the questionnaire.

Oro-Motor Skills

In the present study, oromotor skills and drooling was assessed for all the 74 participants. There were three questions pertaining to oromotor skills (lips, tongue and jaw) and one question pertaining to drooling in the questionnaire. Information regarding mobility, precision and range of motion of these structures was elicited from the parents of children with CP. This was done since most of the children were not cooperative for an oral mechanism examination and the time availability for testing was also restricted. The results of the section on oromotor skills and drooling are depicted in the Table 3.

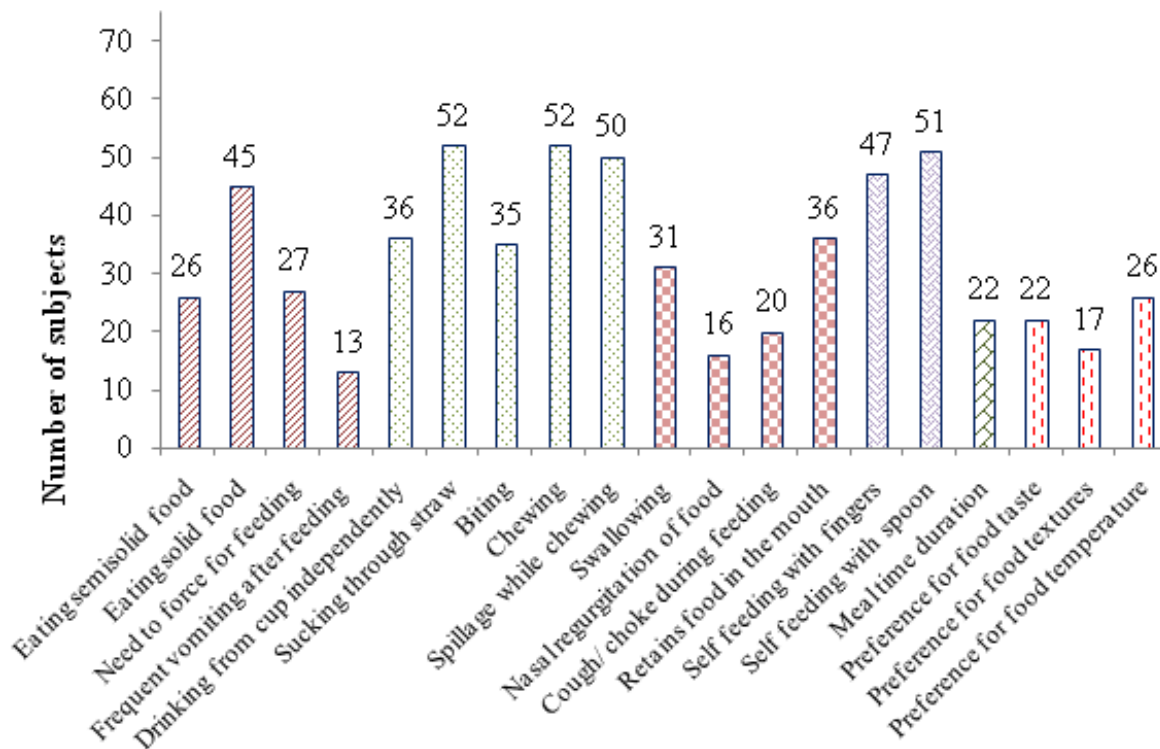


Figure 1: Number of participants with affected feeding skills across the different questions on the questionnaire.

Comparison of Feeding Skills in Children with CP and CP with IDD

The data obtained by administering the questionnaire was analyzed separately for children with CP and CP with IDD with regard to feeding skills. There were 29 participants with CP and 36 participants with CP and IDD. The data was compared using the chi square test. Frequency of feeding problems for the 19 questions in the questionnaire was estimated. Analysis of the results showed a significant difference for five questions between the two groups at $p < 0.05$ level significance and the same is depicted in Table 4.

Overall, it was seen that greater number of children with CP and IDD exhibited feeding deficits compared to those with only CP except on eating solid food and spillage of food/liquid while chewing. However on question nos. 1, 3, 5, 14, 18, there was a significant difference between the groups.

Difficulty in eating semisolid food: Analysis of this question revealed that there was a statistical significance present at $p < 0.05$ ($\chi^2 = 4.95$) between both the groups. It was observed that 20.68% of children with CP had difficulty in eating the semisolid food, and when the CP was associated with other conditions such as IDD; this difficulty in eating semisolid food was even more. It was noted that 47.22% with CP with IDD presented with the same difficulty. This difficulty could be related to the reluctance in eating which was seen in 47.22%

of the children with CP and IDD.

Need to force the child to eat: Statistical significance for this question was present at $p < 0.05$ ($\chi^2 = 6.45$). It was observed that 47.22% with CP with IDD exhibited reluctance to feeding and hence, required to be force fed by their parents. However only 17.24% with CP showed the same features. This could be attributed to the cognitive or behavioural problems in these children with CP who had associated IDD.

Difficulty in drinking liquid from a cup independently: Statistical significance was present at $p < 0.05$ ($\chi^2 = 4.55$) for this question between both the groups under study. 34.48% with CP had difficulty in drinking liquids from a cup independently, and when the CP was associated with IDD; greater numbers of children were not able to perform the task independently. Specifically, 61.11% with CP with IDD exhibited difficulty in drinking liquids from a cup independently. This again could be attributed to the cognitive or behavioural problems in these children with CP who had associated IDD.

Self feeding with fingers: It was observed that 77.7% children with CP with IDD had the most affected self feeding skills especially self feeding with fingers when compared to children with CP (51.72%). Statistical significance was present at

Table 4: Chi-square values of significance across children with CP and children with CP with IDD

Sl. No.	Feeding Skills	Percent of problems in children with CP	Percent of problems in children with CP with IDD	χ^2 (df=2)
1	Eating semisolid food	20.68	47.22	4.94*
2	Eating solid food	65.51	58.33	0.35
3	Need to force the child to eat	17.24	47.22	6.44*
4	Frequent vomiting after feeding	6.89	25	3.74
5	Drinking liquid from a cup independently	34.48	61.11	4.55*
6	Sucking liquid through a straw	51.72	69.44	2.13
7	Biting	41.37	55.55	1.29
8	Chewing	65.51	72.22	0.33
9	Food/ liquid spill from mouth while chewing	65.51	61.11	0.13
10	Swallowing	31.03	52.77	3.09
11	Nasal regurgitation while swallowing	13.79	25	1.26
12	Cough/choke during feeding	20.68	33.33	1.28
13	Retain food in the mouth without swallowing	44.82	50	0.17
14	Self feeding with fingers	51.72	77.77	4.86*
15	Self feeding with spoon	58.62	80.55	3.73
16	Prolonged mealtime	17.24	38.88	3.63
17	Preference for specific food taste	24.13	36.11	1.08
18	Preference for specific food texture	10.34	33.33	4.78*
19	Preference for specific food temperature	24.13	44.44	2.89

*p<0.05

p<0.05 ($\chi^2=4.86$) for this question. The additional cognitive and /or behavioural problems seen in the children with CP and associated IDD could have led to these problems.

Preference for food texture: Analysis revealed that there was a statistical significance present at p<0.05 ($\chi^2=4.78$) for this question among both the groups. It was observed that 10.34% of children with CP had preferences for certain food textures. These children were mainly fed on liquids, and if fed with semisolids/solid food items, zero tolerance was noted in the form of vomiting/ gag reflex. These preferences towards food texture were significantly higher when the CP was associated with IDD. This was noted in 33.33% of children with CP with IDD. From these results it can be inferred that children with CP with IDD had significant deficits related to self feeding skills due to impairment in their cognitive skills. It was observed that these children had problems in eating, self feeding skills, drinking from the cup independently in addition to being force fed and exhibited preferences towards certain food textures.

Relationship Between Oro-Motor Skills and Feeding Skills

Correlation coefficient was obtained between

the two variables under study (oro- motor skills and feeding skills) using Spearman correlation coefficient . It was observed that there was a positive correlation between oro-motor skills and feeding skills in the entire group of participants with CP (p<0.05, $\rho=0.26$). Results revealed that children with oro-motor deficits also had feeding problems indicating a relationship between oro-motor and feeding skills. Further analysis revealed statistical significance at p<0.01 level between feeding and oro-motor skills for lips ($\rho=0.30$) and tongue ($\rho=0.31$) Hence from these results it can be inferred that feeding problems were more evident when children had problems with their oral structures like lips and tongue when compared to jaw.

Discussion

The present study confirms the finding of the previous studies that children with CP exhibit problems in feeding and oromotor skills. In the current study 63.51% and 61.70% of children exhibited feeding and oromotor problems respectively. Odding et al. (2006) also reported feeding and swallowing disorders as first signs of involvement in as many as 60% of children diagnosed with CP. However other investigators such as Rogers et al. (1994) have reported the prevalence of feeding disorder to

be as high as 80%. Reilly et al. (1996) reported that oral motor deficits were predominant in 90% of children.

In the present study, more than 50% of the children with CP and associated problems had difficulty in eating solid food items (60.81%) when compared to semisolid food (35.13%). This could be consequent to difficulties in biting and chewing hard food items because of oromotor deficits. Moreover a few had problems with swallowing which would have had an influence on eating solid food items. Studies in literature however, have revealed even lesser deficits in eating when compared to the present study. The study by Gangil et al. (2001) showed only 33% of children having problems to intake solid food. Another finding that vomiting after eating food was found only in a small percentage of children in most of the studies is in consensus with the present study (17.56%). Sullivan et al. (2000) revealed that 22% of children studied had vomiting after a meal. Other studies by Diwan and Diwan (2013) reported of vomiting in only 3.0% of children studied and Gangil et al. (2001) found similar results with only 23% of the children with CP exhibiting the problem.

The most affected skills under the domain of vegetative skills were chewing (70.27%) and sucking through straw (70.27%) when compared to drinking and biting skills in the current study. Chewing and sucking requires the integrity of the oromotor structures. The deficits in these structures can cause chewing and sucking difficulties. Greater problems with chewing has been noted in previous research by Gangil et al. (2001) who reported of chewing problems in 81% of children with CP examined. However another finding of their study was that a lesser number of children were affected on sucking skills (23%) when compared to the present study. On the contrary, a study by Reilly et al. (1996) reported of greater sucking problems (57%) in children with CP in their first years of life. This variation in findings can be attributed to the age group under study, extent of oromotor deficits and associated problems like IDD/IDD with hearing impairment in children with CP.

In the present study swallowing was affected in 34.79% of the children with CP. This finding is in support of the study by Reilly et al. (1996) wherein swallowing problems were seen in 38% of children with CP. Coughing/ choking during swallowing was noted in studies by Diwan and Diwan (2013) who reported of coughing and choking only in 6.1% of children during feeding. However, other studies report of greater than 50% of swallowing difficulties in the participants studied. For example, Sullivan et al. (2000) found choking to be present in 56% of children with CP and similar problems were reported in 60% of children with CP studied by Odding et al. (2006). Gangil et al. (2001) reported

of swallowing problems in 63% of children with CP while 62% exhibited coughing/choking during feeding and nasal regurgitation was present in only 23% of children. Self feeding abilities were the maximally affected feeding skill in the present study. This finding is in support with previous research demonstrating problems in self feeding with spoon/fingers of children with CP. Sullivan et al. (2000) reported that 89% of children examined required help with feeding and Gangil et al. (2001) found the inability to self feed was in 90% of the children with CP.

Meal time duration was prolonged in the present study (29.72%). As reported by the parents, these children took more than half an hour to complete a meal. This finding is in consonance with the study by Sullivan et al. (2000) who reported prolonged feeding times (3h/day) in 28% of children with CP. They opine to consider meal time duration as a reliable measure in assessing the severity of feeding problems. They also state that if the mother spends more than 3 hours per day in feeding the child then, alternate feeding modes need to be considered.

Children in the present study preferred softer food texture. This may be attributed to the limited oral motor skills such as problems in the lip muscles, limited tongue mobility and restricted jaw movements. Morgan and Reilly (2006) stated that deficits of the oral motor structures, such as deficits in tongue lateralization, essential for bolus formation and bolus transit, leads to problems in the oral phase of the swallow. Other findings that children with CP needed sugar or salt in all the food items and required all the food items to be in warm condition may be due to the oral sensory deficits in them. The feeding problems in children with CP could be attributed to the motor deficits. In the present study 39 children had gross motor deficits and 26 children showed fine motor deficits. The poor alignment of head, neck and trunk could lead to feeding problems. There is frequently an open mouth posture with drooling, poor truncal stability, difficulties in oromotor coordination and inability to initiate, grade, or sustain oral patterns resulting in dysphagia. Children with CP also lack the ability to stabilize their head and trunk which will lead to problems in breathing and swallowing (Arvedson & Brodsky, 2002).

Additionally the feeding problems observed in children with CP could be because of abnormal oral muscle tone and strength, hypersensitive areas inside and outside the mouth regions, lack of tongue lateralization, instability of the lower jaw, phasic biting, and prolonged retention of the reflexes in children with CP which hampers the normal neuromotor development and in turn, normal feeding patterns (Ottenbacher et al. 1983; Rogers et al., 1994; Arvedson & Brodsky, 2002).

Oro-motor skills: Oro-motor dysfunction reported by parents in the study included poor lip closure, tongue thrust, limited lateral and elevation of the tongue, restricted jaw movements and inadequate lip rounding and lip retraction. This finding is in agreement with the studies reported in the literature. Reilly et al. (1996) observed that oro-motor dysfunction was seen in 90% of the individuals with CP. Sjakti et al. (2008) in their study also observed that oro-motor dysfunction was the most frequent cause of feeding problems seen in 56% of the patients studied. Additionally, the data in Table 3 also indicated that 64.86% of children with CP had drooling issues. Studies in literature have reported of a lesser percent of children having drooling when compared to the present study. In the study by Gangilet al. (2001) 52% of parents reported of drooling issues in their children with CP; while Sullivan et al. (2000) reported of drooling issues in only 28% of the children studied.

Greater problems on feeding skills were observed in children with CP and IDD when compared to children with CP only. This could be due of the fact that the children with CP with IDD were not aware of their problems to a greater extent due to their additional cognitive deficits when compared to the other group of children without IDD. Studies in literature concur with the finding obtained in the present study that children with CP with IDD have greater feeding problems. Rezaei et al. (2011) stated that the most prevalent feeding problems in children with CP with IDD included self feeding skills. In the present study, the most prevalent problem was self feeding with fingers and the next most prevalent problem was difficulty in drinking liquids from a cup independently. The study by Srushti and Swapna (2014) revealed no significant difference in mean scores on the feeding handicap index (which assesses the physical, functional and emotional aspects of feeding) across the four groups of children (only CP and three groups of children with different severities of IDD). Amongst the group of children with CP with intellectual developmental disorder, the children with severe grade intellectual developmental disorder exhibited the maximum feeding related problems. In the present study, however, a significant difference was found across the five aspects of feeding such as self feeding with fingers, vegetative skills (drinking liquid from a cup independently), eating skills (eating semisolid food), need to force feed the child and preference for specific food texture. These differences could be attributed to the sample size considered in both the studies.

Feeding problems were more evident when children had problems with their oral structures like lips and tongue when compared to jaw. Oro motor skills are essential for feeding. Lip closure is required to suck the liquids through straw or to re-

tain the bolus in the oral cavity. If the same is problematic, then the spillage of liquids/solids can be observed. The tongue plays a vital role while feeding. Lateral and backward movement of the tongue is essential for bolus formation and transit of the bolus from oral cavity to the pharyngeal cavity. The deficits in the lips, tongue and jaw could lead to the problems with feeding. Feeding problems as a consequence of problems with oro motor structures are clearly explained by Morgan and Reilly (2006) who stated that deficits of the oral motor structures; for instance, deficits in tongue lateralization, essential for bolus formation and bolus transit, leads to problems in the oral phase of the swallow; while, improper control of lips, would result in difficulty clearing food from a spoon, difficulty in sucking and anterior loss of food due to poor lip seal and excessive saliva loss. Other studies by Reilly et al. (1996), Clancy and Hustad (2011) and Diwan and Diwan (2013) also support this finding that children with oro-motor deficits almost always have issue with respect to feeding. Srushti and Swapna (2014) also reported that all 60 children with CP had feeding and oro-motor difficulties and there was a high correlation between FHI and oromotor checklist scores suggesting that oro-motor deficits in these children leads to feeding difficulties.

Conclusions

Feeding problems are most common in children with cerebral palsy. These feeding problems hinder the overall progress of the child in terms of growth and nutrition. Also, it could in turn affect the social and emotional life of the child as well as other family members. However these problems are sometimes ignored by caregivers leading to poor quality of life. Hence it is essential to identify the feeding problems in these children. With this in mind, a questionnaire was developed and the same was administered on 74 parents of children with CP. Results of the survey revealed that all subjects had some degree of feeding problems and overall, 63.51% of children with CP had problems with eating, sucking, biting, chewing, swallowing, and self feeding. Prolonged mealtime durations and preferences towards food taste, textures and temperature were also observed. Another finding was that children with oro-motor deficits had more severe feeding problems. It was also found that children with CP with IDD had more feeding issues when compared to children with CP. From these findings, it can be concluded that feeding problems are extremely prevalent in the children with CP. The developed questionnaire in the present study helps in identifying feeding problems in children with CP and other communication disorders. The results of the study reveal the importance of considering management of feeding problems during the reha-

bilitation process along with communication goals by speech-language pathologists.

However there are a few limitations of the study. In the present study, feeding problems were surveyed by administering the developed questionnaire to the parents of children with CP. Instead, meal time observations by qualified SLPs could be more effective than parental reports. The variation in feeding deficits across the different types or severities of CP was not analysed. Further research can be carried out to compare the feeding problems among different types and severities of CP. In addition, the developed questionnaire can be administered to assess the feeding problems in children with other communication disorders such as autism spectrum disorders and Down syndrome.

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Appendix-1

Questionnaire to Identify Feeding Problems in Children with Cerebral Palsy

Name of the child: _____ Registration No: Sl.No. _____
 Age/ Gender: _____ Date of evaluation: _____
 Provisional Diagnosis:
 a. Delayed Speech and Language with Cerebral Palsy
 b. Delayed Speech and Language with Cerebral Palsy with Intellectual Developmental Disability
 c. Developmental Delay
 Associated problems if any:
 Oromotor problems if any
 Lips: Lip closure +/-, lip spreading +/-, lip rounding +/-
 Tongue: Putting the tongue out +/-, lateral movements +/-, up-down movements +/-
 Jaw: Opening and closing +/-, rotatory movements +/-
 Drooling: Yes/No
 Others:
 Feeding problems:

Does your child have any difficulty in the following?			
Sl.No.	Question	Yes	No
1	Eating semi solid food		
2	Eating solid food		
3	Do you need to force the child to eat?		
4	Does the child frequently vomit after feeding?		
5	Drinking liquid from a cup independently		
6	Sucking liquid through a straw		
7	Biting		
8	Chewing		
9	Does the food/liquid spill from the mouth while chewing?		
10	Swallowing		
11	Does the food come through the nose while swallowing?		
12	Does the child cough/choke during feeding?		
13	Does the child retain food in the mouth after chewing without swallowing?		
14	Self-feeding with fingers		
15	Self-feeding with spoon		
16	Do main meals take a long time (more than half an hour)?		
17	Does the child prefer specific food taste?		
18	Does the child prefer specific food textures?		
19	Does the child prefer specific food temperatures?		

Any other significant information:
 Findings and recommendation:

Speech Language Pathologist