The Impact of Cerebral Palsy on the Health, Functions, and Habits of the Oral Cavity Among Children in Sulaimani City

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Abstract

Objective: Identify the impact of Cerebral Palsy (CP) on oral health, function, and habits.

Methods: A thorough examination of the oral mucosa in one hundred CP children was carried out after obtaining detailed medical and dental histories. ANOVA and Chi-square tests were used to analyze the data, and p-value ≤ 0.05 considered significant.

Results: CP children predominated by males (58%) and spastic type (64%). 27% of them visited a dentist (44.5% pain), 45% performed tooth brushing (57.8% need help), 31.8% mixed CP type only eat liquid diet. CP children had a burning tongue (11%) and halitosis (32%). Dry mouth and cracked lips were the minor symptoms. Functional limitations in chewing (34%), speech (59%), swallowing (37%) were also recorded. The majority of CP children had several oral disorders and habits including: saliva drooling (59%), mouth breathing (45%), thumb sucking (32%) and teeth bruxism (31%). Lip and tongue sucking was significantly more in ataxic type (p = 0.04). Changes in the tongue mucosa were the predominant findings (24%).

Conclusions: The majority of CP children did not perform brushing, and few of them visited the dentist. The tongue mucosa was the most affected site. CP patients had multiple oral habits and orofacial functional difficulties predominated by drooling and mouth breathing.

Keywords: *Cerebral palsy, Kurdish children, Oral habits, Brushing, Drooling, Tongue.*

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Introduction

Cerebral palsy (CP) is a common congenital physical handicap condition of children. It is an analytical term which describes multiple permanent defects of movement and posture leading to decreased activity, that are attributed to non-progressive disorders in the brain of developing fetus or baby. The motor defects frequently associated with mental retardation, epilepsy, eye defects, hearing damage, speaking and oro-motor impairments, with language complaints[1,2].

Cerebral palsy resulted from a broad group of developmental, genetic, metabolic, ischemic, infectious, and other acquired etiologies that produce a group of neurologic phenotypes, due to damage to the motor control centers of the developing brain. It can occur during pregnancy, during childbirth or after birth up to about age three years[2,3]. In birth cohorts from developed countries, the occurrence of CP is 1 to 2 per 1000 live births [1,4] with slight male predominance (male to female ratio: 1.4:1)[2]. Variances in registered rates of CP incidence among different geographical areas are primarily due to discrepancies in the studied criteria[1].

Cerebral palsy categorized according to the type of mobility alteration presented by the affected child as spastic, athetoid, ataxic and mixed[1]. Spastic type appears to be the most common type of CP (80%)[1,2].

Cerebral Palsy patients are more liable to develop dentofacial abnormalities and oral health problems than healthy controls[5-13]. They have uncontrollable movements, bruxism, abnormal attrition and spontaneous dislocation or subluxation of the temporomandibular joint (TMJ)[6,9,11]as well as, they frequently suffer a reduced function of speech, chewing, and swallowing that result in drooling[1,14,15]. Dental caries, gingival alterations, malocclusion, and enamel hypoplasia have been reported as more frequent or severe[5,11,16,17].

All the CP symptoms may complicate dental care for the affected children like those restricted to wheelchairs, epileptic and anxious children, besides communication difficulties, along with poor concentration[16-18]. Dental management of CP patients is challenging and needs special knowledge and skill. Many studies have reported that dental care is the most common unachieved health care need for disabled children[10-12,19]. Although the clinical characteristics of cerebral palsy have been studied in different governorates in Iraq[18,20-24], to the best of our knowledge, the present study was the first to evaluate the orofacial findings of CP children in Sulaimani City/ Iraq. This study aimed to identify the impact of CP on oral health (care, signs, and symptoms), oral functions and oral habits in children. Those patients require special attention and care since they are unable to help themselves due to physical retardation and they are more prone to a variety of oral diseases. A particular preventive care plan and design, and preparing the staff for this program can be built on a baseline data that need to be established in this city.

Materials and methods

This cross-sectional study conducted between May 2017 and May 2018. It included randomly one hundred CP children (regardless of their age) attending the Teaching Children Rehabilitation (TCR) Center in Sulaimani City, Kurdistan region of Iraq. This center is the only administrative center of all over Sulaimani city that provides medical and physiotherapy services for disabled children. The work complied with the Helsinki Declaration and approved by the Human Research Ethics Committee of the Kurdistan Board of Medical Specialties and the Center's manager. The parents signed a consent form after reading and understanding the information sheet. A case sheet was designed to include detailed demographic, medical, and dental information that collected from their medical records and their parents. The oral mucosa of every child was examined by a single dentist (oral medicine trainee), using dental diagnosis tools under good light vision in the hospital.

Children were classified according to their muscle tone impairment (spastic, athetoid, ataxic or mixed)[1], and also sub-classified according to their motor tone impairment (monoplegia, diplegia, hemiplegia, tetraplegia, and unclassified). The recorded information included the frequency of dental visits, teeth brushing, history and consistency of eaten food. Symptoms (pain or burning sensation, dry mouth, halitosis, and cracked lips), oral functional disorders and habits (drooling, mouth-breathing, sucking, bruxism, tongue thrusting) were also recorded. Other functional problems of CP children were classified as: chewing, speaking, swallowing and TMJ problems besides mouth opening deviation.

Data enlisted in an excel worksheet and analyzed by a statistical software package (SPSS for Windows v.16; SPSS Inc.). Data were assessed for their normal distribution; accordingly, the frequency and percentage were measured for non-parametric variables, and the mean ± SD was calculated for the age. ANOVA and

Chi-square tests were used to ascertain the significance of differences among the groups considering significant results when p-value equal or less than 0.05.

Results

The studied sample consisted of 58% males and 42% females with a mean age of 4.72 ±2.82 years old (rang 0.9-12), (male 4.3±2.4, female 3.1±.49, p = 0.08). The male to female ratio was (1.38:1). The most common CP type according to muscle tone impairment was spastic (64%), while the ataxic one was the least common type (5%). According to motor tone impairment, the un-classified type was the most frequently observed (38%), followed by diplegias (22%). Any of the above classifications did not show significant sex or age variations (Table 1).

According to the dental history, only 27% of the CP children visited a dentist, and 44.5% of them seek the dentist's help to control dental pain, while the remaining 55.5% look for a checkup or dental treatment. We found that no ataxic patient visited any dental clinic. Nevertheless, the statistical test was not significant; thus no differences in dental history exist among the CP types. Concerning oral hygiene care, 45% of the CP children performed tooth brushing, among them, 26 child (57.8%) need their parents' help, whereas 13 (28.9%) only can do the job by themselves, with no statistical variation among the CP types. 74% of the children in our sample can eat solid and semisolid food. However, seven children out of 22 (31.8%) with mixed type of muscle tone impairment can only eat liquid food, yet the p-value = 0.49 (Table 2).

As regard to the signs and symptoms, mucosal pain or burning sensation was reported in 11% of the CP patients, predominantly at their tongues and the majority were spastic patients (Table 2). Halitosis was identified in 32% of the CP children as recognized by their parents and proved by the clinician's examination. Dry mouth and cracked lips were the other remaining minor symptoms and signs. The differences in the existence of these parameters among the CP types were not significant. The total sample of our CP patients presented with several oral functional disorders and habits.

Saliva drooling was reported in 59% of the children, however, the mean age of children who had saliva drooling was not significantly different from those without drooling (2.89±4.9 vs. 2.71±4.41, p=0.35). The second frequent disorder was mouth breathing which was found in 45% of all patients. The sucking habit reported in 32% of the total CP children, presented as thumb sucking. Nevertheless, 27 children had additionally the practice of lip and tongue sucking which was significantly more in the ataxic type (p=0.04). Teeth bruxism presented in 31 out of the 100 CP children. Lastly, tongue thrusting was seen in 14% of the total examined children. Three children did not have any habit, and another three children had only one habit, but the majority of the children had 5 to 7 habits.

Regarding the functional limitations and problems among our 100 CP children, there were 34% chewing problem, 59% speech problem, 37% swallowing problem (dysphagia), and 1% mouth deviation. The mixed type had a higher prevalence of functional limitations and disorders than the others (Figure 1). The speech was the main problem in all CP patients, and it was the only functional problem reported in the ataxic children.

Redistribution of our CP children according to their motor impairment did not show statistically significant differences among the studied parameters (data not presented) except for brushing supervision (Table 3). Self-brushing was more in monoplegia while parents' brushing seen predominantly in the unclassified group of CP children (P=0.02). Concerning intraoral examination, changes in the tongue mucosa were predominant constituting 24% of the intraoral findings (9% red tongue, 9% thrush on the tongue and 6% non-thrush coated tongue). It is worth to mention that two children with red tongue also had thrush, and another 3 had red spots on the hard palate and the 3 of them had a painful red tongue. Furthermore, geographic tongue, bifid uvulae, and lymphadenopathy each were seen in 2 children separately. In addition to that, one child presented with a dental abscess. Beside a girl had multiple small visicles on her tongue and a boy had a scar on the palate. Lastly only one child had a mouth deviation during opening (Figure 2).

Table 1: Frequency distribution of CP patients according to muscle and motor tone impairments relating to sex and age.

CP type		Total	Male	Female	X^2 test p value	Age		ANOVA p value
		%	%	%		mean	SD	
Total		100	58	42		4.72	2.82	
Muscle tone impairment	Spastic	64	41	23		4.55	2.54	
	Athetoid	9	5	4	.21	5.4	4.37	0.704
	Ataxic	5	1	4		4.02	1.66	
	Mixed	22	11	11		5.09	3.11	
Motor tone impairment	Monoplegia	10	5	5		5.39	1.81	
	Diplegics	22	15	7		4.42	2.68	
	Hemiplegics	15	9	6	.35	4.38	2.79	0.423
	Quadriplegics	15	11	4		3.78	1.94	
	Unclassified	38	18	20		5.23	3.34	

Table 2: Frequency distribution of CP patients according to muscle tone impairment relating to the dental visit, brushing, eating, and oral symptoms.

Variables			Total (100)		Spastic (64)		Athetoid (9)		Ataxic (5)		Mixed (22)		X^2 test
			No	%	No	%	No	%	No	%	No	%	p value
Dental visit	Visiting dentist		27	27	16	25	3	33.3	0	0	8	36.4	.89
	cause	Pain	12	44.5	8	50	0	0	0	0	4	50	0.32
		Treatment	8	29.6	4	25	2	75	0	0	2	25	
		Checking	7	25.9	4	25	1	25	0	0	2	25	
Brushing	Do brushing.		45	45	29	45.3	6	66.6	2	40	8	36.4	0.099
	Parent brushing		26	57.8	16	55.17	2	33.3	1	50	7	87.5	0.084
	Parent supervision		6	13.3	3	10.44	3	50	0	0	0	0	
	Self-brushing		13	28.9	10	34.48	1	16.7	1	50	1	12.5	
Food	Solid		38	38	25	39.0	3	33.3	4	80	6	27.3	0.49
	Semisolid		36	36	22	34.4	4	44.5	1	20	9	40.9	
	Liquid		26	26	17	26.6	2	22.2	0	0	7	31.8	
Symptoms	Pain		11	11	8	12.5	0	0	1	20	2	9.1	0.62
	Site	Tongue	7	63.6	5	62.5	0	0	1	100	1	50	0.65
		Gingiva	2	18.18	1	12.5	0	0	0	0	1	50	
		Others	2	18.18	2	25	0	0	0	0	0	0	
	Dry mouth		6	6	6	9.4	0	0	0	0	0	0	0.3
	Halitosis		32	32	23	35.9	2	22.2	1	20	6	27.27	0.7
	Cracked lip		3	3	2	3.1	0	0	0	0	1	4.5	0.89

Table 3: Frequency distribution of CP patients according to motor tone impairment relating to the history of dental brushing.

Brushing	CP type according to motor impairment					X^2 test p value
	Monoplegia	Diplegia	Hemiplegia	Quadriplegia	Unclassified	
Parent Brush	1	5	4	4	12	0.029
Parent Supervise	0	1	1	1	3	
Self-Brush	6	3	1	0	3	
Total	7	9	6	5	18	

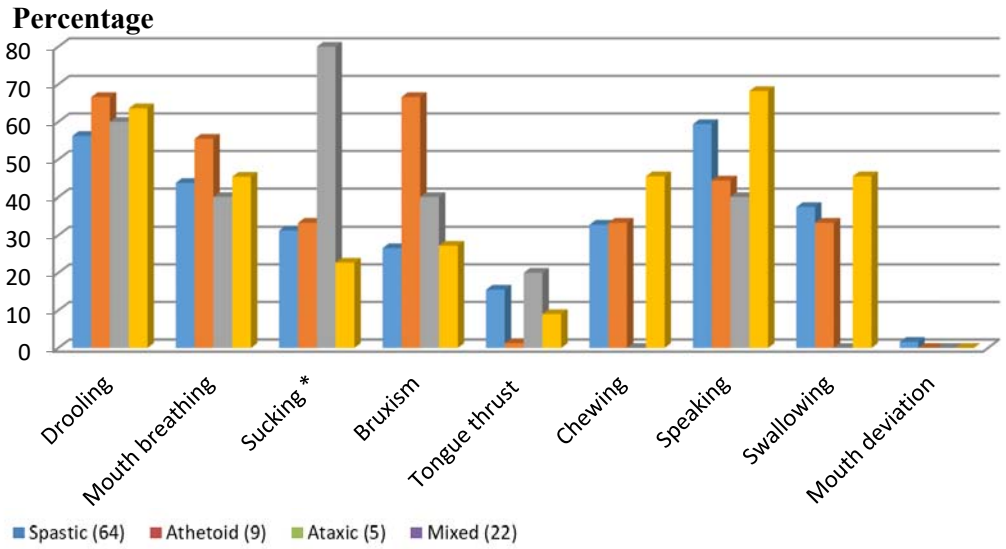

Figure 1: Percentage distribution of existing habits and oral functional problems in CP children subtypes according to muscle tone impairment (* significantly more in ataxic type, p=0.04).

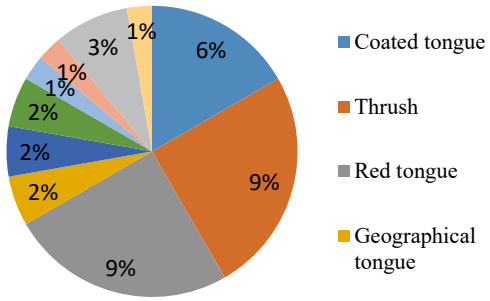

Figure 2. Percentage distribution of intra oral mucosal findings in the total 100 CP children.

Discussion

The oral mucosal changes in CP children were not registered before in the Kurdish population of Kurdistan region/Iraq. This study is the first that highlights the demographic and oral care, functional limitations and habits, and mucosal findings in CP children from Sulaimani City. The study randomly enrolled 100 CP children attending the TCR center. The sample showed male predominance (1.38:1) at an older age than females. The spastic type accounted nearly two-thirds (64%) of our sample. It was in line with the clinical characteristics of CP patients from different Iraqi governorates[18,21-24] except Mosul[20]. In Dohuk/ Iraq, Hassan et al. reported 1.3:1 male to female ratio and they indicated that spastic CP was the most common type (57%) among 100 CP patients. However, the age range of their CP children was between 7-12 months[22].

Abdelelah et al. studied the clinical profiles and gross motor function level of 303 Iraqi children with CP from Baghdad and also they showed male predominance (male to female ratio =1.77:1) and the age of the sample ranged between 10-150 months. The spastic diplegic CP was the common type (43%)[23]. Two other studies conducted in Erbil governorate, in which 50% of CP was at the preschool age, 54% & 58% patients were males, and 75% & 80% of CP was the spastic type[21,24]. The demographic and clinical characteristics of CP among children in Diyala province showed that males affected more than females (male to female ratio =1.4:1). Most of the patients (48.8%) presented between the age of 7-12 months and the spastic CP was the most common type (57.3%)[18]. However, our CP male to female ratio was in contrast to that of Mosul city study, as they reported a female predominance (male to female ratio = 1:1.5)[20].

According to our study, both types of CP classification had similar age and sex distributions. The unclassified and diplegia types were the most common types of spastic CP in our study. Turkish CP children had diplegia in 39.8% of children, hemiplegia in 28%, tetraplegia in 19.9%, ataxia in 5.9%, and dyskinetic (athetoid) in 6.4%[25]. Al-Azzawi reported spastic quadriplegia in 45.1% of CP children in Diyala province[18]. In Baghdad, 43% of the cases were spastic diplegic CP, 19% were hemiplegic CP, 15% were quadriplegic CP, 7% were athetoid CP, and 16% were mixed or ataxic CP[23].

Cerebral palsy is one of the most frequent conditions encountered in the daily practice of dentists who treat special-needs patients, but such centers are not available in Sulaimani city. Those patients treated in a general hospital. All forms of CP suffer from mental problems, strabismus, seizures, and disorders of vision or hearing[1,2]. Therefore, they are more liable to develop dental problems. However, only a small percentage of our patients visited the dentist mainly for pain. This result reflects a delay in dental care and treatment served for this group of children. Thus, the motivation of the parents and providing health personnel could prevent the progression of their dental problems. The remaining children either went for checking or to get treatment in nearly equal percentage.

In comparison to Nouri et al., a study that included 63 CP patients, registered in centers for children with special health care in Jeddah, Saudi Arabia. They reported that 63.4% of their CP patients visited the dentist, of which: 45% sought dental help for pain, and only 12.5% asked for a comprehensive treatment plan, while 42.5% went for checking[10]. Thus in both studies, the common reason for visiting the dentist was pain. We found that no ataxic patient visited any dental clinic which may be attributed to the walking problem that makes it difficult to be manipulated by their parents to attend a dental clinic or due to their families' ignorance. Nevertheless, the differences among the CP types were minor that may be attributed to the small size of subclassification groups.

Tooth brushing plays an essential role in oral health care, especially in CP patients. Slightly more than half of our patients did not clean their teeth. Nearly half of the remaining children who cleaned their teeth, they either needed their parents' supervision or even performed the brushing by their parents themselves because most of those children especially at a younger age had problems in grasping the brush, besides their orofacial dysfunctions (such as speech disorder) and mental problems which play a role in performing tooth brushing. Only 28.9% of our CP sample did the job by themselves, while in comparison to another study[8], oral hygiene was performed by a caregiver in 73.1% of the cases. CP children used to take soft food (frequently those using bottle feeding) and received little attention to keep good oral hygiene, in addition to the weakness of their muscles of the tongue and mastication. Grouping CP cases according to muscle and motor tone impairments did not change dental history except for brushing supervision. Children with monoplegia could brush their teeth quite well; unlike those with the un-classified group that suffered from a great motor weakness, they always need the help to keep good oral hygiene status.

Poor oral motor function leads to several problems in children with CP. These included: reduced lip closure, poor tongue function, tongue thrust, exaggerated bite reflex, tactile hypersensitivity, delayed swallow initiation, decreased pharyngeal motility and drooling. Incapability to ingest solid food by CP patients may result from difficulties in chewing, drinking, sucking, maintaining food in the mouth. Therefore, they take a long time to complete a meal[12,17]. However, food consistency did not consider as a significant problem in our cases. One-quarter of our patients complained from difficulty in eating solid food, and the remaining can took solid and semisolid food. This was in line with de Carvalho et al. study in which, 61.5% of their reported CP patients could eat a solid diet and 38.5% of them consumed non-solid diet (liquid or paste food)[8]. However, our results contradict those reported by Benfer et al., who found that a high percentage of impairment during solid food intake in CP patients resulted from both difficult biting (70%) and chewing (65%)[26]. A study from Dohuk city reported that 68% of their CP patients had swallowing problems and 46% had speech problems[22], in comparison to 37% and 59% for dysphagia and speech problems respectively in our study.

Pain was a significant problem in children and adolescents with CP presented in different site profiles[27]. Oral mucosal pain and burning sensation irritated minor percentage of our CP children. A history of this unpleasant sensation was reported predominantly in the tongue and spastic type. The present work was the first that signified this finding in CP cases.

Halitosis (bad oral smell) attributed to several factors, a high percentage of halitosis cases related to oral conditions as a result of microbial metabolism of organic substrates such as volatile sulfur compounds[28]. In our study, one-third of our CP children had halitosis in which the major involved factor was mouth breathing (45%) (non-oral cause) that negatively affects the jaws and teeth[5], besides a small percentage of coated tongue (6%), dry mouth (6%) and multiple dental problems (data not presented), all led to halitosis.

Perioral chapping (skin cracking), maceration with secondary infection, dehydration, foul odor, aspiration/ pneumonia, speech disturbance and interference with feeding are the main physical effects of untreated saliva drooling[29]. Some of our CP children complained from

dry mouth and cracked lips. However, dry mouth could not be attributed to saliva drooling since it was reported in only one of our CP children. Another three CP cases with dry mouth had dysphagia, tongue sucking and children older than those non-complained (5.29±2.4 vs. 4.6±2.8). Therefore; the main reason possibly related to orofacial dysfunction. On the other hand, cracked lips observed in two out of three male children who did not have the habit of lip sucking or tongue thrusting besides they did not drool but they were mouth breathers and only one had dysphagia.

Drooling of saliva has significant undesirable effects on physical health and lifestyle, it possibly causes loss of self-confidence and communal isolation. Its occurrence in our sample was within the upper limit of the reported range (10-58%) in CP patients[14], and greater than the percentage reported in a previous study (16%)[31]. Sialorrhoea results from either neuromuscular dysfunction or excessive saliva secretion, moreover, anatomical variations and intraoral sensitivity problems may contribute to sialorrhoea. Younger children suffer from sialorrhoea more frequently than older age groups[30]. However, in the present study, no difference in the mean age of CP children was noticed whether they had drooling or not. In comparison to an Indian research[31], our patients had a more frequent complaint from sialorrhoea, whereas Adlakha & Joshi reported only 4 out of 25 CP cases (16%).

Our sample contained five ataxic CP children, and none of them had functional limitation except for speech defect. Whereas problems in chewing, swallowing and speach were predominantly seen in the mixed type. Therefore ataxic children did not report difficulty in taking solid food.

A published report showed that different habits are learned throughout life development, many of which are nonthreatening habits such as nail biting and thumb sucking but they may hurt the teeth and jaws if not controlled, while others are harmful habits like teeth grinding[32]. Parafunctional oral habits are often present in CP patients and are possibly related to orofacial neuro-motor dysfunctions. This study showed that most of our CP children had 5-7 habits simultaneously, and nearly half of the children were mouth breathers which is a frequent finding in CP patients[5], besides that one-third of our patients performed thumb sucking habit and almost one fourth of the patients (predominantly in ataxic CP type) practiced lip sucking. Ortega et al., investigated the frequency of occurrence of parafunctional habits in 65 CP patients, they showed that nine patients (13.8%) presented with pacifier-sucking, 6.1% showed finger-sucking, 18.4% had the habit of objects biting , 41.5% performed tongue interposition, and 36.9% had eccentric bruxism[33]. In comparison to a study that identified factors associated with the presence of oral sucking habits among children with Down syndrome and CP, they found oral sucking habits (bottle feeding and pacifier/finger sucking) in 83% of children[34]. The presence of oral parafunctional habits in individuals with CP indicated establishing protocols for their prevention and clinical intervention to minimize the harmful consequences that may result from such habits.

Literature indicated that bruxism is generally a common finding in CP children, and it may occur due to the effect of the central nervous system hence enhancing children to grind their teeth as a feedback reaction. We found bruxism in one-third of the CP cases. However, the present study disagreed with a previous work[5], as we represented the athetoid type having the highest percentage of bruxism. Dos Santos et al. stated that high rates of malocclusion and bruxism were observed in CP children with permanent dentition[5]. Nouri et al. indicated that 41.3% of CP children had bruxism[10], and Ortega et al., found it to be 36·9%[33].

The most frequent oral mucosal changes observed in CP children were tongue mucosal alterations (thrush and coated tongue). Başarslan et al. confirmed that patients with cerebral palsy were frequently predisposed to the colonization of candida in their mouths due to regular use of antibiotics[35]. In addition to the soft food intake (frequently those using bottle feeding) and the little attention to keep good oral hygiene besides the weak muscles of the tongue. Other oral mucosal changes were minor findings.

This study provides a baseline data for future planning of dental services. It recommends providing our centers by trained dentists and oral-health-care personnel for managing such group of special need children. Moreover, to establish a dental care unit for continuous checking and for the motivation of patients and their parents to perform proper brushing and use axillary tools for dental health care. It is also recommended to use oral gel rather than mouthwash to overcome difficulties in swallowing and orofacial muscle problems.

Conclusion

CP was observed more in males, with the spastic type to be the most prevalent. All kinds of CP children had inadequate dental care, especially in severe cases. A large percentage of our CP children did not brush their teeth, and a small percentage of those children visited the dentist. Dentists need to pay a special attention to the tongue mucosa since it is the most affected site in CP patients. CP children had several oral habits that need to be controlled during their treatment to minimize the harmful effects on their oral health. The orofacial

functional difficulties of CP children require early manipulation. Drooling and mouth breathing were more frequent than thumb sucking and teeth bruxism. Lip and tongue sucking were more in ataxic type who only suffered from minimal oral functional limitation.

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