Original Article

Dental and Maxillofacial Findings in Cerebral Palsy Children from Sulaimani City: Assessment for Unmet Dental Needs

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Abstract

Objective: This study was carried out, aiming to analyze the frequency and factors related to dental and maxillofacial findings, caries experience, and oral hygiene status among Kurdish Children with Cerebral Palsy in Sulaimani governorate.

Methods: This cross-sectional study included 100 cerebral palsy children. They were subjected to extra and intraoral examination for dental and maxillofacial changes after obtaining medical and dental histories. The mean DMF/dmf index, significant caries index, met need index (MNI), restorative index (RI), and simplified oral hygiene index, were recorded. Independent t-test, Chi-square tests, and Spearman correlation coefficient were used to analyze the data, and P-value < 0.05 considered significant**.**

Results: Nearly half of our cerebral palsy children were delivered by Cesarean section, diagnosed after birth with jaundice and had mental retardation. The premature delivery associated with cerebral palsy types (P=.006). Extra-oral features were normal in 41% of children. Hypertelorism was the predominant facial finding (48%), and 55% showed malocclusion (class II & III). Dental caries was observed in 55% of the patients, mostly in the primary dentition (mean dmft index =3.18) and the significant caries index =8.69. The MNI (=0.455) and RI (=0.412) were higher in the permanent dentition. The majority of children had good oral hygiene. No correlation was found between cerebral palsy and the studied parameters.

Conclusions: Children with cerebral palsy showed a high incidence of dental caries in primary dentition, malocclusion, and surprisingly good oral hygiene, but none of which was correlated to any type of cerebral palsy.

Keywords: *Caries, Cerebral palsy, Occlusion, Oral hygiene.*

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Introduction

Bacteria cerebral palsy (CP) is one of the primary neurological diseases. It is considered as the main debilitating condition in children with an incidence of 2-3 per 1000 live births in many populations[1,2]. It causes abnormality in the coordination of muscle movement resulting in an inability to perform normal movement and to maintain posture[3]. The exact etiology of CP is still under investigation. Still, many consider it as a multifactorial condition so that it may be prenatal (genetic malformation), perinatal (neonatal anoxia, prematurity, and low birth weight), or postnatal (meningitis, encephalitis, cerebral vasculitis, and viral infections)[4]. In addition to the neuro-motor defect, visual impairments, hearing problems, communication difficulties, feeding problems, and seizures may also be observed in CP patients[1,3,5].

Classification of CP has neuropathological, etiological, and clinical bases; however, none of which was satisfactory. Therefore, the new classification of CP involved distribution, motor type, and functional level. Thus, it would facilitate the appropriate targeting of interventions and a more accurate prognosis prediction[3]. The currently used classification is the Swedish classification which is based on the type of motor and extremities' involvement and divided into: spastic (increased muscle tone), dyskinetic (Dystonia, Athetosis, and Chorea), ataxic (intention tremor and head tremor), and mixed[2,3]. Also, according to the involved extremities, it may be monoplegia (one limb), hemiplegia (one side of the body), paraplegia (both legs), quadriplegia (all limbs equally) and diplegia (legs and arms) which is rare[6].

Dental examination and treatment for a patient with CP had been addressed as difficult since 1950, because of the involuntary movement and constant spasm of the head and neck muscles. Therefore, an adequate examination of the oral cavity would be difficult. The more severe the neurological damage in children with CP, the higher the risk of oral diseases[7,8]. Many studies indicated that patients with CP have more experience with caries and poor oral hygiene due to an abnormality in the movement of facial muscles[9-14], causing prolonged retention of food particles and difficulties involving self-care. Moreover, the socio-economy of patients with CP is considered as a factor[15-18]. Abanto et al. found that dental caries is strongly associated with a negative impact on the oral hygiene and the quality of life of children with CP and their parents as well; however, a higher family income can improve this negative impact[19]. Delayed eruption of permanent molars, a higher percentage of malocclusion and parafunctional habits, higher mean decayed, missing, and filled surfaces index and higher plaque index are the most often seen oral conditions in patients with CP[18,20,21].

Attempts at behavior modification can perform necessary dental care by establishing personal contact with the dental staff. Sedative techniques cannot be used because of the atypical response patterns. Comprehensive dental treatment can be done under general anesthesia in the operating room[22].

Thus, we performed this clinical survey aiming to analyze the frequency and factors related to dental and maxillofacial changes, caries experience and oral hygiene status among Kurdish Children with CP in Sulaimani governorate to assess the severity of unmet dental needs.

Patients and methods

A randomly collected 100 CP children attending the Teaching Children Rehabilitation Center in Sulaimani City, aged 0.9-12 years, were included in this cross-sectional study. The Research and Ethical committee of the College of Medical Science/ University of Sulaimani approved the study (29-July- 2019), and the parents consented for their children's contribution to the study. The sample consisted of 58 males and 42 females. They were diagnosed to be 64 spastics, nine athetoid, five ataxic, and 22 mixed cases.

The demographic, medical, and dental information was obtained from their medical records and their parents. The information included: CP duration since diagnosis, family history of CP, premature and type of delivery, birth asphyxia, associated other diseases, history of previous seizures, jaundice, hospitalization, chronic medication, and the existence of mental retardation.

Two examiners examined all children for extra- and intraoral findings. At the time of examination, the child's behavior to the doctor and response to light or noise was assessed. For dental features, teeth malalignment, Angle's classification of occlusion[23], teeth delayed eruption, and structure loss, all were recorded. The oral hygiene status was scored by the Simplified Oral Hygiene Index (OHI-S) for permanent and mixed dentition, and the modified version of the Simplified Oral Hygiene Index for primary teeth only[24]. The oral hygiene status was used considering the presence or absence of gingivitis, calculus, and debris. The caries index: decayed-missing-filled teeth in the primary dentition (dmft)/decayed-missing-filled teeth in permanent dentition (DMFT) with Significant Caries Index[25] were recorded as well. In children with mixed

dentition, both indices were registered separately. No radiographic examination was performed.

Consequently, the Met Need Index (MNI refers to the treatment received by an individual) is measured by (mean M+F/mean DMF), and Restorative Index (RI), that is indicated the restorative care of those who have suffered the disease, and it is estimated percentage as (F/F+D) was calculated[26].

Statistical analysis

Data were assessed for their normal distribution (Shapiro-Wilk test). Frequency and percentage were measured for non-parametric variables, the age presented as mean ±SD. Chi-square tests were used to ascertain the significance of differences among the groups. Spearman correlation coefficient (Spearman's rho) was used to find correlations among different variables. Data analyzed using IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp. Statistical significant results considered at a p-value of less than 0.05.

Results

The children enrolled in the study had a mean age of 4.72 ±2.82 years old (male 4.3±2.4, female 3.1±4.9). The male to female ratio was 1.18:1. A total of 74 children were from the center of the Sulaimani governorate, and the other 26 came from ruler areas. The CP family history was reported by 12%. Fifty-one percent of the CP children were delivered by Cesarean section, diagnosed with CP after birth (54%), with jaundice (47%), and had mental retardation (54%). Furthermore, seizures observed in 34% of the total cases. Although spastic type showed the highest incidence of registered parameters; nevertheless, no statistical differences in the medical history findings were observed among the CP types except for premature delivery (Pearson Chi-Square, p=.006) and to less extent jaundice (Pearson Chi-Square, p=.058) that was seen frequently in both spastic and mixed types (Table 1).

Regarding the neuro-motor response of the patients and their behavior to stimuli, 23% of the children had ordinary hand grasping. In comparison, 40% of them showed mild difficulty, and only 11% had a severe disability for hand grasping. Status of mentality showed a significant positive correlation with difficulty in hand grasping (Spearman's rho, p= 0.003, Table 6). On the other hand, 31 children had a normal response to stimuli, with the majority being sensitive to physical contact with doctors (36%) compared to different stimuli (noise 16% and mixed 16%). The above variables did not show any significant variation among the CP types (p> .05) (Table 2).

The studied sample had normal extra-oral features in 41% of the children (Figure1A). Hypertelorism was the predominant facial finding (48%, Figure1B) and correlated significantly positively with each of ptosis (Spearman's rho, p=.04, Table 6) and midline shift (Spearman's rho, p=.021, Table 6). Ptosis observed in 26% of cases (Figure1B) and related significantly positively to each of the high arc palate (Spearman's rho, p=.008, Table 6) and deep bite (Spearman's rho, p=.018, Table 6). The CP types showed significant variation in relation to the ptosis (Pearson Chi-Square, p=.011) and lower ear set (Pearson Chi-Square, p=.039); thus, these two features were most predominantly associated with the athetoid type (6 and 3 out of 7, respectively).

Meanwhile, the frequency of the dental findings in relation to CP revealed class I Angle's classification (45%) and class II (49%) in total. Fifty percent of spastic patients had Angle's class I, and 66.7% of athetoid CP children had class II, while class III was more in the mixed CP type (13.6%) as compared to the other CP types (Table 3). Furthermore, 33% of CP children had high arch palate predominantly in the ataxic type. High arch palate in CP was statistically positively associated with deep bite (Spearman's rho, p=.01, (Table 6). Twenty-five percent of all CP children had shifted dental midline mostly in athetoid type (Pearson Chi-Square, p=.016), and 22% of all the CP patients had delayed or unerupted teeth.

Moreover, a significant positive correlation was found between the age of the children and open bites (Spearman's rho, p=0.019, Table 6). An increased overjet significantly differed among CP types (Pearson Chi-Square, P=.006). It was only seen in athetoid and mixed types. The remaining findings were minorities. Differences in the distribution of several dental outcomes among CP types did not reach a statistically significant level (Table 3).

Concerning CP patients in relation to tooth structure loss, results showed that 21% of our children had a loss of teeth structure, whether broken teeth or due to attrition and erosion (Figure1C), with no significant variation among types (Pearson Chi-Square, p>.05). The broken teeth were associated significantly with open bite (Spearman's rho, p=.000, Table 6).

Table 1: Frequency distribution of CP patients in relation to medical history.

Variable	Family member	Delivery		Diagnosis			Associated condition		Current status			
		Premature	Cesarean	During pregnancy	At birth	After birth	Jaundice	Asphyxia	Other diseases	Drug	Seizure	Mental retardation
Total 100	12	24	51	15	31	54	47	42	30	60	34	54
Spastic 64	7	11	30	7	21	36	32	31	19	36	22	33
Athetoid 9	2	4	6	2	1	6	2	1	3	5	1	5
Ataxic 5	0	4	2	0	3	2	3	3	0	3	2	2
Mixed 22	3	5	13	6	6	10	10	7	8	16	9	14
p- value*	.63	.006	.54	.28			.058	.1	.45	.885	.77	.71

* Pearson Chi-Square test among CP types.

Table 2: Frequency distribution of CP patient types in relation to combined patient's behavior and neuro-motor response assessed by hand grasping, behavior to stimuli, and sensitivity to doctor.

Variables	The activity of hand grasping				p-value*	Sensitive response to stimuli					p-value*
	Normal	Mild	Moderate	Severe		Normal	Doctor	Noise	Mixed	Light	
Total	23	40	26	11	.310	31	36	16	16	1	.419
Spastic	16	23	17	8		22	23	10	8	1	
Athetoid	4	4	0	1		3	5	1	0	0	
Ataxic	1	2	2	0		0	3	0	2	0	
Mixed	2	11	7	2		6	5	5	6	0	

* Pearson Chi-Square test among CP types.

Table 3: The frequency and percentage distribution of CP patients according to motor tone impairment in relation to dental findings.

Variables	Total	Spastic 64		Athetoid 9		Ataxic 5		Mixed 22		p-value
	No.	No.	%	No.	%	No.	%	No.	%	
Class I	45	32	50	3	33.3	2	40	8	36.3	.442
Class II	49	30	46.8	6	66.6	2	40	11	50	
Class III	6	2	3.1	0	0	1	20	3	13.6	
Diastema	8	5	7.8	0	0	1	20	2	9	.619
Delay or Unerupted	22	13	20.3	3	33.3	0	0	6	27.3	.471
Open bite	13	10	15.6	1	11.1	1	20	1	4.5	.571
Increase overjet	3	1	1.7	2	22.2	0	0	0	0	.006
Midline shift	25	14	21.9	6	66.7	0	0	5	22.7	.016
Deep bite	19	10	15.6	4	44.4	2	40	3	13.6	.110
High arch	33§	19	29.7	4	44.4	3	60	7	31.8	.477

* Pearson Chi-Square test among CP types. § Positively associated with deep bite (Spearman's correlation r, p=.01).

Table 4: Caries experience of the primary and permanent dentitions in CP children.

Total caries experience	Total		Male	Female	Caries experience	Child had any			
						DMF (11%)		dmf (47%)	
DMF and dmf =0	45		28	17		No. child	∑ of teeth	No. child	∑ of teeth
DMF and dmf>1	55	3	1	2	Decay	10	30	46	46
DMF=0 & dmf≥1		44	26	18	Filling	3	4	2	2
DMF≥1& dmf=0		8	3	5	Missing	5	16	10	10

∑= summation.

Table 5: Mean DMF/dmf, significant caries index, MNI, and RI for the primary and permanent dentitions in CP children.

Indices	Permanent	Primary
Mean DMF/dmf index	0.55	3.18
Significant caries index	1.66	8.69
Met need index (MNI)	0.455	0.059
Restorative index (RI)	0.412	0.054

Table 6: Correlations among different studied variables using the Spearman correlation coefficient.

	Ptosis	Midline	Palate	Mental	Deep Bite	Open bite	DMF	dmf	Occlusion
Hypertelorism	.040	.021		.042					
Ptosis			.008		.018				
Deep Bite			.01						
Occlusion			.014			.001		.001	
Broken						.000			
Oral hygiene	Oral hygiene with age .000			.008		.045	.000		.007
Age						.019		.019	
Hand				.003					

Regarding our CP patient's oral hygiene status, fortunately, 71% of the CP children had good oral hygiene, whereas 25% had fair, and 4% had poor oral hygiene (Figure1D). The distribution of oral hygiene status among CP types was statistically not significant (Pearson Chi-Square, p>.05). The oral hygiene was significantly positively correlated with each of DMF index, child age, open bite, and state of mentality-

-(Spearman's rho, p= .000, p=0.000, p=.045, and p=.008 respectively, Table 6). Angle's classification of occlusion had a significant positive correlation with both mean dmf index and oral hygiene score (Spearman's rho, p=.001, and p=.007, respectively, Table 6). Thus class I occlusion had less caries experience and better oral hygiene.

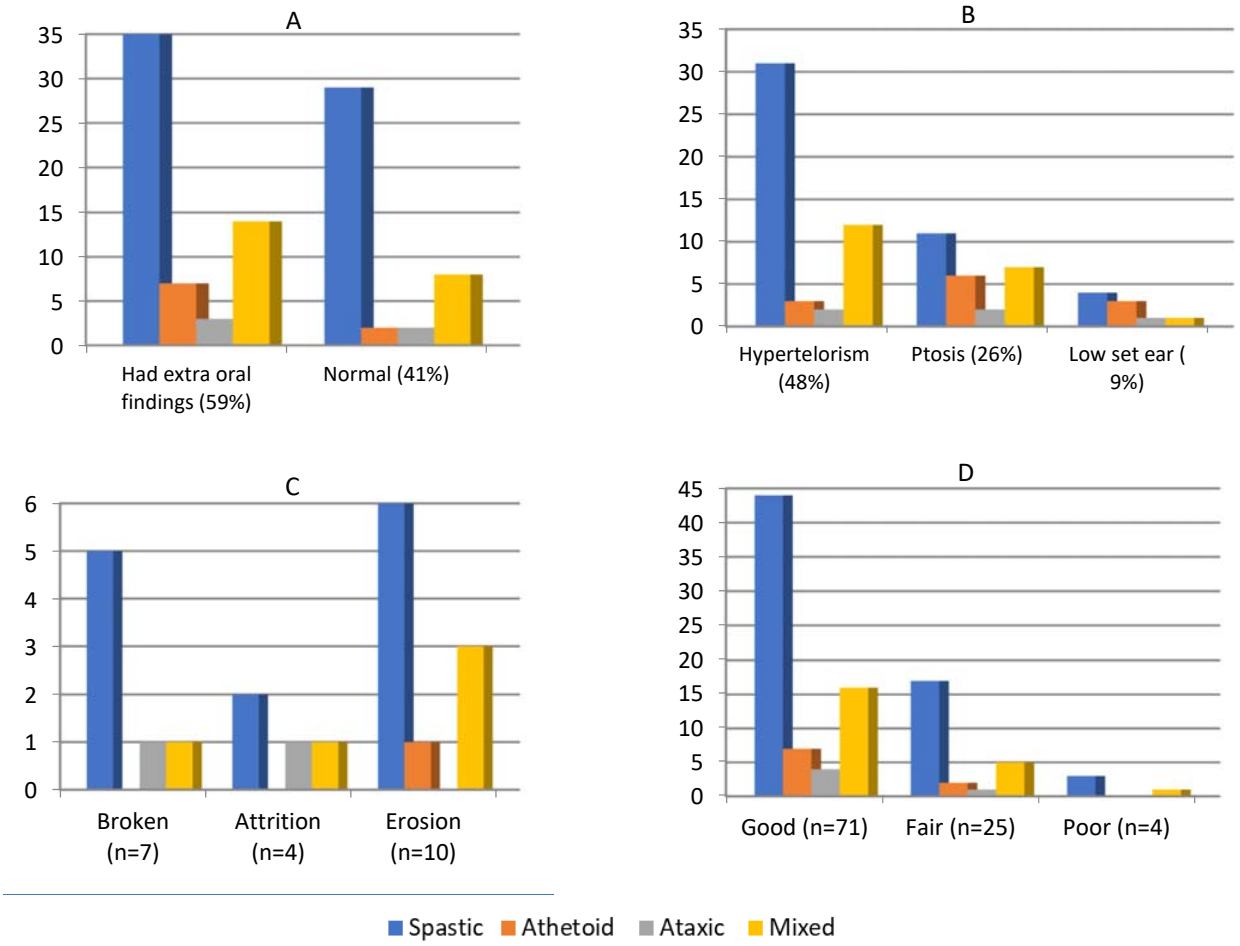

Figure 1: Frequency distribution of different types of CP children in relation to (A) presence of extraoral findings (B) types of extra oral findings (C) tooth structure loss and (D) oral hygiene.Note: 36 children had single extraoral finding and 23 children had combine findings (20 of them had hypertelorism and ptosis).

Children without caries-experience (DMF and dmf =0) represented 45% of the sample (Table 4). Regardless of the CP type, the remaining children (55%) showed high caries-experience in their deciduous teeth (47%, Table 4) that correlated significantly positively with their age (Spearman's rho, p= 0.019, Table 6). Almost all of them had decayed teeth, and ten children had clinically missing teeth, while the dental filling was seen in only two children. On the other hand, caries-experience in permanent teeth was (11%, Table 4). 10 patients had 30 decayed teeth. Four filled teeth were seen in 3 patients. Teeth scored as missing were observed in 5 patients. Males had a non-significant low mean of summation of caries experience (∑=D+M+F) than females (0.21±0.85 vs. 1.02±2.51, independent sample t-test, p=0.053).

The treatment received and restorative care of children with CP is shown in (Table 5). For the primary dentition, the mean dmft index (=3.18) and the significant caries index (=8.69) were higher than the permanent dentition (DMF= 0.55 and SCI=1.66). On the other hand, the MNI (=0.455) and RI (=0.412) were higher in the permanent dentition.

Discussion

CP is a non-progressive central nervous system disorder resulting in abnormality of movement, posture, and muscle coordination. It is also associated with a group of developmental disabilities, including mental retardation, visual, hearing, epilepsy, and behavioral challenges[27]. It can affect both genders; however, males are slightly more affected than females[5]. In our

study group, the male to female ratio was 1.18:1, with slight male predilection, which was similar to the reports of other Iraqi[10,28,29] and international studies[5,14]. Meanwhile, the predominance of the spastic type is in line with the findings in different Iraqi governorates[28,29] and other countries[8,30].

The exact etiology of CP cannot be pointed out; however, certain factors are considered as risk factors such as the type of delivery, jaundice, and asphyxia[4]. In this study, preterm birth and jaundice were highly related to the development of CP, which was close to the finding of Ahmed et al. 2019[28]. On the other hand, more than half of the participants had mental retardation, which was higher than the results of Fidan et al.[5] and less than Rahul et al.[31].

Due to the high sensitivity of CP children to medical/dental personnel and their exaggerated neuro-motor response to different stimuli commonly encountered during dental treatment (such as noise and artificial light), they have difficulties cooperating. Only 31% of our patients showed normal response to stimuli; nevertheless, the majority of them, irrespective of CP severity, were highly sensitive to physical contact, light, and noise. Therefore, at the dental clinic, it is recommended to minimize the lights, sounds, and any unexpected abrupt actions that would trigger sudden reflexes and uncontrolled movements.

Regarding extraoral observations, 41% of our patients showed normal appearance; however, a large percentage (48%) of the sample had hypertelorism, being higher than those found by Jabar and Allouch[14]. Rahul et al.[31] did not report any CP patients having hypertelorism. Furthermore, the observed significant positive association among extra and intraoral findings was not mentioned in any previous study.

Mentally and physically challenged children may have oral and dental abnormalities that would affect the function of the stomatognathic complex[14]. Malocclusion has been reported with increasing incidence in children with CP[13]. In the present study, 55% of examined cases had malocclusion (class II=49 and class III=6), which was close to the finding of Tandon et al.[32] and less than those found by other researchers[14,33,34]. Our observed concern the variation in jaws relationships among CP types needs further confirmation on a larger sample.

Abnormal teeth alignment may interfere with maintaining a clean mouth; thus, it correlated statistically with poor oral hygiene (Spearman's rho, p=.007) and a high dmf index (Spearman's rho, p=.001). Concerning our results about the existence of a high-arched palate in CP children, the data showed (33%), which was between the finding of Rahul et al. (20%)[31] and Jabar and Allouch (65.3%)[14]. High-vaulted palate could be related to the large percentage of class II malocclusion that had a small lower jaw or to the habit of thumb-sucking that is common in CP children[11]. Furthermore, a high-arched palate could result in a narrowed airway and direct the CP child to be a mouth breather[35], which promotes the growth of the upper jaw, leading to increase overjet[13], which was more frequently seen in athetoid types. As the child with CP getting older, there will be more open bite and delayed permanent teeth eruption[34]. Meanwhile, the percentage of delayed eruption (22%) was close to that found by Jabar and Allouch (21%)[14]. The remaining reported dental problems in our children with all types of CP (increased overjet, midline shift, open bite, deep bite, loss of tooth structure) were not noticeably higher as compared to the finding of other studies[11,14,31].

A forty-five percentage of our CP children had no caries-experience. The remaining children had high dental caries-index value in the primary dentition and low value in permanent teeth. Their caries experience showed a correlation with age (Spearman's rho, p= 0.019). This high dmf value is partly due to the habits of taking liquid and semisolid food, difficulty in chewing, and swallowing[35] and partly due to the number of erupted teeth that will be susceptible to decay over time[20]. The situation will require increased oral health promotion for parents and caregivers both at primary school age and at the preschool stage to enable them to implement adequate preventive regimes for their children by continuous motivation, improve access to dental care and encourage having dental services. The dental findings in our study were in accordance with previous studies[12,36,37]. Although caries experience of the studied sample of CP children was lower than the dmft of healthy children of similar age in Sulaimani city[38], early identification of the problem is necessary to provide fast intervention and sparing of the permanent dentition and minimize patients' future struggle.

Regarding the Met Need Index and Restorative Index, our study results revealed that the permanent dentition was higher (0.455 and 0.412) than those found by Jabar and Allouch[14], but the mean DMF/dmf index was less than their finding. Besides, AL Hashmi et al.[11] had recorded a higher RI and DMF index (1.9 and 2.83), and a low MNI (0.32) as compared to our results. Also, our findings of the DMF and dmf indices were close to the

results of Nouri et al.[15]. However, the MNI and RI for deciduous teeth at this age were much less (0.059 and 0.054) than in the permanent dentition. This result was close to the findings of AL Hashmi et al.[11] and similar to the finding of Lemos and Katz[12]. It was clear that the dental treatment of primary dentition in children with CP was not fulfilled. Therefore, CP children need more dental care to preserve their primary dentition in a healthy status to be mixed with the permanent set. Different types of CP did not show a significant relation to the development of dental caries, which was consistent with the result of Rodrigues dos Santos et al.[17]. Although, it is thought that the decreased orofacial movement and the presence of involuntary reflexes in patients with CP would affect caries incidence since they are considered as factors affecting the effective maintaining of good oral hygiene[26]; Our results showed that personal disability variation might not be the leading factor in maintaining dental health in CP patients, but the limited access to dental services with the difficulties in controlling those children supposed to play a significant role. Only emergency treatment is sought when a CP patient experiences dental pain and lead to filling or extraction[35].

Patients with a physical disability like CP have difficulty in controlling oral hygiene[26]. However, in the present study, it was observed that different types of CP classification had no influence on oral hygiene, which is consistent with the finding of Diniz et al.[8]. The majority of the examined CP children in this study (71%) had good oral hygiene, a finding which is similar to the outcome of Nouri et al.[15], and higher than those found by Rahul et al.[31] and Jabar and Allouch[14]. These results might be ascribed to the fact that all patients were collected from a rehabilitation center of CP patients, which encourages tooth brushing and maintaining good oral hygiene. Also, the fact that more than half of our patients had normal activity and mild difficulty (23% and 40% respectively) in hand grasping that can be a factor for our CP patients to have good oral hygiene. Our study revealed that oral hygiene was found to be better with the increasing age of the CP children and with the presence of normal occlusion, but it gets worse with high DMF in the presence of open bite[19]. Reversely, oral hygiene gets worse with a retarded mentality and difficult hand grasping.

This study provides dentists with information about the common dental conditions and diseases seen in CP patients to reduce their incidence and improve the oral hygiene of these patients. CP children require special care and need a dental clinic at the rehabilitation center to provide them with dental treatment, improve their oral health by developing their skills through a structured and visual teaching model, and to provide them and their parents as well with continuous education to emphasize prevention. This goal can be achieved through teamwork with the children's parents to attain regular visits to the dental clinic at the rehabilitation center to improve educational and actual dental services. On the other hand, conducting a similar study to include patients who do not attend the rehabilitation center can enrich our domestic data regarding such a condition.

Conclusions

The majority of our CP children were males, mentally retarded, and of spastic type. They showed a high incidence of dental caries, especially of primary dentition, and significant unmet needs for dental treatment. Besides, most of them had malocclusion and surprisingly good oral hygiene, but none of which was correlated to the presence of CP.

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