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Assessment of Oral Health Status and Impact of Oral Health Promotion on Egyptian Children with Cerebral Palsy

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Abstract:

Objectives: *evaluating the oral health status of cerebral palsied children in Egypt in the terms of caries experience, oral hygiene and gingival health and to assess the impact of oral health promotion program on the oral health status of these children after a 6-month-follow up period.*

Subjects and Methods: *102 cerebral palsied children, divided into three age groups (3-6 years for primary dentition, 6-12 for mixed dentition and above 12 for permenant dentition) were examined. Data were gathered through a face to face interview using a diagnostic chart and clinical examination. The diagnostic chart was used to assess socio-economic characteristics, medical history, past dental visits, oral health practices and dietary habits. Clinical examination assessed caries experience using DMFT/dmf/ def index for permanent, primary and mixed dentitions respectively, oral hygiene index (OHI-S) and gingival index (GI). Oral health education to the patients and their caregivers was executed and follow up was done after 6 months using the same investigations to evaluate the influence of oral health promotion.*

Results: *The mean values of dmft/deft/DMFT indices for cerebral palsied children with carious teeth were 5.88±4.37, 4.19±2.42, 2±2.18 respectively. The majority of children had substandard oral health conditions with mean values of OHI-S (2.06±1.15) and GI (1.44±0.82). No statistically significant differences were found in DMF/dmf/def scores before and after oral health promotion however, a significant reduction in OHI-S was found ($p<0.05$). Also, there was improvement in GI but it was not significant.*

Conclusion: *Children with CP exhibited inadequate oral health status as reflected by substandard oral hygiene scores and gingival health with high dental caries prevalence as well. Thus efforts should be concerted among parents/caregivers, children, and dental professionals to improve the suboptimal oral health of those children.*

Keywords: *Cerebral Palsy, caries, gingival health, oral health status, health promotion.*

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I. Introduction:

Cerebral palsy (CP) is a group of disorders that affect a person's ability to move and maintain balance and posture and is of a particular importance among many diseases of the nervous system, being one of the most common physical disabilities of childhood. [(1)(2)]

CP is not a distinct disease classification, but an umbrella term that encompasses aetiologically heterogeneous symptoms, which vary with age as it is not associated with motor and posture disorders but, it is also associated with a variety of comorbidities such as visual and hearing impairment, epilepsy, cognitive impairment, disturbances of sensation, communication, perception, and behavior disorder[(3)]

CP accounts for 60% of severe motor disabilities in school-aged children.[(4)] Its worldwide prevalence is ranging from 1.5 to more than 4 per 1000 live births [(5)] . Most of them resided in low- or middle-income countries.[(6)]

In Egypt, a study conducted in Al-Karga District reported a prevalence of 2.04 per 1000 live births children. Another one in AlQuseir City, Red Sea Governorate documented a prevalence of 3.06 per 1000 live births in children.[(4,7,8)]

The etiology of CP is multifactorial, heterogenous, and is characterized by an injury to the immature

brain that may be prenatal, perinatal or postnatal.[5]

Prenatal such as anoxia, prematurity and maternal conditions such as mental retardation, seizures, or hyperthyroidism. Perinatal risk factors are significant birth asphyxia, infections, intracranial hemorrhage during delivery, hemorrhage, seizures, hypoglycemia and hyperbilirubinemia Postnatal such as meningoencephalitis and head trauma. Moreover, genetic basis has been reported for some patients. .[5,9–12]

CP may be spastic, dyskinetic, ataxic or combination according to the type of motor symptoms and according to the count of the affected extremities it is termed hemiplegia, diplegia, tetraplegia or quadriplegia. Spastic type is the most predominant one (66-82%)[13]

CP, as a disease, does not cause exclusive intra oral defects, but there are several conditions that occur more likely in patients with CP when compared with other normal individual such as, dental caries, periodontal disease, dental trauma, malocclusion, bruxism, temporomandibular joint disorders, enamel hypoplasia, abnormal oral habits, etc. Most of these oro-dental diseases occur due to the inherent neuromuscular defects leading to lack of lip seal, malocclusion, mouth breathing and to the reduced quality of the oral care.[14,15]

Studies have showed that, the risk of oral disease increase markedly according to the severity of the neurological damage.[16,17] Furthermore, the health of the mouth and oral functioning may be jeopardized by several common medications and therapies used to treat general health issues.[18]

A person's quality of life is markedly impacted by his dental health, which is a prerequisite for overall health. For example, poor dental health and untreated oral diseases like dental caries, gingivitis and periodontal diseases can lead to discomfort, anxiety, decreased food intake, trouble interacting with others, and difficulties in performing daily tasks.[19,20]

It has been reported that children with CP face greater challenges in daily tooth brushing than their healthy counterparts. This may be the result of their inability to develop the necessary manual dexterity for self-care and their lack of awareness of the value of maintaining good oral hygiene.[21]

Therefore; the responsibility of maintaining proper oral hygiene for those children relies on their caregivers and this might be challenging if they lack the importance of oral hygiene.[19]

Because of their disability and activity limitations and their over-dependence on their caregivers for daily activities and oral hygiene practice, caregivers face massive physical and financial burdens.[22]. Parents of disabled children are fully dedicating their time and efforts to learn how to deal with their children and how to control and improve their medical condition. Therefore; the oral health care is considered down on their list of priorities.[22,23]

Unfortunately, there are only few studies that mentioned oral health status of cerebral palsied children in Egypt and discussed recommendations for oral health promotion among these group of children.[16]

Therefore; we are in special need to know well the oral health status of individuals with CP in Egypt to develop the proper clinical and community interventions for oral health promotion and to implement an oral health educational program to the caregivers with evaluation the impact of this program on promoting the oral health of these children.

II. SUBJECTS AND METHODS:

Study design: This study was a Quasi Experimental study; Subtype: A (Before and After Study)

Study Population: A sample of 102 children with 3 different age groups (3-6 years), (6-12 years) and (12-14 years) suffering from CP were recruited from The National Institute of Neuromotor System and pediatric clinic at Faculty of dentistry Ain Shams University, Egypt.

Study procedures: The present study was conducted in two phases, including a 6-month-follow-up period in-between.

Phase I:

A- Data collection:

A special diagnostic sheet was designed and divide d into 5 sectors to collect the following information from the child's parent or caregiver; sociodemographic data, detailed medical and dental history, oral hygiene habits, dietary consistency either solid, semisolid or liquid diet and past dental visits through a face-to-face interview.

B- Clinical examination

Intraoral examination was performed for all the subjects by a single trained investigator at baseline and follow-up visits using disposable diagnostic sets under good illumination of the dental chair. Children were lying on the dental chair or on their parent's lap or on their wheelchair. Intraoral examination including:

1- Dental caries experience using the **decayed, missing, and filled primary and permanent teeth (dmft/deft/DMFT) indices** according to the age.[24]

2- The oral hygiene status using the **Simplified Oral Hygiene Index (OHI-S)** given by Green and Vermilion[25].

➢ OHI-S is composed of simplified debris index (DI-S) and simplified calculus index (CI-S). The examination includes the evaluation of the labial surfaces of maxillary right first molar, maxillary right central incisor, maxillary left first molar and mandibular left central incisor, as well as the lingual surfaces of mandibular left first molar and mandibular right first molar. Each surface was given a score from 0-3 for both DI-S and CI-S, based on numerical determinations representing surface area covered with soft debris and calculus. For each individual, the average score was calculated for both DI-S and CI-S indices, values from 0-3. Then both were combined to obtain the Simplified Oral Hygiene Index score; values from 0 -6.

3- Gingival health using **Löe and Silness Gingival Index (GI)**[(26)]**.**

➢ The six index examined teeth are upper right first permenant molar and permenant lateral incisor, upper left first premolar and lower left first permenant molar and permenant lateral incisor as well.

C- Oral health promotion:

The same investigator provided oral health education for the caregivers using a specially designed educational booklet and a video which were tailored specifically for patients with CP. **The booklet** included recommendations and instructions about the following:

- Early establishment of dental home and importance of first dental visit.
- Daily routine for dental hygiene practices
- Dietary modifications for prevention of dental caries
- Some of the positions that are commonly used for children requiring oral care assistance to safely restrain the child when it is necessary.

Regarding the video, it was tailored in the regional language (Arabic) as voice over a video showing a caregiver who was brushing the teeth of a child with CP with instructions and advices about:

- How to handle the child during toothbrushing and importance of being patient during oral care.
- Brushing technique.
- How to insert toothbrush into the oral cavity for those who refuse to open their mouths.

The examiner discussed all aspects of the booklet with each caregiver with his/her child individually and made sure the caregiver understood the instructions in the booklet well then showed them the video. Regarding illiterate caregivers who couldn't read the booklet, the examiner depended on the pictures in the booklet to illustrate it and on the video later. Any questions or difficulties were discussed at the end of the session.

D- Preventive Measures:

➢ Manual scaling was done for those patients with moderate plaque or calculus levels. Simple Extractions were done as well. For those who had heavy calculus or multiple badly decayed teeth, they were instructed to go to the nearest hospital with the required equipmets to receive the needed dental treatment under either local or general anesthesia.

➢ Mouth props were given to the parents who complained that their children refuse to open their mouths.

➢ Topical fluoride (5% sodium fluoride, Charm fluoride varnish, Denkist,South Korea) was applied to all children, after removal of soft debris by a piece of gauze.

Phase II:

Follow up:

After 6 months from each child's examination, re assessment of the oral health and caries experience of each child was done using the same indices used in the clinical examination. (throughout the 6 months' interval the caregivers were reinforced to follow the instructions in the oral health education program every 2 months through direct interview while the children were receiving their physiotherapy sessions and phone calls) with reapplication of the fluoride varnish.

Statistical analysis:

Categorical and ordinal data were presented as frequency and percentage values. Numerical data were presented as mean, standard deviation (SD), median, and interquartile range (IQR) values. They were analyzed for normality by viewing data distribution and using Shapiro-Wilk's test. Age data were normally distributed, while other numerical data were non-parametric. Numerical and ordinal data were analyzed using Kruskal-Wallis's test, followed by Dunn's post hoc test for different associations and a signed rank test for the effect of health promotion. Correlation analyses were made using Spearman's rank-order correlation coefficient. The significance level was set at $p<0.05$ within all tests.

III. Results:

Sociodemographic data

The summary statistics of sociodemographic data is presented in Table (1).

Out of the 102 individuals surveyed, there was a slightly higher prevalence of males (55.88%) compared to females (44.12%). The average age of the children was (8.34±3.95) years. Regarding parental education, most mothers (45.10) and fathers (53.92%) had basic education. Most of the surveyed children (75.49%) had no dental experience. However, among those who had, (64%) received some form of treatment. A vast majority (82.35%) of the children didn't practice regular teeth brushing, and among those who did, most (72.22%) brushed only once a week. The responsibility for brushing was equally divided between the child and caregivers. For dietary habits, a solid diet was the most common (49.02%).

Table (1): Summary statistics for demographic data.

Parameter		Value
Gender [n (%)]	**Male**	57 (55.88%)
	Female	45 (44.12%)
Age (years)	**Mean±SD**	8.34±3.95
	Median (IQR)	8.00 (7.38)
Mother education [n (%)]	**Illiterate**	42 (41.18%)
	Basic education	46 (45.10%)
	High education	14 (13.73%)
Father education [n (%)]	**Illiterate**	37 (36.27%)
	Basic education	55 (53.92%)
	High education	10 (9.80%)
Previous dental visits [n (%)]	**No**	77 (75.49%)
	Yes	25 (24.51%)
Dental history [n (%)] (n=25)	**No treatment**	9 (36.00%)
	Treatment	16 (64.00%)
Teeth brushing [n (%)]	**No**	84 (82.35%)
	Yes	18 (17.65%)
Brushing frequency [n (%)] (n=18)	**Once/ day**	5 (27.78%)
	Once/ week	13 (72.22%)

Parameter		Value
Brushing by [n (%)] (n=18)	**Child**	9 (50.00%)
	Caregiver	9 (50.00%)
Diet [n (%)]	**Blended diet**	31 (30.39%)
	Semi-solid	21 (20.59%)
	Solid	50 (49.02%)

Effect of oral health promotion:

The effect of oral health promotion on different indices is presented in Table (2) and Figure (1). Oral health promotion significantly affected OHI categories, with the percentage of cases with good scores being significantly higher after promotion ($p=0.042$). Other scores and indices were improved after promotion. However, the effect was not statistically significant ($p>0.05$).

Table (2-A): The effect of oral health promotion on different indices:

Index		Before promotion	After promotion	p-value
dmf	Mean±SD	4.25±5.82	4.12±5.63	0.542ns
	Median (IQR)	1.00 (8.25)	1.00 (8.00)	
DMFT (mixed)	Mean±SD	1.44±2.22	1.44±2.22	1ns
	Median (IQR)	0.00 (3.00)	0.00 (3.00)	
def	Mean±SD	3.07±2.98	3.07±2.98	1ns
	Median (IQR)	3.00 (6.00)	3.00 (6.00)	
DMFT (permanent)	Mean±SD	4.30±3.21	4.36±3.44	0.731ns
	Median (IQR)	4.00 (5.00)	3.50 (6.00)	
	Median (IQR)	2.00 (2.08)	1.30 (1.98)	
	Median (IQR)	1.40 (1.18)	0.90 (1.20)	

ns not significant.

Table (2-B): The effect of oral health promotion on different indices.

Index		n (%)		p-value
		Before promotion	After promotion	
OHI	Poor	29 (28.43%)	21 (23.33%)	0.042*
	Fair	44 (43.14%)	26 (28.89%)	
	Good	29 (28.43%)	43 (47.78%)	
GI	Poor	25 (24.51%)	19 (21.11%)	0.116ns
	Fair	38 (37.25%)	18 (20.00%)	
	Good	39 (38.24%)	53 (58.89%)	

*; significant ($p<0.05$) ns; non-significant ($p>0.05$).

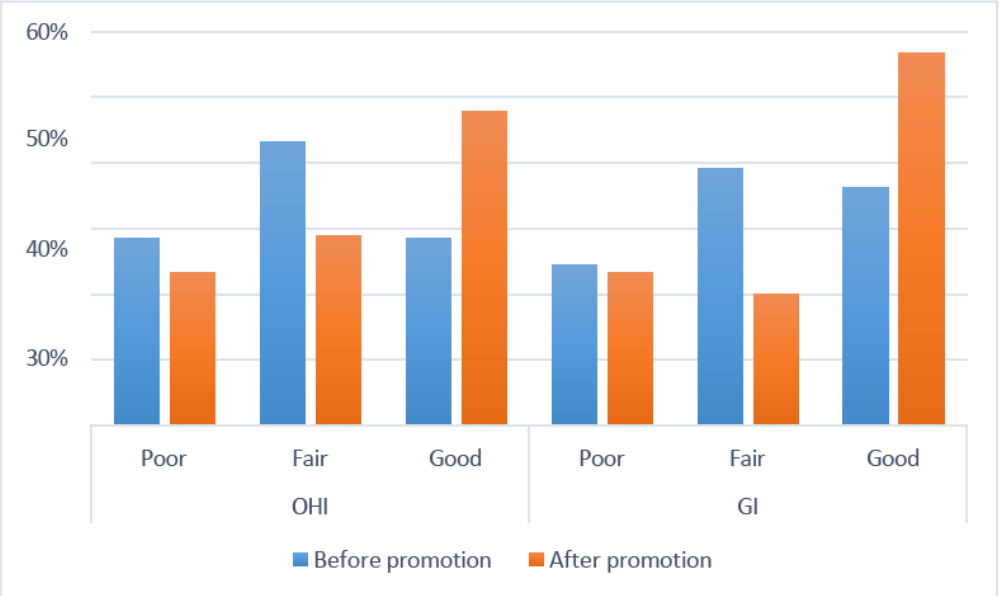

Figure (1): Bar chart showing score categories before and after promotion.

IV. Discussion:

Cerebral palsy is the most common physical childhood disability[27]. Since children with CP present permanent disorders in posture and movement that provoke motor loss and generate difficulties in the performance of daily life activities, they are subjected to have poor oral health that definitely affects the overall general health and oral health related quality of life.

To the best of the investigator's knowledge, several studies associated with the prevalence and severity of oral and dental diseases have been done in the West[28–32], but till now only few studies evaluated the dental problems in CP children in Egypt [16,33]. Therefore, this study was conducted to assess the oral health status of children with CP and to evaluate the effect of oral health education in promoting the oral health of these children throughout a 6-month follow-up period.

Participated children were selected from The National Institute of Neuromotor System and pediatric clinic at Faculty of Dentistry Ain Shams University. This Institute was selected as it is one of the largest centers that have pediatric neurology and physiotherapy clinics, so the children can get their physiotherapy sessions in the same place after diagnosis without high financial compensations, moreover; there are dental clinics in the same place to allow proper diagnosis of the patients on dental chairs with good illumination.

A total 102 participated children were divided equally into three different age ranges (3-6), (6-12) and (12-14) to ensure that different oral health problems are recorded during primary, mixed and permenant dentitions respectively.

One examiner interviewed all parents and caregivers of the participated children and examined all the children throughout the whole study to ensure standardization of the study.

Intraoral examination was done with disposable diagnostic sets for better infection control management.

Oral health education was performed for each patient with his/ her caregiver individually using a specially designed booklet and video. When caregivers are educated well, they can improve their own and CP patient's commitment to oral hygiene, which results in reduction of dental plaque and improves the oral health status.

Results of the current study revealed that the percentage of males (55.88%) was higher than females (44.12%) with male/female ratio 1.3:1 and this is correlated with the findings of other studies [16,34–38]. However; **Daraniyagala TR et al.** reported a higher prevalence in females.[28]

Regarding dental history, only 24.51% of the cerebral palsied children had visited the dentist in the past years. Moreover, the appointment was mostly driven by a specific problem rather than a preventive measure. A similar observation was reported in a study done by **Sinha et al**. [39]. This can be attributed to the physical and financial burden of having a disabled child as parents have been fully dedicating their time and efforts to learn how to deal with their children and how to control and improve their medical condition.[22] Also; the lack of awareness of the caregivers regarding the importance of dental visits and maintaining adequate oral hygiene in these children. Moreover; the low educational level of the parents as 36.27% of their fathers and 41.18% of their mothers were illiterate and oral health needs was of least importance compared to other general health needs. (37,39)

In our present study, most of the cerebral palsied children (82.35%) did not brush their teeth and need supervision upon tooth brushing as children with CP always have difficulties in self-cleaning and communicating oral health needs. children's lack of a regular brushing habit and this seems to be realistic.[40,41]

This finding goes with the study done by **Oredugba et al** [42] that revealed that only 7% of parents brushed their child's teeth twice daily and with the study conducted by **Sinha et al** [39]who reported that only 8 CP children out of 50 (16 %) get their teeth brushed twice daily. On the other hand, this finding was contradicted with the results reported by **Vpk V et al**, who reported that more than 50% of the parents brushed only once daily (43)

Concerning diet and food consistency, the findings of this study revealed that (50.98%) of children with CP depend mainly on soft diet that is either in a liquid or semisolid consistency. This may be due to abnormalities regarding the orofacial muscles, poor lip closure and inadequate tongue movements to manipulate food around the mouth. Thus they may be offered food with a modified consistency (liquid or semisolid) to improve their dietary intake and state of nutrition. Similarly, study done by **Quritum et al** [44] revealed that 63.75% of children with CP were reported to consume semi-solid or liquid diet. These results are also in agreement with **Benfer et al** [45]who reported that food textures were modified to liquid or semisolid consistency for 39% of children with CP.

In the present study, caries prevalence compromised 66.67% among the participating children which is

similar to findings of the study done Mathew et al who reported that caries prevalence was 65.8% among Indian children with CP who aged below 18 years [36], while this finding is higher than that of Chu and Lo where they noted that 43% of the Chinese students with CP had untreated dental caries [46]. In addition, the mean values of DMFT, deft and dmft were 3.07±3.14, 3.07±2.98 and 4.25±5.82 respectively which is higher than the finding of several previous studies done in Egypt[16], Sudan[47] Bangladesh[20,48] , china[46], Brazil[49] and India [50]. On the other hand, Caries in primary teeth (dmft) is considered much less than caries experience reported in Saudi Arabia 18.8±16.3[51] and in Thailand 20.3±21.6[52].

The high caries prevalence in children with CP which left untreated could be attributed to risk factors such long term usage of sugar-based medications[39], high salivary osmolality[53], soft diet intake with food stagnation in the buccal and labial sulci due to their poor masticatory muscular control[36], high frequency of carbohydrate intake and reduced hand dexterity, making it difficult for them to use a toothbrush [48]; all these factors contributing in maintaining adequate oral hygiene.

Regarding the oral hygiene status; the majority of CP children (43.14%) had fair oral hygiene with mean value (2.06±1.15), while the remaining participants showed poor and good oral hygiene equally; (28.43%) in each category. This finding goes in line with the study done by **Sinha et al**[39] who reported that only 30% of the CP children had good oral hygiene. While; this finding is lower than the results reported by **Wyne et al**[54] who mentioned that majority of the children had either fair (55.8%) or poor (34.6%) oral hygiene. Only one in 10 (9.6%) children had good oral hygiene and results reported by **Mathew et al** [36] who found that (66.6%) of CP children had poor oral hygiene.

On assessing the gingival health of the CP children enrolled in our study, it is found that the mean value was (1.44±0.82). This finding is higher than the results reported by **VPK et al** [43] who found that the mean value of GI was (0.172 ± 0.36), while it is lower than the finding of the study done by **Daraniyagala** [28] who reported that the mean value of GI was 2.3 ± 0.62.

Six months following oral health education, a significant reduction in simplified oral hygiene index (OHI-S) was found ($p<0.05$). Also, there was improvement in GI but it was not significant. However, the effect of oral health promotion on caries index was not statistically significant ($p>0.05$) because preventive measures are ineffective in irreversible stages of dental caries, while the limited follow-up period (6 months) may not be an enough period to monitor changes in caries experience.

The present study examined an important group of special health care needs; children with CP. The oral health status and oral health promotion of those children had not been given enough attention in literature. Thus, the goal of this study is to enhance the general and oral health of children with (CP) by implementing educational and preventive measures as soon as the disease is recognized. This could involve motivating and educating caregivers about the proper degree of regular oral hygiene activities.

Ethical consideration:

- An approval from Faculty of Dentistry Ain-Shams University research ethics committee is obtained (FDASU-Rec IM022226).
- An approval from the National Institute of Neuromotor System and the different institutions were obtained before beginning of the study (INM00052).
- All participants were informed and instructed about the aim of the study, with Informed written consent from the caregiver is obtained before any step.

IV. Limitations:

- All the participants were collected only from The National Institute of Neuromotor System and pediatric clinic at Faculty of dentistry Ain Shams University, together with the small sample size could prevent generalization of the findings.
- The current study did not include a healthy control group for comparison of the findings.

V. Conclusion:

Children with a history of CP exhibited inadequate oral health status as reflected by substandard oral hygiene scores and gingival health with high dental caries prevalence as well. Thus efforts should be concerted among parents/caregivers, children, and dental professionals to improve the suboptimal oral health of those children.

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