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The Effect of Full-Mouth Rehabilitation on Dental Status and Oral Health Conditions for Children with Special Health Care Needs in Jeddah City: A One Year Follow-Up

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Abstract. Full-mouth rehabilitation under general anesthesia is required to provide safe and effective dental treatment for children with special health care needs whom are at high risk of oral diseases. The aim of this study was to assess the effect on oral health among a group of Children with Special Health Care Needs Program, in Jeddah, up to 12 months post-operatively as only few studies have been assessed in Saudi Arabia. Forty children with special needs required were assessed in two hospitals. Children were examined for dental caries, oral hygiene habits, malocclusion, oral hygiene status, and dental plaque pre-operatively, 3-, 6-, 9-, and 12-months post-operatively. Follow-up response rate was 87.5%. More than one half of the study population

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were boys (63%) within the age group of 5-8 years. Full-mouth rehabilitation has improved oral hygiene status and reduced plaque index scores throughout the study period. Parents/caregivers reported significant ($p \geq 0.005$) compliance to oral hygiene instructions and provision to help with tooth brushing ($p \geq 0.016$). The effect of full-mouth rehabilitation under general anesthesia, with 3-month recall visits, had a significant clinical effect on oral hygiene habits, oral hygiene status, and dental plaque extending up to 12 months post-operatively.

Keywords: Rehabilitation, General anesthesia, Oral health, Children with Special Health Care Needs Program.

Introduction

Children with special health care needs program (CSHCN) are those who suffer from a mental, physical, medical, or social condition that prevents them from achieving full potential when compared to other children of the same age. The condition may be developmental or acquired and may cause restrictions in carrying out daily self-maintenance activities or significant limitations in a major life activity. Health care for CSHCN requires specialized knowledge, increased awareness and attention, adaptation and accommodative measures beyond what are considered routine[1].

Children with special health care needs suffer more from dental problems than the average person general population at large. Many reports show that CSHCN are more at risk of dental diseases and more missing teeth. They also face problems in maintaining proper dental care as compared to other members of the community[2-4].

There are many reasons why the oral health of people with disabilities are poor than the general population, and the dental approach is more barred such conditions include malocclusion, enamel hypoplasia, bruxism and trauma. Children with special health care needs may have impaired cognitive abilities, behavioral problems, impaired mobility, neuromuscular problems (drooling, gagging and swallowing problems) and unchecked body movements. These complications can preclude competent oral care and increase the risk for developing oral health problems[5].

The high risk of oral diseases in these children may be due to complications of their conditions, medications, diets, and problems performing proper oral hygiene[2]. Although, the number of people with disabilities who need oral health services is rising dramatically, there is a deteriorating dental work-force resulting in increasing challenges for the oral health care system[5].

Despite the existing behavioral management and pharmacological procedures, some cases require full-mouth rehabilitation (FMR) under general anesthesia (GA) to provide secure and adequate dental treatment. Full-mouth rehabilitation (FMR) is defined as restoration of the form and function of the dental and masticatory apparatus to as nearly a normal condition as possible for which includes: Restorative treatment, preventive procedures, and extractions. The main reasons for dental treatment under GA are uncooperative behavior, multiple extractions, extensive dental caries in a young child, and dental treatment for all age groups of people with special needs[6].

Many studies have investigated the prevalence of dental status and oral health conditions in CSHCN[7-14]. However, there have been relatively few studies assessing the effect of FMR under GA on dental status and oral health conditions in Saudi Arabia. Therefore, the aim of this study was to assess the effect of FMR under GA on dental status and oral health conditions for a group of CSHCN in Jeddah up to 12 months post-operatively.

Materials and Methods

This study was a prospective observational cohort study that involved an active attempt to change a disease determinant (dental status and oral health conditions) through treatment (FMR under GA) for one group of patients (CSHCN) in the city of Jeddah. It was carried out at two governmental hospitals (King Abdulaziz University Hospital (KAUH) and King Fahad General Hospital (KFGH)) that offer free FMR under GA for children with special health care needs. King Abdulaziz University Hospital provides one half day (4 hrs per week) while KFGH provides 2 full days (16 hrs per week) for FMR

under GA by qualified pediatric dentist residents supervised by their consultants.

The sample size was pre-determined to include 40 children. All CSHCN who were planned to have FMR under GA, from January 2009 to February 2010, at KAUH and KFGH fulfilling the inclusion criteria were included after parental agreement. The inclusion criteria were as follows:

1. Age range between 5 to 14 years.
2. Should have physical, mental, or sensory disability (separately or combined).
3. Should have minimum of 12 primary, permanent teeth, or both that have not treated for the past 12 months.

The following were excluded:

1. Participation in any other concurrent clinical trials.
2. Presence of serious medical conditions or a transmittable disease such as malignant disease, Hepatitis, AIDS, *etc*.
3. Children with parents who had no home or mobile phone to be contacted post-operatively.
4. Children who had only one post-operative visit.

Children were considered to have a physical, mental or sensory disability if they have one or more of the following: (A) A substantial limitation in the ability to perform basic physical activities such as walking, climbing stairs, reaching, lifting or carrying; (B) Difficulty with learning, remembering or concentrating; and (C) Blindness, deafness or a severe vision or hearing impairment[15]. The study was carried out for period of 24 months. The clinical and dental measurements were assessed at baseline (pre-operative), 3-, 6-, 9-, and 12-month post-operative visits.

Calibration: To reach good intra-examiner and inter-examiner reliability, calibration of the examiners was conducted prior to baseline registration. Ten children were examined for dental caries, dental plaque, and oral hygiene status. They were re-examined a week later and the level of agreement between corresponding readings was assessed using the *Kappa* method.

Personal Data and Informed Consent: The participants found eligible for the study were given individual patient numbers. Children's name, gender, age, addresses and contact information were recorded. Children or their parents were advised of their role in this study and asked to sign an informed consent. No participants were admitted to the study before the informed consent form was duly signed by either the participant or their parents. All the data was presented in the study; however, the identity of the participants was not disclosed.

Disability, Medical, and Dental History: Disability, medical and dental history questionnaires were carried out to extract information related to the disability, medical, and dental history of the participants.

Oral Hygiene: Personal oral hygiene evaluation checklist was designed to evaluate the level of ability of the child in maintaining good oral care. The person who worked most closely with the individual was asked and recommendations for oral hygiene were given accordingly.

Dental Treatment: Full-mouth rehabilitation under GA was planned and designed at the first clinical visit to all participants (based on the medical and dental history). Subsequent scheduled visits were administered to the participants for 12 months post-operatively. The dental treatment included conservative adhesive restorations (CAR), restoration of decayed teeth, fissure sealant, pulp therapy, stainless steel crown, and extraction of non-restorable teeth. All children received dental kits containing an electric tooth brush, tooth paste, tongue cleaners, and mouth wash. Oral hygiene instructions were given to all children during all the follow-up visits.

Procedures for Recording Dental Status and Oral Health Conditions

Dental Caries: The WHO criteria (1997)[16] was used for the diagnosis of dental caries. “The caries was diagnosed on visual evidence after drying and removing the debris from the teeth with the

help of explorer and mirror. Dental caries were scored once at baseline. Radiographs were not used for caries detection[16]".

Oral Hygiene Habits: "This habit was recorded as: Tooth brushing frequency and provision of help with tooth brushing. Oral hygiene habits consisted of tooth brushing frequency (0 = none / < once a day; 1 = once/day; 2 = > once/day) and provision of help with tooth brushing (0 = none, child brushes completely independently; 1 = moderate, child receives some help with brushing; 2 = extensive, parents or caregivers brush child's teeth)". Oral hygiene habits were recorded at baseline and at 12-month post-operative visits.

Malocclusion: This process was identified in accordance with WHO criteria (1987)[17] and was recorded as: No malocclusion 0; Slight malocclusion 1; and Severe malocclusion 2. Two levels of anomaly were registered: Slight malocclusion - such as one or more rotated or twisted teeth, crowding or spacing. Severe malocclusion - anomalies that cause an unacceptable effect on facial appearance, significant reduction in masticatory function, impairment of speech or one or more of the following conditions of the four anterior incisors: Maxillary over jet 9 mm, mandibular over jet one full tooth depth, open bite, midline shift 4 mm, crowding or spacing 4 mm. Malocclusions were recorded at baseline and at 12-month post-operative visits.

Oral Hygiene Status and Dental Plaque: The presence of plaque was recorded as Plaque Index (PI) described by Silness and Löe[18]. "All teeth were scored at baseline, 3-, 6-, 9- and 12-month post-operatively. Mouth mirror and dental explorer were used after air drying of teeth to assess plaque." Each of the four gingival areas of the tooth (distofacial, facial, mesiofacial and lingual) was given a score ranging from 0-3, as follows:

0 = The gingival area of the tooth surface is literally free of plaque. Running a pointed probe across the surface of the tooth at the entrance of the gingival crevice after the tooth has been properly dried tests the surface. If no soft matter adheres to the point of probe, the rear is considered clean.

1 = No plaque can be observed in site by the unaided eye, but the plaque is made visible on the point of the probe after it has been moved across the tooth surface at the entrance of the gingival crevice. Disclosing solution was not used but may be useful for recognizing this film of plaque

2 = The gingival area is covered by a thin to moderately thick layer of plaque. The deposits are visible to the naked eye.

3 = Heavy accumulation of soft matter, the thickness of which fills out the niche produced by the gingival margin and the tooth surface. The interdental area is stuffed with soft depress.

Withdrawals and Drop-outs: Participants were free to withdraw from the study at any time if they so wish. Participants were registered as dropouts if they were absent from or unable to keep up with the appointments as planned. The reasons for each withdrawal / dropout were stated in the participant's form.

Statistical Analysis: Information was analyzed using "Statistical Package for Social Sciences Programme" SPSS computer software (version 17.0, SPSS Inc., Chicago, IL, USA)". Kappa method has been used for inter-examiner and intra-examiner reliability. The results included descriptive and analytical information. Descriptive statistics were displayed as frequency and percentage for qualitative variables or as mean and standard deviation for quantitative variable. Analysis of data was done through significance tests and correlation coefficients. Various statistical methods were used *i.e.,* paired-samples *t*-test, independent-sample *t*-test, and chi-squared correlation coefficient test. The level of significance was set at 0.05 (p-value of less than 0.05 was considered statistically significant).

Ethical Considerations: The study was approved by the Research Advisory and Research Ethics Committees of Sultan bin Abdulaziz Humanitarian City (SBAHC), King Abdulaziz City for Science and Technology (KACST), KAUH and KFGH.

Results

Inter-examiner reliability was determined using Kappa method as 0.90 for dental caries and 0.89 for oral hygiene status, which are in good agreement. Intra-examiner reliability was also determined and found to be 0.95 for dental caries, which is in an excellent agreement.

Demographic Data: The follow-up response rate was 87.5% for 35 participants who had completed a 12-month follow-up visit. Two (5%) participants declined to take part in the study, two (5%) participants could not be contacted during the study period and one (2.5%) participant passed away during the study period as a result of a severe asthmatic attack. The children's age ranged between 5 to 12 years with a mean of 7.3 ± 2.4 years. The frequency and percentage distribution of the study sample based on gender and age at different hospitals is presented in Table 1.

Table 1. Frequency and percentage distribution of the study sample according to age and gender at different hospitals.

Demographic Variables	Hospital		Total
	KFGH[§]	KAUH[‡]	
	N[*] = 13 n[†] (%)	N[*] =22 n[†] (%)	N[*]=35 n[†] (%)
Age Group			
5-8 years	10 (76.9)	14 (63.6)	24 (68.6)
9-12 years	3 (23.1)	8 (36.4)	11 (31.4)
Gender			
Boys	10 (76.9)	12 (54.5)	22 (62.9)
Girls	3 (23.1)	10 (45.5)	13 (37.1)

[*]N= total size of the study sample. [†]n = number of children
[‡] =King Abdulaziz University Hospital. [§]King Fahad General Hospital

Disability History: Mental disability was the most common single disability among 37.1% of the study sample, of whom 8.6% were physically disabled and 8.6% were challenged disabled. Meanwhile, mental disability was found to be the most common type of disability present in boys (22.9%) and girls (14.2%). Less than one half of the study sample (45.7%) had multiple disabilities. Disability was reported to be permanent in 94.3% of the study sample and

65.8% of children had acquired disability prior to 1 year of age. Sixty percent of the study sample needed regular help from parents/caregivers for everyday activities, and 68.6% of participants did not use any equipment currently for their everyday activities. The frequency and percentage distribution of the study sample according to gender and type of disability is presented in Table 2.

Table 2. Frequency and percentage distribution of the study sample according to gender and type of disability.

Disability	Gender				Total	
	Boys		Girls			
	No.*	%	No.*	%	No.*	%
Physical	1	2.9	2	5.7	3	8.6
Mental	8	22.9	5	14.2	13	37.1
Sensorial	3	8.6	0	0.0	3	8.6
Physical / Mental	4	11.4	3	8.6	7	20.0
Physical / Sensorial	1	2.9	0	0.0	1	2.9
Physical / Mental / Sensorial	3	8.6	0	0.0	3	8.6
Mental / Sensorial	2	5.7	3	8.6	5	14.3
Total	22	63	13	37.1	35	100

**No. = Number of Children.*

Dental History: Parents/caregivers reported poor dental follow-up visits. The profile of the study sample according to dental history and oral hygiene skill evaluation is summarized in Table 3 and 4.

Table 3. Profile of the study sample according to dental history.

	No. *	%
Dental Complaint		
Yes	34	97.1
No	1	2.9
Previous Dental Visit		
Yes	17	48.6
No	18	51.4
Dental Visit / Year		
1 / Year	0	0
2 / Year	2	5.7
4 / Year	1	2.9
Emergency only	22	62.9
Never	10	28.6
Previous Dental X-ray		
Yes	5	14.3

No	30	85.7

Table 3. ***(Continuation)*** **Profile of the study sample according to dental history.**

	No.*	%
Frequency of Tooth-Brushing		
3 / Day	4	11.4
2 / Day	8	22.9
1 / Day	16	45.7
1 / Week	1	2.9
2-3 / Month	0	0
Never	6	17.1

**No. = number of children.*

Table 4. Profile of the study sample according to oral hygiene skill evaluation.

	No.*	%
Classification of Cleaning Skills		
Significant assistance	13	37.1
Some dexterity but insufficient cleaning techniques	17	48.6
Effectively brushes with little assistance	5	14.3
Virtually no assistance	0	0
Current Brushing Method		
Manual tooth-brush	32	91.4
Electrical tooth-brush	3	8.6
Specially designed tooth-brush	0	0
Cleans dentures properly	0	0
Appropriate use of Toothpaste		
Yes	26	74.3
No	9	25.7
Rinse		
Able	20	57.1
Unable	15	42.9
Floss		
Able	1	2.9
Unable	28	80
Not indicated	6	17.1

**No. = number of children.*

In addition, participants with serious medical conditions or a transmittable disease such as malignant disease, hepatitis, AIDS etc were eventually excluded from the study. All information components of the medical history built a complete profile to ensure continuity of care, and improve the quality and safety of health care. When openly sharing the medical history, patient confidentiality was

assured. Consideration was given to the value of this information when developing care planning in other sectors. Medical history revealed that convulsions were the most common medical condition/disease affecting the study sample (28.6%) followed by asthma (17.1%), epilepsy (11.4%), anemia (11.4%), pneumonia (8.6%), skin diseases (8.6%), sinusitis (5.6%), cardiac disorders (2.9%) and clotting disorders (2.9%). The majority of the study sample (71.4%) had a previous history of hospitalization.

Dental Status and Oral Health Conditions

Caries Experience: All children (100%) had severe dental caries. The decayed component (dt + DT) of mean (dmft + DMFT) index was the highest component of the index compared to the missing and filled components in both boys and girls. Caries presence among the study sample are summarized in Table 5.

Table 5. Caries experience of the study sample according to gender.

Gender	dmft + DMFT Mean ± SD*	dmfs + DMFS Mean ± SD*	dt + DT Mean	mt + MT Mean	ft +FT Mean	RI† = F/(F+D)X 100 %
Male	14.18 ± 3.59	45.41 ± 22.56	14.18 ± 3.59	0.14 ± 0.47	0.04 ± 0.21	0.32%
Female	12.69 ± 4.63	38.54 ± 26.11	12.15 ± 4.98	0.31 ± 1.11	0.23 ± 0.83	1.86%
P-value‡	0.290	0.458	0.104	0.167	0.03	

**SD = standard deviation; †RI = restorative index; ‡ Using two independent -samples t-test at level of significance 0.05*

Oral Hygiene Habits: A noticeable improvement in the frequency of tooth-brushing was reported. Most of the study sample had their teeth brushed more than once daily at the 12-month post-operative visit (71.4%) compared to baseline (34.3%). In addition, they showed better cooperation with reduced resistance during tooth brushing by the end of this study. Data about tooth-brushing frequency and provision of help during brushing is presented in Table 6.

Malocclusion: Malocclusion was identified in the majority of children (66%) with the prevalence of slight degree of malocclusion both at baseline (61%) and at 12-month (65%) follow-up visits. This finding was statistically significant (p = 0.000). Mentally disabled children had a significantly higher presence of malocclusion than other types of disabilities at baseline (p = 0.000) and 12-month (p =

0.000). There was an increase in malocclusion in mentally disabled children more than the physically disable ones. More than one half of mentally disabled children (53.8%) had slight malocclusion at baseline and 12-month follow-up visits. On the other hand, no statistically significant difference regarding malocclusion before and after full-mouth rehabilitation was observed (p = 1). This finding can be clearly manifested by no change in the frequency and percentage of children pre- and post-operatively.

Table 6. Oral hygiene habits of the study sample.

	Baseline		12-month	
	No. *	**%**	**No. ***	**%**
Tooth-brushing frequency				
None / Once / day	10	28.6	0	0.0
Once / day	13	37.1	10	28.6
> Once / day	12	34.3	25	71.4
Provision of help with tooth-brushing				
None • Child brushes completely independently	2	5.7	2	5.7
Moderate, • Child receives some help with brushing	15	42.9	19	54.3
Extensive, • Parents or caregivers brush child's teeth	18	51.4	14	40.0

* *No. = number of children.*

Oral Hygiene Status and Dental Plaque: Plaque accumulations were reported for all children (100%) throughout the study period. There was a gradual statistically significant increase in the percentage of children with slight plaque accumulation (p = 0.000) accompanied by a gradual statistically significant decrease in the percentage of children with moderate (p = 0.000) and abundant (p = 0.002) plaque accumulations from baseline to 12-month (Table 7). Full-mouth rehabilitation under GA proved to help in improving oral hygiene status and reducing Plaque Index (PI) scores of the study sample. There was a gradual decrease in the means of PI scores throughout the study period. Plaque index of the study sample was reduced significantly from baseline to 3- (p = 0.001), 6- (p = 0.000), 9- (p = 0.000) and 12-month (p = 0.000) post-operatively. In addition, there was a statistically significant reduction in PI scores from 3- to 9-

month (p = 0.022), 3- to 12-month (p = 0.000), and from 6- to 12-month (p = 0.002). On the other hand, the results did not reveal any statistically significant reduction in PI from 3- to 6-month (p = 0.422), 6- to 9-month (p = 0.092), and from 9- to 12-month (p = 0.158). Data describing PI scores according to age, gender and type of disability are summarized in Table 8. Before and after 12 months of rehabilitation, no statistically significant difference (p = 0.298) was found between the mean PI scores of boys and girls as well as between different disability groups (p = 0.163). On the other hand, a strong positive correlation was observed between PI scores and Decayed, Missing and Filled Tooth index scores. However, this correlation was statistically non-significant (p = 0.555) (Table 9).

Table 7. The effect of full-mouth rehabilitation on plaque index of the study sample.

Period	Plaque Index				
	No Plaque	Slight Plaque Accumulation	Moderate Plaque Accumulation	Abundant Plaque Accumulation	Total
	No.* (%) Mean ± SD†	No.* (%) Mean ± SD†	No.* (%) Mean ± SD†	No.* (%) Mean ± SD†	No.* (%)
Baseline	0 (0.0)	5 (14.3)	21 (60.0)	9 (25.7)	35 (100)
	0.0 ± 0.0	0.7 ± 0.25	1.76 ± 0.27	2.41 ± 0.21	
3-month	0 (0.0)	10 (28.6)	19 (54.3)	6 (17.1)	35 (100)
	0.0 ± 0.0	0.82 ± 0.19	1.48 ± 0.24	2.32 ± 0.23	
6-month	0 (0.0)	14 (40.0)	18 (51.4)	3 (8.6)	35 (100)
	0.0 ± 0.0	0.86 ± 0.17	1.58 ± 0.33	2.43 ± 0.35	
9- month	0 (0.0)	18 (51.4)	14 (40.0)	3 (8.6)	35 (100)
	0.0 ± 0.0	0.83 ± 0.18	1.56 ± 0.31	2.33 ± 0.11	
12-month	0 (0.0)	21 (60.0)	13 (37.1)	1 (2.9)	35 (100)
	0.0 ± 0.0	0.83 ± 0.20	1.51 ± 0.30	2.8 ± 0.0	

** No. = number of children. †SD = standard deviation.*

Table 8. The effect of full-mouth rehabilitation on plaque index of the study sample according to age, gender and type of disability.

	Total N*=35 n† (%)	Plaque Index				
		Baseline Mean ± SD‡	3 months Mean ± SD‡	6 months Mean ± SD‡	9 months Mean ± SD‡	12 months Mean ± SD‡
Age group						
5-8 years	24 (68.6)	1.76 ± 0.57	1.49 ± 0.59	1.37 ± 0.55	1.29 ± 0.55	1.20 ± 0.51
9-12 years	11 (31.4)	1.80 ± 0.64	1.32 ± 0.43	1.34 ± 0.57	1.16 ± 0.53	1.00 ± 0.47
Gender						
Boys	22 (62.9)	1.80 ± 0.49	1.59 ± 0.54	1.38 ± 0.50	1.30 ± 0.57	1.09 ± 0.45
Girls	13 (37.1)	1.73 ± 0.73	1.17 ± 0.47	1.34 ± 0.65	1.16 ± 0.49	1.20 ± 0.59
Disability						
Physical	3 (8.6)	2.0 ± 0.70	1.30 ± 0.85	1.53 ± 1.14	1.47 ± 0.81	1.33 ± 1.27
Mental	13 (37.1)	1.65 ± 0.61	1.45 ± 0.55	1.17 ± 0.37	1.14 ± 0.44	1.07 ± 0.40
Sensorial	3 (8.6)	1.47 ± 0.55	1.23 ± 0.30	1.20 ± 0.62	1.07 ± 0.81	.97 ± 0.46
Physical / mental	7 (20.0)	1.93 ± 0.53	1.57 ± 0.64	1.47 ± 0.69	1.37 ± 0.64	1.14 ± 0.58
Physical / sensorial	1 (2.9)	2.60 ± 0.0	1.0 ± 0.0	1.40 ± 0.0	0.70 ± 0.0	1.70 ± 0.0
Physical / mental / sensorial	3 (8.6)	1.97 ± 0.25	1.97 ± 0.32	1.47 ± 0.50	1.8 ± 0.53	1.27 ± 0.30
Mental / sensorial	5 (14.3)	1.64 ± 0.70	1.16 ± 0.34	1.64 ± 0.43	1.12 ± 0.22	1.08 ± 0.11

Table 9. Relationship between plaque index and decayed, missing, or filled tooth index scores.

Plaque Accumulation	No.* (%)	DMFT+dmft Mean ± SD†	Correlation	
			r‡	p-value§
Baseline				
No	0 (0.0)	0.00 ± 0.00		
Slight	5 (14.3)	11.40 ± 4.04	0.843	0.413
Moderate	21 (60.0)	12.62 ± 1.82		
Abundant	9 (25.7)	17.22 ± 2.33		
3-month				
No	0 (0.0)	0.00 ± 0.00		
Slight	10 (28.6)	12.30 ± 1.95	0.811	0.520
Moderate	19 (54.3)	13.58 ± 4.82		
Abundant	6 (17.1)	16.0 ± 2.90		
6-month				
No	0 (0.0)	0.00 ± 0.00		
Slight	14 (40.0)	12.64 ± 3.27	0.791	0.585
Moderate	18 (51.4)	13.83 ± 4.34		
Abundant	3 (8.6)	17.0 ± 4.36		
9-month				
No	0 (0.0)	0.00 ± 0.00		
Slight	18 (51.4)	12.5 ± 3.81	0.653	0.923
Moderate	14 (40.0)	14.71 ± 4.08		
Abundant	3 (8.6)	15.33 ± 4.16		
12-month				
No	0 (0.0)	0.00 ± 0.00		
Slight	21 (60.0)	12.24 ± 3.33	0.868	0.336
Moderate	13 (37.1)	15.38 ± 4.11		
Abundant	1 (2.9)	20.0 ± 0.00		

**No. = Number of children; †SD = Standard deviation; ‡Using chi-square test correlation coefficient*
§Significance level set at 0.05

Discussion

The level of poor oral hygiene reported in this study could, to a certain extent, be explained by restrictions in personal abilities or practical difficulties (*e.g.,* the inability to reach the tooth brush), but there is a solid impression that caretakers and nurses are more concerned with general hygiene than with oral hygiene[19]. Parents and educators of disabled children are well aware of the existence of oral problems such as gingival bleeding, bad breath and the presence

of calculus or plaque. Many described that they had never been given any instructions on oral health care[20,21].

Previous studies have noted that children with disabilities have higher levels of dental diseases and lower levels of care[8-12]. Children's unmet oral health needs raise profound questions about the education of health professionals including dentists, physicians, and other providers of care for children and families[14].

Children and adolescents with disabilities appear to have very bad dental caries experience than their non-disabled counterparts. Variable access to dental care, inadequate oral hygiene and disability-related factors may account for differences. The present study revealed severe caries experience of the study sample in which all participants (100%) were affected by dental caries. The state of dental care for these patients was unsatisfactory. These findings are in agreement with what has been published Shyama *et al.*[8], Al-Qahtani and Wyne[9] and Al-Hammad and Wyne[22].

On the other hand, Shaw *et al.*[23] showed that there were few differences in caries prevalence when comparing handicapped children with children attending normal schools. However, the provision of dental care showed significant differences, with the handicapped children receiving less restorative treatment. Jancy *et al.*[24] concluded that dental caries levels did not differ significantly between children with cerebral palsy and controls, but the fate of carious teeth was significantly different. Ajami *et al.*[11] revealed that the majority of children (81.7%) were caries-free. Simon *et al.*[25] reported that the caries prevalence among handicapped primary school pupils was quite low. However, there was relatively high level of gingival bleeding and calculus.

This conflict in caries experience might be attributed to the oral health condition of CSHCN that is affected by numerous sociodemographic factors, including intensity of impairment and living environments. Those children would gain from parental education on diet adjustment, regular dental visits, and improvement of oral hygiene habits[12].

In the present study, the decayed component (dt + DT) of mean (dmft + DMFT) index was the largest component of the index in both boys and girls. This finding is in agreement with Ajami *et al.*[11].

In addition, the present study revealed a strong positive relationship between the mean DMFT scores and PI at all visits. However, this relationship was not statistically significant. This finding is in agreement with Kotek[10].

In general, oral hygiene status was rather poor in the disabled children examined prior to any dental intervention. The present study revealed that plaque accumulations were reported for all participants (100%) throughout the study period. Approximately one in three disabled children had heavy plaque accumulation prior to any dental intervention. The oral hygiene was totally inadequate in majority of the children examined. The majority of studies investigating the prevalence of oral disease in disabled children showed significantly poor oral hygiene status[24,26,27] that is confirmed in the present study.

The difficulties confronted disabled children in maintaining sufficient level of oral hygiene were emphasized in most of our findings. Lack of motor skills and low powers of concentration in disabled children are the cause of poor oral hygiene[28]. For disabled children, the difficulty in maintaining their oral hygiene is due to lack of manual coordination[28,29]. Other studies revealed that the physical inability to adequately clean the oral cavity is the most apparent problem[30,31]. The intellectually disabled and sensory disabled children have a problem using a toothbrush. A correlation between the level of oral hygiene and severity of the disability was confirmed by the deterioration of oral hygiene standards with the severity of intellectual disability[23]. Generally, there is a wide span of tooth brushing ability, which is related to natural skills, coordinated muscular movements, ability to understand instructions and child age[32].

Tooth brushing is probably the most commonly performed oral hygiene practice in the world. The major purpose of this procedure is to lower the organisms in dental plaque that might be responsible for

oral disease, conditions including dental caries, periodontal diseases and halitosis[33].

In this study, a great majority of the study sample (91.4%) had used manual tooth-brush for oral hygiene practice with less than one half of the study sample (48.6%) was reported to have some dexterity but insufficient cleaning techniques. No participant was able to brush his/her teeth virtually with no assistance. Seventeen percent of participants never had their teeth brushed. These findings are consistent with Gizani *et al.*[27] who reported that 22.1% of mildly mentally retarded children, and 20.9% of learning impaired children did not daily brush their teeth and did not get assistance with tooth-brushing from their parents (91.0%) or guardians (94.7%).

Several studies reported that handicapped children are commonly unable to obtain a sufficient oral hygiene level by hand brushing because of their deficient motor skills, absence of efficient brushing capability and knowledge of oral hygiene. It has been recommended that complete plaque removal with a standard toothbrush is not practical for this group[27,34,35]. Some researchers mentioned that electric tooth-brushes are particularly convenient for people with decreased motor skills[3,36]. However, many different types of specially designed hand-operated tooth-brushes have been evolved. Between them is the triple-headed brush, which is developed to clean the lingual, facial, and occlusal surfaces of the teeth with a single move, and is advocated for specific individuals with little manual skills[37].

Meanwhile, Martens *et al.*[7] concluded that moderately and severely mentally retarded and physically impaired children had significantly worse manual dexterity skills than mildly mentally retarded and learning impaired children. However, this was not demonstrated in better oral hygiene. No difference was found between subtypes in the belief of educators and parents on oral level. However, there was a difference between the clinical picture and their evaluation. In addition, in-use training programmes in oral health care were required for mothers and fathers as well as for educators.

Despite this finding, significant improvement in oral hygiene habits of the study sample regarding the frequency of tooth brushing from baseline to 12 months after dental rehabilitation had been noticed. This finding reflects the compliance of parents/caregivers to oral hygiene instructions given at every follow-up visit after the dental rehabilitation and the ability of adoption of new dental habits by parents/caregivers aiming at improving oral hygiene status. While this is not the case regarding provision of help with tooth brushing, since the results revealed no significant improvement in provision of help with tooth brushing from baseline to 12 months. This finding might be attributed to the continuation of dependency of the children on their parents/caregivers in tooth brushing secondary to their disability.

Diseases can raise the possibility of malocclusion, as determined by the high incidence of malocclusion in populations with disabilities. Congenital malformations, skeletal growth disorders, musculoskeletal conditions and orofacial dyskinesia can enhance the occurrence of malocclusion[38].

Malocclusion was identified in majority of the study sample (66%). Results achieved in the current study were in agreement with some studies[13,26,39]. Nevertheless, investigators have found the prevalence of malocclusion to be within standard limits[31,40]. It has been indicated that in almost all severely brain damaged children, malocclusion is increased[26].

The present study revealed that there was an increase in malocclusion in mentally more than physically disabled children. More than one-half of mentally disabled participants (53.8%) had slight malocclusion at baseline and 12-month follow-up visits. Interestingly, these data were consistent with the data indicating that malocclusion differs according to whether the disability is mental or physical. Overall, the literature revealed that those with visual or hearing impairments had a lower prevalence of malocclusion compared to those with intellectual disabilities[41]. The mental status

severity corresponds with a high incidence of hereditary and acquired orthodontic anomalies[42].

In disabled children, information on plaque accumulation is rare. Examining CSHCN has always been difficult. Due to neuromuscular in-coordination in children with cerebral palsy, dental examination is more challenging. The current study collected information on plaque accumulation and PI of disabled children in the city of Jeddah. It is anticipated that the results of this study will aid in better designing the therapeutic and preventive needs of these children.

Most of the CSHCN (60%) examined in the present study had moderate plaque accumulation before FMR with mean PI score of 1.76 ± 0.27. This study showed that the mean PI values were higher than those recorded for healthy children in some former studies[43,44].

No statistical significance existed between the mean PI scores of females and males at all visits. This finding is in agreement with recent studies[22,45,46]. Plaque index decreased by age without any significant difference among the two investigated age groups. These findings are equivalent to other researches on PI of CSHCN[22,44,47]. However, a study concluded that the difference in PI being of greater statistical significance among older children[25]. Meanwhile, another study concluded that the PI increases significantly and worsens with increasing age[47]. This conflict between various studies might be attributed to the variation in the type and level of disabilities examined. Motor and mental alterations, dyskinetic movements, alterations in intra oral sensitivity and the presence of aberrant oral reflexes such as gagging and vomiting are all major harmful elements for mechanical elimination of plaque in children with cerebral palsy[45].

No statistically significant difference of PI scores existed between different disability groups. This finding is in agreement with a study of Jancy *et al.*[24]; however, it is in contrary to a study of Huang[46] in which he concluded that the plaque index increases significantly and worsens with increasing level of disability.

Full-mouth rehabilitation under GA, which included oral hygiene instructions given at each recall visit, resulted in markedly improved level of oral hygiene and proved to help in reducing PI of the study sample throughout the study period. There was a gradual decrease in the means of PI scores throughout the study period. The study sample showed a significant reduction in PI from baseline to 3-, 6-, 9- and 12-month, from 3- to 9-month, from 3- to 12-month and from 6- to 9-month. On the other hand, the results did not reveal any statistically significant reduction in PI from 3- to 6-month, from 6- to 12-month and from 9- to 12-month. This finding might explain the impact of time factor necessary to make a significant reduction in PI after dental rehabilitation under GA in addition to the cumulative influence of change in PI between consecutive follow-up visits.

Plaque index and the caries experience in children are certainly linked and the significance of a good quality of oral cleanliness in reducing plaque accumulation and preventing disease development afterwards is common information[22,48]. The PI scores in this study were also found to be related to the oral hygiene status and caries experience of the disabled children, as the children with poor oral hygiene got the highest mean PI score associated with severe caries experience. This is in accordance with one of the most important reasons and long-term goals for performing dental treatment, which is to stabilize dental health within susceptible individuals and prevent further loss of dental tissues and periodontal support[49].

The findings of this study were subjected to several limitations associated with the nature of the study. First, the oral examination did not include radiographs to detect interproximal caries; thus, the reported caries levels are almost certainly underestimated compared to the true prevalence. This limitation did not bias the results as it applied to all children examined. Second, difficulties in handling of special need children during recording dental status and oral health conditions necessitating more dental auxiliaries are needed to overcome inaccurate recording of data. This limitation has been overcome in expense of spending more time to accomplish this task appropriately. Although this study presents difficulties and

limitations, it represents a new direction in the field of oral health for children with disabilities. The findings regarding dental status and oral health conditions indicated that these children had a remarkable unmet need for dental preventive and treatment services.

Understanding the differential unmet dental needs of special need children, in respect to the findings in this study, the following recommendations were suggested:

1. Training of dental professionals and auxiliaries in oral health care of special need children should be considered.
2. Greater coordinated efforts should be made by the dental, medical and social services to serve their dental requirements.
3. Providing training to teachers, institutional staff and parents to promote good oral health in children with disabilities.
4. Comprehensive frequent oral health assessment associated with oral hygiene instructions should be introduced every 3 months after dental treatment.
5. Assessing the long term effects of FMR under GA on dental status and oral health conditions needed to continue with larger sample size to confirm these findings, and to implement effective measures to reduce dental problems in special need children.

Conclusion

From the present study, it was concluded that the effect of FMR under GA, with 3-month recall visits for the patients in this study, had a significant clinical effect on oral hygiene status, oral hygiene habits, and dental plaque extending up to 12 months post-operatively.

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References

[1] **American Academy of Pediatric Dentistry**. Definition of special health care needs. *Pediatr Dent* 2012; **34**(special issue): 16.

[2] **Horwitz S, Kerker B, Owens P, Zigler E**. The health status and needs of individuals with mental retardation. Special Olympics, Yale University. Washington, DC: Special Olympics, Inc., 2000.

[3] **Waldman HB, Perlman SP, Swerdloff M**. Use of pediatric dental services in the 1990s: Some continuing difficulties. *J Dent Child* 2000; **67**(1): 59-63.

[4] **Sischo L, Broder HL**. Oral Health-related Quality of Life What, Why, How, and Future Implications. International & American Associations for Dental Research. <http://jdr.sagepub.com/supplemental>.

[5] **Glassman P**. New models for improving oral health for people with special needs. *J Calif Dent Assoc* 2005; **33**(8): 625-633.

[6] **Macpherson LM, Pine CM, Tochel C, Burnside G, Hosey MT, Adair P**. Factors influencing referral of children for dental extractions under general and local anesthesia. *Community Dent Health* 2005; **22**(4): 282–288.

[7] **Martens L, Marks L, Goffin G, Gizani S, Vinckier F, Declerck D**. Oral hygiene in 12-year-old disabled children in Flanders, Belgium, related to manual dexterity. *Community Dent Oral Epidemiol* 2000; **28**(1): 73-80.

[8] **Shyama M, Al-Mutawa SA, Morris RE, Sugathan T, Honkala E**. Dental caries experience of disabled children and young adults in Kuwait. *Community Dent Health* 2001; **18**(3): 181-186.

[9] **Al-Qahtani Z, Wyne AH**. Caries experience and oral hygiene status of blind, deaf and mentally retarded female children in Riyadh, Saudi Arabia. *Odontostomatol Trop* 2004; **27**(105): 37-40.

[10] **Kotek S**. Prevalence of dental caries and oral hygiene in physically handicapped children attending various special schools of Davangere district. Rajiv Gandhi University of Health Sciences. Davangere, Karnataka, India, 2005.

[11] **Ajami BA, Shabzendedar M, Rezay YA, Asgary M**. Dental treatment needs of children with disabilities. *J Dent Res Dent Clin Dent Prospects* 2007; **1**(2): 93-98.

[12] **Oredugba FA, Akindayomi Y**. Oral health status and treatment needs of children and young adults attending a day centre for individuals with special health care needs. *BMC Oral Health* 2008; **8**: 30.

[13] **Winter K, Baccaglini L, Tomar S**. A review of malocclusion among individuals with mental and physical disabilities. *Spec Care Dentist* 2008; **28**(1): 19-26.

[14] **Mehta A, Kaur G**. Oral health-related quality of life—the concept, its assessment and relevance in dental research and education. *Indian J Dent* 2011; **2**(2): 26-29.

[15] **Disability Statistics**. Online Resource for US Disability Statistics. The Employment and Disability Institute, 2000.

[16] **Oral Health Surveys**: Basic Methods, 4th ed. Geneva: WHO, 1997.

[17] **Oral Health Surveys**: Basic Methods, 3rd ed. Geneva: WHO, 1987.

[18] **SILNESS P, LÖE H**. Periodontal disease in pregnancy. *Acta Odontol Scand* 1964; **22**: 121.

[19] **Mann J, Wolnerman JS, Lavie G, Carlin Y, Garfunkel AA**. Periodontal treatment needs and oral hygiene for institutionalized individuals with handicapping conditions. *Spec Care Dent* 1984; **4**(4): 173-176.

[20] **Nicolaci CAB, Tesini DA**. Improvement in the oral hygiene of institutionalized mentally retarded individuals through training of direct care staff: a longitudinal study. *Spec Care Dent* 1982; **2**(5): 217-221.

[21] **Shaw L, Harris BM, McLaurin ET, Foster TD**. Oral hygiene in handicapped children: a comparison of effectiveness in the unaided use of manual and electric tooth brushes. *Dent Health* 1983; **22**(1): 4-5.

[22] **Al-Hammad NS, Wyne AH**. Caries experience and oral hygiene status of cerebral palsy children in Riyadh. *Odontostomatol Trop* 2010; **33**(130): 5-9.

[23] **Shaw L, MacLaurin ET, Foster TD**. Dental study of handicapped children attending special schools in Birmingham, UK. *Community Dent Oral Epidemiol*1986; **l4**(1): 24-27.

[24] **Jancy EC, Pope JEC, Curzon MEJ**. The dental status of cerebral palsied children. *Pediatr Dent* 1991; **13**(3): 156-162.

[25] **Simon EN, Matee MI, Scheutz F**. Oral health status of handicapped primary school pupils in Dar es Salaam, Tanzania. *East Afr Med J* 2008; **85**(3): 113-117.

[26] **Brown JP, Schodel DR**. A review of controlled survey of dental disease in handicapped persons. *J Dent Child* 1976; **43**(5): 313-320.

[27] **Gizani S, Declerck D, Vinckier F, Martens L, Marks L, Goffin G**. Oral health condition of 12-year-old handicapped children in Flanders (Belgium). *Community Dent Oral Epidemiol* 1997; **25**(5): 352–357.

[28] **Full CA, Kerber PE, Boender P, Schneberger N**. Oral health maintenance of the institutionalized handicapped child. *J Am Dent Assoc* 1977; **94**(1): 111-113.

[29] **SNYDER JR, KNOPP JJ, JORDAN WA**. Dental problems of non-institutionalized mentally retarded children. *Northwest Dent* 1960; **44**: 123-126.

[30] **Miller JB, Taylor PP**. A survey of the oral health of a group of orthopedically handicapped children. *J Dent Child* 1970; **37**(4): 331-343.

[31] **Johnson R, Albertson D**. Plaque control for handicapped children. *J Am Dent Assoc*1972; **84**(4): 824-828.

[32] **Unkel JH, Fenton SJ, Hobbs G Jr, Frere CL**. Tooth-brushing ability is related to age in children. *J Dent Child* 1995; **62**(5): 346-348.

[33] **Haffajee AD, Smith C, Torresyap G, Thompson M, Guerrero D, Socransky SS**. Efficacy of manual and powered toothbrushes (II). Effect on microbiological parameters. *J Clin Periodontol* 2001; **28**(10): 947-954.

[34] **Mitsea AG, Karidis AG, Donta-Bakoyianni C, Spyropoulos ND**. Oral health status in Greek children and teenagers, with disabilities. *J Clin Pediatr Dent* 2001; **26**(1): 111-118.

[35] **Rao DB, Hegde AM, Munshi AK**. Caries prevalence amongst handicapped children of South Canara District, Karnataka. *J Indian Soc Pedod Prev Dent* 2001; **19**(2): 67-73.

[36] **Jongenelis APJM, Wiedemann WA**. A comparison of plaque removal effectiveness of an electric versus a manual toothbrush in children. *ASDC J Dent Child* 1997; **64**(3): 176-182.

[37] **Dogan C, Alacam A, Asici N**. Clinical evaluation of the plaque removing ability of three different toothbrushes in a mentally disabled group. *Acta Odontol Scand* 2004; **62**(6): 350-354.

[38] **Bright Futures**. Risk and protective factors for malocclusion, from <http://www.brightfutures.org/oralhealth/pdf/.2006>.

[39] **Franklin DL, Luther F, Curzon ME**. The prevalence of malocclusion in children with cerebral palsy. *Eur J Orthod* 1996; **18**(6): 637-643.

[40] **Rosenbaum CH, McDonald RE, Levitt EE**. Occlusion of cerebral-palsied children. *J Dent Res* 1966; **45**(6): 1696-1700.

[41] **Vignesha H, Soh G, Lo GL, Chellappah NK**. Dental health of disabled children in Singapore. *Aust Dent J* 1991; **36**(2): 151-156.

[42] **Vittek J, Winik S, Winik A, Sioris C, Tarangelo AM, Chou M**. Analysis of orthodontic anomalies in mentally retarded developmentally disabled (MRDD) persons. *Spec Care Dentist* 1994; **14**(5): 198-202.

[43] **Rodrigues dos Santos MTB, Masiero D, Novo NF, Simionato MRL**. Oral conditions in children with cerebral palsy. *J Dent Child* 2003; **70**(1): 40-46.

[44] **De Oliveira Guare R, Ciampioni AL**. Prevalence of periodontal disease in the primary dentition of children with cerebral palsy. *J Dent Child* 2004; **71**(1): 27-32.

[45] **Rodrigues dos Santos MTB, Nagueira MLG**. Infantile reflexes and their effects on dental caries and oral hygiene in cerebral palsy individuals. *J Oral Rehabil* 2005; **32**(12): 880-885.

[46] **Huang S**. The oral health status of people with disabilities in Taiwan. *J Disabil Oral Health* 2006; **7**(2): P08: 14.

[47] **Wyne A, Saleem F, Khan N**. Plaque, gingivitis, enamel defects and tooth wear among cerebral palsy children of Riyadh region. *Saudi Med J* 1996; **17**(4): 467-471.

[48] **Al-Hammad NS, Wyne AH**. Plaque and gingival health status among cerebral palsied children of Riyadh City. *Pakistan Oral Dent J*2011; **31**(1): 118-121.

[49] **Bonito AJ, Lux L, Lohr KN**. Impact of local adjuncts to scaling and root planning in periodontal disease therapy: a systematic review. *J Periodontol* 2005; **76**(8): 1227-1236.

تأثير المعالجة السنية عن طريق التأهيل الفمي الكامل على صحة الفم و الأسنان للأطفال من ذوي الإحتياجات الخاصة في مدينة جدة بعد عام من المتابعة

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المستخلص. إن الأطفال من ذوي الإحتياجات الخاصة هم أكثر عرضة لخطر الإصابة بأمراض الفم والأسنان. يلزم لذلك علاج أسنانهم عن طريق التأهيل الفمي الكامل تحت تأثير المخدر العام لضمان تقديم العلاج الآمن والفعال لهم. تم تقييم تأثير المعالجة السنية عن طريق التأهيل الفمي الكامل على صحة الفم والأسنان في ٤٠ طفلاً من ذوى الإحتياجات الخاصة في اثنين من المستشفيات. تم فحصهم من ناحية تسوس الأسنان، عادات

نظافة الفم، سوء الإطباق، حالة نظافة الفم ومؤشر اللويحة السنية على فترات مختلفة (قبل المعالجة السنية وبعد ٣، ٦، ٩، و١٢ شهر).كان معدل استجابة العينة من حيث المتابعة ٨٧،٥٪. أكثر من نصف عينة الدراسة كانوا من الذكور (٦٣٪) وممن ينتمون الى الفئة العمرية (٨.٥ سنوات). إتضح أن المعالجة السنية عن طريق التأهيل الفمي الكامل تحت تأثير المخدر العام قد حسَّن من حالة نظافة الفم كما قلل من مؤشر اللويحة السنية .كما إنصاع الأهالي لتعليمات العناية بنظافة الفم (٠،٠٠٥ p ≥) والذي أدى الى التحسُّن في حجم المساعدة في تفريش الآسنان (٠،٠١٦ ≥ p). تأثير المعالجة السنية عن طريق التأهيل الفمي الكامل، مع الأخذ بعين الإعتبار المتابعة الدورية كل ٣ أشهر، كان له تأثيراً اكلينيكياً على عادات وحالة نظافة الفم ومؤشر اللويحة السنية بعد ١٢ شهراً.