

The Effect of Full-Mouth Rehabilitation on Oral Health-Related Quality of Life for Children with Special Health Care Needs

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Objectives: Changes in oral health-related quality of life (OHRQoL) among 40 children with special health care needs (CSHCN) aged 5–14 years before and 12 months after full-mouth rehabilitation (FMR) under general anesthesia (GA) in two hospitals in Jeddah city were assessed. **Study design:** The questionnaire was delivered to the parents/caregivers at baseline (pre-operative) and at the 12-month post-operative follow-up visit. Medical and dental histories and clinical findings were correlated accordingly. **Results:** The follow-up response rate was 87.5% with 35 children completing a 12-month follow-up visit. The age range was from 5 to 12 years with a mean of 7.3 ± 2.4 years. More than half of the study sample was boys (63%) in the 5–8 year age-group (69%). The impact on OHRQoL was reportedly negative before FMR under GA, with overall scores ranging from 12 to 68 and a mean of 43.34 ± 14.83 . OHRQoL improved significantly in all aspects evaluated ($P < 0.05$) following FMR under GA with overall scores ranging from 4 to 41 and a mean of 18.86 ± 8.54 . **Conclusions:** Treating CSHCN under GA, with 3-month recall visits for the patients, had a significant long-term effect on their OHRQoL extending up to 12 months postoperatively.

Key words: Rehabilitation, oral health, quality of life, anesthesia, general, follow-up

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INTRODUCTION

Children with special health care needs (CSHCN) are those with any physical, developmental, mental, sensory, behavioral, cognitive or emotional impairment or limiting condition that requires medical management, health care intervention and/or use of specialized services or programmes. The condition may be developmental or acquired and may cause limitations in performing daily self-maintenance activities or substantial 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

Few dentists specialize in caring for individuals with special health care needs. In addition, caregivers often have difficulty fulfilling their daily oral hygiene requirements as they can be uncooperative and resist care. The oral hygiene of these individuals may also be neglected due to their caregivers' lack of concern for dental aesthetics.^{2,3}

The negative impact of oral diseases, especially early childhood caries, on quality of life has been known for years.⁴ Treating a young child with severe dental caries is usually a challenge for dentists, especially when extensive and complex treatment is necessary. Despite the existing behavior management and pharmacological techniques, there are cases when full mouth rehabilitation (FMR) under general anesthesia (GA) is required to provide safe and effective dental treatment.⁵ 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 children with special healthcare needs.⁶ Malden and his co-workers reported that 3% of children have had such treatment by the time they are 5 years old.⁷

Many studies have investigated the quality of the restorative treatment provided under GA.^{8,9} However there have been relatively few studies exploring the impact on oral health-related quality of life (OHRQoL) following dental treatment under GA.

Oral health-related quality of life is a concept that describes the impact of oral health status on general health and everyday life. Measuring children's OHRQoL enables evaluation of the child's oral health status and treatment efficiency.^{10,11} Exploring OHRQoL for adults is not a new research field^{12,13}, but studies assessing it among children following dental treatment under GA are scarce due to the lack of validated measures.

Jankauskiene and Narbutaite conducted a systematic review studying the effect of dental treatment under GA on different aspects of quality of life for children. All studies revealed the same results, in that dental treatment under GA led to an improved quality of life of the child in all the aspects considered. No or little change was detected in only a few cases. The parents pointed out the child's better physical condition, better sleep, appetite and absence of toothache. The quality of life also improved in regard to psychological and social aspects, with the parents noting more smiles, better results at school and increased interaction with others. All these studies presented short-term results in which changes in the quality of life were assessed shortly (2–11 weeks) after treatment.¹⁴

No data were found on long-term effects of OHRQoL among children after dental treatment under GA. It is therefore necessary to assess the long-term effects of dental treatment under GA on patients' quality of life.

Based on the above, as well as the fact that limited studies covering this issue are available in Saudi Arabia, the present study was designed to assess changes in OHRQoL among CSHCN before and 12 months after FMR under GA in Jeddah city. The suggested treatment protocol was adjusted according to the medical and dental histories of the children. The results of this project are expected to help in choosing the necessary measures to prevent/control dental disease and its complication and to improve quality of life for these children.

MATERIALS AND METHOD

This was a prospective study (before-and-after design) that involved an active attempt to change a disease determinant (OHRQoL) through treatment (FMR under GA) in one group of patients (CSHCN) in Jeddah city over a time-period of 12 months. 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 CSHCN. King Abdulaziz University Hospital provides one half day (4 hours per week) while KFGH provides 2 full days (16 hours 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 scheduled to undergo FMR under GA, from January 2009 to February 2010, at KAUH and KFGH and who fulfilled the inclusion criteria were included after parental agreement. The inclusion criteria were as follows:

1. Age range 5 to 14 years.
2. Diagnosed with physical, mental, or sensory disability (separately or combined).
3. Should have a minimum of 12 primary or permanent teeth, or a mixture that had not been treated within the past 12 months.

The following were excluded:

1. Participation in any other concurrent clinical trials.
2. The presence of serious medical conditions or a transmissible disease such as malignant disease, hepatitis, AIDS etc.
3. Children whose parents had no home or mobile phone to enable post-operative contact.
4. Children who had only one post-operative visit.

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

To obtain good intra-examiner and inter-examiner reliability, the examiners were calibrated 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.

The participants found eligible for the study were given individual patient numbers. Each child's name, gender, age, address and contact information were recorded. Children or their parents were advised of their role in this study and asked to provide informed consent. No participants were admitted to the study before the Informed Consent Form was duly signed by the participants or their parents. All the data are presented in the study; however, the identity of the participants is not disclosed.

Disability history questionnaire, medical history questionnaire, and dental history questionnaire were completed to extract information related to disability, medical, and dental history of the participants.

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

Full-mouth rehabilitation under GA was planned and designed at the first clinical visit for all participants (based on their medical and dental history). Subsequent scheduled visits were arranged for the participants for 12 months post-operatively. Dental treatment included: conservative adhesive restorations (CAR), restoration of decayed teeth, fissure sealing, pulp therapy, stainless steel crowns, and extraction of non-restorable teeth. All children received dental kits containing an electric toothbrush, toothpaste, tongue cleaners and mouthwash. 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 were used for the diagnosis of dental caries.¹⁶ Caries was diagnosed on visual evidence after drying and removing the debris from the teeth with the help of an explorer and mirror. Dental caries was scored once at baseline. Radiographs were not used for caries detection.

Oral Hygiene Status. Oral hygiene status was recorded using the special plaque index by visually evaluating the presence of plaque on the buccal and lingual surfaces of upper and lower incisors and canines. Teeth were classified as “good”, if no plaque was visible, “fair”, if there was a small quantity of plaque or recent food accumulation and “poor”, if there was considerable plaque or long-standing accumulation of food.¹⁷ Oral hygiene status was recorded at baseline and at 3-, 6-, 9-, and 12-month post-operative visits.

Oral Hygiene Habits. Oral hygiene habits consisted of tooth brushing frequency and provision of help with tooth brushing. Tooth brushing frequency was classified as 0 = none/ < once a day; 1 = once/day; 2 = > once/day, and provision of help with tooth brushing was classified as 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 the 12-month post-operative visit.

Malocclusion. Malocclusion was identified in accordance with WHO criteria¹⁸ 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, and 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 overjet 9 mm, mandibular overjet one full tooth depth, open bite, midline shift 4 mm, crowding or spacing of 4 mm. Malocclusions were recorded at baseline and at the 12-month post-operative visit.

Plaque Index (PI). The presence of plaque was recorded as described by Silness and Løe.¹⁹ All teeth were scored at baseline and at 3-, 6-, 9- and 12-months post-operatively. A mouth mirror and dental explorer were used after air drying of the 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 completely 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 the probe, the rear is considered clean.
- 1 = No plaque can be observed *in situ* by the unaided eye, but plaque can be seen 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 deposits.

OHRQoL:

We developed a questionnaire, which was completed by asking the parents/caregivers to determine the frequency of various oral health-related impacts on QoL for children with special health care needs aged 5–14 years (Figure 1). It was a modification of the Child Perception Questionnaire for children aged 11 to 14 years (CPQ₁₁₋₁₄) that was originally developed and validated in Toronto, Canada.²⁰ This modification was based upon compatibility with the Saudi population as well as the disabilities associated with the target group. It was professionally translated into Arabic, revised twice and translated back into English for verification. The validity and reliability of the modified Arabic translation of the CPQ₁₁₋₁₄ used in this study were assessed preoperatively. Two general classes of reliability were assessed for this study: 1- Inter-rater reliability (inter-examiner): assesses the degree of agreement between two or more raters in their appraisals. Inter-examiner reliability was determined using the Kappa method and was found to be 0.90 for dental caries and 0.89 for oral hygiene status, which represents a good agreement. 2- Test-retest reliability (intra-examiner): assesses the degree to which test scores are consistent from one test administration to the next. Measurements are gathered from a single rater who uses the same methods or instruments and the same testing conditions. Intra-examiner reliability was also determined and was 0.95 for dental caries, representing excellent agreement. Regarding validity, construct validity was assessed which refers to the extent to which operationalizations of a construct (i.e., practical tests developed from a theory) do actually measure what the theory says they do. As an index of construct validity, Pearson’s correlation was highly significant at the 0.01 level. The questionnaire was delivered to the parents/caregivers at baseline and at the 12-month post-operative follow-up visit. It contained a battery of 24 questions divided into four health domains: oral symptoms ($n = 7$); functional limitations ($n = 7$); emotional well being ($n = 3$); and family well-being/parental distress ($n = 7$). This was designed to extract more detailed information about how frequently in the previous 12 months the children had experienced specific impacts because of problems with their teeth, gingiva or mouth. Each response was scored as follows: (0) never; (1) once/twice; (2) sometimes/often; (3) every day/almost every day; (4) don’t know. The sum of the response code scores for the 24 questions gave an overall evaluation of the extent to which each child’s oral condition affected her or his quality of life. Since there were 24 questions, the highest possible score for the total scale was 96 and the lowest was 0. The sum of the response codes for questions in each subscale gave a total score for each domain.

Withdrawals and Dropout:

Participants were free to withdraw from the study at any time if they so wished. Participants were registered as a dropout if they were absent from or unable to keep an appointment as planned. The reasons for each withdrawal/dropout were stated on their form.

Statistical Analysis:

A bio-statistician was consulted during the planning stages and after collecting data for analysis. Information was analyzed using the Statistical Package for the Social Sciences Programme (SPSS) computer software (version 17.0, SPSS Inc., Chicago, IL). Data were organized and presented numerically, graphically (bar chart, line graph and frequency polygon) and mathematically. 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 variables. Data were analyzed by significance tests and correlation coefficients. Various statistical methods were used i.e., t-test (one sample t-test, paired-two sample t-test, independent two sample t-test), one-way ANOVA, one-way repeated measures ANOVA, Fisher's Least Significant Difference (LSD) test for multiple comparisons, multivariate analysis, chi-square test correlation coefficient, Pearson's correlation coefficient and binomial tests. The level of significance was set at 0.05 with a 95% confidence interval (a *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 King Abdulaziz City for Science and Technology (KACST), KAUH and KFGH.

RESULTS

Inter-examiner reliability was determined using the Kappa method and was found to be 0.90 for dental caries and 0.89 for oral hygiene status, which represents a good agreement. Intra-examiner reliability was also determined and was 0.95 for dental caries, representing excellent agreement. As an index of construct validity, Pearson's

correlation was highly significant at the 0.01 level for total scale and oral symptoms ($r = 0.71$), functional limitations ($r = 0.86$), emotional well being ($r = 0.73$) and family well-being ($r = 0.81$). The oral symptoms subscale was significantly associated only with the functional limitation subscale ($r = 0.55$). The family well-being subscale was significantly associated only with the functional limitations subscale ($r = 0.59$) and with emotional well being ($r = 0.69$). In contrast the functional limitations subscale was significantly associated with all subscales. Cronbach's alpha was 0.87 for the total scale and ranged from 0.65 for the functional limitations subscale to 0.78 for the family well-being subscale, indicating acceptable internal consistency.

Demographic Data:

The follow-up response rate was 87.5% with 35 participants having completed a 12-month follow-up visit (2 participants declined to take part in the study, 2 participants could not be contacted during the study period and 1 participant passed away during the study period as a result of a severe asthmatic attack). The children ranged in age from 5 to 12 years with a mean of 7.3 ± 2.4 years. More than half of the study sample was boys (63%) belonging to the age group 5–8 years (69%). No failed dental treatments were reported throughout the study period. The frequency distribution of the study sample according to age and gender at different hospitals is presented in Table 1.

Figure 1. The modified questionnaire of the CPQ₁₁₋₁₄ used in this study.

	Never	Once/twice	Sometimes/often	Everyday	Don't know
Oral Symptoms 1. Pain in teeth, lips, jaws or mouth? 2. Bleeding gums? 3. Sores in the mouth? 4. Bad breath? 5. Food stuck in the roof of the mouth? 6. Food caught in or between the teeth? 7. Difficulty biting or chewing foods such as fresh apple, corn on the cob or firm meat?					
Functional limitations 1. Breathed through the mouth? 2. Had trouble sleeping? 3. Had difficulty saying any words? 4. Taken longer than others to eat a meal? 5. Had difficulty drinking or eating hot or cold foods? 6. Had difficulty eating foods he/she would like to eat? 7. Had diet restricted to certain types of foods (for example: soft food).					
Emotional well-being 1. Upset? 2. Irritable or frustrated? 3. Anxious or fearful?					
Family well-being/Parental distress 1. Been upset? 2. Had sleep disrupted? 3. Felt guilty? 4. Taken time of work (for example: pain, appointments, surgery)? 5. Had less time for yourself or the family? 6. Worried that your child will have fewer life opportunities? 7. Felt uncomfortable in public places (for example: stores, restaurants) with your child?					

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

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

* N = total size of the study sample. † n = number of children.

‡ King Abdulaziz University Hospital. § King Fahad General Hospital.

OHRQoL:

The data of total scale and subscale scores of OHRQoL for the study sample at baseline and 12-month follow-up visits are summarized in Table 2. The scores for the total scale in the study sample ranged from 12 to 68 at baseline, with a mean of 43.3 ± 14.8 and from 4 to 41 at 12-month follow-up visit, with a mean of 18.9 ± 8.5. There was a statistically significant difference (P<0.05) in the mean scores for the overall scale and the subscales before and 12 months after dental rehabilitation under GA. One hundred percent (100%) of children were reportedly experiencing oral symptoms and functional limitations prior to FMR under GA, with the vast majority of children also reporting emotional impacts (94.3%). Parents/caregivers had reported distress affecting their daily living secondary to their children’s disability (97.1%). There was a slight but significant decrease (P<0.05) in the percentage of children reported to have oral symptoms (97.1%), as well as in the percentage of parents/caregivers with emotional distress (94.3%) at the 12-month follow-up. On the other hand, there was a highly significant decrease (P<0.05) in the percentage of children with emotional impacts (45.7%).

The Relationship of OHRQoL to Demographic Variables, Medical, Dental and Disability Histories. When the effect of demographic variables was analyzed using the chi-square test correlation coefficient, age was not significantly associated with the overall score of OHRQoL (r = 0.926, P = 0.314), or with sex (r = 0.883,

P = 0.449). The Pearson correlation coefficient showed weak, not significant correlations for the relationship between overall scale of OHRQoL and medical and dental histories. Exceptionally, a negative statistically significant correlation for the relationship between overall scale and ability to rinse was found (r = -0.341, P = 0.045). Meanwhile, in respect to the relationship between OHRQoL and disability history, a mediocre but statistically significant relationship between the overall scale and the degree of disability was found (r = 0.393, P = 0.020). In addition, a positive statistically significant correlation was noticed between the overall scale and the need for help on a regular basis (r = 0.351, P = 0.039).

The Relationship of OHRQoL to Dental Status and Oral Health Conditions. Pearson’s correlation coefficient revealed weak but statistically significant correlations between DMFS index and overall scale (r = 0.37, P = 0.027), functional limitations (r = 0.12, P = 0.042), emotional well being (r = 0.15, P = 0.034), and family well-being (r = 0.16, P = 0.037) subscales scores of OHRQoL following dental treatment, indicating that OHRQoL decreased (represented by higher overall scale scores) with increasing DMFS index scores.

The relationships between oral hygiene status, plaque index and OHRQoL at baseline, 3 months, 6 months, 9 months and 12 months postoperatively were summarized in Figure 2. Assessment of the relationship between OHRQoL and oral hygiene status revealed no statistically significant associations except for the relationship between oral hygiene status and overall scale (r = -0.37, P = 0.030) and oral symptoms subscale scores (r = -0.46, P = 0.007) at 9 months post-operatively. Oral hygiene status of the individual was significantly affected by the degree of functional limitation of his/her OHRQoL preoperatively (r = -0.34, P = 0.048). Full-mouth rehabilitation proved to have a significant effect on the relationship between OHRQoL and PI scores, indicating that the lower the scores of plaque index the better the OHRQoL associated with fewer complaints of significant oral symptoms reported after 3 (r = 0.36, p = 0.023) and 9 months (r = 0.40, P = 0.036) post-operatively.

The relationships between oral hygiene habits, malocclusion and OHRQoL at baseline 12 months postoperatively were summarized in Figure 3. There was no statistically significant association between the overall scale and subscale scores of OHRQoL and oral hygiene habits and malocclusion after dental rehabilitation.

Table 2. Overall and subscale scores of OHRQoL for the study sample at baseline and 12-month post-operative visits.

	Baseline		12-months		P value
	Mean ± SD	No. (%)	Mean ± SD	No. (%)	Paired Sample T-test
Total scale	43.3 ± 14.8		18.7 ± 8.5		0.000*
Subscales					
Oral symptoms	15.6 ± 5.3	35 (100)	3.9 ± 2.3	34 (97.1)	0.000*
Functional limitations	11.9 ± 5.3	35 (100)	7.3 ± 4.4	35 (100)	0.000*
Emotional well-being	4.9 ± 2.9	33 (94.3)	1.0 ± 1.5	16 (45.7)	0.000*
Family well-being	10.9 ± 5.4	34 (97.1)	6.7 ± 3.4	33 (94.3)	0.000*

* Statistically significant at 0.05 level since (P≥0.05)

Figure 2. The relationships between oral hygiene status, plaque index and OHRQoL at baseline (BL), 3 months (3 M), 6 months (6 M), 9 months (9 M) and 12 months (12 M) postoperatively (Pearson correlation coefficient): This line graph shows negative correlation between scores of oral hygiene status and OHRQoL. Higher scores of oral hygiene status (good oral hygiene) associated with lower scores of OHRQoL (good quality of life). * This relation was significantly correlated (P=0.03) at 9-month postoperative follow-up visit. On the other hand, a positive correlation was found between scores of plaque index and OHRQoL. Higher scores of plaque index (heavy plaque deposits) associated with higher scores of OHRQoL (poor quality of life).

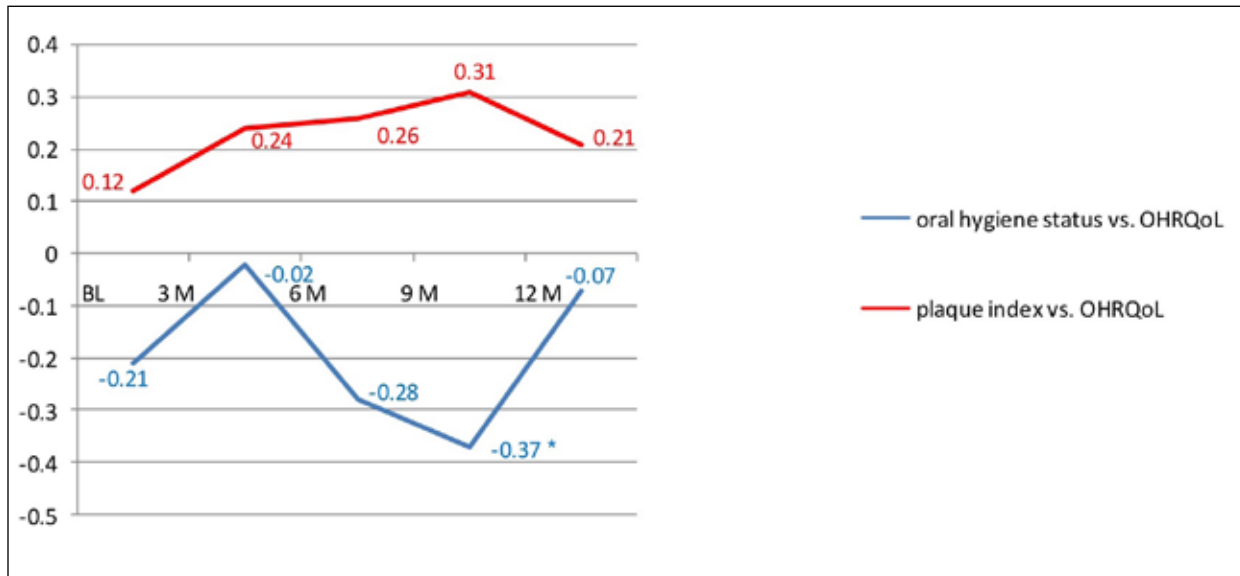
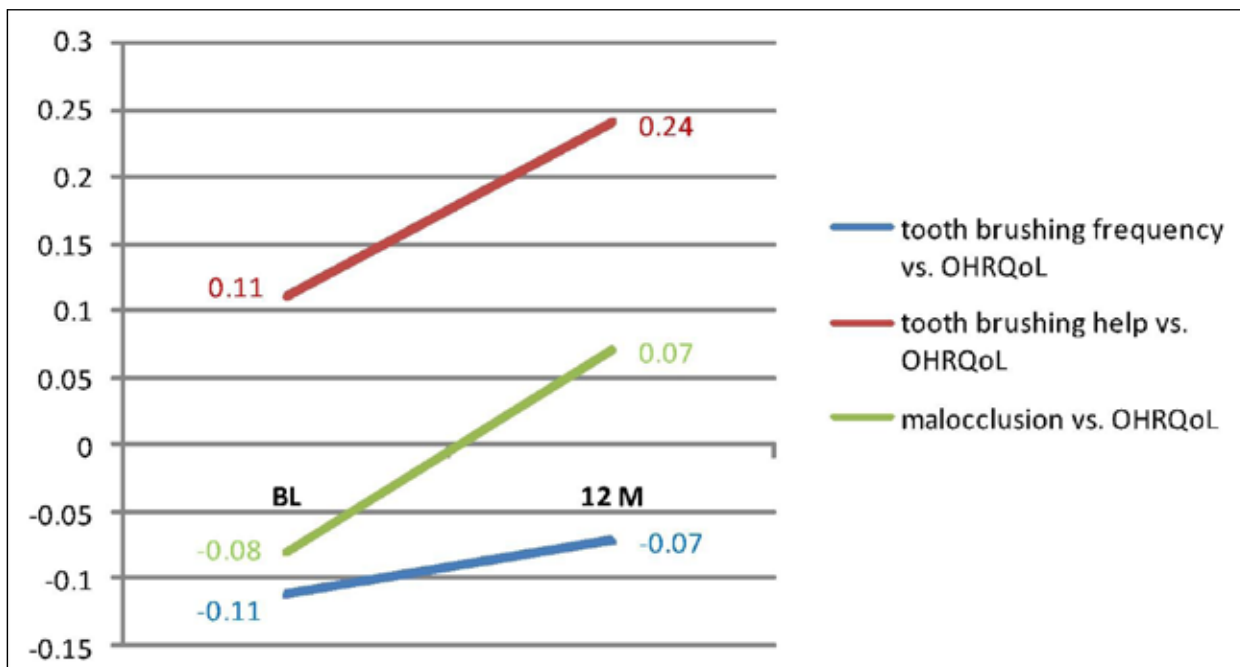


Figure 3. The relationships between oral hygiene habits, malocclusion and OHRQoL at baseline (BL) and 12 months (12 M) postoperatively: This line graph shows negative correlation was found between frequency of tooth brushing and OHRQoL, that more frequent tooth brushing was associated with lower scores of OHRQoL (good quality of life). On the other hand, a positive correlation was found between provision of help with tooth brushing and OHRQoL, that more independency in tooth brushing was associated with lower scores of OHRQoL (good quality of life). The relation between malocclusion and OHRQoL was turned from negative preoperatively to positive postoperatively.



DISCUSSION

Children with special health care needs require special dental health treatment. Behavior guidance of CSHCN can be challenging. Demanding and resistant behaviors may be seen in the children with mental retardation and even in those with purely physical disabilities and normal mental function. These behaviors can interfere with the safe delivery of dental treatment. Therefore, the safety of the patient and practitioner, as well as the need to diagnose and treat, must justify the use of GA. It offers a fast, safe, comfortable and convenient method for both the patient and the dentist.

In the present study, dental treatment provided for each participant was assessed as a part of comprehensive dental care in form of full-mouth rehabilitation under GA. The objectives of this study did not include assessing type of treatment provided e.g. restorations, extraction, pulp therapy, etc. The success and failure of treatment provided was only considered. No failed treatment was reported.

The positive impact of proper and effective dental rehabilitation under GA for children on quality of life has been known for years.¹⁴ The assessment of the quality of life of children often includes surveying parents, although special questionnaires for children in a certain age group have already been developed.^{19, 21} Who should be surveyed to determine the children's quality of life: children or parents? If the questionnaire is filled out by parents the results greatly depend on the parents' ability to offer an objective assessment of the child's physical and mental state and social wellbeing.^{22, 23}

Based on the fact that the questionnaire is filled by asking parents/caregivers instead of children themselves, parents/caregiver response of (don't know) regarding certain oral health-related impacts in OHRQoL of their children with special health care needs was permitted and scored as 4, following the option made by the authors. This option based on the assumption of poorer quality of life associated when parents are not aware about quality of life related oral health problems of their children. The number of (don't know) responses for parents/caregivers that had at least one (don't know) response was mild at baseline (20%) and 12-month postoperative visit (8.6%). However, the exclusion of (don't know) responses leads to the loss of valuable data. These adjusted scores demonstrate good construct validity. The authors suggest that (don't know) answers can be accommodated into the score 4 category without affecting the performance of the questionnaire. In fact, the management of the (don't know) response produced optimal internal consistency of this modified scale.

This is the first report of a clinical study investigating the potential long-term effect (48 weeks) of full-mouth rehabilitation on OHRQoL for both CSHCN and their families at two governmental hospitals in Jeddah city. To the best of our knowledge, all previous studies presented short-term results in which changes in the quality of life were assessed shortly (2–11 weeks) after treatment.^{7, 14, 24, 25}

Several previous studies revealed the results of improved OHRQoL after dental treatment under GA in all aspects considered that were consistent with our study. Malden and his co-workers in 2008 concluded that the provision of dental treatment under GA for young children with severe dental caries experience is associated with substantial and highly significant improvements in both their OHRQoL and in the impact on their families.⁷ Furthermore, Jankauskiene and Narbutaite in 2010 derived from their systematic review that oral rehabilitation under GA results in the immediate

improvement of children's oral health and physical, emotional and social quality of life. It also has a positive impact on the family.¹⁴ Meanwhile, the results of the two studies conducted by Klaassen *et al* in 2008 and 2009 reached that the children's OHRQoL improved after treatment under GA according to their parents.^{24, 25}

In the present study, the association between sex and OHRQoL varied. Females reported poorer OHRQoL (total score=44.84) than males (total score=42.45). This may be attributed to the female physiological and vulnerability nature that makes them more sensitive to pain and consequently expressing more oral-health related impacts. When the effect of demographic variables was analyzed using the chi-square test correlation coefficient, sex was not significantly associated with the overall score of OHRQoL ($r = 0.883$, $P = 0.449$). Lack of gender-related specificity of OHRQoL may be a possible explanation for that.

The impact of oral health problems did decline with increasing age. The youngest children, 5 to 8 years of age, in this study reported more problems (total score= 43.79) related to OHRQoL than did older children, 9 to 12 years of age (total score = 44.84). However, Age was not significantly associated with the overall score of OHRQoL ($r = 0.926$, $P = 0.314$). Authors considered the effect of complexity of the disability might play a major role for individuals of different ages. Authors observed enhanced OHRQoL with rising age after the dental rehabilitation. This indicates that oral health is a matter of clinical condition as well as of social, cultural and behavioral circumstances.

Interestingly, this study revealed a negative statistically significant relationship between overall scale and ability to rinse. The results seem reasonable, from two points of perspectives, the first one is related to the known role of mouth rinsing within the protocol of oral hygiene procedures and its influence on oral health. Secondly, this result is in line with another result obtained from this study in respect to the relationship between OHRQoL and disability. A mediocre but statistically significant relationship between the overall scale and the degree of disability was found, indicating that the individuals' ratings of OHRQoL follow the nature and type of disability with a less complicated degree of disability corresponding to a better performance of oral hygiene procedures including rinsing. On the other hand, dental health behavior, use of floss and toothpicks and oral rinsing were not associated with experiencing problems related to OHRQoL in a recent study.²⁶

A positive statistically significant relationship was also noticed between overall scale and the need for help on a regular basis. This finding shows that OHRQoL depends on the reliability of the patients' families in helping them to maintain oral cleanliness.

Several previous studies have investigated the relationship between dental caries and OHRQoL. One study revealed significant associations between the number of decayed teeth (dmft + DMFT index) and the level of function in respect to OHRQoL.²⁷ A strong correlation was observed in Canadian pedodontic patients between the number of decayed tooth surfaces and the overall scale scores of OHRQoL.²⁰ Another study was carried out in the United Kingdom and the investigators were unable to find any association between DMFT and CPQ₁₁₋₁₄ scores.²⁸ On the other hand, Brown and Al-Khayal in 2006 looked for an association between DMFT and OHRQoL for all children and a relationship could only be demonstrated between DMFT and the oral symptoms subscale.²⁹ In this

study, there was a weak but significant correlation between DMFS and overall scale, functional limitations, emotional well being and family well being subscales scores. Evaluation of quality of life is very strongly influenced by personality and standards of reference. Therefore, a poor correlation between clinical ratings and OHRQoL scores is not unusual.³⁰

This study revealed a significant negative relationship between oral hygiene status and overall scale and the oral symptoms subscale at the 9-month postoperative visit. This finding might explain the impact of the time necessary to make a significant change in OHRQoL after dental rehabilitation under GA secondary to the improvement of oral hygiene status.

On the other hand, this study revealed that there were no significant relationships between overall scale and subscale scores of OHRQoL and malocclusion after dental rehabilitation. This finding is in agreement with two other studies.^{20, 29}

Although most of the relationships between overall and subscale scores of OHRQoL, oral hygiene status and PI at different follow-up visits were not significant; this does not necessarily mean there was no reduction in PI throughout the study period.

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 of 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, to institutional staff and to 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.

CONCLUSIONS

Based on the results of the present study, it was concluded that:

1. Poor oral health can negatively affect OHRQoL in CSHCN.
2. Oral health-related quality of life improved significantly in all aspects considered following FMR under GA for both special needs children and their families.
3. Full-mouth rehabilitation under GA, with 3-month recall visits for the patients in this study, had a positive clinical long-term effect on the OHRQoL extending up to 12 months.
4. Oral health-related quality of life depended on the nature and degree of disability, with a less complicated degree of disability corresponding to a better OHRQoL.

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