CHANGES IN CHILDREN’S ORAL-HEALTH-RELATED QUALITY OF LIFE FOLLOWING DENTAL REHABILITATION UNDER GENERAL ANESTHESIA IN THE UNITED ARAB EMIRATES

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ABSTRACT

Changes in Children’s Oral-Health-Related Quality of Life Following Dental Rehabilitation Under General Anesthesia in the United Arab Emirates

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Background: Early Childhood Caries (ECC) is one of the most common childhood diseases in preschool children. Many young pediatric patients with ECC receive Dental treatment under Dental General Anesthesia (DGA). Changes in Oral Health-Related Quality of Life (OHRQoL) can be used to assess the outcome of DGA treatment. The aim of our study was to assess whether dental rehabilitation of young UAE children under DGA improved OHRQoL for children and their families.

Materials and Methods: A cross sectional study, using a pre-and-post design survey to evaluate changes in OHRQoL following comprehensive dental treatment under GA was conducted. A total of 173 parents completed Early Childhood Oral Health Impact Scale (ECOHIS) before and three to six months after their children mean age 4.6 (+ 1.86 years) underwent comprehensive dental treatment under DGA by a specialist pediatric dentist in a pediatric dental clinic in Al Ain City, Abu Dhabi Emirate during a year period from 1st March 2017 to 28th February 2018. The ECOHIS and its effect size (ES) served to evaluate children's OHRQoL, the Wilcoxon signed-rank, Internal consistency and the Kruskal-Wallis test were used for statistical analyses.
Results: A total of 244 patients who fulfilled the inclusion criteria were included in the study pre-operatively. However, 71 participants did not complete the post-operative questionnaire and a total number of 173 parents completed the pre- and post-operative ECOHIS questionnaires, and this accounted for 71% response rate. The mean dmft of the children prior to the treatment was 13.8 (± 3.07). Pain and eating problems among children and parents feeling upset and guilty were the most frequently reported impacts at baseline. The overall ECOHIS scores decreased significantly (p < 0.001) after DGA treatment, revealing a large ES for the child (2.19) and family (2.79) sections of the ECOHIS. The change in the child’s self-image and social interaction scores was statistically related to their caries experience.

Conclusion: DGA treatment resulted in significant improvement in all child and family physical, psychological and social aspects of oral health quality of life. There is a need for studies to involve more children including those with special needs and medically compromised children in all of the UAE emirates and also studies for surveying the effect of DGA on OHRQoL of school age children, with the questionnaires being completed by children themselves and not their parents/guardians.
DEDICATION

With every cell in my body and every part of my sole, I would like to dedicate this research with all the hard work to:

My father, a man who makes the impossible very much possible and who has chosen the spirit of God within him over the clay of earth. He has supported me in every step clearing stones in my path.

My beloved mother, she taught me to be who I am today, she who carries all burdens of life on her tiny shoulders and never complains.

My husband, who has been a constant source of support and encouragement during the challenges of graduate university and life. I am truly thankful for having him in my life.
DECLARATION

I declare that all the content of the thesis is my own work. There is no conflict of interest with any other entity or organization.

Name: Kholoud Obaid Al Antali

Signature:
ACKNOWLEDGEMENTS

I take this opportunity to present my votes of thanks to all those guideposts that really acted as lightening pillars to enlighten my way throughout this project that has led to successful and satisfactory completion of this study. I am highly thankful to:

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Appendix I. Ethical Approval Forms.

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a) Parents Information and Informed Consent Form.

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Appendix III. Demographic Data collection sheet.

Appendix IV. Questionnaire.

- English version
- Arabic version.

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ABBREVIATIONS

AAPD: American Academy of Pediatric Dentistry
CDC: Centers for Disease Control and Prevention
CDHS: Children’s Dental Health Survey
CFSS-DS: Children's Fear Survey Schedule-Dental Subscale
CHQ: Child Health Questionnaire (CHQ)
CIS: Child Impact Section
CORG: Completed Oral Rehabilitation under General Anesthesia
DEGA: Dental extractions under general anesthesia
DGA: Dental General Anesthesia
DHA: Dubai Dental Authority
Dmft: decay missing filling tooth
ECC: Early childhood caries
ECOHIS: Early Childhood Oral Health Impact Scale
ES: Effect Size
FDA: Food and Drug Administration
FIS: Family Impact Section
GA: General Anesthesia
GCP: Good Clinical Practice
MBRU: Mohammed Bin Rashed University
MOH: Ministry of Health
MS: Mutans Streptococci
OHRQoL: Oral health-related quality of life
P-CPQ: Parental-Caregiver Perceptions Questionnaire
QOL: Quality of Life
UK: United Kingdom
USA: United States of America
UAE: United Arab Emirates
S-ECC: Severe Early Childhood Caries
WHO: World Health Organization
1. INTRODUCTION

Dental caries is reported to be among the most common bacterial disease affecting humans. It is five to eight times more common than the second most common chronic disease in children, asthma\(^1\). Despite the fact that there was a reduction in caries throughout the most recent couple of decades especially in developed countries. Its high prevalence in developed countries and certain fragments of the populace (e.g., youngsters and teenagers, low socioeconomic status children), trouble (e.g., expense and truancy) and different consequences (e.g., pain, absence of rest, and, in uncommon cases, death) require more endeavors from the general population, organized dentistry, and governments to control the pandemic way of oral disease\(^2\).

Early childhood caries (ECC) is an aggressive type of caries influencing children under the age of six. It initially affects the upper central incisors and can damage them to the gum line within a year if not treated. It is defined as the presence of one or more decayed, missing or filled tooth surfaces in any primary tooth of child age 71 months or younger\(^3\). Evidence demonstrates that ECC, especially in severe cases, antagonistically influences the personal satisfaction in children’s; which can prompt agony, contamination, abscesses, unhealthiness, and gastrointestinal issues\(^4\). The most hidden manifestation of severe caries, which is often neglected, is how the children deal with their dental disease and how it affects their daily routines, including school performance, their ability to thrive, and their sense of self-esteem.

Despite the increased risk of treatment of ECC under general anesthesia (GA) and the wait times for operating rooms, which means delays in access to dental treatment for children in urgent need of dental care, GA is considered the most appropriate method for performing a complete rehabilitation of the child’s dentition in a single visit.
Oral dental rehabilitation can be defined in terms of the restoration of function and aesthetics. However, it must include also a philosophy of concern for an oral health preventive plan that would require continued follow up and emphasis for the management of such disability\(^5\).

Studies evaluated the perceived outcomes and parental satisfaction following dental rehabilitation under GA\(^6,7\). Using a single page survey with simple dichotomous items. Acs et al. found that children with ECC receiving comprehensive dental treatment under GA achieved improvements in their quality of life and overall health\(^6\). In addition, a hierarchy of improvement was noted; the greatest being a reduction in pain experienced followed by improved quality in eating and in sleep. Parents were overwhelmingly satisfied with outcomes in their children as well in the process of care, reporting that their expectations had been met.

Research on children’s Oral health-related quality of life (HRQoL) has a short history. It can be traced back to 1990 when the Child Health Questionnaire (CHQ) was published. Canadian-French, German, and UK translations/adaptions of CHQ was then developed, evaluated, and validated in 1998\(^7\). Equally, children’s oral Health Related Quality of Life (OHRQoL) has only recently started to develop, despite the significance of oral diseases in children’s lives. A number of OHRQoL scales were developed and validated\(^8\). Because young children, in particular, are often not a reliable source of medical information, parents are usually relied on as informants for measuring child OHRQoL\(^8\).

The Early Childhood Oral Health Impact Scale (ECOHIS) was developed in the United States of America (USA) by Pahel et al.\(^9\) to assess the negative impact of oral disorders on the quality of life among preschool children (0 to 5 years of age). It is translated to Arabic and validity and reliability were assessed and found that this instrument can be used in Arabic-speaking caregivers of preschoolers aged 2 to 6\(^10\).
In the United Arab Emirates (UAE), ECC is the most common childhood disease. The prevalence of ECC in the Abu Dhabi Emirate has been reported as 94% in 5-year-old children\(^{(11)}\). In Ras Al-Khaimah Emirate, a recent study reported the prevalence of ECC was 74.1\(^{(12)}\).

In most cases, treatment requires full dental rehabilitation under general anesthesia by a pediatric dentist. Therefore, it seems appropriate to study the effects of full dental rehabilitation under GA on the UAE preschool children and their families’ quality of life.
2. LITERATURE REVIEW

2.1 Introduction & background

In this chapter the literature is reviewed regarding the following: Early childhood caries (ECC) epidemiology, diagnosis, prevention and treatment including the indications, advantages and complication of treatment of child dental patients under general anesthesia (GA). Finally, the Oral Health Related Quality of Life’ (OHRQOL) literature is reviewed.

2.1.1 Classification of Early Childhood Caries (ECC)

The expression “dental caries” is utilized to represent the outcomes, signs, symptoms, and side effects of a localized chemical disintegration of the tooth surface (enamel and/or dentin) caused by dental plaque and mediated by saliva\(^{13}\). Caries is considered as a disease with high incidence among childhood chronic conditions, where it is also well-thought-out to cause harm on both the population and individual well-being\(^{14}(15)\). When compared to other common diseases, dental caries is five times as frequent as asthma and seven times as common as hay fever\(^{16}\). In primary teeth, dental caries is a preventable and reversible disease if treated in early stages, but when left untreated it will lead to pain, bacteremia, alteration in growth and development, premature tooth loss, possible speech disorder, increase in treatment costs, loss of confidence, and negative effect on successor permanent teeth. Dental caries in young children has a pattern; diverse terms and terminology have been utilized to express them\(^{17}\). The definitions used previously to describe this bacterial disease were related to cause and the improper utilization of nursing bottle. These terms were used interchangeably: “Early childhood tooth decay,” “Early Childhood Caries (ECC),” “bottle caries,” “nursing caries,” “baby bottle tooth decay,” or “night bottle mouth”\(^{18,19}\).
The expression of “ECC” was proposed more than 20 years ago during a workshop supported by the Centers for Disease Control and Prevention (CDC) trying to scope the consideration upon the various issues, such as financial, socio-psychological, and behavioral, which contribute to the formation of caries at such initial years, instead of attributing its manifestation solely on feeding bottles(20). In 1999, a primary definition was established by a workshop organized by the National Institute for Dental and Craniofacial Research following the conference on ECC that was held in 1997(17,21).

Furthermore, in 2005, the American Academy of Pediatric Dentistry (AAPD) defined Early Childhood Caries as “the presence of one or more decayed (noncavitated or cavitated lesions), missing (because of caries), or filled tooth surfaces in any primary tooth in a child aged 71 months or younger”(22).

The term “Severe Early Childhood Caries (S-ECC)” refers to “atypical” or “progressive” or “acute” or “rampant” patterns of dental caries, where in their definition AAPD scored ECC as the following: “in children younger than 3 years of age, any sign of smooth-surface caries is indicative of S-ECC. From ages 3 through 5, 1 or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth or a decayed, missing, or filled score of ≥4 (age 3), ≥5 (age 4), or ≥6 (age 5) surfaces constitutes S-ECC(23).

Subsequently, it is suggested that the expression "ECC" is a best fit to reflect the multifactorial etiologic process, where also it can be utilized when representing any type of caries in infants and preschool children(24).

2.1.2 Pattern and clinical appearance of ECC

The clinical pattern of ECC is rampant(25). Characteristically, caries usually affects the primary teeth in the following sequence: Maxillary central incisors → Maxillary lateral incisors → Maxillary 1st molars → Maxillary canines and second molars → Mandibular molars → Mandibular canines and incisors.
The stages of severity of ECC and their features are summarized in Table 2.1.

**Table 2.1. Stages of Early Childhood Caries**

<table>
<thead>
<tr>
<th>Severity</th>
<th>Features</th>
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| Mild to Moderate          | • White spot lesions  
                          | • Carious lesions involving the incisors and molars                     |
| Moderate to Severe        | • Labiobuccal carious lesion affecting the maxillary incisors with or without molar caries  
                          | • Mandibular incisors unaffected                                      |
| Severe                    | • Carious lesions involve almost all the teeth  
                          | • Rampant                                                           |

### 2.2 Prevalence of ECC in pre-school children

Dental caries is a major community health problem and remains the most dominant chronic dental disease in both children and adults, despite the fact that is mostly preventable\(^{26}\). Dental caries was the most prevalent worldwide public health disease in 2010\(^{27}\), with caries affecting the primary teeth being the tenth most prevalent disease\(^{27–29}\).

The prevalence of ECC varies considerably in different studies. The prevalence worldwide has been described to vary between 3% and 94%, depending on the context\(^{30–32}\). More specifically, this variation was linked to several factors such as: 1) the age and accessibility of children studied; 2) socioeconomic status; 3) ethnic and cultural factors, and 4) criteria used for diagnosis\(^{33}\).

The prevalence of ECC in one country cannot be compared with another\(^{34}\). Richardson *et al.* reported that even results from one ethnic group cannot be extrapolated beyond that group, even within the same country\(^{34}\). In Western societies, approximately 80% of caries documented are found in children belonging to low socio-economic groups, certain immigrant groups, patients with learning disabilities and those with physical and medical disabilities, representing only about 20% of the population\(^{35}\). Since 1967, industrialized
countries have shown a trend in declining dmft scores, whereas unindustrialized countries have continued to show high scores\(^{36-38}\).

In the UK, the Children's Dental Health Survey (CDHS-2013), revealed that a third (31\%) of 5-year-olds were identified as having obvious decay experience in their primary teeth with 28\% of them having decay into dentine\(^{39}\). Comparatively, an epidemiological survey conducted among 1,151 randomly-selected school children in São Paulo, Brazil (2000) found that the prevalence of primary teeth dental caries among five-year-olds was 45.8\%\(^{40}\).

Interestingly, in Feira de Santana, Brazil (2007), the prevalence of dental caries among 186 children aged 12 to 30 months was 6.4\%\(^{41}\). This great difference in caries prevalence can be related to the water supply as it is optimally fluoridated in Feira de Santana. Mohebbi \textit{et al.} (2006) reported the prevalence of ECC in 483 children in Tehran. The prevalence of ECC among the youngest age group, 12-15 months, was (3\%), for 16-19 months was (9\%), and for 20-25 months was (14\%)\(^{42}\).

Using World Health Organization (WHO) criteria, a 2007 cross-sectional survey of a sample of 2014 Chinese preschool children aged 3-5 years found a prevalence of 55\% of children with regular dental caries and 14\% of children with rampant dental caries. Further, a correlation was established between the increase of age and the increase in the prevalence and severity of caries. A high proportion of young children had dental caries and most decayed teeth were untreated\(^{40,43,44}\).

In the Middle East, the prevalence of caries is reported to be from 22\% to 61\% among pre-school children\(^{11,45,46}\). The extent of the disease varies among socioeconomic groups, gender, and age of individuals\(^{47}\).

In Saudi Arabia, a 2013 systematic review of population-based dental caries among children found that dental caries and its severity were estimated to be approximately
(80%) for the primary dentition with a dmft mean of 5.0\(^{(48)}\). Wyne et al.\(^{(47)}\) reported a caries prevalence of 74.6% with a mean dmft score of 6.9 in a random sample of preschoolers in Riyadh, with a piped water fluoride level of 0.24 ppm.

Information on dental caries among children in the UAE over the past 20 years has been collected from pathfinder surveys; however, these did not represent all seven emirates. Reports on the experience of dental caries in primary dentition were mainly from Abu Dhabi. In 1998, a mean dmft of 7.7 was reported in 5-year-olds in Abu Dhabi\(^{(49)}\). These reports suggested an increasing trend of dental caries in the primary dentition of children in the UAE\(^{(48)}\). A national study conducted during 2001 and 2002 in 5-year-old UAE children by Al-Nadeef (2010) found that only 17% of children were caries-free and the dmft index was 5.1, ranging from 3.8 in Ajman to 6.6 in Dubai. More than (52%) of children had a dmft score of more than four. The major findings of this study suggest that caries is highly predominant within the primary dentition of 5-year-old children and remain mostly untreated\(^{(49)}\).

Hashim and her colleagues\(^{(50)}\) reported a high prevalence of s-ECC in children 5-6 years old in Ajman, UAE. The overall prevalence of s-ECC was 31.1%. The prevalence of s-ECC was higher among children of low-income families, those who had a high snack consumption level, and those who utilized dental services only when they had a problem.

2.3 Etiology of ECC

2.3.1 An introduction to the etiology of dental caries

Researches have confirmed that ECC is a multifactorial disease. As any caries lesion, ECC is caused by poor oral hygiene, bacterial invasion and bad diet habits\(^{(51,52)}\). Moreover, the presence of enamel defects might contribute to the formation of lesion, such as hypoplasia, known as hypoplasia-associated severe early childhood caries\(^{(53)}\).
This type of decay influences generally young children at or beneath levels of poverty, teeth which are usually vulnerable to caries have structural damage.

2.3.2 Risk factors

The causes of caries are multi-factorial, and the individual risk factors associated with ECC are therefore not necessarily causative. The Fisher-Owen diagram\textsuperscript{(54)} summarizes the complicated interaction between oral health influenced by environment at child, family and community levels (Figure 2.1).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{f2_1.png}
\caption{Child, family and community influences on oral health outcomes of children (Fisher-Owens 2007\textsuperscript{(54)}).}
\end{figure}

i. \textbf{Dietary Habits}: High frequency consumption of sugary foods and drinks are risk indicators for caries\textsuperscript{(55,56)}.

ii. \textbf{Bottle feeding}: Frequent bottle feeding with sucrose-containing infant feed, especially night time, is a risk indicator for caries in young children\textsuperscript{(57)}. 


iii. **Socio economic status**: Children who live under poor economic circumstances, belongs to ethnic and racial minorities, have single mothers and parents with low education have increased prevalence to ECC\(^{(58)}\).

iv. **Mutans Streptococci (MS)**: MS maybe transmitted vertically from mother to child through salivary contact. Infants with high levels of MS or those with early colonization are more likely to develop ECC\(^{(58,59)}\). Children whose mothers have good oral hygiene have a lower risk of maternal transmission of Mutans Streptococci (MS) and childhood dental caries.

v. **Visible Plaque**: plaque is strongly associated with ECC. Highest incidence of caries was found among children who did not brush their teeth\(^{(60)}\).

vi. **Early Caries Experience**: Children with early caries development exhibit high caries progression as well as at high risk for further development of an extensive number of new carious lesions\(^{(61)}\).

### 2.3.3 Protective factors

These are factors that can help arrest or reverse dental caries:

i. **Fluoride**: Children living in a fluoridated community or have exposure to fluoridated toothpaste have lower risk of dental caries\(^{(62)}\).

ii. **Regular dental care**: Children with regular dental care have lower caries risk\(^{(63)}\).

### 2.4 Diagnosis of ECC

Diagnosis of ECC is both by visual and clinical examination of children who are at risk.
2.4.1 Visual and clinical examination

Reliable clinical diagnosis and recording of carious lesions and restorations can be achieved if the teeth are clean and dry. The initial appearance of ECC is the presence of opaque white spots which usually starts at the cervical third of upper anterior teeth. It could then affect the occlusal surface of the upper deciduous molars, upper canines, followed by lower deciduous molars, lower canines and lower incisors progressing into yellowish brown carious lesions\(^{(64)}\). In advanced S-ECC, the lesion may progress to expose pulp tissue and breakdown as retained roots.

2.4.2 Radiographic examination

The broad contact points of the primary dentition make diagnosis of approximal caries difficult. Therefore, bitewing radiographs are an important adjunct in detecting proximal caries for children age four and above\(^{(65-67)}\).

If a child is uncooperative for bitewings, a bi-maxillary oblique lateral view may be obtained. Orthopantomomograms are not routinely used for caries diagnosis.

2.5 Prevention of ECC in preschool children

The prevention of S-ECC requires a multi-factorial approach due to its various etiological factors as summarized as follows: good dietary practice advice should be given to new mothers to prevent ECC\(^{(67)}\), healthcare workers must prescribe sugar-free liquid medicines whenever appropriate\(^{(68)}\), toothpastes with fluoride concentration of at least 1000 ppm and above are effective in preventing caries.

Children under 3 years should use a smear of toothpaste whilst those aged 3-6 years should use a pea sized amount of toothpaste\(^{(68,69)}\). For high risk young children, a small amount of resin based fluoride varnish can be applied at intervals of 3 months or 6 months\(^{(70)}\). Reinforce oral hygiene measures to reduce plaque and transmission of cariogenic bacteria\(^{(71)}\).
Other measures include: collaboration with parents and other healthcare providers to ensure all infants and toddlers have access to dental screenings, counseling and preventive procedures\(^{(72)}\). Encourage early dental visits within 6 months of eruption of the first tooth and no later than 12 months of age to conduct a caries risk assessment which can potentially indicate those at risk even before manifestation of carious lesions\(^{(73)}\). Children with special healthcare needs should be referred to a dental practitioner upon diagnosis in order that early diagnosis and preventive measures may be instituted\(^{(74)}\).

### 2.6 Management of ECC

The management of ECC is affected by the extent of the carious lesions and the compliance of the child and parent.

#### 2.6.1 Control of the carious process

An individualized caries risk assessment is the first important step in the management of ECC. It aims to modify the risk factors as discussed in the previous section. Parents should be asked to wean off the child from using a bottle while in bed. In case of considerable emotional dependence on the bottle, suggest the use of plain water. In addition, parents are instructed to brush child’s teeth last thing at night with fluoride toothpaste\(^{(75)}\).

For children aged 3-6 years, chair-side topical fluoride varnish (5% F) application to teeth should be carried out twice yearly\(^{(75)}\).

#### 2.6.2 Stabilization of carious lesions

The second stage of management would involve stabilization of lesions. If the carious lesion is arrested, it should be monitored to ascertain that it remains in non-progressive stage until exfoliation\(^{(75)}\). For non-cavitated proximal enamel lesions, a resin infiltration system used in conjunction with fluoride can be used to control caries progression on
deciduous molar teeth\textsuperscript{(75)}. Teeth that require temporization are excavated with spoon excavators and glass-ionomer cement is used to seal the teeth. Temporization by sealing of the carious cavity after caries removal reduces the load of bacterial colonization in tooth\textsuperscript{(75)}.

When undertaking temporization, evidence shows that sealing partially excavated dentine caries is capable of arresting lesion progression, suggesting that complete removal of dentine caries is not essential to control caries progression\textsuperscript{(76)}.

2.6.3 Restorative treatment of ECC

Restorative treatment of ECC is based on removal of caries and the treatment approach should take into consideration the child’s risk factors and age\textsuperscript{(44)}. In addition, the choice of restorative material used can be influenced by: a) site and extent of decay; b) child’s ability to cooperate and c) longevity of the restoration\textsuperscript{(77)}.

The most commonly used materials in restoring primary teeth are described in the Table \textbf{(2.2)} below.
Table 2.2 The most commonly used materials in restoring primary teeth

<table>
<thead>
<tr>
<th>Material</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amalgam</td>
<td>- Simple</td>
<td>- Not adhesive</td>
</tr>
<tr>
<td></td>
<td>- Quick</td>
<td>- Requires mechanical retention in cavity</td>
</tr>
<tr>
<td></td>
<td>- Cheap</td>
<td>- Environmental and occupational hazards</td>
</tr>
<tr>
<td></td>
<td>- Technique insensitive</td>
<td>- Public concerns</td>
</tr>
<tr>
<td></td>
<td>- Durable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite</td>
<td>- Adhesive</td>
<td>- Technique sensitive</td>
</tr>
<tr>
<td></td>
<td>- Aesthetic</td>
<td>- Rubber dam required</td>
</tr>
<tr>
<td></td>
<td>- Reasonable wear properties</td>
<td>- Expensive</td>
</tr>
<tr>
<td></td>
<td>- Command set</td>
<td></td>
</tr>
<tr>
<td>Glass Ionomer Cement (GIC) (packable)</td>
<td>- Adhesive</td>
<td>- Brittle</td>
</tr>
<tr>
<td></td>
<td>- Aesthetic</td>
<td>- Susceptible to erosion and wear</td>
</tr>
<tr>
<td></td>
<td>- Fluoride leaching</td>
<td></td>
</tr>
<tr>
<td>Resin modified glass ionomer</td>
<td>- Adhesive</td>
<td>- Water absorption</td>
</tr>
<tr>
<td></td>
<td>- Aesthetic</td>
<td>- Significant wear</td>
</tr>
<tr>
<td></td>
<td>- Command set</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Simple to handle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Fluoride release</td>
<td></td>
</tr>
<tr>
<td>High-viscosity glass Ionomer</td>
<td>- Adhesive</td>
<td>- Water absorption</td>
</tr>
<tr>
<td></td>
<td>- Aesthetic</td>
<td>- Colour not as good a match as composite resins, compomers and other GICs</td>
</tr>
<tr>
<td></td>
<td>- Simple to handle</td>
<td>- Poorer mechanical properties than compomer and composites</td>
</tr>
<tr>
<td></td>
<td>- Fluoride release</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- High compressive strength and wear resistance</td>
<td></td>
</tr>
<tr>
<td>Polyacid modified composite resin</td>
<td>- Adhesive</td>
<td>- Technique sensitive</td>
</tr>
<tr>
<td></td>
<td>- Aesthetic</td>
<td>- Less fluoride release than GICs</td>
</tr>
<tr>
<td></td>
<td>- Command set</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Simple to handle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Radiopaque</td>
<td></td>
</tr>
<tr>
<td>Stainless steel crown (SSC)</td>
<td>- Durable</td>
<td>- Extensive tooth preparation</td>
</tr>
<tr>
<td></td>
<td>- Protect and support remaining tooth structure</td>
<td>- Patient co-operation required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Unaesthetic</td>
</tr>
</tbody>
</table>
There are no significant differences in the outcome of restorative materials as there are not enough clinical trials to support any particular material\(^{(78)}\). However, studies on longevity of restorations tend to favor SSC\(^{(78)}\) and amalgam over resin based materials\(^{(79)}\). In young children with high risk for caries, there is good evidence that SSC function better than multi-surface intra-oral restorations\(^{(80)}\).

Alternatively, the Hall technique using preformed metal crowns cemented with no local anesthesia, caries removal or tooth preparation has shown favorable outcomes for pulp health and restoration longevity than conventional restorations\(^{(80)}\).

2.6.4 Pulp therapy/ extraction

For teeth that are pulpaly involved, the clinician may decide to conduct pulp therapy treatment or extraction. Pulp therapy involves either pulp capping, pulpotomy or pulpectomy. The decision to extract should only be made after considering both general and local factors\(^{(81)}\).

2.6.4.1 General factors: including patient’s cooperation, medical condition and dental infection, which may increase patient’s morbidity

2.6.4.2 Local factors: including restorability, extent of caries which may involve the pulp and roots and potential malocclusion and disturbances in the development of the dentition. Balancing and compensating extractions may be considered.
2.7 Treatment under General Anesthesia

If the child is unable to be compliant during dental treatment or if the child requires extensive treatment, then referral to a pediatric dental specialist should be made where the use of GA may be considered. Outcome of treatments related to quality of the restorations performed under GA are better than sedation for all parameters examined\(^{(82)}\).

Evidence suggests that comprehensive treatment appears to reduce the bacterial load within the oral cavity and full mouth rehabilitation under GA produced a statistically significant decrease in MS levels for at least three months\(^{(83)}\). Oral rehabilitation coupled with regular application of 10% povidone iodine can be a good alternative to control dental caries in children affected with ECC.

2.7.1 Indications for dental rehabilitation under GA.

There are several categories of dental problems in children that cannot be treated optimally in the dental office settings and are best managed in the hospital theatre. The ability to treat children in the hospital environment in order to provide comprehensive dental care using GA is a valuable option to the pediatric dentists, despite some degree of risk to the patient\(^{(83)}\).

The clinical guidelines of the American Academy of Pediatric Dentistry\(^{(84)}\) state that the goal of GA in the pediatric dental patient is to eliminate cognitive, sensory, and skeletal motor activity to facilitate the delivery of quality comprehensive diagnostic, restorative, and/or other dental services.
There are general indications for the use of general anesthesia to treat children and these are as follows:

- Management problems in the dental office: young children, or extremely uncooperative, fearful or anxious, or an adolescent with extensive dental needs and for whom office dentistry has been unsuccessful, or an uncooperative child who remains uncontrollable after all alternative means of patient management have been unsuccessfully tried\(^{(85,86)}\).
- Patients with medical disorders requiring close supervision: such as congenital heart disease, blood dyscrasias, or seizure disorders who are in need of dental treatment and close monitoring after the operation\(^{(87–89)}\).
- Special needs or physical disabilities: Patients with sensory, physical, or mental conditions severe enough to prevent proper oral evaluation and treatment. Common examples are Down's syndrome, autism, intellectual disability, cerebral palsy, and seizure disorders\(^{(90)}\).
- Local anesthesia problems: Patients with extensive dental needs on whom local anesthesia is generally ineffective; or inefficacy due to acute infection and anatomic variations; or because of allergic reactions to certain local anesthetic agents.
- Patients who have sustained extensive oro-facial and/or dental trauma.
- Patients with extensive dental needs who live in remote areas where dental care is unavailable, or transportation is a problem or for reasons of parental convenience and demands.
- Young patients with craniofacial anomalies who require extensive dental treatment for which normal treatment would require an unacceptably long period of time.
- Children or adolescents in need of extensive dental care with a high failure rate for dental appointments because of psychological problems or medical neglect and whose health and welfare are the financial responsibilities of a social service agency.
• Patients who have an increased gag reflex\(^{(91)}\).

• Patients who need minor oral surgical procedures but cannot withstand the operations in the conventional dental office environment.

2.7.2 Mortality, morbidity, and complications of general anesthesia.

General anesthesia is a procedure that is not without risks, the risks are difficult to quantify, and the technique is extremely valuable either for the very young or for those with extensive disease. The use of anesthetic drugs and muscle relaxants for oral rehabilitation procedures increases the risks and recovery time after the procedure\(^{(92)}\).

The number of GA procedures performed on dental patients in nontraditional settings such as office or outpatient facilities has risen over the last few years. The need for GA have increased, reimbursement levels for in-hospital procedures have decreased, and safety and effectiveness of drugs and monitors have improved significantly\(^{(93)}\).

The provision of dental GA is a controversial topic which was illustrated by a report in 1990 in the United Kingdom that concluded that general anesthesia should be avoided and other techniques should be used whenever possible\(^{(94)}\). Nevertheless, the use of GA for the extraction of teeth in children and adolescents is still a common practice in the United Kingdom\(^{(95,96)}\).

2.7.2.1 Mortality under general anesthesia

Mortality rates are commonly used as indices of safety when referring to GA. The decision to utilize GA always involves a judgment based on the known medical risks, although the mortality rate associated with dental GA is considered to be extremely low\(^{(97)}\). With modern advances in medications, monitoring technology, and safety systems, as well as highly educated anesthesia providers, the risk caused by anesthesia to a patient undergoing routine surgery is very small. While the risk of mortality associated with Dental General Anesthesia DGA is low, approximately one in 250,000 the morbidities associated with DGA are significantly more common. The most common
associated morbidities include nausea, pain and bleeding, and are experienced by 40-90% of children following DGA\(^{(98)}\).

2.7.2.2 Morbidity of general anesthesia

Morbidity is considered to be a more useful variable than mortality when discussing complications associated with GA, as it describes to some extent the nature of the problems encountered. Although life-threatening complications rarely occur after GA, discomfort that prolongs or complicates recovery is common.

In pediatric anesthesia, the most commonly reported post-operative complications are sore throat, headache, muscle pains, nausea and vomiting and post-operative pain\(^{(99-101)}\). Libman and co-workers (1979) \(^{(102)}\) emphasized that the most frequent complication is post-operative fever (hyperthermia), which represented 97.5% of all complications noted in their study. Other reported complications included distress, oral pain, extubation spasm, stridor, hypotension, bradycardia, restlessness, prolonged recovery, coughing, hiccups, drowsiness, shivering, sickness, prolonged bleeding, discomfort, laryngeal oedema, laryngospasm, traumatic injury, aspiration, upper respiratory tract infections, dehydration, enuresis, continued crying, psychological trauma, continuing bad memories, apnea, depression and recurrent nightmares\(^{(103,104)}\). It may also be associated with malignant hyperthermia, a rare, inherited muscular condition in which exposure to some (but not all) general anesthetic agents results in acute and potentially lethal temperature rise, hypercarbia, metabolic acidosis, and hyperkalemia\(^{(86)}\).

The morbidity following extractions under GA in general dental practice is common. The longer the period of observation the greater the opportunity for symptoms to occur and so to be reported. Bridgeman and co-workers (1999) reported that 92% of the children complained of one or more symptoms after GA. Bleeding and emotional distress were common during the immediate post-treatment period but nausea and vomiting seldom occurred\(^{(103)}\).
By contrast, the frequency of various complications changed after the children reached their homes with nausea and vomiting increasing whilst pain, crying and bleeding being reduced. Even after a month, the experience of dental GA had imprinted a distress memory in some children.

Atan et al (2004)\(^{(105)}\) reported the following:

- The morbidity related to GA is less than the morbidity related to dentistry.
- The numbers of subjects complaining of nausea, sleepiness, weakness and dizziness tailed off quickly after the first post-operative examination.
- Dental treatment under GA had a significant effect on the post-operative morbidity.
- Pain following dental GA was the most prevalent and long lasting symptom.

Studies conducted in pregnant animals, young animals, and children exposed early in life suggest repeated or prolonged use of general anesthetic and sedation drugs may have negative effects on the developing brain.

Based on Food and Drug Administration FDA’s understanding of brain development, the data suggest that the fetuses of women in their third trimester of pregnancy and children younger than 3 years are most likely vulnerable to this effect\(^{(106)}\).

Recent studies in children suggest that a single, relatively short exposure to general anesthetic and sedation drugs in infants or toddlers is unlikely to have negative effects on behavior or learning. More research is still needed to fully understand how anesthetics might affect brain development, especially longer or repeated exposures and in more vulnerable children.

Most anesthetic drugs have been shown to cause these negative effects on brain development in different species of animals, and no specific medications have been shown to be safer than any other.
Anesthetic and sedation drugs are necessary for infants, children, and pregnant women who require surgery or other painful and stressful procedures. Moreover, untreated pain can be harmful in children and to their developing nervous systems (106).

Parents and caregivers should ask for information about the planned surgery or procedure, including the likely duration of surgery and the need, if any, for repeated procedures. Parents should also discuss with their child’s health care professional the potential adverse effects of anesthesia on brain development and appropriate timing of procedures that can be delayed without jeopardizing their child’s health. Pregnant women should have similar conversations with their health care professionals (6,107).

2.7.3 Benefits and advantages

All anesthetics are administered either by a doctor who has specialized in anesthesia, or by a supervised doctor who is training to be a specialist. In almost all cases, the benefits of surgery are much greater than the risks of anesthesia. However, it is patient/carer right to be informed about treatments to be carried out. Meeting the anesthetist before the operation is important to answer patient/carer questions about anesthesia, including the possible risks.

2.7.4 Advantages of General anesthesia

GA reduces intraoperative patient awareness and recall (107); allows proper muscle relaxation for prolonged periods of time; facilitates complete control of the airway, breathing, and circulation; can be used in cases of sensitivity to local anesthetic agent; can be administered without moving the patient from the supine position; can be adapted easily to procedures of unpredictable duration or extent and can be administered rapidly and is reversible.
2.8 Quality of life following general anesthesia

Oral Health Related Quality of Life’ (OHRQOL) has been used to measure the oral health outcomes for children following dental rehabilitation under GA. In a study by Acs et al.\(^\text{(108)}\) an improvement in pain was the predominant outcome, while children with special health care needs were more likely to have improved eating and sleeping abilities and significantly improved overall health\(^\text{(109)}\).

Parents’ also reported more smiling, improved school performance, and increased social interaction after the procedure\(^\text{(110)}\). Also, following therapeutic intervention, ECC children exhibited significantly increased growth velocities, reflecting the phenomenon of catch up growth\(^\text{(109,111)}\).

Despite such a positive change in the QOL of the child and their families, it is unrealistic to assume that their long-term overall oral health will improve. One study found that only 10% of patients returned for recall visits once treatment was completed\(^\text{(112)}\). This low recall rate may be that parents do not consider the need for dental visits after treatment is complete since the child is no longer in pain\(^\text{(113)}\).

Among parents of children who received GA again, Amin et al\(^\text{(111)}\) found that parents perceived their child to be less susceptible to new cavities because all the teeth were now “fixed” and they were less motivated to spend time and energy on their child’s oral health. In a similar study done by Amin et al\(^\text{(112)}\), parents of children who underwent GA again had poor dental self-efficacy related to their child, which stemmed from: 1) own poor childhood dental care; 2) inadequate or incorrect knowledge; 3) limited family income; and 4) external influences (i.e. access to dental services and commercial products).

Therefore, to improve children’s oral health we need a better understanding of how parents’ beliefs and attitudes are operationalized within the context of the family, and in relationship to the surrounding external environment\(^\text{(112)}\).
2.8.1 Parental acceptance of general anesthesia for dental rehabilitation

Parental acceptance of GA relative to other behavior management techniques has increased over the past two decades\(^{(114)}\). According to Eaton \textit{et al.}\(^{(113)}\) today GA is ranked as the third most acceptable technique below tell-show-do and nitrous oxide. This was not the case 25 years ago, as shown by Murphy \textit{et al.} in 1984. His study found that parents were most accepting of tell-show-do and least accepting of the papoose board and GA, not to mention that, parents of higher social status demonstrated less approval for GA than did parents of low social status\(^{(115)}\). Over the years as opinions have changed and more people are familiar with outpatient surgeries, many feel that GA allows for high-quality dental care to be completed safely and efficiently. Furthermore, it may prove to be the choice of behavior management technique for treating special needs patients and children with severe dental decay. However, despite its many advantages, there is a higher level of risk and cost involved, as compared to conventional care.

According to Kanellis \textit{et al.}\(^{(114)}\), the average cost for dental care provided to a child in a hospital operating room under GA was $2,009 per case, compared with $104 for non-hospitalized children\(^{(116)}\).

2.8.2 Measuring and defining Oral Health-Related Quality of Life

In response to the WHO’s definition of health as “a complete state of physical, mental, and social well-being and not just the absence of disease”, health service researchers have focused on health as a multidimensional concept\(^{(117)}\). This concept of health status embraces the biopsy social model of health into which symptoms, physical functioning, and emotional and social well-being are incorporated\(^{(118)}\).

Quality of life (QoL), or individuals’ “perceptions of their position in life in the context of culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns”\(^{(118)}\), is now recognized as a valid parameter in
patient assessment in nearly every area of physical and mental healthcare, including oral health.

2.8.3 Why OHRQoL is important?

OHRQoL is important for both theoretical and practical reasons. The Surgeon General in the USA identified OHRQoL as a health priority\textsuperscript{(119)}, and “QoL issues are now at the forefront of public health policy”\textsuperscript{(118)}. The Surgeon General’s report and conference, The Face of the Child, highlighted the importance of children’s oral health to their overall health and well-being and the profound impact that oral health can have on children’s QoL\textsuperscript{(120,121)}. Oral health can affect anyone’s life; OHRQoL research has shown its utility in the study of diverse populations including patients with oral cancer\textsuperscript{(122)}, toddlers with ECC\textsuperscript{(123)}, or children with craniofacial anomalies\textsuperscript{(124)}.

Assessment of OHRQoL allows for a shift from traditional medical/dental criteria to assessment and care that focus on a person’s social and emotional experience and physical functioning in defining appropriate treatment goals and outcomes\textsuperscript{(125)}. Medical and dental research on HRQoL has flourished because of: (1) the patient’s more active role as a member of the treatment team; (2) the need for evidence-based approaches in health practices; and (3) the fact that many treatments for chronic diseases fail to ‘cure’ the health condition, thereby elevating the importance of HRQoL as a valuable health outcome variable\textsuperscript{(125,126)}.

Finally, OHRQoL is important because of its implications for oral health disparities and access to care. Unfortunately, socio-economic and racial/ethnic oral health disparities constitute a major social problem\textsuperscript{(127)}. Health disparities can be explained, in part, by limited access to care. Locations within developing countries may have minimal dental health professionals, and rural areas often lack facilities offering dental services. In developed countries, treatment access is limited by high costs and sometimes by
transportation difficulties. OHRQoL can be useful in measuring the impact of oral health disparities on overall health and QoL.

2.8.4 OHRQoL in survey research

Exploring the literature deeply with studies from all over the world of the impact of DGA treatment on children’s OHRQoL have shown significant improvement in oral health and psychological, social and overall wellbeing as well as a positive impact on the family.

Park et.al in Feb 2018 in a meta-analysis study concluded that there was evidence to support that the OHRQoL of children improved, with large effect size, in the short-term following DGA. Jankauskiene et al. in 2014 found that pain and eating problems among children and parents feeling upset and guilty were the most frequently reported impacts at baseline by which Early Childhood Oral Health Impact Scale (ECOHIS) score decreased significantly after DGA treatment, revealing a large effect size (ES) for the child and family. Malden et.al 2008 evaluated properties of the Parental-Caregiver Perceptions Questionnaire (P-CPQ) and the Family Impact Scale (FIS) which were acceptable and there were substantial and highly statistically significant reductions in mean P-CPQ and FIS scores after treatment, with effect sizes ranging from moderate to large, depending on the subscale being examined.

Klaassen et.al. 2009 used both ECOHIS and the Children's Fear Survey Schedule-Dental Subscale (CFSS-DS) to assess OHRQoL and dental fear, respectively, before and after the rehabilitation procedures. In the total CFSS-DS scores no effects were found.

Andreson et.al 2004 concluded that treating young children with high disease experience in a single session under GA results in immediate improvement in oral health and aspects of their QoL for both the children and their families. The majority of parents reported a high degree of satisfaction with the care received. Almaz et al in Turkey 2014 reported a significant reduction was observed in ECOHIS scores with moderate and large effect sizes (0.36 to 1.63). Yawary et.al 2016 in Australia concluded that the
OHRQoL of children in both age groups (<6 and 6–14 years) was significantly improved after Completed Oral Rehabilitation under General Anesthesia CORGA with large ES\(^{(134)}\). Wong \textit{et.al} 2017 in Australia conducted a study that resulted an overall ECOHIS, CIS, and FIS scores decreased significantly after emergency dental extractions under general anesthesia (DEGA ), demonstrating large effect size\(^{(135)}\). Lee \textit{et.al} in 2011 reported in his study done in Hong Kong that following treatment under GA, there was significant changes in ECOHIS scores and many of its sub-domains\(^{(136)}\). A cross sectional study done by Foroogh \textit{et.al.} in Iran 2017 reported that there was no significant relationship was found between the \textit{dmft} and ECOHIS indices in children. No significant difference was found between two genders in terms of the mean \textit{dmft}, which is consistent with some of the studies conducted in Iran on \textit{dmft}\(^{(137)}\). Jabarifar \textit{et.al} 2009 reported in his study done in Iran that provision of dental treatment under general anesthesia for uncooperative, young children with extensive dental problems had significant effects on quality of life of both children and their families\(^{(138)}\). Kumar \textit{et.al} 2014 conducted a systematic reviews who found that majority of the studies suggest that the children from families with high income, parental education and family economy had better OHRQoL. Mothers’ age, family structure, household crowding and presence of siblings were significant predictors of children’s OHRQoL\(^{(139)}\).

In a Gulf region study was done by Ziad \textit{et.al} in Saudi Arabian 2014 who reported that the overall P-CPQ and FIS scores showed a significant decrease following treatment, concomitant with large ES in both scales and all their subscales with the exception of social wellbeing, which showed moderate ES\(^{(2)}\). Farsi \textit{et.al} 2017 conducted a study in Jeddah, Saudi Arabia to evaluate the responsiveness of the A-ECOHIS (Arabic version) to dental rehabilitation under general anesthesia (DRGA). The A-ECOHIS scores were higher among parents who reported poor oral health on the global question than those...
reporting better oral health. The majority of parents reported improvement in children’s overall oral health-related quality of life post-operatively (94%)\(^{(10)}\).

As per our knowledge, no similar study was conducted in UAE which leads us to our aim in this study to assess whether dental rehabilitation of young UAE children under GA improves OHRQoL for children and their families.

2.9 Aims and objectives of the study

2.9.1 Aims

The main purpose of this study will be to assess whether dental rehabilitation of young UAE children under GA improves OHRQoL for children and their families.

2.9.2 Specific objectives

The following objectives were formulated to reach the above-mentioned aims:

1. To identify dental epidemiological factors that are associated with parental ratings of children’s OHRQoL and changes associated with dental treatment.

2. To study the effect of socio-demographic variables such as: sex and age of child; parent education level on OHRQoL.
3. MATERIALS & METHODS

In this chapter the study logistics are presented, including the study design, criteria and statistical analysis. A study methodology summary flowchart is presented in figure 3.1.

3.1 Study design

This study is a cross sectional study, using a pre-and-post survey design to evaluate changes in OHRQoL following comprehensive dental treatment under GA. The sample consisted of all children aged 2-6 years scheduled for Dental General Anesthesia (DGA) by a specialist pediatric dentist in a pediatric dental clinic in Al Ain City, Abu Dhabi Emirate who received referral from all regions of the UAE for pre-school children in need of DGA during a year period from 1st March 2017 to 28th February 2018.

3.2 Permission and ethical approval

A Research Protocol was submitted to the Research and Ethics Review Committee of Mohammed Bin Rashid University MBRU, and approval was obtained (see Appendix 1) to conduct the study.

3.3 Study population/ location

The sample consisted of parents of all eligible children receiving DGA in a pediatric dentistry clinic in Al Ain City during a year period from 1st March 2017 to 28th February 2018. Before treatment under GA, parents/guardians and children were informed about the treatment procedures and dental treatment planning for the child. At that time, oral and written information about the study were given to the parents/guardians of the children qualifying for the study. A signed informed consent form was required for participation by the parents/guardians (Appendix 2).
3.3.1 Study inclusion and exclusion criteria

3.3.1.1 Inclusion Criteria

- Parents of children (aged 2-6 years) referred for pediatric specialist treatment in Al-Ain, and in need of treatment under general anesthesia (GA).
- UAE and non-UAE citizen parents.

3.3.1.2 Exclusion Criteria

- Children with special healthcare needs and/or medically compromised.
- Parents who refuse to consent.
- Children younger than 2 or older than 6 years.

3.3.3 Sample type and size

A convenience sample of all children aged 2-6 years who are scheduled for GA dental rehabilitation at a pediatric dentistry clinic in Al Ain during the time frame of data collection between 1st March 2017 and 28th February 2018. A total of 244 patients who fulfilled the inclusion criteria were included in the study pre-operatively. However, 71 participants who received treatment under GA and filled pre-operative questionnaires were excluded because they did not complete the post-operative questionnaire.

3.3.4 Data collection

The demographic data of the children and parents were collected using a special data collection form (Appendix 3). Before treatment, child and parent demographic information including patient’s age, gender, parent’s age, education and occupation were collected from the dental records (Appendix 3). Cumulative caries data (dmft) according to WHO criteria (1997)(140) were also collected. For non-cooperative children clinical data were collected under GA before treatment. Parents filled the pre-operative questionnaires after the signed the consent which had been given by Pediatric dentist who will do DGA for their child. Intra examiner calibration was done.
Following the treatment under general anesthesia, in 3-6 months’ time, the parents were interviewed through phone calls by the principal investigator and asked to answer the same questions of the survey filled prior to the dental GA. Consideration was given whenever possible to interview the same parent who had initially completed the survey before the procedure. At this time, the parents and the principal investigator had no access to the questionnaire that was completed before the treatment.

3.3.4.1 The Early Childhood Oral Health Impact Scale

A previously validated Early Childhood Oral Health Impact Scale (ECOHIS)\(^{(10)(141)}\) was used (Appendix 4) to assess changes in the OHRQoL of both child and family. It is structurally composed of 13 items distributed between two sections namely; the Child Impact Section (CIS) and Family Impact Section (FIS). The CIS has four subscales: child symptoms, child function, child psychology and child self-image and social interaction. The FIS has two subscales: parental distress and family function. The questionnaire is scored using a simple five-point Likert scale with responses ranging from “never” to “very often” (equivalent to a score of 1 and 5, respectively) (1 = never; 2 = hardly ever; 3 = occasionally; 4 = often; 5 = very often; 0 = don't know). ECOHIS scores were calculated as a simple sum of the response codes for the CIS and FIS after recoding Don't Know responses as "missing”.

A total score ranging from 1 to 65 was calculated as a simple sum of the responses with higher scores denoting a greater oral health impact and/or poorer OHRQoL. The different ranges of the subscale scores were as follows: child impact section: child symptom – one item, range 1 to 5; child function – four items, range 1 to 20; child psychology – two items, range 1 to 10; and child self-image/social interaction – two items, range 1 to 10. Family impact section: parental distress – two items, range 1 to 10; family function – two items range 1 to 10. The English original version was used for English speaking parents\(^{(142)}\). For the Arabic speaking parents, the Arabic version of ECOHIS
questionnaire which was previously validated in a Saudi Arabian sample of parents by Pani et al. (2012) was used.

3.3.5 Statistical analysis

Data was entered into computer using IBM-SPSS for windows version 23.0 (SPSS Inc., Chicago, IL). Frequency tables’ bar and lines graphs, measure of percentage, measure of tendency and dispersion were performed as descriptive statistics. Categorical variables were cross-tabulated to examine the independency between variables, for such variables the χ2 test or Fisher’s exact test as appropriate were used. Kolmogorov-Smirnov was used to test the normality of continuous variables. The Mann-Whitney test was used to compare the pre-overall score of ECOHIS between demographical variables taken into two classes. The Wilcoxon signed-rank test was used to test the changes in the score of ECOHIS between baseline and the follow-up score, followed by calculating the effect size of each component by dividing the mean of the corresponding component by its standard deviation. When comparing the means of the score between more than two groups the Kruskal-Wallis test was used. Internal consistency was assessed by using Cronbach’s alpha and factor analysis for the items of the questionnaire. A P-value of less than 0.05 was considered significant in all statistical analysis.

3.4 Ethical issues

The proposal of this study was submitted and approved by the research and ethics committee of MBRU. This study was conducted in full conformance with principles of the Good Clinical Practice (GCP) and within the laws and regulations of Dubai. All data collected was anonymous and no patients’ identifiers were used.
Figure 3.1 Study Flow Chart

Aim
A cross-sectional study to assess whether dental rehabilitation of young UAE children under GA improved OHRQoL for children and their families.

Study Design, Location
A convenience sample of all children aged 2-6 years who were scheduled for GA dental rehabilitation in a pediatric dentistry clinic- Al Ain during the time frame of data collection between March, 1st 2017 to February, 28th 2018.

Ethical Approvals
MBRU Research Ethical Committee

Study sample (n=244)
Excluded n=71
Included n=173

Final Sample (n=173)
173 participants' data collected and analysed
4. RESULTS

During the time frame of data collection between March 1st 2017 and 28th February 2018, a total of 244 children (109 boys and 135 girls) participated in the study. The mean age of the children, who received DGA treatment at a pediatric dental clinic in Al Ain City in the Emirate of Abu Dhabi, was 4.6 (± 1.86 years) and the range was 2.5–5.9 years. The mean \( dmft \) of the children prior to the treatment was 13.8 (± 3.07). A total number of 173 parents, 140 mothers (80.9%) and 33 fathers (19.1%) completed the pre- and post-operative ECOHIS questionnaires, and this accounted for 71% response rate representing parents of 80 boys and 93 girls. The internal reliability of the scale as tested through Cronbach's alpha was 0.83. The majority of the parents, 63(36.4%), were from Al Ain City, 51(29.47%) from Abu Dhabi, 23(13.29%) from Ras al Khaimah, 14(8%) from Dubai, 13(7.5%) from Sharjah and finally 9(5.2%) from Fujairah. The demographic characteristics of participants are presented in Table 4.1
Table 4.1 Demographic characteristics of study participants.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Nr(%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender of the children</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>93 (53.7)</td>
</tr>
<tr>
<td>Male</td>
<td>80 (46.2)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>2-4 years</td>
<td>86 (49.7)</td>
</tr>
<tr>
<td>4-6 years</td>
<td>87 (50.2)</td>
</tr>
<tr>
<td>Parents</td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>140 (80.9)</td>
</tr>
<tr>
<td>Father</td>
<td>33 (19.1)</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
</tr>
<tr>
<td>Low educated</td>
<td>23 (13.3)</td>
</tr>
<tr>
<td>High Educated</td>
<td>150 (86.7)</td>
</tr>
<tr>
<td>Occupational status of the parents</td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>105 (60.6)</td>
</tr>
<tr>
<td>Un employed</td>
<td>68 (39.3)</td>
</tr>
<tr>
<td>Parents age Mean (SD)</td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>34.7 (+7.6)</td>
</tr>
<tr>
<td>Father</td>
<td>38 (+7.3)</td>
</tr>
<tr>
<td>Number of siblings Emirates</td>
<td></td>
</tr>
<tr>
<td>Mean 3.8 (+1.7)</td>
<td></td>
</tr>
</tbody>
</table>

* percentages between parenthesis are rounded and included for comparison

4.1 Pre- and post- Early Childhood Oral Health Impact Scale (ECOHIS).

Comparison between pre and post-operative average of the items of the ECOHIS questionnaires is presented in Table 4.2. For the child symptoms domain (Q1) there was a statistically significant difference between parental pre-and post-operative responses. The mean values were 3.0 (+1.17) and 1.24 (+0.65) respectively and the p-value < 0.001. The first and second subscales of the child function domains concerned about whether the child had difficulty in drinking hot or cold beverages (Q2) or while eating some foods (Q3) because of dental problems or dental treatments. There was also a statistically significant differences between pre- and post-operative parental responses. The mean
values pre-operatively were: 2.58 (+1.33), 2.95 (+1.31) while post-operatively 1.15(+0.63), 1.17(+0.58) respectively with a p-value of < 0.001.

Third and fourth subscales of the child function domains concerned about whether the child had difficulty pronouncing any words (Q4) or had missed preschool or daycare (Q5) because of dental problems or dental treatments. There was also a statistically significant difference between pre- and post-operative parental responses. The mean values pre-operatively were 1.93 (+1.28), 1.77 (+1.14) while post-operatively 1.26 (+0.72), 1.09 (+0.47) respectively and the p-value < 0.001.

The first and second subscales for the child psychological domains explored whether the child had trouble sleeping (Q6) or had been irritable or frustrated (Q7) because of dental problems or dental treatment. The difference between pre- and post-operative parental responses was statistically significant. The mean values pre-operatively were 2.46 (+1.31), 2.25 (+1.26) and post-operatively were 1.05 (+0.33), 1.08 (+0.39) respectively and the p-value < 0.001.

The first and second subscales for the child self-image and social interaction domains focused on whether the child avoided smiling or laughing (Q8) or avoided talking when around other children (Q9) because of dental problems or dental treatments. The difference was statistically significant between pre- and post-operative parental responses. The mean values pre-operatively were 1.08 (+1.19), 1.79 (+1.17) while post-operatively 1.12 (+0.52), 1.08 (+0.48) respectively and the p-value < 0.001.

The second section was the family impact section (FIS) that involved only two domains. The first and second subscales for parent distress domain questioned whether parents or another family member had taken time off from work (Q10) or felt upset (Q11) because of their child's dental problems or dental treatments. There was a statistically significant difference between pre- and post-operative parental responses. The mean values pre-
operatively were 1.73 (±1.48), 3.34 (±1.49) while post-operatively 1.168 (±0.57), 1.16 (±0.55) respectively and the p-value < 0.001.

Finally, the two questions for family function domain focused on whether parents or another family member had taken time off from work (Q12) or had a financial impact (Q13) because of their child's dental problems or dental treatments. The difference was statistically significant between pre- and post-operative parental responses. The mean values pre-operatively were 2.44 (±1.41), 2.16 (±1.27) and post-operatively were 1.04 (±0.37), 1.42 (±1.03) respectively and the p-value < 0.001.

Table 4. 2 Comparison between pre and post-operative average of the items of the ECOHIS questionnaires.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Pre-DGA</th>
<th>Post-DGA</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. How often has your child had pain in the teeth, mouth or jaws? (child symptoms domain)</td>
<td>3 ± 1.17 Occasionally</td>
<td>1.24 ± 0.65 Never</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Q2. How often has your child had difficulty drinking hot or cold beverages because of dental problems or dental treatments? (child function domain)</td>
<td>2.58 ± 1.33 Occasionally</td>
<td>1.15 ± 0.63 Never</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Q3. How often has your child had difficulty eating some foods because of dental problems or dental treatments? (child function domain)</td>
<td>2.95 ± 1.31 Occasionally</td>
<td>1.17 ± 0.58 Never</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Q4. How often has your child had difficulty pronouncing any words because of dental problems or dental treatments? (child function domain)</td>
<td>1.93 ± 1.28 Hardly ever</td>
<td>1.26 ± 0.72 Never</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Q5. How often has your child missed preschool, daycare or school because of dental problems or dental treatments? (child function domain)</td>
<td>1.77 ± 1.14 Hardly ever</td>
<td>1.09 ± 0.47 Never</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Q6. How often has your child had trouble sleeping because of dental</td>
<td>2.46 ± 1.31 Hardly ever</td>
<td>1.05 ± 0.33 Never</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Q7. How often has your child been irritable or frustrated because of dental problems or dental treatments? (child psychological domain)</td>
<td>2.25 ± 1.26</td>
<td>Hardly ever</td>
<td>1.08 ± 0.39</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Q8. How often as your child avoided smiling or laughing when around other children because of dental problems or dental treatments? (Child self-image/social interaction domain)</td>
<td>1.08 ± 1.19</td>
<td>Never</td>
<td>1.12 ± 0.52</td>
</tr>
<tr>
<td>Q9. How often as your child avoided talking with other children because of dental problems or dental treatments? (child self-image/social interaction domain)</td>
<td>1.79 ± 1.17</td>
<td>Hardly ever</td>
<td>1.08 ± 0.48</td>
</tr>
<tr>
<td>Q10 How often have you or another family member felt guilty because of your child’s dental problems or dental treatments? (Parent distress domain)</td>
<td>1.73 ± 1.48</td>
<td>Hardly ever</td>
<td>1.16 ± 0.57</td>
</tr>
<tr>
<td>Q11 How often have you or another family member been upset because of your child's dental problems or dental treatments? (Parent distress domain)</td>
<td>3.34 ± 1.49</td>
<td>Occasionally</td>
<td>1.16 ± 0.55</td>
</tr>
<tr>
<td>Q12 How often have you or another family member taken time off from work because of your child’s dental problems or dental treatments (Family function domain)</td>
<td>2.44 ± 1.41</td>
<td>Hardly ever</td>
<td>1.04 ± 0.37</td>
</tr>
<tr>
<td>Q13 How often has your child had dental problems or dental treatments that had a financial impact on your family? (Family function domain)</td>
<td>2.16 ± 1.27</td>
<td>Hardly ever</td>
<td>1.42 ± 1.03</td>
</tr>
</tbody>
</table>
4.2 Distribution of the scores of pre and post-operative domains of the ECOHIS questionnaires

The distribution of the scores of pre and post-operative domains of the ECOHIS questionnaires is presented in Figure 4.1. The average of the items among all pre-operative domains were higher than the average among post-operative except for the domains of child self-image/social interaction (Q8).

![Figure 4.1 The distribution of the scores of pre and post-operative domains of the ECOHIS questionnaires.](image-url)
4.3 Distribution of the scores of ECOHIS domains by demographic characteristic of participants.

Table 4.3 summarizes the pre-operative scores of ECOHIS domains by demographic characteristic of participants. A total of 80 and 93 male and female parents were included in the study respectively with almost equal numbers of children who were 2-4 years or 4-6 years old. Highly educated parents exceeded the lower educated by 127. From the Table 4.3 below, we found that highly educated parents with an average score of 20.48 (+7.19) reported greater impacts on boys 20.58 (+6.57) than on girls 20.37 (+7.78). The overall scores of the child impact sections (CIS) showed that older children (4-6 years) experienced more impacts than did the younger children (2-4) with an average of 21.5 (+7.47). Males, 3.1(+1.1), experienced more pain than females [2.9 (+1.2)] and older aged children, (4-6 years) more than younger (2-4) by 2.1 as reported mostly by lower educated parents 3.1 (+1.25). The second domains from CIS by which lower educated parents 4.95 (+2.40) narrated greater impact than highly educated 4.68 (+2.22) in child psychology domains.

On the other hand, FIS in general showed that lower educated parents 11.08(+3.8) had lower scores than highly educated 11.37 (+3.81) with 0.82 differences between boys and girls with older children 11.8 (+4.06) experienced more impacts than younger children 10.8 (+3.45). Parent distress domains from this section showed that low educated parents 7.08 (+2.71) expressed greater impacts especially for boys 7.03 (+2.79) whose age between (4-6 years). In contrast, older children with highly educated parents 4.67 (+2.14) had higher scores than low educated parents in boys 4.73(+2.15) and in girls 4.45 (+2.19).
Table 4.3 Distribution of the scores of ECOHIS domains by demographic characteristics of participants.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Gender</th>
<th>Age (years)</th>
<th>Parental Education</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male 80</td>
<td>2-4 87</td>
<td>4-6 86</td>
</tr>
<tr>
<td>Child impact section</td>
<td>Female 93</td>
<td>19.4 ± 6.8</td>
<td>21.5 ± 7.47</td>
</tr>
<tr>
<td>Child symptoms</td>
<td>3.1 ± 1.1</td>
<td>2.7 ± 1.06</td>
<td>3.2 ± 1.2</td>
</tr>
<tr>
<td>Child psychology</td>
<td>4.91 ± 2.18</td>
<td>4.6 ± 2.06</td>
<td>4.8 ± 2.4</td>
</tr>
<tr>
<td>Child self-image and social interaction</td>
<td>3.20 ± 1.89</td>
<td>3.3 ± 1.98</td>
<td>3.6 ± 2.3</td>
</tr>
<tr>
<td>Family impact section</td>
<td>11.77 ± 3.84</td>
<td>10.8 ± 3.45</td>
<td>11.8 ± 4.06</td>
</tr>
<tr>
<td>Parent distress</td>
<td>7.03 ± 2.79</td>
<td>6.35 ± 2.6</td>
<td>7.15 ± 2.69</td>
</tr>
<tr>
<td>Family function</td>
<td>4.73 ± 2.15</td>
<td>4.4 ± 2.05</td>
<td>4.7 ± 2.29</td>
</tr>
</tbody>
</table>

4.4 Changes in ECOHIS scores from baseline to follow-up

Changes in ECOHIS scores from baseline to follow-up are summarized in Table 4.4. For the child impact section there was a statistically significant (p<0.001) reduction of the scores on the follow-up than the baseline from 20.47 (+7.23) to 10.28 (+2.59) and the effect size was 2.195. The highest effect size was noticed in child symptoms domain by 3.417 and there was also a significant reduction of the scores on the follow-up than the baseline from 3 (+1.17) to 1.24 (+0.65). Child function domain showed a statistically significant (p<0.001) reduction of the scores on the follow-up than the baseline from 9.23 (+3.57) to 4.69 (+1.44) with large effect size of 2.13. Third domains from CIS was child psychology that had large effect size (1.56) with a significant reduction of the scores on the follow-up than the baseline from 4.7 (+2.24) to 2.13 (+0.59). Lastly, child self-image and social interaction that showed the lowest effect size compared to the rest of domains
of CIS with an effect size of 1.104 with a significant reduction of the scores on the follow-up than the baseline from 3.52 (+2.16) to 2.208 (+0.972).

On the other hand, in the family impact section there was also a statistically significant reduction of the scores on the follow-up than the baseline from 11.33 (+3.79) to 4.78 (+1.45) (p<0.001) and the effect size was 2.792. First domain was parent distress that showed a significant reduction of the scores on the follow-up than the baseline from 6.75 (+2.68) to 2.32 (+1.09) with a large effect size of 2.81. Finally, family function domains also showed a significant reduction of the scores on the follow-up than the baseline from 4.58 (+2.17) to 2.45 (+1.09) with large effect size of 1.97.

Table 4.4 The mean change in ECOHIS scores between pre and post surveys with effect sizes (N =173).

<table>
<thead>
<tr>
<th>ECOHIS domain (no. of items)</th>
<th>Baseline</th>
<th>Follow up</th>
<th>Change in score ± SD</th>
<th>Effect-size</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Range</td>
<td>Mean ± SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child impact section (9)</td>
<td>20.47 ±7.23</td>
<td>3-45</td>
<td>10.28 ± 2.59</td>
<td>9-23</td>
<td>10.185± 4.64</td>
</tr>
<tr>
<td>Child symptoms (1)</td>
<td>3 ±1.17</td>
<td>1-5</td>
<td>1.24 ± .655</td>
<td>1-3</td>
<td>1.76 ± 0.515</td>
</tr>
<tr>
<td>Child functions (4)</td>
<td>9.23 ± 3.57</td>
<td>1-20</td>
<td>4.69 ± 1.44</td>
<td>4-12</td>
<td>4.54 ± 2.13</td>
</tr>
<tr>
<td>Child psychology (2)</td>
<td>4.7 ± 2.24</td>
<td>0-10</td>
<td>2.13 ± 0.59</td>
<td>2-6</td>
<td>2.58 ± 1.65</td>
</tr>
<tr>
<td>Child self-image and social interaction (2)</td>
<td>3.52 ± 2.16</td>
<td>0-10</td>
<td>2.208 ± 0.972</td>
<td>1-10</td>
<td>1.31± 1.188</td>
</tr>
<tr>
<td>Family impact section (4)</td>
<td>11.33 ± 3.797</td>
<td>1-20</td>
<td>4.78 ± 1.45</td>
<td>3-10</td>
<td>6.555 ± 2.347</td>
</tr>
<tr>
<td>Parent distress (2)</td>
<td>6.75 ± 2.68</td>
<td>1-10</td>
<td>2.32 ±1.094</td>
<td>2-8</td>
<td>4.422 ± 1.57</td>
</tr>
<tr>
<td>Family function (2)</td>
<td>4.58 ± 2.17</td>
<td>0-10</td>
<td>2.45±1.09</td>
<td>1-6</td>
<td>2.133 ±1.08</td>
</tr>
</tbody>
</table>
4.5 Relationship between baseline \textit{dmft}, CIS and FIS

The relationship between baseline \textit{dmft} scores, CIS and FIS is presented in Table 4.5. There were neither statistically significant differences between baseline \textit{dmft} and CIS with p-value of 0.081 nor with FIS with p-value of 0.995. However, there was a statistically significant relationship between baseline \textit{dmft} and the change in the score of self-image and social interaction domains of the CIS with p-value of 0.023, but not in child symptoms, functions and psychology domains with p-value of 0.99, 0.243, and 0.108 respectively and neither with parent distress and family function domains with p-value of 0.740 and 0.669 respectively.

Table 4.5 Relationship between baseline \textit{dmft} scores, CIS and FIS.

<table>
<thead>
<tr>
<th>Variables</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child impact section 9</td>
<td>0.081</td>
</tr>
<tr>
<td>Child symptoms 1</td>
<td>0.999</td>
</tr>
<tr>
<td>Child functions 4</td>
<td>0.243</td>
</tr>
<tr>
<td>Child psychology 2</td>
<td>0.108</td>
</tr>
<tr>
<td>Child self-image and social interaction 2</td>
<td>\textbf{0.023}</td>
</tr>
<tr>
<td>Family impact section 4</td>
<td>0.995</td>
</tr>
<tr>
<td>Parent distress 2</td>
<td>0.740</td>
</tr>
<tr>
<td>Family function 2</td>
<td>0.669</td>
</tr>
</tbody>
</table>
4.6 Dental treatment provided under GA

**Figure 4.2** illustrates the distribution of the treatment provided under GA. The mean $dmft$ of the children prior to the treatment was $13.8 \pm 3.07$ ranging from 6 to 20. The most common treatment provided was cervical pulpotomy pulp therapy procedure (45%) and performed metal crowns (46.5%) for the posterior teeth. The decayed anterior teeth were restored either with strip crown composite restorations (15.3%) or zirconia crowns (22.3%). Prior to strip or zirconia crown restorations, 12% of the decayed anterior teeth required pulpectomy compared to 1% restored with pulpotomy. Extraction was the treatment option for 5.6% of the decayed anterior teeth and 5% of posterior teeth were extracted.

**Figure 4.2 The distribution of the treatment provided under GA.**
5. DISCUSSION

This study presents new information about OHRQoL among young UAE children prior to and after DGA treatment. Although young children and their families suffered greatly from the consequences of poor dental health, their OHRQoL improved significantly after DGA treatment. The data were collected over a one-year period. The sample population of this survey were young DGA patients treated in a pediatric dental clinic in Al Ain city in the Emirate of Abu Dhabi. Dental treatment under GA is not covered by many medical insurance companies in the UAE, and there is a long list of pediatric dental patients waiting to undergo GA in the Ministry of Health and Dubai Health Authority, which provide such treatment free of charge.

Our patient sample came from a large medical referral center in Al Ain city that accepted referrals from all over the UAE.

The majority of participants (44.4%) were from Abu Dhabi and Al Ain compared to other UAE cities. The location convenience, acceptance of many insurance coverage and faster treatment provision could be reasons for this. The response rate in our study was higher than in other similar study\(^{(130)}\). The primary caregivers involved in this study were the mothers. As mothers play the dominant role in raising the child and are involved in activities concerning the child’s welfare, therefore they were more willing to participate in the study. As such, their input and understanding of the scale was important.

The ECOHIS chosen for our study for pre-school age children was validated for many languages including the Arabic language and was found to be valid for measuring OHRQoL in children\(^{(10)}\). Many of the other DGA studies used the Parental-Caregivers Perceptions Questionnaire and Family Impact Scale (P-CPQ and FIS), a much broader questionnaire (49 questions) designed for school-age children\(^{(8,130,131)}\).

A shorter OHRQoL questionnaire (13 vs.49 questions) in the ECOHIS seemed to have advantages in evaluating young children’s quality of life, as found in a Dutch study,
where both questionnaires were used\textsuperscript{(144)}. Nevertheless, the ECOHIS had recently been found to have some limitations which could undermine its suitability for use with children affected by severe dental caries\textsuperscript{(145)} when compared to the new short-form P-CPQ and FIS scales\textsuperscript{(146)}. Due to the aforementioned reasons, the different development process of the ECOHIS and the short-form P-CPQ and FIS scales\textsuperscript{(9,146)}, the ECOHIS might be better deployed in epidemiological surveys, and the short-form P-CPQ and FIS would be preferable for work in clinical samples with high disease levels, as suggested by Thomson \textit{et al.}\textsuperscript{(145)}. On the other hand, a UK study that used ECOHIS showed its limited sensitivity to change due to the low levels of dental problems reported in their sample at baseline\textsuperscript{(142)}. Comparisons of OHRQoL before and after GA between different studies should be interpreted with care. First, the outcome may be influenced by the country’s general oral health situation. Thus, the dental condition leading to treatment under GA may have an impact on the results and the potential for improvement would vary with the degree of severity. Second, cultural differences may have an impact on how children and parents experience an improvement in oral health; in some countries, more serious problems may over shadow oral health problems. Third, variations in instruments used to measure OHRQoL and age of the children may influence the results. The aforementioned factors were recently discussed in a systematic review\textsuperscript{(147)}.

Still, our findings of a positive effect of dental treatment of children with severe caries are in line with the conclusions made in the Jankauskiene \textit{et al.} review\textsuperscript{(147)}, that dental treatment under GA resulted in an immediate improvement in quality of life for the child and for the family.
5.1 Pre- and post- Early Childhood Oral Health Impact Scale (ECOHIS).

OHRQoL was originally conceptualized in 1978 and is defined as that part of a person’s quality of life affected by the oral health\(^{148}\). This concept focused on the patient as a whole and, therefore, emphasized the holistic model of oral health. OHRQoL is assessed by either asking patients questions regarding person’s functioning (e.g., biting, chewing), sensation of pain, psychological (self-esteem), and social wellbeing, or having caregivers answer these questions for pediatric patients (proxy measurement). The latter approach was followed in the present study.

5.1.1 Child impact

By analyzing the distribution of child impact factors in our study, when asked regarding child pain symptoms, in the first survey before DGA, most of the parents suggested that their children occasionally complained of pain. The results of this study for this factor were different from that of the study conducted by Hashim et al. in Malaysian children\(^{149}\). The majority of the parents in the present study suggested that their children occasionally had difficulty in drinking hot or cold beverages due to dental problems while in Pahel et.al.,\(^{(9)}\)Hashim et.al.\(^{(149)}\) and Farsi et.al.\(^{(10)}\) studies, parents suggested that their children never/hardly ever complained. For the issue of difficulty in eating, the majority of the parents in our study suggested that their children occasionally had difficulty in eating due to dental problems or treatments; which was different from parents reported by Hashim et.al.\(^{(149)}\) and Pahel et.al.\(^{(9)}\).

Many parents reported that their child hardly ever or never complained of difficulty in pronunciation, missed preschool/school or daycare, had been irritated or frustrated, avoided smiling or laughing or avoided talking due to dental treatments or problems which were in accordance with the studies conducted by Pahel et.al.\(^{(9)}\) Hashim et.al.\(^{(149)}\) and Farsi et.al.\(^{(10)}\).
Explanation for a higher number of “occasionally or hardly ever” responses from parents of children with high $dmft$ ($dmft = 13.8$) score maybe attributed to the fact that dental caries and infections are mostly chronic in nature and do not cause severe pain in many instances$^{(150)}$.

5.1.2 Family impact

In the present study, most of the parents suggested that they have occasionally or hardly ever been upset, guilty, or taken time off from work because of their child's dental problems or dental treatments which was analogous to that of the study conducted by Pahel et.al.(9). This piece of the results was different from Pahel et.al.(9) and Hashim et.al.(149) studies for the issue related to financial impact where in most of the parents suggested that they had never have financial impact due to their child's dental problems or treatments while in our study the parents’ answer to the same issue was “hardly ever”.

5.2 Distribution of the scores of ECOHIS domains by demographic characteristic of participants.

In our study, the 173 participants were 2-6-year-old preschool children with ECC. They were almost equal numbers of children who were 2-4 years or within 4 to 6 years old. Dental treatment of children under GA is the last treatment option after treatment on dental chair is unsuccessful based upon expert and/or consensus opinion by experienced clinicians$^{(133)}$.

We found that many preschool children with ECC came from families whose parents had a high educational level. These finding were opposite to findings from another related study that showed children with higher levels of parental education had decreased prevalence of dental caries$^{(139)}$. 
The parents reported greater impacts on boys than on girls which was similar to Jankauskiené study\textsuperscript{(129)}, while Klaassen \textit{et al.} found no gender differences in impacts were observed\textsuperscript{(131)}. Psychological factors may have played a role, but confirming and explaining this finding will require further research. The highly educated parents reported higher child impacts than did parents with a lower level of education. This is an interesting finding that raises questions about different health values among parents with regard to their educational level. In general population, a higher level of parental education is associated with better OHRQoL in children\textsuperscript{(139)} but this might be different among parents of children in areas with high levels of dental disease.

5.3 Changes in ECOHIS scores from baseline to follow-up.

The majority of parents in our study reported that their children had dental problems requiring treatment. This was reflected in this study by the high mean UAE-ECOHIS scores at baseline in both CIS (20.47) and FIS (11.33). In this respect, the baseline and follow up mean scores of a similar study conducted among Chinese children in 2011 revealed lower mean ECOHIS scores compared to our study\textsuperscript{(136)}. Higher mean scores of ECOHIS were reported in other studies conducted among Australian children in 2016 and 2017\textsuperscript{(134,135)}.

In our study, the mean scores significantly declined following dental treatment under GA, indicating an improvement in preschool children’s OHRQoL. Therefore, the UAE-ECOHIS was sensitive to changes in OHRQoL because the mean scores between pre- and post-treatment were statistically different.

Overall, the magnitude of change of the UAE-ECOHIS following treatment which was assessed by the effect size (ES) was considered large (ES>0.7). The ES of both CIS and FIS was (2.8) and (2.2) respectively. A larger ES of CIS and FIS may be due to the fact that all our sample children had severe ECC. Hashim \textit{et al.} in 2018 reported ECC to be
significantly related to OHRQoL of preschool children\(^{(149)}\). The aforementioned study also found large effect size for CIS impact but medium ES of FIS impact\(^{(149)}\). A Saudi study in 2014 showed that both CIS and FIS scales and all their subscales had large ES with the exception of social wellbeing, which showed moderate ES (ES=0.59)\(^{(2)}\).

The greatest relative changes were seen in the oral symptoms (ES= 3.4) and the parent distress (ES= 2.8). This indicated that treatment of ECC under GA had an immediate effect on preschool children’s OHRQoL compared to that of the family. Dental diseases frequently caused oral pain which might cause oral dysfunction, i.e. difficulty in eating or drinking, and disturbed child psychology, i.e. having trouble sleeping. Therefore, the impacts on the child were felt by parents a lot more than other domains. These findings were consistent with findings from other similar studies\(^{(2,136,142)}\).

‘Child self-image and social interaction’ domain of CIS sub-scale showed large ES but lowest compared to the rest sub scales in accordance with another similar study\(^{(129)}\).

Possible explanations might be that a child’s oral health and appearance was not important for peer-group acceptance at such a young age, and may demonstrate limited parents’ knowledge about the social aspects of a child’s OHRQoL\(^{(129,151)}\).

These findings can partly be attributed to different follow-up times, but the high prevalence of caries and poor dental health among young UAE children certainly plays a role also: the more serious the problem, the more evident the results would be.

5.4 Relationship between baseline dmft, CIS and FIS

There was no statistically significant relationship between UAE-ECOHIS score change and the dmft of the children except with changes in child self-image and social interaction. A similar study found that ECOHIS change was statistically significantly higher in children with higher dmft scores compared with lower dmft\(^{(10)}\). On the other hand, other studies conducted in India and Iran found no difference in the ECOHIS change in score
relative to \textit{dmft} scores\textsuperscript{(152,153)}. Possible explanation to this might be related to the nature of detection of carious lesions using the \textit{dmft} scoring system. The \textit{dmft} score does not take into account the stages of progression of carious lesions, for example early lesion or deep severe carious lesion were charted as decayed teeth only. Therefore, the use of a more precise charting techniques such as the ICDAS II or the Pulpal involvement, Ulceration due to trauma, Fistula and Abscess (PUFA/pufa) index for the detection of carious lesions may provide better clinical information in the investigation of OHRQoL in children\textsuperscript{(153,154)}.

\textbf{5.5 Dental treatment provided under general anesthesia}

Our study presented new information about the types of dental treatment under GA among children in UAE. The mean \textit{dmft} was 13.8 (+3.07), which is higher than other national reports by Kowash \textit{et.al.}\textsuperscript{(155)} in a study conducted in Al Ain 2014 investigating the severity of and contributing factors of early childhood caries (ECC) in preschool children seeking care in Al Ain Dental Centre who found that the \textit{dmft} was (10.9) and also international studies, for example, Jankauskienè \textit{et.al} \textsuperscript{(12.9 ± 3.5)}\textsuperscript{(129)}.

The majority of treatment provided for our study population were preformed metal crowns (46.5\%) cervical pulpotomy (a pulp therapy procedure -45\%) for the posterior teeth. On the other hand, 22.3\% of anterior teeth were restored with zirconia crown which was a preferred treatment option for its esthetics and retention properties\textsuperscript{(156)}, compared to 15.3\% restored with composite restoration. This was different than other studies where most common treatment were either extraction\textsuperscript{(157)} or composite restorations\textsuperscript{(158)}. So, restorative treatments were one of most common treatments in our study which is in agreement with previous studies in many European countries\textsuperscript{(159,160)}, North America\textsuperscript{(161)}, the Middle East\textsuperscript{(162)}, Asia\textsuperscript{(163,164)}, and New Zealand\textsuperscript{(165)}. This is in contrast with other
centers that provide mostly exodontia services under GA among British and Australian children\textsuperscript{(157,166,167)}.

5.6 Limitations of the study

- The sample of the study was a convenience sample, a more representative sample with proper randomization could have resulted in less biased results.
- The present study was conducted in a center that provided only same day DGA for ASA I and II patients, therefore medically compromised patients who are commonly treated with DGA were excluded.
- The reporting of pain could have been underestimated by parents due to the fact that pain might not have been present at the time the questionnaires were completed.
- An attempt was made to conduct the study in a referral specialized center that treated children from all of the Emirates of the UAE. However, the majority of the participants were from the Abu Dhabi Emirate. As discussed before, the reasons may be attributed to the following: the higher caries levels in Abu Dhabi Emirate, the ease of access and the full insurance cover provided for the benefit of Abu Dhabi Emirati children.
- An attempt was made to have the same parent who completed the first survey to do the same for the second survey, in very few cases; the same parent was not available and we had to settle for the other parent to do so.
- The first survey was conducted on paper and second survey was conducted by a telephone call. This might have affected the consistency between the answers.
• It would have been advantageous to record the weight of all the children receiving DGA before the procedure and at the time of the follow up questionnaire to monitor improvement in the child development.

• We didn’t take multiple extraction of posterior teeth into account when asking Q3 (regarding the ability to chew food) in the 2nd survey. Multiple extraction of posterior teeth might have a negative impact on the masticatory function.
6. CONCLUSIONS AND RECOMMENDATIONS

Within the limitations of this study, the following conclusions and recommendations can be drawn:

Conclusions:

- Significant improvements were found in all child and family physical, psychological and social aspects of oral health quality of life following comprehensive dental treatment under GA.
- The effect size of CIS and FIS factors following DGA were found to be large (ES> 0.7)
- The changes in the oral health impact of the child self-image and social interaction was statistically related to the child’s caries experience.
- The majority of treatment provided under DGA in our study population were cervical pulpotomies and preformed metal crowns.

Future recommendations:

- There is a need for studies to involve more children including those with special needs and medically compromised children in all UAE seven emirates.
- The participants in this study were preschool children. There is a need for studies surveying the effect of DGA on OHRQoL of school age children and may be with the questionnaires being filled by children and not their parents/guardians.
- In this study and most other studies the effects of DGA were assessed only for a short period of time. It would be beneficial to assess the long term effects of dental treatment under GA on the patients’ quality of life.
7. REFERENCES


83. McDonald RE. Dental caries in the child and adolescent In: McDonald RE, Avery DR: Dentistry for the child and adolescent. 7th edition 2000;326-327.


106. US Food and Drug Administration. FDA review results in new warnings about using general anesthetics and sedation drugs in young children and pregnant women


Appendix I: Ethical Approval Forms

Date: 6/12/2016

Dear Dr Al Antali – Paediatric dental Resident

Re: Your research protocol

Titled: Changes in children’s……

Thank you for submitting your research protocol to the Research and Ethics committee of the Hamdan Bin Mohammed College of Dental Medicine, MBRU.

It was considered at the meeting held on: 23/10/2016

After appropriate revision of the protocol approval has been given. If you need specific guidance, please make an appointment to see the Chair, Prof A Milosevic, as soon as possible. The committee would like to remind you that it is a requirement of the programme that you complete a research dissertation, which comprises 15% of credits within the 3-year MSc programme.

With best wishes
Yours sincerely,


Prof A Milosevic

Chair, Research and Ethics Committee, HBMCDM
Appendix II: Consents Form

Parents Information and Informed Consent Form

Title of Study: Changes in Children’s Oral-Health-Related Quality of Life Following Dental Rehabilitation Under General Anaesthesia in Dubai, United Arab Emirates

Principal Investigator: Dr. Kholoud Obaid Al Antali, Department of Paediatric Dentistry, Hamdan Bin Mohammed College of Dental Medicine, Building 34, Dubai Healthcare City, Dubai, UAE. Telephone: (050) 8167799

Please take your time to review this information form, and feel free to consult with or discuss this study with your dentist, colleagues, family, friends, and/or physician before deciding whether or not to participate. If you have any questions regarding the study or any related issues we encourage you to ask the principal investigator, as listed above. This consent form may contain words that you do not understand. Please ask the research staff to explain any words or information you do not clearly understand.

Purpose of the study

This study is being conducted at the Hamdan Bin Mohammed College of Dental Medicine, Department of Paediatric Dentistry; to assess whether dental rehabilitation of young UAE children under GA improved OHRQoL for children and their families, to identify epidemiological factors that are associated with parental ratings of child’s OHRQoL and changes associated with dental treatment.

Study procedures

If you choose to take part in this study, the following procedures will happen: your child will be examined clinically as part of her/his assessment before undergoing general anesthesia dental treatment using mouth mirror and probe and the presence or absence of
dental caries (“cavities”) will be recorded. You will also have requested to complete short questionnaire before and after your child’s treatment (see attached copy).

No treatment will be provided to, or denied from, your child as a result of your participation in this study. You may stop participating in this study at any time. However, if you decide to stop participating, we encourage you to talk to the research staff first.

**Risks and discomforts**

There are no recognized risks or discomforts that may be caused to your child by participation in the study.

**Benefits**

There may or may not be a direct benefit to your child from participating in this study. We hope the information we collect will help profession in providing the best possible oral health care for their children.

**Cost / Payment**

There is no cost to you for participating in the study and you will receive no payment or reimbursement for any expenses related to taking part in this study.

Alternatives: You should feel no obligation to participate in the study.

**Confidentiality**

All information obtained from this study is confidential and will remain so. Information gathered in this study may be published or presented in public forums; however your and your child’s name and other identifying information will not be used or revealed. In any published data, your identity (and your child’s) will be protected and treated as confidential according to the Personal Health Information Act of UAE. To protect your identity, every participant will be given a Study Number instead of their name in all documents related to the study. All information obtained from this study will be used strictly for research purposes only. If the study information is to be used in any subsequent
investigation, your consent will be taken.

Hamdan Bin Mohammed College of Dental Medicine Research Ethics Board may review study records for purposes of quality assurance only. Despite efforts to keep your personal information confidential, absolute confidentiality cannot be guaranteed. Your personal information may be disclosed if required by law.

All records relating to this study will be kept in a secure, locked area and only those persons identified will have access to these records. If any of your child’s medical/research records need to be copied to any of the above, his/her name and all identifying information will be removed. No information revealing any personal information such as your/your child name, address or telephone number will leave the HBMCDM.

Voluntary participation / Withdrawal from the study

Your decision to allow your child to participate in the study is voluntary. You may refuse to give consent for child to participate in the study or withdraw from it at any point in time. If the research staff feels that it is in your child best interest to withdraw her/him from the study, they will remove you without your consent.

We will tell you about any new information that may affect your child health, welfare, or willingness to stay in this study.

Questions

Please feel free to ask questions regarding the study or anything related to it that requires further clarification. To contact the research staff regarding a question, please call:

Dr. Kholoud Obai Al Antali at (050) 8167799 or Dr. M. Kowash at (050) 593-9004.

Do not sign this consent form unless you have had a chance to ask questions and have received satisfactory answers to all of your questions.
b. Statement of Consent

I have read this consent form. I have had the opportunity to discuss this study with **Dr.Kholoud Al.Antali** and/or her research staff. I have had my questions answered in a language I understand. All risks, benefits, costs, and alternatives regarding this study have been thoroughly explained to me. I believe that I have not been unduly influenced by any research team member to participate in the study by any statements or implied statements. Any relationship I or my child may have with the research team has not affected my decision to participate. I understand I will be given a copy of this consent form after signing it. I understand my and my child’s participation in the study is voluntary and I may choose to withdraw my child from it at any point in time. I freely agree to participate in this research study and I give consent for my child to participate in the research study as well.

I understand that any information regarding my child’s identity will be kept confidential, but that confidentiality cannot be guaranteed. I authorize the inspection of any of my records related to this study by the Hamdan Bin Mohammed College of Dental Medicine Research Ethics Board for quality assurance purposes.

By signing this consent form I have not waived any of the legal rights that I or my child have as a participant in a research study.

Parent/legal guardian’s signature: ______________________

Date: ____________________ (day/month/year)

Parent/legal guardian’s printed name: _______________________________

I, the undersigned, attest that the information in the participant Information and Consent Form was accurately explained to, and apparently understood by, the participant or the
participant’s legally acceptable representative and that the consent to participate in this study was freely given by the participant or the participant’s legally acceptable representative.

Witness signature: ____________________________

Date: ___________________ (day/month/year)

Witness printed name: ______________________________________
استمارة الموافقة

هذا البحث تقوم به د. خلود عبد الخديم، طالبة ماجيستر في طلب أسنان الأطفال في كلية حمدان بن محمد لطب الأسنان، جامعة محمد بن راشد للطب والعلوم الصحية، دبي.

موضوع البحث: استبيان في البحث عن التغييرات في الأطفال المتعلقة بصحة الفم و الأسنان و تأثيرها على حياتهم اليومية بعد إعادة تأهيل الأسنان تحت التخدير العام في دبي، دولة الإمارات العربية المتحدة.

المشاركين: من أجل التأهيل للأجابة على الاستبيان، يجب أن يكون المشاركون في الاستبيان أحد القائمين على رعاية الأطفال في مرحلة ما قبل الدراسة من عمر 2-6 سنوات.

تتوقع أن يشارك 100 شخص في هذه الدراسة.

الإجراءات: يمكن ملء الاستبيان عن طريق حوار مباشر مع طبيب الأسنان، الجزء الأول من الاستبيان يتكون من معلومات عامة مثل عمر الطفل و المستوى التعليمي. الجزء الثاني من الاستبيان يتكون من 13 سؤال مبني على المعرفة والمقاييس والتجارب والمخاطر والفوائد. الاستبيان يستغرق حوالي 10 دقائق.

هذه الدراسة اختيارية تماما. إذا كانت هناك أي أسئلة لا تريد الإجابة عنها يمكن تركها بدون جواب.

المخاطر والفوائد: لا يوجد مخاطر معروفة مرتبطة بهذه الدراسة. النتائج التي ستمتغلب عليها ستلعب دورا مهما في تحديد الاهداف المناسبة التي يمكن أن تساهم في تطوير برامج الصحة الفموية الوقائية التي ستساعد في الحد من انتشار تسوس الأسنان في الإمارات.

المشاركة اختيارية: وهذا يعني أنه يمكن أن تقرر عدم المشاركة. لك كامل حرية الانسحاب من الدراسة في أي وقت دون تحمل أي أثر مترتبة عليها.

السرية: المعلومات التي يتم الحصول عليها من هذه الدراسة سرية. أي معلومات يمكن استخدامها لتعرف عليك أو على الطفل سيتم حفظها بسرية تامة.
موافقة: لقد قرأت وفهمت المعلومات المذكورة أعلاه. أوافق على المشاركة في الدراسة. في حال كانت عندي أي أسئلة يمكنني التواصل مع الباحث: د. خلود عبيد الخديم على الرقم: 0508167799 أو عن طريق البريد الإلكتروني Kholoud.Alantali@hbmcdm.ac.ae.

أو التواصل مع المشرف د. مولود كواش - مسؤول قسم طب أسنان الأطفال في كلية حمدان بن محمد لطب الأسنان، دبي mawlood.kowash@HBMCDM.ac.ae.

اسمك: 
توقيع:
Appendix III: Demographic Data Collection Sheet

I.D number: ..........................................................

Child Medical file No.: __________________________

Gender: ☐ Male    ☐ Female

Child Date of birth: D/d☐☐ M/m☐☐ Y/y☐☐☐☐

Number of Siblings including the study child: ………

Mother age: ☐ 20-29    ☐ 30-39    ☐ 40-49    ☐ 50-59

Father age: ☐ 20-29    ☐ 30-39    ☐ 40-49    ☐ 50-59

Educational level (M): ☐ None    ☐ primary education    ☐ Secondary education    ☐ Tertiary education

Occupational Status (M): ☐ Unemployed    ☐ student    ☐ Businesswomen    ☐ Professional

Educational level (F): ☐ None    ☐ primary education    ☐ Secondary education    ☐ Tertiary education

Occupational Status (F): ☐ Unemployed    ☐ student    ☐ Businessman    ☐ Professional
Appendix IV: Questionnaires

English version

The Early Childhood Oral Health Impact Scale (ECOHIS)

"Problems with the teeth, mouth or jaws and their treatment can affect the well-being and everyday lives of children and their families. For each of the following questions please circle the number next to the response that best describes your child's experiences or your own. Consider the child's entire life from birth until now when answering each question. If a question does not apply, check 'Never'"


1. How often has your child ..... in the teeth, mouth or jaws? (Child symptoms domain)
   a. had pain

2. How often has your child......because of dental problems or dental treatments? (Child function domain)
   a. Had difficulty drinking hot or cold beverages
   b. Had difficulty eating some foods
   c. Had difficulty pronouncing any words
   d. Missed preschool, daycare or school

3. How often has your child......because of dental problems or dental treatments? (Child psychological domain)
   a. Had trouble sleeping
   b. Been irritable or frustrated
4. How often as your child......because of dental problems or dental
treatments? (Child self-image/social interaction domain)
   a. Avoided smiling or laughing when around other children
   b. Avoided talking with other children
5. How often as your child......because of dental problems or dental
treatments? (Child self-image/social interaction domain)
   a. Felt guilty
   b. Been upset
6. How often.... (Family function domain)
   a. Have you or another family member taken time off from
      work.....Because of your child's dental problems or dental treatments
   b. Has your child had dental problems or dental treatments that had a
      financial impact on your family?
## Arabic version

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*หมายَة عربية*
Appendix V: Data Collection Proforma
Appendix VI. BSPD Poster

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Changes in UAE children’s oral-health-related quality of life following dental general anaesthesia
K. ALANTALI, M. ALHALABI, I. HUSSEIN, A. KHAMIS & M. KOWASH
Mohammed Bin Rashid University of Medicine and Health Sciences, Dubai, UAE

Background: Early childhood caries (ECC) is a very common disease that results in poor Oral Health Related Quality of Life (OHRQoL) and general health if left untreated. Many patients with severe ECC receive treatment under dental general anaesthesia (DGA).

Aim: To examine the OHRQoL of United Arab Emirates (UAE) preschool children in need of DGA and analyse the impact of DGA treatment on the OHRQoL of the children and their families.

Methods: 173 parents (of 173 children, mean age 4.6 years ±1.86) completed an Early Childhood Oral Health Impact Scale survey [(ECOHIS) prior to and 2–3 months’ post DGA. Child Impact Section (CIS) and Family Impact Section (FIS) of ECOHIS scores range from 0 to 45 and 0 to 20, respectively. Higher scores indicate a greater oral health impact and poorer OHRQoL. Post-operative data were compared with baseline data gathered before DGA using paired t-test.

Results: The ECOHIS decreased post-operatively, indicating an improvement in the children’s OHRQoL immediately after the DGA treatment (P < 0.05) and the scores remained low at the 2–3 months’ evaluation. There was a reduction in the CIS from 20.47 (±7.23) to 10.29 (±2.60) and in the FIS from 11.345 (±3.80) to 4.78 (±1.45) using the Kruskal-Wallis test. Parents rated their child’s oral health as higher after the DGA treatment (P < 0.001)

Conclusion: The OHRQoL of preschool UAE children requiring DGA was seriously compromised. DGA treatment resulted in significant improvement of the children’s OHRQoL. DGA, according to the parents, had a positive impact on the family’s quality of life.