

## ORIGINAL RESEARCH

# Change in oral health-related behaviours of children before and after dental treatments under general anaesthesia

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**Abstract**

This study evaluated the behavioural changes pertaining to children's oral health before and after the dental general anaesthesia (DGA), with particular focus on the factors associated with these changes. The records were collected for the children who received DGA from July 2015 to November 2016, and relevant questionnaires were obtained from their parents/guardians for the information prior to and after the DGA. The questionnaire included Early Childhood Oral Health Impact Scale (ECOHS) and Dental Subscale of Children's Fear Survey Schedule (CFSS-DS) to investigate the changes in Oral Health-related Quality of Life (OHRQoL) and dental fear. The DGA impact on children's oral hygiene habits and oral health-related behaviours was assessed by analysing the data. The chi-square test and Mann-Whitney test were employed to evaluate the differences. Total of 141 patients (89 before DGA and 77 after DGA, 25 being common) participated in this study. There were 60 children below 5 years and 29 over 5 years before DGA, while 41 children below 5 years and 36 over 5 years after DGA. Most parents/guardians were educated above undergraduate level (59.6% before DGA, 55.8% after DGA). More children lived with grandparents (61.8% before DGA, 54.5% after DGA) than only with parents (20.2% before DGA, 26.0% after DGA). In total, 73.0% (65/89) children before DGA brushed teeth more than twice a day. This proportion increased to 90.9% after DGA (70/77,  $p = 0.03$ ). The eating difficulty decreased after DGA according to ECOHS ( $p = 0.01$ ). CFSS-DS score also decreased after DGA ( $p < 0.05$ ). After DGA, children's oral hygiene habits and oral health-related quality of life (OHRQoL) improved, children fear for dental treatment decreased, and parents became more attentive towards children oral health.

**Keywords**

Dental general anaesthesia (DGA); Dental anxiety; Oral health-related behaviours

## 1. Introduction

Early childhood caries (ECC) refers to the caries lesions in primary tooth of children below 71 months age [1]. Professional treatment needs cooperation from children with ECC, and children behaviour mainly depends on age [2]. Children below 6 years require additional assistance in dental treatment especially with prolonged or multiple visits. The ambulatory treatment is thus problematic in paediatric dentistry because of fear, anxiety or disabilities [3].

According to the American Academy of Pediatric Dentistry (AAPD), dental general anaesthesia (DGA) is a potential treatment for paediatric patients not tolerating the routine dental treatment [4]. General anaesthesia (GA) can provide a better operative environment in which high-quality dental treatment can be completed in a single session [5]. DGA is safe and effective compared to the conventional restraint treatment [6]. However, potential risks associated with anaesthesia make it a

last resort for dental treatment [7–9].

Although DGA has been widely used, the dental caries risk in children after DGA remained high. Ehlers V *et al.* [10] revealed high caries risk in children even after receiving DGA. Further prophylaxis programmes were necessary to prevent caries and to use general anaesthesia. Lin YT *et al.* [11] found that past caries in primary dentition could be a risk for future caries in permanent teeth. Some studies suggested increase in the rate of repeated DGA in 10 years [12]. Therefore, prevention of caries recurrence and improvement of oral health care in at-risk children were of paramount importance.

When evaluating the effectiveness of dental treatment, changes of patients' quality of life should be measured [13]. Recent studies on OHRQoL reflect the link between oral health and social factors, contextual factors and rest of the body [14, 15]. Changes in the OHRQoL of children with severe dental caries were observed before and after DGA. Several studies portrayed improvements in OHRQoL after

DGA [16–19]. There were other studies presenting different perspectives. Klaassen *et al.* [20] found minor improvements in the life quality. Aikaterini L *et al.* [21] depicted that oral health-related behaviour was not improved as expected after DGA. Changes in oral health-related behaviours of children before and after DGA were ambiguous and uncertain. The purpose of this survey was thus to evaluate changes in children oral health-related behaviours before and after DGA, with focus on the factors associated with these changes.

## 2. Materials and methods

### 2.1 Participants

A total of 141 patients aged 2–9 years were included in this study. Eighty-nine (89) patients participated in the questionnaire before DGA, 77 after DGA, and 25 were common in both before and after DGA.

The inclusion criteria were: (a) dental treatment under general anaesthesia; and (b) no systemic diseases. The study collected information regarding the OHRQoL and family education of the patients before and after DGA treatment at Guangzhou Women and Children's Medical Center from July 2015 to November 2016. The questionnaires were completed by their parents/guardians.

### 2.2 DGA procedure

The preoperative examinations included blood tests, urine tests, coagulation, liver and kidney function tests, chest lateral radiographs and electrocardiograms. Preoperative oral hygiene guidance and precautions were given to the patients without contraindications before general anaesthesia. Signed informed consents about DGA were acquired, and children were scheduled for the surgery. Treatments included tooth extraction, gap retention, caries filling, endodontic treatment (such as pulpotomy, root canal), anterior transparent crown restoration, and posterior metal preformed crown restoration. Local fluoride coating, and pit and fissure sealing were applied for the prevention (Fig. 1).

### 2.3 Questionnaires

The OHRQoL instrument was a 38-item questionnaire including five sections: basic information (age, patient sex, parent education and family structure), children brushing habits (brushing frequency, brushing time and parental assistance), part of the Early Childhood Oral Health Impact Scale (ECO-HIS) [22], part of the Children's Fear Survey Schedule-Dental Subscale (CFSS-DS) [23], and family education. The part of ECOHIS had functional limitations (3 items) and social well-being (3 items). The answers were scored through four-point Likert scale (response options: 0, "Never"; 1, "Once or twice"; 2, "Sometimes"; 3, "Often"). CFSS-DS had 6 items for assessing children anxiety. Parents rated children fear on 1–5 scale with 1 meant "not afraid at all" and 5 "very afraid".

### 2.4 Data collection

In this study, the hospital records were gathered for the children who received DGA, and the assistant administered question-

naire prior to dental treatment received by the child under general anaesthesia. The questionnaire was administered again if child returned for the visit within study period. The data were integrated and analysed for DGA effect on children and linked with their family education.

## 2.5 Statistical analyses

The data of basic information were presented as percentage (%). The ECOHIS and CFSS-DS total scores were attained by summing up the scores of individual items. The chi-square test and the Mann-Whitney test were employed to evaluate the differences. Calculations for all tests were made using IBM SPSS version 22 (IBM, Armonk, NY, US) with 0.05 significance level.

## 3. Results

### 3.1 Sample characteristics

A total of 141 parents or guardians (89 before DGA and 77 after DGA) participated in this study. The patients' basic information is shown in Table 1. Boys were more (66.3% before DGA, 58.4% after DGA) than the girls (33.7% before DGA, 41.6% after DGA). There were 60 children below 5 years and 29 over 5 years before DGA, while 41 children below 5 years and 36 over 5 years after DGA. A high questionnaires proportion was completed by children's mothers (68.5% before DGA, 62.3% after DGA). The guardians' education was above undergraduate level (59.6% before DGA, 55.8% after DGA). More children lived with grandparents (61.8% before DGA, 54.5% after DGA) than with only parents (20.2% before DGA, 26.0% after DGA).

### 3.2 Oral hygiene habits

Table 2 depicts the changes in children tooth-brushing habits before and after DGA. The frequency of children tooth-brushing after DGA was higher than before DGA ( $p = 0.003$ ). A total of 73.0% (65/89) children brushed teeth for more than twice a day before DGA, while 90.9% (70/77) children after DGA. However, no significant difference was found in children's time spent in brushing, or if they required assistance from parents after DGA compared to before DGA.

### 3.3 Aspects of oral health-related behaviours

The scores of items on ECOHIS and CFSS-DS are given in Tables 3 and 4, respectively. In the functional limitations subscale of ECOHIS, the degree of difficulty in eating after the DGA was lower than that of before DGA ( $p = 0.01$ ). However, no significant changes were observed in the difficulty of drinking hot or cold beverages before and after DGA, or difficulty in pronouncing words. The children scores before and after DGA were not much different on emotional and social well-being subscales. In the CFSS-DS items, the children fear after DGA was less than before DGA regarding going to hospital ( $p = 0.005$ ), examining mouths ( $p = 0.003$ ), instruments in mouths ( $p = 0.006$ ), and dentist drilling ( $p = 0.001$ ). However, no significant change was seen in children's attitudes towards



**FIGURE 1.** Oral condition of patients before and after DGA. (A–C) Intraoral view of 3 patients before and immediately after DGA.

dental injections before and after DGA.

### 3.4 Family education

Table 5 illustrates the changes in children's family education before and after DGA. The study found that more parents spent time explaining children of the oral health importance (98.7%, 76/77) after DGA than before DGA (88.8%, 79/89,  $p = 0.01$ ). However, no significant difference was observed between the families before and after DGA regarding intimidation from dentist, encouraging and praising children, being a role model for children, framing rules to follow, and having strict requirements for children.

## 4. Discussion

It was found at the clinics during follow-up visits that the oral hygiene of children underwent DGA and their cooperation

during dental treatment had improved. This led to the study herein for exploring reasons of these changes. The changes in OHRQoL were recorded for children undergoing DGA to prevent dental caries in high-risk children by changing their oral hygiene habits. Study showed the change trend of children's family education before and after DGA which had been undermined in previous studies. The preoperative and postoperative behaviours of the same group of children were not compared, however the study showed overall trend of behavioural changes in children before and after DGA.

Most DGA patients was below 5 years age as children over 5 years age could cope with routine dental treatments. Most questionnaires were completed by children's mothers meaning that in the Chinese family structure, mothers were investing more in companionship, education and childcare, and they had significant impact on children development. Parents education had vital role in maintaining family health and well-being.

**TABLE 1. Characteristics of the included children and guardians before DGA.**

Characteristics	Before DGA		After DGA	
	Number	Percent	Number	Percent
<b>Gender</b>				
Boy	59	66.3%	45	58.4%
Girl	30	33.7%	32	41.6%
<b>Age</b>				
<5	60	67.4%	41	53.2%
≥5	29	32.6%	36	46.8%
<b>Relationship with patients</b>				
Father	26	29.2%	25	32.5%
Mather	61	68.5%	48	62.3%
Else	2	2.3%	4	5.2%
<b>Guardian education</b>				
Below junior high school	2	2.2%	5	6.5%
High school	34	38.2%	29	37.7%
University or above	53	59.6%	43	55.8%
<b>Family structure</b>				
Parents and children	18	20.2%	20	26.0%
Grandparents, parents and children	55	61.8%	42	54.5%
Else	16	18.0%	15	19.5%

DGA: dental general anaesthesia.

**TABLE 2. Brushing habits changes of children before and after DGA.**

Brushing habits	Before DGA		After DGA		p value
	Number	Percent	Number	Percent	
More than twice a day	65	73.0%	70	90.9%	0.003*
Parental assistance	74	83.1%	57	74.0%	0.151
More than one minute at a time	69	77.5%	68	88.3%	0.068

\*Statistically significant. Statistically test: Chi-square test. DGA: dental general anaesthesia.

**TABLE 3. Mean values of the early childhood oral health impact Scale (ECOHIS) scores before and after DGA.**

	Before Score	After Score	p value
Difficulty drinking hot or cold beverages	111	83	0.22
Difficulty eating some foods	176	128	0.01*
Difficulty pronouncing any words	63	71	0.18
Had trouble sleeping	79	52	0.11
Avoided smiling or laughing when around other children	220	181	0.57
Avoided talking with other children	239	203	0.84
Total score	888	718	0.09

\*Statistically significant. Statistically test: Mann-Whitney test.



**TABLE 4. Mean values of the children's fear survey schedule-dental subscale (CFSS-DS) scores before and after DGA.**

	Before Score	After Score	<i>p</i> value
Having to go to the hospital	286	222	0.005*
Having someone examine your mouth	291	219	0.003*
Having somebody put instruments in your mouth	340	269	0.006*
Injections (shots)	327	261	0.311
The dentist drilling	402	297	0.001*
The noise of the dentist drilling	390	291	0.004*
Total score	2036	1559	<0.001*

\*Statistically significant. Statistically test: Mann-Whitney test.

**TABLE 5. The changes of parents' education methods before and after DGA.**

Parents' education methods	Before DGA		After DGA		<i>p</i> value
	Number	Percent	Number	Percent	
Intimidate children with a dentist	4	4.5%	8	10.4%	0.144
Explain to children the importance of oral health	79	88.8%	76	98.7%	0.010*
Always encourage and praise children	81	91.0%	64	83.1%	0.127
Be a good role model for children	77	86.5%	71	92.2%	0.240
Give children clear rules and execute	50	56.2%	54	70.1%	0.077
Has strict requirements for children	27	30.3%	33	42.9%	0.094

\*Statistically significant. Statistically test: Chi-square test. DGA: dental general anaesthesia.

Studies found that parents with higher education had better oral health care awareness [24]. This survey found that the education level of guardians was mostly above the bachelor's degree.

DGA is linked to emotions, lack of knowledge and uncertainties which bring variety of expectations [25]. With the boom in Chinese economy, young parents are more educated and willing to provide dental treatments under general anaesthesia to their children. More children undergone DGA lived with grandparents than only with parents, suggesting differences in feeding habits, educational achievements and oral hygiene habits between the supervisions of grandparents and parents.

ECC is a complex, multifactor and behaviour-related disease requiring multidimensional arrangements [1]. Fillings are only one aspect of dental caries treatment, however they need assistance pertaining to eating habits, oral hygiene and regular examinations [26]. In this study, it was found that children brushing time and parents help in brushing teeth did not change much after DGA. However, children brushing frequency was improved after DGA which was in accordance with the current literatures [27, 28]. Amin MS *et al.* [29] however believed that dental treatment under general anaesthesia might prompt patients to change oral health-related behaviours in short term, but it was difficult to maintain in the longer run. Therefore, patients treated under general anaesthesia required to strengthen the oral hygiene habits.

Oral diseases could affect children eating, sleep, physical and mental development and imposed burden on parents'

working hours. Studies had shown that dental treatment under general anaesthesia improved patients' oral health, body, emotions and life quality and thus had positive effect on the family [17, 30]. In the ECOHIS, this study indicated that children had fewer eating difficulties after DGA which would help children's physical and mental health. However, in the emotional and social well-being subscales, the children scores before and after DGA were not much different. This might be because most children in this study were preschoolers. They lacked awareness of emotional and social well-beings and were less attentive to these problems [31].

Dental anxiety refers to fear and nervousness levels during oral diagnosis and treatment, and patients' behaviour towards dental anxiety is characterized by increased sensitivity, reduced tolerance and evasion or rejection of diagnosis and treatment [32]. Dental anxiety is a common phenomenon in clinics, however more common in children. The incidence of childhood dental fear is over 80% as per the literature [33, 34]. Dental fear requires management for guiding children back to normal dental care after DGA, since it is linked with behaviours [35]. Regarding the CFSS-DS, this study exhibited that children fear of dental treatment was reduced after DGA. Almost all the participants undergone DGA in the past and being uncooperative answered positively to the facial image scale [21]. These results suggested that treating dental diseases under general anaesthesia was preferred in children with dental anxiety which was also confirmed by previous studies [16].

The DGA intervention on children oral health related behaviours and oral hygiene habits is multifaceted. DGA brings

positive change in attitudes. The changes in children's family education were also explored before and after DGA. Parents gave more importance to children oral health education after DGA. Consequently, it was important to remind dentists to provide relevant education to the parents in their clinical work. Positive guidance of parents to children oral health related behaviours might reduce recurrence of dental caries in children after DGA. Finally, it is acknowledged that this study had limitations including small sample size, and short-term follow-up. More longitudinal studies are required to confirm the results.

## 5. Conclusions

This study revealed that oral hygiene habits and oral health-related life quality of children after DGA were improved, while children's fear of dental treatment was decreased. Parents paid more attention to children oral health education after DGA.

## AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the corresponding author.

## AUTHOR CONTRIBUTIONS

KC—designed this review; MXL—wrote the first draft of Article and analyzed the data; HCX—collected patients' information and extracted the data and checked accuracy of statistical analyses; MML and WWC—issued and collected questionnaires, and all authors critically reviewed the manuscript. The authors declare no competing financial interests.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The protocols were approved by the ethics committee of the Guangzhou Women and Children's Medical Center (2015020908). Informed consents were signed by patients' parents/guardians.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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