

Impact of Dental Rehabilitation Under General Anesthesia on Oral Health-Related Quality-of-Life and Dental Anxiety in Turkish Children

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ABSTRACT

Objective: To analyze children's and parents' oral health-related quality of life (OHRQoL) and children's dental fears before and after the dental rehabilitation under general anesthesia (DRGA). **Material and Methods:** 104 parents and their 3 to 13-year-old children (5.90 ± 2.42) who received DRGA were surveyed before and after DRGA. The children were divided into two groups: Group 1 - healthy children ($n=43$) and Group 2 - children with medical problems ($n=61$). After recording their socio-demographic information, parents completed a self-administered questionnaire named Early Childhood Oral Health Impact Scale (ECOHIS), which includes two main parts - Child Impact Section (CIS) and Family Impact Section (FIS). On the other hand, the children received a dentist-administered questionnaire named Children's Fear Survey Schedule-Dental Subscale (CFSS-DS) and Frankle Behavior Scale (FBS). For statistical analyses, Wilcoxon Signed-Rank, Mann Whitney-U, Kruskal-Wallis, and Spearman's Correlation tests were used. **Results:** A statistically significant decrease in all CIS, FIS, ECOHIS and CFSS-DS scores was observed after DRGA ($p<0.01$). This decline was greater in healthy children than in children with systemic problems ($p<0.01$). **Conclusion:** Children's and parents' OHRQoL showed better results after DRGA. The decreases in dental anxiety in children were observed after DRGA.

Keywords: Oral Health; Child; Quality of Life; Dental Anxiety; General Anesthesia.

Introduction

Dental caries is one of the most prevalent chronic diseases among children [1]. Early childhood caries (ECC) is a common health problem that is described as one or more decayed, missing or filled tooth surfaces in any primary teeth in children the birth to seventy-one months of age [2]. Functional, social and psychological problems due to dental caries affect children and their families negatively and reduce their quality of life [1]. Preschool children are reluctant for treatment because of extensive caries, long-lasting treatment sessions and high levels of dental anxiety [3,4]; moreover, behaviour changes are associated with age [5]. In addition, children with special health care needs (SHCN) have congenital or acquired disabilities that can be physical, developmental, mental or behavioural and need regular medical controls, specialized programs and services [6,7]. Thus, dental rehabilitation under general anesthesia (DRGA) may be preferred for non-cooperated, very young aged children and/or SHCN [5,8]. DRGA is a good treatment option that can be performed in a single session and in a controlled environment in all cases. DRGA also provides pain-free treatment, which decreases dental anxiety [9].

Dental problems in children and adolescents affect daily life and psychological status of patients and their families [10]. Performing all dental treatments under general anesthesia has brought the idea of measuring the change in Oral Health Related Quality of Life (OHRQoL) [5,11-14]. Early Childhood Oral Health Impact Scale (ECHOHIS) can be used to assess OHRQoL before and after the rehabilitation procedures [15]. Although the ECHOHIS was initially used among the children aged 6-14 [15-18], it was developed for children aged 0-5 years who could not answer the questionnaire [15]. Thus, Family Impact Scale (FIS) was defined. The ECHOHIS was constituted in the United States [15], but it has been adapted to use among children in other countries such as French [19], Chinese [20], Swedish [8], Lithuanian [11] children. Thus, the ECHOHIS, which was proved by Peker et al. [21] for the validity and reliability in Turkish population, have been used in Turkey.

Dental anxiety among children, which is recognized as a public health problem in many countries, has a multifactorial etiology [4]. The dental subscale of the children's fear survey schedule (CFSS-DS) is one of the fear survey schedules to evaluate dental anxiety in children. CFSS-DS was developed by Cuthbert and Melamed [22] and validated in Turkish language [23]. Besides, the Frankle Behavior Scale (FBS) is one of the commonly used anxiety scales in children [24].

The aim of this study was to evaluate the effects of general anesthesia in dental treatment on the quality of life, dental fear, and dental anxiety in healthy children and children with systemic diseases.

Material and Methods

Study Design and Sampling

This study is a prospective cross-sectional study. The minimum sample size required to detect a significant difference in ECHOHIS scores was calculated to be at least 39 in each group, (78 in total), considering type I error (α) of 0.05, power (1-beta) of 0.8, an effect size of 0.64 and two-sided alternative hypothesis (H_1).

One hundred and four children aged 3 to 13 who received DRGA at Department of Pediatric Dentistry, İnönü University, Turkey, between January 2019 and December 2019 were included in the study.

CSHCN and the children who did not accept the conventional treatment in the clinic because they had dental anxiety or they were too young were included in this study, while the children who were unable to perform the CFSS-DS questionnaire due to their mental retardation, the children who previously received DRGA, and the children whose parents did not complete the questionnaire were excluded in this study.

Data Collection

The patients applied to the pedodontics clinic one week before the operation. A survey with questions about socio-demographic status, quality of life, and dental anxiety was applied to the children and their parents (63-mother, 41-father) under the supervision of the pediatric dentist, and then they were transferred to the anesthesia pre-operative clinic.

The Turkish version of ECOHIS scale, which had been proven to be valid and reliable by Peker et al. [21], was filled out by the parents under the supervision of a pediatric dentist, and the children responded to the questions in an interview. The ECOHIS based on 13 items were divided into the Child Impact Section (CIS) and the Family Impact Section (FIS). The CIS includes 4 subsections (9 items): symptoms (1 item), function (4 items), psychology (2 items), and self-image and social interaction (2 items). The FIS includes 2 subsections (4 items): parental distress (2 items) and family function (2 items). The ECOHIS items were scored according to the answers from 0 to 5 (0: "never", 1: "hardly ever", 2: "occasionally", 3: "often", 4: "very often", 5: "don't know"). The score ranges for the total ECOHIS, CIS, and FIS are from 0 to 52, from 0 to 36, and from 0 to 16, respectively. The "don't know" responses were recorded as missing. The recommendations in the original version of the survey were followed for data scoring [15]. When there were two missing responses in the CIS and/or one missing response in the FIS, these values were imputed using the other responses' mean value in the corresponding section. Participants with more missing values were excluded from the analysis [15,21]. A higher ECOHIS data score indicates greater impact and/or more problems for OHRQoL [15].

The Turkish version of CFSS-DS, which had been proven to be valid and reliable by Serim-Yıldız and Erdur-Baker [23], was carried out in children by a pediatric dentist (GD or RK) and the parents and children responded to the questions in an interview. The scale includes 15 items related to various aspects of dental treatment. Each item can be scored on a 5 point scale from 1 (not afraid) to 5 (very afraid). The total score range was 15–75. The scores within the range 15–31 indicate a low level of anxiety, while the scores within the range 32–38 indicate a medium level of anxiety, and the scores within the range 39 or more indicate a high level of anxiety [22,23].

The FBS was carried out in children by a pediatric dentist (GD or RK). The scale divides the child's behavior into four categories, ranging from "definitely negative" to "definitely positive" (range from 1 to 4) [24–26].

A medical examination was performed when the children came to the anesthesia clinic with their parents for pre-operative examination by a physician under the supervision of a specialist anesthetist (ASO), and the parents responded to the questions about medical history in an interview. The patients were categorized according to the American Society of Anesthesiologists (ASA) classification [27].

The 104 children were divided into two groups. Group 1 consisted of 41 healthy (ASA I), non-cooperated children, and group 2 was 63 CSHCN (epilepsy, congenital cardiac anomaly, hyperthyroidism,

hearing impairment, etc.) (ASA II - with mild systemic disease: n=29 (27.9%) and ASA III - with severe systemic disease: n=32 (30.8%)).

On the day of the operation, standard anesthesia monitorization was performed peri-operatively to all the patients, such as non-invasive blood pressure, peripheral oxygen saturation, heart rate and electrocardiography. The patients were premedicated in a different room 20 minutes before the induction of anesthesia. If the patient was provided with intravenous cannulation for the induction of anesthesia, premedication was achieved intravenously. If not provided, oral or nasal route was preferred. Nasal route is often routinely preferred in our anesthesia clinic for premedication. Midazolam was administered at a dose of 0.5 mg/kg, 0.5 mg/kg, and 0.1 mg/kg with oral, nasal, and intravenous route, respectively. Twenty minutes after the premedication, the patient was transferred to the operating room. Standard anesthesia induction was preferred and sevoflurane 8% and N₂O 30% in oxygen with a facemask were used for the anesthesia induction. The child was intubated with a nasoendotracheal tube after administering muscle relaxant (rocuronium). Tramadol at a dose of 1 mg/kg or paracetamol at a dose of 15 mg/kg was administered for post-operative analgesia. For each child, hemodynamic data were noted during anesthesia.

The clinical dental examinations were carried out with the assistance of a mouth mirror and a probe in a dental chair under the light of a reflector during DRGA by an experienced pediatric dentist (GD or RK). Before the oral examination, the examiners were trained and calibrated to perform the DMFT/dmft score examination. The intra-examiner reliabilities were recorded as 0.983 and 0.978, respectively, and the inter-examiner reliability was 0.985 (ICC>0.90 is excellent). DMFT/dmft scores were recorded, but any missing teeth not caused by dental caries were not included in DMFT/dmft score. The necessary dental treatments (fillings, pulp amputations, root canal treatments, extractions, scaling and polishing, etc.) and preventive applications (fissure sealant, fluoride varnish) were performed to all the patients.

After the surgery, the patient was extubated and kept in the recovery room under observation. None of the patients had any medical complications during DRGA or in the recovery room. The patients were discharged with the permission of the anesthesiologist. All the parents and the children were given oral hygiene training before the patients were discharged from the hospital.

One month after the operation, the children were called again to the pedodontics clinic with their parents, and the ECOHIS, CFSS-DS, and FBS sections of the questionnaire were repeated. The same parents (63-mother, 41-father), who completed baseline, completed the follow-up surveys. For the children and the illiterate parents, the questionnaire was read aloud and their responses were recorded by the examiner (GD or RK). In addition, these same parents completed the questionnaires under the supervision of the same pediatric dentist. The data were recorded by the same pediatric dentist (GD or RK).

The mean scores before and after ECOHIS for each section were calculated. For each section, the change in scores after the DRGA was calculated by subtracting the mean post-operative scores from the mean pre-operative scores. Negative change scores indicated an improvement in OHRQoL, while positive change scores indicated deterioration [15,21,28].

The effect sizes (ESs) were calculated by dividing the mean of change scores by the standard deviation of the baseline scores [29]. An effect of <0.2 indicated a small but clinically meaningful magnitude of change, 0.2-0.7 a moderate change, and >0.7 a large change [29].

Statistical Analysis

IBM SPSS software (version 21.0 for Windows, IBM Corp., Armonk, NY, USA) was used for data analyses. Kolmogorov-Smirnov ($n > 50$) and Shapiro-Wilk ($n < 50$) were applied to the test for a normal distribution. The pre-treatment and post-treatment scores were compared using the Wilcoxon Signed-Rank test. Mann Whitney-U and Kruskal-Wallis tests were used for comparison between the groups. Spearman's Correlation test was used to measure the correlation between the change score of ECOHIS/CFSS-DS and DMFT/dmft. Also, Multiple Linear Regression test was used to determine the effect of socio-demographic characteristics on OHRQoL. The significance level was accepted as $p < 0.05$.

Ethical Clearance

The study was conducted after obtaining approval from local ethics committee of Medical School (2019/178). The children's parents were well informed on the purpose of the study and they all signed a consent form.

Results

The findings of socio-demographic status are presented in Table 1.

Table 1. Socio-demographic status.

Variables	N (%)
Age (Mean and SD)	5.90 ± 2.42
Sex	
Girl	41 (39.4)
Boy	63 (60.6)
Medical Condition	
Healthy	43 (41.3)
CSHCN	61 (58.7)
Number of Siblings	
1	12 (11.5)
2	41 (39.4)
3	30 (28.8)
4 ≥	21 (20.2)
Order of Birth	
1st	50 (48.1)
2nd or Other	54 (51.9)
Paternal Age (Mean and SD)	39.13 ± 5.52
Maternal Age (Mean and SD)	34.48 ± 6.48
Age of the Parent Completing the Questionnaire (Mean and SD)	36.58 ± 6.47
Paternal Education	
Illiterate	2 (1.9)
Primary School	25 (24.0)
Secondary School	7 (6.7)
High School	35 (33.7)
University	35 (33.7)
Maternal Education	
Illiterate	10 (9.6)
Primary School	55 (52.9)
Secondary School	9 (8.7)
High School	0 (0.0)
University	30 (28.8)

Education Level of the Parent Completing the Questionnaire	
Illiterate	6 (5.8)
Primary School	38 (36.5)
Secondary School	7 (6.7)
High School	12 (11.5)
University	41 (39.4)
Place of Residence	
City Center	91 (87.5)
Suburb	13 (12.5)
Patients' Location	
In the Same City as the General Anesthesia Center	57 (54.8)
In a Different City from the General Anesthesia Center	47 (45.2)
Income Level	
Low (<2000 TRY)	46 (44.2)
Medium (2000-5000 TRY)	53 (51.0)
High (>5000 TRY)	5 (4.8)
DMFT/dmft score (Mean and SD)	11.19 ± 3.65

SD: Standard Deviation, TRY: Turkish Lira.

Of the patients, 144 were treated under general anesthesia, but 40 of them (27.8%) were excluded from the study (72.2% with follow up rate) because the parents of 25 patients did not fill out the survey for some reason before or after the treatment, and 15 of them missed more than two items in the CIS or more than one item in the FIS.

The rest 104 children (63 boys and 41 girls) whose mean ages were 5.90 ± 2.42 (range 3 to 13 years) were included in this study. The survey was filled out by 40.4% fathers (mean age: 34.48 ± 6.48 years) and 59.6% mothers (mean age: 39.13 ± 5.52 years). Of the children, 41.3% were healthy (ASA I) (mean age: 4.42 ± 1.44), while 58.7% of them had systemic problems (ASA II and III) (mean age: 6.95 ± 2.43).

The mean DMFT/dmft score before the treatment was 11.19 ± 3.65 (range: 5–20). It was 10.93 ± 3.48 in healthy children and 11.38 ± 3.78 in CSHCN ($p > 0.05$).

As illustrated in Table 2, the baseline ECOHIS scores were significantly higher than the ECOHIS scores after the treatment. Following the DRGA, in all of the questionnaire sections, there was a significant reduction in the ECOHIS scores ($p < 0.001$). The reductions in CIS and FIS scores following the treatment were 87.5% and 91.2%, respectively, and there was an 88.7% reduction in the total ECOHIS score.

As for the magnitude of change, the total ECOHIS, the CIS, and the FIS demonstrated a large magnitude of change. The ES for each section was large, except for “child self-image” (0.1). The largest ES was for “child symptoms” (2.9), followed by “parental distress” (1.7) (Table 2).

According to the CIS score, no change was observed in the results of 2 children, while the results in one child showed deterioration. Based on the FIS score, no change was observed in 5 parents, while deterioration was detected in 1 parent's score. No change was observed in the results of 3 children according to the total ECOHIS score. In healthy children group, in baseline, CIS, FIS, ECOHIS scores, the “child self-image” and “parental distress” subsections were higher than in CSHCN group ($p < 0.01$).

The spearman correlation coefficients between the CIS and FIS scores were in baseline; $r = 0.464$, $p < 0.001$ and after treatment; $r = 0.439$, $p < 0.001$.

The socio-demographic variables determined in the regression model explain 2.9% of the variances in the change score of ECOHIS (before ECOHIS - after ECOHIS) (Table 3). Although the “education level of the parent completing the questionnaire” variable had the most explanatory power ($\beta = 0.234$), there was no

statistically significant difference in the change score of ECOHIS in terms of this variable ($p > 0.05$). The "ASA" variable had the second most explanatory power ($\beta = 0.143$), and there was a statistically significant difference in the change score of ECOHIS between ASA I and ASA II ($p < 0.05$).

Table 2. Mean total and subscale ECOHIS scores at baseline and follow-up and their observed effect mean differences and effect sizes.

Variables	Pre-Treatment Mean (SD)	Post-Treatment Mean (SD)	p-value*	Change in Score (SD)	Effect Size
Healthy Children (n=43)					
CIS	15.49 (6.71) ^a	2.00 (3.61)	<0.001	-13.49 (6.79)	+2
Child Symptoms	3.44 (0.96)	0.16 (0.43)	<0.001	-3.28 (1.08)	+3.4
Child Function	6.67 (3.16)	1.16 (2.01)	<0.001	-5.51 (3.53)	+1.7
Child Psychology	4.44 (2.73)	0.12 (0.50)	<0.001	-4.33 (2.82)	+1.6
Child Self-image and Social Interaction	0.93 (2.28) ^a	0.56 (1.82)	0.320	-0.37 (2.32)	+0.16
FIS	8.07 (3.39) ^a	0.49 (1.28)	<0.001	-7.58 (2.89)	+2.2
Parental Distress	5.23 (2.20) ^a	0.28 (0.91)	<0.001	-4.95 (2.10)	+2.3
Family Function	2.84 (2.52)	0.21 (0.64)	<0.001	-2.63 (2.38)	+1
ECOHIS	23.56 (8.71) ^a	2.49 (3.86)	<0.001	-21.07 (8.53)	+2.4
CSHCN (n=61)					
CIS	12.77 (5.70) ^b	1.54 (3.16)	<0.001	-11.23 (6.30)	+2
Child Symptoms	3.16 (1.10)	0.34 (0.81)	<0.001	-2.82 (1.23)	+2.6
Child Function	5.74 (3.21)	0.75 (1.54)	<0.001	-4.98 (3.51)	+1.6
Child Psychology	3.72 (2.37)	0.31 (0.89)	<0.001	-3.41 (2.49)	+1.4
Child Self-image and Social Interaction	0.15 (0.68) ^b	0.13 (0.81)	0.786	-0.02 (1.07)	+0.03
FIS	6.16 (3.46) ^b	0.71 (1.82)	<0.001	-5.46 (3.22)	+1.6
Parental Distress	3.95 (2.49) ^b	0.41 (1.22)	<0.001	-3.54 (2.43)	+1.4
Family Function	2.21 (2.15)	0.30 (0.78)	<0.001	-1.92 (2.01)	+0.9
ECOHIS	18.93 (7.72) ^b	2.25 (4.61)	<0.001	-16.69 (8.28)	+2.2
Total (n=104)					
CIS	13.89 (6.25)	1.73 (3.34)	<0.001	-12.16 (6.57)	+2
Child Symptoms	3.28 (1.05)	0.27 (0.69)	<0.001	-3.01 (1.19)	+2.9
Child Function	6.13 (3.21)	0.92 (1.75)	<0.001	-5.20 (3.51)	+1.6
Child Psychology	4.02 (2.55)	0.23 (0.75)	<0.001	-3.79 (2.65)	+1.5
Child Self-image and Social Interaction	0.47 (1.60)	0.31 (1.33)	0.359	-0.16 (1.70)	+0.1
FIS	6.95 (3.54)	0.62 (1.61)	<0.001	-6.34 (3.25)	+1.8
Parental Distress	4.48 (2.45)	0.36 (1.10)	<0.001	-4.13 (2.40)	+1.7
Family Function	2.47 (2.32)	0.26 (0.72)	<0.001	-2.21 (2.19)	+1
T-ECOHIS	20.85 (8.42)	2.35 (4.30)	<0.001	-18.50 (8.62)	+2.2

*Wilcoxon; Effect size ($-\infty$ $+\infty$); 0.2>: Small; 0.2-0.7: Moderate; 0.7<: Large; ^{a,b}Mann Whitney U, $p < 0.01$; Different letters indicate statistically significant differences; SD: Standard Deviation.

Table 3. Explanation of the OHRQoL with multiple linear regression analysis.

Model	B	Std. Error	β	t	p-value
(Constant)	40.828	8.574		4.762	0.000
Gender	-1.065	1.766	-0.061	-0.603	0.548
Medical Status (Healthy/ CSHCN)	-7.194	4.097	-0.413	-1.756	0.082
ASA Classification	1.451	2.485	0.143	0.584	0.561
Number of Siblings	1.196	1.317	0.131	0.908	0.366
Order of Birth	-3.230	2.229	-0.188	-1.449	0.151
Parent (Mother or Father) Completing the Questionnaire	-3.779	2.599	-0.216	-1.454	0.149
Education Level of the Parent Completing the Questionnaire	1.381	1.632	0.234	0.846	0.400

Paternal Education	-0.345	1.315	-0.049	-0.263	0.793
Maternal Education	-1.846	1.299	-0.308	-1.422	0.159
Place of Residence	-2.003	2.835	-0.077	-0.706	0.482
Patients' Location in the Same/Diferent City as/from the General Anesthesia Center	0.320	1.797	0.019	0.178	0.859
Income	-1.253	2.047	-0.085	-0.612	0.542
Model Summary	R	R ²	Adjusted R ²	SEE	
	0.377 ^a	0.142	0.029	8.48998	

^aDependent Variable: The change in ECOHIS score; *Multiple linear regression analysis.

There was a correlation between the change score of ECOHIS and DMFT/dmft score ($r=0.888$, $p=0.014$).

There was a statistically significant decrease in CFSS-DS and FBS in both groups and overall ($p<0.001$) (Table 4). According to the CFSS-DS, an increase in anxiety level was observed in 19 children, while 14 children showed no anxiety change. The remaining 81 children exhibited a decrease in had reduced anxiety. Based on the FBS, the anxiety level increased in 4 children, did not change in 48 children and decreased in 52 children after DRGA. The percentage of the decrease in CFSS-DS following the treatment was 22.3%. This shows that the anxiety decreased after the operation in children who had their dental treatments under GA. However, there was no statistically significant correlation between the DMFT/dmft score and the change score of CFSS-DS ($r=0.035$, $p=0.725$), while there was a negative correlation between the children's ages and the change scores of CFSS-DS ($r=-0.293$, $p=0.003$). In terms of CFSS-DS and FBS scores, there were no statistically significant differences between groups and between genders.

Table 4. The mean (SD) CFSS-DS and FBS at baseline and follow-up and their observed effect mean differences and effect sizes.

Group	Pre-Treatment		Post-Treatment		p-value*	Change in Score (SD)	Effect Size
	Mean (SD)	Anxiety Level	Mean (SD)	Anxiety Level			
CFSS-DS							
Healthy	38.93 (14.03)	High	25.67(15.81)	Low	<0.001	13.26 (14.95)	+1
CSHCN	37.11 (16.93)	Medium	32.03(16.47)	Medium	<0.001	5.08 (11.06)	+0.3
Total	37.87 (15.75)	Medium	29.40 (16.42)	Low	<0.001	8.46 (13.37)	+0.5
FBS							
Healthy	1.33 (0.78)		2.51 (1.24)		<0.001	-1.19 (1.32)	-1.5
CSHCN	1.61 (1.01)		2.18 (1.13)		<0.001	-0.57 (0.94)	-0.6
Total	1.49 (0.92)		2.32 (1.19)		<0.001	-0.83 (1.14)	-0.9

*Wilcoxon; Anxiety Level = 15-31: Low; 32-38: Medium; 39 or More: High; SD: Standard Deviation.

The features of the anesthesia and the analgesia distributions and the evaluation data were shown in Table 5. General anesthesia was preferred for the dental treatment in all the patients. General anesthesia was previously applied to 48 of the patients (46.2%). Midazolam was administered to all the patients for premedication and appropriately applied to the patients nasally, orally, and intravenously 79 (76%), 15 (14.4%), and 10 (9.6%) of the patients, respectively. Paracetamol and tramadol were also administered for post-operative analgesia in 83 (79.8%) and 21 (20.2%) of the patients, respectively.

There was a significant difference between intraoral and intranasal applications from the premedication routine in terms of the change in CFSS and FBS ($p<0.05$).

Table 5. Features of anesthesia and analgesia distributions and CFSS-DS's and FBS's observed effect mean differences and effect sizes.

Variables	Categories	N	%	Pre-Treatment		Post-Treatment		Change in Score (SD)	p-value*	p-value**
				Mean (SD)	Anxiety Level	Mean (SD)	Anxiety Level			
CFSS-DS										
Anesthesia Type	General Anesthesia	104	100.0	37.87 (15.75)	Medium	29.40 (16.42)	Low	8.46 (13.37)	<0.001	-
History of General Anesthesia	Yes	48	46.2	35.71 (16.38)	Medium	29.13 (16.31)	Low	6.58 (13.30)	<0.001	0.466
	No	56	53.8	39.71(15.10)	High	29.64 (16.67)	Low	10.07 (13.33)	<0.001	
Premedication Drug	Midazolam	104	100.0	37.87 (15.75)	Medium	29.40 (16.42)	Low	8.46 (13.37)	<0.001	-
Premedication Route	Nasal	79	76	37.97 (15.87)	Medium	28.11 (16.2)	Low	9.86 (12.80) ^a	<0.001	0.012
	Oral	15	14.4	32.73 (17.19)	Medium	32.93 (16.2)	Medium	-0.20 (13.10) ^b	0.814	
	Intravenous	10	9.6	44.70 (10.01)	High	34.30 (17.9)	Medium	10.40 (14.54) ^{ab}	0.024	
Post-Operative Analgesia	Paracetamol	83	79.8	38.73 (15.95)	High	29.22 (16.62)	Low	9.51 (13.28)	<0.001	0.092
	Tramadol	21	20.2	34.43 (14.82)	Medium	30.14 (16.01)	Low	4.29 (13.21)	0.050	
FBS										
Anesthesia Type	General Anesthesia	104	100.0	1.49 (0.92)		2.32 (1.19)		-0.83 (1.14)	<0.001	-
History of General Anesthesia	Yes	48	46.2	1.63 (1.04)		2.31 (1.22)		-0.69 (1.17)	0.001	0.428
	No	56	53.8	1.38 (0.80)		2.32 (1.16)		-0.95 (1.12)	<0.001	
Premedication Drug	Midazolam	104	100.0	1.49 (0.92)		2.32 (1.19)		-0.83 (1.14)	<0.001	-
Premedication Route	Nasal	79	76	1.49 (0.92)		2.47 (1.14)		-0.98 (1.07) ^a	<0.001	0.016
	Oral	15	14.4	1.73 (1.16)		1.80 (1.21)		-0.07 (1.28) ^b	0.854	
	Intravenous	10	9.6	1.10 (0.32)		1.90 (1.29)		-0.80 (1.14) ^{ab}	0.066	
Post-Operative Analgesia	Paracetamol	83	79.8	1.49 (0.93)		2.40 (1.16)		-0.90 (1.14)	<0.001	0.144
	Tramadol	21	20.2	1.48 (0.93)		2.00 (1.27)		-0.52 (1.12)	0.062	

*Wilcoxon; **Mann-Whitney U /Kruskal-Wallis; SD: Standard Deviation; ^{a,b}Different letters indicate statistically significant differences; Anxiety Level = 15-31: Low; 32-38: Medium; 39 or More: High.

Discussion

In this study, the effects of the dental treatments under general anesthesia on OHRQoL and the anxiety in children were evaluated, and both the increase in the OHRQoL of the children and the decrease in their dental anxiety were determined after the treatment.

Although there are studies in the literature evaluating the effect of dental treatment under general anesthesia on OHRQoL [5,11-13,30], a study sample comparing healthy children with CSHCN has not been found. In this study, the ECOHIS scores before the dental treatment were found to be lower in CSHCN compared to the healthy children. The reason for this difference is that "Child self-image and social interaction" and "Parental distress" scores were higher in healthy children than in CSHCN. General health conditions of CSHCN, as well as regular visits to doctors, drug use, hospitalization, etc. may have overshadowed dental problems. CSHCN and their families may not have considered dental problems to be the most basic or primary problem.

In our previous study [31], we compared the oral findings of the children with epilepsy and healthy children and found that the oral findings of the children with epilepsy were much worse. In another previous study [32], we found that CSHCN had poor oral health. In this study, DMFT/dmft scores of CSHCN (11.38 ± 3.78) were higher than those of healthy children (10.93 ± 3.48), but this difference was not statistically significant.

The results of the questionnaire show that OHRQoL has improved in most children. In parallel with our study, there are studies in the literature indicating that dental treatments under general anesthesia improve the OHRQoL according to the ECOHIS [5,11-14]. This improved OHRQoL can be explained by several advantages of DRGA, such as safety, efficiency, convenience, high-quality restorative and preventive (e.g., fissure sealing) dental treatments, and one session requirement [14]. It should not be forgotten that untreated dental caries represents a real clinical problem and it is associated with poor quality of life. Based on the CIS score, no change was observed in the results for 2 children, while the results for one child showed deterioration. No change was observed in the results for 3 children according to the total ECOHIS score. Although DRGA has a positive effect on a child's OHRQoL, the extraction of heavily decayed and unrecoverable teeth creates functional limitations on nutrition and speech, which may jeopardize the children's ability for social interaction [13,33]. In this study, there was a small change in the "Child self-image and social interaction" section after treatment (ES:0.1), and only 1-month follow-up findings were evaluated. Some children may not have been able to adjust to the new changes such as dental restoration, tooth extraction, etc. in their mouths yet. In two different studies [11,13], the "Child self-image and social interaction" sections were reported to show the least change after general anesthesia.

The largest ES in our study was found in the "Child symptom" section, which is similar to the study by Farsi et al. [13]. The elimination of toothache was directly reflected in the questionnaire scores. However, it should be noted that parents completed the questionnaire and that they had limited knowledge of their children's pain experience [11,34].

While no change was observed in 5 parents according to the FIS score, deterioration was detected in 1 parent's score. Some families may not have realized this completely even if the child's dental problems had disappeared, and they may even have answered the questions by considering that the problem would remain [11,34].

In this study, the same parents completed the questionnaires under the same pediatric dentist's supervision in both periods. Including the same parents in the questionnaire before and after the treatment was

important in order to prevent inconsistency in the responses, which may arise when different parents participate.

According to the linear regression model analysis, socio-demographic variables could explain only 2.9% of the improvement in the OHRQoL. The “education level of the parent completing the questionnaire” variable had the most explanatory power ($\beta=0.234$), followed by the variable “ASA” ($\beta=0.143$).

Dental fear in children has been recognized in many countries as a public health problem [35]. DRGA is preferred as an alternative to performing dental treatment because of dental fear in children [36]. As the perioperative period, especially for children, is a stressful event, premedication must be applied first and it is estimated that up to 65% of children experience intense anxiety in the perioperative period and during induction of anesthesia [37]. Premedication is commonly used to reduce perioperative anxiety [37] and facilitate anesthesia [38]. Benzodiazepines, mainly midazolam, are most commonly used as a premedication for anxiolysis [38]. Some studies have shown a reduction in induced anxiety with the use of midazolam [39,40]. In our study, midazolam was preferred for premedication in all the patients and given to them with different routes.

Although it is suggested that different scales should be used in children under 6 years of age to determine their dental anxiety, there are studies using the CFSS-DS [14,36]. In our study, the CFSS-DS, as well as FBS, which is frequently preferred in young children [26], were used in all age groups. Based on the CFSS-DS, it was determined in our study that 19 children experienced an increase in anxiety, whereas 14 children showed no change in anxiety. The remaining 81 children experienced a decrease in anxiety. According to the results of this study, it can be said that DRGA is a procedure that mostly reduces anxiety. Similarly, Güney et al. [12] stated that there was a decrease in anxiety, whereas Cantekin et al. [14] reported that there was an increase in anxiety and Klaassen et al. [36] reported no change in anxiety. The reason for the decrease in anxiety could be that the child knows that dental treatments are finished, and so they will go to the dental clinic only for a follow-up visit.

In our study, the anxiety at younger ages decreased dramatically ($r=-0.293$, $p=0.003$). Similarly, the decrease in anxiety for younger children was significant in the study carried out by Güney et al. [12].

There was a significant difference between intraoral and intranasal applications from the premedication routine in terms of the change in CFSS and FBS ($p<0.05$). However, the children who took midazolam administered orally showed no change in anxiety after dental treatment because they already had more cooperative behavior than other children.

Some limitations should be noted in the following points: First, the study was performed in a small group of patients, and the results may not be generalized to other races and countries outside Turkey because the population in this study was composed of Turkish people. Second, this study was conducted in a follow-up period of four weeks, which is relatively inadequate. Although it is known that the OHRQoL increased by 88.7% in the first month after the treatment, it is not known how much it will change in the future. Third, the patients could not be fully standardized in terms of administration routes of midazolam.

On the other hand, having the same parents complete the questionnaires eliminated the differences in the parents' opinions, which can indicate the strength of this study. In addition, conducting the questionnaire by both parents and children under the supervision of a pediatric dentist and conducting it in an interview eliminated the difficulties in understanding the questionnaire's content.

Conclusion

The ECOHIS showed that it is sensitive to DRGA in children. An increase in OHRQoL and a decrease in dental anxiety were observed in healthy children and in CSHCN undergoing dental treatment under general anesthesia after a 1-month follow-up period. We propose a longer follow-up period to test the sustainability of treatment effects and the likelihood of response shift.

Authors' Contributions

GD		https://orcid.org/0000-0002-6756-6637	Conceptualization, Methodology, Formal Analysis, Investigation and Writing - Original Draft.
RK		---	Conceptualization, Investigation, Resources and Writing - Review and Editing.
ASO		https://orcid.org/0000-0002-4543-8853	Investigation and Writing - Review and Editing.
All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.			

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None.

Conflict of Interest

The authors declare no conflicts of interest.

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Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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