

A Comprehensive Survey of Dental Rehabilitation Under General Anaesthesia at a Dental Hospital in Turkey

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ABSTRACT

Objective: Although families worry about possible complications of dental rehabilitation under general anaesthesia (DRGA), it is a treatment option for children with dental anxiety or special needs. DRGA, one of the indispensable treatment options of dentistry, is especially common in paediatric dentistry. The purpose of this survey was to describe the characteristics of the children receiving DRGA at a faculty of dentistry in Turkey, and to investigate the complications of DRGA and families' approach to the issue.

Methods: 372 children under the age of 16, who underwent DRGA were included. The patients were divided into two groups. Group 1 was formed from healthy children with dental anxiety (n=159), and Group 2 was formed from CSHCN (n=213). The complications during and after DRGA were recorded. A survey was conducted to parents.

Results: The mean age of the CSHCN was 7.04 ± 3.02 , while the mean age of the healthy children was 4.87 ± 1.87 . 1798 teeth extractions, 2450 teeth fillings, 225 pulp amputations, 30 root canal treatments, 396 fissure sealants, 280 fluoride varnish applications, and 204 scaling-polishings were performed in patients under GA. Feeling sleepy from post-operative complications was at the highest percentage (40.3%). 72.6% of the parents had concern about the safety of DRGA.

Conclusions: Conservative dental treatment methods were mostly preferred in healthy children, while dental extraction was preferred for CSHCN. Parents and caregivers should be briefed on DRGA as a treatment option.

Key words: Children with special needs, Dental treatment, General anaesthesia

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INTRODUCTION

Early childhood caries is the most common chronic disease of childhood [1]. The World Health Organization (WHO) emphasized that dental caries affects 60-90% of school children [2].

Especially in young children, dental caries may be associated with low quality of life for both children and their families [3]. Paediatric dentists can solve dental problems for babies, pre-school children and children with special health care needs.

Both pharmacological and non-pharmacological behaviour guidance techniques can be used safely to alleviate dental anxiety and provide high standard oral health services to babies, children, adolescents and people with special health care needs.

With non-pharmacological behaviour guidance techniques such as tell-show-do, positive reinforcement, and voice control, it is possible to reduce the anxiety in children.

However, these techniques are not effective in children with special health care needs (CSHCN) and in children who have extensive dental problems. They can't cooperate due to a lack of psychological or emotional maturity [4]. Pharmacological techniques include sedation and/or general anaesthesia (GA).

The term CSHCN was defined as "any physical, developmental, mental, sensory, behavioural, cognitive or emotional impairment or limiting condition that requires medical management, health care intervention and/or use of specialised services or programs" by American Academy of Paediatric Dentistry in 2004 [5]. The incidence of dental problems increases in CSHCN since they are hospitalized very frequently due to various serious medical problems. The presence of sugar in drugs and the reduction of saliva due to excessive drug use lead to more dental problems in these patients [6,7]. The CSHCN are not able to tolerate the dental rehabilitation with only local anaesthesia or with inhaled sedatives. Dental treatments such as endodontic treatments, crown fabrications and multiple restorations can be done in a single appointment [8].

The treatment can be considered to be reliable because dental rehabilitation under general anaesthesia (DRGA) is

performed in a controlled environment such as the hospital environment and it also allows a convenient and high quality restorative and preventive dental treatment even for a patient with a high level of dental fear [9,10]. DRGA is generally the last treatment option for parents to consider due to its high cost and risk-benefit relationship, although it is effective.

This purpose of this study was (i) To describe the characteristics of the children receiving comprehensive DRGA at a faculty of dentistry in Turkey, (ii) To evaluate the difference between treatment options in healthy children and CSHCN, (iii) To identify the complications during and after DRGA, and (iv) to evaluate parents' opinion and awareness about DRGA.

MATERIALS AND METHODS

372 children, undergoing DRGA at Inonu University-Faculty of Dentistry-Department of Paediatric Dentistry from January 2019 to January 2020 were included in this study, and a questionnaire was done to their parents or caregivers. Ethical approval for the study was received from The Ethics Review Board of the Medical Faculty of Inonu University (2019/179).

CSHCN (down syndrome, autism, cerebral palsy, epilepsy, congenital cardiac anomaly, hyperthyroidism, hearing impairment, mental retardation and other systemic diseases) and healthy, non-cooperated children *under the age of 16*, participated in this study. Children who had no indication for DRGA, who had no family consent, and who were over 16 years of age were excluded from the study.

The patients were divided into two groups. Group 1 was healthy children with dental anxiety (n=159, 66 girls, 93 boys), and Group 2 consisted of CSHCN (n=213, 64 girls, 149 boys).

All the patients received dental treatments under GA according to standard principles. Midazolam was administered to all patients for premedication. Nasotracheal intubation was performed. Local anaesthesia was used for the whole tooth extractions. Tramadol or paracetamol was administered for postoperative analgesia at dose 1 mg/kg and 15 mg/kg, respectively.

The complications encountered during and after GA (such as nausea and vomiting, dry mouth or sore throat, sleepiness, sweating or shivering, agitation, dental bleeding, and dental pain) were recorded. Oral feeding was initiated after 4 hours from recovery. The patients were discharged on the day of the procedure, within 5-6 hours after recovery.

In addition to DRGA, all parents filled out a questionnaire about whether their children had received DRGA before,

whom they had heard of DRGA from first, and what kind of difficulties they had during the treatment. After DRGA, all parents were given some advice on their children's oral care.

All the families were contacted after 1 month, and their feedback about the DRGA experience was asked.

Statistical analyses

Statistical analyses were evaluated by using SPSS version 22 (SPSS Inc., Chicago, IL, USA). Kolmogorov-Smirnov test, Independent sample t-test, and Chi-square test were used for statistical analyses. The level of significance was determined at $p < 0.05$.

RESULTS

In this study, 372 patients, 130 female (35%) and 242 male (65%) and their parents were examined. The patients' ages ranged from 1.0 to 16.0 years (mean \pm SD: 6.11 ± 2.81 years). Group 1 consisted of 159 (42.8%) healthy children (mean age: 4.87 ± 1.87 years), Group 2 included 213 (57.2%) CSHCN (mean age \pm SD: 7.04 ± 3.02 years). 61.5% of CSHCN had systemic problems including epilepsy, bleeding disorders, cardiovascular anomalies, diabetes, cancer etc., while 38.5 % had mental retardation with/without systemic problems. Of 213 children with diseases, 34 (16%) were ASA I, 128 (60%) children were ASA II, and 51 (24%) children were ASA III.

The number of children in the period of primary dentition, mixed dentition and permanent dentition was 190 (51.08%), 168 (45.16%), and 14 (3.8%) respectively.

The extraction of 1798 teeth (1684 primary teeth, 117 permanent teeth), the filling of 2450 teeth, the pulp amputation of 225 teeth, the root canal treatment of 30 teeth, and the fissure sealant application of 396 teeth were performed. Moreover, fluoride varnish and scaling-polishing were applied to 280 and 204 patients, respectively.

In CSHCN, compared to healthy children, while the tooth extraction was more performed, endodontic treatments such as root canal treatment, pulp amputation were less performed ($p < 0.05$). The percentages of the primary teeth extractions by physiological resorption, infection and periodontal bone resorption were 13%, 86.5% and 0.5%, respectively. The reason of permanent teeth extractions was the infection in 94% cases, dental cysts in 5.1% cases, and impaction in 0.9% cases. The percentage distributions of the operation times were presented in Table 1.

Table 1: The percentage distribution of the operation time in terms of groups.

Healthy children with dental anxiety	CSHCN	Total
n (%)	n (%)	n (%)

<1h	13 (8.2%)	51 (23.9%)	64 (17.2%)
1-2h	135 (84.9%)	120 (56.3%)	255 (68.5%)
>2h	11 (6.9%)	42 (19.7%)	53 (14.2%)

Complications during and after DRGA

In 12 patients, the intubation tube moved during the operation. In 4 patients nasotracheal intubation could not be performed, but orotracheal tube was used instead.

The post-operative complications were presented in Table 2. The highest incidence of complications was sleepiness (40.3%), followed by dental bleeding (28.8%), dry mouth/ sore throat (19.9%), agitation (18.3%), nausea and vomiting (14.2%), sweating/ shivering (10.5%), and dental pain (9.9%). These complications

were evaluated statistically according to the medical status, operation time, and the number of tooth extractions (Table 2).

Three hundred and sixty-four patients were discharged on the day of the procedure, within 5-6 hours after recovery. Eight patients experienced postoperative complications, such as not being able to eat, vomiting, fever and they were hospitalized for further 24 hours for postoperative follow-up.

Table 2: The percentage distribution of the complications encountered after GA.

		Nausea and vomiting	Dry mouth/ sore throat	Sleepiness	Sweating/ shivering	Agitation	Dental bleeding	Dental pain
Medical status	Healthy children with dental anxiety	19 (11.9%)	31 (19.5%)	52 (32.7%)	11 (6.9%)	21 (13.2%)	44 (27.7%)	18 (11.3%)
	CSHCN	34 (16%)	43 (20.2%)	98 (46%)	28 (13.1%)	47 (22.1%)	63 (29.6%)	19 (8.9%)
	*p value	0.172	0.488	0.006	0.037	0.019	0.388	0.276
Operative time	<1h	11 (17.2%)	6 (9.4%)	31 (48.4%)	7 (10.9%)	11 (17.2%)	22 (34.4%)	7 (10.9%)
	1-2h	33 (12.9%)	44 (17.3%)	95 (37.3%)	25 (9.8%)	42 (16.5%)	76 (29.8%)	28 (11%)
	>2h	9 (17%)	24 (45.3%)	24 (45.3%)	7 (13.2%)	15 (28.3%)	9 (17%)	2 (3.8%)
	*p value	0.567	<0.001	0.219	0.756	0.124	0.095	0.269
The number of tooth extractions	0	0 (0%)	27 (48.2%)	29 (51.8%)	5 (8.9%)	6 (10.7%)	0 (0%)	0 (0%)
	1 to 5	6 (3.5%)	43 (24.9%)	79 (45.7%)	13 (7.5%)	32 (18.5%)	2 (1.2%)	0 (0%)
	5 to 10	20 (19%)	4 (3.8%)	33 (31.4%)	9 (8.6%)	20 (19%)	42 (40%)	11 (10.5%)
	11 to 15	23 (67.6)	0 (0%)	6 (17.6%)	12 (35.3%)	10 (29.4%)	32 (94.1%)	24 (70.6%)
	15<	4 (100%)	0 (0%)	3 (75%)	0 (0%)	0 (0%)	4 (100%)	2 (50%)
	*p value	<0.001	<0.001	0.001	<0.001	0.206	<0.001	<0.001
Total		53 (14.2%)	74 (19.9%)	150 (40.3%)	39 (10.5%)	68 (18.3%)	107 (28.8%)	37 (9.9%)

*Chi-Square

Parental opinion about DRGA

Table 3 presents the distribution of the parents' opinion and awareness about DRGA. More than half of the families reported that their children could not be provided with dental treatment in a dental clinic before

DRGA (57.5%). Families had heard from dentists that dental treatment is performed under GA (75.3%). 72.6% of parents reported that they were concerned about the safety of GA s/he had. 356 families (95.7%) expressed

their satisfaction with DRGA over the phone, one month after the operation.

Table 3: Percentage distribution of answers to survey questions about parents' awareness of GA.

	Healthy	CSHCN	Total
Did your child undergo dental treatment at a clinic before going under GA? *			
Yes, but s/he didn't allow the treatment.	53 (32.7%)	45 (21.1%)	97 (26.1%)
Yes, a few treatments were done, but then s/he didn't allow the rest.	40 (25.2%)	21 (9.9%)	61 (16.4%)
No treatments tried. S/he was referred directly to the DRGA.	67 (42.1%)	147 (69%)	214 (57.5%)
Who did advise you DRGA for your child? *			
the doctor in a private clinic	48 (30.2%)	24 (11.3%)	72 (19.4%)
the doctor in oral health center	50 (31.4%)	109 (51.2%)	159 (42.7%)
the doctor in university hospital	61 (38.4%)	80 (37.6%)	141 (37.9%)
Did you ever hear dental treatments can be performed under GA? **			
Yes	107 (67.3%)	125 (58.7%)	232 (62.4%)
No	52 (32.7%)	88 (41.3%)	140 (37.6%)
If yes; where did you hear from?*			
medical doctor	8 (5%)	20 (9.40%)	28 (7.5%)
dentist	118 (74.2%)	162 (76.1%)	280 (75.3%)
teacher	0 (0%)	0 (0%)	0 (0%)
friend/relative	25 (15.7%)	25 (11.7%)	50 (13.4%)
TV	0 (0%)	0 (0%)	0 (0%)
social media	8 (5%)	6 (2.8%)	14 (3.8%)
What challenges did you face before DRGA? (multiple choice) *			
Only a few health centrals had DRGA	86 (54.1%)	107 (50.2%)	193 (51.9%)
Private clinics did not admit my child because of his/her medical status	61 (38.4%)	42 (19.7%)	103 (27.7%)
Having a treatment appointment was very difficult	24 (15.1%)	21 (9.9%)	45 (12.1%)
We waited too long for DRGA	71 (44.7%)	90 (42.3%)	161 (43.3%)
We had to postpone our DRGA appointment because my child had had an upper respiratory tract infection	10 (6.3%)	18 (8.5%)	28 (7.5%)
I was afraid if my child could not wake up because of the side effect of GA	123 (77.4%)	150 (70.4%)	273 (73.4%)
I was afraid my child would be damaged due to GA s/he had.	123 (77.4%)	147 (69%)	270 (72.6%)
Chi-Square. *p<0.01, **p<0.05			

DISCUSSION

DRGA is an important treatment option for CSHCN and children with dental anxiety that requires an efficient and high-quality dental treatment in a single appointment. DRGA in children is mostly used for the treatments of caries. The World Health Organization (WHO) has emphasized that dental caries affects 60-90% of school children [2]. The most commonly rehabilitated group under GA consists of the patients with multiple caries lesion that need to be restored. In addition, having a lot of caries is linked to a dental fear and management problems [11]. Therefore, if young children need an extensive dental treatment but cannot tolerate it, DRGA may be an acceptable option for them [12].

The incidence of dental and periodontal problems increases in CSHCN since they are hospitalized very frequently due to various serious medical problems. The presence of sugar in drugs and the reduction of saliva due to medication overuse lead to more dental problems in these patients [6,7]. The CSHCN have poor oral hygiene and more periodontal diseases than healthy children [13,14]. They are not able to tolerate the dental rehabilitation with only local anaesthesia or with inhaled sedatives [8].

The number of fillings and filled tooth surfaces in healthy children was statistically higher than in the CSHCN ($p<0.01$). This can be associated with receiving less *oral health* care and the need for the tooth brushing assistance to CSHCN [15,16].

Although DRGA could improve the children's oral health, it also has disadvantages, such as nausea and vomiting, dry mouth/ sore throat, sleepiness, sweating/ shivering, agitation, dental bleeding, and dental pain, in the postoperative period. In this study, the highest incidence of postoperative complications was sleepiness, followed by dental bleeding and dry mouth/ sore throat.

Farsi *et al.* [17] reported that post-operative complications were higher incidence in medically compromised children compared with healthy children. The percentages of post-operative complications were lower in this study compared with Farsi *et al.* [17] and Chao *et al.* [18] In Chao *et al.*'s study, [18] 45% of children's operation time was more than 2 h, while in our study this percentage was only 6.9%. The long operation time may have increased post-operative complications. Also, as the number of tooth extractions increased, post-operative complications increased as well.

Farsi *et al.* explained the fever by the longer duration of children pre-operative fasting and their inability to eat post-operatively. Previous studies have demonstrated a strong association between dehydration and fever. [17,19,20] Our results showed the positive relationship between the fever and the number of tooth extractions, unlike Farsi *et al.* [17] and Holan *et al.* [21].

In this study, the agitation in children was often manifested in the form of bad sleep and cry similar to Farsi *et al.* [17] and Bridgman *et al.* [22] This demonstrates the link between medical status and the number of tooth extractions.

The sleepiness had the highest percentage among all complications (40.3%). The number of tooth extractions had a negative effect on sleepiness and drowsiness. Also, CSHCN were more prone to sleepiness.

The dry mouth/ sore throat was the third-highest complication (19.9%). The reason may be the traumatic intubation, and dehydration due to post-operative fasting. Anaesthesia duration, as expected, increases the symptoms of dry mouth/ sore throat. However, as the number of tooth extractions increased, the symptoms of the dry mouth/ sore throat decreased. This may be because dental bleeding increases salivary secretion. As expected, dental bleeding was positively associated with the number of tooth extractions.

The dental treatment itself (such as root canal treatment and tooth extraction) could cause pain. So, during the treatment, the use of local anaesthetics may alleviate such symptoms. In this study, local anaesthesia was used for the whole tooth extractions and IV paracetamol or tramadol was given routinely to all the patients during recovery. We found that the percentage of dental pain was low compared to other studies [17,18]. The severity of pain reported in this study was limited to the mild-moderate category. These findings confirmed the benefit of good analgesic control with Paediatric DRGA procedure. Our results showed that high number of tooth extractions significantly increased postoperative dental pain. However, although the number of tooth extractions

was higher in CSHCN than in healthy children, the percent of dental pain was less in CSHCN. This result may be related to the fact that 38.5% of children have mental retardation and therefore they may not be able to express their pain.

More than half of the children could not be provided with dental treatment in the dental clinic before DRGA. This may be due to the inability to treat disabled children in the clinical setting and children with extreme anxiety, who do not even allow dental examination. Most families are concerned about DRGA [23]. This is probably due to intubation process in children and possible complications of GA. The families' concern, which is completely understandable, should be considered and necessary explanations should be made to minimize their concerns.

Chao *et al.* [18] reported that although the families had a positive effect on DRGA (80.4%) and their overall experience was satisfactory (82.8%), 78.1% of them did not want another DRGA for their children. Chao *et al.* [18] stated that this contrast is related to the cost of DRGA and the traditional opinion (GA is not good for their children's health).

In this study, overwhelming majority of families (95.7%) expressed their satisfaction with DRGA over the phone one month after the operation. The reason of this high satisfaction rate compared with Chao *et al.*'s study [18] may be associated with the government coverage of DRGA cost. The unsatisfied parents often complained about waiting too long for the appointment. Increasing the number of GA centres will be a solution to this problem that families experience.

CONCLUSION

DRGA is a crucial treatment option in Paediatric dentistry for the children with extreme dental anxiety and CSHCN. Also, it offers an efficient and high-quality dental treatment for multiple caries in a single appointment for the patients at very young ages and in special healthcare needs.

Parents and caregivers of CSHCN and healthy non-cooperated children should be educated about early and regular dental visits and should be given information about DRGA as a treatment option. Families' concerns about DRGA should be minimized. Future studies are needed in order to reduce the complications and to improve the satisfaction of the parents.

AUTHOR'S CONTRIBUTIONS

GD conceived the idea for the research, collected the data, wrote the initial framework, performed the statistical analysis, and drafted the manuscript as the principal author. RK participated in the design of the study, collected the data, and wrote the initial framework. VAG conceived the idea for the research and revised the manuscript.

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