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# Analysis of paediatric dentistry cases operated under general anaesthesia: is the number of operating rooms sufficient for dental general anaesthesia?

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## ABSTRACT

**Objective:** Aim of this study is to analyse the characteristics of pediatric dentistry patients who were operated under general anesthesia (GA) and sedated, and the adequacy of the number of operating rooms.

**Material and Methods:** The study examined the records of 218 paediatric patients who could not be operated under local anaesthesia (LA) in the Faculty of Dentistry and therefore needed general dental anaesthesia (DGA) for the dental treatments using nasotracheal intubation in the operating room of the Faculty of Medicine between January 2019 and December 2020. Demographic data of all patients, American Society of Anesthesiologists (ASA) scores, type of anesthesia (general anesthesia, sedation), duration of anesthesia, types of surgery performed, additional diseases, syndromes and requested consultations were analysed.

**Results:** The mean age of the study population was 5 (4–7) years. Among these patients, 106 (48.6%) were female and 112 (51.4%) were male. There were 161 patients (73.9%) who underwent DGA and were healthy with no additional health-related problems. Fifty-seven (26.1%) patients included in the study were children with comorbidities.

**Conclusion:** The need for timely treatment of paediatric dentistry patients under GA or sedation is highly significant. It is recommended that the number of operating rooms allocated specifically for dentistry should be increased to improve the usability and accessibility of DGA services. Further comprehensive studies focusing on the accessibility of operating rooms for DGA are needed.

**Keywords:** Paediatric dentistry patients, Dental diseases, Dental general anaesthesia, Operating Rooms, Anesthesia.

## INTRODUCTION

Oral health is an important component of general health, well-being and quality of life. Oral and dental diseases are among the most common non-communicable diseases that affect people of all age groups throughout their lives. Oral, maxillofacial and dental traumas, dental caries, periodontal diseases, oral cancers, cleft palate and cleft lip anomalies and similar diseases are encountered in all age groups (1). Dental diseases (DD) account for a significant part of these diseases. Recently, surgical interventions for DD have increasingly become common in anaesthesia practice. Currently, treatments are mostly performed under local anaesthesia (LA); however, the need for dental general anaesthesia (DGA) is gradually increasing in adult and paediatric cases of DD. Although most of these cases are paediatric patients with mental retardation and genetic syndrome, receiving dental treatment under DGA, there has been an increase in the need for DGA in healthy children over the recent years.

In the group of patients scheduled for dental treatments under general anaesthesia (GA), the risks of anaesthesia must be thoroughly investigated, especially in the paediatric age group. Children can be convinced to undergo the dental treatment by means of non-pharmacological behaviour management or under sedation.

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However, young children and those with severe anxiety, mental or physical disabilities can only be treated under DGA (2). GA is needed for the treatment of patients with congenital anomalies, genetic syndromes, mental retardation and in cases of poor cooperation of patients with psychiatric diseases, dental anxiety and incompatibility. Additionally, GA might be required in cases where patients fear dentists and need the presence of their family members as well as in patients with advanced craniofacial anomalies and orofacial traumas (3).

DGA is typically an outpatient general anaesthetic method. Compared with the outpatient treatments in paediatric dentistry, DGA for children is advantageous. DGA is the most effective option to provide high-quality dental treatments in a single session for procedures that require multiple sessions, such as treatment of dental caries and caries-related complications, frenotomy, root canal treatment, pulpitis treatment, tooth extraction and dental filling (3, 4).

At present, most of the dentistry cases where GA is administered consist of patients undergoing oral and maxillofacial surgery, patients with mental retardation and genetic syndrome and paediatric patients with lack of cooperation for the treatment to be performed under LA. The current study presents a retrospective investigation on the characteristics of paediatric dentistry patients who were operated under GA and sedated in the operating room of the hospital. The records of the patients were examined and were subsequently evaluated for pre-anaesthesia characteristics, anaesthesia applications and post-anaesthesia recovery in reference to the data available in the literature. Moreover, the study aimed to raise a discussion on the necessity of a regular operating room at hospitals for administering DGA in paediatric patients.

## MATERIAL and METHODS

For this study, an Ethics approval (HRU/21.22.26) was obtained from Harran University Faculty of Medicine, Non-Drug Clinical Research Ethics Committee, dated 13.12.2021, in the 22th session. After obtaining the approval from the ethics committee, the study retrospective examined the records of 218 paediatric patients who could not be operated under LA in the Faculty of Dentistry and therefore needed DGA for the dental treatments using nasotracheal intubation in the operating room of the Faculty of Medicine between January 2019 and December 2020.

The files of the patients were used to access and record the relevant demographic data (age, gender), American Society of Anesthesiologists (ASA) scores, type of anaesthesia (GA, sedation), duration of anaesthesia, types of surgery, complications, anaesthetic agents and analgesics used, comorbidities, syndromes and requested consultations.

To perform GA, children were administered propofol (Propofol %1, Fresenius Kabi, Germany), rocuronium bromide (Esmeron, MSD, UK) and remifentanyle (Ultiva, GSK, UK) as standard anaesthesia. As a maintenance gas for the GA, sevoflurane (Sevorane, AbbVie, USA) and desflurane (Suprane, Baxter, USA) were administered in 215 and 2 patients, respectively. In the remaining one patient, sedation with midazolam (Dormicum, DEVA, TR) was sufficient for a single tooth extraction. After admission to the hospital, all patients were treated with outpatient surgery.

Statistical analyses were performed with SPSS 25.0 software (SPSS Institute, Chicago, IL, USA). The continuous data were analysed for normality with the Kolmogorov Smirnov test. Normally distributed data were expressed as mean ± standard deviation, whereas the non-normally distributed data were expressed as median (25th–75th quartiles). The categorical variables were expressed as numbers and percentages.

## RESULTS

The data of 218 patients who could not be treated with LA and needed GA during 2019–2020 were analysed (**Table I**). The mean age of the study population was 5 (4–7) years. Among these patients, 106 (48.6%) were female and 112 (51.4%) were male. To distribute the patients based on their ASA scores, 71.1% were found to be of ASA I, 22.9% ASA II and 5.5% ASA III. GA was administered in 217 patients, whereas sedation was applied to one patient to perform the dental procedures.

The mean operative time of the patients was 92 (59–178) min. Tooth extraction was performed in 29.8% of the patients, whereas both tooth extraction and dental filling were performed for multiple teeth in the same session in 54.6% of the patients. There were 161 patients (73.9%) who underwent DGA and were healthy with no additional health-related problems. Parol and tramadol were sufficient as postoperative analgesics in 59.6% and in 19.4% of the patients, respectively. The remaining 21% of the patients did not need analgesics (**Table II**).

Fifty-seven (26.1%) patients included in the study were children with comorbidities. As presented in the comorbidities encountered in children, epilepsy was the most commonly found comorbidity in the population of treated patients. Down syndrome was present as a congenital malformation and genetic syndrome in approximately 1.8% of the patients. As for the most commonly encountered comorbidities in this patient population, the top three were epilepsy, cerebral palsy and congenital heart disease.

The most requested consultations were paediatrics and paediatric neurology. The most common postoperative complications were nausea and allergies, whereas difficult intubation (found in five patients) was the least common complication (**Table III**).

**Table I.** General characteristics of the patients

| **Children (n%)** | 218(100) |
|---|---|
| Age (years) | 5 (4–7) |
| Female | 106 (48.6) |
| Male | 112 (51.4) |

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**Table II.** General characteristics of the paediatric patients

| | |
|---|---|
| **ASA n(%)** | 218 (100) |
| ASA I | 155 (71.1) |
| ASA II | 50 (22.9) |
| ASA III | 13 (6) |
| **Anaesthesia time (min)** | 92 (59–178) |
| **Anaesthesia procedure n (%)** | 218 (100) |
| Sedation | 1 (0.5) |
| Genel | 217 (99.5) |
| **Type of surgery n(%)** | 218 (100) |
| Tooth extraction | 65 (29.8) |
| Tooth extraction and dental filling | 119 (54.6) |
| Dental filling | 5 (2.3) |
| Pulpitis treatment | 5 (2.3) |
| Cleft palate repair | 2 (0.9) |
| Mandibular fracture | 6 (2.8) |
| Jaw cyst | 9 (4.1) |
| Maxillary tumour excision | 3 (1.4) |
| Mandibular tumour excision | 1 (0.5) |
| Oral mass | 1 (0.5) |
| Maxillary fracture | 2 (0.9) |
| **Anaesthetic agent used n (%)** | |
| **Postoperative analgesic drug n (%)** | |
| No | 49 (22.5) |
| Paracetamol n (218-%) | 130 (59.6) |
| Tramadol n (218-%) | 42 (19.3) |
| **Complications after anaesthesia n (%)** | |
| No | 177 (81.3) |
| Allergy | 12 (5.5) |
| Nausea | 24 (11) |
| Difficult intubation | 5 (2.2) |

ASA, American Society of Anesthesiologists

**Table III.** Comorbidities and consultations

| | |
|---|---|
| **Comorbidity n (%)** | 218 (100) |
| No | 161 (73.9) |
| Yes | 57 (26.1) |
| **Comorbidities n (%)** | |
| Mental retardation | 4 (1.8) |
| Autism | 5 (2.3) |
| Cerebral palsy | 9 (4.1) |
| Epilepsy | 14 (6.4) |
| Thalassemia | 3 (1.4) |
| Haemophilia | 1 (0.5) |
| Juvenile hyaline fibromatosis | 1 (0.5) |
| Down syndrome | 4 (1.8) |
| Growth hormone deficiency | 1 (0.5) |
| Osteopetrosis | 2 (0.9) |
| Biotinidase deficiency | 1 (0.5) |
| Portal hypertension | 1 (0.5) |
| Hydrocephalus | 2 (1) |
| Asthma | 3 (1.4) |
| Allergy | 2 (0.9) |
| Atopic body | 1 (0.5) |
| Hypopituitarism | 1 (0.5) |
| Visual impairment | 1 (0.5) |
| Smoking | 4 (1.8) |
| Cardiac diseases | 8 (3.8) |
| Atrial Septal Defect (ASD) | 3 (1.4) |
| Ventricular Septal Defect (VSD) | 1 (0.5) |
| Atrio-ventricular Septal Defect (AVSD) | 3 (1.4) |
| Aortic transposition | 1 (0.5) |
| **Paediatrics Consultation n(%)** | 218 (100) |
| No | 148 (67.9) |
| Paediatrics consultation | 40 (18.3) |
| Paediatric cardiology | 8 (3.7) |
| Paediatric neurology | 15 (6.9) |
| Paediatric metabolism | 3 (1.4) |
| Paediatric haematology | 1 (0.5) |

# DISCUSSION

Although GA is preferred in the dentistry treatments for all age groups, especially in children with congenital malformation, genetic syndrome and comorbidities, it is now increasingly preferred in cases of healthy children because of the higher level of socioeconomic welfare. Children's fear of dental treatment, their lack of cooperation and parents' or dentists' requests are the factors that lead to opting GA. The increase in preference for GA is also because it allows multiple procedures to be performed in one single session and prevents wasting time and economic resources with repeated treatments. In our study where we investigated a group of children who received DGA, we found the rate of the healthy children receiving dental treatment under DGA to be higher than that of those with mental retardation, congenital malformation, genetic syndrome and comorbidities.

DGA has not yet been established as a routine anaesthesia practice in dentistry treatments. Anaesthesia is safely performed in patients of all age groups and can also be performed in patients undergoing dental treatments. Dental treatment under DGA is mandatory for patients with comorbidities, high level of dental fear or anxiety or a life-threatening orofacial emergency (5). Most of the patients receiving DGA in Turkey include children with mental retardation, congenital malformation, genetic syndrome and comorbidities. Dental treatment under GA has come to the forefront as a goal to be addressed by healthcare policies due to its increased use, despite the cost and risks associated with it (6-9). Recently, the need of DGA for dental treatments in healthy children has also been increasing. DGA is mandatory, especially in patients who lack cooperation for the administration of the treatment and who have dental anxiety and will undergo multiple procedures in a single session (10). In the present study, among the paediatric cases treated under DGA, the children with mental retardation, congenital malformation, genetic syndrome and comorbidity were found to account for a smaller part of the study population.

Dental patients are usually ASA I patients and majority of them are children. In a previously reported review, the treatment prevalence was found to be higher in a group of patients with special needs suffering from DD, reaching as high as 87.7% vs the rate of 69.9% in the group of healthy patients. In the same review, 16 different studies were discussed in which dental caries was the most common indication for DGA, followed by patients' lack of cooperation and/or fear, as found in eight studies (11). In this study, the rate of DGA administration was found to be higher in the group of healthy children compared with the patients with special needs. However, being the most common indication for DGA, tooth extraction and dental filling due to dental caries were found to be at similar rates in both the patient groups.

Dental treatment under DGA is essential for paediatric patients who require extensive dental care but cannot be treated with LA as they have not responded to the standard behaviour management techniques. Chronic pain, deterioration in eating and sleeping habits and growth retardation are commonly seen.

Chronic pain was reported in at least two-thirds of the paediatric patients before receiving dental treatment; 42%–71% experienced eating difficulties and sleep disturbance was reported by 25%–50% of them. A study conducted in Turkey reported that 95% of them had sleep difficulties (12). DGA can reduce caries activity for short- to medium-term and improve children's oral health behaviour, nutritional and laboratory status, as well as their physical and mental health (13-16). Given the low rates of postoperative complications, dental treatment under GA can be considered as an important and beneficial treatment option for children whose lack of cooperation makes conventional dental treatments impossible (17).

According to Guney SE et al., dental rehabilitation under DGA and IVS (intravenous sedation) improves quality of life and dental behaviour. They found that dental anxiety and fear decreased in 3–5 year old children after treatment under GA but not after IVS (18). They reported that DGA achieved better treatment outcomes than IVS. In our study, in terms of age groups treated, DGA was applied in a higher number of cases, especially in children of young age, whereas sedation was applied only to one patient. This suggests that DGA improves treatment outcomes; therefore, it is preferred over IVS.

The effect of agents and anaesthetic gases used in GA are not fully known and it is assumed that they adversely affect the neurocognitive activity of children. The U.S. Food and Drug Administration (FDA) issued its warning on 14 December 2016, stating that exposure to certain sedating drugs and general anaesthetics may affect the brain development of children under the age of 3, especially in procedures lasting longer than 3 h (19, 20). In a study involving preschool children, it was reported that DGA administered with only sevoflurane did not adversely affect neurocognitive function 6 months after the surgery, compared to LA (21). Studies have shown that anaesthetic neurotoxicity does not make a significant contribution to adverse neurodevelopmental outcomes in most healthy children requiring surgery. Biological, environmental and social factors are of great importance for the neurodevelopment of children (22). Our findings are based on a duration of anaesthesia shorter than 3 h in all the paediatric age groups (with a mean duration of 92 min and a mean age of 5), which was found to be compatible with the FDA recommendations for children's neurodevelopment.

DGA was administered to perform dental treatments of the paediatric dental patients in the operating room. These dentistry treatments included tooth extraction, dental filling, root canal treatment, pulpitis treatment, cyst and mass excision, mandibular and maxillary fractures. In the literature, nasotracheal intubation was performed in most of the patients. We performed nasotracheal intubation in all the children who underwent DGA. The variety of the surgical procedures and anaesthesia applications performed were consistent with the literature (23).

DD negatively affect the quality of life and psychosocial status of children and their families and result in practical problems for dentists. These effects worsen due to the time spent waiting on appointment lists for treatment. It is also costly for dental institutions and families (24). DGA can relieve the frustrations of patients, parents and dentists, minimising the time and economic burden due to repeated treatments for patients and their families. Morphology and chewing function improved in most of the cases treated for caries under DGA. The oral micro-ecological environment is stabilised and the risk of caries and dental anxiety are reduced in children (25). DGA is a safe treatment for non-cooperative children of young age and medically challenged patients (26).

The advantage of GA for children is that it facilitates efficient and appropriate treatment in a single visit and also creates a more favourable environment for patients, families and dentists (27). However, there may be risks and complications to the general health of patients (nausea, vomiting, headache, agitation, vertigo, dizziness, diplopia along with other more serious problems, such as heart problems, anaphylaxis, laryngospasm, respiratory depression and respiratory arrest) (28, 29). There are also some issues related to cost, parental acceptability and long lists of cases with surgical appointments. For this reason, GA is considered a last resort for patients and is not intended for regular use in dental treatment. But once we have clear evidence of its benefits for children and their families, GA may be the best choice for patients and dentists. It is more suitable for patients who lack cooperation with the dentist and who fear the operation and/or need multiple dental treatments (30).

The need for timely treatment of paediatric dentistry patients under GA or sedation is highly significant. Anaesthesia services minimise anxiety in children and allow the dentist to provide high quality care to patients. Improving the availability and accessibility of these services can improve the quality of life among patients. There are several challenges that prevent patients from receiving care under DGA. These challenges include long lists of patients waiting for getting appointment, lack of qualified personnel, insufficient number of operating rooms for DGA. In a previous study, Percival T et al. studied with dentistry patients and based on the data obtained, the researchers recommended that the private operating rooms for DGA should be promoted to improve the healthcare services in local hospitals and reduce the adverse effects of long waiting periods of patients for receiving treatment under GA/sedation in these healthcare institutions (31).

Vo AT et al. reported in their study that paediatric dentists of the United States had difficulty in getting access to the operating rooms for DGA and waited for long periods of time to receive appointments to use these operating rooms. They continued reporting that the patients could not receive their treatment in a timely manner because of the aforementioned problem as well as that the patients' immense pain and anxiety elevated and subsequently led them to give up the surgery. They reported that the difficulty of accessing operating rooms is an issue for paediatric dentists in most states of the United States (32). The number of days when the operating rooms are allowed for DGA and the number of operations performed in our hospital suggest that this will continue to remain a problem in Turkey.

Due to the limited number of qualified health personnel, there could be long waiting periods for DGA before undergoing the intervention. To solve this issue, measures need to be taken to reduce delays and improve access to oral health care for this particular group of patients (33). Contrastingly, in our operating room, a half-day surgery per week was reserved for

DGA during the study period. In our opinion, the reasons for the low number of patients in our study are the small number of operating rooms, the long waiting periods for the patients to receive treatment and hence the low number of patients admitted during this period.

## CONCLUSION

In conclusion, DGA is known to be beneficial in treating paediatric dental patients. In the literature, there are many publications on DGA, especially in paediatric patients. There are several challenges that prevent patients from receiving care. The need for timely treatment of paediatric dentistry patients under GA or sedation is highly significant. In addition to minimising anxiety of dentists, patients and families, the DGA healthcare services help in providing high-quality treatment for patients. It is recommended that the number of operating rooms allocated specifically for dentistry should be increased to improve the usability and accessibility of DGA services. Thus, it is predicted that the quality of life of patients will be enhanced with better access to such services among patients and their physicians. Further comprehensive studies focusing on the accessibility of operating rooms for DGA are needed.

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**Ethical approval:** The study was conducted according to the guidelines of the Declaration of Helsinki and approved by Local Ethical Committee.

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