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Original Article

Oral and maxillofacial surgery and dental rehabilitation under sedation and general anesthesia

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Abstract

Aim: The aim of this study was to retrospectively analyze dental procedures performed under general anesthesia (GA) or deep sedation at Dicle University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery from May 2013 to May 2018.

Methodology: This study included 182 patients treated under GA and sedation from May 2013 to May 2018. The records of these cases were reviewed retrospectively in terms of patient demographic characteristics, medical history, dental procedures, and treatment duration. Children and adults were compared in terms of general anesthesia (GA) and deep sedation (SD).

Results: Of 182 patients (age range: 1-61 years), 63 were had an American Society of Anesthesiology (ASA) status of I (completely healthy) and 119 were of ASA II status (mild systemic disease). A total of 143 patients (60 children and 83 adults) underwent GA, while 39 patients (18 children and 21 adults) underwent deep sedation. The mean duration of the procedures performed under GA and deep sedation was 75 and 40 min, respectively. Following the procedure, 103 patients were discharged on the same day, whereas 78 patients required postoperative care and were discharged on the following day. The number of patients exposed to GA and SD were 143 and 39, respectively. The number of child patients exposed to GA was 60, while that of adults was 83.

Conclusions: The frequency of dental rehabilitation under GA or sedation is increasing. Patients who cannot undergo dental procedures under local anesthesia can be treated under preferably GA, as long as the indications, patient characteristics, and anesthesia plan are carefully considered. Data suggest that adults are more suitable for GA than children. However, due to the risks associated with GA, anesthetic procedures should only be performed by experienced anesthetists under operating room conditions.

Keywords: Dental extraction, dental treatments, general anesthesia, sedation

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Introduction

The majority of dental treatments can be performed under local anesthesia. However, treatment may be performed under general anesthesia (GA) in pediatric or uncooperative patients, patients with intellectual disabilities or severe anxiety, and patients with a severe craniofacial anomaly or orofacial trauma injury (1). The history of GA application for dental treatment parallels the history of modern anesthesia (2). Nitrous oxide and diethyl ether were the first inhalation anesthetics used in modern clinical practice, and the first used during dental treatment (3). Nitrous oxide is still used alone for conscious sedation in some clinics (4). For tooth extraction in children, intranasal midazolam is used alone (5), or in combination with sufentanil or ketamine (6), in many clinics. Halothane and sevoflurane (inhaled) (7-9) and propofol (intravenous) are also used (10).

The aim of this study was to retrospectively analyze dental procedures performed under general anesthesia (GA) or deep sedation at Dicle University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery from May 2013 to May 2018.

Materials and Methods

We retrospectively analyzed the records of dental procedures performed from May 2013 to May 2018 under GA and sedation in our hospital. Data were obtained from the records of 182 patients (age range: 1–61 years), including relevant medical history, cooperativeness, the treatment indication and procedure, and other factors related to whether GA or deep sedation was performed. Of the 182 patients, 36 were aged 1–11 years, 42 were aged 11–16 years, and 104 were aged 19–61 years. Eighty patients had intellectual or other disabilities, including nine with epilepsy, one with Down syndrome, and one with autism. (In Group 1, 9 of them had mental retardation and also epilepsy, one of them had mental retardation and also down syndrome, one of them had mental retardation and also autism.) The remaining group of 102 patients included five children with Down syndrome, three individuals with epilepsy, non-cooperative children, and healthy adults.

Prior to the procedures, all patients were evaluated, their medical histories were taken, their airways were examined, and the required laboratory tests were requested. The aspartate transaminase (AST), alanine transaminase (ALT), prothrombin time (PT), partial thromboplastin time (PTT), international normalized ratio (INR), sodium, potassium, and hemogram data of all patients were examined. In addition, consultations with relevant departments were scheduled for patients with systemic disease. The patients were categorized according to the American Society of Anesthesiology (ASA) Patient Status Classification system (Table 1) (11). ASA class I includes healthy individuals, while ASA class II includes patients with mild systemic disease. The number of patients in ASA classes I and II was 63 and 119, respectively.

The patients were informed about the risks of anesthesia and surgery and consent forms were signed by all adult patients, and the parents or guardians of pediatric or disabled patients. A fasting period of 6 hours was required before the procedures were performed.

The American Dental Association (ADA) created a guide to sedation in dentistry (12). According to this guide, conscious sedation minimizes the ability of the patient to maintain an independent and continuous airway during pharmacological, non-pharmacological, or combined treatment methods, and significantly reduces their ability to react to physical stimuli and verbal commands. The requirements for conscious sedation include the following: 1) patients must consent to the procedure, 2) communication with the patient be continual, especially in the context of regional anesthesia for pain management, 3) all protective reflexes must be active (13), and 4) changes in vital signs should be minimized. It should also be noted that patients may experience slight amnesia.

Conscious sedation allows patients with dental anxiety to be treated safely without GA (14). The advantages of conscious sedation over GA include: 1) no loss of consciousness, 2) no depression of protective reflexes, 3) no depression of respiration, and 4) no depression of the cardiovascular system (15). Conscious sedation can be applied by oral, inhalation, intranasal, intravenous, intramuscular, rectal, or sublingual means (16). In deep sedation, awareness is suppressed via externally applied pharmacological agents, and patients cannot be easily awakened by verbal stimuli (17). Deep sedation is a reversible condition that may be responsive to painful or recurrent stimuli and orders, but respiratory-circulatory support may be required (17). To maintain airway viability, simple interventions or respiratory-opening techniques may be required (17). (Table 2).

Overall, 143 of our patients were treated under GA, and 39 were treated under deep sedation and analgesia. Three patients were meant to receive deep sedation but GA was applied instead due to non-cooperation. One patient had an acute upper respiratory tract infection and the operation was therefore canceled. Orotracheal intubation was performed in four of the patients treated under GA, while the others underwent nasotracheal intubation. In addition, 114 of the patients (43 children and 71 adults) were premedicated with sedatives prior to intravascular injection. These patients were drowsy, restless, unable to inhibit their movements, or aggressive; thus, injection was difficult to perform while these patient were awake. For pediatric patients, sedation was provided by sevoflurane via inhalation, while intramuscular injection of ketamine was used in adult patients.

The average duration of the procedures performed under GA was 75 min, versus 40 min for those done under deep sedation. The procedures involved scaling and root planing, filler treatment, debonding, etc., in addition to tooth extraction. (Table 3).

Table 1. Classification of American Society of Anesthesia (ASA) determining preoperative physical status and anesthesia risk.

Class	Definition
I.	A fully healthy individual
II.	Individual with a mild systemic disorder
III.	An individual with a disease that limits activity but does not leave power
IV.	An individual with a serious systemic disease threatening life
V.	Individuals who cannot survive more than 24 hours with or without surgery
VI.	Individuals with brain dead who are eligible for organ transplant

Table 2. Number of patients treated under general anesthesia and deep sedation.

	Patients treated under General Anesthesia	Patients treated with Deep Sedation
Child	60	18
Adult	83	21
Total	143	39

Table 3. Distribution of patients according to the anesthetics used.

	Number	Propofol first Applied	Ketamine first Applied	Sevoflurane first Applied
Pediatric Patient:	60	21	15	24
Adult Patients	83	17	31	35
Total	143	38	46	59

During the procedure, the patients' heart rate, oxygen saturation, and blood pressure were monitored. After the procedure, patients were taken to the recovery room and observed. Dure to the occurrence of blood loss during the operation, the patients were maintained in the recovery position and their vital signs were monitored. The patients were discharged from the hospital on achieving a Postanesthesia Discharge Scoring System (PADSS) score > 8 (Table 4). In total, 103 patients were discharged on the day of the procedure. These patients were generally under deep sedation, in good health, had minimal risk of bleeding, and minimal pain that could be controlled with medications. The remaining 78 patients required postoperative care, generally due to a risk of bleeding and residual sedation. These patients were kept under observation and discharged the next day.

Table 4. Postanesthesia Discharge Scoring System (PADSS).

Criterias	Scores
Vital signs	
Within 20% of preoperative initial value	2
Within 20-40% of preoperative initial value	1
> 40% preoperative initial values	0
Activity Level	
Stable posture, no vertigo, preoperative level	2
Need help	1
No activity	0
Sickness and vomiting	
Minimal, being treated with oral medications	2
Middle, being treated parenteral medications	1
Continuing despite repeated medications	0
Pain; minimal or no pain, acceptable according to patient can be controlled by oral medication	
Yes	2
No	1
Bleeding after tooth extraction	
Minimal; no need to change medical dressing	2
Middle; up to 2 medical dressings will change	1
Serious; up to 3 or more medical dressings will change	0

Statistical Analysis

The statistics were based on two groups: General anesthetized patients and deep sedated patients. Both groups included children and adults. The patients were subjected to general anesthesia (GA) using three different drugs such as Propofol, Ketamine and sevoflurane. Any ratio of any group was obtained by dividing the number of patients in this group by the total number of patients. The ratios were compared for analysis.

Results

In our retrospective analysis of 182 cases of patients aged between 1 and 61 years, the type of anesthesia applied during the dental procedures was chosen based on the patient's medical history and cooperativeness, the nature of the procedure to be performed, and other patient factors. The ASA Patient Status Classification system was used to determine the preoperative physical status and anesthesia risk for all patients. Overall, 63 patients were of ASA class I (completely healthy) and 119 were of ASA class II (mild systemic disease).

GA/conscious sedation and deep sedation were selected based on the guidelines of the ADA. A total of 143 patients (60 children and 83 adults) underwent GA, while 39 patients (18 children and 21 adults) underwent deep sedation. After determining the type of anesthesia to be administered, anesthetic drug(s) were chosen based on the medical history of the patients. Of the total of 60 children, propofol, ketamine, and sevoflurane served as the primary anesthetic for 21, 15, and 24 patients, respectively. In adults, propofol, ketamine, and sevoflurane served as the primary anesthetic for 17, 31, and 35 patients, respectively.

The average duration of the procedures performed under GA and deep sedation was 75 and 40 min, respectively. Patients were discharged on achieving a PADSS score > 8. Accordingly, 103 patients were discharged on the same day, whereas 78 patients required postoperative care due to a risk of bleeding or decreased activity level, and were thus discharged the next day.

The results obtained for statistical evaluation are given in Table 5. This Table shows that the ratio of patients exposed to GA to the total number of patients (143/182 = 79%) is significantly higher than those exposed to deep sedation (39/182 = 21%). The ratio of child patients exposed to GA is 33%, while those for adult patients exposed to GA is about 46%. The ratio of total child number exposed to GA to that of total adult number exposed to GA (60/83) was about 72%. The ratios of child patients exposed to propofol, ketamin and sevofloran were respectively 11.5, 8.2 and 13.2, while those for adults were 9.3, 17, 19,2.

Table 5. Statistical Evaluation of patient groups in terms of anesthesia procedures. GA denotes general anesthesia.

PROCEDURES	Number of patients according to the procedures		PERCENTAGE (%)	Distribution of patients in terms of anesthesia used	Child	adult	Child (%) GA	Adult (%) GA
Distribution of patients exposed to general anesthesia (GA)	Large cyst enucleatio	32	79	Patients who were first exposed to Propofol	21	17	15	12
	Genioplasty	11						
	Osteosarkoma	3						
	Ameloblastoma	7		Patients who were first exposed to ketamin	15	31	10	22
	Squamous cell carcinoma in maxilla	4						
	Zygomaticomaxillary trauma	13						
	serial tooth extraction	37		Patients who were first exposed to sevofloran	24	35	17	25
	Apical sesection	20						
	Mandibula fracture	16						
	TOTAL GA	143						
Patient distribution exposed to deep sedation (DS)	serial tooth extraction	22	21	Distribution of patients in terms of Deep Sedation			18	21
	Apical sesection	9						
	Mandibula fracture	8						
	Total DS	39						

Total Patients (TP) : 182 TCGA/TP (%) : 33
Total child number exposed to GA (TCGA): 60 TAGA/TP(%) : 46
Total adult number exposed to GA (TAGA) : 83 TCGA/TAGA(%) : 72

Discussion

The majority of dental treatments can be performed under local anesthesia. However, treatment may be preferentially performed under GA in pediatric or uncooperative patients, and in patients with mental disabilities or severe anxiety, or a severe craniofacial anomaly or orofacial trauma injury (1). Lee et al. (19) reported that in children with certain health issues, GA renders dental treatment less complicated and reduces the risk of complications related to the procedure (20). Before GA is induced, patients with intellectual disabilities required premedication to reduce anxiety, facilitate separation from the family, and allow for safe induction of anesthesia (21).

Pharmacological premedications can be delivered in many ways, but the oral route is the easiest and is preferred because it is reliable, painless, short-onset, short-duration, and results in rapid recovery (22,23). For sedation, ketamine (4%), meperidine (2%), midazolam (85%), and transmucosal fentanyl (3%) are preferred (23). During vascular puncture, cooperation may be limited, even in healthy patients (24). Therefore, our non-cooperative patients (24 pediatric patients) underwent vascular access following sevoflurane induction with a face mask. In this way, the time before beginning the operation was shortened and agitation of the patients was prevented. For anesthesia induction, sevoflurane is non-irritating to the airway, and has a low blood-gas partition coefficient (0.69) and short half-life, making it an ideal inhalation agent (25). In our study, 21 adult patients with intellectual disabilities were sedated by intramuscular ketamine administration (1 mg/kg) prior to vascular access. The first effects of ketamine occur 1–5 min after intramuscular injection (26). Phencyclidine and ketamine can cause dissociative anesthesia (27), euphoria, and dream-like hallucinations in a dose-dependent manner (28). As such, they are not recommended for use in epileptic patients because of their psychomimetic side effects (27). Nevertheless, analgesic efficacy is observable even at subanesthetic doses (6), while hypersalivation, an increase in muscle tone, abnormal eye movements, and hepatic dysfunction can occur due to chronic abuse (29). In our patients, an increase in saliva was observed in accordance with the literature, but no abnormal eye movements were observed.

Changpong et al. reported that fear and anxiety levels tended to be very high in response to dental procedures, where sedation was necessary to prevent this (30). In our study, 4 patients underwent orotracheal intubation under GA, while 138 underwent nasotracheal intubation. Two patients were difficult to intubate, including one adult (aged 61 years) and one child (aged 4 years). The ASA describes difficult intubation, in the case of an experienced anesthesiologist, as the requirement for more than 10 min and/or three attempts to intubate, non-availability of direct laryngoscopy, the requirement for use of an auxiliary device, and an inability to visualize the glottis despite external pressure. The Mallampati and Wilson risk-sum scores, as well as laryngoscopic evaluation, measurement of the sterno-mental distance, evaluation of the anatomy of the anterior mandibular region and degree of extension of the head, radiological examination, and computerized imaging are used to predetermine intubation difficulty (32,33). The incidence of difficult intubation and ventilation varies between 1–13%, and severe intubation difficulty may be encountered in 2–3% of cases (34).

A study by Foley involving 166 pediatric patients reported that the average procedure time for minor oral surgeries with GA or nitrous oxide sedation was 30 min (35). Sahin, in a study of 12 intellectually disabled patients, reported that tooth extractions under GA usually lasted for 6–15 min (36). In our study, the average duration of the procedures was 75 min for GA and 40 min for deep sedation. The reason for these long durations is that, in our study, patients were treated not only for tooth extraction, but also for filling caries; scaling and root planing, cyst enucleation, endodontic treatment, apical resection, amputation, and removal of fixed prostheses were also involved.

Postoperative complications and some side effects may occur in patients treated under GA (37,38), including eating difficulties, drowsiness, pain, bleeding, sore throat, vomiting, fever, and cough (39). Farsi et al. reported that these complaints decreased significantly in all patients on postoperative day 3 (39). Similarly, in our patients these complaints were significantly reduced within 2–3 days. Pneumomediastinum (38-40), pneumoperitoneum (40), pneumopericardium (40) and fatal venous air embolism (41) are also mentioned in the literature. It is reported that air embolism during dental procedures is mostly due to the compressed air supplied directly to gingival defects during treatment (42). Air embolism did not develop in any case in this study.

Statistical evaluation indicates that GA is a convenient procedure for most patients. It also shows that adults are more suitable to GA. As for drug application. Propofal and and semvofloran seems to be more suitable for child group, while ketamin ve sevofloran for adults.

Conclusions

The frequency of dental treatments performed under GA or sedation is gradually increasing. With the right indication, judicious patient selection, and a comprehensive anesthesia plan, patients who cannot be treated under local anesthesia can be treated safely under preferably GA. Data suggest that adults are more suitable for GA than children. However, because of the potential risks associated with GA, anesthetic procedures should be performed by experienced anesthesiologists in an operating room environment. Due to its attendant risks, dental treatments should only be performed under GA when medically indicated; it should not be performed arbitrarily at the request of patients or their relatives.

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