

Potential complications and preventive measures in pediatric dental treatments performed under general anesthesia and sedation

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Abstract

The aim of this review was to evaluate the potential complications associated with pediatric dental treatments performed under general anesthesia and sedation and to outline preventive measures to enhance patient safety and clinical outcomes. The number of dental treatments for pediatric patients under general anesthesia and sedation is rapidly increasing in dentistry in Türkiye and worldwide. With this increase, it has been noticed that despite similar procedures with general anesthesia and sedation applications applied in medicine, pedodontics, and anesthesiology, there are significant differences in indication decisions and complications. The fact that general anesthesia and sedation applications in pedodontics do not have an exceptionally long history creates the need to establish specific standards and safety measures. Based on the experience gained in this field, these measures will give dental professionals a sense of security and confidence and include the lessons learned in the training and practice curricula. Accordingly, in the present review, complications and problems that may occur before, during, and after treatment specific to pedodontic applications are mentioned, as well as suggestions for their solution. Postoperative complications commonly include hemorrhage, nausea, vomiting, soft tissue injuries due to biting, restoration fractures, and delayed recovery. Children with multiple extractions or extensive dental procedures are at higher risk for postoperative bleeding and discomfort. Preventive strategies include thorough preoperative planning, adherence to legal and clinical standards, appropriate anesthesia technique selection, careful intraoperative monitoring, use of checklists, and detailed postoperative instructions for caregivers. In conclusion, dental treatment under general anesthesia and sedation can be performed safely in pediatric patients when strict protocols and preventive measures are followed. A multidisciplinary approach, continuous training, and increased awareness of potential complications are essential to minimize risks, improve treatment quality, and reduce the need for repeat anesthesia in children.

Keywords: General anesthesia, sedation, children, dental treatment, complication

1. Introduction

Pediatric dentists frequently encounter children who are too young to cooperate or have elevated levels of fear/anxiety despite having a large number of advanced dental problems in their clinical practice. Behavioral guidance techniques often fail in these children or are impossible to apply due to their early age. At this point, general anesthesia and sedation applications allow children to be treated quickly and safely in a single session (1-6).

As in the rest of the world, 30-40 years ago, only a limited number of children were treated under general anesthesia or sedation in very few centers in Türkiye, whereas currently, dental treatment of children can be performed under general anesthesia/sedation in a significant number of large private treatment centers and almost all state institutions (7). However, it is a prerequisite in the standards of specialty education that the institution in which the training is received has the necessary infrastructure for applying general anesthesia and sedation. The rapid increase in the number of patients undergoing dental treatment under general anesthesia and sedation and the number of application centers in Türkiye has led to the establishment of some standards and safety measures besides the applications for medical purposes.

General anesthesia and sedation management for dental treatment have distinctive characteristics from other anesthesia applications regarding the risks of working in the oral environment. In addition to the fact that pedodontists do not have the knowledge, experience, and expertise in general anesthesia and sedation applications as medical specialists, anesthesiologists do not have the experience of working with pedodontists performing dental treatment procedures in the oral environment. This leads to the need to establish different procedures and safety measures due to the increasing number of cases and to add these teachings to the training curricula. This review aims to include the complications encountered in general anesthesia and sedation applications for patients who mostly need dental treatment and the precautions that can be taken. It also seeks to contribute this knowledge to the application procedures and guidelines to be prepared in the future. At the same time, it is aimed to create a resource for anesthesia applications for the training curriculum of pediatric dentists.

2. Preoperative evaluation and preparation for anesthesia

Deciding to perform dental procedures under anesthesia in pediatric patients is as important as deciding on the need for and method of anesthesia, similar to other general medical practices. Performing procedures under

local conditions should be the physician's priority, and general anesthesia and/or sedation should be preferred only when indeed indicated. (8) It is often not possible to perform a detailed dental examination in young or disabled children. It is almost impossible to perform dental examinations in older disabled children (2, 9). Even in the worst-case scenario, relying only on the anamnesis information obtained from the parent when deciding on treatment under anesthesia would not be the right approach, as it would risk anesthesia in a child who does not need treatment.

In determining the method of anesthesia (sedation or general anesthesia), many factors, such as the number and difficulty level of the patient's treatment needs, the presence of the need for restoration renewal, limitations due to the patient's systemic condition, and the patient's age, should be evaluated together (2). Ensuring airway safety during oral procedures is even more specific and essential. The gold standard for ensuring airway safety is endotracheal intubation (ETI). Endotracheal intubation is an invasive procedure that ensures the patient's airway safety and ventilation during general anesthesia applications. It is performed by advancing a tube suitable for the patient's age and anatomy through the vocal cords. Sedation applications are more superficial anesthesia applications in which anxiety and fear are eliminated, and analgesia is provided without suppressing the patient's spontaneous ventilation. During sedation, the unconscious patient continues to breathe on his/her own; therefore, airway safety is not fully ensured. Pedodontists and anesthesia practitioners who perform dental treatment in the mouth should be more careful to ensure airway safety. While sedation applications provide advantages regarding patient safety, recovery, and more efficient use of the anesthesia environment, they have limitations regarding airway safety in terms of limited working time and blocking the oral environment due to the patient's breathing. General anesthesia, on the other hand, allows for more comprehensive and prolonged treatments than sedation (2).

Effective communication and collaboration between the pedodontist, pediatrician, and anesthesiologist are crucial for preoperative evaluation. This collaborative approach, where the three physicians discuss the case regarding their specialties and make decisions together, is key to planning a successful operation based on the treatment needs of the case and the patient's systemic condition.

Another critical issue before anesthesia is to thoroughly discuss with the parents the method of anesthesia and the anticipated treatment plan and procedures, including before and after anesthesia. This discussion should include the need for treatment, the problems that may be encountered due to not performing the treatments, the expected benefit from the therapy, and possible complications. It should be remembered that the patient's guardian is the crucial point in the operation decision, and the final decision of the patient's guardian should be respected.

Before the operation, it is crucial to record the information obtained from the patient's parents and, if possible, the anamnesis information (patient's pain type and area, abscess history, radiographic findings, success of previous treatments, drug allergies, etc.) on the treatment planning form, especially in centers where the physician filling this form and the physician operating are different. As a result, it should be explained to the patient's parents that the treatment plan prepared before the operation is a prediction and that there may be changes in the planning during the operation. In this way, expectations for treatment planning will not be created by the patient's parents, and it will be easier for the physician to decide on the changes that need to be made during the pre-planning stage of the operation. In pre-treatment planning, physicians often do not have the opportunity to examine the patient comfortably due to their extreme non-compliance or immature age. Radiographic evaluation and pulp health assessment methods are also frequently unavailable. For this reason, special attention should be paid to teeth with active care. A deciduous tooth with a minimal carious lesion may exhibit advanced pulp degeneration. Likewise, if the lesion color is close to the tooth's color, it increases the probability of error in caries detection (5, 12).

Dental treatment under general anesthesia and sedation should be performed in institutions and organizations that comply with the legislation of the Ministry of Health of the Republic of Türkiye and only under the authority of the anesthesiologist. It is vital to check the operating room environment and dental equipment before the operation. Because the problems that may be experienced in this regard after the start of the operation may cause serious problems and may lead to grave situations, such as unnecessary anesthesia for the patient. Sedation applications, especially in dental offices outside the operating room, should be provided in environments that follow legislation, and sedation and anesthesia should not be applied in any clinic or office. A list of materials and equipment required for sedation and general anesthesia applications should be created. In this list, especially the control method of the devices should be written, and the approval and signature of the assistant personnel performing the control should be ensured (8, 13).

3. Complications during treatment

The team providing healthcare services is responsible for the patient's safety and is prepared for dental treatments in the perioperative period. During the removal of the unconscious patient in the operating room environment and preparation for anesthesia, there is a possibility of falling off the table due to unconscious movements they make. In this respect, the whole team should be careful, never leave the patient alone, and always pay attention to the patient.

Before anesthesia, it is necessary to indicate in the treatment planning whether there is a luxated tooth in the

patient's mouth, naturally exfoliated, or extracted empty tooth areas. Nevertheless, it is helpful for the pedodontist to check this situation once again before anesthesia. Because there is a risk that a luxated tooth may escape into the patient's respiratory system during intubation, however, the probe's contact will enable a faster decision about whether the loss of a luxated tooth causes bleeding that may occur in the patient's palate.

During the preparation phase of anesthesia, attention should be paid to cutting and piercing instruments, such as needles, around the patient, and materials that may harm the patient should be removed from the environment as soon as possible. Since the child under anesthesia will be deprived of reflexes to protect himself/herself, the operation team and especially the pedodontists are responsible for the risks of extra-operative injuries and damage. For this reason, it should be ensured that the patient's limbs do not remain flaccid or twisted, towels are placed under the equipment in contact with the patient, the patient's eyes are isolated, the patient's heating system is working, and the patient is covered in a way that protects him/her.

Intubation can be performed nasally or orally in patients undergoing general anesthesia. Likewise, a nasal mask or laryngeal mask (LMA) can be used for sedation applications is possible. If there are many lengthy procedures in the oral environment under general anesthesia, if the patient's mouth opening is limited, nasal intubation instead of oral intubation, and if the use of aqueous systems such as airtor is foreseen under sedation, the choice of LMA instead of the mask will be more accurate. Nevertheless, owing to patient-related variables and limitations, the choice of method should be agreed upon between the anesthesiologist and pedodontist before the operation. For example, caution should be exercised in cases such as epidermolysis bullosa or syndromic children for whom the use of muscle relaxants is not appropriate.

During operations, pedodontists often use a plastic mouth opener. This opener should be placed so that the lip is not damaged during the procedure and does not press on the tongue and lip afterward. Bleeding lips, especially during insertion, will make the physician's work during the operation exceedingly challenging.

Especially in sedation applications, it is an essential advantage for the pedodontist to work close to the patient's face. This is because cyanosis of the lips, which is the first sign of an unexpected decrease in oxygen saturation, may occur during the operation. Likewise, during general anesthesia, the pedodontist should be able to recognize situations such as dislocation of the intubation tube or leakage in the circuit and alert the anesthesiologist early. In case of emergency intervention requirements, the pedodontist and their assistant staff should be trained and experienced in evacuating the oral environment as soon as possible and cleanly to allow the anesthesiologist to intervene in the patient. Before the operation, an experienced pedodontist pays attention to the patient's lip color and minimizes possible complications by monitoring changes in this color.

Special attention should also be paid to the rotary instruments used during the operation. At this point, the tissues at the most significant risk of injury are the patient's lips, tongue, gums, and cheeks. Likewise, matrix carriers and bands polishing disks can cause considerable damage to the patient if not used carefully. Unused rotary instruments should never be left on the patient and must be replaced. This is because accidentally pressing the pedal when it is left near the patient may cause body injuries to the patient. Rotary handpieces should be checked to ensure that the burs are fully seated, and that the patient's respiratory system is open, especially during sedation. Physicians are responsible for protecting auxiliary staff and patients. For example, rotary instrument injuries are possible when the assistant performs an excision with their finger instead of a mirror. Another risk associated with rotary instruments is that they can quickly wrap if they come into contact with fibrous materials, such as cotton. In such cases, the burr must be replaced because even a tiny piece of cotton can cause severe damage to the tissues around the rapidly rotating tip.

It is vital to protect the physician and the patient from chemical materials such as formocresol and phosphoric acid as rotary instruments. It should be noted that there is no protective mucus layer on the soft tissues in the oral environment, primarily due to the drugs used in general anesthesia. The places where these materials are prepared and disposed of after use should be clear and protected.

In the operating room environment, it should be preferred that the physician assistant is an experienced person who can work quickly without losing concentration for a long time. Because the harmony between the pedodontist and the physician assistant plays a key role in the safety of the operation, the quality of the treatments, and the rapid completion of the case. When the assistant staff sits opposite the physician, the physician assistant can see the oral environment from the opposite direction, which can be of great benefit in situations where the physician may overlook.

When working in the oral environment under sedation, some situations require more attention than general anesthesia. The main ones are not to exert pressure on the mandible to narrow the patient's airway and not to push the mask towards the nose to interfere with the patient's ventilation. In both cases, there is a risk of decreasing the patient's oxygen saturation. These risks can be avoided by having the physician's assistant support the patient's lower jaw or by having the physician ensure that the mask is positioned on the nose and does not cover the patient's nostrils.

Employing risky treatment methods, such as direct hairdressing of deciduous teeth, is inadvisable when treating the patient. It is essential to consider that even an unsuccessful treatment may result in the need for reoperation in the current patient group. This is particularly relevant for deciduous teeth with active caries lesions. The high rate of caries progression and high microbial activity in these teeth may have initiated pulpal inflammation before reaching the pulp, especially

in young permanent teeth, owing to the wide structure of the dentin canals.

Sometimes, unexpected or fundamental changes occur in the treatment plan during surgery. Explaining the new situation to the patient's parents using photos and videos taken during the operation will produce more satisfactory results.

After completing the patient's dental treatments other than the tooth extraction, it is necessary to check the presence of any particles that may have been left behind and the treatments other than the tooth extraction to ensure that they are complete and intact. This is because bleeding during tooth extraction prevents these checks. The best method is to prepare a checklist, and the most reliable method is to conduct these checks with the dentist and auxiliary staff according to the order of this list.

4. Postoperative evaluation and follow-up

After the operation, attention should be paid to the final preparations before the patient leaves the operation area. The patient's mouth area must be cleaned, the long sponges left in the mouth must be replaced if extraction has been performed, and the patient must be transferred to his/her room in a clean manner. The patient's parents are in a stressful and anxious waiting period during the operation. Immediately after the operation, they should be reassured with a few minutes of explanation before the child leaves the operation area. Psychologically relieved parents have smooth dialogues with the staff in the waiting area.

The recovery process, which occurs until the child regains consciousness, is extremely important. After the patient is taken to his/her own bed, standard patient discharge criteria should be prepared for patients who underwent sedation and general anesthesia, and the patient should be discharged after an appropriate follow-up period (Alderete Score). The child should never be left alone during this period and for the first 24 hours after discharge. The patient should be followed up, discharged, and accompanied by their parents. Discharge recommendations should be explained to the parents and, if necessary, provided in writing (14). Postoperative antibiotics and/or any treatment recommendations should be prescribed, and the patient should be informed about the treatment.

Another important detail is that numbness in the tongue and lip area caused by the mandibular nerve block, especially in pediatric patients and mentally retarded patients, can disturb patients, especially during the period of awakening from anesthesia and recovery, and may cause the unconscious patient to bite his tongue and lip and cause severe damage because he does not feel pain (15). To avoid this risk, a mandibular block should be avoided unless it is necessary. (16) In cases where local anesthesia is used, the patient's parents

should be warned to prevent the child from involuntarily biting the oral tissues. It is appropriate to explain to the patient's parents that the swelling in the bitten area may increase for a while after this most common complication, which may occur due to biting or sucking due to local anesthesia and may even prevent feeding and speech, depending on the amount. To speed up the healing process, mouthwash as an antimicrobial spray may be recommended. It is also recommended that children with this complication be monitored for the risk of bacterial infection, and antibiotic treatment should be initiated if necessary.

One of the most common postoperative complications is hemorrhage (14). Dental bleeding, which generally does not last for a long time, may last longer or in copious amounts as a result of a large number of extractions, extractions of teeth with widespread chronic infection, or challenging extractions, such as ankylotic teeth. Especially in patients with multiple extractions, it is helpful to suture the extraction site, apply pressure to the extraction site with a sponge for a while after extraction, and wait for it to decrease. It is also essential to prevent the child from poking the extraction site with the tongue, which increases bleeding, not to consume hot foods that cause vasodilation, and to avoid the use of drugs that may prevent clotting. The sponge used to stop the bleeding must be monitored. Especially in patients with intellectual disabilities, it should be kept in mind that the sponge may be chewed and swallowed, mistaken for food.

Restoration fractures due to severe contraction and jaw clenching that may occur during awakening are rare. Nevertheless, when such a situation is recognized, it is crucial to prevent the child from aspirating the broken pieces.

5. Conclusion

With the application of interventional procedures in the mouth, the presence of particles and debris in the mouth during the application, and the need to use water-cooled rotary instruments most of the time, cases where dental treatments are performed under anesthesia have significant differences compared to general medical practice in terms of the issues to be considered and risks. Considering the rapidly increasing number of cases, knowledge and experience in this field are urgently needed, both on the anesthesia front and on the pedodontic front. However, it should not be forgotten that even the most ideal restorative treatment planning and execution is only part of the treatment of children, and it is vital to evaluate the effectiveness of caries risk reduction measures that can prevent both treatment complications and the need for re-treatment under anesthesia with follow-up of the patients treated.

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