

# What Types of Sedation are used in Pediatric Dentistry?

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## Abstract

Some children are not able to cooperate in dentistry for reasons such as low age, physical and mental disabilities, or severe and uncontrolled anxiety. Therefore, performing dental treatments in the office may be a risk factor for them. Besides, one of the important goals in children's dentistry is to maintain mental health while in evolution; and also create a positive memory of dentistry. In the event of an unpleasant childhood memory, the whole future of a person's dentistry may be affected. Consequently, for these children, dental treatments are recommended under anesthesia or sedation.

Nowadays, there are several drugs available to help patients' comfort and relaxation during dental works. Oral sedation, nitrogen oxide, intravenous relaxation, and ultimately general anesthetic are major types of Anesthetics that are used in pediatric dentistry. Factors such as the age of the child, the severity and extent of dental caries, the dentist's expectation of the outcome of the treatment, the risk of treatment, and the satisfaction of the parents would affect the decision of the dentist to select the appropriate type of anesthesia.

**Keywords:** Anesthesia, Physical and Mental Disability, Fear, Nitrous Oxide, Bitter Dental Experiences, Low Age.

## Introduction

Non-cooperative children with uncontrolled anxiety and anxiety in dentistry are one of the most important challenges for both dentists and parents. Many factors, such as information transmitted from parents and friends, a previous painful experience of dentistry, low age of the child, and fear of the presence of sound and water during dental procedures, would affect the lack of cooperation of the child, which makes it

impossible to perform child's dental treatment.

In the past and even now, in many Pediatric dental centers, the dentist has no other choices except to let his assistants and even parents immobilize and hold the child firmly for a while so the dentist should be able to perform a limited treatment in the shortest time. In another word, the lack of cooperation of the child will reduce the quality and standard of provided health care.

Also, physical intimidation, in addition to reducing the accuracy and quality of work, can create unpleasant psychological outcomes in the child. Unfortunately, in many cases, this is the only way to relieve the child from dental pain. An alternative to solving this problem for this group of children is to perform dental treatment under general Anesthesia to protect the child from the fear of exposure to dental treatment.

About 50 years ago, the dangers of Anesthesia were enormous, but nowadays, due to the needs of patients' referral to well-equipped facilities with general anesthesia, and the development of monitoring and monitoring systems in the operating rooms, the level of Anesthetic risks and complications for patients are very low. When a dentist is performing dental procedures, the Anesthesiologist simultaneously examines the symptoms of the patient, including blood pressure, respiration, and Anesthetic state; and fully controls the condition of the patient.

### History of application of Anesthesiology in Pediatric Dentistry

The history of using anesthesia will be very long and tedious. As a result, the following explanation is a brief overview of the application of dentistry in the last 150 years.

Gardner Colton revived nitrous oxide use in dentistry in 1863, and by 1868 he claimed that he had treated 20,000 cases and extracted 75,000 teeth using N<sub>2</sub>O anesthesia. In the meantime, other agents were also introduced that provided conscious sedation and/or pain relief, or general anesthesia. The first general Anesthetic drug was *Ether* introduced in 1846, and *Chloroform* followed a year later. [1]

By 1895 there was enough literature available to support the continued use of nitrous oxide and oxygen for prolonged dental cases, mainly based on the work of Herbert Paterson, and Clover, and Coleman. Reports of dentists using nitrous oxide to provide inhalational conscious sedation, rather than general anesthesia, started to appear in the early 1900s. This was done by an American dentist on children for the first time.

By the 1930s, an intravenous barbiturate, *hexobarbitone*, was in use in UK dental practices for sedation. During the 1950s and 1960s, the teaching of nitrous oxide inhalation sedation was introduced in US dental schools. [1]

Today, nitrous oxide is still widely used in both dentistry and medicine. It has proven to be a very safe and popular sedative agent and a Mild Anesthetic agent at higher concentrations. Administered properly, the nitrous oxide-oxygen technique has a very high success rate with a very small number of adverse effects and complications.

### What is Sedation in Dentistry?

Sedation levels which are used are including:

- Mild sedation: The patient is alert but relaxed.
- Moderate sedation (scientifically "alertness"): A patient may stutter while talking and does not remember much of the treatment.
- Deep sedation: The patient is on the border between sleep and awakening, but can still be awake and alert.
- General Anesthesia: The patient is completely anesthetized.

### What children can use sedation techniques for dental treatments?

The sedation technique is the most appropriate method for those who have a lot of fear or anxiety that prevents them from going to dental offices. Dental procedures in sleep may also be appropriate for these people, those who have the following conditions.

- Have a low pain threshold.
- Cannot stay motionless on the dental unit.
- Difficulties to control their movements.
- Have Very sensitive teeth.
- With severe gag reflexes.
- Full Dental treatment.
- Limited time for dental treatment.
- There are pathologic experiences with dentistry.
- Local anesthesia works hard for them.
- Fear of injection
- Cerebral Palsy or Parkinson's disease

Some children become anxious when they visit the dentist. Consequently, they are unable to sit motionlessly and cannot remain for prolonged treatment. In this case, the dentist may prescribe an Anesthetic that the child can tolerate the treatments. Children are divided into the following groups for Anesthesia. [2]

1. Non-cooperative children: Children who are not normally prepared to cooperate with a dentist. This is the most common cause of referral pediatric patients for application of anesthesia (85%) (3).
2. Disabled and mentally retarded children: Those who have less ability and cooperation with a dentist

specialist.

3. Young children (toddlers): Those children with a large number of decayed teeth (5 to 10 cases) whose physical control is partially impossible and overwhelming.
4. Shy and timid children: Because of unnecessary fear, this group of children is not willing to treat their teeth. Sedation is the only way that they can be treated to reduce their fear and anxiety over time.
5. Children with a wide range of dental works: Numerous referrals for dental work will cause fatigue and reduction of self-confidence in children; and therefore, results in not coming back again to the dental office for further dental procedures.
6. Children with bad dental experiences: This is one of the most common cases in which children do not allow the dentist to work with a local Anesthetic. Such kids scream and shout from the time they enter the office because the dental office looks like a terrifying place for them. With this action and behaviour, they want to stop the dentist's work.

### Types of sedation applied in pediatric dentistry

Nowadays, there are several drugs available to help patients' comfort and relaxation during dentistry. Some drugs control pain, some of them relaxing, and others take the patient to deep sleep during treatment. Although for most patients, a local Anesthetic is used to prevent pain, on the other hand, sedative (*Mild Anesthetic*) and *General Anesthetic* may be used for safety, effectiveness, and completion of dental treatments making the final decision for using sedation is based on individual assessment and the dentist conversation with the patients.

Oral sedation, nitrogen oxide, intravenous relaxation, and ultimately general Anesthetic are the major types of Anesthetic that are used in Pediatric dentistry.

**Oral Sedation:** Depending on the dose, oral administration can be for mild to moderate sedation. For mild sedation, they give the patient a drug is commonly called Halcion (generic name: Triazolam), a member of the Benzodiazepines group; and it usually takes about an hour before the start of the treatment. [4- 6]

This pill makes the patient sleepy and drowsy, although the kid still awake and alert. To have more sedation, a larger dose should be given. This is a sedative that is most commonly used in Pediatric dentistry (dentistry in sleep). With moderate sedation, some kids are sufficiently loose and sleepy and practically asleep while they are treated even though they can usually wake up with a small shake.

In the oral sedative method, taking into account the specific circumstances of the child, his age, and weight, the sedative medications are used to reduce the patient's anxiety and stress. This method has been used for many years in dental and medical services.

One of the best medications that can have minimal side effects in addition to its beneficial effects for kids' relaxation is *Midazolam* a member of the *Benzodiazepines* group. [7, 8]

If this medication is taken orally and at a controlled dose, there will be no sustained side effects. The drug should be taken under the supervision of the dentist at the office, and the exact amount of use should be determined by the pediatric dentist. This sedation is done in non-cooperative children who need limited treatments. When choosing a drug type, the dentist will consider the following factors: level of anxiety, cooperation, and types of treatments.

With oral sedation, the baby becomes slightly sleepy, but can still respond to simple stimuli and instructions. Some minor side effects include nausea or vomiting in some of these medications. After the treatment, the dentist should provide a care pamphlet for parents. It is necessary to stay in the recovery room for some time after he becomes conscious so that his physical condition is controlled by the dentist. Dental staff should be assured of the complete recovery, and they should monitor the child for any problems in responding to stimulation.

**Mild Inhaler sedation:** A patient breathes a combination of nitrous oxide gas (another name is "*laughing gas*") and oxygen through a mask that is placed on his nose. The child will feel relaxed in five minutes. Then, at the end of this method, pure oxygen is given to the patient to clear the remaining nitrous oxide. This form of Anesthetic is recommended for children who are slightly anxious or nervous. This gas helps him to relax during the treatment. It should be noticed this method is the only form of sedation that the patient may be able to drive home after his treatments.

This gas allows children to relax more safely by eliminating their fear. In this case, treatment is easier and safer. The effects of nitrous oxide are mild, safe: and quickly is disposed of the body. The baby is awake during treatment and interacts with the dentist.

Sedation is done through the mouth and nose. On the other hand, this method can be implemented as soon as a child patient arrives at the hospital. This type of sedation usually gives the dentist 20 minutes to work on the teeth. In other words, the inhaler sedative does not sleep the patients but helps them to calm down and relax.

The point to be taken into account is that sometimes young children are reluctant to put on masks. In this case, nitrous oxide

is not a good option for him. Besides, this sedative can cause nausea in the baby [9]. If this type of Anesthetic is to be used, it is better not to feed the child a few hours before starting treatment; and give him just some fluids or a light meal. Also, if your child is suffering from a Cold or having difficulties with nasal breathing on the day of the treatment, this type of anesthesia will have less effect on him.

**Deep Sedation:** The patient receives a sedative drug through the vessel, so it works much faster. This method allows the dentist to constantly adjust and control the sedative level in the patient. In this method, which is performed by an anesthesiologist, the children are completely in a deep sleep state, but all vital acts of the child, such as breathing and swallowing, are still carried out by the child. In other words, the dentist can perform longer treatments than that one in oral doses. Some patients may be completely anesthetized with IV sedation, although some may be semi-conscious.

**General anesthesia:** The last alternative treatment for children, who are not cooperative with a dentist for various reasons, is the use of general anesthesia. In this method, in addition to having the child completely available to the dentist, it is possible to carry out more extensive treatments than the two methods of oral sedation and deep sedation.

Dental treatment under general anesthesia despite a high risk of side effects nowadays is recognized as a safe and useful treatment in hospitals [10]. The application of this method in dental treatments by Pediatric dentists is increasing [11]. Also, the increased popularity of General anesthesia among parents is very significant [12].

During anesthesia, the patient experiences a decrease in consciousness and does not remember the events during the operation. There is also complete pain relief for the baby, and no movement is done by him. This condition allows the dentist with a thorough and accurate observation to finish his treatments. If the child has a fever, infection, or a cold, treatment is postponed to another day. The patient would take medications that make him almost unconscious or completely unconscious (deep sleep) during dental treatment.

While the patient is fully anesthetized, he cannot be awakening up easily until then the effect of the Anesthetic drug is eliminated or neutralized by a neutral drug.

#### **General anesthesia is recommended if:**

- The child cannot stay motionless during the treatment even with an application of sedation techniques and behavioural management.
- A surgery is required that the child cannot tolerate that in awakening.
- Dental works have to be done over a long time.
- The child has a type of disability that is unable to

understand the treatment.

- In the event of a possible injury to the child during work under oral sedation.

#### **General anesthesia for dentistry is performed by one of the following people:**

- Anesthesiologist
- Dental Anesthesiologist
- Oral and maxillofacial surgeon

Each of these people has seen training in these techniques; they monitor the condition during the treatment. Before the work starts, the child is examined for any medical condition and problems.

The Academy of American Pediatric Dentistry (AAPD) has recommended general anesthesia to be used for comprehensive treatment and emergency dental works in the event of the ineffectiveness of local Anesthetic, anatomical variation, or allergy to local anesthesia [13].

**Other Anesthesia Methods:** All sedative medications do not need to be given by oral routes. They can be delivered through the nose, suppository, intramuscular injection, or intravenous injection. This method requires more experience and should be monitored properly. Intravenous injection should only be done by dentists who are highly skilled in this technique.

#### **Advantages of oral sedation**

The main advantages of oral sedation versus other sedation methods are [14-17]

- Ease of administration (only have to take a pill)
- Effectiveness
- No needles involved
- High patient acceptance
- Amnesic effect
- Lower cost vs. intravenous sedation

#### **Disadvantages of oral sedatives**

Since the medications are administered orally, it is not possible to get a consistent level of sedation on every patient. The most important disadvantages of the oral sedation method include the following: [15- 17]

- No analgesic effect of oral sedatives
- Not enough for severe anxiety or phobias
- Long latent period
- Non-predictable sedation level of orally taken sedatives
- Difficulty to adjust sedation level

- Monitoring requirements
- Prior arrangements are required
- Prolonged duration of action of oral sedatives

### The advantages of intravenous sedation

Some of the benefits of IV sedation in dentistry are: [16-18]

1. High level of anesthesia: Compared with oral anesthetics, IV has high anesthetized levels.
2. Immediate effect: Once injected, it starts to show its effect, while oral anesthesia takes some time to take effect.
3. Quick Recovery Time: IV recovery time is much faster than oral anesthesia.
4. Use in severe anxiety: People with high levels of anxiety get more of this Anesthetic.
5. Amnesia: One of the side effects of IV sedation is short-term forgetting that kids do not remember something from the time of action.
6. Patient alertness: the patient remains conscious throughout the procedure makes IV conscious sedation a much safer alternative to General Anesthesia.

### IV Sedation Disadvantages

Despite the several benefits that IV sedation can offer, this type of sedation is not as popular as often as oral or inhalation sedation by pediatric dentists. The main risks and possible side effects of IV sedation are also included: [16- 18]

- Over-sedation
- Respiratory depression
- Hematoma formation Amnesia
- Sexual fantasies
- Intravenous access
- Escort required.
- Cost of IV sedation.
- Availability

### Advantages of general anesthesia

The application of this method in dentistry for children, who are not able to cooperate due to their age, fear, and special medical needs, seems to be essential. The advantages of using general anesthesia for children with special needs are shown below [19- 23].

- Relieves anxiety
- No memory of the dental procedures
- Reduced gag reflex
- Finishing the whole procedures in one session
- Pain relief
- No needs for the child's cooperation
- Positive psychological effects on the child
- Positive reinforcement of parenting view

### Disadvantages of general anesthesia

General anesthesia may be necessary for certain patient groups, or some extensive oral surgery procedures, however, *Conscious sedation* can be suggested as an alternative sedation method for the majority of dental treatments due to some side effects [17, 24, and 25].

- Allergic reactions to Anesthetic drugs
- Damage to the front teeth when intubation
- Sore throat
- High costs and non-insurance coverage
- Special medical and hospital types of equipment and expensive tools
- Unconsciousness during treatment
- Lack of protective reflexes
- Need special rooms for hospitalization and patient recovery
- Handling the situation event during and after the treatment
- Aspiration
- Anesthesia awareness

### The most popular sedation method

The most common type of sedation and in pediatric dentistry is the use of mild sedation, such as nitrogen oxide (by inhalation through a mask) or oral intake of a sedative such as *Ativan* for patient relaxation. *Lorazepam*, sold under the brand name *Ativan* among others, is a benzodiazepine medication [26].

Nitrogen oxide with oxygen is used in this method. This method allows the patient to maintain his consciousness in a state of relaxation. To raise the level of sleepiness, it may be combined with other medications to temporarily increase its effect; and may cause some sleepiness.

### Selection between general anesthesia and IV sedation

Pediatric dentistry with anesthesia can be done in two ways: complete anesthesia and IV sedation (the child is awake in this case and this method is for cases where treatment requires a little time). It should be noted that the Anaesthesiologists preference is general anesthesia because it does not damage the lungs, but in IV sedation the lung may find spasms; may be harmful to the child in the future.

Safe to say, making decisions between anesthesia and relaxation is often difficult. However, in both methods, the risk of mortality is very low, but there are inevitable complications after treatment, which should be taken into consideration. Also, both methods require the use of medications, experienced medical staff, and special medical types of equipment, which should be included in the treatment protocol.

The choice of using the Anesthetic or sedative method for the child is entirely the responsibility of both the pediatric dentist and the anesthesiologist. Usually, based on the number of teeth in the needs of treatment, the general health status of the child, and the length of time required for the treatment, the necessary decisions are made.

In sedation procedures in dentistry or dentistry in sleep, a drug is used to help patients relax during dental treatments. Patients are generally alert in this method, except those who are under complete anesthesia. These treatments are performed in a hospital environment under the supervision of an anesthesiologist. Certain medications are prescribed by the intravenous injection for the child, and after the effects of the aforementioned drugs, dental treatment is started.

During anesthesia, the patient experiences a decrease in consciousness and becomes unconscious; and does not remember the events during the operation. There is also complete pain relief for the patient, who allows the dentist to have full control over the treatment; and he would be able to carefully consider what treatment is needed for his patient. Therefore, most pediatric dentists consider this method as a good substitute for intravenous sedation.

### How is safe the application of general anesthesia in dental treatment?

Are the treatments with an Anesthetic medicine could be a risk to the child? This is a question that is often raised by parents. First of all, if a child has advanced illnesses; or anesthesia is a high risk for the child's physical condition, there should be an immediate consultation with both the Pediatric dentist and anesthesiologist so that they will come up with an appropriate solution.

If the treatment center is valid and well-equipped and also the treatment will be done by a specialized person under the

supervision of the expert staff, the child will not be exposed to risk. Furthermore, it does not require hospitalization too. The child will be discharged from the hospital three to four hours after the completion of the work unless the child has certain diseases or physical and mental disorders that may be monitored by an anesthesiologist for some time in the hospital.

This treatment is preferably done by a pediatric dentist who has undergone anesthesia courses. Recently, many general dentists have performed this kind of treatment that requires the necessary documentation to show their abilities and authorization to do this kind of treatment to children's parents. The dentist must make sure that he performs the child's treatment in a well-equipped hospital or limited surgical center. The quality of the devices and the type of medications used in children will have a great impact on the quality of anesthesia. It should be noted that these treatments should not be performed in the dental office at all.

There is always a risk to the use of anesthesia and local anesthetics. This method is usually low risk and safe if it is done by an experienced specialist. However, certain people, including people with obesity or those with sleep apnea or respiratory failure, should certainly talk to their dentist before using sedation, because these people are more likely to have serious problems after having anesthesia and sedation.

In the year 1990, Poswillo considered the use of general anesthesia as inappropriate sedation for dentistry [27]; and the British Dental Committee did consider the use of general anesthesia to be hazardous to some extent [28].

At the moment, new anesthetics have been developed that have more efficacy and fewer side effects. It should be noted that drugs such as *Halothane* that is commonly used in adult anesthesia, are not recommended for children. Halothane, sold under the brand name *Fluothane* among others, is a general Anesthetic [29]. This necessitates up-to-date information from both Pediatric dentists and anesthesiologists who are involved in the treatment of children.

### Preoperative Considerations

Before the treatment, the dentist should check the medical history of the patient. The dentist should also know if the patient is a good candidate for sedation; and will ask his parents about any medications he has recently taken.

Parents should ask about the child's health status and the required dosage of sedatives for the child's age. They must receive a brochure describing the risks of this method. Study it thoroughly and ask the dentist if they are faced with unclear and vague issues.

Parents must be sure that their children have not been taking milk or solid foods 8 hours before dental procedures.

Descriptions of the fasting conditions on the day of Anesthetic counselling will be given to the parents in full for the specific situation of each child. Parents should be sure to do the necessary tests at the request of the dentist; consult with the anesthesiologists before the day of dental treatments. Colds and allergic reactions due to respiratory system involvement are considered important risk factors in anesthetized patients. When treating the child, symptoms of cold or allergies should not be observed in him.

Finally, the dentist should monitor the patient's vital signs during the treatment. The staff should also have oxygen (artificial ventilation) and medicines that eliminate the effects of sedation so that they can use them for the patient.

### Post-treatment considerations

The child may be slightly sleepy after anesthesia or sedation; hence, parents should take care of their child on a day of dental procedures. The child's feeding should start with fluids and then continues with soft foods. Normal nutrition often begins on the next day, and the kid returns to normal the day after the procedures.

1. Evidence suggests that children after 1 to 2 hours after anesthesia can start their normal diet with priority liquids and most importantly with low volume.
2. Parents should pay attention to not feed their children solid and heavy foods.
3. The most common complication after anesthesia is swelling of the lip and tongue. Therefore, parents should pay attention to the doctor's recommendations so that they do not cause swelling of the lips and tongues.
4. The most common complications after anesthesia include restlessness, vomiting, and pain. Parents should pay attention to the dentist's recommendations to eliminate these complications.
5. Parents should try to modify or change their children's inappropriate food habits after restoring their teeth. Due to the abundance of sugar in sugary foods and snacks (sweets, ice cream ....), carbonated drinks, and most of the substances that increase the risk of caries they should place the prevention of treatment as one of the priorities of their children's oral health. Treatments under anesthesia are merely dental treatment, and parents should not expect miracles. In the case of non-observance, caries is reversible. The real wonderwork is in the hands of the parents, which is primarily controlled by the child's diet; and secondarily observing regular oral hygiene would result in a mouth free of decayed teeth.

6. Pay attention to oral hygiene (brushing at least twice in the morning and at night, and rinsing with mouthwash) after eating a variety of sweets and snacks, using dental floss, and even brushing the tongue and periodic Fluoride therapy should be the next part of the parents' program.

### Does dental treatment worth it to put children under anesthesia?

Since teeth have a very important role in the nutrition and development of the child, and because their tooth loss can cause problems in the eruption of the permanent teeth, in the event of timely treatment, one might observe the significant effects on the health of the child. On the other hand, if their teeth are not treated appropriately; and the treatment has been delayed up to the next years, the child may suffer from acute dental abscesses that can spread to facial spaces, hence, it may be dangerous to the child. Therefore, if the child is not adequately involved in dental treatments for any reason, with the proper treatment of the teeth under anesthesia or sedation conditions, many problems that can be troublesome for the child, can be prevented.

Although control of the child's behaviour is preferred through non-pharmacological methods, some children sometimes cannot be treated with any of these methods. Therefore, in the case of toddlers and non-cooperative children with severe dental caries and dental problems, sedation or general anesthesia may be the most appropriate way to control their behaviour.

In recent years, alternative therapies such as dentistry under conscious anesthesia or general anesthesia have been introduced to protect the child from the fear of exposure to dental treatment. However, choosing the best treatment should be based on factors such as the age of the child, the severity and extent of dental caries, the dentist's expectation of the outcome of the treatment, the risk of treatment, and the satisfaction of the parent. On the other hand, due to the side effects and risk involved in performing general anesthesia, after applying all the methods and behavioural techniques, the dentist will preferably go with the Anesthetic treatments.

### Conclusion

Behavioural control in children is one of the important issues in dentistry. Since many children are not able to cooperate at optimal levels for dentistry, unfortunately, these treatments are postponed; and children might experience severe pain or even lose some of their teeth. Furthermore, children with special therapeutic needs, such as low age, physical and mental

disabilities or severe and uncontrolled anxiety, communication disabilities, physical constraints, motor limitations, behavioural and motor disorders, and chronic medical conditions, require the use of specific sedation techniques including general anesthesia.

It is important to note that the decision-making process for Anesthetic treatments is conducted by assessing all aspects of a dentist, anesthetist, and parents of the patient, and it is important in the field of applied sciences.

Ultimately, the extensive efforts of the dentist and his team under general anesthesia in cases such as lack of cooperation of the patient, the existence of disabilities and physical problems, and even illnesses (with acceptable results, low complications, and preventable) can be done. Therefore, planning such as the development of specialized hospital dental courses can increase the quality and safety of dental Anesthetic care in children.

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