Content available at: https://www.ipinnovative.com/open-access-journals

International Journal of Oral Health Dentistry

Journal homepage: www.ijohd.org

Review Article

Sedation and general anaesthesia in paediatric dentistry: A review

Chandrappa Sreekanth[1], Bharath Kandanattu[2], Raj Narayan Mandal[3], Akshaya N Shetti[4*]

[1]Dept. of Emergency Medicine, Bangalore Baptist Hospital, Bangalore, Karnataka, India
[2]Dept. of Pediatric and Preventive Dentistry, Institute of Dental Studies & Technologies, Ghaziabad, Uttar Pradesh, India
[3]Dept. of Anaesthesia and Critical Care, 167 Military Hospital, Pathankot, Punjab, India
[4]Dept. of Anaesthesia and Critical Care, DBVPRMC, PIMS (DU), Loni, Maharashtra, India

Abstract

Pain and anxiety management are critical components of paediatric dentistry to ensure effective treatment and a positive patient experience. Sedation and general anaesthesia (GA) are commonly used techniques to facilitate dental procedures in children who are unable to tolerate conventional treatment due to fear, anxiety, or special healthcare needs. Various anaesthetic modalities, including minimal, moderate, and deep sedation, as well as general anaesthesia, provide different levels of consciousness and pain control. Day-care anaesthesia has emerged as a safe and effective approach, reducing hospital stay and associated costs. However, the administration of anaesthesia in paediatric patients poses unique challenges such as airway management, dosing considerations, and safety concerns. Recent advances in pharmacology, monitoring technologies, and anaesthetic techniques have improved patient outcomes. The training and competency of paediatric dentists in administering sedation safely are essential for optimal patient care. Preoperative evaluation plays a crucial role in identifying indications and contraindications for sedation and GA. This review discusses the different types of anaesthesia, the concept of day-care anaesthesia, challenges in paediatric anaesthetic management, recent advancements, training requirements for dentists, and the importance of preoperative assessment in ensuring safe and effective treatment.

Keywords: Anaesthesia, Day-care, Paediatric dentistry, Sedation, Training, Dexmedetomedine.

Received: 05-02-2025; **Accepted:** 03-03-2025; **Available Online**: 29-04-2025

This is an Open Access (OA) journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprint@ipinnovative.com

1. Introduction

Paediatric dentistry requires the care of young children who are more prone to be anxious and fearful when undergoing dental treatments. Appropriate pain and anxiety management is essential to promote a stress-free dental visit and increase patient compliance.[1,2] Sedation and general anaesthesia (GA) have a strong role in making safe and effective dental treatment for those children feasible who cannot otherwise endure chairside dental procedures on account of age, medical disorders, or fear issues. The dentist should be comfortable in performing the procedure, for which a calmness in the child is most important.[3]

Sedation in children's dentistry varies from light sedation, where the child is conscious and responsive, to deep sedation and general anaesthesia, where unconsciousness is achieved. The type of anaesthesia is determined by various factors, such as the child's medical history, anxiety level, and difficulty of the dental procedure. The need for sedation and general anaesthesia has grown, especially in young children and those with special needs, making it imperative to have a proper understanding of its indications, contraindications, and safety protocols. Most of the time it is the general anaesthesia which is chosen in case of a child with mental retardation due to any reason.[4,5]

Day-care anaesthesia usage has become popular because it saves hospitalization and healthcare expenditure without compromising on effective treatment. Yet, paediatric anaesthesia is associated with several challenges like airway management issues, drug dosing, and risk of complications. Current technological and pharmacological advances have helped improve monitoring of the patient and anaesthetic safety. In addition, paediatric dentists should receive proper

*Corresponding author: Akshaya N Shetti
Email: aksnsdr@gmail.com

https://doi.org/10.18231/j.ijohd.2025.003
© 2025 The Author(s), Published by Innovative Publications.

training for administering sedation to ensure it is done safely and complications are well managed. This should also be backed with all emergency drugs, instruments and anaesthesiologist. The purpose of this review is to address the forms of anaesthesia employed in paediatric dentistry, day-care anaesthesia as a concept, issues with paediatric sedation, recent developments in anaesthetic procedures, trainings for dentists, and preoperative assessment's role in providing safe and effective dental treatment.[6]

2. Types of Anaesthesia in Paediatric Dentistry

Paediatric dentistry anaesthesia can be divided into local anaesthesia, sedation (minimal, moderate, and deep), and general anaesthesia. Local anaesthesia is used for normal dental treatment and entails the use of an anaesthetic agent to desensitize the area of treatment. But in instances where local anaesthesia is not adequate, sedation or general anaesthesia can be needed particularly in uncooperative paediatric patients.[3]

Minimal sedation, commonly obtained through nitrous oxide-oxygen sedation, permits the child to be conscious but relaxed. It is the most frequently used and safest sedation method in paediatric dentistry. Moderate sedation, commonly obtained with oral or intravenous sedatives, produces a higher degree of relaxation while still retaining the child's responsiveness to stimuli. Deep sedation with deeper depression of consciousness is also utilized in more invasive procedures and needs strict observation.[7] General anaesthesia produces full unconsciousness and are limited to very lengthy procedures, uncooperative child or the mentally retarded children.

3. Day-care Anaesthesia in Paediatric Dentistry

Day-care anaesthesia is the term used to describe outpatient anaesthesia services in which children receive sedation or general anaesthesia for dental treatments and are sent home on the same day. It is helpful in decreasing hospital stays, reducing expense, and enhancing patient convenience. Improvements in anaesthetic agents with short recovery profiles and better monitoring techniques have helped to make day-care anaesthesia successful and safe. Yet, judicious patient selection, preoperative evaluation, and postoperative surveillance are essential to avoid complications and achieve safe discharge criteria.[8,9]

4. Day-care Anaesthesia using Nitrous Oxide

Nitrous oxide sedation is a common technique in paediatric dentistry for day-care anaesthesia. It is an effective, safe, and minimally invasive procedure that alleviates anxiety and pain in children during dental treatment. The use of nitrous oxide with oxygen provides quick onset and recovery, which is suitable for outpatient dental clinics. Nitrous oxide is a central nervous system depressant that exerts its effect by modulating neurotransmitter activity, specifically by augmenting gamma-aminobutyric acid (GABA) receptors, which cause relaxation and decrease anxiety.[10-13] This gas is delivered via a nasal mask, with control over its concentration being easily achieved. Because nitrous oxide is poorly soluble in blood, it has a quick onset of action and rapid recovery when administration is discontinued. This renders it a good method of sedation for short and minimally invasive dental treatments.[14]

Children are kept awake and responsive throughout the procedure with a sedative effect. Ease of use and rapid reversibility are among the major benefits of nitrous oxide sedation, allowing children to resume normal activities soon after treatment. Proper monitoring and dosage adjustment according to the child's weight and requirement are necessary for safety and efficacy. Nitrous oxide is used extensively in dental outpatient clinics because of its safety, simplicity of administration, and quick recovery. The action is through the displacement of nitrogen from the lungs, causing augmented oxygenation and a sedative effect on the central nervous system.[15] This produces anxiolysis, light analgesia, and euphoria, which makes it an ideal option for paediatric dental procedures.

5. Indications, Contraindications, and Safety Guidelines

Nitrous oxide is generally recommended for the treatment of dental fear and anxiety in children, patients with mild to moderate dental phobia, brief-duration dental procedures, patients with a severe gag reflex, and special needs patients who need mild sedation.[16] But its administration is contraindicated in the presence of respiratory diseases like COPD or severe asthma, upper respiratory infections, recent middle ear surgery because of pressure changes, pregnancy (especially during the first trimester), and patients with known hypersensitivity or adverse effects to nitrous oxide.

To provide nitrous oxide anaesthesia safely, some guidelines must be adhered to. Appropriate patient selection from medical and dental history is essential to prevent complications. Monitoring oxygen saturation and vital signs throughout the procedure increases safety and enables early intervention in the event of a reaction. Use of a scavenging system minimizes environmental nitrous oxide exposure, as well as protecting both patient and healthcare worker. Following the procedure, 100% oxygen administration for 3-5 minutes prevents diffusion hypoxia and allows smooth recovery. Dental personnel giving nitrous oxide should receive proper training and certification, assuring proficiency in sedation procedures and emergency availability, including resuscitation equipment.[17-21] It is advisable that one should have anaesthesiologist as a standby person to address any adverse event that could occur. It is also best that the operating dentist should have had resuscitation guidelines and should be updated from time to time. The dental suit should also carry all the emergency life saving drugs and the resuscitation equipment. It is also suggested that the dentist

must have a relationship with closest nursing home with paediatric critical care unit so that the safety of paediatric patient can be assured. [22]

6. The Role of Dexmedetomedine for the Sedation for Dental Procedure

Dexmedetomidine has become the focus in paediatric dental anaesthesia because of its pharmacologic specificity. Dexmedetomidine is a highly selective alpha-2 adrenergic agonist that produces sedation, anxiolysis, and analgesia without compromising respiratory function. Unlike other sedatives, dexmedetomidine causes a state of conscious sedation in which the child will be calm and easily arousable, rendering it an ideal drug in paediatric dental care.

One of the most important benefits of dexmedetomidine is that it has minimal effects on respiratory drive, lessening the risk of respiratory depression that is so prevalent with other sedatives. This makes it especially useful in treating young or medically vulnerable patients who could be more sensitive to respiratory depressants.[21] Its analgesic effects also help to bolster pain management, lessening the reliance on additional opioid administration during procedures. When used in combination with other sedatives like midazolam and fentanyl, dexmedetomidine produces an optimally balanced sedation protocol that maximizes safety and patient comfort. Midazolam adds to the anxiolytic activity, and fentanyl adds to pain control, thus providing a comfortable and stress-free dental experience for children. The synergistic effect of these drugs enables lower dosages, thereby reducing the risk of adverse effects while still achieving the desired sedation level.[21-23]

Dexmedetomidine is typically used intravenously or intranasally, the intranasal route being particularly beneficial in children's dental offices because it is non-invasive. The drug has a quick onset of action, with prolonged sedation effects, which will permit unattended dental procedures. Additionally, the ability to achieve stable hemodynamic parameters adds to its safety margin, making it a popular choice for paediatric dental sedation in ambulatory centres.

7. Challenges in Paediatric Anaesthesia

Anaesthesia administration to children is faced with special challenges. Airway management is the most important due to the fact that children are anatomically different from adults and have smaller airways and greater collapsibility of the airway. Proper dosing of the anaesthetic agent is also necessary because children are metabolically different and have dissimilar drug clearance compared to adults. The threat of adverse events, such as respiratory depression and postoperative nausea, adds another layer of difficulty to paediatric anaesthesia. The psychological component is also responsible for making it more complicated in the management of anxious children, where paediatric dentists have to incorporate a friendly-child approach coupled with the assurance of safe administration of anaesthetics. One should not forget that during the time when the dental treatments are performed under sedation, the aspiration of irrigating fluid and blood could be aspirated into the lung. The children are very sensitive for this and can cause drop in saturation, bradycardia and cardiac arrest. Therefore it is recommended that, proper suctioning facility and emergency airway related equipment should be present in the operation room.

Hypoglycemia is one of the risks associated with paediatric patients undergoing general anaesthesia or sedation for dental work. Children also possess lower stores of glycogen and a higher rate of metabolism and, as a result, are more at risk of fluctuations in blood glucose, especially if fasting has been induced prior to treatment.[1,7] Extended fasting, stress, and use of some anaesthetic drugs may lower blood sugar levels to the point of causing symptoms like irritability, drowsiness, perspiration, or even loss of consciousness in extreme instances.

It is ideal to keep the minimum required drugs and instruments in the dental OPD where the sedation is practiced for the safety of the patients as shown in **Table 1**.

Table 1: Minimum drugs and equipment that should be kept in the dental OPD if the sedation is practiced

S. No.	Name of the Item
1	Functioning suction apparatus
2	Laryngoscope with different sized blades
3	Different size endo tracheal tube
4	Inj Adrenaline
5	Inj Atropine
6	Inj Hydrocortisone
7	Inj Dexmedetomedine
8	Nebulization - salbutamol
9	Preservative free Inj Lignocaine
10	Inj Calcium gluconate
11	Inj Glucogon
12	Inj 25% Dextrose
13	IV cannula – 24 G, 22 G, 20 G
14	IV set
15	IV fluids – RL, NS, DNS
16	Paediatric self-inflating resuscitation bag
17	Adhesive tapes
18	Oral and nasopharyngeal airways of different sizes
19	Suction catheters
20	Ryles tube
21	Defibrillator /AED
22	Oxygen Cylinder

8. Conclusion

Sedation and general anaesthesia are critical components of paediatric dentistry as they facilitate safe and effective treatment of young and fearful patients. Familiarity with various types of anaesthesia, advantages of day-care anaesthesia, paediatric anaesthesia challenges, recent developments, training needs, and the role of preoperative assessment are important to maximize patient outcomes. With ongoing development in anaesthetic methods and better safety precautions, paediatric dental anaesthesia is changing and providing improved patient care and improved treatment for kids.

9. Source of Funding

None.

10. Conflict of Interest

None.

References

1. Nelson TM, Xu Z. Paediatric dental sedation: challenges and opportunities. *Clin Cosmet Investig Dent.* 2015;7:97–106.
2. Zub D, Berkenbosch JW, Tobias JD. Preliminary experience with oral dexmedetomidine for procedural and anesthetic premedication. *Paediatr Anaesth*. 2005;15(11):932–8.
3. Cimen ZS, Hanci A, Sivrikaya GU, Kilinc LT, Erol MK. Comparison of buccal and nasal dexmedetomidine premedication for pediatric patients. *Paediatr Anaesth*. 2013;23(2):134–8.
4. Shannon M, Albers G, Burkhart K, Liebelt E, Kelley M, McCubbin MM, et al. Safety and efficacy of flumazenil in the reversal of benzodiazepine-induced conscious sedation. The Flumazenil Pediatric Study Group. *J Pediatr.* 1997;131(4):582–6.
5. Ingrande J, Lemmens HJM. Dose adjustment of anaesthetics in the morbidly obese. *Br J Anaesth*. 2010;105(Suppl 1):i16–i23
6. Tan GM. A medical crisis management simulation activity for pediatric dental residents and assistants. *J Dent Educ*. 2011;75(6):782–90.
7. Jevtovic-Todorovic V, Hartman RE, Izumi Y, Benshoff ND, Dikranian K, Zorumski CF, et al. Early exposure to common anesthetic agents causes widespread neurodegeneration in the developing rat brain and persistent learning deficits. *J Neurosci*. 2003;23(3):876–82.
8. Inchingolo F, Inchingolo AM, Ferrante L, de Ruvo E, Di Noia A, Palermo A, Inchingolo AD, Dipalma G. Pharmacological Sedation in Paediatric Dentistry. *Eur J Paediatr Dent*. 2024;25(3):230–7.
9. Ashley P, Anand P, Andersson K. Best clinical practice guidance for conscious sedation of children undergoing dental treatment: an EAPD policy document. *Eur Arch Paediatr Dent*. 2021;22(6):989–1002.
10. Gao F, Wu Y. Procedural sedation in pediatric dentistry: a narrative review. *Front Med (Lausanne).* 2023;10:1186823.
11. Mittal N, Goyal A, Jain K, Gauba K. Pediatric Dental Sedation Research: Where Do We Stand Today? *J Clin Pediatr Dent*. 2015 Spring;39(3):284–91.
12. Webb MD, Moore PA. Sedation for pediatric dental patients. *Dent Clin North Am*. 2002;46(4):803–14.
13. Moore PA, Mickey EA, Hargreaves JA, Needleman HL. Sedation in pediatric dentistry: a practical assessment procedure. *J Am Dent Assoc.* 1984;109(4):564–9.
14. Ashley PF, Chaudhary M, Lourenço-Matharu L. Sedation of children undergoing dental treatment. *Cochrane Database Syst Rev.* 2018;12(12):CD003877.
15. Hosey MT; UK National Clinical Guidelines in Pediatric Dentistry. UK National Clinical Guidelines in Paediatric Dentistry. Managing anxious children: the use of conscious sedation in paediatric dentistry. *Int J Paediatr Dent.* 2002;12(5):359–72.
16. Ramazani N. Different aspects of general anaesthesia in pediatric dentistry: A review. *Iran J Pediatr*. 2016;26:e2613.
17. Mohite V, Baliga S, Thosar N, Rathi N. Role of dexmedetomidine in pediatric dental sedation. *J Dent Anesth Pain Med*. 2019;19(2):83–90.
18. Coté CJ, Wilson S. Guidelines for Monitoring and Management of Pediatric Patients Before, During, and After Sedation for Diagnostic and Therapeutic Procedures. *Pediatrics*. 2019;143(6):e20191000
19. Wilson S, Houpt M. Project USAP 2010: Use of Sedative Agents in Pediatric Dentistry-a 25-year Follow-up Survey. *Pediatr Dent*. 2016;38(2):127–33.
20. Davis MJ. Conscious sedation practices in pediatric dentistry: a survey of members of the American Board of Pediatric Dentistry College of Diplomates. *Pediatr Dent.* 1988;10(4):328–9.
21. Rodrigues VBM, Costa LR, Corrêa de Faria P. Parents' satisfaction with paediatric dental treatment under sedation: A cross-sectional study. *Int J Paediatr Dent.* 2021;31(3):337–43.
22. Zouaidi K, Olson G, Lee HH, Kalenderian E, Walji MF. An Observational Retrospective Study of Adverse Events and Behavioral Outcomes during Pediatric Dental Sedation. *Pediatr Dent.* 2022;44(3):174–80.
23. Oh S, Kingsley K. Efficacy of Ketamine in Pediatric Sedation Dentistry: A Systematic Review. *Compend Contin Educ Dent*. 2018;39(5):e1–e4.

Cite this article: Sreekanth C, Kandanattu B, Mandal RN, Shetti AN. Sedation and general anaesthesia in paediatric dentistry: A review. *Int J Oral Health Dent*. 2025;11(1):18–21.