

# Conscious sedation vs general anesthesia in pediatric dentistry – a review

Cátia Carvalho Silva,<sup>1</sup> Carla Lavado,<sup>2</sup> Cristina Areias,<sup>2</sup> Joana Mourão,<sup>3</sup> David de Andrade<sup>2</sup>

<sup>1</sup>Universidade Fernando Pessoa, Departamento de Odontologia Pediátrica, Porto, Portugal <sup>2</sup> Universidade do Porto, Faculdade de Medicina Dentária, Departamento de Odontologia Pediátrica, Porto, Portugal <sup>3</sup> Universidade do Porto, Faculdade de Medicina Dentária, Departamento de Anestesiologia, Porto, Portugal

**INTRODUCTION:** Performing dental treatments on pediatric patients who present behavioral problems is usually a great clinical challenge. Depending on the patients' emotional maturity and their physical, psychological and mental skills, the usual behavior control techniques may not offer adequate efficacy and safety when dental procedures are being carried out. In these circumstances, alternative and more invasive methods such as conscious sedation and general anesthesia may become necessary.

**OBJECTIVE:** To compare the indications and contraindications of conscious sedation and general anesthesia in pediatric dentistry.

**METHOD:** Literature research undertaken through the MEDLINE/Pubmed, Science Direct and B-on search engines between April and June 2013 using a 5 year time frame and the following keywords: conscious sedation, general anesthesia, pediatric dentistry and guidelines.

**RESULTS:** Conscious sedation is recommended to anxious patients who have dental and needle phobia, to patients that present an increased vomiting reflex and also to patients with special needs but capable of communicating. General anesthesia is indicated for non-cooperating patients under the age of four, in mouth breathers, in children ASA III or higher and in pediatric patients who do not communicate.

**CONCLUSIONS:** Each technique must be selected according to the characteristics showed by patient. Although conscious sedation and general anesthesia introduce benefits to pediatric dentistry, they should not be regarded as priority intervention techniques for behavior control. The pediatric dentist's previous knowledge of these techniques provides a better level of dental care quality as well as more safety and less discomfort for their patients.

**KEYWORDS:** Dentistry; anesthesia; sedation; pediatrics.

Silva CC, Lavado C, Areias C, Moura<sup>o</sup> J, Andrade D. Conscious sedation vs general anesthesia in pediatric dentistry – a review. MedicalExpress (São Paulo, online). 2015;2(1):M150104.

Received for publication on October 10 2014; First review completed on November 4 2014; Accepted for publication on January 21 2015

E-mail: catiacarvalhosilva@hotmail.com

## ■ INTRODUCTION

The American Academy of Pediatric Dentistry (AAPD), a highly reliable entity dedicated to the oral health of babies, children, teenagers and people with special needs, recognizes the existence of a patient population for whom routine dental care, based only on nonpharmacologic behavior guidance techniques, is not a viable approach. The AAPD also recognizes that patients who present needs of extensive treatments, acute anxiety situations, non cooperative behavior, an immature cognitive system may benefit of dental treatment using conscious sedation or general anesthesia,<sup>1</sup> the same applies to patients with physical or

psychological disabilities or patients who show a severe clinical condition.

Pediatric dentists have long been seeking to provide excellent dental care to their youngest and most disabled patients while, at the same time, encouraging these patients to develop a positive attitude towards dental treatment. Basic behavior control techniques have created the conditions for a level of minimal discomfort without the associated fear experienced by the majority of children.<sup>2</sup>

Conscious sedation has made it possible for many patients with specific characteristics to accept dental treatment in the dental office.<sup>3</sup> However, some children and some patients with development problems require the administration of general anesthesia for the implementation of therapeutic measures in an efficient and safe way.<sup>1,2</sup>

In the United States of America, certain specialists in pediatric dentistry who have a specific training in this area

DOI: 10.5935/MedicalExpress.2015.01.04

seek to provide treatment under general anesthesia in their dental offices or in other places outside of the traditional hospital environment where the use of drugs and patient monitoring are performed by certified professionals.<sup>4</sup>

In 1998, the AAPD established guidelines concerning the elective use of the minimal, moderate and deep sedation and also the use of general anesthesia in pediatric patients.<sup>5</sup>

In 2006, the American Academy of Pediatrics and the AAPD worked together in an effort to unify the guidelines for the use of conscious sedation by dentists and doctors who are not anesthesiologists. These entities created a document entitled "Guideline for Monitoring and Management of Pediatric Patients During and After Sedation for Diagnostic and Therapeutic Procedures",<sup>6</sup> which reflects the current understanding regarding the monitoring of adequate needs; it also defines and characterizes the three levels of sedation (minimal, moderate and deep) and of general anesthesia, involving pediatric patients.<sup>7</sup>

When deep sedation or general anesthesia is performed in a private dental office, the pediatric dentist must be responsible for verifying the educational and professional qualifications of the doctor who will perform these techniques. The pediatric dentist is also responsible for establishing a safe environment in accordance with local and national legislation and regulations as well as making sure that the guidelines for the monitoring and handling of pediatric patients during and after sedation for diagnosis and therapeutic procedures are complied with, in order to guarantee their own safety.<sup>7</sup>

According to the AAPD, deep sedation and general anesthesia should only be performed by qualified health professionals, who have a specific training and who are legally accredited to perform such activities. It must be stressed that the acquisition of knowledge concerning the administration of deep sedation and general anesthesia cannot be obtained through post-graduate education in pediatric dentistry or through lifelong learning. In the United States of America only dentists who have completed an advanced course that complies with the requisites of the American Dental Association (ADA) are considered as qualified to administer drugs for deep sedation and general anesthesia.<sup>5,7</sup>

As previously mentioned, the pediatric dentist is responsible for providing a safe environment so that deep sedation and general anesthesia can be performed. In addition to the evaluation of the anesthesiologist's qualifications, he must verify the following aspects in order to minimize the risks that can affect the patient: (1) venues and equipment, (2) monitoring and documentation, (3) selection of patients through their medical records and physical conditions, (4) indications relating to the use of anesthesia, (5) preoperative assessment, (6) properly trained support staff, (7) emergency drugs, equipment and protocols, (8) provision of preoperative and postoperative instructions to patients/legal representatives (9) proper knowledge regarding the recovery criteria that permit patients to be discharged and sent home.<sup>6,7</sup>

In order to reduce the risk of medical mistakes and to determine the cause/effect relationships, adverse events must be registered and meticulously analyzed for the future decrease of associated risks and consequently, to improve the satisfaction of patients and their legal representatives.<sup>8</sup>

This review aims at carrying out a bibliographic research of the specific indications and contraindications of conscious sedation and general anesthesia in pediatric dentistry.

## ■ MATERIAL AND METHODS

Literature research was undertaken through database searches through MEDLINE/PUBMED, B-On and Science Direct as well as through the library archives of Porto University's School of Dental Medicine, using the following terms of research: conscious sedation, general anesthesia, pediatric dentistry and guidelines. Research limits were imposed, namely articles in English published between 2008 and 2013. In total, 119 articles were obtained but only 24 were selected, according to the following inclusion criteria: articles released by Porto University's School of Dental Medicine's servers through SCOPUS, ISI, Cochrane and PUBMED database, and articles with titles referring to the following keywords: conscious sedation and general anesthesia and articles with abstracts that referred to the indications and contraindications of conscious sedation and general anesthesia in pediatric dentistry. Moreover, clinical decision criteria regarding the use of each one of these advanced behavior control techniques were also taken into consideration. Articles about systematic and narrative revision and meta-analysis were selected.

## ■ CONSCIOUS SEDATION

Conscious sedation can be defined as a technique that can be performed using one or more drugs that produce a state of depression in the central nervous system, allowing the desired treatment to be made. Verbal contact with the patient must be always maintained throughout the period of sedation,<sup>8</sup> which means that it is a medically controlled state of depression of conscience that allows the patient to preserve his protective reflexes, a free respiratory airway and also present an appropriate response to physical stimulus and verbal commands such as, e.g., "open your mouth". Drugs and techniques used for conscious sedation during dental treatment must present a sufficient safety margin so that loss of conscience can be expected to be a completely unlikely event.<sup>9</sup>

Pain and anxiety are crucial matters in dentistry. About 10 to 30% of adults and children may present some kind of fear or anxiety related to dental treatment. There is evidence that these patients will benefit from conscious sedation in the performance of their treatments.<sup>10</sup>

### Conscious Sedation with Nitrous Oxide

Nitrous oxide (N<sub>2</sub>O) is a non-irritating respiratory tract gas, which presents fast action on induction as well as during recovery (these effects occur within a few minutes). It presents low solubility in the tissues, as well as a minimal alveolar concentration (MAC) which is so high that its anesthetic effect is poor under normal atmospheric pressure.<sup>11</sup>

Machines intentionally designed for the administration of inhalation sedation in dentistry should be used and be capable of administering N<sub>2</sub>O to a maximum limit of 70% with not less than 30% of oxygen in volume, even though in the majority of cases, adequate analgesia is achieved with concentrations of N<sub>2</sub>O that do not exceed 50% in volume. These machines must be in conformity with the European (or

otherwise applicable) legislation and be maintained and serviced according to the producers' orientations. It is also important that regular maintenance be documented, where all safety rules must be respected, such as for instance, the presence of a device that cannot fail in an emergency (if the oxygen pressure drops, N<sub>2</sub>O supply must automatically stop).<sup>10</sup>

The European Academy, the American and British Societies of Pediatric Dentistry recommend a technique of "titration" which involves the raising of N<sub>2</sub>O doses in oxygen by stepwise increments of 5 to 10% per minute and, depending on the patient's response, until the desired sedation effect is reached.<sup>10</sup>

Conscious sedation with N<sub>2</sub>O is effective in children and adults when supported by behavior control techniques.<sup>12</sup> In 2008, a Cochrane review reports high probability of beneficial effects on behavior and anxiety when N<sub>2</sub>O is used. Furthermore, this technique has been described as standard technique in pediatric dentistry<sup>13</sup> and can be successful in up to 90% of the cases, provided that patients are carefully selected.<sup>10</sup>

The patient's evaluation must include a medical and dental complete record as well as his social history.<sup>14</sup> Each patient must be classified, according to the American Society of Anesthesiologists' (ASA) classifying system of physical condition<sup>15</sup> (Table 1). ASA I or ASA II patients may be considered candidates for conscious sedation for outpatient care (ambulatory). ASA III and IV patients show special problems and so require individual care. For this reason, they should be treated in a hospital environment.<sup>16</sup>

The goals of performing conscious sedation with N<sub>2</sub>O aim to satisfy the needs of the child and the pediatric dentist. Firstly, the child will experience a decrease of fear and awareness of pain during the treatment and collaboration will be facilitated, preventing the development of fear or anxiety related to dental procedures. Secondly, the treatment will be easier for the pediatric dentist to carry out; stress will be reduced and so will be the probability of appearance of unpleasant emotions. It also contributes to the prevention of the "burn-out" syndrome.<sup>17</sup>

Conscious sedation with N<sub>2</sub>O is indicated for pediatric patients who show low anxiety, needle phobia, the classic "fear of the dentist", for not very cooperative patients, for patients with increased vomit reflex, for patients with special needs but who maintain communication capacity<sup>10</sup> and finally, for children who are 4 years old or more. In contrast, this technique of behavior control should not be administered to patients who are incapable of communicating, to mouth breathers, to patients who suffer from serious psychiatric and behavior disorders, to patients with chronic

obstructive pulmonary disease, neuromuscular disorders and to patients undergoing chemotherapy<sup>3,10</sup> (Table 2).

Considering the inherent contraindications to this technique, other alternatives of behavior control should be considered, particularly general anesthesia.

**■ GENERAL ANESTHESIA**

Dental procedures under general anesthesia are a therapeutic option for many children since it can provide for a broad and high quality dental care, when conventional dental treatment is not a viable option. Dental procedures in children are undertaken using general anesthesia for many reasons: very young patients, medically complex pathologies, physical and mental incapacities, extensive treatment necessities, long surgical treatments, emergency treatments, patients who need special safety conditions, who present linguistic obstacles that do not allow normal communication and, finally, patients who travel long distances in order to receive a specialized dental treatment.<sup>18,19</sup>

The AAPD approves the use of general anesthesia in pediatric dentistry under the following conditions: patients who are not capable of cooperation, patients who have been submitted to local anesthesia which was inefficient, extremely anxious children, who are excessively afraid and incapable of communicating, patients that need significant surgical procedures, in order to prevent psychological trauma and to decrease health risks, and finally, dental procedures that require immediate action<sup>1,18</sup> (Table 3).

Pediatric dentists must have a specific training, which permits the recognition of the need of general anesthesia. Thus, they must be qualified to integrate a

**Table 1 - American Society Anesthesiologists Physical Status Classification<sup>15</sup>**

Category	Physical Status
I	Normal, healthy patient
II	Patient with moderate systemic disease
III	Patient with severe systemic disease that limits activity but does not cause incapacity
IV	Patient with severe systemic disease that is a constant threat to life
V	Moribund patient who is not expected to survive without the operation

**Table 2 - Indications and Contraindications of Conscious Sedation in Pediatric Dentistry<sup>3,10,17</sup>**

Indications	CONSCIOUS SEDATION	
	Contraindications	
Low anxiety	Incapacity of communication	
Dental phobia	Mouth breathing	
Needles phobia	Chronic obstructive pulmonary disease	
Uncooperative behavior	Neuromuscular disorders	
Increased vomit reflex	Patients under chemotherapy	
Special patients with communication capacity	Serious psychiatric and behavior disorders	
≥ 4 year-old patients	Respiratory airway obstruction	

**Table 3 - General Anesthesia Indications in Pediatric Dentistry<sup>1,18,19</sup>**

GENERAL ANESTHESIA	
Indications	
< 4 year-old patients	
Complex medical pathologies (respiratory, kidney and liver diseases, high intracranial pressure, epilepsy)	
Physical and mental limited incapacities	
Necessary of extensive treatment	
Long surgical treatment	
Emergency treatment	
Patients with special safety needs	
Communication incapacity	
Inefficient local anesthesia treatment	
Extreme phobia and anxiety	
ASA III patients or higher	

multidisciplinary team capable of providing the best dental care to their patients.<sup>20</sup>

Pediatric patients ASA I or II are frequently treated in an outpatient care environment (ambulatory), with minimal to moderate sedation, although general anesthesia is the most adequate therapeutic method when patients require extensive treatment and their level of cooperation is low. ASA III or higher patients are generally not good candidates for moderate sedation; they are treated in a safer way with general anesthesia in a hospital environment.<sup>18,20</sup>

Restorative treatments under general anesthesia are often more efficient and profitable than a sequence of several visits to the dental office for treatment under conscious sedation.<sup>21</sup> This kind of restorative treatment, when carried out under general anesthesia and especially in cases of caries in early childhood, is reported as capable of providing more quality and durability comparing to restorative treatments using conscious sedation.<sup>22,23</sup> There is also evidence showing that children under 36 months submitted to general anesthesia to receive dental procedures present more positive behavior in future dental appointments.<sup>24</sup>

## ■ CONCLUSION

Conscious sedation and general anesthesia are behavioral control techniques increasingly used in pediatric dentistry. Conscious sedation is indicated for anxious patients, with phobia of the dentist and of needles, in patients who present increased vomit reflex and patients with special needs but who are capable of communicating. General anesthesia is indicated for patients under 4 years of age who experience dental phobia, in mouth breathers, in children ASA III or higher, with physical and mental limiting incapacities, in emergency and long surgical procedures and finally, in every child who does not communicate. Previous knowledge by the pediatric dentist regarding the indications for conscious sedation and general anesthesia provides a better quality dental care, ensuring more safety and less discomfort for their patients.

## ■ SEDAÇÃO CONSCIENTE VS. ANESTESIA GERAL EM PEDIATRIA ODONTOLÓGICA – UMA REVISÃO

### ■ RESUMO

**INTRODUÇÃO:** A execução de tratamentos odontológicos em pacientes pediátricos que apresentam alterações comportamentais constitui frequentemente um grande desafio clínico para o odontopediatra. Dependendo da maturidade emocional dos pacientes e de suas habilidades físicas, psicológicas e mentais, as técnicas de controle de comportamento usuais podem não oferecer a eficácia e a segurança adequadas à realização dos procedimentos dentários. Nestas circunstâncias, podem ser necessários métodos alternativos e mais invasivos, como a sedação consciente e a anestesia geral. Neste trabalho comparam-se as indicações e contra-indicações de sedação consciente e anestesia geral em odontopediatria.

**MÉTODO:** A revisão da literatura foi realizada através dos motores de pesquisa MEDLINE/PubMed, Science Direct e B-ON, entre abril e junho de 2013, com uma limitação temporal de cinco anos e as seguintes palavras-chave: sedação consciente, a anestesia geral, odontopediatria e diretrizes.

**RESULTADOS:** A sedação consciente é recomendada para pacientes ansiosos, com “medo de dentista e de agulhas”, para pacientes que apresentam um maior reflexo do vômito e também para pacientes com necessidades especiais, mas capazes de comunicação. Por outro lado, a anestesia geral é recomendada para pacientes com idade inferior a quatro anos que não colaboram, para respiradores orais, para crianças ASA III ou superior e para crianças que não se comunicam.

**CONCLUSÕES:** Cada técnica deve ser escolhida de acordo com as características do paciente. Apesar da anestesia geral e da sedação consciente

introduzirem benefícios no atendimento dentário do paciente infantil, estas não devem ser consideradas como técnicas de intervenção prioritária no controle comportamental. O conhecimento prévio das indicações e contra-indicações destas técnicas permitem ao odontopediatra proporcionar um maior nível de qualidade no atendimento dentário, assegurando a maior segurança e o menor desconforto para os seus pacientes jovens.

**UNITERMOS:** Odontologia; odontopediatria; anestesia; sedação.

## ■ REFERENCES

1. American Academy of Pediatric Dentistry. Guideline on Behavior guidance for pediatric dental patient. *Pediatr Dent.* 2008-2009;30(7 Suppl):125-33.
2. American Academy of Pediatric Dentistry. Guideline on use of Anesthesia Personnel in the Administration of Office-based Deep Sedation/General Anesthesia to the Pediatric Dental Patient. *Pediatr Dent.* 2013;34(5):170-2.
3. Sury M. Conscious sedation in children. *Continuing Education in Anaesthesia, Critical Care & Pain.* 2012;12(3):152-6.
4. Salles PS, Tannure PN, Oliveira CA, Souza IP, Portela MB, Castro GF. Dental Needs and Management of Children With Special Health Care Needs According to Type of Disability. *J Dent Child (Chic).* 2012;79(3):165-9.
5. American Academy of Pediatric Dentistry. Guideline on the elective use of minimal, moderate, and deep sedation and general anesthesia in pediatric dental patients. *Pediatr Dent.* 2004;26(7 suppl):95-103.
6. American Academy of Pediatric Dentistry. Guideline for monitoring and management of pediatric patients during and after sedation for diagnostic and therapeutic procedures. *Pediatr Dent.* 2009-2009;30(7 suppl):143-59.
7. American Academy of Pediatric Dentistry. Policy on the use of deep sedation and general anesthesia in the pediatric dental office. *Pediatr Dent.* 2008-2009;30(7 Suppl):66-7.
8. American Dental Association. Guidelines for the use of sedation and general anesthesia by dentists. Available at: [http://www.ada.org/~media/ADA/Advocacy/Files/anesthesia\\_use\\_guidelines.aspx](http://www.ada.org/~media/ADA/Advocacy/Files/anesthesia_use_guidelines.aspx) on June 16th, 2013.
9. Hosey MT. 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.
10. Council of European Dentists. The Use of Nitrous Oxide Inhalation Sedation in Dentistry. in Dentistry. Available at: [http://www.eudental.eu/library/policy.html?filter\\_id=22](http://www.eudental.eu/library/policy.html?filter_id=22) on May 13th, 2013, 2012.
11. Curl C, Boyle C. Sedation for patients with movement disorders. *Dent Update.* 2012;39(1):45-8.
12. Hosey MT. Managing anxious children: The use of conscious sedation in paediatric dentistry. *Int J Paediatr Dent.* 2002;12(5):359-72.
13. Sury M, Bullock I, Rabar S, Demott K, Guideline Development Group. Sedation for diagnostic and therapeutic procedures in children and young people: summary of NICE guidance. *BMJ.* 2010;16:341-c6819.
14. Nelson T, Nelson G. The role of sedation in contemporary pediatric dentistry. *Den Clin North Am.* 2013;57(1):145-61.
15. Daabiss M. American Society of Anaesthesiologists physical status classification. *Indian Journal of Anaesthesia.* 2011;55(2):111-5.
16. Sury M. Sedation of children – perspectives across hospital specialties. *SAAD Dig.* 2013;29:60-3.
17. Hallonsten AL, Jensen B, Raadal M, Veerkamp J, Hosey MT, Poulsen S. EAPD Guidelines on Sedation in Paediatric Dentistry. <http://www.eapd.gr/8B927172.en.aspx> on July 7th, 2013.
18. American Academy on Pediatric Dentistry Ad Hoc Committee on Sedation and Anesthesia; American Academy on Pediatric Dentistry Council on Clinical Affairs. Policy on the use of deep sedation and general anesthesia in the pediatric dental office. *Pediatr Dent.* 2008-2009; 30(7 suppl):66-7.
19. Ba'akdah R, Frasi N, Boker A, Al Mushayt A. The use of general anesthesia in pediatric dental care of children at multi-dental centres in Saudi Arabia. *Pediatr Dent.* 2008;33(2):147-53.
20. American Academy on Pediatric Dentistry Dental Care Committee; American Academy on Pediatric Dentistry Council on Clinical Affairs. Policy on hospitalization and operating room access for dental care of infants, children, adolescents, and persons with special health care needs. *Pediatr Dent.* 2010;30(7 suppl):68-9.
21. Lee JY, Vann WF, Roberts MW. A cost analysis of treating pediatric dental patients using general anesthesia versus conscious sedation. *Pediatr Dent.* 2000;22(1):27-32.
22. Eidelman E, Fabis S, Peretz B. A comparison of restorations for children with early childhood caries treated under general anesthesia or conscious sedation. *Pediatr Dent.* 2000;22(1):33-7.
23. Al-Eheideb AA, Herman NG. Outcomes of dental procedures performed on children under general anesthesia. *J Clin Pediatr Dent.* 2003;27(2):181-3.
24. Fuhrer CT 3rd, Weddell JA, Sanders BJ, Jones JE, Dean JA, Tomlin A. Effect on behavior of dental treatment rendered under conscious sedation and general anesthesia in pediatric patients. *Pediatr Dent.* 2009;31(7):492-7.