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"Revolutionizing Paediatric Anaesthesia: Conscious Sedation From The Lens Of Paedodontist"

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I.INTRODUCTION

The provision of adequate anxiety control is an integral part of the practice of dentistry. The General Dental Council has indicated that this is both a right for the patient and a duty placed on the dentist. All patients deserve appropriate anxiety control for any dental procedure; in order to be appropriate the methods used must be considered for the individual patient having a specific treatment. A 'one size fits all' approach is inappropriate. A range of options is required[1].

It is important that a wide margin of safety between conscious sedation and the unconscious state provided by general anaesthesia is maintained. In conscious sedation, verbal contact and protective reflexes are maintained, whereas in general anaesthesia these are lost[2]. The area of conscious sedation has attracted more reports than any other area of the practice of dentistry4-10.

Since 1998 there has been a sea change in the provision of pain and anxiety management in dentistry in the World[3]. This has resulted in an increased emphasis on the safe provision of conscious sedation instead of a reliance on general anaesthesia that is demand led. This review will provide a depth of knowledge on how to practice conscious sedation in dentistry with special emphasis on Paediatric Patients.

II.DEFINITION OF CONSCIOUS SEDATION

The following definition is accepted by the National Dental Advisory Committee, General Dental Council, Standing Dental Advisory Committee and the Dental Sedation Teachers Group6,8,11,13-15: A technique in which the use of a drug or drugs produces a state of depression of the central nervous system enabling treatment to be carried out, but during which verbal contact with the patient is maintained throughout the period of sedation. The drugs and techniques used to provide conscious sedation for dental treatment should carry a margin of safety wide enough to render loss of consciousness unlikely.
For the purpose of this guidance, the following other definitions are used:

Child	A person under 12 years of age[6,8]
Young person	A person aged 12 – 16 years[6]
Adult	A person aged 16 years or over[6]
Standard sedation techniques*	Also known as 'basic' techniques. Includes: • For a child, young person or adult, inhalation sedation with nitrous oxide/oxygen and • For a young person or adult, midazolam by any route (intravenous, oral or transmucosal)

Advanced sedation techniques*	Also known as 'alternative' techniques. Includes: • For a child, young person or adult: o certain drugs used for sedation (e.g. ketamine, propofol, sevoflurane); o combinations of drugs used for sedation (e.g. opioid plus midazolam, midazolam plus propofol, sevoflurane plus nitrous oxide/oxygen); o combined routes of administration (e.g. oral plus intravenous)[6,8] and • For a child, midazolam by any route
Dental sedation team	Clinical staff involved directly in sedation, including dedicated sedationist (dental professional, medical practitioner, anaesthetist), operator-sedationist and dental sedation nurse (or other sedation assistant)
Clinical team	Dental sedation team members and any additional clinical staff involved in the care and management of patients having sedation for dental treatment

III.PRINCIPLES OF GOOD SEDATION PRACTICE

Good sedation practice requires practitioners to consider the range of non-pharmacological and pharmacological methods of anxiety management in treatment planning for individual patients. It is essential that conscious sedation is provided to the highest possible standards, respecting the rights of patients as individuals. The provision of safe and effective conscious sedation requires both regulation and, more importantly, education of the profession and [4].

• It is of fundamental importance that the level of sedation must be such that the patient remains conscious, and is able to both understand and respond to verbal commands. If a patient is unable to respond to verbal contact when fully conscious, their usual method of communication must be maintained.

• The definition describes the state of conscious sedation, and does not attempt to prescribe how it is achieved. Specifically, it is acknowledged that a number of techniques involving the use of one or more drugs administered via different routes will fulfil this definition provided that there is an adequate margin of safety.

• Any technique resulting in the loss of consciousness is defined as general anaesthesia, and in the UK 'deep sedation'9,16 is considered within this category13.

V.ADVANTAGES OF CONSCIOUS SEDATION

Conscious sedation is a technique in which the use of a drug or drugs produces a state of depression of the central nervous system (CNS) enabling treatment to be carried out, but during which verbal contact with the patient is maintained throughout the period of sedation[5]. The drugs and techniques used to provide conscious sedation for dental treatment should carry a margin of safety wide enough to render loss of consciousness unlikely[6].

[1] Conscious sedation retains the patient's ability to maintain a patent airway independently and continuously[7].

[2] Conscious sedation is a drug-induced depression of consciousness during which the patient responds purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained[8].

[3] Careful presedation evaluation with respect to airway, fasting, and understanding about the pharmacodynamics and pharmacokinetics of the drugs must be established. Availability of airway management equipment, venous access, and appropriate intraoperative monitoring and well-trained staff in the recovery area must be ensured[9].

[4] Conscious sedation can be administered through various routes such as oral, intramuscular, intravenous, and inhalational[10].

VI.CHALLENGES IN DENTAL CONSCIOUS SEDATION

The challenges in dental conscious sedation are as under:[4,5]

1. Shared airway between the dentist and the anesthesiologist

2. Phobia and anxiety
3. Coexisting medical conditions such as cardiac anomalies, mental instability, and epilepsy
4. Chances of arrhythmias during surgery due to trigeminal nerve stimulation
5. Enlarged tonsils and adenoids in children likely to precipitate respiratory obstruction
6. Risk of patient losing consciousness, respiratory, and cardiovascular depression
7. Vasovagal syncope due to the dependent position of legs in dental chair.

VII.INDICATIONS FOR CONSCIOUS SEDATION IN CHILDREN

Indications for the use of conscious sedation as an adjunct to patient management include patients with[11]:
• dental anxiety and phobia;
• prolonged or traumatic dental procedures;
• medical conditions potentially aggravated by stress;
• medical conditions affecting the patient's ability to cooperate;
• special needs.

VIII.PHARMACOLOGY OF DRUGS USED FOR CONSCIOUS SEDATION

It is mandatory to secure an intravenous(IV) line with the help of an appropriate-sized IV cannula before administering any drug or inhalational anesthesia[12,13].
In many cases, mild anxiolytic along with local anesthesia is sufficient to reduce fear and anxiety in the patient.

Nitrous oxide

Mixture of nitrous oxide (N2 O) and oxygen is used as a sedative. N2 O is a colorless gas used as an inhalational anesthetic agent[14]. It is an anxiolytic/analgesic agent that causes CNS depression and varying degree of muscle relaxation and euphoria with hardly any effect on the respiratory system.[11]
Recent research shows analgesic effects of N2 O is initiated by the neuronal release of endogenous opioid peptides with activation of opioid receptors and descending gamma-aminobutyric acid (GABA) and noradrenergic pathways that modulate nociceptive processing at the spinal level[16,17]. Anxiolytic effect involves the activation of GABAA receptor through benzodiazepine-binding site. The anesthetic effect appears to be caused by inhibition of N-methyl-D-aspartate (NMDA) glutamate receptors, thus removing its excitatory influence in the nervous system[19].
The technique employs subanesthetic concentrations of N2 O delivered along with oxygen from dedicated machinery through a nasal mask. The N2 O/oxygen delivery systems are manufactured with oxygen fail-safe devices that stop the flow of N2 O when the flow of oxygen is stopped[20,21,22]. The safety mechanism ensures delivery of at least 30% oxygen in all situations. N2 O has low tissue solubility and high minimum alveolar concentration which enables rapid onset of action coupled with a rapid recovery; thus ensuring a controlled sedation and quick return to normal activities[23]. It is very safe as the patient remains awake and responsive and reflexes are retained. The use of N2 O is contraindicated in patients with common cold, porphyria, and COPD[25,26].

Sevoflurane

Sevoflurane is an ether inhalational anesthetic agent with low pungency, a nonirritant odor, and a low blood–gas partition coefficient. Its low solubility facilitates precise control over the depth of sedation and rapid and smooth induction and emergence from sedation[28].Sevoflurane, therefore, remains an ideal induction agent before starting infusion of a total IV anesthetic such as propofol to maintain sedation[30].

Benzodiazepines

Benzodiazepines, including diazepam and midazolam, have proved to be safe and effective for IV conscious sedation[31]. Their sedative and selective anxiolytic effects and wide margin of safety contribute to their popularity in dentistry. Apart from anxiolysis and amnesia, benzodiazepines are known to possess skeletal muscle relaxation and anticonvulsant activity; however, these drugs have no analgesic properties. Mechanism of action is through GABA-mediated opening of chloride channels. They have high lipid solubility giving rise to rapid onset of action[30]. They are normally added to N2 O/oxygen for conscious sedation, as N2 O produces the analgesic effects. The most commonly used benzodiazepine is midazolam. Its high first-pass metabolism makes it a short-acting one.
It is used for conscious sedation in the pediatric dentistry. It is mixed with a sweet vehicle, such as simple syrup, and used orally either via drinking cup or through a syringe without needle and deposited in the retromolar area. Syrup can be given 20 min before the procedure. Dose under 25 kg is 0.3–0.5 mg/kg in adults but should be administered in a hospital setup only. It can also be given intramuscularly, intravenously, rectally, and nasally. Its effects are enhanced by various drugs such as opioids, clonidine, antidepressants, antipsychotics, erythromycin, antihistaminics, alcohol, and antiepileptics and should be avoided or used with caution[31]. All practitioners using these drugs must have flumazenil, the specific benzodiazepine receptor antagonist, as one of the emergency drugs in the institution. Flumazenil causes rapid reversal of all benzodiazepines. However, it is contraindicated in patients taking benzodiazepines for seizure disorder or high doses of tricyclic antidepressants[30].

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Ketamine

Ketamine, a phencyclidine derivative, is an NMDA receptor antagonist. It is a unique drug giving complete anesthesia and analgesia with preservation of vital brain stem functions. This "dissociative" state has been described as "a functional and neurophysiological dissociation between the neocortical and limbic systems." Dissociation results in a state of lack of response to pain with preservation of cardiovascular and respiratory functions despite profound amnesia and analgesia, described as "Catalepsy." This trance-like state of sensory isolation provides a unique combination of amnesia, sedation, and analgesia[32].

The most commonly seen disadvantage of ketamine is emergence phenomenon which occurs in 5%–50% of adults in 0%–5% in children[32].Ketamine increases salivary and tracheobronchial mucus gland secretions, so it is recommended to use an antisialagogue before administering ketamine.[12] The emetic side effect of ketamine producing an incidence of vomiting in 10% of children can be lessened by administering atropine which reduces salivary flow.[13] Ketamine can be given intramuscularly at a dose of 3–4 mg/kg or intravenously at a dose of 1–2 mg/kg as per the review conducted by Green et al. [14] However, administering a lower dose of the drug may be safer to achieve adequate levels of sedation in children due to the problem of potential severe respiratory depression.

Propofol

Propofol is chemically described as 2,6-diisopropylphenol. Being insoluble in water, it is available in white, oil-in-water emulsion which facilitates IV delivery of this fat-soluble agent. Propofol is readily oxidized to quinine which turns the suspension yellow in color after approximately 6 h of exposure to air. Propofol exerts its hypnotic actions by activation of the central inhibitory neurotransmitter GABA[33]. High lipophilicity ensures rapid onset of action at the brain, and rapid redistribution from central to the peripheral compartment causes quick offset of anesthetic action.[15]Elimination half-life is 2–24 h. Apfel et al. studied six interventions for the prevention of postoperative nausea vomiting (PONV) and found that the use of propofol reduced risk for PONV by 19%.Sedative doses are not analgesic, and a large proportion of patients experience pain on injection.Volatile anesthetic agents are used for the induction of anesthesia to avoid the struggle to get IV access before the child is asleep[32].

With sevoflurane, propofol is given usually at a dose of 1 mg/kg body weight, followed by maintenance dose ranging from 0.3 to 4 mg/kg/h.[18]

Opioids

All of the above-mentioned drugs do not have analgesic effects except ketamine. Opioid analgesic, therefore, needs to be supplemented. Fentanyl is a short-acting opioid 60–80 times more potent than morphine and with a rapid onset of analgesia and sedation.[33] Duration of action is 30–60min. Fentanyl can be administered by parenteral, transdermal, nasal, and oral routes. A"lollipop" delivery system is more acceptable to children than any other route. Fentanyl being a lipophilic drug is absorbed from the buccal mucosa, metabolized in the liver, and secreted in the urine. Recommended dose is 1 μg/kg/dose IV which can be repeated by 1 μg/kg increments if required[35].

IX.PREPARATION FOR SEDATION

I.A.Responsibilities of the Referring Dentist

- To make as thorough a clinical assessment of the patient as possible.
- To explore alternative methods of pain and anxiety management with the patient.
- To assess whether referral, which may include sedation to enable the delivery of dental care, is absolutely necessary.
- If referring the patient, to try to ensure that if sedation is offered on referral, it is conscious sedation according to the agreed definition (Section 1.3).
- To provide appropriate clinical information about the patient with the referral, as far as patient compliance allows.
- To provide the patient with information about why they are being referred, likely options for care and what to expect.
- To provide preventive oral health advice and to encourage the patient to seek continuing dental care.
- To record details of the referral.

Having discussed alternative methods of pain and anxiety management with the patient, referring practitioners must satisfy themselves that the care ultimately offered on referral is conscious sedation according to the agreed definition11. It is the duty of both the referring practitioner and the dentist providing treatment with sedation to encourage the patient to seek continuing dental care[33].

I.Responsibilities of the Treating Dentist

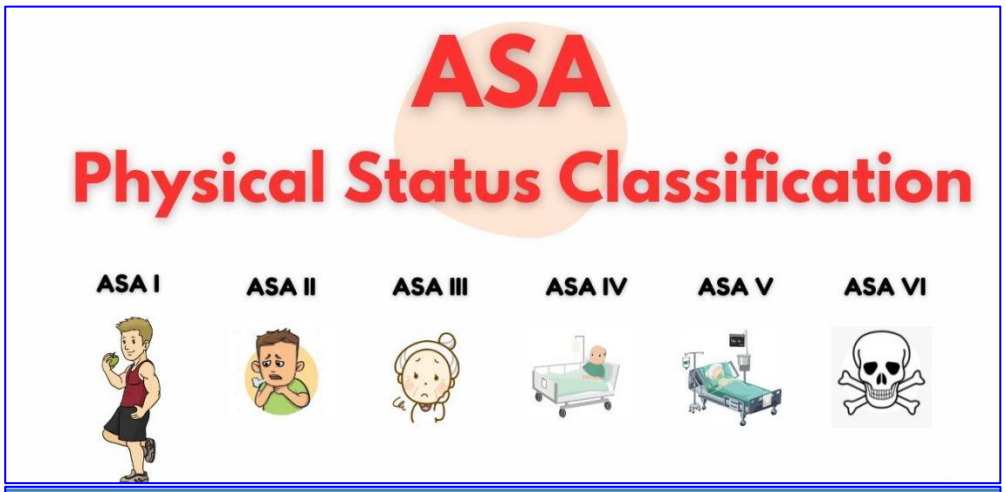
The dentist providing treatment with sedation should keep the referring practitioner informed of treatment plans and treatment provided.

- To ensure that a full assessment of the patient is carried out to confirm the dental treatment required, the need for sedation and the preferred technique (Section 3.2).
- To agree with the patient a treatment plan appropriate for the patient's needs and inform the referring practitioner of the treatment provided.
- To obtain written valid consent for provision of dental care with conscious sedation

(Section 3.3).
• To provide the patient with information about their sedation including pre- and post sedation instructions (Section 3.4).
• To provide safe and effective sedation for dental treatment.
• To provide preventive oral health advice and to encourage the patient to seek continuing dental care.

II.Patient Assessment and Selection

Patient assessment must be carried out, preferably at a separate visit to the patient's treatment under sedation. Careful and thorough assessment of the patient is necessary to ensure correct decisions are made regarding the planning of treatment[11]. All relevant anxiety management techniques including, where necessary, general anaesthesia must be explored with the patient to ensure that when conscious sedation is required the most suitable form is selected on each occasion and administered in the correct environment[11]. It is not a requirement to fail in a technique before advancing to another technique. Due consideration should be given to a patient's American Society of Anaesthesiologists (ASA) physical status17 when determining where the sedation is provided[11].



ASA-PS class	Description
Class I	A normal healthy patient
Class II	A patient with mild systemic disease
Class III	A patient with severe systemic disease
Class IV	A patient with severe systemic disease that is a constant threat to life
Class V	A moribund patient who is not expected to survive without operation
Class VI	A declared brain-dead patient whose organs are being removed for donation

X.CONSCIOUS SEDATION FOR CHILDREN

This section is generally applicable to children under 12 years of age. Conscious sedation for children must be provided only by those who are trained and experienced in sedating children and where the appropriate equipment and facilities are available11. The child's response to their environment and to interventions may vary, influenced by such factors as their degree of cognitive ability and cooperation and the influence of their medical history on the proposed treatment[9]. Corresponding adaptations in treatment protocols may be required: for example, pre-operative recording of physiological data or intra-oral examination may not be possible. In such cases, reasons for deviations from standard practice should be recorded. On the basis of the available Cochrane evidence, it was not possible to reach a definitive

conclusion about which drug or method of conscious sedation is the most effective[34]. Inhalation Sedation Nitrous oxide/oxygen is usually the technique of choice for conscious sedation of paediatric dental patients[10].

III.History

A thorough medical, dental and social history must be taken, with particular attention to both prescribed and non-prescribed drugs, to ensure that the conscious sedation technique chosen is the most appropriate to enable treatment to be carried out for each individual[16].

IV.Examination and Treatment Planning

Whenever possible an oral examination and treatment planning should be undertaken as part of the assessment. Recording of blood pressure is part of the assessment process for all patients having intravenous11, oral or transmucosal sedation‡, unless lack of patient compliance renders pre-sedation measurement impossible[16]. The ASA status must be determined and recorded. Specialist advice should be sought if there is doubt about the impact of the patient's physical status on their sedation.

V.Consent

Consent should follow the principles set out in current guidance[18]. Written valid consent must be obtained prior to premedication or the administration of sedative drugs unless the patient is unable to complete a consent form[14].

VI.Pre- and Post-sedation Instructions

In advance of the procedure, patients must receive careful verbal and written instructions regarding the effects of their proposed sedation and their responsibilities both before and immediately after treatment[14].

1, Ensure that the information provided explains what to expect before, during and after sedation, including clear instructions about fasting and escort requirements.

2.The information provided should be appropriate for the patient's age and learning ability.

3.For some patients, alternative forms of communication may be required, such as sign language or video recordings.

4.Include details of escort responsibilities, post-operative risks and possible complications, analgesia, aftercare advice (including about the patient's usual medication), restrictions on post-sedation activities, contact details for the care provider and out-of-hours contact details for emergency advice and services.

5.Record the instructions given in the patient's clinical notes

VII.Escort

A responsible adult escort, who is capable of looking after the patient unaided, must accompany the patient home after treatment under conscious sedation and remain with them as a minimum for the rest of the day[18]. The responsibility of the escort extends to ensuring that the patient takes their normal prescribed medication and carries out the routines required to manage any concurrent chronic health conditions. Note that an adult who receives only nitrous oxide/oxygen inhalation sedation does not normally require an escort.

VIII.Facilities and Staff

It is anticipated that regular independent inspections of all facilities in India that provide conscious sedation for dentistry will be introduced as part of a quality assurance programme[21].

Conscious sedation for dentistry must be carried out in an environment that is fit for the purpose. Such an environment should include staff, facilities and equipment that are appropriate to the form(s) of conscious sedation practised. Contemporaneous records of all related operational procedures

IX.Equipment

Inhalation Sedation with Nitrous Oxide Dedicated, purpose-designed machines for the administration of inhalation sedation for dentistry must be used. Such machines must conform to current British Standards and be maintained according to manufacturers' guidance with regular, documented servicing[21].

Gas cylinders must be stored safely with regard to current regulations and secured to prevent injury11,22. Scavenging of waste gases must be active and sufficient to fully conform to current COSHH standards[11,22,23].

Intravenous, Oral and Transmucosal Sedation‡ All the necessary equipment for the administration of intravenous sedation, including sedation and appropriate antagonist drugs, cannulae and labels, must be available in the treatment area[21]. Calibrated and appropriately maintained equipment is required for all intravenous infusion techniques.

XI.CONSCIOUS SEDATION TECHNIQUES

I.Intravenous Sedation

Few randomised controlled trials were found in which intravenous sedation of paediatric dental patients has been reported as a safe and effective technique[35,36]. Intravenous sedation for children must be provided only by those who are

trained in these techniques for patients of this age group[36]. Intravenous sedation for children is appropriate in a minority of cases. If practical, a topical anaesthetic should be used prior to venous cannulation.

II.Oral and Transmucosal Sedation

Most of the randomised controlled trials using oral and transmucosal sedation have concerned the sedation of children, and in these studies have been safe and effective[32,34,36,49,50]. These techniques should be used when the titratable techniques (inhalation and intravenous sedation) are deemed to be inappropriate. Oral and transmucosal sedation is appropriate in a minority of cases. 4.4 Advanced Techniques If neither inhalation sedation nor sedation using midazolam is suitable or sufficient, refer to a fully trained specialist team working in an appropriate environment for an alternative sedation technique[50,54]

III.Conscious Sedation for Children with Special Needs

This section is generally applicable to adults and children whose disabilities affect the provision of their dental care. Conscious sedation for such patients must be provided only by those who are experienced in sedating people with special needs and where the appropriate equipment and facilities are available[36,37,38]. The patient's response to their environment and to interventions may vary, influenced by such factors as their degree of cognitive ability and cooperation and the influence of their medical history on the proposed treatment[38].It can be difficult to judge the level of sedation in patients who are unable to respond well to verbal communication. Despite this, the level of sedation must not go beyond the definition of conscious sedation. In the case of patients who are unable to respond to verbal contact when fully conscious, their usual method of communication must be maintained[38].

X.Discharge

All patients must be individually assessed for their suitability for discharge and should be allowed to leave only when they have returned to a normal level of responsiveness and orientation for age and mental status and can walk unaided (if appropriate). The decision to discharge a patient following any type of sedation must be the responsibility of the sedationist[39].

XI.Aftercare Instructions

The patient and escort should be provided with written details of post-operative risks, pain control and management of possible complications. Information regarding aftercare arrangements and emergency contacts must also be provided[40].

XII.Records and Documentation

For each patient, a detailed record of the pre-sedation assessment, the visit for conscious sedation, the treatment procedure and the recovery should be kept. Comprehensive and contemporaneous clinical records must be maintained for every patient and provide evidence to support the formal consent process[41].

It is recommended that the documentation for each patient includes details of[42]: The Pre-sedation Assessment • A fully recorded medical history. • Blood pressure. • Weight, if recorded. • ASA status. • A dental history. • A conscious sedation and general anaesthetic history. • Dental treatment plan. • The selected conscious sedation technique. • Any individual patient requirements. • Provision of pre- and post-operative written instructions provided before treatment. • Written consent for conscious sedation and dental treatment. The Visit for Dental Treatment Under Conscious Sedation • The presence of an accompanying responsible adult escort (if required). • The time that food and drink were last consumed. • Arrangements for suitable post-operative transport and supervision (if required). • Compliance with the pre-treatment instructions. • Presence of written consent for the procedure. • Any changes in the recorded medical history or medication.

The Treatment Procedure[43] • Dose, route and time(s) of administration of drugs. • Comprehensive details of clinical and electromechanical monitoring. • Personnel present in surgery. • Patient reaction and success of sedation. • Dental treatment provided. Recovery • Monitoring – appropriate details of all observations and measurements throughout. • Pre-discharge assessment by sedationist – appropriate discharge criteria met. • Written post-operative instructions given and explained to patient and escort. • Time of discharge.

XII.Clinical Governance

It is a requirement of clinical governance and fundamental good practice that all clinicians work to monitor and constantly strive to improve the quality of care they and their teams provide to patients[44]. Those involved in sedation practice should seek to regularly audit their practice. There should be a system of local protocols for the care and management of complications. There should be a positive environment of training for the whole dental team. Clinical governance and audit procedures should include all patient groups being managed by the dental team. All sedation practices should carry out adverse-event analysis. All facilities that provide conscious sedation for dentistry should undergo regular independent inspections as part of a quality assurance programme[45].

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XIII.Training in Conscious Sedation for the Dental Team

I.Sedation Training for Dentists

Intravenous Midazolam and Inhaled Nitrous Oxide The standards for training in conscious sedation can be found in 'Training in Conscious Sedation for Dentistry'[46]. This document details the training required for a dentist to practise intravenous sedation with midazolam and inhalation sedation with nitrous oxide/oxygen. The training includes supervised clinical practice in the techniques. All those who provide sedation using these techniques must be trained in accordance with these standards[47].

II.Training for Other Techniques

The training of sedationists to use techniques other than intravenous administration of midazolam and inhalation using nitrous oxide is less well established[48]. Oral and Intranasal Sedation The recommendations of the Dental Sedation Teachers Group (DSTG) state 'that the use of oral and intranasal sedation techniques by practitioners who are already competent in intravenous sedation requires very little additional training' [49]. Although that training has not been detailed, it must include supervised clinical practice. Advanced Techniques Postgraduate courses will vary in the range of conscious sedation techniques covered. Any course should include revision of the core sedation curriculum in addition to covering any additional pharmacology and clinical techniques[50]. Supervised clinical practice involving the whole dental team is an integral part of all training in conscious sedation. Such supervised practice should be assessed by those providing the course or appropriately trained and experienced assessors[51].

CONCLUSION

Conscious sedation is a technique meant for dealing with dental phobia and should not be considered an alternative to effective local anesthesia or good behavioral management[52].

Route of administration and the drug should be selected on an individual patient basis. Importance of adequately trained staff in an area adequately equipped with monitoring tools along with importance of detailed presedation assessment cannot be overemphasized. When practicing sedation in a dental setting, awareness of limitations is necessary.

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