

DENTAL ANAESTHESIA: AN OVERVIEW

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ABSTRACT: *Dentists have been the founder of anaesthesia because of their day to day experience of pain while doing their job. Due to high morbidity and mortality, general anaesthesia never won the heart and trust of the dentist. Although several local anaesthetic agents were used in dental practice but they could not last long due to toxic side effects. A new chapter was written in dental anaesthesia with the invention of wonder drug “Lidocaine” and till date it remains the most popular drug amongst the dental fraternity for the majority of the dental procedures. Recently due to safe new drugs, techniques and advanced monitoring the concept of general anaesthesia for dental surgeries has reemerged and is being used with minimal morbidity and mortality at several centers. In the present review article after obtaining the literature from PUB MED/MEDLINE, books and print journals we have discussed in detail the drugs, techniques, complications along with their management, and new development in dental anaesthesia.*

KEYWORDS: Dental anaesthesia, General anaesthesia, Local anaesthesia, Sedation.

INTRODUCTION

In the early days dental surgery was mainly restricted to dental extraction with or without pain relief. Surprisingly it is the dentists not the medical doctors were the pioneer in the discovery of anaesthesia. Professor G.Q.Colton (1844) a chemist by profession administered nitrous oxide to Horace Wells a dentist and another Dentist John Riggs extracted the tooth without pain. The concept of general anaesthesia as a means of performing painless surgery was born on 16th October 1846 when Morton WTG yet another dentist gave a public demonstration of ether anesthesia for removal of mandibular tumor.^{1,2} First regional anaesthesia in the oral cavity was performed by the surgeon Halsted in 1884, when he removed a wisdom tooth without pain with cocaine infiltration but soon it became unpopular due to high mortality. In the early 19th century a new era of local anesthesia (LA) in dentistry started when Einhorn (1905) reported the synthesis of procaine, followed by other substances like tetracaine, propoxycaine and chloroprocaine but these drugs did not enjoy the support of dentists due to high incidences of allergy. Later on Lofgren (1943) synthesized lidocaine, the first “modern” local anaesthetic agent which had a quick onset, smooth course and safe recovery. Thereafter a number of other drugs like Mepivacaine (1956), Prilocaine(1960), Bupivacaine (1963), Etidocaine (1971) was used in dentistry but Lidocaine remains the main choice of most dental practitioner.³ Recently, Articaine is widely used in USA, Germany, France and other European countries.

General anaesthesia (GA) was never a first choice of dentists due to the large number of deaths associated with it especially between 1970 and 1980. Professor David Poswillo and his colleagues made certain recommendations in1990 for the safe provision of GA in dentistry outside hospital. Unfortunately many of these recommendations were not uniformly taken up and after an initial fall further increase in anaesthetics related deaths were reported.⁴ In the late 1990 s, the General Dental Council and the Royal College of Anaesthetists again highlighted that GA was often used inappropriately as a method of anxiety control in situations where LA with or without sedation might be appropriate. Therefore these institutions recommended that GA should only be administered where no alternative existed and this resulted in a marked reduction in the provision of GA.^{5,6} Since January 1,2002 GA for dentistry has been confined to a hospital setting with critical care facilities.⁷

Author searched the literature from PubMed, books and print journals from anaesthesiology, pharmacology and dentistry specialties. In present overview different anaesthesia drugs, techniques, complications with management and recent advances have been discussed in detail.

Challenges during dental anaesthesia

Problems during dental anesthesia are multifold including those in patients, surgical procedure, anaes-

thetia drugs and techniques and pre existing diseases especially in elderly patients.

The majority of the patients in dentistry is from extremes of ages. Young, uncooperative children with respiratory infections for the dental corrective procedure or elderly patients suffering from multiple card-respiratory, endocrine or neurological diseases receiving multiple drugs like anti-hypertensive, coronary dilators, anti diabetics, aspirin or antiplatelet drugs are commonly encountered during dental practice. Anxious young female is the other group of patients who needs special care during dental procedures. In dental chair anaesthesiologist often find the difficulty in managing the patent airway especially under deep sedation or GA as mouth and pharynx are filled with secretion, blood, debris and water flows.

Injection of local anaesthetic drugs in already swollen inflamed painful area is sometimes difficult and gives partial effect due to low pH.

The dentist often encounter fear, anxiety and pain induced vasovagal or cardioneurogenic syncope due to a sudden decrease in venous return and hypotension.⁸

Armamentarium

Like any other surgical procedure all the essential drugs and resuscitation equipments should be readily available at the workplace to deal with any untoward incidence. (Table 1)

Types of dental anaesthesia

In the outpatient department level majority of dental procedures can be performed under LA infiltration, nerve block alone or under mild sedation especially in anxious patients whereas GA is required in pediatric, mentally challenged patients, or a true allergy to local anaesthetic drugs. All other major dental operations are performed after admission to the inpatient department under conscious sedation, deep sedation or general anesthesia. A complete general and systemic examination along with relevant investigation should be carried out before giving any sedation or anaesthesia.

Local anaesthesia (outdoor/dental chair) in dentistry

Short dental procedures in relaxed, educated adults without much mental or physical disability (ASA grade I and II) can be performed under LA with or without sedation. However patients with COPD, neuromuscular disorders, coagulopathies and hemoglobinopathies, marked oro-facial swelling (edema and trismus), potential difficult airways, marked congenital heart defects, extreme obesity, multiple drug therapy, and full stomach should be avoided in outdoor clinics especially under sedation or general anaesthesia.

Local anaesthetic drugs

Many local anaesthetic drugs have been used in dental practice. Two groups of local anaesthesia drugs namely ester and amide group are available. Ester group of local anaesthetic drugs (Procaine, Benzocaine, Chlorprocaine,) have short duration of action (except for Tetracaine), short shelf life and high incidence of allergic reactions. On the other hand amide compounds like Prilocaine, Lidocaine, Bupivacaine, Ropivacaine are very stable and have less incidence of allergic reactions. A number of properties are desirable for an ideal local anaesthetic agent like rapid onset, sufficient duration, reversible action, non irritant to the tissues, no or minimal allergic or systemic toxicity, quick metabolism in the body and stability at room temperature. Lignocaine with adrenaline is most commonly used drug in dentistry because it nearly fulfills all the criteria of a safe local anesthetic agent.⁹ Both bupivacaine and ropivacaine are now being used in dental practice because of prolonged duration of action. Ropivacaine has an additional advantage of rapid onset of action.^{10,11} Recently, Articaine a newer local anaesthetic agent containing both amide as well as an ester molecule with rapid onset and quick recovery due to dual mode of metabolism is widely used all over especially in the western world.¹²

Testing of local anaesthetic drugs

Local anaesthetic drugs are usually well-tolerated, but they can precipitate adverse reactions of different types and severity including allergic reactions. The true incidence of allergic reaction is unknown although an incidence of less than 1% of all local anesthesia drug adverse reactions has been reported.¹³ In another study author did not find a single case of true allergy to local anaesthetic drug in 5018 cases.¹⁴ Preservatives like methylparaben and bisulfites are widely used as additives which can give false positive results,¹⁵ therefore local anaesthetic drugs without preservative or vasoconstrictor should be used for intra dermal or patch testing. However, testing should always be done in patients with a history of allergic disease/drug allergy.

Local anaesthetic drugs and vasoconstrictors

Addition of a vasoconstrictor (Adrenaline/Epinephrine) to a local anesthetic drug have several beneficial effects like, decrease in the sudden peak plasma concentration thus avoiding toxicity,¹⁶ increase in the duration and the quality of anaesthesia, reduction of the minimum concentration of anesthetic required for nerve block, and decreased blood loss during surgical procedures.¹⁷ For long time physician and dentist were afraid to use adrenaline in cardiac patients because of possible effects like hypertension, tachycardia, chest pain, arrhythmia etc.,¹⁸ but recent studies have confirmed its safety in these group of patients if used in lower concentrations (1:200,000).^{19,20} Felypressin(0.03 ml/ml) , a synthetic

Table I: Essential armamentarium for Dental Anaesthesia at outpatient Department.

Drugs	Resuscitation Equipment
• Adrenaline 1/1000 • Aminophylline • Atropine • Calcium gluconate • Diazepam/Midazolam • Dexamethasone /Hydrocortisone • Naloxone/ Flumazenil • Sodium bicarbonate • Suxamethonium • Thiopentone • Vasopressors:Ephedrine/Mephentermine • GTN tablets or spray • Nifedipine • IV Fluids	• Oxygen cylinders • Full range of tracheal tubes , airway, stylette & other accessories • Two working laryngoscopes with adult and paediatric size blades • Ambu-Bag • Defibrillator • Suction Machine

Table II: Problems during local/regional Dental Anaesthesia.

Complications of Local Blocks	• Muscle Pain due to local infiltration • Paraesthesia due to nerve injury • Middle ear problems • Ophthalmic complication Diplopia, mydriasis, palpebral ptosis, abduction difficulties • Palpitation • Nausea & vomiting
Complications of Injections	• Injury to blood vessels Blanching of skin Necrosis and ulceration of the skin • Broken needle • Infections
Reactions to Local Anaesthesia	• Syncopy/vasovagal attack Fainting Cardiovascular collapse • Toxic Excitement or Depression • Allergic Immediate- target lungs and circulatory Delayed-minor type

analogue of vasopressin and phenylephrine (1:2000-20000), a α_1 adrenergic agonist do not increase the heart rate when used with local anesthetic drugs, therefore may be preferable for the patient with cardiovascular diseases.^{21,22}

However, vasoconstrictor agents should be used with caution in patients with unstable angina, recent myocardial infarction, recent coronary artery bypass surgery, untreated or uncontrolled severe hypertension, untreated or uncontrolled congestive heart failure and hyperthyroidism. French speaking society of oral medicine and oral surgery have recommended safe use of 1:200,000 concentrations of adrenaline with various local anesthetic agents.²³

Types of local anesthesia used in dental practice

1. Topical: Topically applied anaesthetics provide anesthesia for non keratinized tissue (e.g., oral mucous membrane) up to a depth of 2 to 3 mm only which facilitates the painless injection of local anaesthetics. Lignocaine swabs (4%), spray (10%) and Benzocaine 20% are commonly used for topical anaesthesia. Lignocaine containing bioadhesive patch have been used successfully in alleviating the needle pain in dental practice.²⁴
2. Infiltration: 2% Lignocaine with /without epinephrine is injected directly into the tissue at the site of dental procedure e.g. buccal, gum tissue or palatal.
3. Blocks: Injection of 2% Lignocaine with/without epinephrine near the nerve numbs the entire area innervated by the nerve e.g.: mandibular nerve, inferior alveolar nerve block etc.

Problems during local anaesthesia blocks

The incidence of complications with LA in dental practice is around 4.5%, although the majority of these were transient.²⁰ Local complications like muscle pain, injury to nerve, blood vessel during local block due to needle insertion or withdrawal have been reported. Temporary or permanent paraesthesia due to injury to nerve from direct trauma, hematoma formation or neurotoxicity of local anesthetic drugs have been encountered during dental practice. Lingual nerve, inferior alveolar nerve is the most commonly involved nerves.²⁵ Other dreaded complication during dental block is the injury or piercing of blood vessel during local block leading to intravascular injection and various complications ranging from mild syncopal attack to life threatening collapse,²⁶ hematoma formation,²⁷ blanching,²⁸ necrosis and ulceration of skin.²⁹ A series of 14 reversible ocular complications like diplopia, mydriasis, palpebral ptosis, and abduction difficulties of the affected eye have been reported possibly due to diffusion of drug towards orbit

through vascular, neurologic, myofascial, and/or lymphatic networks.³⁰ Middle ear complications like headache, pressure in ear, difficulty in hearing and equilibration were reported following mandibular block.³¹ Cases of broken needle during dental nerve block have been reported in the literature from time to time.^{32,33}

Spread of infection due to passage of the needle through infected tissue and idiosyncrasy to local anesthetic drugs are the other complications observed during the dental block. **(Table 2)**

Syncope or vasovagal attack is very common during dental procedures, especially in children, females and nervous patients due to needle phobia.³⁴

Hyperventilation syndrome is often encountered during dental work. Emotional stress leading to rapid shallow breathing resulting into hypocapnia, respiratory alkalosis, intense cerebral vasoconstriction and hypoxia. Clinical features like paresthesia, numbness, muscular rigidity, tetany, convulsion and several gastrointestinal and cardiovascular disturbances have been observed. Simple assurance and anxiolytic drugs can prevent its onset.³⁵ Allergic reactions, trauma to the nose, buccal mucosa, postoperative nausea and vomiting are the other complications often encountered during local dental blocks.

Complications in dental chair

Various types of complication have been observed during a dental procedure in the dental chair, whether performed under local block with or without sedation and general anaesthesia. **(Table 3)**

I. Respiratory complication

1. Airway Obstruction: In dental chair anaesthesiologist often find difficulty in managing the patient's airway especially under deep sedation or general anaesthesia as mouth and pharynx is filled with secretion, blood, debris and water flush and tongue fall leading to airway spasm and or obstruction.³⁶ Immediate suction of oropharyngeal contents and lateral position prevents the aspiration. Maintenance of airway with triple maneuver, oropharyngeal airway or endotracheal tube could be required to prevent hypoxia.

2. Respiratory Depression: Over dosage or excessive effect of narcotic and sedative drugs can cause hypoventilation, hypoxia and hypercarbia. Immediate ventilatory support with face mask, ambu bag or expired air airway should be provided. Effect of narcotic drugs is reversed with Inj Naloxone 400 μ gm IV. If respiration is still depressed then assisted or controlled ventilation may be instituted.

Table III: Complication in Dental chair.

Respiratory	<i>Hypoventilation, Airway Obstruction, hypoxia,Hypercapnia</i>
Cardiovascular	<i>Hypotension, Bradycardia, Dysarrythmia , Fainting Tachycardia/Dysarrythmia</i>
Allergic	<i>Urticaria , Pruritus, Facial edema, Hypotension, ,Bronchospasm/ Laryngeal edema, Dyspnoea, Hypoxia</i>
Miscellaneous	<i>Nasal/Buccal Mucosa Trauma, Nausea &Vomiting Aspiration of Blood/Water/Vomit</i>

Table IV: Different drugs and techniques of sedation in dental anaesthesia.

Non Titrable Techniques		
	Oral Sedation	Alprazolam 0.25-0.5 mg Chloral hydrate 50 mg/kg Diazepam 5-10 mg Midazolam 0.2-0.5mg/kg
	Rectal Sedation:	Diazepam 0.6 mg/kg Midazolam 0.4mg/kg
	Intramuscular Sedation	Diazepam, 5-10mg Midazolam 0.2-0.3 mg/kg
	Submucosal Sedation	Fentanyl 3 µgm/kg
	Intranasal Sedation	Midazolam 0.4mg/kg Sufentanyl 1.0 and 1.5 µgm/kg
Titrable Technique		
	Inhalational Sedation	N ₂ O:O ₂ N ₂ O:O ₂ and Sevoflurane 1-3%
	Intravenous Sedation/ Narcotic	Diazepam 5-10 mg Midazolam 1-2.5 mg Pethidine 25-50 mg Fentanyl 1-2µgm/kg Dexmedetomidine 6mcg/kg/hr followed by0.2mcg/kg/hr infusion
Combination of two techniques		
	Intravenous and Inhalational	Midazolam withN ₂ O:O ₂ and Sevoflurane

II. Cardiovascular complications

Fainting/Vaso-vagal syncopal attack: Syncope is defined as an abrupt, transient, short term loss of consciousness and postural tone, followed by spontaneous and complete recovery. Apprehension, needle phobia, pain are the common factors for sudden un-responsive, bradycardia, hypotension, hypoxia, collapse, convulsions and sometimes death. A limbic cortex-hypothalamus-reflex result in vasodilatation and increased parasympathetic activity leads to bradycardia. Immediately procedure should be stopped and the patient is put in head down-elevated leg position to improve venous return. Inj. Atropine 0.6 mg IV, Vasopressor like Mephenteramine 6-12mg, Inj. Hydrocortisone 100 mg and O₂ supplement are the main line of treatment.

Tachy-arrhythmias: Sudden increase in heart rate (>120/min) or alteration in rhythm like ectopic can be observed in some patients especially with cardiac diseases. Sedation with IV Diazepam 5-10 mg can control the heart rate, if not beta-blockers can be used after consulting a physician/cardiologist. Cardiac arrhythmias especially during general anaesthesia are seen in cardiac patient due to hypoxia and hypercarbia.³⁶

Cardiac Arrest; Death during dental anesthesia is relatively rare but can occur in the middle aged or elderly patient, especially those who are at high risk due to myocardial infarction, mostly precipitated by pain or vasovagal hypotension. Disappearance of pulse, blood pressure and heart beat is a real emergency situation which requires immediate call for the HELP. Whether to start resuscitation in the dental chair,³⁷ or to shift the patient on the floor³⁸ has always been controversial. Start resuscitation by taking care of Airway, Breathing and Circulation. Once revived immediately shift the patient to the nearby critical care unit for further management.

II. Allergic complication

True allergic reactions to local anesthetic drugs are extremely rare because this requires the formation of an antibody to an antigenic substance. To date, no evidence is available that antibodies are formed in response to a challenge by an amide-type local anesthetic drug.

Once allergic reactions are suspected stop anaesthesia/surgery and give Inj Pheniramine maleate 2ml IM/IV, Inj Dexamethasone 4-8 mg IM/IV or Inj Hydrocortisone 100-200mg IV and Inj Calcium gluconate 10% 10ml IV and Vasopressor drug if needed.

Monitored anesthesia care in dentistry

The majority of the dental procedures can be performed under LA, but uncooperative children, young female, patients with physical, mental or medically compromised conditions often require light sedation

without the loss of consciousness for examination, long, complex, or multiple procedures at a single session as they are afraid of pain due to needle prick and surgical procedure. Various drugs with different techniques are in use for two types of sedation namely conscious or deep sedation in dental surgeries. (Table 4)

Moderate or conscious sedation

A technique which produces depression of consciousness but the patient is arousable, responds to purposeful command along with maintained airway/ventilation and cardio-vascular function.

Deep Sedation

A technique which produces depression of consciousness and the patient is not arousable but responds to painful stimuli and his cardiovascular functions are maintained whereas ventilation often needs assistance

Faculty of Dental surgery, the Royal College of Surgeons of England and the Royal College of Anaesthetists and American Dental Associations have renewed the guidelines for conscious sedation, sedation and anaesthesia in dentistry.^{39, 40}

"Child is not a small man" this statement becomes significant in dentistry. Management of sedation needs special attention while dealing with pediatric population because the drug, dose and route of administration are entirely different from that of adults. Guidelines for managing anxious children under sedation have been published in the literature.⁴¹ We recommend that sedation should be given by either medical or paramedical personnel under monitored care.

General anaesthesia in dentistry

General anaesthesia is defined as a controlled state of unconsciousness, accompanied by a partial or complete loss of protective reflexes. Very often general anaesthesia is not a choice in dental practice due to high morbidity and mortality. An indication for general anaesthesia includes paediatric and adolescent patients with multiple teeth involvement, local sepsis, allergy or sensitivity to local anaesthetics, mentally challenged or epilepsy. General anaesthesia in dentistry covers three main types of surgical procedures: Dental chair anaesthesia, Day care anaesthesia and In-patient anaesthesia.⁴²

Pre-anesthetic assessment: Like all other surgical patients a thorough medical history, clinical examination along with relevant investigations like, complete blood count, blood sugar, blood urea, electrocardiogram are the prerequisites for general anaesthesia. Optimization of medical disease, well informed written consent should be obtained before admitting the patient for general

anaesthesia. Dentist along with anaesthetist must visit the patient preoperative to assure the patient and to obtain written consent about the procedure.

Premedication: Keep the patient nil orally for six hours for food and two hours for clear fluids before the procedure. Oral Midazolam (7.5mg) or Diazepam (5-10 mg) can be given two hours before to anxious patients. Inj Glycopyrrolate (0.2 mg) or Inj Atropine (0.6 mg) should be given to reduce salivation and vagal stimulation during the procedure.

Monitoring: Apart from clinical observation other minimal monitoring including pulse rate(PR), blood pressure(BP), electrocardiogram(ECG), O₂ saturation(SpO₂), and end-tidal CO₂ should be used in all types of general anaesthesia procedures to minimize the morbidity and mortality.

Induction and Maintenance: Start crystalloid fluid (5% dextrose saline or ringer lactate) after securing an intravenous line. Induction of general anaesthesia can be achieved with either inhalational (sevoflurane/ isoflurane/ halothane) or intravenous (Propofol/SodiumPentothal/ Ketamine) agents. Airway can be secured with LMA/Oro tracheal/nasotracheal tube with or without short acting muscle relaxant. Anaesthesia can be maintained with O₂:N₂O+Opioidanalgesic (fentanyl/ sufentanyl) + Inhalational sevoflurane / isoflurane / halothane) either on spontaneous or controlled ventilation with non-depolarizing agents like Atracurium.

For very short procedures Total intravenous anesthesia can be used due to its faster and better quality of recovery.⁴³

Reversal and post operative recovery: If controlled anaesthesia with muscle relaxant is given then extubation is facilitated with Glycopyrrolate + Neostigmine combination. After extubation keep the patient in left lateral position to prevent aspiration of oral contents. Injectable anti-emetic (Ondansetron 4-8 mg) and analgesics (Inj Diclofenac Sodium 75 mg IM/IV or Inj Tramadol 1-2mg/kg, or Inj Pentazocine 0.5 mg/kg) should be given to prevent nausea, vomiting and pain in the postoperative period.

All the patients should be observed in the recovery room for vital signs like PR, BP and SpO₂ before transfer to indoor ward.

Complications of general anaesthesia.

Incidence of complications during general anaesthesia is according to the physical status of patients ranging from 12.3 % (ASA I) to 34.9% (ASA IV).⁴⁴

In another study 99% of the children had various problems ranging from inability to eat, sleepiness, pain to

psychological disorders.⁴⁵ Following problems are commonly observed under general anaesthesia:

Cardiac arrhythmias: Dysrhythmias during general anaesthesia especially with inhalational anesthetic agents (halothane>enflurane>sevoflurane) have been frequently reported during dental surgery. Factors like age, preexisting cardiac disease, medication like digitalis, diuretics, spontaneous respiration, hypoxia, hypercarbia, use of exogenous epinephrine have been attributed for these arrhythmias.⁴⁶⁻⁴⁸ All types of cardiac arrhythmias have been reported but ventricular arrhythmias are much more common than nodal or atrial.^{46,49} Jacobson et al could not establish any relation of arrhythmia incidence with increasing age, gender, status of medication and concluded that majority of these arrhythmias were benign in nature.⁵⁰

Dysrhythmias also have been reported with intravenous anaesthetic agents.⁵¹⁻⁵³

Most of these arrhythmias do not require any treatment, only removal of the precipitating factor leads to their disappearance. If any haemodynamic imbalance develops then these should be treated with appropriate physician consultation.

Nausea and vomiting: Up to 20-50% incidences of post-operative nausea and vomiting (PONV) after general anaesthesia have been reported in different studies.⁵⁴⁻⁵⁷ PONV is thought to be multifactorial in origin, involving anesthetic, surgical, and individual risk factors.^{58, 59} PONV causes distress, agony, aspiration, airway problems, along with a prolonged hospital stay leading to increased cost of treatment. H₁-receptor blocker (Promethazine), Anti-dopaminergic drugs (Droperidol, Metoclopramide), 5HT₃ blockers(Ondansetron, Granisetron), NK₁ blocker (Aprepitant), Dexamethasone all have been used either alone or in combination for the prevention and treatment of PONV in dental surgeries.

Aspiration of Secretion/Blood/Debris: Risk of contamination of the airway with blood, secretions and debris due to regurgitation and aspiration is much less in a dental chair sitting position with a cuffed tracheal tube in situ. However, there are high chances of aspiration in post operative period due to sedation and sluggish protective reflexes.

Dizziness /Confusion: Up to 46% dental patients experienced these problems in early as well as the late postoperative period leading to delayed street fitness.^[59] Shivering: Incidence of postoperative shivering in patients undergoing different types of anesthesia is around 5-65%,^{60, 61} which causes discomfort and increased O₂ demand of the body leading to various complications especially in morbid patients.

Damage to teeth, lips or tongue: Minor injuries to dental and oral structures are common adverse events in association with anaesthesia due to preexisting poor dentition, reconstructive work and moderately difficult to very difficult intubation.^{62, 63}

Anaesthetic Awareness: This is a rare phenomenon but can occur in about 0.1% to 0.2% of all anaesthesia cases.⁶⁴ Awareness during anaesthesia can lead to post traumatic stress disorder in which patient recalls the event along with sleep disturbances, anxiety and other psychological disturbances.

Death: In present era death under general anaesthesia in dentistry is rare due to modern anaesthesia techniques, newer safe drugs and advanced monitoring devices. Lee and Roberts did not find any death in a survey conducted among 22000 dental procedures.⁶⁵ In another retrospective survey between 1973-1995, only four deaths in 2,830,000 patients were reported during anaesthesia and deep sedation given by dental anaesthetist or maxillofacial surgeon.⁶⁶

what's new in dental anaesthesia?

Single tooth anaesthesia (STA)

This fast acting constantly monitored dynamic pressure-sensing technology provides minimal anaesthesia to keep the area pain free to the tooth needing the repair, hence providing increased comfort and less tissue damage than seen with traditional devices.^{67, 68}

Computer-controlled local anaesthetic delivery systems

A computer controlled device is used for controlled drug delivery with a lightweight hand piece and a foot control. The operator holds the needle in place and the drug is injected by a preprogrammed system into the tissue comparatively pain free as compared to conventional injection.⁶⁹

Nusstein et al found similar grade pain during needle insertion but lesser pain during drug deposition.⁷⁰

Vibraject

It is a battery operated device which reduces pain during needle prick.⁷¹ This works on the gate control theory of pain management in which high frequency vibration stimulates nerve endings to stop transmission of low frequency pain conduction to brain. This non-invasive device is good for needle phobic patients especially during palate and mandibular block. However, the results of this device are conflicting. Few studies found it is effective whereas others did not.^{72, 73}

Electronic dental anaesthesia

Transcutaneous electrical nerve stimulation (TENS) has been used as a pain relieving measures in various conditions like obstetric analgesia, low back ache, trigeminal neuralgia and atypical facial neuralgia, etc. Although TENS was first used in dentistry in 1967,⁷⁴ but recently its use in dental anaesthesia has reemerged. Two electronic pads are applied either inside or outside the oral cavity and a low current of electricity through these contact pads is applied which target a specific electronic waveform directly to the nerve bundle at the root of the tooth. This is used either alone or with N₂O:O₂ combination. Many authors have found it very effective especially in children.^{75, 76}

CONCLUSION

Dental anaesthesia has come a long way since its first use. However it is worth emphasizing that the newer drugs and methods along with modern technology has considerably reduced the morbidity and mortality associated with dental anaesthesia. It needs to be mentioned that the majority of the procedures done under LA are managed by the dental surgeon and not the anaesthesiologist therefore use of minimum monitoring like pulse oxymeter to keep a watch on vitals during the procedure in the absence of a standby anaesthesiologist could raise a alarm before the occurrence of serious complications.

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