



## **Awareness on Commonly used Sedatives Hypnotic in Dental Practices among Dental Students**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author NS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors DG and KKP managed the analyses of the study. Author AV managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Fear or anxiety towards dental procedures can discourage patients from getting dental treatment done. The management of anxious patients undergoing dental treatment is still a challenge in clinical practices. The increased use of sedative and hypnotics in dental practices appears to indicate that the assessment of dental student's awareness of it, is essential. This survey is carried out to determine the awareness of sedatives and hypnotics used in dental practices among dental students. A questionnaire-based survey study was conducted among 100 undergraduate students at Saveetha Dental College and hospital. The study revealed 94% of the students are aware of the commonly used sedatives and hypnotics in dental practices.

**Keywords:** Midazolam; benzodiazepines; barbiturates; general anesthesia; nitrous oxide.

## 1. INTRODUCTION

Fear or anxiety towards dental procedures can discourage patients from getting dental treatment done. The management of anxious patients undergoing dental treatment is still a challenge in clinical practices. Several methods are known to control these situations, such as the use of anxiolytics, sedatives, and hypnotics [1]. Despite a wide variety of drugs for oral sedation in adult patients, there are relatively few systematic reviews that compare the effectiveness and safety of different drugs administered via this route. In this group, the most commonly used drug is benzodiazepines, and when properly used, it can help to increase the patient's well-being and the quality of the dental treatment [2].

A small, but a significant portion of the public, have fears so great that it impedes their ability to properly maintain oral health care [3]. Patients with a high level of fear who probably do not seek dental care on a regular basis. Moderate levels of fear and anxiety are able to tolerate minor dental treatment but having a higher level of anxiety for more involved treatment administered under general anesthesia of dental procedures have shown the reduction of patient pain and anxiety [4]. Generally, some patients cannot be treated with local anesthesia alone for various reasons due to behavioral problems resulting from some form of disability. In such cases, dental procedures should be performed under conscious sedation.

The increased use of sedative and hypnotics in dental practices appears to indicate that the assessment of dental student's awareness of it is essential. This survey is carried out to determine the awareness of sedatives and hypnotics used in dental practices among dental students.

## 2. MATERIALS AND METHODS

### 2.1 Participants and Study Design

A questionnaire-based survey study was conducted and the participants were 100 undergraduate students at Saveetha Dental College and hospital. The participants were informed prior to the study and identities were kept anonymous.

### 2.2 Data Collection Methods

The questionnaire had 10 selected questions, with 2 questions eliciting demographic details and 8 questions eliciting awareness related to

sedative-hypnotics among 100 dental students through a survey planet. The responses were collected. The incomplete responses were excluded and the results were studied and analyzed. The results were expressed as percentages.

## 3. RESULTS AND DISCUSSION

In this survey, awareness of sedative and hypnotics among dental students was evaluated by assessing the set of questions. About 1% of the students answered that inhaled minimal sedation is only used, 2% of the students answered only oral sedation is used. While 3% answered that it is done through IV sedation, 1% answered that it is done through general anesthesia and the rest 93% of the students answered that the sedation in dental practice is done through all the mentioned methods [Fig. 1].

Awareness of dental students on the fastest acting sedatives used, nearly 76% answered that midazolam is the fastest acting sedative used in dental practice. While 22% chose benzodiazepines and 2% barbiturate [Fig. 2].

About 72% answered that nitrous oxide is used, 12% of the students consider it is done through carbon dioxide and the rest of 16% answered that oxygen [Fig. 3].

66% of the students answered that general anesthesia is commonly used among children while 30% answered that both children and adults and the rest of 4% answered that adults only use it [Fig. 4].

The question on awareness of students on hypnotic drugs, 6% of the students answered that it will induce sleep, 6% answered that it is used as a psychoactive drug, 2% answered hypnotics are used for the treatment of insomnia and 86% answered that hypnotics are used for all the mentioned options [Fig. 5].

About 69% of the students answered that the strong acting sedatives are benzodiazepines, 11% answered it is barbiturates and 20% answered that midazolam to this open ended question [Fig. 6].

The question related to the knowledge of the students on when to use the sedatives and hypnotics on the patients, about 3% of the students answered when the patients' have a low pain threshold, 7% answered that it is used when the patients have sensitive teeth, 5% answered

that it is used when the patient can't sit still in the chair and the rest 85% of the students answered that all the reasons are applied in using sedatives and hypnotics in dentistry [Fig. 7].

Finally, the last question on awareness of the students whether local anesthesia should be used; 74% of the students answered that it should be used while 26% denied it [Fig. 8].

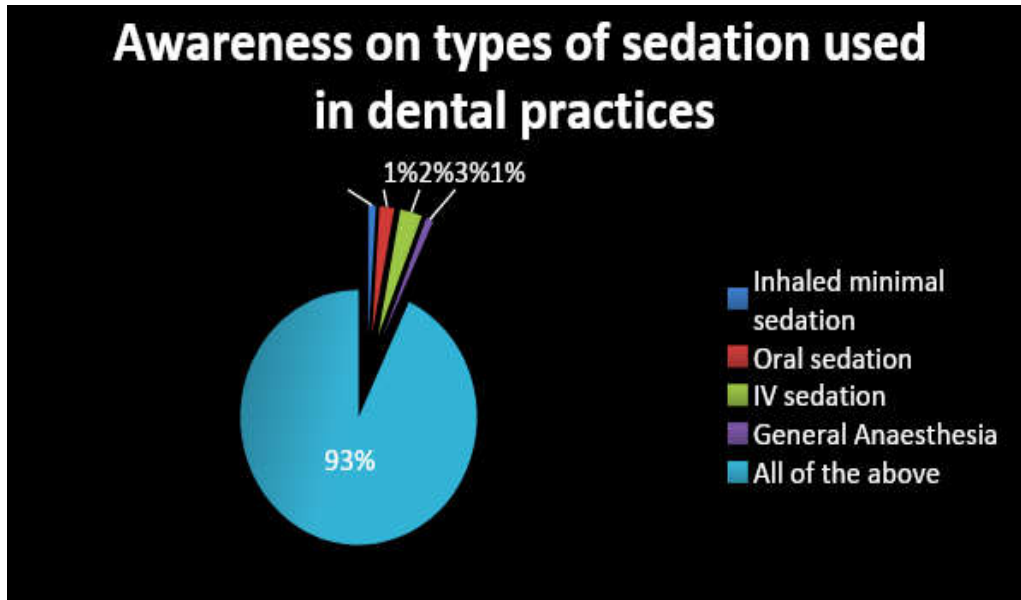


Fig. 1. Pie chart representing awareness of students on sedation used in dental practice. It shows 93% of the dental students are aware that all the mentioned sedatives are used in dental practices. of the types of sedatives used in dental practices. The rest of 1% of the students consider only minimal sedation is used, 2% of them said only oral sedation is used, 3% said only IV sedation is used while the rest 1% of them said only general anesthesia is used

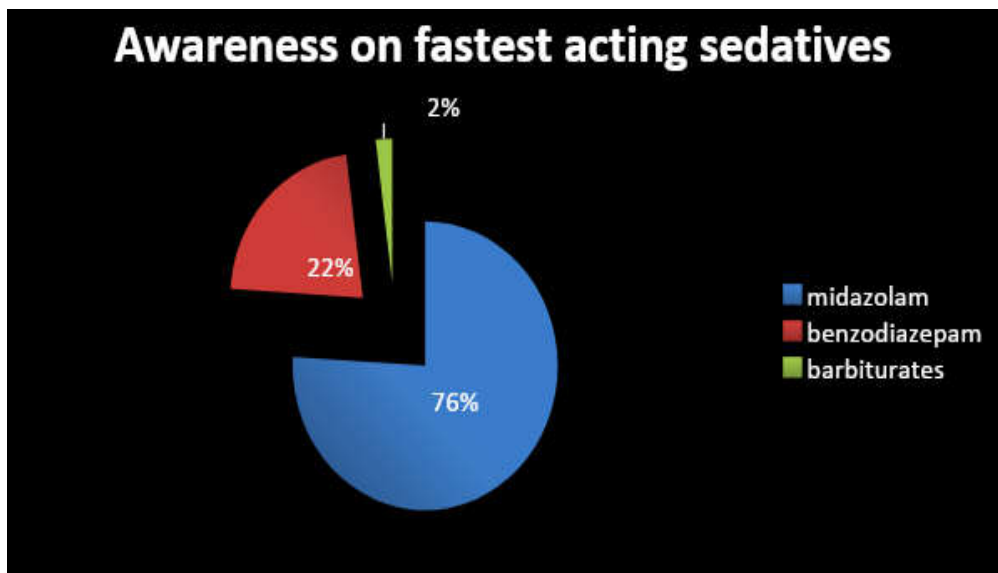
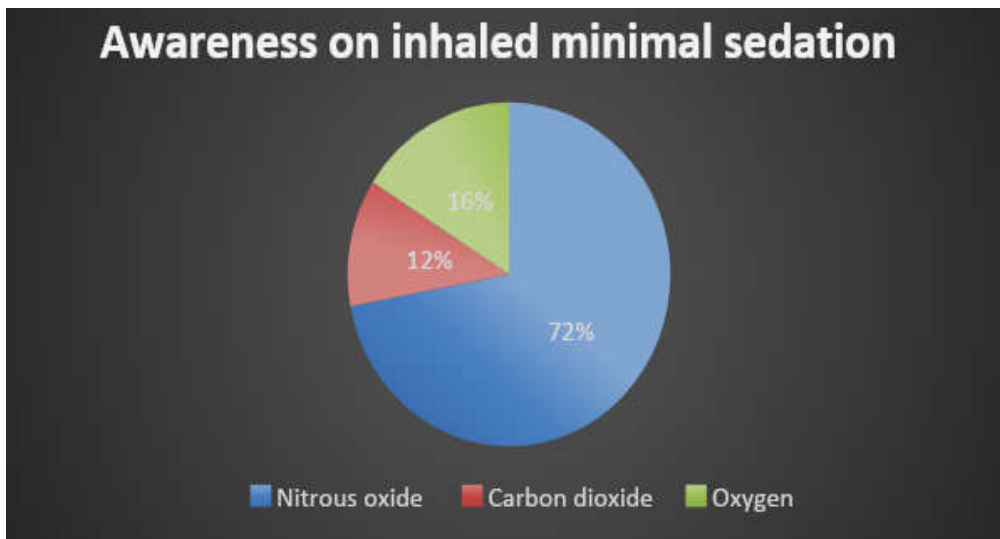
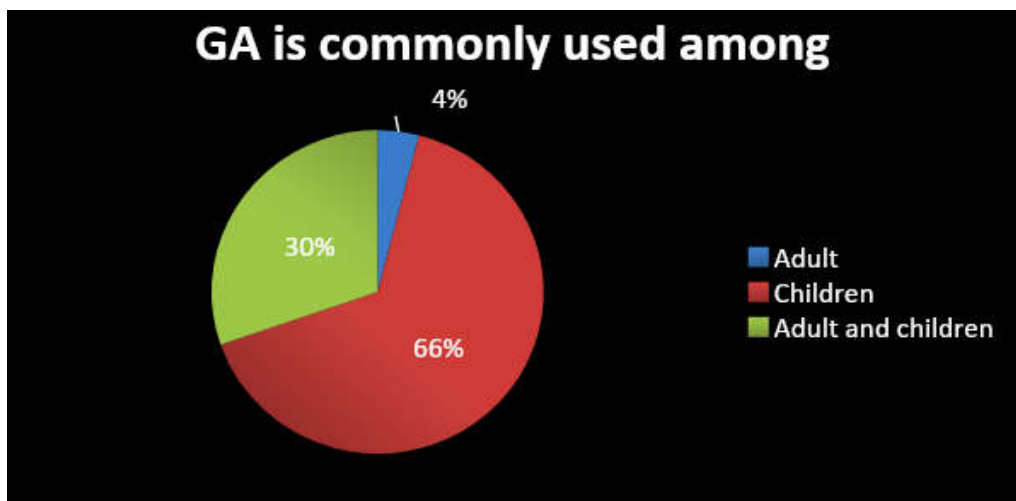


Fig. 2. Pie chart representing the awareness of dental students on fastest acting sedatives used among dentists. Awareness of dental students on the fastest acting sedatives used, nearly 76% answered that midazolam is the fastest acting sedative used in dental practice. While 22% chose benzodiazepines and 2% barbiturate



**Fig. 3.** Pie chart representing the awareness of dental students on gas used in inhaled minimal sedation. About 72% answered that nitrous oxide is used, 12% of the students consider it is done through carbon dioxide and the rest of 16% answered that oxygen



**Fig. 4.** Pie chart representing awareness of students on individuals using general anesthesia in dentistry. 66% of the students answered that general anesthesia is commonly used among children while 30% answered that both children and adults and the rest of 4% answered that adults only use it

An intravenous (IV) line must be secured with the aid of an appropriate IV cannula prior to any medication or inhalation anesthesia. For certain cases, mild anxiolytics, combined with local anesthesia, are helpful in reducing fear and anxiety in the patient.

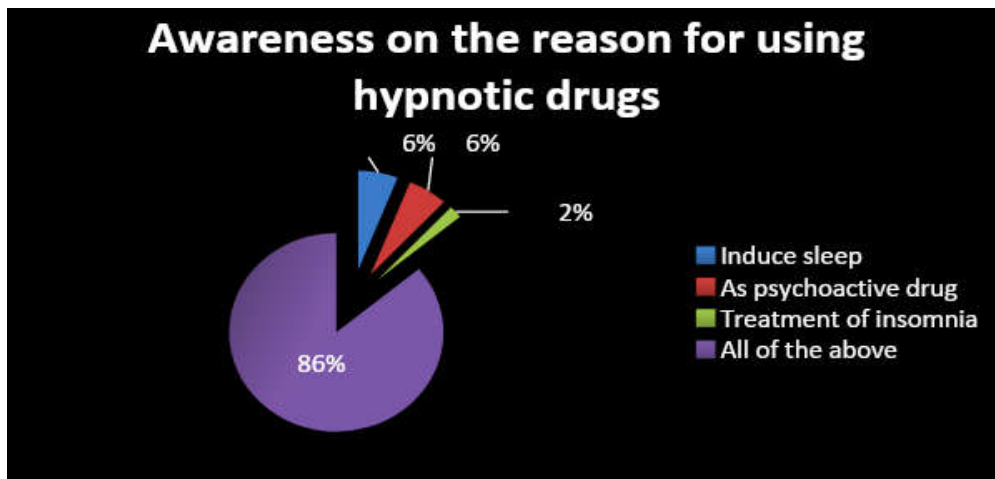
### 3.1 Nitrous Oxide

A mixture of nitrogen oxide (N<sub>2</sub>O) and oxygen is used as a sedative. N<sub>2</sub>O is a colorless and odorless gas used as inhalation anesthetic. This

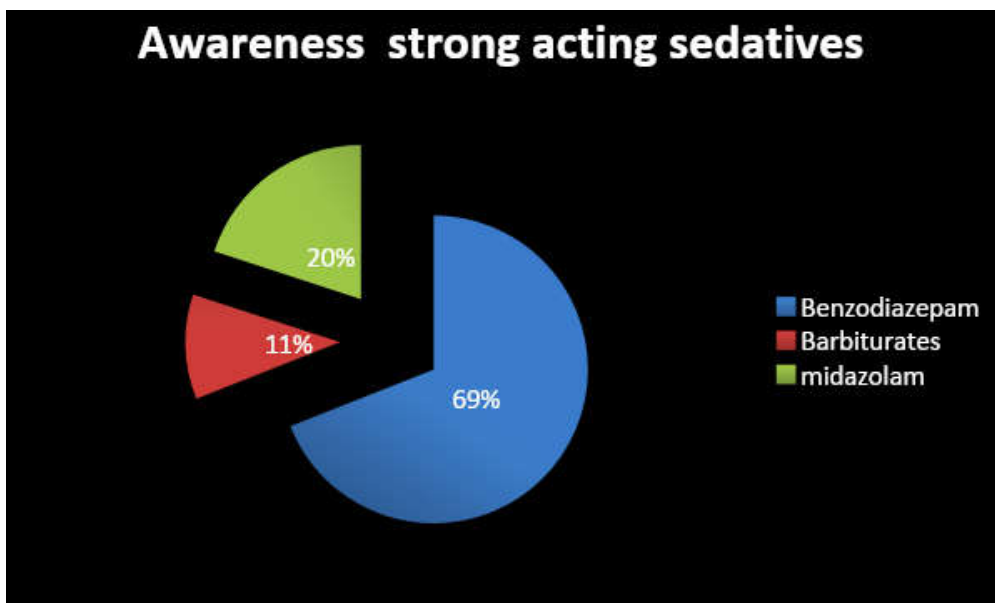
is an anxiolytic / analgesic agent that induces CNS depression and varying degrees of deep relaxation and elation with limited or barely any effect on the respiratory system [5]. Recent work has shown that the analgesic actions of nitrous oxide are caused by neuronal secretion of endogenous opioid transcription factors with opioid receptor stimulation and descending gamma-aminobutyric acid (GABA) as well as noradrenergic pathways that regulate nociceptive care at the spinal node. The anxiolytic effect includes the activation of GABA receptors via

benzodiazepine binding sites. The anesthetic effect seems to be triggered by inhibition of N-methyl - D-aspartate (NMDA) glutamate receptors, thereby suppressing its excitatory impact in the nervous system [6]. The procedure uses subanesthetic doses of nitrous oxide supplied with oxygen from specialized machines via a nasal mask. Nitrous oxide / oxygen delivery systems are made with fail-safe oxygen devices that interrupt the release of nitrous oxide when the release of oxygen is halted. The preventive

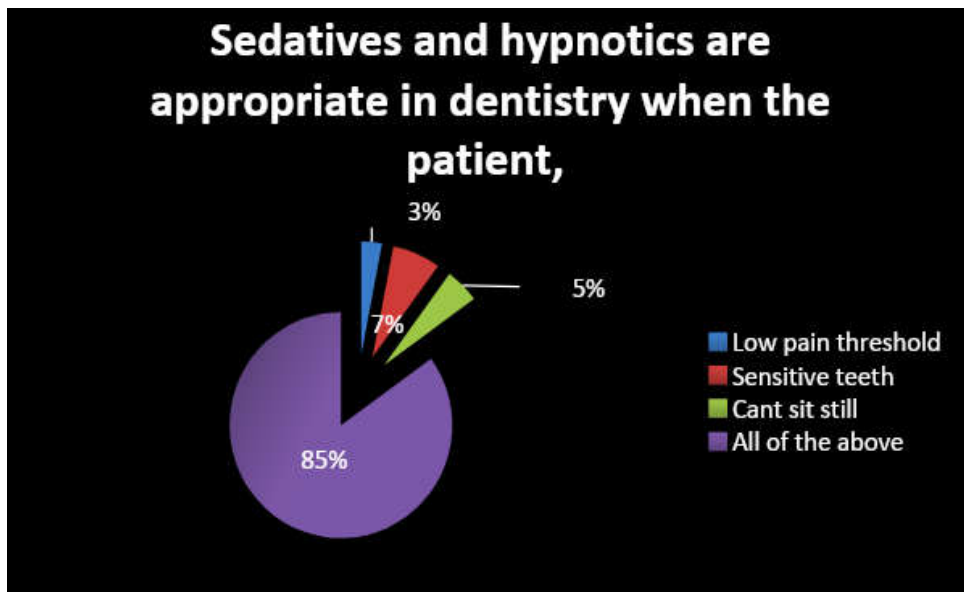
system guarantees that at least 30% of oxygen is supplied in all cases. Nitrous oxide has decreased tissue solubility and a high minimum alveolar concentration that allows rapid onset of action combined with rapid recovery, allowing regulated sedation and a rapid return to normal activities. It is considered a better option because the patient stays awake and alert and reflexes are retained. Use of nitrous oxide is not indicated in patients with chronic colds, porphyria and COPD.



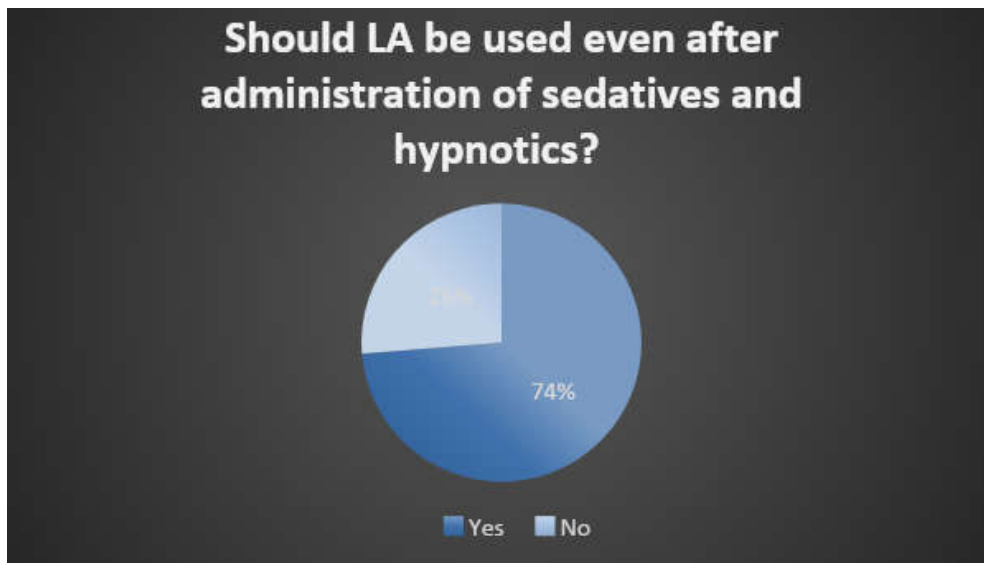
**Fig. 5.** Pie chart representing awareness of the dental students on the reasons for using hypnotic drugs in dental procedures. 2 % answered hypnotics are used for treatment of insomnia, 6% said it is used as a psychoactive drug, 6% of them said it used to induce sleep and 86% answered that hypnotics are used for all the mentioned options



**Fig. 6.** Pie chart representing the awareness of the students on strong acting sedatives. About 69% of the students answered that the strong acting sedatives are benzodiazepines, 11% answered it is barbiturates and 20% answered that midazolam



**Fig. 7. Pie chart representing the awareness of dental students of when to use the sedatives and hypnotics on the patients. 3% of the students answered when the patients' have low pain threshold, 7% answered that it is used when the patients have sensitive teeth, 5% answered that it is used when the patient can't sit still in the chair and the rest 85% of the students answered that all the reasons are applied in using sedatives and hypnotics in dentistry**



**Fig. 8. Shows the awareness of the students whether local anesthesia should be used even after the administration of sedatives and hypnotics. 74% of the students answered that it should be used while 26% denied it**

### 3.2 Sevoflurane

Sevoflurane is an ether anesthetic agent with a mild pungency, a non-irritant odor and a low blood-gas partition coefficient. Its low solubility facilitates accurate regulation of sedation depth and fast and smooth induction and sedation generation [7].

Sevoflurane therefore remains the perfect induction agent to sustain sedation before beginning the infusion of a complete IV anesthetic such as propofol.

### 3.3 Benzodiazepines

Benzodiazepines, particularly diazepam and midazolam, have been shown to be safe and

efficient for IV-conscious sedation. Their sedative as well as limited anxiolytic effects and health margin of error lead to their success in dentistry. Other than anxiolysis and amnesia, benzodiazepines are considered to serve as skeletal muscle relaxation and anticonvulsant interaction; nevertheless, these medications do not have analgesic properties. The mode of action of this drug is the GABA-mediated activation of chloride channels. They have higher lipid absorption which gives rise to an early onset of action [8,9]. These are typically applied to nitrous oxide / oxygen for active sedation because nitrous oxide causes analgesic effects. Midazolam is the most widely used benzodiazepine. A high first-pass metabolism gives it a short-acting metabolism. It is used in pediatric dentistry for active sedation. It is mixed with a pleasant vehicle, like simple syrup, and then used orally either by having a cup or a syringe without a needle or dispersed in the retromolar region. The syrup can be supplied 20 minutes before the operation. The dosage below 25 kg is 0.3–0.5 mg / kg in adults but should only be given in hospital settings. It can also be given intramuscularly, intravenously, rectally, or nasally. The effects are exacerbated by various medicines such as morphine, clonidine, antidepressants, antipsychotics, erythromycin, antihistamines, alcohol and antiepileptic medications and should be prevented or used with precaution.

Those clinicians prescribing such medications will have flumazenil, a common benzodiazepine receptor blocker, as one of the emergency medicines in their clinics. Flumazenil triggers a rapid reversal of all benzodiazepines. Nonetheless, it is avoided in patients using benzodiazepines for seizure disorder or for heavy doses of tricyclic antidepressants [10].

### 3.4 Ketamine

Ketamine, a phencyclidine derivative, is an antagonist of the NMDA receptor. This is a rare medication that provides full anesthesia and analgesia to preserve essential brain stem functions. This "dissociative" condition has been described as a "functional and neurophysiological dissociation between the neocortical and limbic systems." Dissociation results in a condition of loss of responsiveness to pain in the maintenance of cardiovascular and respiratory functions, despite profound amnesia and analgesia, characterized as a "catalepsy." The trance-like state of sensory deprivation

offers a rare mix of amnesia, sedation, and analgesia [11]. While the eyes sometimes remain open, nystagmus is frequently observed. Heart rate and blood pressure remain normal and are also enhanced by sympathomimetic acts. Functional residual capacity and tidal volume are preserved with bronchial smooth muscle relaxation and preservation of airway and respiration. The most frequently observed ketamine downside is a condition that occurs in 5 percent – 50% of adults in 0 percent – 5% of infants. Ketamine improves salivary and tracheobronchial mucus secretions, so it is advised that an antisialagogue be used prior to the administration of ketamine [12]. The emetic side effect of ketamine, which causes vomiting in 10 % of children, can be minimized by the administration of atropine, which decreases salivary flow [13]. In 0.4% of cases, laryngospasm is monitored through 100 % positive pressure oxygen.

Ketamine can be administered intramuscularly at a dose of 3–4 mg / kg or intravenously at a dose of 1–2 mg / kg as per the study conducted by Green et al. [14]. However, a lower dose of the medication may be safer to maintain an acceptable level of sedation in children due to the potential for serious respiratory depression.

### 3.5 Propofol

Propofol is chemically referred to as 2,6-diisopropyl phenol. It's insoluble in mud. This is available in a clean, oil-in - water emulsion that enables the IV delivery of this fat-soluble product. Propofol is readily oxidized to quinone, which transforms into a yellow suspension after approximately 6 hours of exposure to oxygen. Propofol exercises its hypnotic function by activating the main receptor GABA neurotransmitter. Fast lipophilicity guarantees a quick onset of action in the brain, and quick transfer from the central compartment to the peripheral compartment contributes to rapid anesthetic offset [15]. The removal of half-life is 2–24 hours. The most common hemodynamic effect is a reduction in blood pressure and also in the heart rate. In addition, sedative doses have little to no impact on the respiratory system [16]. Apfel et al. tested six strategies to avoid postoperative nausea vomiting (PONV) and found that the use of propofol reduced the risk of PONV by 19 per cent [17]. Sedative doses are not analgesic and a significant proportion of patients feel pain throughout injection. By use an antecubital vein instead of a hand vein for

propofol, lidocaine mixing is a simple and efficient way by relieve pain. Volatile anesthetic agents are used to cause anesthesia in order to prevent the pain of getting access to IV until the child is asleep. Propofol is typically supplied at a dose of 1 mg / kg body weight followed by a maintenance dose of 0.3 to 4 mg / kg / h with sevoflurane [18].

### 3.6 Opioids

Each of the medications listed above do not have analgesic effects except ketamine. Therefore, opioid analgesic should be administered separately to patients. Fentanyl is a short-acting opioid 60–80 times more potent than morphine and has a fast onset of analgesia and sedation [19]. The onset of treatment is 30–60 min. Fentanyl may be administered via parenteral, transdermal, nasal and oral routes. The "lollipop" delivery system is generally known to be used by children rather than any other road. Fentanyl, which is a lipophilic substance, is absorbed from the buccal mucosa, metabolized in the liver and excreted in the urine. The recommended dose is 1 µg / kg / dose IV, which may be repeated in increments of 1 µg / kg if necessary. Constipation, nausea and vomiting are the most common side effects of these medicines. Dose-dependent respiratory disturbance and sometimes bradycardia and chest wall stiffness are associated with rapid IV injection [20].

### 3.7 Sufentanil

Sufentanil is a synthetic analgesic opioid drug. It is 5–10 times more potent than its parent opioid drug and 500 times more potent than morphine. It has a shorter distribution and reduction of half-lives. In outpatient surgery, sufentanil IV produces an antidote similar to isoflurane or fentanyl. Recovery for this drug is fast, while the demand for postoperative analgesia is lower [21]. However, side effects such as decreased compliance with the chest wall and increased rate of nausea and vomiting and extended discharge times compared to midazolam render it an uncommon option as a premedication [22,23].

## 4. CONCLUSION

The study revealed 94% of the students are aware of the commonly used sedatives and hypnotics in dental practices. However, more continuing dental education programs and seminars must be conducted to further enhance the knowledge and understanding of dental

students about sedative-hypnotics in dental practice.

## CONSENT AND ETHICAL APPROVAL

As per university standard guideline, participant consent and ethical approval have been collected and preserved by the authors

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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