ISSN 2515-8260 Volume 07, Issue 09, 2020

COMPARATIVE EVALUATION OF EFFICACY OF INTRAVENOUS SEDATION REGIMENS IN DENTISTRY: AN ORIGINAL RESEARCH

Dr. A V Thomas Raja[1], Dr. Siva Kumar Pendyala[2], Dr. Rahul VC Tiwari[3], Dr. Sharnjot Kaur[4], Dr. Fida Qadri[5], Dr. Mohammed Ibrahim[6], Dr. Heena Tiwari[7]

1. Assistant Professor, Dept of Dental and Oral Surgery, ASRAM Medical College, Eluru, Andhra Pradesh;
2. Associate Professor, Department of Oral & Maxillofacial Surgery, Faculty of Dentistry, AIMST UNIVERSITY, Semeling, Bedong, Kedah-08100, Malaysia;
3. OMFS, FOGS, PhD Scholar, Dept of OMFS, Narsinbhai Patel Dental College and Hospital, Sankalchand Patel University, Visnagar, Gujarat;
4. BDS, Genesis Institute of dental Sciences and research, Ferozepur, Punjab , 152002, India;
5. BDS, Panineeya Institute of Dental Sciences and Research Centre, Hyderabad, India;
6. Assistant Professor, Department of Oral and Maxillofacial Surgery, College of dentistry, King Khalid University, Abha, Kingdom of Saudi Arabia;
7. BDS, PGDHHM, MPH Student, Parul Univeristy, Limda, Waghodia, Vadodara, Gujarat, India.

Corresponding Author:

Dr. A V Thomas Raja, Assistant Professor, Dept of Dental and Oral Surgery, ASRAM Medical College, Eluru, Andhra Pradesh

ABSTRACT

Aim Purpose of our research was to compare and analyze the efficacy of sedation regimens frequently used in dentistry by intravenous approach.

Methodology A total of 50 patients were provided one of four treatments: placebo; midazolam provided (mean dose, 8.6 milligrams); fentanyl (1.4 micrograms/kilogram) plus midazolam to get similar amount of sedation (mean dose, 5.7 mg); or fentanyl (1.4 (μg/kg), midazolam (mean dose, 5.8 mg) and methohexital (mean dose, 61.0 mg) used in the surgery.

Results Each drug regimen decreased anxiety during surgery when compared with placebo, with the combination of midazolam, fentanyl and methohexital resulting in drastically less anxiety in as compared to other treatment groups. Pain felt by patients during surgery decreased significantly by the combination of fentanyl, midazolam and methohexital.

Conclusion It was observed that drugs and doses evaluated resulted in therapeutic benefit for patients undergoing dental procedures, with less possibility of potentially serious adverse effects.

Keywords intravenous sedation, conscious sedation, anxiety, therapeutic benefit.

INTRODUCTION

IV conscious sedation, also referred to as parenteral or moderate sedation, is defined as a drug-induced depression of consciousness during which patients respond 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, as well as cardiovascular function.[1] In addition, patients must retain their protective airway reflexes, and be able to respond to and understand verbal communication. The drugs and techniques used must therefore carry a margin of safety broad enough to make loss of consciousness and airway control unlikely.[2] Conscious sedation is intended to allow the patient to maintain protective reflexes, but sedation represents a continuum and at times an individual patient may experience a deeper sedation than was anticipated. It is extremely important that the practitioner has the requisite knowledge, training, and skill to manage all levels of sedation adequately, identify unintended outcomes, and manage an emergency until either assistance arrives or the patient is successfully recovered to baseline status.[3] Therefore, understanding the levels of anaesthesia is helpful in guiding provider in selection of the proper sedation technique and drugs. A study published by the Journal of the American Dental Association in 2001 comparing 4 IV sedation drug regimens in 997 patients concluded that the drugs and doses evaluated were of therapeutic benefit in the outpatient setting and there was minimal incidence of potentially serious adverse effects. This study helped to reinforce the safety of the use of conscious sedation using different drug combinations with careful titration and adequate provider training.[4] In contrast, a more recent study published in the Journal of Public Safety by Karamnov and colleagues,[5] in a retrospective review conducted on 143,000 moderate sedation cases performed outside the operating room, showed that adverse events were associated with patient characteristics and procedure types. Patient harm was associated with age, body mass index (BMI), comorbidities, female sex, and gastroenterology procedures.[6] Guidelines established by the ASA in 2001 and updated in 2002 provided the foundation for provision of sedation in most practice settings.[1,6] Having a satisfactory outcome from IV sedation and anaesthesia greatly depends on the experience of the provider, patient selection, and the sedation plan (preoperative and postoperative). It is critical that the approach to sedation involves a preoperative evaluation of the patient that includes a comprehensive medical and dental history and physical examination. Additional information should include an anaesthesia history and any record of adverse reactions to sedation or anaesthesia.[7] The drugs currently used most frequently for parenteral sedation in dental outpatients are a benzodiazepine (diazepam or midazolam), either alone or in combination with an opioid (fentanyl or meperidine), an ultra short-acting anesthetic (methohexital or propofol) or both. Few reliable estimates of morbidity and mortality are available to support the claims of safety of parenteral sedation administered by dentists.[8] Clinician surveys lack scientific rigor, and the results can, at best, be generalized only to the population of practitioners from which the samples are drawn. Although a consensus panel of experts has stated that the use of sedative and anesthetic drugs in the dental office "has a remarkable record of safety," there are no reliable data to document this assertion.[9-11] Fear of the pain of

ISSN 2515-8260 Volume 07, Issue 09, 2020

dentistry and of local anesthetic administration is magnified in young children, in emotionally and physically disabled patients, in patients undergoing an extensive surgical procedure and in patients who have become phobic because of previous unpleasant dental or medical procedures. As a consequence, patients continue to seek dental care performed with anxiolytic drugs, including parenterally administered sedation.[8]

AIM OF THE STUDY

Purpose of our research was to compare and analyze the efficacy of various sedation regimens frequently used by parenteral administration in dental patients undergoing disimpaction of molars.

METHODOLOGY

50 Dental clinic outpatients from the various sites who required the surgical removal of impacted third molars with parenteral sedation were invited to participate. The nature of the procedure and the research protocol were explained to patients, and they each signed an institutionally approved consent form. Inclusion criteria included the need for removal of two to four third molars, one of which was at least partially impacted in bone; anticipated surgical duration of 30 minutes; ASA physical status of P1 or P2. Patients were excluded from participation if they were pregnant or lactating; had any systemic illness that increased the risks associated with outpatient oral surgery or parenteral sedation. The four treatment groups consisted of three active treatments and a placebo control. Fentanyl (50 micrograms/ milliliter) was administered first in a fixed dose of 0.1 milligram per 70 kilograms body weight (1.4 (μg/kg) via slow intravenous infusion over two minutes; a matching saline placebo was administered to subjects in the treatment groups not receiving this opioid. Midazolam (1 mg/mL formulation), or a matching saline placebo, then was administered at a rate of 1 mL/minute until a clinical endpoint, characterized by slurred speech, patient self-reports of relaxation or drooping eyelids, was noted, or a maximum dose of 15 mL (equivalent to a maximum dose of 15 mg) was reached. In the group receiving methohexital (10 mg/mL), a 1-mL bolus was administered after the midazolam titration and shortly before the local anesthetic was administered intraorally (patients in the other four groups received a 1-mL bolus of saline) along with midazolam and fentanyl. The oral surgeon and observer also independently rated patient cooperation in terms of movements during administration of the local anesthetic and during the extractions, as follows:

0–no interfering movements;

1–minor movements, but patient's position remained appropriate;

2–minor movements that required repositioning of the patient;

3–movements that grossly interfered with the procedure.

The surgeon and observer independently rated the efficacy of the sedation as poor (0), fair (1), good (2) or excellent (3). Physiological variables and continuous patient self-report measures, such as anxiety and pain, were analyzed via one-way analysis of variance, or ANOVA. $\chi 2$ tests were used to evaluate the incidence of recalling clinical events as well as the incidence of elevated carbon dioxide or lowered oxygen saturation.

RESULTS

The distribution of sex, age, weight, height, procedure duration, local anesthetic dose and health status was similar across treatment groups. The mean duration of surgery and the type of extractions performed also were similar across groups. Patients in all three of the active treatment groups reported significantly less anxiety than did patients in the placebo group during the procedure. (Table 1) The administration of additional midazolam during the procedure did not seem to provide any further anxiety relief than that achieved when midazolam was only administered before the procedure, when assessed at five minutes intraoperatively or at the completion of surgery. The combination of midazolam, fentanyl and methohexital resulted in significantly less anxiety at both evaluation times. (Table 2) The incidence of side effects elicited from patients at the end of surgery was low among the placebo group (6.7 percent); the frequency was elevated among the groups that received drugs, but did not differ substantially among the midazolam group (19.7 percent). However, the incidence of side effects was slightly higher for the group that received midazolam, fentanyl and methohexital (24.9 percent). Adverse events reported were primarily those that were consistent with the sedative property of these drugs (that is, drowsiness, incoordination, disorientation) and the stress of a minor surgical procedure (that is, syncope, nausea, vomiting). (Table 3)

Table 1- Surgical variable observed in the present study.

TREATMENT GROUPS	Procedure Duration (Minutes) [Mean±SD]	Local Anesthetic Lidocaine (Milligrams) [Mean±SD]	Dental Anxiety Trait Score * [Mean±SD]
Placebo group	25.2 ±9.5	204.2 ±74.4	8.1 ±2.7
Midazolam	24.9 ±9.0	196.1 ±62.8	8.0 ±2.7
Fentanyl, midazolam	24.4 ±9.0	193.8 ±71.0	8.6 ±3.0
Midazolam, Fentanyl and Methohexital	25.2 ±8.8	189.5 ±66.2	8.0 ±2.6

***** *The scores range from 4 (relaxed) to 20 (frightened, physically sick). A mean score of 8 is equivalent to "a little uneasy" at the prospect of dental therapy.*

Table 2-Surgeon and observer ratings during the surgical procedure.

TREATMENT GROUPS	Interfering Movements	Verbalization of Discomfort	Nonverbal Signs of Discomfort
Placebo group	0.59 ± 0.78	1.35 ± 1.08	1.10 ± 1.01
Midazolam	1.01** ± 0.95	1.44 ± 1.05	1.22 ± 1.07
Fentanyl, midazolam	0.53 ± 0.73	1.06** ± 1.10	0.81** ± 0.98
Midazolam, Fentanyl and Methohexital	0.51 ± 0.81	0.65** ± 0.92	0.53** ± 0.77

Interfering movements*-On a scale from 0 (no interfering movements) to 3 (grossly interfering movements).* ***Verbalization of discomfort*** *-On a scale from 0 (none) to 3 (frequent complaints).*

Non-verbal signs of discomfort*- On a scale from 0 (none) to 3 (marked discomfort).** P < .05 compared with placebo.*

Table 3- Side effects noticed in different regimens of intravenous sedation.

TREATMENT GROUPS	Nausea	Vomiting	Drowsiness
Placebo group	6.7 %	0%	0.3%
Midazolam	19.7 %	0.2%	1.03%
Fentanyl, midazolam	18.3%	0.6%	1.4%
Midazolam, Fentanyl and Methohexital	24.9 %	1.1%	3.6%

DISCUSSION

It was noted that midazolam when administered intravenously in our study with the purpose of evading anxiety as well as having less amnesic effects on patients during and after treatment without any particular distressing side effects. However, sometimes physiological monitoring catches serious sequalae but it happens very less, mostly in elderly patients.

The combination of midazolam, fentanyl and methohexital is characterized as deep sedation,[12] and can result in CNS depression which can be more sedative as compared to conscious sedation. However in this study; it was observed that clear sedation was achieved which also had an advantage therapeutically in terms of anxiety relief, intraoperative pain control, amnesia and the global evaluation of efficacy. This intravenous drug regimen was rated as the best by the oral surgeons participating in the study. Various therapeutic advantages were linked with decreased respiratory rate, transient apnea in 38 percent of the sample, slight drop in oxygen saturation and temporary carbon dioxide retention. Use of intravenous sedation similar to dentistry is in cases of gastrointestinal endoscopy. A large-scale study (more than 20,000 cases) yielded a predictable incidence of cardiovascular side effects of 5.4 per thousand cases and a mortality rate of 0.3 per thousand cases.[13] with this it was concluded that the concomitant use of opioids with a benzodiazepine as a factor leading to increased morbidity and mortality. The incidence of mortality was similar to estimates of mortality associated with inpatient general anesthesia: one to three deaths per 10,000 procedures.[14] Adverse outcomes were associated with all routes of drug administration and all classes of medication, and dental specialists had the greatest frequency of negative outcomes associated with the use of 3 or more sedating medications.[15] As with adult moderate sedation, sedation of children can also result in significant risk. The requirements for sedation for pediatric patients mirror those outlined for adults. When planning moderate sedation for pediatric patients it is important to understand that they may require meticulous scrutiny above and beyond what is required for adult patients in the preoperative, operative, and postoperative stages. However, in recent years, increasing liability insurance costs and risks

associated with office-based moderate sedation have caused more pediatric dentists to favor oral sedation.[16,17] Prospective data from dental outpatients are needed to provide credible evidence that these discrepancies are real, and can be attributed to such factors as a healthier population of dental patients than patients in whom anesthesia and sedation are produced on an inpatient basis, the decreased likelihood of anesthetic complications with shorter-duration outpatient procedures, the effect of state regulations governing the use of sedative agents in dentistry, and the safety of conscious sedation in comparison with that of general anesthesia.
In a study carried out by AL–Zahrain, it was recommended that a waiting period of at least 25 to 30 minutes. The time taken for the maximum sedation had an average of around 33 minutes[18] which is in accordance with the study by Mohammad[19] and Darlong[20] who found an easier parental separation after 19 minutes. A noteworthy limitation that we observed were that the patients included in the present study were young healthy adults rather than all other age groups. While such patient selection is appropriate for a controlled clinical trial, prospective studies that include the young, the elderly, patients with preexisting disease and patients being treated with other medications are needed to provide evidence regarding the safety of parenteral sedation in these populations. Nevertheless, fear of dentistry remains an important impediment to care for a large segment of the population,[21-23] and trained dentists will continue to be needed to provide safe and effective anesthesia and sedation for emotionally and physically challenged patients.

CONCLUSION

The long-term need for anesthesia and sedation in dentistry may diminish as the decreased incidence of dental caries and tooth loss lessens the occurrence of traumatic procedures during childhood and adolescence that contribute to dental phobia in adulthood.

REFERENCES

1. American Society of Anesthesiologists. Continuum of depth of sedation: definition of general anesthesia and levels of sedation/analgesia (approved by the ASA House of Delegates on October 13, 1999, and last amended on October 15, 2014).
2. Collado V, Faulks D, Nicolas E, et al. Conscious sedation procedures using intravenous midazolam for dental care in patients with different cognitive profiles: a prospective study of effectiveness and safety. PLoS One 2013;8(8):e71240.
3. Guidelines for the use of sedation and general anesthesia by dentists. Available at: http://www.ada.org/w/media/ADA/About%20the%20ADA/Files/anesthesia_use_guidelines.ashx. Accessed October 25, 2015.
4. Dionne RA, Yagiela JA, Moore PA, et al. Comparing efficacy and safety of four intravenous sedation regimens in dental outpatients. J Am Dent Assoc 2001; 132(6):740–51.
5. Karamnov S, Sarkisian N, Grammer R, et al. Analysis of adverse events associated with adult moderate procedural sedation outside the operating room. J Patient Saf 2014;10(3):125–32.

6. American Society of Anesthesiologists Task Force on Sedation and Analgesia by Non-Anesthesiologists. Practice guidelines for sedation and analgesia by nonanesthesiologists. Anesthesiology 2002;96:1004–17.
7. Southerland & Brown**.** Conscious Intravenous Sedation in Dentistry. Dent Clin N Am 60 (2016) 309–346.
8. Dionne RA, Gift HC. Drugs used for parenteral sedation in dental practice. Anesth Prog 1988;35(5):199-205.
9. ASOS anesthesia morbidity and mortality survey. J Oral Surg 1974;32(10):733-8.
10. Lytle JJ, Yoon C. 1978 anesthesia morbidity and mortality survey: Southern California Society of Oral and Maxillofacial Surgeons. J Oral Surg 1980;38(11):814-9.
11. Lytle JJ, Stamper EP. The 1988 anesthesia survey of the Southern California Society of Oral and Maxillofacial Surgeons. J Oral Maxillofac Surg 1989;47(8):834-42.
12. Anesthesia and sedation in the dental office. National Institutes of Health Consensus Development Conference Statement. Washington: National Institutes of Health; 1985;5(10):1-6.
13. Arrowsmith JB, Gerstman BB, Fleischer DE, Benjamin SB. Results from the American Society for Gastrointestinal Endoscopy/ U.S. Food and Drug Administration collaborative study on complication rates and drug use during gastrointestinal endoscopy. Gastrointest Endosc 1991;37(4):421-7.
14. Keats AS. Anesthesia mortality in perspective. Anesth Analg 1990;71(2):113-9.
15. Jimenez N, Posner KL, Cheney FW, et al. An update on pediatric anesthesia liability: a closed claims analysis. Anesth Analg 2007;104(1):147–53.
16. Lee HH, Milgrom P, Starks H, et al. Trends in death associated with pediatric dental sedation and general anesthesia. Paediatr Anaesth 2013;23(8): 741–6.
17. Cote´ CJ, Karl HW, Notterman DA, et al. Adverse sedation events in pediatrics: analysis of medications used for sedation. Pediatrics 2000;106(4):633–44.
18. Al-Zahrani AM, Wyne AH, Sheta SA. Comparison of oral midazolam with a combination of oral midazolam and nitrous oxide-oxygen inhalation in the effectiveness of dental sedation for young children. J Indian Soc Pedod Prev Dent. 2009; 27(1):9-16.
19. Rabie ME. Combination of oral ketamine and midazolam versus midazolam alone as a premedication in children undergoing tonsillectomy. AJAIC. 2005;8(3):58-64.
20. Darlong V, Shende D, Singh M, Garg R, Pandey R, Punj J. Low- versus high-dose combination of midazolam-ketamine for oral premedication in children for ophthalmologic surgeries. Singapore Med J. 2011;52:512-516.
21. Dionne RA, Gordon SM, McCullagh LM, Phero JC. Assessing the need for anesthesia and sedation in the general population. JADA 1998;129(2):167-73.
22. Gordon SM, Dionne RA, Snyder J. Dental fear and anxiety as a barrier to accessing oral health care among patients with special health care needs. Spec Care Dentist 1998;18(2):88-92.