NEW METHOD OF SEDATION IN ORAL SURGERY

Gintaras Juodzbalys, DMS, PhD
Rimvydas Giedraitis, MD
Vita Mačhiulskienė, DDS, PhD
Luc W. J. Huys, DDS
Ricardas Kubilius, DMS, PhD

KEY WORDS

Sedation
Dental implantation
Guided bone regeneration

Local anesthesia, the well-known method of sedation, usually is insufficient for dental implantation and the augmentation of the alveolar ridge, because the operations last for 1 to 2 hours and patients may experience fear and strain. This article examines a new complex sedation method using ketorolac, midazolam, and a local anesthetic 4% solution of articaine hydrochloride and epinephrine (Septanest) in combination with a vasoconstrictor. This method was applied to 67 patients operated on for dental implantation with screw implants or for the alveolar ridge augmentation with biocompatible materials. The control group, which consisted of 20 patients, received local anesthesia with articaine-epinephrine only. Most of the control patients were found to have experienced fear and strain during the aforementioned surgical procedures; their blood pressure and pulse rate increased, and more than half of them experienced pain. No disorders of hemodynamics or the psychoemotional status of the patients were observed during sedation with ketorolac, midazolam, and articaine-epinephrine. Furthermore, anterograde amnesia was determined for the 80% of the patients in the test group.

Gintaras Juodzbalys, DMS, PhD, *is associate professor of the Department of Maxillofacial Surgery, Kaunas University of Medicine, Lithuania, Dental Implant Center "Stilus Optimus," Kaunas, Lithuania. Correspondence should be addressed to Dr Juodzbalys at Vainiku 12, LT- 46383 Kaunas, Lithuania (gintaras@stilusoptimus.lt).*

Rimvydas Giedraitis, MD, *is with the Dental Implant Center "Stilus Optimus," Kaunas, Lithuania.*

Vita Mačhiulskienė, DDS, PhD, *is associate professor with the Department of Dental and Oral Pathology, Kaunas University of Medicine, Kaunas, Lithuania.*

Luc W. J. Huys, DDS, *is with the Hospital Queen Fabiola, Blankenberge, Belgium.*

Ricardas Kubilius, DMS, PhD, *is professor with the Department of Oral and Maxillofacial Surgery, Kaunas University of Medicine, Kaunas, Lithuania.*

INTRODUCTION

Operations in ambulant oral surgery are mostly performed with the patient under local infiltration or block anesthesia. Articaine hydrochloride is one of the most effective anesthetics.[1,2] Dental implantation and augmentation of the alveolar ridge last from 1 to 2 hours, and patients experience psychoemotional strain and fear.[3] Therefore, local anesthesia usually is insufficient for these operations. Most of the authors recommend performing them with the patient under sedation using local anesthetic in combination with analgesic and sedative agents.[4–7] The purpose of this study was to examine and evaluate the sedation method proposed by the authors.

MATERIAL AND METHODS

Sixty-seven patients aged 17 to 64 years participated in the study (30 men and 37 women). We performed dental implantation with titanium screw implants for 45 patients and alveolar ridge augmentation with biocompatible materials (guided bone regeneration) for 22 patients. All the patients were in good health.

The control group consisted of 20 patients aged 18 to 62 years (11 men and 9 women). We performed dental implantation

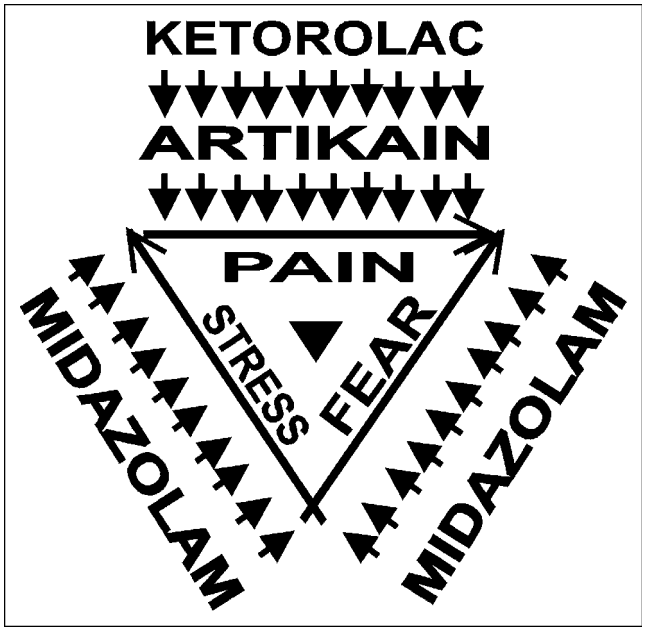


FIGURE 1. Action scheme of sedation.

for 12 of them and guided bone regeneration for 8. Control group patients were operated on while they were under local anesthesia using articaine, and the test group was operated on while they were under sedation. We suggested a method of sedation using the nonsteroidal anti-inflammatory drug ketorolac, the benzodiazepine midazolam, and a 4% solution of articaine hydrochloride and epinephrine (Septanest) in combination with a vasoconstrictor. These agents act potentially and diminish psychoemotional strain and fear (Figure 1).

An intramuscular injection of 60 mg of ketorolac (Ketanov) was performed first. Then an intravenous injection of 0.1 mg/kg of midazolam followed after 20 minutes. If the operation lasted longer or the effect of midazolam was insufficient, 0.02 to 0.03 mg/kg of midazolam was injected additionally. This was usually necessary only for young patients, because the elder ones are more sensitive to midazolam.[8] Disturbed speech fluency and horizontal nystagmus are the indicators of sufficient midazolam dose control. Monitoring of these symptoms ensures safe dosage of the preparation. The local anesthetic articaine-epinephrine was injected 5 minutes after the midazolam injection.

The arterial blood pressure (BP) was measured and the pulse rate was estimated before, during, and 5 minutes after the injection of local anesthetic. The psychoemotional status of the patient was evaluated before and 5 minutes after the injection of local anesthetic. Strain and fear served as evaluation criteria of psychoemotional status. Psychoemotional status was considered normal if the patient did not experience either fear or strain. Pathologic psychoemotional conditions were categorized into 3 groups: mild, when the patient experiences either strain or fear; moderate, when the patient experiences both strain and fear; and severe, when the patient experiences strain and fear and can hardly control his or her emotions.

Patients were asked to evaluate the anesthetic effect on a 10-point scale after the operation. Patients were asked the following 5 questions to diagnose the anterograde amnesia: (1) when was the intravenous injection performed, (2) when was local anesthesia performed, (3) what were the details of the operation, (4) do you remember the stitching of wound(s), and (5) do you remember the physician's recommendations after the operation? Ten milligrams of ketorolac orally 3 times daily was prescribed from 1 to 4 days postoperatively according to the extent of postoperative pain intensity and edema.

RESULTS

After the patient was seated in a chair, arterial BP and pulse rate were measured and found to have increased for both the test and control groups (Table 1). These indicators did not differ significantly for both groups. The arterial BP and pulse rate decreased significantly in the test group because of the effect of midazolam while injecting the local anesthetic but increased in the control group. The systolic BPs of the test and control groups differed by 24%, and the diastolic BPs differed by 22% during the injection of local anesthetic agents and 5 minutes after the injection by 25% and 25%, respectively. The greatest difference in pulse rate between the 2 groups was observed during the injection of the local anesthetic (20%). The mean pulse rate was 92/min in the control group 5 minutes after the injection of local anesthetic and 80/min in the test group. The BPs and pulse rates became normal in the test group during this time but remained increased in the control group (Figures 2 and 3).

TABLE 1

Mean values and differences of arterial blood pressure and heart rate, related to injection of the local anesthetic, in the test and control patients*

	Control group			Test group			Difference			Difference in %		
Evaluation time	ABP(S)	ABP(D)	Heart rate	ABP(S)	ABP(D)	Heart rate	ABP(S)	ABP(D)	Heart rate	ABP(S)	ABP(D)	Heart rate
At the outset	152	99	94	149	98	96	3	1	−2	−2	−1	2
During injection	164	106	100	125	83	80	39	23	20	−24	−22	−20
5 min. after injection of the local anesthetic	163	106	92	122	79	80	41	27	12	−25	−25	−13

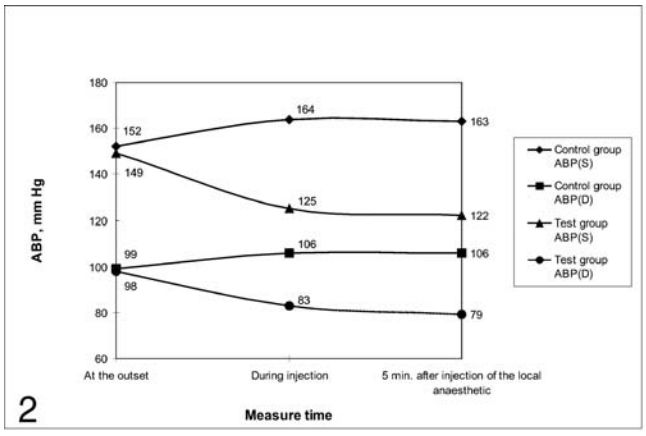
*ABP(S), indicates arterial blood presure (systolic); ABP(D), arterial blood presure (diastolic); and HR, heart rate.

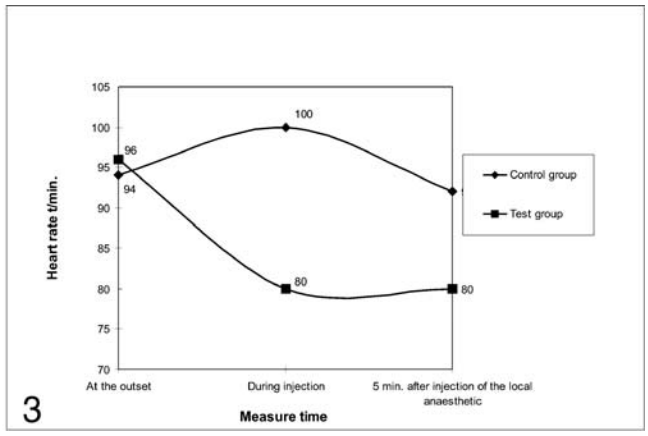
The psychoemotional status of most of the patients in both groups was characterized as a moderately expressed pathologic one before the injection of local anesthetic for 78% of the patients in test group and 50% in the control group. Mild pathological psychoemotional status was found in 9% of the patients in the test group and 35% in the control group (Table 2). After the injection of midazolam and local anesthetic, normal psychoemotional status was found in 97% of the patients in the test group. The psychoemotional status worsened in the control group after the injection of local anesthetic, because the percentage of moderately expressed pathological status increased from 50% to 70%.

The anesthetic effect was rated on a 10-point scale as follows: 62% of the patients in the control group rated pain at 3 and 4 points, 23% rated pain at 5 points, and 1 patient indicated the highest score of 6 points. Pain intensity of 1 point was rated by 90% of the patients in the test group. The greatest pain intensity of 3 points was indicated by only 1 patient (Table 3).

DISCUSSION

Significantly better indexes of hemodynamics, psychoemotional status, and anesthetization effect during the operations were found using the sedation method proposed by the authors compared with the same indexes in the control group. Positive dynamics of these indexes are related to the effects of midazolam and ketorolac. These medications were selected because of their proven positive properties. Midazolam is a water soluble, nonirritating, and lipophilic benzodiazepine of short action that quickly passes the blood-brain barrier. Plasma elimination half-life is 45 to 60 minutes in children and 2 to 6 hours in adults. The maximum effect is reached 2 to 4 minutes after the intravenous injection.[9] Midazolam is distinguished for its good analgesic and hypnotic effect.[10,11] After examining the potential adverse effects of midazolam, it was established that, by combining it with a local anesthetic and vasoconstrictors, there





FIGURES 2-3. FIGURE 2. Arterial blood dynamics related to the injection of the local anesthetic. FIGURE 3. Heart rate dynamics related to the injection of the local anesthetic.

TABLE 2
Distribution of test and control patients relating to psychoemotional status type

	Control group, No. (%)				Test group, No. (%)			
		Impaired				Impaired		
Evaluation time	Stable	Slight	Medium	Heavy	Stable	Slight	Medium	Heavy
Before injection	1 (5)	7 (35)	10 (50)	2 (10)	4 (6)	6 (9)	52 (78)	5 (7)
After injection	0 (0)	4 (20)	14 (70)	2 (10)	65 (97)	2 (3)	0 (0)	0 (0)

was no statistically reliable risk of ischemia.[12] Midazolam shows a good effect of anterograde amnesia; therefore, patients, especially children, would not be afraid of surgical interventions in the future.[13–15] We found anterograde amnesia in 80% of our patients. Therefore, all the recommendations and prescriptions should be written down and given to the accompanying person. We noticed during this study that patients became indifferent to the operation performed 5 minutes after the midazolam injection. However, it was possible to communicate with them because they remained conscious. In this respect, our data match the data from other authors, which state that midazolam stabilizes hemodynamics during the intervention while the patient remains conscious.[16]

We used the nonsteroidal antiinflammatory agent ketorolac to potentiate the analgesic effect. It has an analgesic effect similar to morphine.[17] Usually ketorolac is used in oral surgery for diminishing postoperative pain and edema.[18,19] Ketorolac was supposed to cause bleeding from the operative field or digestive tract if taken for a long time.[20] Research during recent years has shown that the probability of bleeding from the operative field is low when using ketorolac. However, bleeding may occur if ketorolac is administered in high doses for more than 5 days or if the patient is 75 years or older.[21] It is not expedient to give ketorolac in higher doses, because the effect of 10 mg of ketorolac is the same as 20 mg.[22]

TABLE 3
Evaluation of anesthetization effect

	Grading of pain intensity (1–10)										
Patient group	1	2	3	4	5	6	7	8	9	10	Total
Control group, No. (%)	0	1 (8)	4 (31)	4 (31)	3 (23)	1 (8)	0	0	0	0	13
Test group, No. (%)	80 (90)	6 (9)	1 (1)	0	0	0	0	0	0	0	67

CONCLUSIONS

Many authors have proposed that local anesthesia is often insufficient for dental implantations and augmentation of the alveolar ridge. In this study, 62% of patients rated pain during the operation at 3 and 4 points. In addition, hemodynamics was disturbed during the operation, with significant increases in BP and pulse rate. Nearly all the patients (97%) experienced psychoemotional strain and fear.

The sedation method proposed herein of ketorolac, midazolam, and the local anesthetic articaine-epinephrine in combination with a vasoconstrictor was significantly more effective. A total of 90% of the patients experienced no pain during the operation (rated at 1 point). The BP and pulse rate became normal 5 minutes after the injection of midazolam and the local anesthetic. Mild pathologic psychoemotional status was found in only 9% of the patients, and anterograde amnesia was observed in 80% of the patients. Therefore, in all probability patients, especially children, need not fear surgical interventions in the future.

REFERENCES

1. Cowan A. Clinical assessment of a new local anaesthetic agent-carticaine. *Oral Surg.* 1997;43:174–180.

2. Meechan JG, Robb ND, Seymour RA. *Pain and Anxiety Control for the Conscious Dental Patient.* London, England: Oxford University Press; 1998:53.

3. Chanavaz M, Ferri J, Donazzan M. Intravenous sedation in implantology. *Rev Chir Maxillofac.* 1997;98:57–61.

4. Berge TI. Acceptance and side effects of nitrous oxide sedation for oral surgical procedures. *Acta Odontol Scand.* 1999;57:201–206.

5. Campbell RL, Smith PB. Intravenous sedation in 200 geriatric patients undergoing office oral surgery. *Anesth Prog.* 1997;44:64–67.

6. Coulthard P, Craig D. Conscious sedation. *Dent Update.* 1997;24:376–381.

7. Moore PA, Finder RL, Jackson DL. Multidrug intravenous sedation: determinants of the sedative dose of midazolam. *Oral Surg Oral Med Oral Pathol Radiol Endod.* 1997;84:5–10.

8. Platten HP, Schweizer E, Dilger K, Mikus G, Klotz U. Pharmacokinetics and the pharmacodynamic action of midazolam in young and eldery patients undergoing tooth extraction. *Clin Pharmacol Ther.* 1998;63:552–560.

9. Roelofse JA, Louw LR, Roelofse PG. A double blind randomized comparison of oral trimeprazine-methadone and ketamine-midazolam for sedation of pediatric dental patients for oral surgical procedures. *Anesth Prog.* 1998; 1:3–11.

10. Juodžbalys G, Giedraitis R. Vietinė anestezija ir sedacija vaikų stomatologijoje: lietuvos stomatologų sąjungos suvažiavimas, II: tarptautinis stomatologų kongresas. *Medicina.* 1999;35:51–53.

11. Runes J, Storm C. Midazolam intravenous conscious sedation in oral surgery: a retospective study of 372 cases. *Swed Dent J.* 1996;20:29–33.

12. Middlehurst R, Coulthard P. The effect of midazolam sedation on indicators for myocardial ischemia. *Oral Surg Oral Med Pathol Oral Radiol Endod.* 1999; 88:400–405.

13. Jansco J, Fodor A. Use of Dormicum (midazolam) injection in oral surgery under local anesthesia. *Fogorv Sz.* 1994;87:329–334.

14. Nadin G, Coulthard P. Memory and midazolam conscious sedation. *Br Dent J.* 1997;183:399–407.

15. Thompson JM, Neave N, Moss MC, Scholey AB, Wesnes K, Girdler NM. Cognitive properties of sedation agents: comparison of the effects of nitrous oxide and midazolam on memory and mood. *Br Dent J.* 1999;187: 557–562.

16. Baris S, Karakaya D, Aykent R, Kirdar K, Sagkan O, Tur A. Comparison of midazolam with or without fentanyl for conscious sedation and hemodynamics in coronary angiography. *Can J Cardiol.* 2001;17:277–281.

17. Gillis JC, Brogden RN. Ketorolac: a reappraisal of its pharmacodynamic and pharmacokinetic properties and therapeutic use in pain management. *Drugs.* 1997;53:139–188.

18. Pendeville PE, Van Boven MJ, Contreras V, et al. Ketorolac tromethamine for postoperative analgesia in oral surgery. *Acta Anesthesiol Belg.* 1995;46: 25–30.

19. Walton GM, Rood JP, Snowdon AT, Rickwood D. Ketorolac and diclofenac for postoperative pain relief following oral surgery. *Br J Oral Maxillofac Surg.* 1993;31:158–160.

20. Storm BL, Berlin JA, Kinman JL, et al. Parenteral ketorolac and risk of gastrointestinal and operative site bleeding: a postmarketing surveillance study. *JAMA.* 1996;275:376–382.

21. Jelinek GA. Ketorolac versus morphine for severe pain. *BMJ.* 2000;321: 1236–1237.

22. Olmedo MV, Galvez R, Vallecillo M. Double-blind parallel comparison of multiple doses of ketorolac, ketoprofen and placebo administered orally to patients with postoperative pain. *Pain.* 2001; 90:135–141.