Dental implant placement is a routine oral surgical procedure that can be efficiently managed under local anesthesia. However, long-lasting procedures and conditions such as dental anxiety and gag reflex necessitate conscious sedation. The choice of sedation method is crucial for minimizing the risk of respiratory depression, as the buccal cavity provides an entrance to the airways.

Intravenous administration facilitates rapid onset and is considered to be the gold standard. Besides, the practitioner can adjust the dose when required. Since there are various alternatives, choosing the most convenient sedative agent is confusing. Midazolam, the most common member of the benzodiazepines, is a preferred sedative for many procedures in medicine due to its anamnesic and anxiolytic properties, with 1.8 to 6.4 hours (mean: approximately 3 hours) of terminal elimination half-life in healthy patients. However, it may impair respiratory reflexes in a dose-dependent manner and may even cause apnea.

Dexmedetomidine, a selective agonist of the alpha-2 adrenergic receptor, causes a reduction in postsynaptic depression, as the buccal cavity provides an entrance to the airways.

Materials and Methods: This study was a prospective double-blind randomized controlled study. The patients who needed dental implant placement were divided into two randomized groups for either midazolam or dexmedetomidine. The amount of sedative agent used, duration of the procedure, onset of sedation, use of additional same sedative agent, and occurrence of desaturation were recorded. Hemodynamic and respiratory variables (mean blood pressure, heart rate, oxygen saturation, and respiratory rate) were recorded every 10 minutes, starting immediately before the loading dose until the end of the procedure. Patients completed a Likert scale for their satisfaction, and patient pain was scored using the numeric rating scale postoperatively. The amount of painkiller usage was recorded and reported. All surgical procedures were performed by the same surgeon, and all recordings were taken by an anesthesiology technician; both were blinded for the randomization. Descriptive and bivariate statistics were computed, and the $P$ value was set at $< .05$.

Results: This study included patients who were scheduled for two to five dental implant insertions to either arch under conscious sedation. A total of 163 dental implants were inserted into 43 patients. Patients receiving dexmedetomidine had lower pain, higher satisfaction with the procedure, and less desaturation ($P = .002$). The onset of sedation was more rapid with midazolam ($P = .001$). The number of implants according to drugs did not differ statistically. On the other hand, the mean operation time was $52.09 \pm 20.12$ minutes in the dexmedetomidine group and $87.14 \pm 26.15$ minutes in the midazolam group ($P = .001$). No significant difference was found for retrograde amnesia and preference of sedative between midazolam and dexmedetomidine.

Conclusion: Dexmedetomidine is a good alternative to midazolam for conscious sedation during dental implant procedures, with its better anamnesic property and minimal respiratory side effects.

Keywords: Analgesia, Conscious Sedation, Dental Implant, Dexmedetomidine, Midazolam
adrenergic activity by decreasing noradrenaline release with approximately 2 hours of terminal elimination half-life.\textsuperscript{4,6} It is a potent sedative that provides analgesia with minimal influence on respiratory physiology.\textsuperscript{6} One of the unique features of dexmedetomidine is its hypnotic action.\textsuperscript{4} Unlike other sedatives, its sedative action resembles a physiologic state that is described as physiologic sleep. It allows full awakening with physical stimulation, which is a desirable effect in dental procedures.\textsuperscript{4,7}

The U.S. Food and Drug Administration approved the use of dexmedetomidine for some procedures undertaken outside intensive care units and operation theaters; however, dexmedetomidine has not yet been used as a common sedative for dental procedures. It was originally developed, and is still preferred, for short-duration sedation for intubated intensive care unit patients. The need for a controlled infusion device is a drawback for outpatients in dental clinics.\textsuperscript{8,9}

Various clinical studies have evaluated the effects of dexmedetomidine in oral surgery as a sedative agent.\textsuperscript{1,2,7,10,11} However, this study is the first to investigate the perioperative and postoperative effects of dexmedetomidine during dental implantation, by comparing it with midazolam. This study aimed to compare the amnesic, analgesic, and respiratory effects of dexmedetomidine and midazolam during and after dental implant surgery.

**MATERIALS AND METHODS**

This study was conducted between November 2016 and January 2017 and was approved by the local ethics committee of Istanbul Medipol University (05/10/2016-approval No: 466), according to the Declaration of Helsinki. The sample size estimation was carried out to maintain adequate power to assess the outcomes of this study with G*Power software. The primary hypothesis of this study was that the comfort of dental implant surgery increases under conscious sedation (duration of the procedure, additional use of sedatives, and patient and surgeon satisfaction). A total of 21 individuals per group would be required to ensure a power of 91\%, with a two-sided test (the independent \( t \) test) at a .05 level of significance. The following parameters were used: input effect size \( d = .88 \), \( \alpha \) error = .05, power = .91, number of groups = 2. Patients who were scheduled for dental implant surgery were enrolled in the study. The clinical trial followed the CONSORT statement guidelines.\textsuperscript{5} The patients were scheduled for dental implant insertion in the maxilla or mandible—only one side (eligibility assessment protocol). Written informed consent was obtained from all participants. The inclusion criteria were American Society of Anesthesiologists (ASA) physical status I or II, being older than 18 years of age, below 100 kg of weight, and having dental anxiety as well as not having previous sedation experience. Initial (preoperative) dental anxiety scores were recorded using the Amsterdam Preoperative Anxiety and Information Scale for all patients. A total of six items of the Amsterdam Preoperative Anxiety and Information Scale were rated on a 5-point Likert scale ranging from 1 to 5. The exclusion criteria were obvious respiratory diseases, obesity (body mass index > 30 kg/m\(^2\)), pregnancy, clinically significant major organ disease, any hypersensitivity to sedatives, antibiotics or non-steroidal anti-inflammatory drugs, consumption of an agent with sedative properties within 24 hours prior to commencement of the study, and need for bone grafting in the implant procedure. All patients were informed of the requisite preoperative fasting for at least 6 hours and having a companion at the appointment.

All operations were performed in an operation room located in the dental hospital of Istanbul Medipol University. Twenty gauge intravenous cannula was inserted into the branchial vein for transfusion, and mean blood pressure, heart rate, oxygen saturation, and respiratory rate were recorded at 10-minute intervals by the anesthesiology technician who was blinded to the study. The Ramsay sedation scale was used to determine the degree of sedation at 15, 30, 45, 60, and 75 minutes. The patients were supplied with oxygen (2 l/min) via a nasal cannula during the procedure.

The study was designed as a parallel, randomized group in blind fashion (patients and practitioners did not know the chosen sedative agent). Patients were randomly allocated with a coin toss to one of two sedation groups with a similar allocation ratio (22:21) for each group without any bias. To prevent bias, sedative agents were identically sealed by one resident who was not included in the study. Furthermore, study data were recorded by an exterior resident. One of the groups was administered 0.03 mg/kg bolus midazolam, following 0.02 mg/kg/h infusion dose, and the other group was administered with 1 \( \mu \)g/kg bolus dexmedetomidine, following a 0.5 \( \mu \)g/kg/h infusion dose. Local anesthesia was achieved with 4\% articaine HCl with 1:100,000 epinephrine (Maxicaine, Vem Ilaç Sanayi ve Ticaret A.S.) 10 minutes after the bolus dose. All dental implant procedures were performed by the same surgeon (I.N.G.). A crestal incision was performed followed by mucoperiosteal flap elevation. Alveolar bone was exposed, and implant holes were prepared by drilling under saline irrigation. The implants were inserted without any bone removal or augmentation, and the incision was closed primarily with 3.0 silk sutures. When needed, the same sedative was additionally administered during the procedure, and the dose was recorded. After the procedure, the patient was transferred to the recovery room.
All demographic variables including ASA status, medical history, age, body mass index, sex, amount of local anesthetics used, duration of the surgical procedure, onset of sedation, requirement of additional sedative, and occurrence of desaturation (oxygen saturation < 95%) during the surgical procedure and number of inserted implants were recorded. Hemodynamic and respiratory variables (mean blood pressure, heart rate, oxygen saturation, and respiratory rate) were recorded every 10 minutes, starting immediately before the loading dose until the end of the procedure. The patients and surgeon were ultimately asked to evaluate their level of satisfaction based upon a five-point Likert scale, with the answers ranging from “extremely unsatisfied” to “extremely satisfied.” All the patients and the surgeon were asked if they would prefer the same sedation protocol if needed. The degree of pain was evaluated using the numeric rating scale with “0” defining “no pain” and “10” defining “unbearable pain.” Patients were asked to mark this scale considering their pain level every day at the same time during the following week. Patients were verbally informed during the operation at specific stages of the procedure such as “local anesthesia injection,” “preparation of the implant socket,” or “implant placement.” Patients were also asked to assess the degree of amnesia using a questionnaire in the recovery room. Questions related to the timing of some steps of the operation, such as injection of local anesthesia, insertion of implants, and conversations were answered by the patients during the operation. Patients were discharged when the modified Aldrete score was at least “10.” Patients with numeric rating scale > “4” were administered intravenous tenoxicam 20 mg (Oksamen-L, Mustafa Nevzat Ilac Sanayi ve Ticaret A.S.) before discharge. Amoxicillin plus clavulanic acid 1,000 mg (Augmentin BID, GlaxoSmithKline) and Naproxen Sodium 275 mg (Apranax, Abdi Ibrahim Ilac Sanayi ve Ticaret A.S.) were prescribed to all patients as postoperative medications. Patients were advised to take painkillers if the postoperative numeric rating scale was more than “4.” Patients were also asked to record and report the time and amount of painkillers used daily.

Statistical Analysis

Statistical analyses were performed using commercial software IBM SPSS Statistics 22 (IBM SPSS). The chi-square test was used for categorical data. In addition to descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum, maximum), all variables were tested for normal distribution using the Shapiro-Wilk test. The Mann-Whitney U test was used for comparing two groups of quantitative data that did not show normal distribution. The significance of differences between groups with normal distribution was assessed with the Student t test. The Spearman correlation test was used to determine the relationship between measurements. Significance was evaluated at \( P < .01 \) and \( P < .05 \) levels.

RESULTS

Forty-eight patients who passed the eligibility assessment were enrolled in the study. Five patients were excluded from the study; three did not meet the inclusion criteria, and two declined to participate. Therefore, the study was carried out with 43 patients (n2:n1 = 22:21). The flowchart of the study design is shown in Fig 1. There were no significant differences between the groups regarding age, body mass index, sex, ASA status, initial anxiety levels, or number of implants inserted (Table 1).

Sedation Effects

The mean onset of sedation was 10 ± 3, 16 minutes in the midazolam group (n = 21) and 17.5 ± 2.99 minutes in the dexmedetomidine group (n = 22; \( P = .001 \)), and also, the level of sedation was more superficial with dexmedetomidine according to the Ramsay Sedation Scale. A statistically significant correlation (45.6%) was found between the duration of sedation and operation \( (r = -0.456; P = .002; P < .05) \). The necessity of using extra sedatives was determined in relation to the decrease in the Ramsay Sedation Scale (< 2). It was significantly higher in the midazolam group (42.9%) than the dexmedetomidine group (9.1%; \( P = .029 \)). This was accepted as an indication that the sedation provided by midazolam remained more undulating. The patients were given a questionnaire prior to discharge, which is a modified version of a questionnaire reported by Wakita et al.10 This questionnaire was used to evaluate the patients’ memory regarding the administration of anesthesia, incision, flap elevation, and implantation. Patients were asked to answer questions during the procedure regarding the conversations and the timings of the operation, such as injection of local anesthesia and insertion of implants. The amnesic property of midazolam was deeper than dexmedetomidine. The patients in the dexmedetomidine group remembered all stages of the operation; however, the difference in total reminiscence was not statistically significant (Table 2).

Analgesic Effects

The numeric rating scale scores (Fig 2) and the amount of painkillers in the postoperative period were compared (Fig 3). The requirement of rescue analgesics via intravenous route before discharge was also lower in the dexmedetomidine group (22.7%) than the midazolam group (85.7%; \( P = .001 \)). This may be the result of analgesic effects of dexmedetomidine.
### Table 1 Study Findings

<table>
<thead>
<tr>
<th></th>
<th>Midazolam group</th>
<th>Dexmedetomidine group</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>51.28 ± 11.99</td>
<td>54.95 ± 9.68</td>
<td>.271*</td>
</tr>
<tr>
<td>BMI</td>
<td>27.89 ± 3.73</td>
<td>27.37 ± 1.97</td>
<td>.563*</td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
<td>1.000**</td>
</tr>
<tr>
<td>Female</td>
<td>10 (47.6%)</td>
<td>10 (45.5%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>11 (52.4%)</td>
<td>12 (54.5%)</td>
<td></td>
</tr>
<tr>
<td>ASA status, n (%)</td>
<td></td>
<td></td>
<td>1.000**</td>
</tr>
<tr>
<td>I</td>
<td>15 (71.4%)</td>
<td>15 (68.2%)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>6 (26.6%)</td>
<td>7 (31.8%)</td>
<td></td>
</tr>
<tr>
<td>APAIS scores</td>
<td>21.3 ± 8.03</td>
<td>22.03 ± 7.14</td>
<td>.347*</td>
</tr>
<tr>
<td>No. of implants</td>
<td>4.1 ± 0.73</td>
<td>4.8 ± 1.1</td>
<td>.617*</td>
</tr>
<tr>
<td>Duration of the operation</td>
<td>80.71 ± 22.25</td>
<td>66.5 ± 26.55</td>
<td>.014***</td>
</tr>
<tr>
<td>Onset of sedation (min)</td>
<td>10.0 ± 3.16</td>
<td>17.50 ± 2.99</td>
<td>.001***</td>
</tr>
<tr>
<td>Need for additional sedative, n (%)</td>
<td>9 (42.9%)</td>
<td>2 (9.1%)</td>
<td>.029**</td>
</tr>
</tbody>
</table>

Bold numbers indicate statistical significance.

*Student t test. **Yates’ correction for continuity. ***Mann-Whitney U test.

ASA = American Society of Anesthesiologists; BMI = body mass index; APAIS = Amsterdam Preoperative Anxiety and Information Scale.

### Table 2 Questionnaire to Assess Reminiscence

<table>
<thead>
<tr>
<th>Amnesia questions</th>
<th>MID n (%) “yes”</th>
<th>DEX n (%) “yes”</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you remember the operation?</td>
<td>16 (76.2%)</td>
<td>22 (100%)</td>
<td>.021**</td>
</tr>
<tr>
<td>Do you remember the injection for local anesthesia?</td>
<td>17 (81%)</td>
<td>22 (100%)</td>
<td>.048**</td>
</tr>
<tr>
<td>Do you remember the cut of your gum by using scalpel?</td>
<td>10 (47.6%)</td>
<td>19 (86.4%)</td>
<td>.017**</td>
</tr>
<tr>
<td>Do you remember the conversations during the operation?</td>
<td>11 (52.4%)</td>
<td>21 (95.5%)</td>
<td>.004**</td>
</tr>
<tr>
<td>Do you remember the preparation of the implants’ holes?</td>
<td>13 (61.9%)</td>
<td>21 (95.5%)</td>
<td>.009**</td>
</tr>
<tr>
<td>Do you remember the insertion of the implants?</td>
<td>13 (61.9%)</td>
<td>22 (100%)</td>
<td>.001**</td>
</tr>
<tr>
<td>Did you feel any pain during the preparation of the implants’ holes?</td>
<td>8 (38.1%)</td>
<td>4 (18.2%)</td>
<td>.2652</td>
</tr>
<tr>
<td>Did you feel any pain during the insertion of the implants?</td>
<td>9 (42.9%)</td>
<td>3 (13.6%)</td>
<td>.0732</td>
</tr>
</tbody>
</table>

Total rate of reminiscence 57.74 ± 33.65 (75) 76.14 ± 10.14 (75) .1673

Median

1Fisher exact test. 2Continuity (Yates) correction. 3Mann-Whitney U test.

*P < .05.

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**Fig 1** Flowchart of the study design.

**Fig 2** Pain assessment postoperatively.

**Fig 3** Amount of painkillers used postoperatively.
Hemodynamic Effects
There was a significant difference in the decrease of mean blood pressure 30 minutes after the procedure compared with the preoperative measurements; the amount of hypotension was more obvious in the midazolam group than the dexmedetomidine group ($P = .041$). There was no significant difference in the decrease of mean blood pressure at 15, 45, 60, and 75 minutes of the procedure. There was a significant difference in the reduction of heart rate at 30 and 45 minutes after the procedure compared with preoperative measurements; it was more obvious in the midazolam group than the dexmedetomidine group ($P = .012, P = .003$). There was no significant difference in the decrease of heart rate at 15, 60, and 75 minutes of the procedure. No significant difference in the reduction of respiratory rate at 15, 30, 45, 60, and 75 minutes after the procedure was found, compared with preoperative measurements. The drop in saturation with midazolam (52.4%) was significantly higher than dexmedetomidine (4.5%; $P = .002$). There was a significant difference in the desaturation at 75 minutes of the procedure compared with preoperative measurements; desaturation was more distinct in the dexmedetomidine group than in the midazolam group ($P = .043$). There was no significant difference in the decrease of heart rate at 15, 30, 45, and 60 minutes after the procedure. There was no significant difference in the Ramsay Sedation Scale values at 15, 30, 45, 60, and 75 minutes after the procedure between the groups.

Duration of the Procedure
Although the number of implants was similar and the onset of sedation was more rapid, the mean duration of the procedure was higher in the midazolam group than the dexmedetomidine group ($P = .014$; Table 3).

Patient and Surgeon Satisfaction
The satisfaction of the patients and the surgeon was also higher in the dexmedetomidine group than the midazolam group ($P = .01; P = .029$). All patients (100%) in the midazolam group and 90.9% of those in the dexmedetomidine group stated that the same sedation procedure would be preferable if needed in the future, despite the weaker amnesic effects of dexmedetomidine.

Except for the questions about the pain that the patients felt and what details were remembered during the procedure, the reminiscence rate of the dexmedetomidine group in all questions was higher than the midazolam group; however, the difference in total reminiscence was not statistically significant (Table 2).

The results showed that patient satisfaction was more associated with “painless procedure” rather than the “amnesia effect.”

DISCUSSION
Midazolam, a common sedative agent in dentistry, has been associated with rapid, easy, and efficient sedation in many studies.12,13 As an alternative to midazolam, in recent years, dexmedetomidine has been used in dental procedures. Dexmedetomidine is not known to cause respiratory depression and provides good analgesia.14,15 In this study, the desaturation rate was significantly lower in dexmedetomidine.

Many mechanisms have been described for analgesia with alpha-2 adrenergic agonists. Supraspinal, ganglionic, spinal, and peripheral effects have been shown to play a role in the analgesic effect.16 Several studies in the literature have reported some positive effects of dexmedetomidine on pain control.17–19 Li et al reported that dexmedetomidine provided a decrease in the use of postoperative morphine.19 Jaakola et al investigated the analgesic effect of dexmedetomidine in healthy volunteers by determining the time course of pain threshold with dental dolorimetry, and by quantifying the subjective pain induced by a standard ischemic pain stimulus on the upper arm with a visual analog scale (VAS). Besides, the study showed that dexmedetomidine provided sufficient analgesia at any dose over 0.5 μg/kg, and thus, the analgesic effect of dexmedetomidine was not dose-dependent.20 Scheinin et al also showed that the opioid requirements in the post-anesthesia care unit were reduced by intravenous dexmedetomidine 10 minutes before the induction of anesthesia.21 Similarly, the study showed that the need for postoperative analgesics was significantly reduced when dexmedetomidine was

### Table 3 Timing and Number of Implants

<table>
<thead>
<tr>
<th>No. of implants</th>
<th>Dex</th>
<th>Mid</th>
<th>$p^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>3.73 ± 0.7</td>
<td>3.86 ± 0.73</td>
<td>.595$^a$</td>
</tr>
<tr>
<td>Min–Max (median)</td>
<td>3–5 (4)</td>
<td>3–5 (4)</td>
<td></td>
</tr>
<tr>
<td>Duration of operation</td>
<td>Mean ± SD</td>
<td>Dex</td>
<td>Mid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>52.09 ± 20.12</td>
<td>87.14 ± 26.15</td>
</tr>
<tr>
<td></td>
<td>Min–Max (median)</td>
<td>31–121 (45)</td>
<td>45–134 (85)</td>
</tr>
</tbody>
</table>

$^a$Mann-Whitney U test. **$P < .01.$
used as a sedative in dental surgery. Although it has become routine practice in oral and maxillofacial surgery to administer a combination of potent opioids, such as fentanyl, with short-acting benzodiazepines to achieve the desired level of analgesia, no opioids were administered in combination with midazolam in this study. Makary et al reported that despite the poor analgesic effect of dexmedetomidine, it significantly reduces the need for concomitantly administered opioids, allowing the dosage of opioids to be decreased and, as a result, minimizing the adverse effects of narcotics.8

Despite the similar number of implants inserted between the groups, awakenings were more frequent with midazolam; therefore, more patients needed additional same sedative agent during the procedure in the midazolam group. This may explain why the duration of the surgical procedure was longer in the midazolam group than the dexmedetomidine group.

The prevalence of postoperative bradycardia in healthy patients who received dexmedetomidine has been reported as high as 40% in a dose-dependent manner.22 However, Houmans reported that dexmedetomidine has a significant bradycardic effect on the cardiovascular system, and Xu et al reported that the decrease in blood pressure with dexmedetomidine was below the baseline.23,24 This study also reported that the alteration in blood pressure caused by dexmedetomidine did not result in any adverse effects.25 In this study, the decrease in blood pressure was approximately significant at 30 minutes perioperative, and both groups showed no adverse reactions because of this reduction.

One of the most controversial characteristics of dexmedetomidine is its superficial amnesic property in comparison with midazolam.

Questionnaires that aimed to detect the amnesic property of sedatives in regard to remembering the steps of the procedure were described as a test of amnesia in various studies.10,26 Similar to the test method, visual reminders such as pictures were also used in some studies.27 Wakita et al reported that the amnesic effect of dexmedetomidine was sufficient for dental procedures; however, this was shallow in comparison to midazolam.10 Ustün et al remarked that they even detected no signs of amnesia with dexmedetomidine in conscious sedation.2 Hall et al reported that the amnesia with dexmedetomidine was evident in half of the patients when administered at 6 μg/kg/h for 10 minutes and continued by 0.2 or 0.6 μg/kg/h infusion for 50 minutes, and this feature was dose-dependent.28 Like Wakita et al, probably due to the low doses of dexmedetomidine applied comparatively, the patients did not show any high degree of amnesia.

As another weaker feature, Makary et al8 suggested that dexmedetomidine had a prolonged recovery time in office-based oral surgeries; there are several studies (including the present study) that did not support this study in the literature.2,9-11,29

Ustün et al conducted a double-blind crossover study with 20 patients who required third molar extraction and found no difference in the sedative properties of dexmedetomidine and midazolam.2 Fan et al also concluded that dexmedetomidine works as well as midazolam for dental procedures and can be used as an alternative.29

The present study may claim that dexmedetomidine is better than midazolam, with features such as analgesia, lack of causing respiratory depression, and higher patient satisfaction. Similar to this study, Cheung et al found that dexmedetomidine was advantageous due to its analgesic and relatively protective properties compared with midazolam in a randomized double-blind study for intravenous sedation during third molar surgery.30

The most distinctive aspect of the present study compared with similar studies is that it deals with dexmedetomidine and midazolam in terms of patient-physician cooperation and comfort during dental implant surgery. Although the desired sedation level started slowly, the number of implants was similar, the duration of the operation was shorter in the dexmedetomidine group. According to the results, this study suggests that minimal sedation with dexmedetomidine impairs patient cooperation less than midazolam. In this way, patient-doctor communication is stronger and easier, and the operation takes less time. Another possible factor in this situation may be that the operation is more comfortable for the patient thanks to the pain relief effect of dexmedetomidine.

The main limitation of this study may be the small sample size. The structure of this study built upon mostly continuous outcomes, and thus, a smaller sample size can be used to have statistically significant differences. Nevertheless, further studies with larger sample sizes can reveal more comprehensive data. The other limitations may be the subjectivity of pain between the individuals, and the higher ratios of pain in the midazolam group can also be a result of the longer duration of the procedure. Furthermore, the study was conducted with a generalized population, so the results may be inapplicable for specified populations (eg, elderly patients, children, etc).

The major contribution of the present study was that dexmedetomidine produced a more comfortable sedation compared with midazolam in a procedure in which high verbal cooperation between the patient and surgeon is needed for success, such as dental implant surgery.

CONCLUSIONS

Patient-physician comfort and cooperation are crucial for dental implant surgery. Sedative agents mostly tend
to decrease the cooperation between the patient and the physician while increasing the comfort of the procedure. The study demonstrates that dexmedetomidine seems to provide better sedation in dental implant surgery with a shorter duration of the procedure, which probably depends on its awakening like the sedation profile. Besides, regarding the oxygen saturation levels of the patients, dexmedetomidine has significantly better results, which also leads to a more comfortable operation and to a shorter duration of the procedure. Furthermore, the results of this study suggest that the decrease of pain in the perioperative and postoperative periods and decrease in use of analgesics during both early and late postoperative periods could play an important role in the more common use of dexmedetomidine for conscious sedation in dental surgeries. Thus, dexmedetomidine can be a candidate for a better alternative to midazolam for oral surgical procedures. At the same time, further studies with larger sample sizes are still needed.

ACKNOWLEDGMENTS

The authors declare that there is no conflicts of interest.

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