Comparison of Remimazolam and Propofol for Intubated General Anesthesia for Oral and Maxillofacial Surgery

Yoshio Hayakawa, DDS, PhD; Keiko Fujii-Abe, DDS, PhD; Sayaka Akitomi, DDS; Shihomi Niwa, DDS; Michiru Abe, DDS; Manami Otsuka, DDS, PhD; Maho Ikeda, DDS; Takumi Ishikawa, DDS, PhD; Manami Yajima, DDS, PhD; and Hiroshi Kawahara, DDS, PhD

Department of Dental Anesthesiology, Tsurumi University

Objective: Remimazolam is a new, ultra-short-acting benzodiazepine that can be used for induction and maintenance of general anesthesia. We compared the hemodynamic stability and depth of anesthesia during general anesthesia using remimazolam or propofol along with remifentanil for oral and maxillofacial surgery.

Methods: A total of 95 patients were divided into remimazolam and propofol groups and then subdivided into bispectral index (BIS) and patient state index (PSI) groups. Blood pressure, heart rate, and BIS/PSI values were compared at fixed time points perioperatively. Time to loss of consciousness and total opioid doses were also compared across groups. Other items that were compared included intraoperative arousal and postoperative nausea and vomiting.

Results: Propofol produced more significant hemodynamic depression than remimazolam, although both groups were stable. BIS/PSI values were similar in both groups. Time to loss of consciousness was significantly shorter in the remimazolam group. Total opioid dosing was higher in the remimazolam group, and there were no differences regarding other postoperative complications.

Conclusion: The perioperative hemodynamics with remimazolam were more stable that with propofol, especially during induction. Therefore, remimazolam may be a safe alternative to propofol for providing TIVA general anesthetics.

Key Words: Remimazolam; Propofol; General anesthesia; Total intravenous anesthesia (TIVA); Oral maxillofacial surgery; Dentistry.

Remimazolam besylate (Anerem in Japan/Byfavo in United States; Paion AG, Aachen, Germany) is a new, ultra-short-acting intravenous (IV) sedative-hypnotic that has an imidazobenzodiazepine skeleton. It acts like other benzodiazepines to potentiate gamma aminobutyric acid (GABA) effects via positive allosteric modulation involving $GABA_A$ receptors. Its metabolic pathway does not involve cytochrome P450 as it is instead rapidly hydrolyzed by tissue esterases, primarily by carboxylesterase in the liver.[1,2] Due to its unique metabolism, remimazolam has a very short clinical duration of action as underlined by its context sensitive halftime of 7 to 8 minutes following a 2-hour infusion. As a comparison, propofol has a context sensitive half-time that approximates 10 minutes after a 2-hour infusion.[3]

In August 2020, remimazolam was launched in Japan as an induction and maintenance agent for general anesthesia. Remimazolam does not contain fat like propofol does, so no lipid load occurs with long-term administration, and the possibility of bacterial reproduction is low because of the absence of fatty components. As a water-soluble benzodiazepine, remimazolam does not cause vascular pain upon injection, has a specific antagonist, and can provide stable hypnotic effects without significant cardiovascular depression if used alone.[1,2]

Propofol is a widely used IV sedative-hypnotic. Its advantages over volatile inhalational agents include less postoperative nausea and vomiting (PONV), no air pollution concerns,

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Address correspondence to Dr. Yoshio Hayakawa, Tsurumi University, School of Dental Medicine, Department of Dental Anesthesiology, 2-1-3 Tsurumi, Tsurumiku, Yokohama, Kanagawa, 230-8501, Japan; hayakawa-y@tsurumi-u.ac.jp.

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and a rapid and clean emergence profile with less emergence delirium. However, propofol has some notable drawbacks including lack of a specific antagonist, potential for significant cardiovascular depression, vascular pain during injection, and high fat content, and it is not water-soluble.

This study compared the use of remimazolam or propofol as the general anesthetic agent in oral surgical operations for up to approximately 2 hours. The main objective of this study was to compare remimazolam and propofol used for general anesthesia by assessing cardiovascular stability and anesthetic depth as determined by EEG. Secondary objectives included time to loss of consciousness, time to extubation, administered opioid dosing, surgical and anesthetic times, local anesthetic totals, and the incidence of side effects. This clinical research was conducted under the approval of the Ethical Review Committee of Tsurumi University Dental Hospital (No. 1816).

METHODS

Inclusion criteria consisted of patients with American Society of Anesthesiology Physical Status (ASA-PS) 1 or 2 and ages ranging from 18 to 80 years undergoing general anesthesia for up to approximately 2 hours for oral and maxillofacial surgery (ie, sagittal split osteotomies, plate removal, cyst enucleation, and dental extractions). Exclusion criteria were patients who had an ASA-PS of 3 or greater, ages younger than 18 years or older than 80 years, use of central nervous system depressants, or those with psychiatric disorders, cerebrovascular disorders, asthma, neuromuscular diseases, or acute angle closure glaucoma. Although not an exclusion criterion in this study, patients with ASA-PS3 or higher were excluded, so there were no other patients with significant cardiovascular disease.

General anesthesia was provided using total IV anesthesia. Both groups were maintained with remifentanil infusions and fentanyl along with the infusions of propofol or remimazolam. Patients were divided into the propofol or remimazolam groups using the envelope method with equal allocation and were blinded to group allocation. Within each group, patients were further divided equally into 2 groups based on whether bispectral index (BIS) or patient state index (PSI) was used to assess the depth of anesthesia.

In the propofol group, a target-controlled infusion (TCI) of propofol was started at 3.0 μg/mL according to the Japanese package insert. Infusion rates were maintained at 2.5 to 5.0 μg/mL, considering age and estimated brain concentration at loss of consciousness.

In the remimazolam group, a continuous infusion of remimazolam was started at 12 mg/kg/h until loss of consciousness and then maintained at 1 mg/kg/h according to the Japanese package insert.

In addition to the propofol or remimazolam infusion, a continuous infusion of remifentanil (0.5 μg/kg/min) was started at the same time. All patients were administered rocuronium (0.9 mg/kg) after induction to facilitate laryngoscopy and oral or nasal intubation. Neuromuscular blockade was monitored with a peripheral nerve stimulator placed along the ulnar nerve, and sugammadex (200 mg) was administered to ensure full return of neuromuscular function prior to extubation. Following conclusion of the surgical procedure, all patients were awake, able to comply, and were extubated after stable spontaneous ventilations were confirmed.

Local anesthesia was administered in all cases using 1% lidocaine with 1:100,000 epinephrine. Local anesthetic dosing as well as the techniques used (ie, block vs infiltration) were determined by the oral surgeon and depended primarily on the planned surgical procedure.

Fentanyl was administered intraoperatively as needed at the discretion of the anesthesiologist. Fentanyl, acetaminophen, and nonsteroidal anti-inflammatory drugs were administered as postoperative analgesics on an individual case basis.

To continuously assess the patients' cardiovascular dynamics and anesthetic depth, the following anesthetic monitors were used: a noninvasive automatic blood pressure cuff, a pulse oximeter, 5-lead electrocardiography, and either a BIS (BIS View A-300, Aspect, Inc) or PSI monitor (SedLine2, Masimo, Inc). Items were measured at each point according to the protocol sheet (Figures 1 and 2).

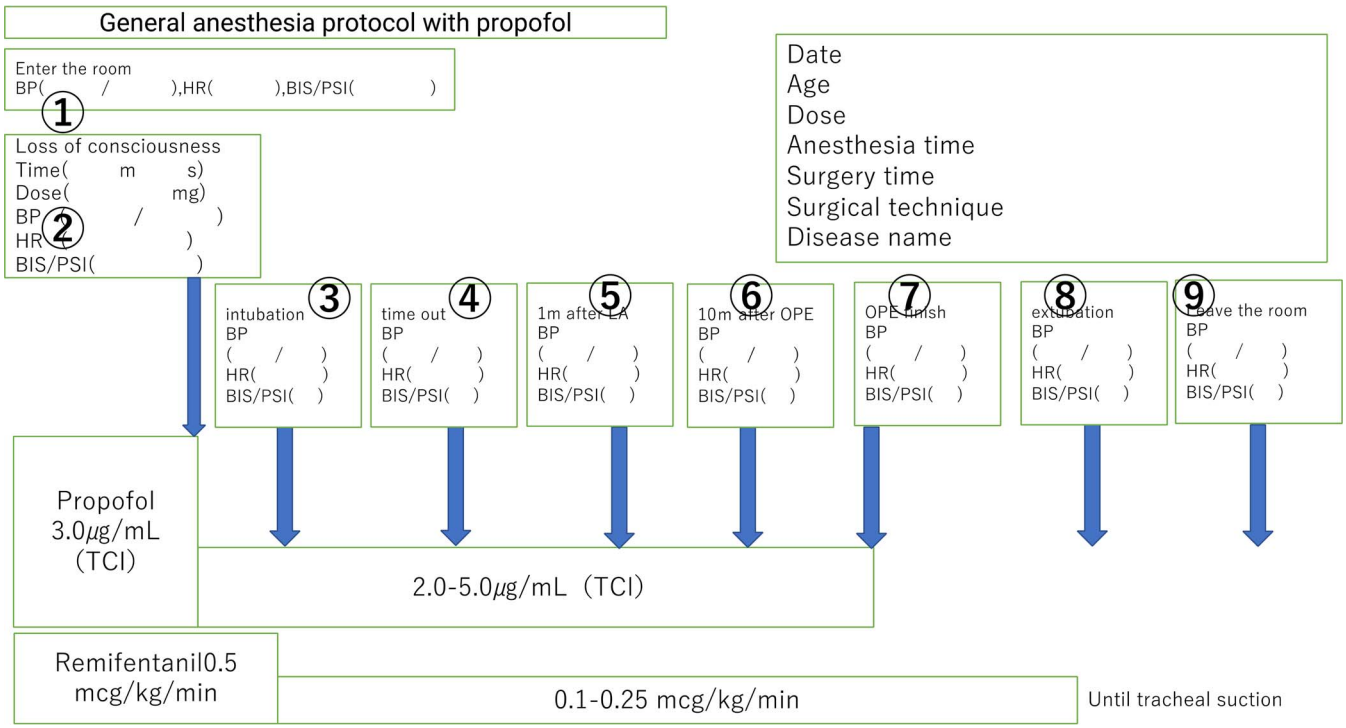
Outcome Measures

Baseline measurements were obtained once the patient had arrived in the operating room (OR), had anesthetic monitors applied, and was ready for induction. Measured variables included BIS or PSI values, blood pressure, and heart rate, all of which were compared between groups at the following times:

1. baseline,
2. loss of consciousness,
3. immediately after intubation,
4. time-out (noninvasive time right after intubation),
5. 1 minute after administration of local anesthesia,
6. 10 minutes after the start of surgery,
7. end of surgery,
8. immediately before extubation, and
9. immediately before the patient(s) left the OR (Figures 1 and 2).

Blood pressure was measured at 2.5-minute intervals during induction of anesthesia and at 5-minute intervals during maintenance. Time to loss of consciousness, propofol/remimazolam dosing, and total opioid dosing were also compared. Other items that were compared were the presence or absence of intraoperative arousal and PONV.

Figure 1. Propofol Protocol



Protocol of induction and maintenance of anesthesia with propofol. ① Baseline; ② Loss of consciousness; ③ Immediately after intubation; ④ Time out; ⑤ 1 minute after local anesthesia; ⑥ 10 minutes after the start of surgery; ⑦ End of surgery; ⑧ Immediately before extubation; ⑨ Before leaving the OR.

Statistical Analysis

An a priori power analysis was performed using G*power 3.1.9.6 (Heinrich-Heine-Universität Düsseldorf) to determine the sample size. The sample size was determined to be 76 total for the 4 groups, calculated with an effect size of 0.4 (per the software recommendation), a power of .8, and an alpha error of .05.

All data are reported as mean ± standard deviations. Age (y), height (cm), weight (kg), time to loss of consciousness (s), time to extubation (min), fentanyl dosing (μg), total remifentanil dose (mg), surgery time (min), and anesthesia time (min) were analyzed using a t test for 2 groups. Systolic, diastolic, and mean arterial pressure (MAP), heart rate (HR), and BIS and PSI values were analyzed using a one-way ANOVA followed by Tukey–Kramer's multiple comparison post hoc tests. Differences were considered significant at $P < .05$.

RESULTS

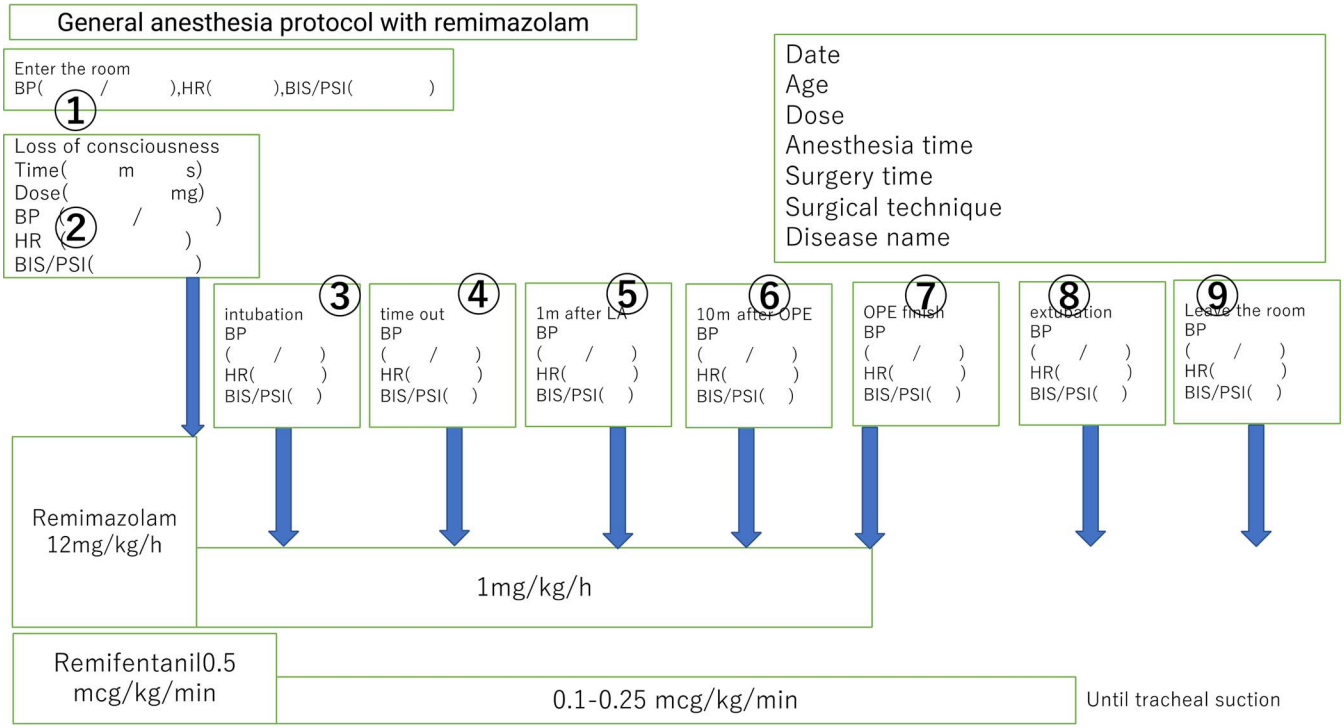
A total of 100 patients, 50 in the remimazolam group and 50 in the propofol group, were recruited to participate in the study. Within each of those groups, 25 were divided into the PSI group and 25 into the BIS group (Table 1). However, there were a total of 45 patients in the remimazolam group and 50 in the propofol group due to 5 patients being excluded.

Two patients were ultimately deemed ASA-PS3 and subsequently excluded from the study. Medical histories of those patients included obesity, anemia, smoking, and hypertension. There were 6 patients with hypertension, 4 in the remimazolam group and 2 in the propofol group. All those patients were taking Ca^{2+} channel blockers or angiotensin receptor inhibitors and had their hypertension under control. Another 3 patients received flumazenil due to prolonged emergence and were also excluded.

Looking at the demographic and clinical characteristics of the 2 groups, there were no significant differences with male/female ratio, age, height, and weight having almost equal numbers in both. Differences in clinical characteristics lacked statistical significance aside from time to loss of consciousness and mean fentanyl dose which are presented in greater detail below (Table 1).

Additionally, the types and totals of the surgical procedures for both groups were similar (Table 2). Dental extractions were the most common type of surgical case, followed by hardware/plate removal. Although hardware/plate removal was twice as common in the propofol group, the degree of invasiveness is like that of dental extractions.

Figure 2. Remimazolam Protocol



Protocol of induction and maintenance of anesthesia with remimazolam. ① Baseline; ② Loss of consciousness; ③ Immediately after intubation; ④ Time out; ⑤ 1 minute after local anesthesia; ⑥ 10 minutes after the start of surgery; ⑦ End of surgery; ⑧ Immediately before extubation; ⑨ Before leaving the OR.

Cardiovascular Stability

Blood pressure (BP) and HR measurements at baseline were not significantly different between the groups. Systolic and diastolic BP, MAP, and HR were not significantly different at baseline, but decreased trends in the propofol group were observed during the perioperative period. Compared to the remimazolam group, the propofol group had significantly decreased mean systolic pressures at times 3, 6, and 7 and mean diastolic pressures at times 2, 3, and 6

Table 1. Patient Demographics and Clinical Characteristics

	Remimazolam (n = 45)	*Propofol (n = 50)*	*P value*
	Demographics		
Sex, No. (%)			
Male	19 (42)	23 (46)	.618
Female	26 (58)	27 (54)	
ASA-PS, No. (%)			
1	37 (82)	41 (82)	.97
2	8 (18)	9 (18)	
Age, mean (SD), y	34.4 mean (SD) 14.0	38.7 mean (SD) 15.1	.1594
Height, mean (SD), cm	164.9 mean (SD) 9.7	165 mean (SD) 7.6	.9784
Weight, mean (SD), kg	60.1 mean (SD) 11.2	59.8 mean (SD) 11.8	.8994
	Clinical characteristics		
Loss of consciousness, mean (SD), s	99.5 mean (SD) 20.4	186.4 mean (SD) 76.2	<.0001*
Time to extubation, mean (SD), min	13.3 mean (SD) 0.99	12.2 mean (SD) 5.2	.3473
Fentanyl dose, mean (SD), μg	155 mean (SD) 71.4	119.5 mean (SD) 60.7	.0111*
Total remifentanil dose, mean (SD), mg	1.50 mean (SD) 0.88	1.31 mean (SD) 0.7	.2580
Surgery time, mean (SD), min	79.2 mean (SD) 39.3	79.64 mean (SD) 50.1	.9590
Anesthesia time, mean (SD), min	131.7 mean (SD) 41.2	132.5 mean (SD) 55.0	.9352
Total local anesthetic, mean (SD), mL	8.582 mean (SD) 4.33	8.092 mean (SD) 4.35	.5884

* Signifies $P < .05$.

Table 2. Surgical Procedures

	Remimazolam (n = 45)	*Propofol (n = 50)*
Dental extraction, No. (%)	22 (49)	19 (38)
Hardware/plate removal, No. (%)	7 (16)	14 (28)
Cystectomy, No. (%)	6 (14)	2 (4)
Sagittal split ramus osteotomy, No. (%)	1 (2)	1 (2)
Tumorectomy, No. (%)	5 (11)	8 (16)
Dental implant, No. (%)	0 (0)	3 (6)
Sialolith removal, No. (%)	2 (4)	1 (2)
Alveolar ridge augmentation, No. (%)	1 (2)	2 (4)
Sequestrectomy, No. (%)	1 (2)	0 (0)

($P < .05$; Tables 3 and 4; Figure 3). The average MAP was significantly lower in the propofol group at times 2, 3, 6, and 7 ($P < .05$; Table 5; Figure 4). Mean heart rate was also significantly lower in the propofol group at times 2, 3, and 7 ($P < .05$; Table 6; Figure 5).

In the propofol group, hypotension (BP of 70–60/40–30 mm Hg) and bradycardia (HR of 40 bpm) were observed in 11 patients, and all required treatment with ephedrine (4–16 mg) or etilefrine (0.1 mg) and atropine (0.5 mg) and responded well. In contrast, the remimazolam group had 2 hypotension (BP of 70–60/40–30 mm Hg) patients and 0 bradycardia patients. The 2 hypotension patients required treatment with ephedrine (4–16 mg) and responded well.

Anesthetic Depth

There were no significant differences between the 2 groups for both BIS and PSI values at any of the times (Figure 6). BIS and PSI values were stable, and there were no complaints of intraoperative arousal, suggesting that intraoperative awakenings did not occur.

Secondary Outcomes

The time to loss of consciousness was significantly longer in the propofol group (186.4 ± 76.2 s) than the remimazolam group (99.5 ± 22.5 s; $P < .0001$; Table 1). Additionally, the remimazolam group received higher total opioid doses than the propofol group. The use of fentanyl was significantly higher in the remimazolam group (155 ± 71.4 μg) than in the propofol group (119.5 ± 60.7 μg; $P = .0111$). Remifentanil dosing was higher in the remimazolam group (1.50 ± 0.88 mg) than in the propofol group (1.31 ± 0.7 mg) although that difference was statistically insignificant ($P = .2580$; Table 1). There was no significant difference between the groups for the time to extubation (Table 1).

Perioperative Complications. PONV was observed in 2 patients in the remimazolam group while the propofol group had none. Excessive movement (attributed to light anesthesia) occurred in 1 patient in each group, and rocuronium was readministered in each case. Shivering occurred in 2 patients in the remimazolam group only. SpO_2 was not decreased during the perioperative period. No significant differences were noted between the groups in the occurrence of perioperative complications.

DISCUSSION

The participants divided into the 2 groups, propofol vs remimazolam, had no substantial differences in terms of gender, age, height, weight, or BMI, nor were there differences in terms of operative time or anesthesia time. When planning for surgical cases to include in this study, we opted to focus on those with surgical times of 2 hours or less which resulted in a large variation in the types of surgical procedures. However, upon looking at the case types and totals, we felt there was a sufficient degree of similarity between the 2 groups. Although there was generally no bias in the length of surgery or the degree of invasiveness, we believe that case bias needs to be examined in the future.

Cardiovascular Stability

In the present study, remimazolam reduced BP less than propofol did during the perioperative period. Propofol is

Table 3. Mean Systolic Blood Pressures at Each Time

Measurement time	*Remimazolam* (mm Hg)*	*Propofol* (mm Hg)*	*Mean difference (mm Hg)*	*P value*
(1) Baseline	127.3	130.3	−2.949	>.9999
(2) Loss of consciousness	116.5	106.4	10.09	.090
(3) Immediately after intubation	110.5	98.60	11.89	.0131†
(4) Time out	102.0	94.00	8.00	.442
(5) 1 min after local anesthesia	102.4	94.36	8.01	.4386
(6) 10 min after start of surgery	102.9	89.58	13.35	.0019†
(7) End of surgery	109.7	98.08	11.65	.0174†
(8) Immediately before extubation	123.9	116.0	7.911	.4647
(9) Before leaving the OR	129.1	124.3	6.32	.9845

* Data presented as mean values.
† Signifies $P < .05$.

Table 4. Mean Diastolic Blood Pressures at Each Time

Measurement time	*Remimazolam* (mm Hg)*	*Propofol* (mm Hg)*	*Mean difference (mm Hg)*	*P value*
(1) Baseline	76.87	77.36	−0.4933	>.9999
(2) Loss of consciousness	68.64	60.28	8.364	.0217†
(3) Immediately after intubation	66.31	56.20	10.11	.0009†
(4) Time out	58.47	51.00	7.467	.0804
(5) 1 min after local anesthesia	58.07	52.94	5.127	.6855
(6) 10 min after start of surgery	56.93	48.54	8.393	.0208†
(7) End of surgery	63.38	54.40	8.978	.0078
(8) Immediately before extubation	74.07	68.36	5.707	.4874
(9) Before leaving the OR	78.36	72.88	5.476	.5672

* Data presented as mean values.
† Signifies $P < .05$.

known to cause a decrease in cardiac output and systemic vascular resistance. This phenomenon is thought to involve vasodilation,[4,5] baroreceptor reflex inhibition,[7] and suppressed myocardial contractility.

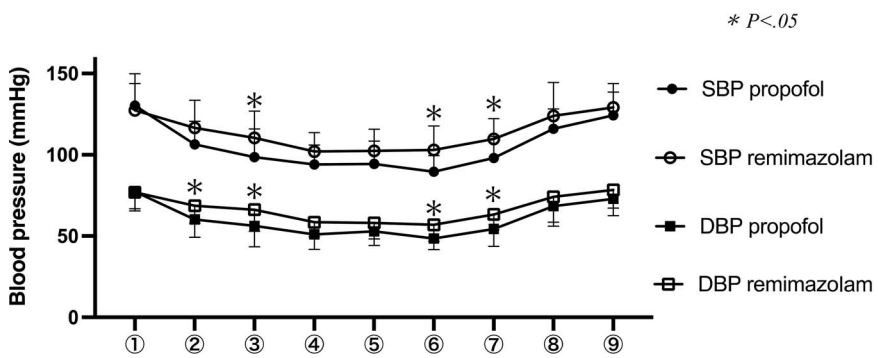
In hypertensive patients and elderly patients, who are expected to have greater cardiovascular variability during general anesthesia, we infer from this study's data that the use of remimazolam may produce more stable cardiovascular dynamics than propofol. However, because remimazolam does not decrease blood pressure and heart rate as much as propofol, it may not be as advantageous for use in surgeries where elective hypotension is warranted such as orthognathic surgeries.

Tang et al[7] reported that remimazolam reduced hemodynamic fluctuations, minimally affected surgical stress responses and respiratory function, and had recovery and extubation times that were significantly lower than patients who received propofol. Remimazolam patients in that study also had reduced incidences of hypotension and PONV as compared to propofol patients. Hasegawa et al[8] reported that propofol down-regulated sympathetic nervous system dominance and that remimazolam provided a more balanced sympathetic and parasympathetic nervous system activity profile. The cardiovascular dynamics of propofol and remimazolam were both reported by that study to be stable, particularly for remimazolam, as was found in our study.

Anesthetic Depth

Depth of anesthesia was primarily measured using BIS and PSI monitors. The EEG-based measurements obtained from both monitors can be used to quantify the depth of anesthesia. The BIS monitor combines 4 sub parameters obtained from EEG analysis and coefficients obtained from the EEG database. The PSI[10] is calculated by quantitatively analyzing the power within the α, β, δ, and θ frequency bands and the temporal and spatial gradients that occur between these frequency bands when the anesthetic depth is varied.[11] The BIS and PSI monitors functioned similarly regardless of whether remimazolam or propofol was used,

Figure 3. Comparisons of Blood Pressure



Systolic and diastolic blood pressure (mean ± SD) comparisons were made between each group. A significant decrease in blood pressure was observed in the propofol group (shown as *). ① Baseline; ② Loss of consciousness; ③ Immediately after intubation; ④ Time out; ⑤ 1 minute after local anesthesia; ⑥ 10 minutes after the start of surgery; ⑦ End of surgery; ⑧ Immediately before extubation; ⑨ Before leaving the OR.

Table 5. Mean Arterial Pressures at Each Time

Measurement time	*Remimazolam* (mm Hg)*	*Propofol* (mm Hg)*	*Mean difference (mm Hg)*	*P value*
(1) Baseline	93.68	94.99	−1.312	>.9999
(2) Loss of consciousness	84.61	75.67	8.941	.0225†
(3) Immediately after intubation	81.04	70.33	10.70	.0012†
(4) Time out	72.98	65.33	7.644	.1227
(5) 1 min after local anesthesia	72.84	66.75	6.090	.4954
(6) 10 min after start of surgery	72.27	62.22	10.05	.0039†
(7) End of surgery	78.83	68.96	9.870	.0052†
(8) Immediately before extubation	90.68	84.24	6.441	.3868
(9) Before leaving the OR	95.26	90.01	5.253	.7560

* Data presented as mean values.
† Signifies $P < .05$.

suggesting either can be used with remimazolam. However, it should be noted that neither monitor was developed specifically for remimazolam (Figure 6).

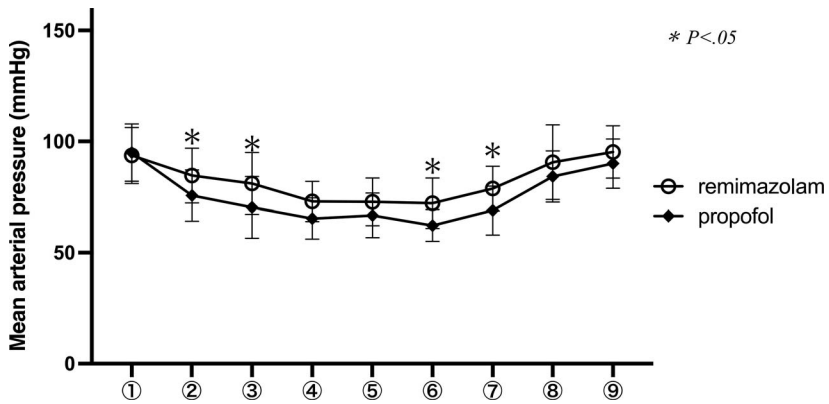
Secondary Outcomes

The time to loss of consciousness was significantly shorter with remimazolam (Table 1). This difference may be attributed to the use of a propofol TCI at 3.0 μg/mL for induction as administered according to the Japanese package insert. Investigators have reported that patients lose consciousness in 1.5 minutes with a propofol TCI of 4.0 μg/mL and in 1 minute 5 seconds with a propofol TCI of 6.0 μg/mL.[11] In some instances, patients took approximately 7 minutes to lose consciousness. The package insert states that if loss of consciousness is not attained after 3 minutes at 3.0 μg/mL, the target blood concentration should be increased by 1.0 to 2.0 μg/mL each minute. In our study, the time to loss of consciousness may have been further prolonged because we used a constant propofol TCI until the patient was induced. In the future, we would like to conduct a comparative study using the same method as described in the package insert that permits adjustments to the TCI rate to facilitate a faster induction.

In the remimazolam group, perioperative opioid analgesic use was significantly higher for fentanyl. Although the remifentanil dosing was higher for the remimazolam group, that difference was insignificant. The increased fentanyl and remifentanil dosing may be attributed to the lower impact remimazolam has on hemodynamics vs propofol.

Perioperative Complications. No significant difference existed between the 2 groups in the occurrence of PONV. In this study, only the immediate postoperative period was examined. In some cases, antiemetic drugs were administered in the wards as needed, but the incidence of these drugs could not be determined in this study. Future studies should also examine the administration of antiemetic drugs in hospital wards and PONV following the immediate postoperative period.

Figure 4. Comparisons of Mean Arterial Blood Pressure



Mean arterial pressure (MAP; mean ± SD) comparisons were made between each group. A significant decrease in MAP was observed in the propofol group (shown as *). ① Baseline; ② Loss of consciousness; ③ Immediately after intubation; ④ Time out; ⑤ 1 minute after local anesthesia; ⑥ 10 minutes after the start of surgery; ⑦ End of surgery; ⑧ Immediately before extubation; ⑨ Before leaving the OR.

Table 6. Mean Heart Rates at Each Time

Measurement time	*Remimazolam* (bpm)*	*Propofol* (bpm)*	*Mean difference (bpm)*	*P value*
(1) Baseline	74.58	77.76	−3.182	.9969
(2) Loss of consciousness	77.07	61.70	15.37	<.0001†
(3) Immediately after intubation	76.71	62.72	13.99	<.0001†
(4) Time out	66.16	63.02	3.136	.9974
(5) 1 min after local anesthesia	72.36	64.44	7.916	.0721
(6) 10 min after start of surgery	71.60	63.62	7.980	.0663
(7) End of surgery	67.42	58.74	8.682	.0249†
(8) Immediately before extubation	81.69	75.06	6.629	.2949
(9) Before leaving the OR	81.76	74.84	6.916	.2253

* Data presented as mean values.
† Signifies $P < .05$.

Among the 50 patients treated with remimazolam, flumazenil was used in 3 patients who were ultimately excluded from this study. The 2 males and 1 female rapidly emerged following flumazenil doses of 0.2 to 0.3 mg. In 1 patient, flumazenil was needed because of severe somnolence after extubation. In the other 2 patients, flumazenil was administered due to inadequate arousal but excessive body movement attributed to stimulation from the endotracheal tube. Unlike with propofol, delayed emergence with remimazolam can be resolved by the administration of flumazenil.

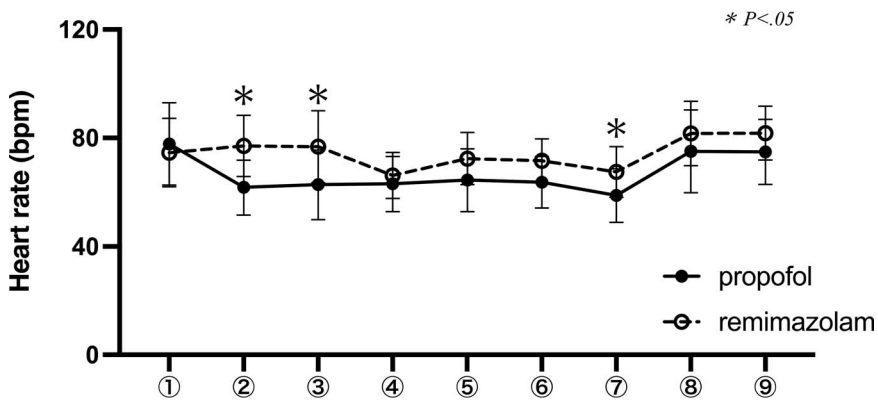
Study Limitations

This study had several notable limitations. Possible participants for this study were limited to those undergoing short, minor oral surgery procedures and those who were otherwise healthy (ASA-PS scores of 1–2). Future studies should consider increased surgical procedure homogeneity to better ensure consistency between groups. Although a few hypertensive patients were included in the study in both groups, they ideally should have been excluded due to the potential to impact the assessed cardiovascular variables.

CONCLUSION

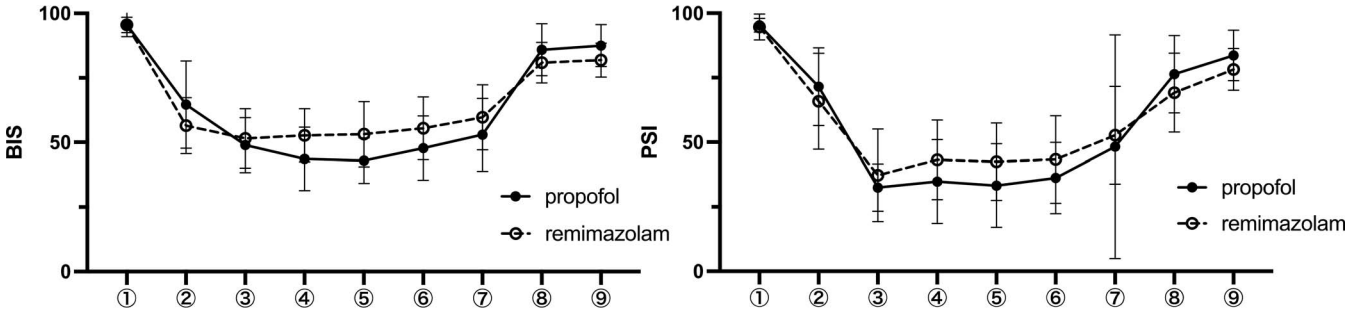
Both remimazolam and propofol were successfully used as primary general anesthetics for short oral surgery procedures, although the perioperative hemodynamics produced with remimazolam were more stable than with propofol, especially during induction. Propofol had more significant perioperative hemodynamic decreases and a higher incidence of vasopressor use than remimazolam. BIS and PSI both produced similar results for each group, suggesting that either can be used to monitor anesthetic depth with remimazolam or propofol. There were no significant differences in the occurrence of perioperative complications such as PONV and shivering. Remimazolam appears to be a safe

Figure 5. Comparisons of Heart Rate



Heart rate (mean ± SD) comparisons were made between each group. A significant decrease in heart rate was observed in the propofol group (shown as *). ① Baseline; ② Loss of consciousness; ③ Immediately after intubation; ④ Time out; ⑤ 1 minute after local anesthesia; ⑥ 10 minutes after the start of surgery; ⑦ End of surgery; ⑧ Immediately before extubation; ⑨ Before leaving the OR.

Figure 6. Comparisons of EEG Monitor



EEG monitor (mean ± SD) comparisons were made between each group. No significant differences were noted between the groups for both BIS and PSI, suggesting that remimazolam can be used to evaluate the depth of anesthesia. ① Baseline; ② Loss of consciousness; ③ Immediately after intubation; ④ Time out; ⑤ 1 minute after local anesthesia; ⑥ 10 minutes after the start of surgery; ⑦ End of surgery; ⑧ Immediately before extubation; ⑨ Before leaving the OR.

alternative to propofol for providing intubated general anesthesia for oral and maxillofacial surgery procedures.

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