

## Effectiveness of Different Anesthetic Doses in Mandibular Third Molar Surgery: Impact on Pain, Anesthesia Duration, and Need for Additional Anesthesia

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### Abstract

**Background:** This study aimed to evaluate the effectiveness of different anesthetic doses (0.5 cc, 1 cc, 1.5 cc, and 2 cc) in mandibular third molar surgery by assessing postoperative pain, anesthesia duration, and the need for additional anesthesia.

**Methods:** A total of 80 patients undergoing prophylactic extraction of impacted mandibular third molars were randomly assigned to 4 anesthetic dose groups. Pain levels were recorded using the Visual Analog Scale immediately after surgery, at the second and sixth hours. The duration of anesthesia effect and the requirement for additional intraoperative anesthesia were also analyzed.

**Results:** The 2 cc group had the lowest postoperative pain scores, with a statistically significant reduction in pain at the sixth hour compared to other groups ( $P=.001$ ). While the 1 cc and 1.5 cc groups showed similar pain levels, the 0.5 cc group had significantly higher pain scores at both the second and sixth hours ( $P < .05$ ). The duration of anesthesia effect was longest in the 2 cc group, but the difference among groups was not statistically significant ( $P=.12$ ). The need for additional intraoperative anesthesia was highest in the 0.5 cc group (30%) compared to the 1 cc (10%), 1.5 cc (15%), and 2 cc (10%) groups, though this difference was not statistically significant ( $P=.267$ ).

**Conclusions:** While the 2 cc dose provided the most effective pain control, lower doses (1–1.5 cc) may be sufficient for adequate anesthesia, reducing drug exposure and potential side effects. Further research is needed to refine optimal dosing strategies balancing efficacy and safety.

**Keywords:** anesthesia duration, anesthetic dose, local anesthesia, mandibular third molar extraction, postoperative pain

### INTRODUCTION

The use of local anesthesia in oral surgery is a fundamental step in managing intraoperative and postoperative pain.<sup>1,2</sup> Ensuring effective anesthesia is particularly critical during surgical procedures such as mandibular third molar extractions to prevent patients from experiencing pain.<sup>3</sup> The dose of the anesthetic solution administered directly influences the success of anesthesia, the surgical process, and the overall patient experience.

### What is already known on this topic?

- Local anesthesia is essential for pain control during mandibular third molar extractions. The effectiveness of anesthesia depends largely on the dose and technique used. Insufficient doses can cause intraoperative pain and require additional anesthesia, whereas excessive doses increase the risk of systemic toxicity. Previous studies on third molar surgery have mainly focused on postoperative analgesic use rather than on determining the optimal anesthetic dose. Therefore, there is limited evidence regarding how different local anesthetic volumes affect pain, anesthesia duration, and the need for supplemental anesthesia.

### What this study adds on this topic?

- This study provides comparative data on the clinical effects of different anesthetic doses (0.5, 1, 1.5, and 2 cc) used in mandibular third molar surgery. It demonstrates that while a 2 cc dose offers the most effective postoperative pain control, lower doses (1–1.5 cc) can still provide sufficient anesthesia with less drug exposure. These findings help define an optimal anesthetic dose that balances efficacy, safety, and patient comfort.

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The dosage of the anesthetic solution is a key variable in achieving adequate analgesia.<sup>4,5</sup> Insufficient anesthesia may lead to intraoperative pain, necessitating additional anesthesia administration.<sup>6,7</sup> On the other hand, excessive use of anesthetic agents increases the risk of systemic toxicity and results in unnecessary drug exposure.<sup>8-10</sup> Therefore, determining the optimal anesthetic dose is of great importance for both patient comfort and surgical efficiency.<sup>11</sup>

The existing literature includes various studies on pain management in mandibular third molar extractions, primarily focusing on the use of analgesic medications.<sup>12,13</sup> However, these studies are often limited in evaluating the impact of anesthetic solution dosage on clinical outcomes.

This study aims to assess the effectiveness of anesthetic solutions administered at doses of 0.5 cc, 1 cc, 1.5 cc, and 2 cc during mandibular third molar extraction to contribute to the determination of the ideal dose. The evaluation criteria include the need for additional anesthesia during tooth extraction, visual analog scale (VAS) pain scores immediately postoperatively as well as at the second and sixth hours, and the duration until the anesthesia effect wears off. This study seeks to enhance the understanding of how different anesthetic doses influence patient experience and surgical efficacy.

## MATERIALS AND METHODS

This study was approved by the Ethics Committee of Sivas Cumhuriyet University (Approval No.: 25\_01\_20; Date: January 16, 2025) and was conducted in accordance with the principles of the Declaration of Helsinki. Written and verbal informed consent was obtained from all participants. The study included patients who underwent prophylactic extraction of asymptomatic impacted mandibular third molars at the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Sivas Cumhuriyet University, between June and December 2024.

### Inclusion and Exclusion Criteria

The inclusion and exclusion criteria applied in this study were as follows:

Inclusion criteria:

- Patients aged 18–45 years.
- Impacted mandibular third molars classified as class II, position B, and mesioangular according to the Pell and Gregory Classification.
- Asymptomatic teeth extracted for prophylactic purposes.
- Patients with a normal body mass index<sup>14</sup> (BMI of 18.5–24.9 kg/m<sup>2</sup>).
- American Society of Anesthesiologists I patients with no systemic diseases.

Exclusion criteria:

- Patients with acute infection, swelling, or systemic antibiotic use within the 7 days preceding surgery.
- Pregnant or breastfeeding individuals.
- Smokers.
- Patients with a history of allergy to local anesthetics.
- Teeth with different impaction classifications or requiring alternative surgical techniques.
- Patients who did not attend postoperative evaluations.

### Randomization Protocol

Randomization was performed by the researcher HNB using specialized randomization software. The software was programmed to randomly assign numbers from 1 to 80 into 4 groups. Patients included in the study were sequentially allocated to the study groups according to the predetermined randomization order.

### Blinding Procedure

This study was conducted using a double-blind design. Neither the operating surgeon nor the patients were aware of the anesthetic volume allocated to each case. The anesthetic doses (0.5 cc, 1 cc, 1.5 cc, and 2 cc) were prepared in identical, unlabeled syringes by a researcher who was not involved in the surgical procedures or postoperative evaluations. The surgeon performed all injections without knowledge of the administered dose, and patients were not informed about their group assignment. Data collection and postoperative assessments were carried out by an independent evaluator who was also blinded to group allocation. This blinding process was implemented to minimize bias and ensure the reliability of the study outcomes.

### Study Groups and Anesthesia Protocols

Patients were divided into 4 groups based on the volume of anesthetic solution administered for mandibular anesthesia: 0.5 cc, 1 cc, 1.5 cc, and 2 cc. All anesthetic procedures were performed by a single surgeon (Researcher ZDB). All patients received inferior alveolar nerve block anesthesia using Ultracain (4% Articaine HCl with 1 : 100 000 epinephrine) as the anesthetic solution. A standard dental syringe with a 27-gauge long needle was used for anesthesia administration. The anesthesia was performed as follows:

- The patient's mouth was opened, and the injection site was identified near the pterygomandibular raphe.
- The needle was advanced toward the region of the mandibular foramen as the target site.
- After aspiration to confirm that the injection was not intravascular, the solution was injected slowly.
- All patients received a buccal nerve block with 0.2 cc of anesthetic solution for soft tissue anesthesia.

### Surgical Procedure

All surgical procedures were performed by a single surgeon (Researcher YB) to standardize techniques. The operating surgeon was blinded to the study group and anesthetic

volume used for each patient. The following surgical protocol was followed:

- A mucoperiosteal flap incision was made using the Winter technique.
- If the patient experienced pain during the procedure, an additional 0.2 cc of anesthetic solution was administered.
- The distal bone overlying the tooth was removed using a round bur with sterile saline irrigation.
- The crown of the tooth was sectioned, with the distal fragment extracted first.
- The remaining crown and roots were removed using a Bein elevator.
- The socket was irrigated with sterile saline, and primary closure was achieved using 3-0 silk sutures.
- Patients were given routine postoperative instructions and were advised not to take analgesics for the first 6 hours postoperatively.

**Evaluated Parameters**

In this study, the need for additional anesthetic solution during surgery, the VAS pain scores measured immediately after surgery, at the second hour, and at the sixth hour (0=no pain, 10=unbearable pain), and the duration of anesthesia effect were recorded. The duration of anesthesia effect was defined as the time in minutes until normal sensation returned to the anesthetized region.

**Sample Size Calculation**

A pilot study including 40 patients (10 per group) was conducted for sample size calculation. Data from this pilot study were used for power analysis, with the primary outcome variable being the duration of anesthesia effect. The mean duration of anesthesia effect in the 0.5 cc group was 358 minutes, in the 1 cc group it was 377 minutes, in the 1.5 cc group it was 367 minutes, and in the 2 cc group, it was 388 minutes. The standard deviation within the groups was 15 minutes. Power analysis was performed using G\*Power 3.1.9.7 software. The calculated effect size was 0.746101. With an  $\alpha$  error rate of 0.05 and a power (1- $\beta$ ) of 0.95, the actual power was calculated as 0.95559669, indicating that a minimum of 36 patients was required for the study. Taking into account potential data loss and the desire to increase the study's power, the sample size was doubled, and the study was conducted with a final sample size of at least 80 patients.

**Statistical Analysis**

Statistical analyses were performed using JASP v0.19.3 (Jeffreys's Amazing Statistics Program, JASP Team, University of Amsterdam, Amsterdam, Netherlands) to evaluate the data obtained in the study. The normality of the data distribution was assessed using the Shapiro-Wilk test, and the suitability for parametric tests was confirmed. Differences in age and surgical duration between the groups were compared using one-way analysis of variance (ANOVA), while the distribution of gender and the need for intraoperative additional doses

were analyzed using the chi-square ( $\chi^2$ ) test. For the postoperative pain levels measured at the second and sixth hours, a one-way ANOVA test was applied, and post hoc Tukey tests were used to determine differences between the groups. To assess changes in pain levels over time, repeated-measures ANOVA was used, and post hoc analysis was performed to determine the statistical significance of differences between groups. The differences in the duration of anesthesia effect between groups were analyzed using one-way ANOVA. Before performing the ANOVA tests, the assumption of homogeneity of variances was assessed using Levene's test, and the results confirmed that the variances were homogeneous across groups. A statistical significance level of  $P < .05$  was considered for all tests.

**RESULTS**

A total of 80 patients, including 40 women and 40 men, were included in the study. No patient was excluded from the study after the randomization process. The age, gender distribution, and operation duration of the patients included in the study were statistically evaluated, and the results are summarized in Table 1. The mean age in the 0.5 cc group was  $27 \pm 6.649$  years, in the 1 cc group it was  $23.3 \pm 3.246$  years, in the 1.5 cc group it was  $23.45 \pm 4.395$  years, and in the 2 cc group, it was  $26.45 \pm 6.262$  years. There was no significant difference between the groups in terms of age ( $F=2.68, P=.053$ ). Each group consisted of 10 women and 10 men, and there was no significant difference in gender distribution between the groups ( $\chi^2=0.000, P=1.000$ ). The operation duration was  $1059.5 \pm 429.743$  seconds in the 0.5 cc group,  $1020.5 \pm 430.966$  seconds in the 1 cc group,  $1059 \pm 423.94$  seconds

**Table 1. Statistical Analysis of the Difference Between the Groups in Terms of Age, Gender, and Operation Time**

Age					
Group, cc	N	Mean	SD	F	P*
0.5	20	27	6.649	2.68	.053
1	20	23.3	3.246		
1.5	20	23.45	4.395		
2	20	26.45	6.262		
Gender					
Group, cc	Female	Male	$\chi^2$	df	P**
0.5	10	10	0.000	3	1.000
1	10	10			
1.5	10	10			
2	10	10			
Operation Time (Second)					
Group, cc	N	Mean	SD	F	P*
0.5	20	1059.5	429.743	0.955	.419
1	20	1020.5	430.966		
1.5	20	1059	423.94		
2	20	1230	429.369		

\*ANOVA.  
\*\*Chi-squared.

**Table 2. Difference Between Groups in Pain Levels at 2 and 6 Hours**

Pain – 2nd Hour					
Group, cc	N	Mean	SD	F	P*
0.5	20	1.7	0.459	6.913	.001
1	20	0.35	0.182		
1.5	20	0.6	0.197		
2	20	0.1	0.069		
Pain – 6th Hour					
Group, cc	N	Mean	SD	F	P*
0.5	20	4.6	0.634	11.146	.001
1	20	3.5	0.505		
1.5	20	3.8	0.588		
2	20	0.7	0.179		

\*ANOVA.

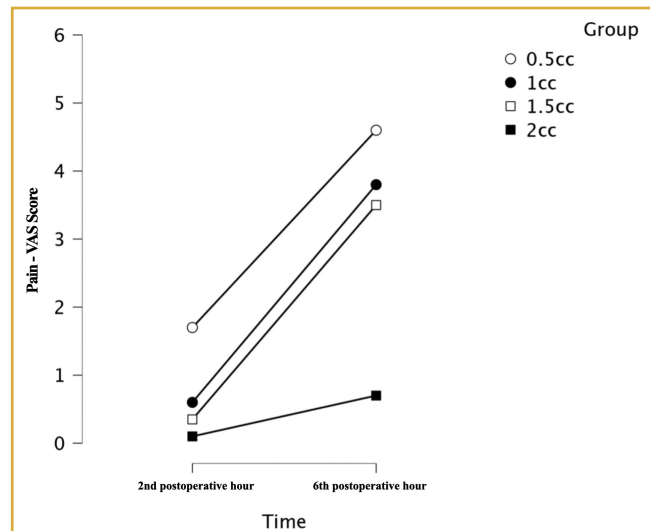
in the 1.5 cc group, and 1230 ± 429.369 seconds in the 2 cc group. There was no statistically significant difference in operation duration between the groups ( $F=0.955, P=.419$ ).

When comparing the postoperative pain levels between the groups, the pain scores at the second hour postoperatively were 1.7 ± 0.459 in the 0.5 cc group, 0.35 ± 0.182 in the 1 cc group, 0.6 ± 0.197 in the 1.5 cc group, and 0.1 ± 0.069 in the 2 cc group (Table 2). Statistical analysis revealed a significant difference between the groups ( $F=6.913, P=.001$ ). The pain scores at the sixth hour postoperatively were 4.6 ± 0.634 in the 0.5 cc group, 3.5 ± 0.505 in the 1 cc group, 3.8 ± 0.588 in the 1.5 cc group, and 0.7 ± 0.179 in the 2 cc group, and a significant difference was found between the groups ( $F=11.146, P=.001$ ). The post hoc analysis, shown in Table 3, revealed that the 0.5 cc anesthesia group had significantly higher pain scores at the second hour compared to the other groups ( $P < .05$ ). There was no statistically significant difference in the second hour pain scores between

**Table 3. Post Hoc Analysis of the Difference Between the Groups in Pain Levels at 2 and 6 Hours. Bolded P-values indicate statistically significant results ( $p < 0.05$ ).**

Pain – 2nd Hour Post Hoc					
Group-1, cc	Group-2, cc	Mean	SE	t	P***
0.5	1	1.1	0.379	2.9	<b>.025</b>
	1.5	1.35	0.379	3.559	<b>.004</b>
	2	1.6	0.379	4.218	<b>.001</b>
1	1.5	0.25	0.379	0.659	.912
	2	0.5	0.379	1.318	.554
1.5	2	0.25	0.379	0.659	.912
Pain – 6th Hour					
Group, cc	N, cc	Mean	SE	F	P***
0.5	1	0.8	0.719	1.112	.683
	1.5	1.1	0.719	1.529	.425
	2	3.9	0.719	5.422	<b>.001</b>
1	1.5	0.3	0.719	0.417	.975
	2	3.1	0.719	4.31	<b>.001</b>
1.5	2	2.8	0.719	3.893	<b>.001</b>

\*\*\*Post Hoc Tukey Test.



**Figure 1. Graph of changes in pain levels. Level 1 represents the second postoperative hour, while level 2 represents the sixth postoperative hour.**

the 1 cc, 1.5 cc, and 2 cc groups ( $P > .05$ ). At the sixth hour, the 2 cc group had statistically significantly lower pain scores by an average of 2.8 to 3.9 points compared to the other anesthesia dose groups ( $P=.001$ ). The changes in the average pain levels at the second and sixth hours are shown in Figure 1.

When evaluating the change in pain levels between the postoperative second and sixth hours (Table 4), a statistically significant difference was found between the groups ( $F=93.02, P=.001$ ). According to the post hoc analysis, there was a statistically significant higher increase in pain in the 0.5 cc group compared to the 1.5 cc group by an average of 1.225 points ( $P=.038$ ), compared to the 2 cc group by an average of 2.75 points ( $P=.001$ ), in the 1 cc group compared to the 2 cc group by an average of 1.8 points ( $P=.001$ ), and in the 1.5 cc group compared to the 2 cc group by an average of 1.525 points ( $P=.006$ ).

The durations of the loss of anesthesia effect between the groups were statistically evaluated, and it was found that the loss of anesthesia effect occurred at 4.7 ± 0.405 hours in the 0.5 cc group, 5.7 ± 0.385 hours in the 1 cc group, 5.55 ± 0.42 hours in the 1.5 cc group, and 6.05 ± 0.407 hours in the 2 cc group (Table 5). No statistically significant difference was found between the groups ( $F=2.01, P=.12$ ).

The need for additional anesthesia doses during surgery was analyzed between the groups, and the results are summarized in Table 6. The need for additional doses was observed in 6 patients (30%) in the 0.5 cc group, in 2 patients (10%) in the 1 cc group, in 3 patients (15%) in the 1.5 cc group, and in 2 patients (10%) in the 2 cc group. The statistical analysis revealed no significant difference between the groups ( $\chi^2=3.949, P=.267$ ).

**Table 4. Statistical Evaluation of the Difference Between Groups in Pain Change Over Time**

Change in Pain Level Between 2 and 6 Hours						Repeated-Measures ANOVA	
Post Hoc Analysis							
Group 1, cc	Group 2, cc	Mean	SE	t	P***	F	P****
0.5	1	0.95	0.447	2.123	.155	93.02	.001
	1.5	1.225	0.447	2.737	.038		
	2	2.75	0.447	6.145	.001		
1	1.5	0.275	0.447	0.615	.927		
	2	1.8	0.447	4.022	.001		
1.5	2	1.525	0.447	3.408	.006		

\*\*\*Post Hoc Tukey test.  
\*\*\*\*Repeated-measures ANOVA.

## DISCUSSION

This study aimed to evaluate the effectiveness of anesthetic solutions used in different doses during mandibular third molar tooth extraction and to contribute to determining the ideal dose. The results obtained contributed to identifying the effective dose in terms of anesthesia duration and post-operative pain.

In this study, statistically significant differences were found between the postoperative pain levels measured at the second and sixth hours ( $P < .05$ ). Specifically, the 2 cc dose group had the lowest pain levels, suggesting that higher doses may prolong postoperative analgesia. This finding is consistent with previous studies in the literature. In a study by Yan et al,<sup>15</sup> it was shown that increasing the dose of local anesthetics in opioid-free anesthesia protocols significantly improved postoperative pain control and reduced the need for opioids. Similarly, Shetti et al<sup>16</sup> reported that the use of high-dose bupivacaine provided lower pain levels for up to 48 hours compared to ropivacaine. However, it has also been reported in the literature that increasing the anesthetic dose beyond a certain threshold does not provide additional analgesic benefit.<sup>17-19</sup> In this study, no significant difference was found in pain scores at the second hour between the 2 cc groups, while at the sixth hour, the 2 cc group showed an advantage ( $P = .001$ ). Similarly, in this study, no statistically significant difference was found in the second hour pain scores between the 1.5 cc and 2 cc dose groups, but the 2 cc dose group showed a significant advantage in the sixth hour pain scores ( $P = .001$ ). This situation suggests that the dose maintains its effect over a specific time interval depending on the pharmacokinetic properties of the anesthetic agent, but in the long term, the highest dose provides the best effect.

**Table 5. Statistical Evaluation of Intergroup Differences in the Duration of Anesthetic Effect Loss**

Anesthetic Effect Loss Time (Hour)					
Group, cc	N	Mean	SD	F	P*
0.5	20	4.7	0.405	2.01	.12
1	20	5.7	0.385		
1.5	20	5.55	0.42		
2	20	6.05	0.407		

\*ANOVA.

In this study, no significant difference was observed between the groups in terms of anesthesia duration ( $P = .12$ ). The pharmacodynamic properties of anesthetic agents vary depending on the administered dose. Research has shown that as the anesthetic dose increases, the duration of anesthesia also increases, but this effect remains optimal only up to a certain point and does not follow a linear model. In a study by Rosenberg et al,<sup>20</sup> it was observed that increasing the dose of local anesthetics prolonged their effect, but beyond a certain threshold dose, no further increase in effect was achieved. Fenten et al<sup>21</sup> found that the total dose of mepivacaine led to a significant increase in anesthesia duration, but higher concentrations resulted in longer-lasting effects. Almasi et al<sup>22</sup> emphasized the importance of volume and concentration of local anesthetics used in brachial plexus blocks, noting that lower doses provided shorter, controlled effects, while higher doses increased the duration of effect but raised the risk of toxicity. In a study by Khafagy et al,<sup>23</sup> it was found that intravenous magnesium sulfate prolonged the duration of anesthesia and altered the pharmacodynamic effects of different dose regimens on general anesthesia. It is emphasized that dose-dependent changes are not solely dependent on the amount of anesthetic but are also influenced by the individual's metabolism, gender, and genetic factors. Xue et al<sup>24</sup> studied the dose-response curve of rocuronium and showed that the duration of effect was longer in female patients compared to males. This may be due to the genetic and hormonal differences in women affecting anesthetic metabolism. In conclusion, increasing the anesthetic dose prolongs the duration of effect up to a certain point, but beyond that, it can increase the risk of toxicity. Instead of increasing the dose, anesthesia duration can be extended more safely by using appropriate anesthetic combinations or additional pharmacological agents.

In this study, although more intraoperative additional anesthesia was applied in the 0.5 cc group compared to the

**Table 6. Statistical Evaluation of Intergroup Differences in the Need for Intraoperative Additional Doses**

Additional dose	Group				$\chi^2$	P**
	0.5 cc	1 cc	1.5 cc	2 cc		
No	14	18	17	18	3.949	.267
Yes	6	2	3	2		

\*\*Chi-squared.

other groups, no statistically significant difference was found between the groups in terms of the need for intraoperative additional doses ( $P = .267$ ). This finding suggests that even low doses can provide sufficient intraoperative anesthesia and that the need for additional doses may be limited. However, some studies have indicated that the use of low-dose anesthesia may be inadequate in maintaining intraoperative stability and may cause the patient to respond to pain or surgical stimuli. For example, White<sup>25</sup> reported that patients required additional intraoperative doses more frequently when low doses of intravenous anesthetics were used. However, low-dose use may offer advantages by reducing postoperative side effects such as nausea, vomiting, and sedation. The use of high-dose anesthesia may reduce the need for intraoperative additional doses but can increase side effects such as cardiovascular depression, respiratory depression, and prolonged postoperative sedation.<sup>26</sup> Studies have shown that the use of high-dose anesthetics ensures hemodynamic stability, but patients may require mechanical ventilation for a longer duration.<sup>27</sup> The optimal dose in anesthesia management depends on various factors, including the patient's age, weight, metabolic status, and the duration of the surgery. Swain et al<sup>28</sup> stated that the addition of adjuvant drugs (such as clonidine or opioids) reduces the need for anesthetic agents and minimizes the requirement for additional intraoperative doses. The effect of different doses of the same anesthetic agent on the need for intraoperative additional doses varies depending on many clinical factors. While the need for intraoperative additional doses increases with low-dose use, high-dose use may lead to hemodynamic instability and postoperative side effects. Therefore, individualized anesthesia management and the use of additional pharmacological support are among the most effective methods for optimal dose adjustment.

The results of this study provide important insights for clinical applications. First of all, it appears that the 2 cc dose is the most effective option in terms of postoperative pain management. However, the lack of a significant difference between doses in terms of anesthesia duration and the need for intraoperative additional doses suggests that lower doses may also be preferred in clinical practice. This is because the use of lower doses may provide advantages in terms of reducing drug toxicity and side effects. However, caution should be exercised regarding the safety of high-dose use. Therefore, further randomized controlled trials are needed to determine the most effective and safest dose. Although the 2 cc anesthesia group had lower pain scores at the sixth hour compared to the other groups, postoperative anesthesia can also be provided with analgesic agents, so anesthesia at doses lower than 2 cc may be preferred for third molar extractions.

Another factor that may potentially influence anesthetic effectiveness is the variability in surgical difficulty and operator-related differences. Although all procedures in the present study were performed by a single experienced surgeon to minimize variability, differences in impaction depth,

bone density, root morphology, or access difficulty can inherently affect operative duration and patient perception of pain. Previous research has shown that increased surgical difficulty is associated with higher rates of intraoperative discomfort and postoperative pain, regardless of anesthetic dosage. Furthermore, operator variability—including technical proficiency, tissue handling, and injection technique—has been identified as a factor influencing anesthetic success. By standardizing the surgeon and surgical protocol, this study aimed to reduce these confounding effects; however, their possible residual influence cannot be completely excluded and should be considered when interpreting the findings.

This study has some limitations. First, although the sample size was sufficient for power analysis, the 80-patient sample size is limited in evaluating the effects of the anesthetic agent, and the findings need to be confirmed in studies with larger patient groups. Second, the study was conducted on a specific local anesthetic agent, and the effectiveness of different agents was not evaluated. Future studies can compare the dose-dependent effectiveness of different local anesthetics and provide clearer data on optimal dosing. Additionally, the effectiveness of different doses in terms of postoperative long-term pain control should be assessed in long-term follow-up studies.

## CONCLUSION

This study highlights the importance of selecting an appropriate anesthetic dose to balance patient comfort, procedural efficiency, and drug exposure in mandibular third molar surgery. While higher doses may offer extended postoperative comfort, the findings suggest that commonly used intermediate doses, such as 1–1.5 cc, can provide clinically adequate anesthesia with minimal need for supplemental injections. These results support a more tailored approach to anesthetic dosing, allowing clinicians to optimize patient care based on individual needs while avoiding unnecessary increases in anesthetic volume. Further research in broader patient populations may help refine dose recommendations and enhance the generalizability of these findings.

**Data Availability Statement:** The data that support the findings of this study are available on request from the corresponding author.

**Ethics Committee Approval:** This study was approved by the Ethics Committee of Sivas Cumhuriyet University (Approval No.: 25\_01\_20; Date: January 16, 2025) and was conducted in accordance with the principles of the Declaration of Helsinki.

**Informed Consent:** Written informed consent was obtained from all participants who participated in this study.

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