Original Article

Comparing the Effect of 0.75% Ropivacaine and 2% Lidocaine on Intraoperative Bleeding and Postoperative Pain of Third Molar Surgery: A Double Blinded, Split Mouth Study

Sahand Samieirad [1], Elmira Pourafshar [2], Armaghan Salehi [3], Farid Shiezadeh [4], Majid Hosseini Abrishami[1*]

1. Oral and Maxillofacial Surgery Department, Mashhad Dental School, Mashhad University of Medical Sciences, Mashhad, Iran
2. Dentist, Privet Practice, Mashhad, Iran
3. Student Research Committee, Faculty of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran
4. Dental Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

***Corresponding Author:**

Majid Hosseini Abrishami

Department of Oral and Maxillofacial surgery, Faculty of Dentistry, Mashhad University of Medical Sciences, Vakilabad Boulevard, Mashhad, Iran.

Tel.: +98 915 3200781
Email:
hoseiniabrishamim@mums.ac.ir

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ABSTRACT

Background: We aimed to compare the effect of 0.75% ropivacaine and 2% lidocaine with 1:100,000 epinephrine on intraoperative bleeding and postoperative pain following mandibular third molar surgery.

Methods: In this split-mouth clinical trial, 60 patients required bilateral impacted third molar of the mandible were prepared for operation in the Department of Maxillofacial Surgery of Mashhad Dental Faculty, Mashhad, Iran. Surgery was performed randomly on one side using ropivacaine and on the other side with lidocaine with epinephrine. The intraoperative bleeding, the postoperative pain (at 3, 6, 12, 18, and 24 hours after the operation), and the difficulty of the surgery were measured in each group and compared.

Results: In all postoperative time intervals, the pain was lower in the ropivacaine group than in the lidocaine group. The rate of intraoperative bleeding in the ropivacaine group was lower than in the lidocaine group. In the lidocaine group, pain initially increased and reached its maximum value after three hours, but decreased after the sixth hour and reached its minimum value 24 hours after surgery. In the ropivacaine group, the pain increased initially and was at its peak at 3 and 6 hours, after which it decreased and reached its lowest value at 24 hours.

Conclusion: Postoperative pain was less in the 0.75% ropivacaine group than in the 2% lidocaine with 1:100,000 epinephrine group during all postoperative periods. Also, the amount of bleeding during the operation was less in the ropivacaine group.

KEYWORDS
Local anesthesia; Impacted teeth; Ropivacaine; Lidocaine; Postoperative pain

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INTRODUCTION

Third molar impaction is a common problem related to periodontal pockets, adjacent tooth decay or root resorption, crowding, and cyst formation. One of the most frequent dental procedures is the surgical removal of this molar[1]. Experiencing different levels of postoperative pain is a common occurrence which persist three to five hours after the

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anesthetic effect ends. Pain may cause by surgical trauma and the release of pain mediators such as histamines, bradykinins, and prostaglandins, during and after surgery [2]. Patients have described their postoperative pain in various ways, including as throbbing, sharp, stabbing, and debilitating[3]. However, the pain decreases or disappears two days after surgery but it influences patient satisfaction [4].

The pain during and after surgery reduced by anesthetic drugs. Local anesthetics include three major structural parts: a lipophilic ring, an amide or ester intermediate ring, and an amine ring [5]. During the last 20 years, amides have been the most widely used anesthetics in dentistry and among them lidocaine and mepivacaine are the most often anesthetics used in dentistry. Anesthesia induced by amides is faster and more durable than esters, and less sensitivity has been reported after their injection [6].

Clinical use and research have indicated lidocaine's high efficacy, low sensitization, and low toxicity. Combining this agent with vasoconstrictor medications results in a higher anesthetic effect [7, 8]. Ropivacaine was entered the world market in 1996. Ropivacaine is a long-acting amide anesthetic that is similar to bupivacaine and mepivacaine but has less cardiovascular and neurological toxicity compared to bupivacaine. Moreover, ropivacaine can control bleeding with its vasoconstrictor properties. Its utility for peripheral, epidural, or spinal nerve block anesthesia in high doses has been confirmed in several trials. It is available in doses of 0.75%, 0.5%, 0.375%, and 0.25%, and it has the intrinsic properties of vasopressors. Ropivacaine's main metabolism is hepatic and by Cytochrome P450 enzyme. It is among category B drugs in pregnancy and category S in breastfeeding [8, 9].

Preoperative anesthesia minimizes the need for postoperative analgesics after different surgeries. Although there are many anesthetic medications accessible in dentistry today, the preferred goal is to use anesthetics with few side effects, a long duration of effect, and rapid induction of anesthesia in the minimum dose possible. The effectiveness of using ropivacaine as a preoperative anesthetic drug in surgeries of different parts of the body has been investigated. However, the effectiveness of ropivacaine on pain and bleeding in oral surgeries has not been clearly investigated. This could be due to lack of ropivacaine as a common dental cartridge. Therefore, we aimed to compare the efficacy of ropivacaine with lidocaine on postoperative pain and intraoperative bleeding of third molar surgeries, hypothesizing that inferior alveolar nerve block (IANB) of ropivacaine has a greater effect on reducing postoperative pain and controlling bleeding during surgery.

MATERIALS AND METHODS

Ethical Approval

All procedures performed in this study involving the human participant were in accordance with the ethical standards of institutional research committee and with the Helsinki Declaration and its later amendments or comparable ethical standards. This double-blinded clinical trial was approved by the Ethics Committee of the Mashhad University of Medical Sciences (IR.MUMS.DENTISTRY.REC.1398.119) and registered in the Iranian Registry of Clinical Trials with IRCT20181023041425N3. The Consolidated Standards of Reporting Trials (CONSORT) guidelines and the Helsinki Declaration principles have been followed in this study. All participants provided written informed consent before enrollment.

All patients of both gender between 18 to 40 years old, who need bilateral mandibular impacted third molar surgery, between January and December 2022 were included in the study. All patients were asked about medical history and if they had any systemic problems such as blood pressure, heart disease and liver disease et al. they were not included in this study. Exclusion criteria were the patient's unwillingness to continue participating, need for supplemental injection, the occurrence of complications during or after surgery such as paresthesia, iatrogenic fracture, abnormal bleeding during surgery (inferior alveolar arterial bleeding), and abnormal prolongation of the surgery period (more than 30 minutes).

The sample size was calculated as 53 patients with alpha 0.05 and beta 0.20, increased to 60 in order to increase the power of the study. A total of 60 patients underwent split mouth surgery at the oral and maxillofacial surgery department of the Mashhad Faculty of Dentistry. All the surgeries were performed by one OMFS post-graduate student. On one side, 1.8 cc of 0.75% ropivacaine (Naropin-

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Techradaro-Italy), and on the other side 1.8 cc of 2% lidocaine with 1.100000 epinephrine (Persocaine-Daropakhsh_Iran) was used for inferior alveolar nerve block and long buccal anesthesia. The order of using anesthesia in sessions was random. There was 2 weeks interval between two extractions in each patient. In this double-blinded study patients and analyzer were blinded by the used anesthesia agent.

The intraoperative bleeding volume was measured by subtracting the amount of serum consumed from the suctioned blood volume. The pain level of the patients after each surgery was measured through the Visual Analogue Scale (VAS) immediately after the surgery,3,6,12,18 and 24 hours later. On the VAS scale, patients rate their pain between 0 (no pain) and 10 (very severe pain). The patient was also asked about pain after flap removal, after osteotomy, and after tooth extraction to know even supplemental injection is need. The same medication protocol as Amoxicillin 500 mg every 8 hours, Gelofen 400 mg every 6 hours, and chlorhexidine mouthwash twice a day for 7 days was prescribed for all patients. The severity of surgery was determined based on Peterson and Gregory's classification.

Age, gender, bleeding volume, and pain level were recorded. The results have entered the checklist and subjected to statistical analysis. The Friedman, Mann-Whitney and T-test was used for data analysis also repeated measures was used for analysis of variance. The significance level for statistical tests was considered 0.05. The research data were analyzed using SPSS version 20 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 60 patients who required bilateral surgical removal of the mandibular third molar were enrolled. None of the patients were excluded from the study due to exclusion criteria. There was 44 women and 16 men between the ages of 18 and 40 who had participated in this study. This study was conduct as a split mouth and each individual was compared with himself, therefore no comparison was made between the age and sex of each group.

The difference in intraoperative bleeding volume, pain, and difficulty of surgery in the two groups of ropivacaine and lidocaine are shown in Tables 1 and 2. The VAS scores of pain in all the postoperative periods and the amount of bleeding were significantly lower in the ropivacaine group (P<005).

In the ropivacaine group, pain at 24 hours and 18 hours of the postoperative period was significantly lower than at 3, 12, and 6 hours after surgery. The pain was also lower one hour after surgery compared to 3, 12, and 6 hours after surgery. In the lidocaine group, pain 24 hours after surgery was significantly less than postoperative pain at 18, 12, 3, and 6 hours (P<005).. Pain 18 hours and 1 hour of the postoperative period was significantly less than pain 12, 3, and 6 hours after surgery. The pain 3 hours after surgery was at the highest level in both ropivacaine and lidocaine groups. Figure 1 shows the comparison of pain in the postoperative period in two groups of ropivacaine and lidocaine.

In the ropivacaine group, there was no significant relationship between the degree of surgical difficulty

Table 1: The differnce of surgery difficulty and bleeding volume in ropivacaine and lidocaine groups

Parameter	Average difference	P value
Surgery difficulty	- 0/70	0/94
Bleeding volume	- 5/40	<0/00

Table 2: The differnce of pain scores in ropivacaine and lidocaine groups (P<0.001)

Pain	Average difference
Pain 3 hour after surgery	- 4/19
Pain 6 hour after surgery	- 4/38
Pain 12 hour after surgery	- 4/16
Pain 18 hour after surgery	- 4/90
Pain 24 hour after surgery	- 3/77

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with the amount of bleeding and pain, but in the lidocaine group, the difficulty only had an inverse and significant relationship with the amount of bleeding. In none of the two ropivacaine and lidocaine groups, pain and bleeding after surgery were related to the surgical side.

The relationship between gender, age, and the evaluated parameter is shown in Tables 3 and 4. As can be seen, there is no significant relationship between age and gender and other variables.

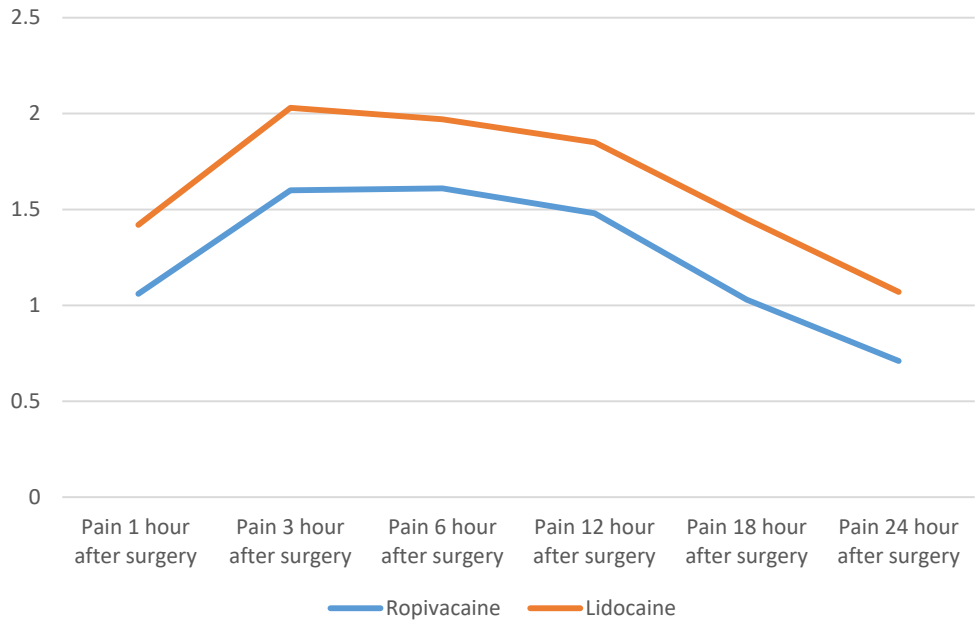

Figure 1: Comparison of postoperative pain in Ropivacaine and Lidocaine group

Table 3: The relationship between gender and the evaluated parameter

Gender	Parameter	Group	*P* value
Female	Pain	Ropivacaine	0.27
		Lidocaine	0.54
	Surgery difficulty	Ropivacaine	<0.00
		Lidocaine	<0.00
	Bleeding volume	Ropivacaine	<0.00
		Lidocaine	<0.00
Male	Pain	Ropivacaine	0.27
		Lidocaine	0.56
	Surgery difficulty	Ropivacaine	<0.00
		Lidocaine	0.07
	Bleeding volume	Ropivacaine	<0.00
		Lidocaine	<0.00

Table 4: The relationship between age and the evaluated parameter

	Parameter	Group	*P* value
Age	Pain	Ropivacaine	0.38
		Lidocaine	0.39
	Surgery difficulty	Ropivacaine	0.56
		Lidocaine	0.61
	Bleeding volume	Ropivacaine	0.69
		Lidocaine	0.20

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DISCUSSION

Actual or potential tissue damage is described as "pain" which is an unpleasant sensory and emotional experience[8]. Pain after third molar surgery is one concern of patients and dentists and usually presents as acute pain of moderate to severe intensity. Therefore, different local anesthesia and drug prescriptions are used to reduce postoperative pain [10].

The present study was conducted using the split mouth method, as a result, the effect of confounding factors has been minimized. Intraoperative bleeding and postoperative pain (POP) from third molar surgery were investigated in two anesthesia groups: lidocaine and ropivacaine. Intraoperative bleeding and pain at all postoperative periods in the ropivacaine group were significantly less than in the lidocaine group. The lowest VAS Score of POP was in 24 hours after surgery. The highest score in the ropivacaine group was 6 hours later, while in the lidocaine group, it was 3 hours after surgery, and both groups had a decreasing trend after that.

Clinical investigations have demonstrated the effectiveness of ropivacaine, a local anesthetic that is chemically different from the most often used local anesthetic in dentistry, lidocaine, which is the gold standard of anesthetics [8]. The potency and toxicity levels of the local anesthetic agent are affected by its chemical structure. The tissue pH and pKa and concentration of the anesthetic agent are the important factors influencing the onset and duration of local anesthesia [11, 12]. Moreover, higher dissolution rate in fats and protein binding capacity play a role in the onset and effectiveness of anesthetics [13]. The anesthetic pKa of ropivacaine is equal to 8.1 and lidocaine is equal to 7.9 [14]. Due to all these factors, the ropivacaine group showed fewer pain score in all postoperative intervals than lidocaine, as found in the present study. Corroborating with our findings, ropivacaine showed more effectiveness, less pain in postoperative intervals, and later onset of pain compared with lidocaine [4, 8, 10, 15-17].

It has been observed that 0.5% and 0.75% ropivacaine induced better anesthesia in inferior alveolar nerve block injection than in maxillary infiltration [18-20]. The onset of anesthesia was significantly faster in 0.75% than in 0.5% ropivacaine [21]. Thereby, a concentration of 0.75% ropivacaine was used in this study similar to the study of Rajpari and colleagues [15].

The effect of using ropivacaine on bleeding during third molar surgery was not investigated in previous studies. However, the bleeding rate in blepharoplasty surgery using ropivacaine anesthesia has been reported to be less than prilocaine [22]. Also, the bleeding rate in cleft palate graft surgery in the ropivacaine group was lower than in the lidocaine group [23]. In the present study, intraoperative bleeding was significantly lower in the ropivacaine group. Using ropivacaine reduced intraoperative bleeding which can give a surgeon better view and access.

Anesthetics may cause several adverse reactions. Hyperventilation, nausea, and changes in blood pressure are the most often reported consequences [5, 24]. Changes in blood pressure and heart rate have been reported in the injection of 2% lidocaine, while these changes were less in the injection of ropivacaine in different concentrations [15, 25]. Allergies can also occur after anesthesia injection, and their symptoms may be confused with psychogenic complications. Allergies to other ingredients in the cartridges such as methylparaben may also exist. There is also a sensitivity to sulfites, which are a type of antioxidant in anesthesia cartridges. Antioxidants are present in cartridges containing epinephrine [5, 24].

The use of vasoconstrictors can extend the duration of local anesthesia effect, particularly when the anesthetic has a short or intermediate duration of action. Nevertheless, the length of this extension is observed to be shorter when using long-lasting anesthetics[26]. Epinephrine is a vasoconstrictor administered with anesthetics to prevent vasodilation effect of them. Due to ropivacaine vasoconstriction properties, using ropivacaine may be a good option when using vasoconstrictors is contraindicated.

The studies conducted on the effectiveness of ropivacaine anesthesia for intraoral surgeries are very limited. In the present study, other factors such as pain during surgery, duration of onset of anesthesia, time of disappearance of anesthesia, vital signs, blood pressure, and heart rate were not recorded. For this reason, it is suggested that future studies investigate these factors.

CONCLUSION

The use of 0.75% ropivacaine anesthesia is more effective than 2% lidocaine with 1:100000 epinephrine in controlling postoperative pain and intraoperative bleeding. Therefore, ropivacaine

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is a safe, effective, and clinically acceptable local anesthesia for the surgical removal of third molars.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this study.

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