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RESEARCH ARTICLE

Is Preemptive Analgesia Effective on Postoperative Complications Occurring After Impacted Third Molar Surgery under General Anaesthesia?

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ABSTRACT

Introduction: In this study, it was aimed to investigate the effects of preemptive analgesia on postoperative pain severity, pain onset time, analgesic need, edema and trismus caused by impacted third molar surgery.

Material and Methods: ASA I-II group of patients who underwent third molar surgery under general anesthesia was given intravenous 0.3 mg/kg tenoxicam 20 minutes before the surgery and 20 minutes after the end of the surgery. The data records of the patients who were applied tenoxicam were examined regarding VAS values, and the presence of swelling and trismus, retrospectively.

Results: The VAS values in the preemptive group were significantly lower than the values in the group 2 at the postoperative 1st, 3rd and 6th hours ($p<0.05$). It was found that 36 patients (76.6%) in group 2, and 13 patients (31.0%) in group 1 needed additional postoperative analgesia. Trismus was observed in 28 patients (59.6%) in the group 2 and 6 patients (14.2%) in group 1. Analgesia time provided in the preemptive group was found to be significantly longer than the postoperative group ($p <0.05$).

Conclusion: We believe that preoperative analgesic application as part of multimodal analgesia in patients undergoing impacted third molar surgery under general anesthesia offers successful and reliable results in postoperative pain management.

Keywords: third molar surgery, preemtive analgesia, postoperative pain

INTRODUCTION

Impacted third molar surgery is one of the most performed operations in oral and maxillofacial surgery. Pain occurring after the surgical extraction of impacted wisdom teeth is a distressing problem for both the patient and the oral surgeon that affects the quality of life of patients. Various medications and methods are applied before and/or after the operation to prevent pain after surgical extraction.

The concept of preemptive analgesia minimizes postoperative pain by preventing central sensitization. Central sensitization due to tissue damage can be inhibited by the preoperative administration of an analgesic. Crile, who introduced the method of preemptive analgesia, advocated the use of regional blocks in addition to general anaesthesia to prevent intraoperative nociception caused by changes in the central nervous system during surgery.[1] Woolf, on the other hand, suggested that the administration of opioids or local anaesthetics before surgery

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may prevent intraoperative nociception caused by changes in the central nervous system during surgery, thereby reducing the intensity of postoperative pain.[2]

The purpose of preemptive analgesia is to prevent or reduce the occurrence of any pain memory in the nervous system and, in turn, the need for analgesia. This is considered as a successful method to suppress postoperative pain that will occur. For this purpose, opioids, local anaesthetics, COX-2 inhibitors, nonsteroidal anti-inflammatory drugs (NSAIDs) can be used as medication.[3]

This study aims to investigate the effect of preemptive analgesia on early postoperative pain control in patients who underwent impacted third molar surgery under general anaesthesia, as well as the effects of swelling and trismus, a natural result of the inflammatory process.

MATERIAL AND METHODS

Patient file records were selected from cases performed with general anesthesia under standard conditions in the Aydın Adnan Menderes University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery operating room. This study followed the recommendations of the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist. The study was approved according to the ethical rules of the Declaration of Helsinki by the Ethics Committee of Aydın Adnan Menderes University Faculty of Dentistry with the protocol number ADÜDHF2019/067, based on the opinion that it was not against the ethical rules.

The study retrospectively analysed patients who had undergone third molar surgery under general anaesthesia. The surgery was for asymptomatic, intraoral unexposed full mucous and/or bone retention. ASA [The American Society of Anaesthesiology] I-II patients who were applied routine anaesthesia protocol according to recorded file data matching the criteria were included in the study. Patients with symptoms of pain, swelling and/or infection before the operation, impacted teeth associated with pathological lesions, drug allergy, and uncontrolled systemic disease, multidisciplinary dental procedures, and records with missing data were excluded from the study.

Our routine general anaesthesia protocol was applied to all patients included in the study. In this protocol, following induction of anaesthesia by using 1 ug.kg-1 fentanyl, 2 mg.kg-1 propofol, and 0.8 mg/kg-1 rocuronium, patients were administered 1-2% volume of sevoflurane in 50% O_2 and 50% N_2O for maintenance of anaesthesia. After the patients were taken to the recovery room following extubation after surgery, all hemodynamic parameters (ECG, NIBP, SpO2), vital signs, and early postoperative complications were recorded.

Tenoxicam, which is a nonsteroidal anti-inflammatory drug, was used as analgesic medication. According to the preferred postoperative pain management modalities, patients were divided into two groups based on the information regarding the time of application of Tenoxicam. Patients who were applied Tenoxicam 0.3 mg/kg-1 20 minutes before the start of surgery were defined as the Group 1-preemptive group, and those who were applied 20 minutes after the end of the surgery, i.e. conventionally, were defined as the Group 2-postoperative group. To assess the effect of analgesia modality on pain in hourly follow-ups in the early postoperative period, the records in patient files regarding VAS values, presence of pain and pain onset time, additional analgesic requirements, as well as the presence of swelling and trismus were used.

The visual technique of VAS (Visual Analogue Scale) was used to measure the pain level. With the inclusion of asymptomatic teeth in the preoperative period, the patient's preoperative VAS score was assumed to be 0. As for pain levels for each individual, values recorded at the 1st, 3rd, and 6th hours from postoperative routine hourly measurements were used. While evaluating the presence of pain in the early postoperative period, the patients with VAS pain score 0 at the end of the first 6 hours were categorized under the heading 'pain absent', and those with a value other than 0 in the first 6 hours were categorized as 'pain present'. Postoperative analgesics applied after the recovery period of the patients were expressed in the file data as 'present' or 'absent' under the heading "additional analgesic requirements". In the patient file data, pain onset time records, which indicate the termination of the analgesic effect, were used to evaluate this parameter.

The presence of trismus was defined by considering preoperative and postoperative mouth opening measurements specified by the determination of incisal edge distance between the maxillary and mandibular 1st incisors by means of the digital calliper in millimetres, as well as expressions indicating restriction to mouth opening, and records of feeding difficulty related to mouth opening that were in patient file data. Patients were categorized as 'trismus present' and 'trismus absent' by

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considering the measurements in the data and expressions of mouth opening restriction.

VAS method was used to assess edema after surgical procedure. VAS edema scores recorded in the 6th postoperative hours were used in postoperative edema size determination. At the postoperative 6th hour, a value between 1 and 3 was used for postoperative edema size determination, as "1 = No/ mild swelling" - "2 = moderate swelling" - "3 = severe swelling" (Table 1).

Table 1. Expressions Used in the Evaluation of Edema

1- Mild Swelling	No swelling/There is mild swelling but not noticeable
2- Modarete Swelling	Swelling is noticeable but does not hinder chewing movements much
3- Severe Swelling	Swelling is noticeable and severely restricts chewing function

Statistical analysis

Statistical analysis was performed using SPSS (version 18.0, SPSS Inc., Chicago, Illinois, USA). The normal distribution assumption of the data was checked with the Kolmogorov-Smirnov test. Correlations between categorical variables were analysed by the Chi-squared test. Comparisons between groups were analysed using the Mann-Whitney U test. Descriptive statistics were presented as SD and interquartile range (IQR), number and percentage, quantitative and categorical variables, and mean, respectively. A p-value of <0.05 was considered significant for all comparisons.

RESULTS

Archives of a total of 89 patients, 46 males, and 43 females were included in the study. Flowchart of the patients in the study formed according to the inclusion criteria is shown in figure 1.

The fact that no statistically significant difference was found (p>0.05) between postoperative and preemptive groups in terms of the distribution of the duration of surgery from the incision to the performance of the final suture, the number of operated teeth, the tooth, and jaw relationship that indicates the position of the jaw where the impacted third molar teeth were operated, and the dental retention type of the

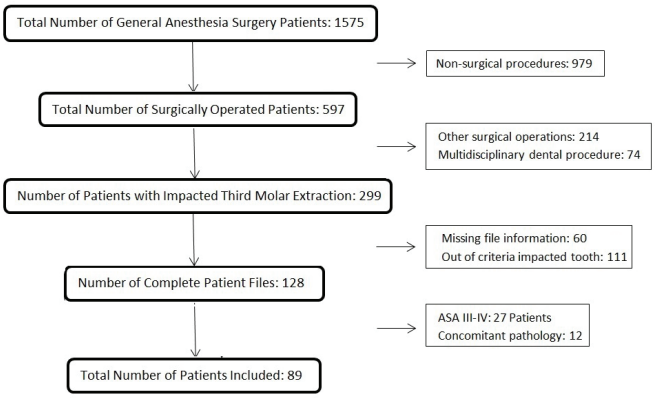

Figure 1. Flowchart of the patients in the study formed according to the inclusion criteria

impacted teeth that were operated was evaluated in favor of standardization in the study regarding the effect of surgical factors on postoperative early period pain severity. This, in turn, was evaluated in favor of standardization in terms of assessing postoperative early period pain management with different analgesic methods in patients who underwent impacted third molar surgery under varying general anaesthesia.

The patient age range in the selected archives is 22-36. Table 2 summarizes the mean and p values of the demographic data. There was no statistically significant difference between postoperative and preemptive groups in terms of age, gender, body weight, ASA classification (p>0,05). This, in turn, was evaluated in favour of standardization in terms of assessing postoperative early period pain management with different analgesic methods in patients who underwent impacted third molar surgery under varying general anaesthesia.

Table 3 contains information about the operated teeth. The distribution of teeth in the maxilla and mandible, the number of teeth extracted per patient and the impaction status of the teeth are seen.

Table 4 summarizes the mean and p values of the postoperative data in our study. According to the preference of the postoperative analgesic method, the VAS pain values recorded at 1st hour show a statistically significant difference (p <0.05). The VAS pain values at the 1st hour in the postoperative group were statistically significantly higher than the preemptive group.

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Table 2. Demographic data of Preemptive and Postoperative groups

		Group1 (Preemptive) (n = 42)	Group2 (Postoperative) (n=47)	p value
Age (years)		27.0 (22.0-34.0) 28.62 ± 8.51	29.0 (23.0-36.0) 30.94 ± 9.60	0.934
Body Weight (kg)		65.0 (59.5-75.3) 67.45 ± 11.05	70.0 (58.0-77.0) 67.23 ± 31.42	0.234
Gender	Female	21 (50%)	22 (46.8%)	0.101
	Male	21 (50%)	25 (53.2%)	
ASA	I	31 (73.8%)	34 (72.3%)	0.934
	II	11 (26.2%)	13 (27.7%)	

P<0.05 value was considered statistically significant

Table 3. Teeth distributions of Preemptive and Postoperative groups

		Group1 (Preemptive) (n = 42)	Group2 (Postoperative) (n=47)	p value
Number of teeth of the patient		1.31 ± 0.75	1.36 ± 0.81	0.751
Impacted Teeth	Bone	26 (61.9%)	36 (76.6 %)	0.234
	Mucosal	16 (38.1%)	11 (23.4%)	
Teeth - Jaws	Maxilla	12 (22.2%)	18 (28.1%)	
	Mandible	42 (77.8%)	46 (71.9%)	
	Total	54	64	

P<0.05 value was considered statistically significant

Table 4. Postoperative data of preemptive and postoperative groups

		Group1 (Preemptive) (n=42)	Group2 (Postoperative) (n = 47)	p value
Postoperative pain (VAS) 1st hour		0.0 (0.0-0.0) 0.15 ± 0.02	0.0 (0.0-1.0) 0.54 ± 0.28	0.003
Postoperative pain (VAS) 3rd hour		0.0 (0.0-2.0) 1.06 ± 0.88	1.0 (2.0-3.0) 1.85 ± 1.21	<0.001
Postoperative pain (VAS) 6th hour		2.0 (1.0-2.3) 1.86 ± 1.37	4.0 (2.0-6.0) 3.89 ± 1.77	<0.001
Pain onset time		3.0 (3.0-5.0) 3.78 ± 0.95	3.0 (1.3-3.0) 2.77 ± 1.29	0.002
Early postoperative period presence of pain	Absent	19 (45.2%)	3 (6.4%)	<0.001
	Present	23 (54.8%)	44 (93.6%)	
Additional analgesic requirement	Absent	29 (69.0%)	11 (23.4%)	<0.001
	Present	13 (31.0%)	36 (76.6%)	
Swelling	Mild	23 (54.8%)	17 (36.2%)	0.020
	Moderate	17 (40.5%)	18 (38.3%)	
	Severe	2 (4.8%)	12 (25.5%)	
Trismus	Absent	36 (85.7%)	19 (40.4%)	<0.001
	Present	6 (14.3%)	28 (59.6%)	

p <0.05 value was considered statistically significant.

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While the mean VAS pain score record at the 1st was 0.54 ± 0.28 in the postoperative group, it was 0.15 ± 0.02 in the preemptive group. When the VAS pain values recorded at the 3rd hour are considered, the mean VAS pain score record was 1.85 ± 1.21 in the postoperative group and 0.15 ± 0.02 in the preemptive group. The VAS pain values at the 3rd hour in the postoperative group were statistically significantly higher than the preemptive group (p<0,05). When the VAS pain values recorded at the 6th hour are considered, the VAS values at the 6th in the postoperative group were statistically significantly higher than the preemptive group (p<0,05). When compared between groups, the mean 6th-hour VAS pain score record was found 3.89 ± 1.77 in the postoperative group, and 1.86 ± 1.37 in the preemptive group. When the hourly VAS pain scores were evaluated and the presence of early postoperative pain was examined, 44 patients had pain and 3 patients had no pain in the postoperative group, whereas 23 patients had pain and 19 patients had no pain preemptive group. Between the groups, the presence of early postoperative pain is statistically significantly higher in the postoperative group than in the preemptive group (p<0,05) (Figure 2).

When the pain onset time was evaluated, the mean pain onset time in the postoperative group was found as 2.77 ± 1.29 hours, and it was 3.78 ± 0.95 in the preemptive group. The preferred postoperative analgesic method shows a statistically significant difference (p<0,05). The time provided for analgesia in the preemptive group was statistically significantly longer than the postoperative group.

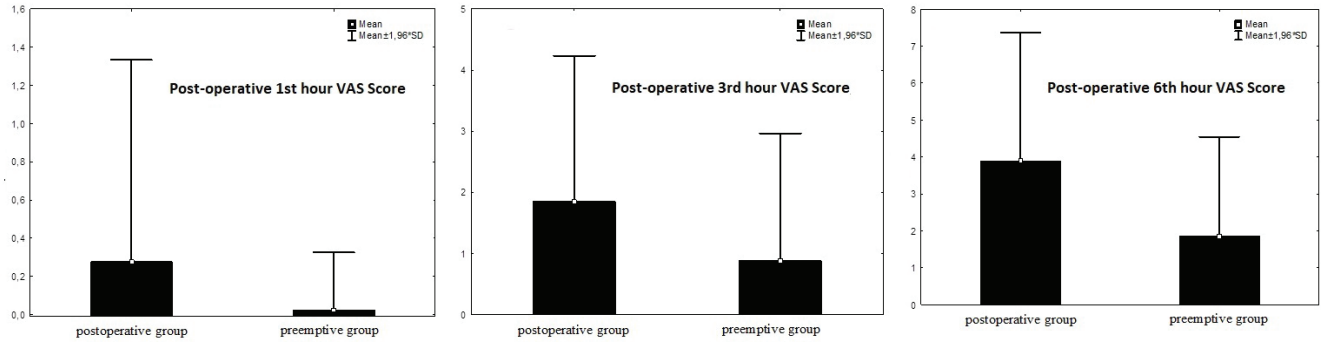

Figure 2. Postoperative VAS scores of preemptive and postoperative groups (A: 1st hour; B: 3rd hour C: 6th hour)

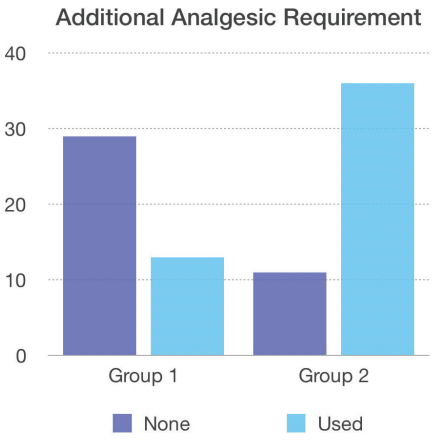

Figure 3. Additional analgesic requirements of preemptive and postoperative groups in the first 6-hour period

According to the preference of the postoperative analgesic method, additional analgesic requirement in the first 6-hour period was statistically significantly higher in the postoperative group compared to the preemptive group (p<0,05). In the postoperative group, 36 patients required additional analgesia and 11 patients did not, while in the preemptive group, 13 patients required additional analgesia and 29 patients did not (Figure 3).

In the postoperative group, 17 mild, 18 moderate, 12 severe edema values were found, whereas, in the preemptive group, 23 mild, 17 moderate and 2 severe edema were scored. The amount of postoperative edema in the postoperative group is statistically significantly higher than in the preemptive group (Figure 4).

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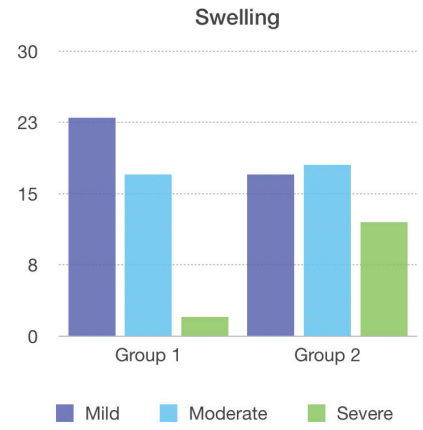

Figure 4. Postoperative edema values of preemptive and postoperative groups

According to the preference of the postoperative analgesic method, trismus shows a statistically significant difference ($p<0,05$). In the postoperative group, a total of 28 patients had trismus after surgery and 19 patients had none. In the preemptive group, 6 patients had trismus after surgery and 36 patients had none. According to our evaluation, the amount of trismus after surgery in the postoperative group is significantly higher than the preemptive group (Figure 5).

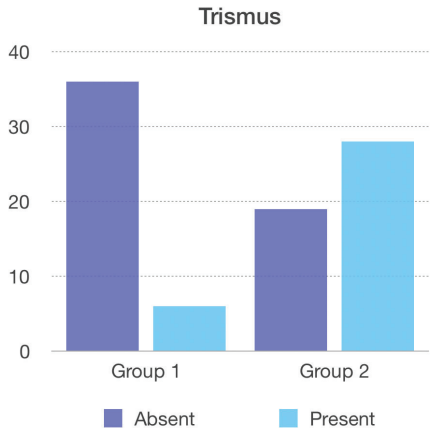

Figure 5. Postoperative presence of trismus in preemptive and postoperative groups

DISCUSSION

Third molars have the highest incidence of impacted teeth, and postoperative complications on these teeth extraction are among the most common conditions encountered by oral and maxillofacial surgeons.[4] The preemptive analgesia method, which is one of the pain management modalities, can be used to prevent or minimize the pain that occurs after the extraction of the impacted third molar.[5] Preemptive analgesia application is defined as the treatment that prevents the occurrence of central sensitization caused by incisional and inflammatory injuries.[6] The prevention of central sensitization, which is aimed with the preemptive application of drugs, begins before the incision and continues during the surgery and in the postoperative period. Thus, physiological pain can be treated and pathological pain can be prevented. In a study conducted by Kara et al. with 50 patients scheduled for graft/flap repair, it was determined that preemptive dexketoprofen administration kept postoperative VAS pain score and extra tramadol consumption lower.[7]

NSAIDs are frequently used as an alternative to opioids in preemptive analgesia applications. Various studies indicate that the quality of postoperative analgesia increases when NSAIDs are applied pre-emptively.[8] Tenoxicam is a long-acting, IV NSAID agent which is frequently used in mild and moderate pain, and also an oxicam derivative. NSAID application can provide effective analgesia in the postoperative period [9].

Postoperative pain severity reached the maximum level in the first 6 to 12-hour period.[5,10] In our study, we examined the measurement scores at the 1st, 3rd and 6th hours, by taking into consideration the pain reaching the maximum level in the early postoperative period and similar applications in the literature and using the registered VAS scales of the patients. In their study on 41 patients undergoing laparoscopic cholecystectomy, Yağar et al. applied tenoxicam 40 mg iv to patients 30 minutes before surgery and at the end of the surgery, and compared their effectiveness on postoperative pain, and stated that preemptive application does not change pain perception compared to the application at the end of surgery. [11] İlhan et al. compared the effects of methylprednisolone and tenoxicam on pain, edema and trismus after mandibular third molar extraction and observed that tenoxicam was more effective in postoperative pain control.[12] They reported that preemptively applied tenoxicam provided better analgesia than the one applied after induction. This conclusion is supported

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by the fact that, according to the statistical results obtained in our research, when considered separately, the VAS pain measurement values at the 1st, 3rd and 6th hours of the patients in the group who were applied preemptive tenoxicam were statistically significantly higher than the VAS data at the 1st, 3rd and 6th hours in the postoperative group.

There are a limited number of studies evaluating the parameter pain onset time. In their study evaluating the effects of preemptive gabapentin and preemptive pregabalin application on postoperative early neuropathic pain management in 60 patients, Saraswat et al. reported that these applications provided effective analgesia, and effective analgesia times were achieved.[13] As a result, it was determined that the postoperative analgesic duration of preemptive tenoxicam application was significantly extended and the requirement for additional analgesic was significantly reduced. The statistical results of our study have also followed a similar trend. Postoperative early period pain onset times were significantly higher in the group of patients with preemptive analgesia application compared to the postoperative group. In our study, an additional analgesic requirement in the postoperative group in the early postoperative period was significantly higher than the preemptive group supports this effect of preemptive analgesia.

The data related to the edema that occurred as a natural result of the inflammatory process along with postoperative pain were also included in the study. In our study, VAS edema scores recorded at the postoperative 6th hour were used to determine the amount of edema. In their study conducted on 60 patients to evaluate the effect of the preemptive application of diclofenac sodium on postoperative pain, trismus, and edema occurring after impacted third molar extraction, Shah et al. found that it was more effective in postoperative pain management, but did not provide effective management in the amount of edema and trismus.[14] Cebi et al. examined the effect of diclofenac sodium and tenoxicam on trismus and edema after impacted third molar surgery and reported that tenoxicam provided more effective control.[15] According to the statistical results of our study, the fact that postoperative edema amount was significantly higher in the postoperative group compared to the preemptive group confirms the effect of preemptive analgesia on managing the inflammatory process in the early postoperative period.

Trismus is very strongly related to postoperative pain, therefore it is stated that pain is among the most important causes of the occurrence of trismus. Hupp claimed that postoperative edema and trismus are not related to the duration of surgical intervention, but postoperative trismus was caused by the pain after surgery. The restriction to mouth opening, which starts after molar surgical procedures, increases and reaches the maximum level on 1st and 2nd days.[16] In our study, after the termination of surgical intervention, the myorelaxant effect of the agent applied during the routine general anaesthesia procedure was antagonized with the application of atropine and neostigmine to the patients, and the myorelaxant effect factor of the intraoperative medication on postoperative trismus was thus excluded. In their study involving 29 patients, Moore et al. examined the effect of the preemptive application of rofecoxib and dexamethasone on trismus and pain occurring after impacted third molar surgery, and reported that these provided effective management.[17] Considering the statistical findings in our study, the difference between the trismus presence data of the patients in the preemptive group and the patients in the postoperative group shows that preemptive anaesthesia application provides effective management over trismus.

The effectiveness of postoperative analgesia is directly related to the severity of complications, regardless of preferred pain management modalities. In this regard, the type and duration of surgery, the extent of tissue damage, the presence of infection, the relationship of the tooth with the alveolar canal, the type of impacted tooth retention, the physiological and psychological state of the patient are among the factors.[18] Many of these are difficult to control in studies. The retrospective nature of the article can be seen as a limitation of the study. Due to the data loss, the number of patients was limited. Among the limitations of our study are that maxillary and mandibular surgical procedures were included in the same evaluation in the patient file selections made in our study, that the operations were not performed by the same surgeon in terms of physician experience factor directly affecting the surgical time. In future studies, increasing the number of patients by conducting prospective studies will increase the power of the article.

CONCLUSION

Preemptive analgesic applications used in the management of postoperative pain are gradually becoming established in routine dentistry practice. In addition, we concluded that

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it postpones pain onset time, reduces additional analgesic requirement, and decreases the amount of trismus and edema. Therefore, we believe that preoperative analgesic application as part of multimodal analgesia in patients undergoing impacted third molar surgery under general anaesthesia offers successful and reliable results in postoperative pain management.

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Author contributions

All authors read and approved the final manuscript. M.H.T.: Acquisition, interpretation and analysis of data, Study coordination, manuscript drafting of manuscript. H.O.Ş.: Conception, and design of intellectual and scientific content of the study, interpretation, and analysis of data; manuscript writing. Ö.K.: Conception, and design of intellectual and scientific content of the study, Interpretation and analysis of data, manuscript writing, critical revision.

Declaration of Competing Interest

None.

Patient consent

Not required.

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