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Evaluation of the average number of anesthetic tubes for effective analgesia and intervention time in surgery of impacted mandibular third molars

Abstract

Surgical removal of third molars is the most common type of surgery in dentistry. It is estimated that more than 10 million third molar extraction surgeries are performed in Brazil each year, even considering that this intervention is mandatory for the Unified Health System (SUS) through the Dental Specialty Center (CEO). There are several protocols for performing the surgery, from the safe amount of anesthetic to the sections of the impacted tooth, in addition to the time variation depending on the degree of difficulty. This study is part of a bioequivalence clinical trial to evaluate the efficacy and safety of postoperative pain control after surgeries to remove impacted lower third molars in 231 participants of both sexes, aged 18 to 40. Among the exclusion criteria, two situations initially proved challenging: performing the surgical procedure in up to 50 minutes and using a maximum of two tubes of the anesthetic mepivacaine hydrochloride 2% with epinephrine 1:100,000. Therefore, the objective of this study was to evaluate, using standard anesthetic techniques, the average number of anesthetic tubes used that produced sufficient analgesia for the removal of impacted mandibular third molars, as well as the average time from intervention to suturing. It can be concluded that in 92.2% of cases, up to two tubes of anesthetic were sufficient for analgesia and completion of the surgical procedure in up to 50 minutes. In 18 participants (7.8%), more than two to four anesthetic tubes were required and the operative time was longer than 60 minutes.

Keywords: local anesthetics, oral surgery, third molar, impacted teeth, mepivacaine

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Introduction

Third molar extraction is the most common surgery in dentistry, being a frequent procedure in Brazil, with approximately 10 million extractions annually, including those offered by the SUS (Unified Health System) and by Dental Specialty Centers (CEO). The reasons for these extractions are malposition, difficulty in hygiene, carious lesions, periodontal disease, and the presence of cysts or tumors.

Naghipour et al.,[1] evaluated anesthesia method comparing effect lidocaine only with application of lidocaine and articaine reducing complications and impacted third molar surgery on 13 patients referred elective surgical removal with similar difficulty on both sides. Each patient was randomly assigned 2% lidocaine for conventional inferior alveolar nerve block and 4% articaine for local infiltration before surgery on one side (group A) and 2% lidocaine only block and infiltration before surgery on other side (group B). Choice of appropriate anesthetic on oral surgery, specifically impacted third molar surgery, depend on clinician's opinion however, it appears that combination of lidocaine and articaine control patient pain significantly better than lidocaine only.

Velioglu et al.,[2] compared anesthetic efficacy, duration of anesthesia, postoperative analgesia lidocaine and bupivacaine, and differences in hemodynamic parameters in 38 patients aged 18 to 40 years who required extraction impacted third molars being two local anesthetics were randomly selected for dental extractions. Parameters evaluated were onset of anesthetic action, duration of surgery, duration of postoperative analgesia, and postoperative visual analog scale scores. Analysis of anesthesia time showed difference approval of lidocaine. Duration of action was longer in bupivacaine group than lidocaine group. According to study results, postoperative analgesic efficacy of bupivacaine was alike that of lidocaine. Lidocaine and bupivacaine should be used in dental practice; however, slower effect of bupivacaine and faster effect of lidocaine make the latter preferable.

Yang et al.,[3] commented that there is currently no evidence comparing anesthetics. Comprehensive review of the PubMed, ScienceDirect, CENTRAL, Embase, Web of Science, CBM, and CNKI databases, 33 clinical trials analyzed using assessment, development, and classification to determine the overall quality of evidence in all comparisons. Success rate of inferior alveolar nerve block 2% lidocaine and epinephrine was lower than of combined buccal (IB) and lingual (IL) infiltration of 4% articaine. Meta-analysis demonstrated that intraosseous injection of 4% articaine and epinephrine had higher success rate. However, combination of IB and IL 4% articaine and epinephrine and lingual infiltration 0.5% bupivacaine is,according to the visual analog scale, most effective. Rapid onset of action was produced by combined IB with IL 4% articaine with epinephrine and by inferior alveolar nerve block (IANB) 2% mepivacaine with

epinephrine, while longest duration action was generated by IANB of 0.5% levobupivacaine or 0.5% bupivacaine.

Bhattarai et al.,[4] compared anesthetic and analgesic efficacy bupivacaine with other local anesthetics used in lower third molar surgeries. Used electronic databases (PubMed, Scopus, Cochrane, and Web of Science) of randomized clinical trials published up to February 10, 2019. Anesthetic and analgesic efficacy was assessed by 6 outcomes: onset of anesthesia, success, duration of analgesia, pain score at the fourth postoperative hour, and number of analgesics consumed in 1,078 lower third molar surgeries in 858 patients. The local anesthetics were bupivacaine, lidocaine/lignocaine, articaine, etidocaine, levobupivacaine, and carbonated bupivacaine. Compared to other anesthetics, bupivacaine showed a longer duration of anesthesia, lower pain scores at 4 and 8 hours post-operatively, and a lower need of analgesics, without statistically significant between local anesthetics relation to anesthesia success and duration of analgesia. Exception of onset of anesthesia, bupivacaine demonstrated better anesthetic and analgesic properties than other local anesthetics in third molar surgery.

Ferreira Filho et al.,[5] reported accidents and complications related third molars and procedures and precautions to be taken using literature review methodology whose research sources were: Google Scholar, Scientific Electronic Library (SciELO), PubMed, and books. Third molar extraction frequently performed in surgical clinics, and imaging examination is important good diagnosis and surgical planning. Theoretical and practical knowledge of dentist is essential, including familiarity with the anatomical area and its development. Pre-, trans, and post-operative care is important to avoid accidents and complications during extraction, and prevention is the main objective associated with professional's knowledge.

Malamed[6] pointed out duration of local anesthetics is intermediate, equivalent 60 minutes. In fact, 2% mepivacaine with 1:100,000 epinephrine begins its anesthetic effect between 3 and 5 minutes, with average duration of 1.9 hours, whose onset of action is faster than other salts (1.5 minutes), making it indicated for surgeries of intermediate duration. Furthermore, it showed characteristics and benefits of epinephrine, a reference vasoconstrictor compared other vasoconstrictors in terms of potency and safety, acting similarly to endogenous adrenaline released by the adrenal gland. Epinephrine associated local anesthetics, at existing concentrations, is well tolerated in patients with cardiovascular diseases, considering minimum quantity for maximum product efficacy, i.e., maximum of 2 ampoules for cardiac patients, prior aspiration, and slow injection. Its overall efficacy is comparable to lidocaine, with greater potency, lower toxicity, and greater safety. The cartridge is unbreakable even if dropped on the floor and does not deform inside the syringe during application.

Rossi et al.,[7] evaluated efficacy of different anesthetic solutions in controlling pain immediately after tooth extraction. In 9 databases used to identify randomized clinical trials, without restrictions on language or year of publication, with 13 studies included in meta-analysis. 2% Lidocaine + clonidine showed lower pain scores compared to 4% articaine + epinephrine, followed by 0.5% bupivacaine + epinephrine. Concluded that 2% lidocainewith clonidine and 0.5% bupivacaine with epinephrine were anesthetics most likely to control pain immediately after surgical removal of impacted third molars. The use of anesthetics with effective pain control may contribute to a more comfortable postoperative period.

Amorim et al.,[8] compared efficacy local anesthesia a 0.75% ropivacaine versus 2% lidocaine with 1:100,000 epinephrine in postoperative analgesia following extraction of impacted third molars. Pain recorded using the visual analog scale (VAS) at 4, 8, 12, 24, and 48 hours post-surgery. Analgesic use and presence of adverse effects were recorded. Duration of soft tissue anesthesia with ropivacaine was significantly longer than lidocaine group. Lidocaine group showed significantly higher VAS scores all postoperative time intervals, except last 48 hours. Analgesic use was higher in lidocaine group. Two patients in each group used rescue medication and postoperative bleeding was noted in the ropivacaine group. Concluded ropivacaine injection prior to surgical procedures may be associated preventive analgesia in the extraction of lower third molars.

Tokuç and Coşkunses[9] evaluated anesthetic, analgesic, and hemodynamic effects of articaine and bupivacaine in 26 patients undergoing bilateral extraction of lower third molars, divided into 2 groups: articaine and bupivacaine. Parameters analyzed were: onset of anesthetic action, intraoperative comfort, quantity of solution used, duration postoperative anesthesia and analgesia, need for rescue analgesics, postoperative pain, intraoperative bleeding, and hemodynamic parameters. Articaine group, the onset of anesthetic action was faster, intraoperative comfort was greater, and anesthesia was effective, requiring less local anesthesia. Bupivacaine group showed a longer duration anesthesia and postoperative analgesia and lower values on visual analog scale (VAS) at 6 and 48 hours after surgery. There was no statistically significant difference between the 2 solutions regarding use of rescue analgesics, intraoperative bleeding, or hemodynamic parameters. Concluded that articaine showed greater clinical efficacy than bupivacaine in intraoperative anesthesia, with faster onset of anesthetic action and greater comfort, requiring less reinforcement during surgery. Bupivacaine was superior in terms of postoperative anesthesia, reducing postoperative pain due to residual anesthetic and analgesic effects. Both anesthetic solutions showed similar hemodynamics at low doses.

Conceição et al.,[10] in review on complications associated with the extraction of semi-impacted or impacted third molars using odontosection or osteotomy and commonly employed techniques, as well as coronectomy, rarely used technique despite being safe, easy to perform, and avoiding injury to inferior alveolar nerve. The main surgical complications reported in literature are pain, paresthesia, hemorrhage, edema, trismus, root fractures, alveolitis, acute infection, orosinusal communication, tooth displacement to vital regions, and even rare lesions such as subcutaneous emphysema. The main factors causing post-surgical complications of third molar extraction, as cited, were failure in therapeutic planning, inadequate surgical technique, incorrect use of instruments, excessive force at site, and professional inexperience.

Couto et al.,[11] stated that third molar extraction is procedure with potential risk of difficulty, making planning necessary to prevent accidents and postoperative complications. Although surgeries are performed by specialized and trained professionals, they are not without complications. The authors selected 19 studies indexed in VHL, Lilacs, SciELO, and PubMed databases. Third molar removal involves complications such as alveolitis, hemorrhages, nerve injury, and fractures. In the literature, these complications are fortunately not routine, but they do exist. It is important have knowledge and mastery of subject, both in prevention and in managing the situation.

Flor et al.,[12] stated that complications occur after surgery, although these unplanned events occur during the intraoperative period. The literature indicates that among the main accidents and complications during and after third molar extraction are tooth fracture, paresthesia of the inferior alveolar nerve, orosinusal communication, hemorrhage,

hematoma, alveolitis, pain, edema, trismus, joint displacement, and mandibular fracture. It is important that the dentist seeks prior theoretical and practical knowledge of the dental procedures to be performed, as well as conduct and care in cases of complications. In this literature review on surgical complications and accidents involving third molars, the objective was to discuss factors that lead to their occurrence, with the selected databases being Google Scholar and PubMed, chosen according to inclusion and exclusion criteria.

Berriel et al.,[13] determined the profile third molars in patients indicated extraction, and surgical treatment performed. Patient data were obtained from treatments performed at faculty clinics, including personal information, presence or absence of systemic diseases, Pell & Gregory and Winter classifications third molars, and whether the tooth caused any mechanical, nervous, infectious, or tumoral disturbance. A form regarding the postoperative period was completed indicating the occurrence of any disturbance. Over three years, 134 patients were treated, 57% women and 43% men, aged between 20 and 29 years, totaling 275 extracted teeth. In 54% of cases, lower molars were extracted, with positions A and class II being the most prevalent, according to the Pell & Gregory classification. All third molars with most frequent vertical position were extracted, present in 58% of cases, according to Winter classification. Concluded that majority of patients were female and that extraction procedures lower third molars were predominant. The most frequent postoperative complications were edema, alveolitis, and paresthesia of the inferior alveolar nerve.

Afonso et al.,[14] described all surgical procedures, preoperative planning of surgical technique with surgical principles are importance to reduce incidence of complications. Third molar removal is no different, but common procedure sometimes results relatively rare complications. Proposed study assessment literature on accidents and complications related to third molar lower extractions, as well as define the most appropriate procedure be performed situations. A bibliographic survey conducted in SciVerse Scopus, Scientific Electronic Library Online (Scielo), U.S. National Library of Medicine (PUBMED), and ScienceDirect databases. Articles were covered between 2010 and 2021. Complications of third molar lower extraction surgery can be classified as tooth fractures, oro-sinus communications, and lacerations, and more serious complications that often require specialized treatment, such as major oro-sinus communications, instrument fractures with total tissue penetration, some cases of needle fracture, intraoperative mandibular fractures, and other injuries to noble structures, as cases of nerve damage. Prevention of complications should be objective of surgeons, and detailed planning with professional knowledge are basic. More complex surgical technique requiring osteotomy and odontosection, greater the chance of postoperative complications, such alveolitis, trismus, and paresthesia, requiring greater caution of the professional.

Tenglikar et al.,[15] reported randomized controlled was conducted evaluate effectiveness 0.5% bupivacaine with 4% articaine lower molar tooth extraction in 100 individuals were classified 2 groups, with 50 samples each. Participants group A treated 0.5% bupivacaine with 1:200,000 epinephrine, and group B treated 4% articaine with 1:100,000 epinephrine for extraction first and second lower molars. Were evaluated criteria such onset and duration of anesthesia, pain during procedure, pain during injection, and pain after procedure. Systolic and diastolic blood pressure (mmHg) and heart rate (per minute) were all participants. There was faster of action (53.2 vs. 83.1 s) and shorter duration of action (216.6 vs. 298.4 min) with articaine (group B) compared bupivacaine (group A). Thirty-eight (76.0%) participants group A and 44 (88.0%) group B did not require re-anesthesia, while 12 (24%) participants group A and six (12%) group B required re-anesthesia, was insignificant. The articaine had faster onset of action but relatively shorter duration of action requires statistically insignificant but less re-anesthesia. As result, anesthesia with articaine can be effectively recommended oral surgical techniques.

Hemmi et al.,[16] explicate without pain postoperative period can be significantly prolonged with use long-acting local anesthetics, such ropivacaine. The local anesthetics are known their slower onset of action. To compensate a mixture of short-action (e.g., lidocaine) and long-action local anesthetics is used. However, the efficacy of anesthetic cocktail has not been elucidated in field of oral and maxillofacial surgery. Meet purpose research, this prospective randomized controlled trial included 56 patients scheduled for impacted third molar extraction. All patients received inferior alveolar nerve block (IANB) using 2% lidocaine with epinephrine or 1:1 mixture 2% lidocaine with epinephrine and 0.75% ropivacaine. Patients anesthetized lidocaine-ropivacaine mixture significantly prolonged postoperative analgesia and pain control than anesthetized lidocaine only. Intracranial local anesthetic block (ICLB) with a mixture lidocaine and ropivacaine can provide prolonged postoperative anesthesia and pain control. The method may be notable addition to existing methods as local anesthesia extraction.

Nogueira et al.,[17] attempted to find scientific evidence, through systematic review and meta-analysis, for choice of articaine over lidocaine in removal of third molars. Searches were the MEDLINE/PubMed, EMBASE, Cochrane Library (CENTRAL), Web of Science, and SCOPUS databases in 403 articles were found, only 14 met the eligibility criteria. A total of 1,114 third molars were removed: 557 with articaine and 557 with lidocaine. Articaine had higher success rate than lidocaine, shorter subjective latency time, less intraoperative pain, longer duration, and less postoperative pain. Concluded articaine is superior to lidocaine for use in lower third molar surgeries due to its higher success rate, shorter onset, greater control intraoperative pain, and longer duration of anesthetic effect. Although more side effects than lidocaine, articaine did not cause any permanent or serious, and meta-analysis revealed no significant difference in number of events.

Oliveira et al.,[18] commented that complications range from temporary discomfort to more problems during or after surgery. This study explores strategies for effective management these challenges, highlighting importance of prior assessment, surgical planning, and application of technologies. Conducted a comprehensive literature review using PubMed and Google Scholar, with terms such as "third molar," "impacted teeth," and "surgical complications." The analysis included only articles in Portuguese to ensure accurate interpretation. Risk factors such as anatomical position, patient age, and systemic conditions were identified as decisive. Post-surgical complications related inflammation and infection require prior analysis to determine need for antibiotic therapy. The review addressed the importance of anamnesis, imaging exams, and aseptic protocols. New technologies, such as cone-beam computed tomography (CBCT), 3D printing, diode lasers, and ultrasound, were also mentioned. Concluded that third molar extraction requires careful preventive approach. Identifying risk factors, implementing preventive strategies, and using innovative technologies are basal to success of surgery.

Huang et al.,[19] compared anesthetic efficacy and safety infiltrative anesthesia 4% articaine with epinephrine 1:100,000 and block anesthesia 2% lidocaine with epinephrine 1:100,000 lower third molar extraction of 30 patients with bilateral lower third molars. Participants were assigned receive 4% articaine by infiltration anesthesia on one side and 2% lidocaine by block anesthesia opposite side. Parameters such as heart rate, blood pressure, oxygen saturation, anesthetic,

operation duration, pain score, satisfaction, and adverse events were recorded and analyzed. Finally, 26 participants with bilateral third molar extraction were included. No significant differences in heart rate, blood pressure, oxygen saturation, and maximum fluctuations during the extraction procedure between two groups, except maximum heart rate fluctuation showing statistical significance. Amount of anesthetic used was significantly lower in Articaine group than Lidocaine group. No significant differences in duration, pain score, and satisfaction between 2 groups, and no adverse events were reported in either group. Use of 4% Articaine infiltrative anesthesia offers pain control comparable to use of 2% Lidocaine for block anesthesia in third molar extraction surgery. In 4% articaine can safely achieve similar pain control with lower doses and less invasive anesthesia techniques.

Geçkil[20] evaluate preoperative anxiety and fear levels and postoperative symptoms patients undergoing impacted third molar surgery and compare relevant psychological and physical findings between genders and women at different stages menstrual cycle. The population of prospective, clinical study consisted of patients who applied to dental school impacted third molar extraction. Menstrual cycles female patients included the study ranged from 26 to 32 days. Female patients in study were divided 3 groups according first day menstrual cycle and bleeding status. All patients were administered Spielberger State-Trait Anxiety Inventory Form (STAI-S), Dental Fear Survey (DFS), Modified Dental Anxiety Scale (MDAS) preoperatively, and postoperative satisfaction and complication questionnaires. The mean age patients included the study was 27.04 ± 4.62 years. Of these patients, 79 (61.7%) were female and 49 (38.3%) were male. Female patients had significantly higher scores STAI-S, MDAS, and DFS than male patients. Female patients had significantly higher complication rates significantly lower satisfaction levels than male patients. STAI-S, MDAS, and DFS scores were high women in the secretory phase that complications were high and satisfaction low. Women have more difficulty undergoing surgical process and that timing is important reducing preoperative anxiety and fear levels increasing satisfaction levels and pos-operative complication rates.

Samieirad et al.,[21] compared effect of 0.75% ropivacaine and 2% lidocaine with 1:100,000 epinephrine on intraoperative bleeding and postoperative pain third molar surgery. This split-mouth clinical trial, 60 patients required bilateral impacted third molar were choice for surgery at the Department of Maxillofacial Surgery. Surgery was performed randomly one side ropivacaine and the other side lidocaine. Intraoperative bleeding, postoperative pain at 3, 6, 12, 18, and 24 hours after, and difficulty of surgery were measured each group and compared. All postoperative time, pain was lower the ropivacaine group than lidocaine group. Bleending rate the ropivacaine group was lower than lidocaine group. Lidocaine group, pain initially increased and after 3 hours, but decreased after the sixth hour and reached its minimum value 24 hours after surgery. The ropivacaine group, pain initially increased and peaked at 3 and 6 hours, after which decreased and reached its minimum value at 24 hours. Concluded postoperative pain was lower the 0.75% ropivacaine group than 2% lidocaine with 1:100,000 epinephrine group during all postoperative periods.The amount of bleeding during surgery was lower in ropivacaine group.

Tamer et al.,[22] confirmed that coronectomy is alternative to traditional third molar extraction when inferior alveolar nerve is associated with the roots molars. This retrospective study evaluated long-term clinical and radiographic outcomes after coronectomy, with minimum period of 5 years. All patients with impacted lower third molars treated with coronectomy at institution who agreed to return for follow-up evaluation 5 years or more after the original procedure. Postoperative clinical outcomes were assessed: inferior alveolar nerve injury, root migration distance, root exposure in oral cavity, unhealed socket, pain or tenderness in coronectomy area, and presence of periapical pathology. Of the 196 participating patients, 66 patients (32% men and 68% women) underwent a total of 75 coronectomies in study. In 2 patients required reoperation for root eruption into oral cavity. Two-thirds of roots migrated from their position in preoperative radiographs. The average migration distance was 3.2 ± 1.3 mm. In 2 patients (2.6%) presented with soft tissue pain around coronectomy site. Concluded coronectomy is effective treatment option preventing damage to the inferior alveolar nerve when it is located near the roots of these molars.

Anatomical characteristics, location, inclination and degree of retention, difficulty of access, limited mouth opening, difficulty in anesthetic absorption, surgical time, age represent traumatic overload the intervention, consequently affecting quality of postoperative period, imposing need for medication to control pain and minimize possibility of complications, which occur 10% of cases, various reasons besides postoperative pain, such as bleeding, edema, alveolitis, abscesses, trismus, paresthesia, and fractures. The amount of injectable anesthetic varies between groups and work philosophies. Some suggest up 2 tubes initially, with supplementation as needed, while others opt for higher doses, which represents a safer and uninterrupted intervention. The purpose of this study was to evaluate the minimum dose of local anesthetic applied, operating with two ampoules as needed and interventions lasting up to 50 minutes, considering cases of high difficulty.

Methodology

This work developed by the UNIFAG Research Center (Integrated Unit of Pharmacology and Gastroenterology) at São Francisco University, which evaluated effectiveness and safety a fixed-dose mixture of 10 mg ketorolac tromethamine + 50 mg tramadol hydrochloride compared to isolated active ingredients in control of acute pain.

The inclusion criteria considered were ability to understand and consent to participation in clinical trial, expressed by signing the Free and Informed Consent Form (FICF), age between 18 and 40 years, good physical and mental health, not being pregnant, with clinical and radiographic diagnosis impacted lower third molar with indication surgical removal in vertical, mesioangular, or horizontal position according to classification of Winter[23] and Class II A, Class II B, or Class III B according to classification of Pell & Gregory,[24] as shown in participants' panoramic radiographs illustrating impacted lower third molar in vertical, mesioangular, or horizontal positions (Figure 1).

Exclusion criteria were: patients with one or more flu-like symptoms such as fever, cough, dyspnea, myalgia, and fatigue; respiratory symptoms; gastrointestinal symptoms such as diarrhea in the 14 days prior to the screening consultation; presence of an event and/or disease at the site of interest that interfered with or contraindicated the surgical procedure, at the investigator's discretion; pericoronitis, periodontitis, odontogenic tumors or cysts associated or not with the tooth; trauma; presence of edema and/or bacteria in the area to be operated on; surgical procedure (consultation 0) lasting more than 50 minutes, counted from the incision of the mucosa and obtaining the flap for access to the tooth until the completion of the dental extraction, not counting the suturing procedure; surgical procedure (consultation 0) in which more than 2 tubes of 2% mepivacaine hydrochloride anesthetic with 1:100,000 epinephrine were used; Surgical procedure (consultation 0) that presented any type of unforeseen intraoperative accident, such as bleeding or injury; inferior alveolar nerve injury,

bone fracture or other complications; previous diagnosis of alcohol and drug use defined by DSM-V; current or past history (at least 12 months) of smoking, drug use, pregnancy or breastfeeding, as well as women with a positive pregnancy test (β-hCG) during the screening/selection period; clinical (physical), laboratory or cardiac (ECG) evaluation interpreted by the physician and/or researcher as a risk to the participant; bleeding or coagulation disorders; gastric ulcer and/or active peptic hemorrhage; moderate or severe renal insufficiency; chronic heart failure; cardiovascular diseases or increased risk of cardiovascular events; hypovolemia or dehydration; asthma and/or history of bronchospasm; epilepsy not adequately controlled with treatment or susceptible to seizures; known hypersensitivity to local anesthetics, especially mepivacaine, metoclopramide hydrochloride and paracetamol; Participants undergoing concomitant treatment with other NSAIDs, dipyrone, paracetamol, pentoxifylline, probenecid, or lithium salts were excluded. If the participant has used medication previously, the 7 half-lives of the medication must be respected before screening, as well as for participants undergoing treatment with monoamine oxidase inhibitors (MAOIs) in the last 14 days. After signing the Informed Consent Form, cardiac function was evaluated, as well as dental condition, including panoramic radiography, and the results of laboratory tests such as complete blood count, serum creatinine, glycated hemoglobin, total bilirubin, total proteins, serum albumin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), total cholesterol, triglycerides, prothrombin time, activated partial thromboplastin time (aPTT), and suspected pregnancy.

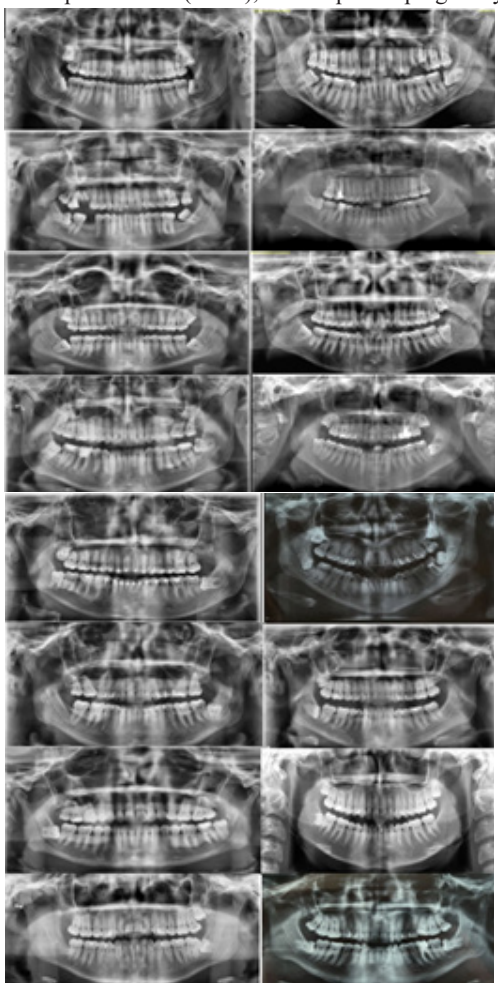

Figure 1 Panoramic views of impacted lower third molars in vertical, mesioangular, or horizontal positions.

Prior to surgery, antibiotic prophylaxis with 2 g amoxicillin was administered one hour before the procedure. Extraoral antisepsis was performed with a 2% chlorhexidine solution, and intraoral antisepsis with gauze soaked in 0.12% chlorhexidine. Local anesthesia was applied to inferior alveolar, lingual, buccal, and pterygomandibular nerves. Buccal nerve block technique was performed using 2% mepivacaine hydrochloride with 1:100,000 epinephrine, in a standardized maximum quantity of 2 tubes per surgery. A primary L-shaped incision was made for surgical access. Osteotomy of occlusal, vestibular, and distal regions of the third molar, as well coronal and/or radicular odontosections, when necessary, were performed with rotary carbide surgical burs number 702 or 703 under constant irrigation/cooling with sterile 0.9% saline solution, according to surgical needs.

Following tooth avulsion, curettage, and alveolar cleaning, the flap margins were sutured with 3.0 silk suture. The time elapsed from the primary mucosal incision was timed and recorded. Procedures exceeding 50 minutes, counted from the primary mucosal incision and flap access to the tooth until completion of the extraction, and, if necessary, the use of more than 2 carpules (tubes) of 2% mepivacaine hydrochloride anesthetic with 1:100,000 adrenaline, and/or the occurrence of any type of unforeseen intraoperative accident, such as hemorrhage, inferior alveolar nerve injury, bone fracture, or other complications, resulted in participants being considered "disqualified" according to the study's exclusion criteria. Analgesics and anti-inflammatory medication were administered. The patient returned one week later for suture removal and general evaluation.

Results

The results of this investigation are Table 1 and 2.

Table 1 Representation of results indicating the number of tubes used for sensitivity-free operation and the number of participants

Number of tubes	Number of participants	
1	32	
1,25	42	
1,5	60	213 (92.2%)
1,75	49	
2	30	
2,5	6	18 (7,8%)
3	5	
4 or more	7	
Total	231	

Table 2 Representation of the number and porcentage of participants divided by gender

Gender	Number of participants
Male	78 (33,76%)
Female	153 (66,23%)

Discussion

Lower third molars are generally extracted to prevent cavities and periodontal disease because their unfavorable position makes hygiene difficult, leading to the accumulation of plaque and tartar. Pain and infections can occur because semi-impacted teeth cause gum inflammation (pericoronitis), leading to discomfort, and can also cause impaction of the second molar. The pressure from the growing wisdom tooth compromises the second molar, leading to its loss or root resorption, which can form cysts and tumors in this region. Extraction is essential to allow for prosthetic rehabilitation or orthodontic treatment.

More applications are needed to prolong the duration of action, leading to greater patient comfort and ensuring they do not feel pain during surgery. Each local anesthetic has a specific molecular mechanism of pharmacological action, indications, and contraindications. Knowing them is an obligation of the dentist for efficient dental practice during clinical procedures, in order to reduce the possibility of putting the patient at risk.

As Naghipour et al.,[1] point out, the choice of appropriate anesthetic during surgical procedures on impacted third molars, especially the combination of lidocaine and articaine, effectively controls postoperative pain better than the use of lidocaine only.

Velioglu et al.,[2] observed duration of anesthesia and postoperative analgesia of lidocaine and bupivacaine in remove impacted molar teeth, from onset of action of anesthetic agent, duration of procedures, and duration postoperative analgesia. When the time anesthesia was analyzed according to both anesthetic solutions, the difference favored lidocaine. The duration of action was longer in bupivacaine group than the lidocaine group. According the results, the postoperative analgesic efficacy of bupivacaine is similar to lidocaine. The use of lidocaine and bupivacaine, are safe, however, more effect of bupivacaine and rapid effect of lidocaine may make lidocaine more efficiency. Nevertheless it is important decide a clinically effective and safe anesthetic solution.

Yang et al.,[3] explained that pain management during lower third molar extraction represents provocation, but currently a lack of convincing evidence concerning comparative anesthetics. Although, is noted that rapid onset of anesthetic was produced buccal infiltration nerve combined with lingual infiltration nerve of 4% articaine with epinephrine and inferior alveolar nerve lock injection of 2% mepivacaine with epinephrine, while longest duration of action was generated by inferior alveolar nerve block injection of 0.5% levobupivacaine or 0.5% bupivacaine.

One more acceptable comparison made by Bhattarai et al. (2020) contrast that anesthetic and analgesic efficacy of bupivacaine with other local anesthetic agents routinely used for third molar surgery in 858 patients. Confront with lidocaine/lignocaine, articaine, etidocaine, levobupivacaine, and carbonated bupivacaine, bupivacaine presented a longer duration of anesthesia, little pain scores the fourth and eighth postoperative hours, and fewer analgesic requirements. However, the onset of anesthesia was slower with bupivacaine. The local anesthetic agents showed no significant differences anesthesia success and duration analgesia. Except for the onset of anesthesia, bupivacaine showed better anesthetic and analgesic properties than other local anesthetic agents third molar surgery.

In respect, Rossi et al.,[7] evaluated efficacy of various anesthetics in controlling postoperative pain after extraction of impacted lower third molars, indicating variation between very low and moderate, which means that 2% lidocaine with clonidine and 0.5% bupivacaine with adrenaline are anesthetics with a higher probability of controlling postoperative pain. Clinically, this means that the use na available anesthetic with effective pain control contributes to more comfortable postoperative period, find not observed by Samieirad et al. (2025) since postoperative pain was lower in ropivacaine group compared to lidocaine group in all postoperative periods, and bleeding during surgery was reduced in ropivacaine group.

Relevant finding, highlighted by Conceição et al.,[10] and Couto et al.,[11] is that the extraction of impacted third molars, besides being a common practice in dental offices, represents a challenge for dentists when deciding when surgery is essential. It is a procedure with risks and complications during and after surgery, being more unfavorable in elderly patients. Therefore, it is a practice with a potential risk of causing complications, as observed by Flor et al.[12] Accidents are events that arise after surgery, and there are accidents that occur outside the planned procedure during the intraoperative period. These authors observed that the literature confirms that the main accidents and complications during and after third molar extraction include dental fracture, paresthesia of the inferior alveolar nerve, oroantral communication, hemorrhage, hematoma, dry socket, pain, edema, trismus, joint dislocation, and mandibular fracture.

On the other hand, Ferreira Filho et al.[5] estimated that third molar extraction is one of the most common procedures based on its accidents and complications regarding the care to be taken. Because it is common procedure, imaging exams are essential in establishing the diagnosis. In fact, the methodology of investigation established a clinical and radiographic diagnosis of impacted lower third molar as evaluation of excellent surgical planning, combining theoretical and practical knowledge. The profissional must understand the anatomical area and dental development, preventing accidents and complications during surgery. Moreover, logical prevention, the main objective combined with professional knowledge, is also important. Corroborating these facts above, Conceição et al.[10] and Couto et al.,[11] report post-surgical difficulties with third molars that are relevant in this context, such as inadequate therapeutic planning, incorrect surgical technique, incorrect use of instruments, excessive force applied to area, and professional inexperience.

Regarding surgical removal of third molars, Afonso et al.,[14] emphasized that it is common procedure in daily oral surgery practice, and that all surgical techniques should take into account adequate preoperative planning and combination of surgical technique with the surgical concept, reducing incidence of complications. Third molar extraction is no different, but it is such a common procedure that complications are relatively rare.

Considerations on complications reviewed so far, evaluated by Oliveira et al.,[18] indicated that third molar extraction, despite being a common surgical intervention in dentistry, presents challenges due to complex anatomy of region. Complications during or after surgery range from temporary discomfort to problems such as risk factors, anatomical position, patient age, and systemic conditions. It is important to note significant value of medical history taking, imaging tests, and aseptic protocols, as well new technologies such as CBCT, 3D printing, diode lasers, and ultrasound, as use of innovative technologies is fundamental to success of surgery.

Concerning the influence of the use of a mixture of short-action local anesthetics, such lidocaine, and long-action anesthetics, Hemmi et al.,[16] elucidated that pain-free postoperative period can be significantly prolonged to use long-acting local anesthetics, such ropivacaine. Compensation improved efficacy, an anesthetic cocktail is applied, significantly extend the duration of postoperative analgesia and pain control compared patients anesthetized with lidocaine only in the lower third molar extractions.

It is important clarify that, according to Malamed,[6] the duration of the local anesthetic used in this study is 60 minutes, the average duration represented by 2% mepivacaine hydrochloride + epinephrine 1:100,000.

In fact, the patient's perception of anesthesia onset ranged from 3 to 5 minutes, a time defined by Malamed.[6] In fact, for a surgical stage intended to be performed safely in free time without interruption with a dosage of only 2 vials of local anesthetic and intervening in up to 50 minutes, considering highly difficult cases, the aforementioned author reveals that the injection of mepivacaine hydrochloride has a half-life

of 1.9 hours. If well planned and excellently managed, this surgical planning is carried out by a competent professional incorporating theoretical and practical knowledge. This particular case is considered by Ferreira Filho et al.[5]

Furthermore, Malamed[6] mentions the benefits of epinephrine, a reference vasoconstrictor compared to other vasoconstrictors in terms of potency and safety, acting similarly to endogenous adrenaline released by the adrenal gland. Its efficacy is analogous to lidocaine,[1] with greater potency and less toxicity. Many studies conducted to date indicate that duration of anesthesia is definitively related to its anesthetic efficacy, that is, the type of anesthetic used, its dose administered, and location of blockade, duration of operation and duration postoperative analgesia. It is known that local anesthetics modify duration of action, ranging from minutes to hours. This effect is controlled by anesthesiologist, who adjusts the dose and formulation of the anesthetic drug according to needs of technique, ensuring patient comfort.

The vast majority of studies confirm satisfactory and conclusive results, and there is currently scientific evidence proving the benefits of third molar surgery, anesthetic duration, and the type of anesthetic used.

Studying the use of a specific anesthetic in this surgical procedure increases our understanding of anesthetic action, helping to produce consistent results when mepivacaine is used in this study, taking into account the skill and experience of the practitioner, who can influence the final outcome.

Certainly, it is important define a clinically effective and safe anesthetic solution for activity being performed.Velioglu et al.,[2] comparing anesthetic efficacy, anesthetic duration, and postoperative analgesia lidocaine and bupivacaine, concluded that the long-lasting reaction bupivacaine and the rapid effeciency lidocaine get the latter preferable.

Yang et al.,[3] discurssing relationship between pain management and lower third molar extraction, since there was a lack of persuasive evidence and comparing anesthetics, concluded that rapid onset of action was produced by inferior alveolar nerve lock injection of 2% mepivacaine with epinephrine, as prolonged duration of action was generated by inferior alveolar nerve lock injection of 0.5% levobupivacaine or 0.5% bupivacaine.

Although different types of anesthetics may present differences in the results of their application, Bhattarai et al.,[4] comparinganesthetic and analgesic efficacy of bupivacaine with other local anesthetic agents used lower third molar surgery, except for onset of anesthesia, bupivacaine better anesthetic and analgesic properties than other local anesthetic agents third molar surgery. Malamed[6] points out mepivacaine is sterile injectable solution of mepivacaine hydrochloride 2% (20 mg/mL) combined with epinephrine 1:100,000 (0.01 mg/mL), with shorter onset of action than other solutions (1.5 min). It is indicated for medium-duration procedures, such surgical procedures. Furthermore, epinephrine's vasoconstrictor is potent and long-lasting compared to other vasoconstrictors. When combined with local anesthetics at the available concentrations, it is well tolerated by patients with cardiovascular disease, considering minimum dose (a maximum of 2 tubes heart patients), prior aspiration, and slow injection.

Efficacy indicators between ropivacaine 0.75% and lidocaine 2% with epinephrine 1:100,000, investigated by Amorim et al.,[8] considering postoperative analgesia after extraction of impacted lower third molars, showed that injection of 0.75% ropivacaine before surgical procedure is associated with preventive analgesia extraction of impacted third molars. Although, more significant postoperative bleeding was observed ropivacaine group.

Regarding to establishment anesthetic effects from onset of action, intraoperative comfort, total amount solution used, duration anesthesia and postoperative analgesia, rescue analgesics, postoperative pain, intraoperative bleeding, and hemodynamic parameters, Tokuç and Coşkunses[9] demonstrated articaine greater clinical efficacy than bupivacaine intraoperative anesthesia, faster onset of anesthetic action, greater patient comfort and less surgical assistance. However, bupivacaine was superior decrease postoperative pain acknowledgment its anesthetic and residual analgesic effects. Thus were effective at low doses, as demonstrated Tenglikar et al.,[15] particularly when using articaine with epinephrine at 1:100,000, which resulted in recommendation due its effectiveness in oral surgical techniques.

As a matter of fact, in their search for scientific evidence, Nogueira et al.,[17] through a meta-analysis investigating articaine versus lidocaine in third molar removal, found articaine had higher success rate than lidocaine, shorter subjective onset time, less intraoperative pain, longer duration, and less postoperative pain. Deduced articaine is superior to lidocaine for use lower third molar surgeries due to its higher success rate, shorter onset, greater pain control, and longer duration anesthetic effect. However, it more side effects than lidocaine.

Although articaine is widely used anesthetic in dentistry, recent years, Huang et al.,[19] compared anesthetic efficacy and safety infiltration anesthesia with 4% articaine (with epinephrine) and lock anesthesia with 2% lidocaine (with epinephrine) in extraction of third molar, appraise parameters such heart rate, blood pressure, oxygen saturation, anesthetic, duration of operation, pain score, satisfaction, and adverse events were recorded and analyzed. No significant differences heart rate, blood pressure, oxygen saturation, and maximum fluctuations during extraction procedure observed between two groups, except maximum fluctuation heart rate statistical significance with lower amount of anesthetic in articaine group (1.5 ± 0.4 cartridges) than in lidocaine group (2.2 ± 0.5 cartridges). There were no significant differences in duration of operation, pain score, and satisfaction between 2 groups, no adverse events. The choice of infiltration anesthetic technique provided by 4% articaine offered pain control comparable to 2% lidocaine, but lock anesthetic technique in third molar extraction surgery. In regard, infiltration anesthesia is important when infiltrating as complement to buccal nerve injection, as was the case in this study with mepivacaine.

Concerning the results, Table 1 presents detail the number and percentage of tubes used during sensitivity-free surgical procedure and number of participants. According to table, 32 patients used one anesthetic tube, followed by 42 with 1.25, 60 with 1.5, 49 with 1.75, and only 30 patients required 2 tubes. It is important note in Table 1 that 32 patients undergoing surgical procedures, only one anesthetic cartridge was used to achieve anesthetic effect. Furthermore, this took an average of 4.5 minutes in all cases, fact corroborated by Malamed.[6]

Also Table 1, it can be seen that 7 patients, 4 or more anesthetic cartridges were used for anesthetic effect, while 5 patients used 3 cartridges and 6 patients used 2.5 cartridges, totaling 7.8%. This occurrence in daily clinical practice represents common occurrence, especially professionals with little clinical experience. Therefore, adequate planning is essential to prevent intraoperative accidents and postoperative complications, since although surgeries are scheduled and performed by specialized and trained professionals, they are not exempt complications. Preventing complications should be primary

goal of surgeons, and adequate planning combined with professional knowledge are fundamental factors. The more complex surgical technique need osteotomy and odontosection, greater possibility postoperative complications, resulting in longer than desired surgical time.

Table 2 shows the number and percentage of male and female participants. This table indicates approximately 33.76% were male of the 231 patients included in this study and higher percentage of 66.23% were female. This finding observed by Berriel et al.,[13] Geçkil,[20] and Tamer et al.,[22] who found that larger proportion of females were more likely to undergo lower third molar surgery.

Thus, this perspective highlights that only a small percentage of procedures generate good results most of the time, which reinforces the identification of procedures, allowing for better work without errors.

Conclusion

Based the results, it concluded the use of up to two vials of 2% mepvacaine anesthetic with 1:100,000 epinephrine was sufficient to remove impacted lower third molars (92.2% of cases), provided adequate knowledge of anatomy and surgical technique is required. The same applies to the surgical time (up to 50 minutes). In only 7.8% of cases, the number of anesthetic vials and the surgical time did not reach the proposed time in the larger study.

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None

Conflicts of interest

The authors declare that there are no conflicts of interest.

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