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PREVENTION AND MANAGEMENT FOR THE COMPLICATION OF THIRD MOLAR SURGERY : A SYSTEMATIC REVIEW

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ABSTRACT

Background: *Impacted third molar surgery is one of the most common procedures performed by maxillofacial surgeons and it is often attended by complications. Although clinical conditions associated with retained third molars are well understood, little is known about the impact of those conditions on the quality of life among affected patients. There is growing recognition that the impact of oral conditions on quality of life is an important outcome that can be quite useful in making treatment decisions. All the information in this review could be useful for the clinicians in order to show the surgical and pharmacologic parameters that may influence the postoperative discomfort in the third molar surgeries.*
Methods: *This systematic review followed the recommendations in PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Some of the key words or Medical Subject Heading (MeSH) terms used in in the two data bases (Proquest and Google Scholar) were: (1) Third Molar Surgery, (2) Complication, (3) Prevention. The articles were published in English from 2009 to 2019.*
Results: *Studies were eligible if they evaluated prevention and management for the complication of third molar surgery, and eight studies for qualitative synthesis. Of the eight articles, all studies were selected with Randomized Control Trial. Eight studies were included because they discussed the prevention and management of third molar surgery complication. Almost all of the practices of prevention and management of third molar surgery complication described that analgetic ibuprofen and paracetamol were used for decreasing the pain, and also amoxicillin tablet was used as an antibiotic for preventing high risk complication. According to studies, prophylactic use of chlorhexidine mouth rinse in third molar surgery are equally effective in keeping post operative infection to a minimum level in medically competent patient.*
Conclusions: *All studies revealed that the most common complications of third molar surgery were pain, trismus, swelling, alveolar osteitis, and dry socket. Those studies discussed the prevention and management third molar surgery complication. Ibuprofen and paracetamol were used to decrease the pain, amoxicillin (1g) and amoxicillin/clavulanate (875/125mg) had similar efficacious in preventing infection after retained third molar extraction, but amoxicillin and clavunate (875/125mg) produced more gastrointestinal discomfort. Prophylactic use of chlorhexidine mouth rinse and gel in third molar surgery were equally effective in keeping post operative infection. Corticosteroid had a significant and sustained anti-inflammatory effects.*

Keywords: *Third Molar Surgery; Complication; Prevention.*

INTRODUCTION

The surgical extraction of an impacted third molar is a routine but traumatic procedure which is performed by oral and maxillofacial surgeons. Third molar surgery postoperative complications are affected by many factors and variables [1]. Certain challenges cause esthetic and functional problems for surgeons and patients [2]. The outcome of various clinical and surgical procedures in the third molar surgery is affected by several factors such as patient, defect, and surgical variables [2,3]. An awareness of systemic conditions and medicines that could affect bone and adjacent soft tissues may be important to identify patients at increased risk of poor clinical and postoperative results [3]. In order to prevent or reduce these complications, many studies have investigated the use of various medicines, biological factors, and surgical techniques [4].

Third molar surgery is the most common procedure performed by oral and maxillofacial surgeons worldwide. Surgical removal of impacted third molars is one of the most common procedures carried out in oral and maxillofacial surgery. Most of third molar surgeries are performed without complications. However, such procedure can lead to serious complications to the patients, such as hemorrhage, persistent pain and swelling, infection, dry socket (alveolar osteitis), dent alveolar fracture, paresthesia of the inferior alveolar nerve and of the lingual nerve, temporomandibular joint injury and even mandibular fracture [4].

Prior to any surgical procedure, the patient must be informed about the possible accidents and/or complications that may occur during the entire treatment, being aware of the fact that any unexpected situation should be dealt with the best possible way. It is thought that complications like pain, edema and trismus are caused by surgical trauma depending on the inflammatory process. In surgeries for impacted mandibular third molar, time of the intervention is thought to be associated with tooth position, angle and the experience of the surgeon and these parameters determine the difficulty of the surgery and are related to the intensity and time of pain, edema and trismus. Longer surgical interventions may increase tissue damage and vascular permeability that lead to postoperative edema and affect its intensity. In all surgical procedures, proper pre-operative planning and the blending of surgical technique with surgical principles are of paramount importance to decrease the incidence of complications [2].

Factors reported to be associated with third molars complications include age, gender, medical history, oral contraceptives, presence of pericoronitis, poor oral hygiene, smoking, type of impaction, relationship of third molar to the inferior alveolar nerve, surgical time and technique, surgeon experience, number of teeth extracted, irrigation of the surgical site, use of analgetic, use of perioperative antibiotics, use of topical antiseptics, use of intra-socket medications and anesthetic technique [5,6,7,8,9,10,11,12].

METHODS

This systematic review was performed according to PRISMA statement [13], including a checklist to ensure consistent reporting of a systematic review. The search included articles from inception of the databases up to week 1 of March 2019, which were obtained through an extensive search of the following electronic databases: Proquest and Google Scholar. Some of the key words or Medical Subject Heading (MeSH) terms used in the search were: “third molar surgery,” “complication,” and “prevention.” Only studies published in English were included. Exploring literature was focused on the articles published from 2009 to 2019. The exploring process obtained 8 articles that met the requirements for inclusion and exclusion criteria.

Study Selection

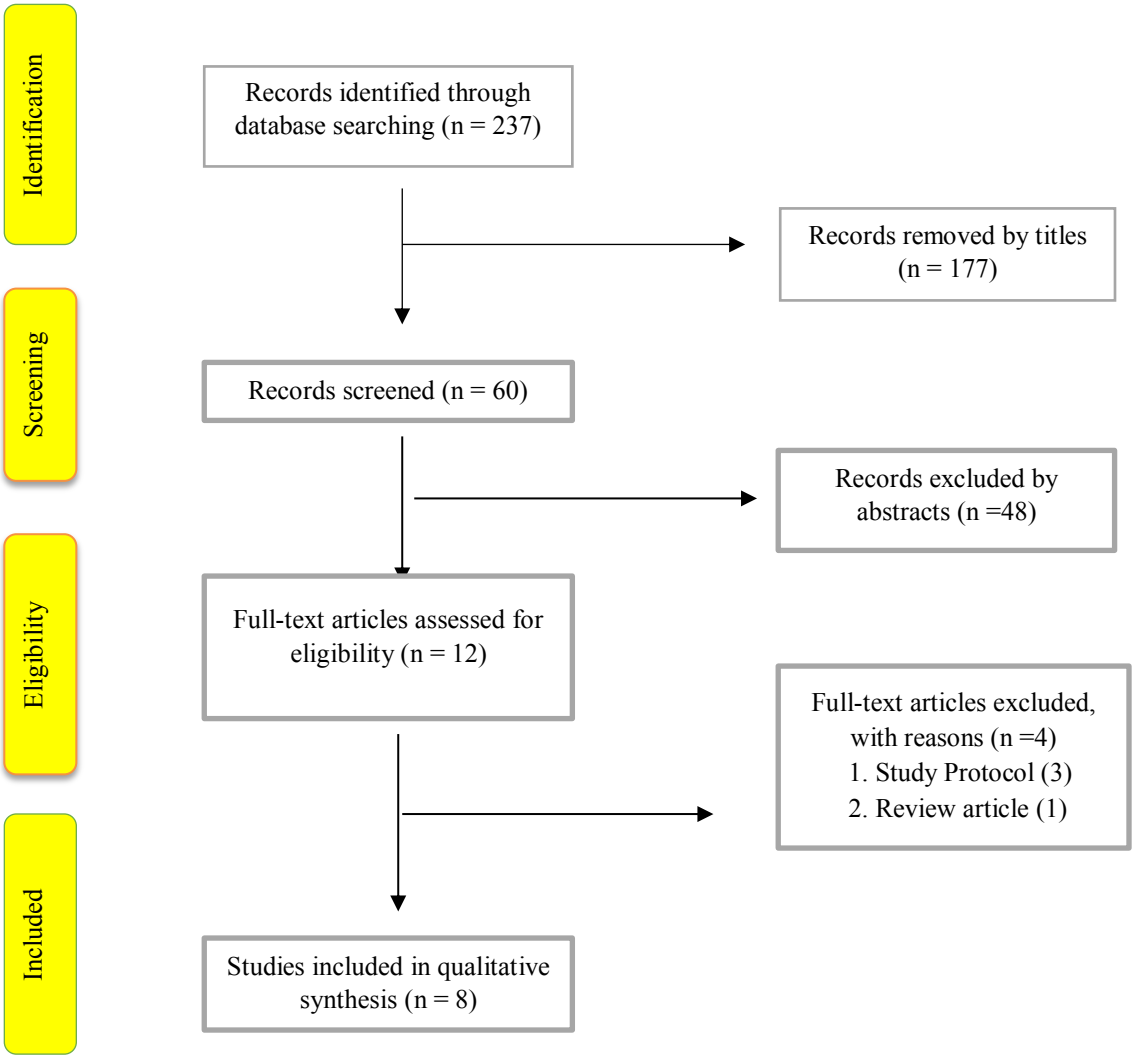

Figure 1. Flow diagram of search strategy

RESULTS

Initially, a total of 237 potentially relevant articles were obtained. After screening title and reviewing abstracts, 12 full texts were assessed for eligibility. Eventually, only 8 articles met all inclusion criteria in this review (Figure 1). Of the 8 articles, all of studies used randomized controlled trials. Eight studies discussed the prevention and management odontectomy complication. Almost all of the practices of prevention and management of odontectomy complication used analgetic ibuprofen and paracetamol for decreasing the pain, and also used amoxicillin tablets as antibiotics for preventing high risk complication. According to studies, prophylactic use of chlorhexidine mouth rinse in third molar surgery are equally effective in keeping post operative infection to a minimum level in medically competent patient.

Table 1. Review Results

No	Title (Year)	Authors	Setting	Intervention	Comparators	Outcome	Study Design
1.	An Evaluation of Effects of Platelet-rich-ring on Post-operative Morbidities after Lower Third Molar Surgery (2019)	F Asutay, Ü Yolcu, O Geçör, AH Acar, SA Öztürk, S Malkoç	Thirty patients (6 male/24 female, mean age was 20.32 years old) with bilateral symmetric impacted third molars were enrolled in this study to receive surgery	The PRF mass was randomly placed in one of the extraction sockets	Another socket was left without treatment	Statistical analyses revealed that there were no significant differences between the control and study groups regarding postoperative pain, swelling, and trismus ($P > 0.05$).	A randomized, double-blinded, split-mouth, single-center clinical trial
2.	Comparative trial between the use of amoxicillin and amoxicillin clavulanate in the removal of third molars (2014)	Fernando Iglesias-Martín, Alberto García-Perla-García, Rosa Yañez-Vico, Elena Aced-Jiménez, Esther Arjona-Gerveno, Juan-David González-Padilla, Jose-Luis Gutierrez-Pérez, Daniel Torres-Lagares	546 patients (233 male and 313 Female). The average age of males was 29.04 years old and women was 27.93 years old. Attending for removing a retained third molar and divided into two groups:	Group 1 amoxicillin and clavunate (875/125mg) group (n=257)	Group 2 amoxicillin (1g) group (n=289).	From a total of 546 patients, the frequency of infection was 1.4%, without no statistically differences between the two groups. Group 1 showed statistically higher presence of patients with gastrointestinal complications ($p>0.05$). Among 546 patients, 2.7% of patients reported severe pain that would not relieve with medication. The results of this study indicated that amoxicillin (1g), and amoxicillin and clavunate (875/125mg) had similar efficacious in preventing infection after retained third molar extraction but amoxicillin and clavunate (875/125mg) produced more gastrointestinal discomfort.	A randomized trial

No	Title (Year)	Authors	Setting	Intervention	Comparators	Outcome	Study Design
3.	Effect of intra-alveolar placement of 0.2% chlorhexidine bioadhesive gel on the incidence of alveolar osteitis following the extraction of mandibular third molars. A double-blind randomized clinical trial (2015)	Josep Rubio-Palau 1, Jordi Garcia-Linares 2, Juan-Antonio Hueto-Madrid 3, Javier González-Lagunas 4, Guillermo Raspall-Martin 5, Javier Mareque-Bueno 6	160 patients were randomly selected to evaluate the efficacy of 0.2% bioadhesive chlorhexidine gel placed intra-alveolar to prevent AO after the extraction of mandibular third molars and to analyze the impact of risk factors such as smoking and oral contraceptives in the development of AO.	0.2% bioadhesive chlorhexidine gel (80 patients)	Bioadhesive placebo (80 patients).	0.2% bioadhesive chlorhexidine gel applied in the alveolus after third molar extraction reduced the incidence of dry socket by 22% compared to placebo with differences that were not statistically significant. Smoking and the use of oral contraceptives were not related to higher incidence of dry socket. Female patients and the difficulty of the surgery were associated with a higher incidence of AO with statistically significant differences. 0.2% bioadhesive chlorhexidine gel did not produce any side effects related to chlorhexidine rinses.	a randomized, double-blind, placebo-controlled, single-center, parallel-group clinical trial
4.	Effect of the local administration of betamethasone on pain, swelling and trismus after impacted lower third molar extraction. A randomized, triple blinded, controlled trial (2014)	José Marques 1, Jordi Pié-Sánchez 1, Rui Figueiredo 2, Eduard Valmaseda-Castellón 3, Cosme Gay-Escoda 4	25 patients required the surgical removal of symmetrical lower third molars. It was performed to assess postoperative pain, visual analogue scales and the use of rescue analgesic. The facial swelling and trismus were evaluated by measuring facial reference distances and maximum mouth opening.	12-mg dose of betamethasone was administered submucosally after surgical procedure	Placebo (sterile saline solution) injected in the same area	The injection of a single dose of betamethasone does not seem to reduce pain, facial swelling and trismus after impacted lower third molar removal compared to placebo.	A split-mouth, triple-blind, randomized, placebo-controlled clinical trial

No	Title (Year)	Authors	Setting	Intervention	Comparators	Outcome	Study Design
5.	Efficacy and complications associated with a modified inferior alveolar nerve block technique. A randomized, triple-blind clinical trial (2014)	Marta Montserrat-Bosch 1, Rui Figueiredo 2, Pedro Nogueira-Magalhães 1, Josep Arnabat-Dominguez 3, Eduard Valmaseda-Castellón 4, Cosme Gay-Escoda	A randomized, triple blind clinical trial was performed in 109 patients. All participants were submitted to the surgical removal of an impacted lower third molar between January and June 2012 in the Dental Hospital of the University of Barcelona	Experimental technique (Modified technique)	Conventional technique	A total of 100 patients were randomized selected. The modified technique group showed a significantly higher onset time in the lower lip and chin area, and was frequently associated with a lingual electric discharge sensation. Three failures were recorded, two of them were in the experimental group. No relevant local or systemic complications were registered.	A randomized, triple blind clinical trial
6.	Postoperative effects on lower third molars of using mouthwashes with super-oxidized solution versus 0.2% chlorhexidine gel: A randomized double-blind trial (2018)	Ana Coello-Gómez 1, Selene Navarro-Suárez 1, José-María Diosdado-Cano 1, Francisco Azcárate-Velazquez 1, Patricia Bargiela-Pérez 1, María-Ángeles Serrera-Figallo 1, Daniel Torres-Lagares 2, Jose-Luis Gutiérrez-Pérez 3	20 patients with a split-mouth design. The study recruitment period lasted from January to December 2016.	Dermacyn Wound Care, the super-oxidized solution (SOS) mouthwash was provided sufficiently for one week so that patients may wash their mouth three times per day after brushing	a single dose of 0.2% chlorhexidine was administered to the socket before placing the suture (4-0 silk)	No statistically significant differences were found between the two groups regarding infectious complications, swelling, or wound healing. The use of analgesics and self-reported pain levels were slightly lower in the experimental group than in the controlled group during day 6 and 7 of the study ($p < 0.05$). The global treatment tolerance was satisfactory and similar in both groups.	A randomized double-blind prospective study
7.	Postoperative socket irrigation with drinking tap water	H. Ghaeminia1 & Th. J. M Hoppenreijs2 & T. Xi1 & J. P. Fennis2	A multicenter randomized controlled trial was	158 patients were instructed to irrigate the	175 patients performed the standard postoperative	According to the intention-to-treat (ITT) analysis, inflammatory complications occurred in 18 cases in the Monoject® group (11.4 %)	

No	Title (Year)	Authors	Setting	Intervention	Comparators	Outcome	Study Design
	reduces the risk of inflammatory complications following surgical removal of third molars: a multicenter randomized trial (2017)	& T. J Maal1 & S. J. Bergé1,3 & G. J. Meijer1,4	carried out from June 2013 to June2014	tooth socket and surgical site with a Monoject® Curved 412 Tip Syringe (Tyco/healthcare-Kendall, Mansfield, MA, USA) with tap water	instructions excluding irrigation instructions	compared to 34 cases (19.1 %) in the controlled group (p = 0.04). Irrigation of the surgical site with drinking tap water using a curved syringe following removal of third molars is effective in reducing the risk of inflammatory complications. Water is a very accessible, cost-effective irritant without side effects and the results from this study have proven that it can be used to reduce the risk of inflammatory complications and associated morbidity following lower third molar removal.	
8.	Value of Prophylactic/Postoperative Antibiotics and Corticosteroids in Reducing Morbidity Following Surgical Extractions of Impacted Third Molars. (2017)	Chakranarayan A, Jeyaraj CP.	A total of 150 patients were randomly divided into two groups. There were 75 patients in each group, aged 18 to 61 years old with peak age incidence was between 20 to 30 years old	The patients of group II were prescribed Ibuprofen 400 mg + Paracetamol 325 mg and Amoxicillin 500 mg for 5 days.	The patients of Group I were prescribed Ibuprofen 400 Mg + Paracetamol 325mg for 5 days.	In this study, the analgesic and inflammatory effects of the combination of Ibuprofen and Paracetamol were found to be clinically effective in the management of postoperative morbidity following surgical extraction of mandibular third molars. The results of this study also showed that the prophylactic antibiotics do not have statistically significant effects on postoperative infections.	A randomized trial

DISCUSSION

This study helps to set valuable guidelines for prevention and management of post operative complications and morbidity following surgical extraction of mandibular third molars.

The possible effects of PRF on postoperative morbidities (pain, edema, and trismus) in the third molar surgery were evaluated by VAS (for assessing pain), 3dMD imaging system (for assessing edema), and manual caliper (for assessing trismus) [5].

Pain, trismus, and swelling are almost universal complications. The removal of impacted third molars can negatively impact the quality of life of patients. Gender, type and depth of impaction, level of difficulty, experience of the surgeon, patient medical condition, as well as smoking and use of oral contraceptive pills may affect postoperative complications [12,14]. PRP and PRF are among the most advantageous tools that used widely in surgery clinics. PRF second generation platelet concentrate has been less studied and compared to PRP, has the advantages of being cost−effective, easy to manipulate, lack of biochemical handling, and does not dissolve quickly. Moreover, in surgical extraction of the third molars, dry socket has been found to develop in up to 30% of cases [15]. In the present study, only four sites developed dry socket (4 of 60 teeth, 6.7%), and there was no statistically significant difference between the groups. Relatively low frequency of dry socket may be due to good oral hygiene motivation. Third molar extraction presents a challenge to surgeons. In order to solve or reduce these problems, many medicines, biofactors, and methods have been studied. The results of this clinical study showed that PRF has no significant positive effect on postoperative pain, swelling, and trismus after the surgical removal of impacted lower third molars [16].

The use of antibiotic prophylaxis is normal in third molar surgery since it is considered clean-contaminated surgery. However, the use and the correct use of routine antibiotic prophylaxis is a controversial topic [17]. Infectious pathology associated with third molars has created the necessity of multiple studies that have been carried out with different antibiotics, and whether infection prevention is really necessary or not [18]. There is no consensus on prophylaxis guidelines in selecting antibiotics [19]. Siddigi's and Zeitler's research indicated that the infection of the surgical wound infection rate was low and infrequent, then, they did not advise the use of antibiotics as routine prevention in the removal of third molars [20,21]. In the study, it was found that amoxicillin (1g) and amoxicillin/clavulanate (875/125mg) have similar efficacious in preventing infection after retained third molar extraction, but amoxicillin and clavunate (875/125mg) produce more gastrointestinal discomfort [6].

Alveolar osteitis (AO) is a common complication after third molar surgery. Chlorhexidine (CHX) is one of the most effective agents to prevent the complication. A higher incidence of alveolar osteitis was found more in the surgical extractions (23.23%) than in simple extractions (14.75%) p=0.226, and operations that lasted longer than 10 minutes had higher incidence of alveolar osteitis (21.43-25%) than those which are shorter than 10 minutes (17.28%) p=0.284. The statistically differences were not significant. There are many studies and reviews claimed that chlorhexidine rinses and gel reduce the incidence of AO after the extraction of mandibular third molars. A 22% reduction of the incidence of alveolar osteitis with the application of 0.2% bioadhesive chlorhexidine gel compared to placebo indicated that no statistically significant difference was found. The lack of adverse reactions and complications related to chlorhexidine gel supports its clinical use in simple extractions and adds some advantages compared to the rinses in terms of duration of the treatment and reduction of staining and taste disturbance [7].

The third molar surgical extraction is often related to severe postoperative discomfort. Thus, many clinicians routinely use corticosteroids in order to prevent and reduce the postsurgical sequelae [22]. Several papers have shown a significant reduction of trismus, pain and facial swelling when corticosteroids are administered, but few reports used the local injection of these medicines in the third molar region [23,24]. Different administration routes have been used for these medicines in oral surgery. The oral route is more comfortable for the patients and ensures rapid and almost complete absorption, but its efficacy compared to parenteral administration is questionable [25]. The intravenous administration affords excellent and immediate plasma drug levels, although this route is not frequently used in an outpatient environment. Some studies revealed that a single preoperative intravenous dose offers almost immediate benefits in terms of pain, swelling and trismus, but frequently a supplemental dosing is needed, in order to ensure optimum clinical efficacy [25,26]. Corticosteroid was expected to have a significant and sustained anti-inflammatory effect [8].

An adequate pain control when performing dental procedures in the posterior area of the mandible is often difficult to achieve. Infiltration techniques have shown extremely high success rates in the maxilla but seem to have disappointing figures when made in the lower molar region. [27,28,29]. Therefore, most authors recommended IANBs when a dental treatment is being made in this region. [30,31,32,33]. However, this technique can be difficult to perform because the use of anatomical landmarks are not always reliable, and also because of the long distance between the injection point and the area where the local anesthetic is finally placed [30,34,35,36]. This fact along with the considerably high positive aspiration rate shows the need for alternative techniques to the traditional IANB. Lower third molar removal has been frequently considered as a good model in pain clinical trials. This surgical procedure requires a profound pulpal and soft tissue anesthesia; therefore, it is suitable for a trial with these characteristics. Furthermore, several authors have thoroughly described this research design. In our opinion, the only problem that should be addressed in the future is related to the blinding of the surgeons who performed the extraction, since in some cases, a small bleeding point can be observed in the injection area.

In the present report, an IANB was classified as a failure when the patient did not refer a numbness area in the lower lip and chin region after 5 minutes. Other authors used longer times or the reanesthesia rate to assess the efficacy of IANB. Although no statistical significant differences were found between the 2 techniques regarding these variables, the experimental technique had a higher rate of failures (4% vs. 2%) and of reanesthesias (48% vs. 37%). All these results along with significantly longer onset time in the modified technique are probably related to the fact that the anesthetic solution is placed when the inferior alveolar nerve (IAN) is already inside of the mandibular canal. This fact might increase the onset time and slightly decrease the efficacy of IANB, since the local anesthetic needs more time reach the nerve compared to the conventional technique. These results clearly show that changing the injection site to a more inferior location, compromises the efficacy of IANBs [9].

When performing oral surgery, numerous types of oral antiseptics can be use as adjuvants. They are used to encourage tissue healing and obtain better postoperative results, for example, antiseptics can be found in different compositions and different routes of administration. It is important to evaluate the different effects of administering these solutions before or after the surgery, as well as considering to the type of solution and route of administration. Mouthwashes and gels are the most commonly used and requested by both clinicians and patients. They are used to decrease the microbial load in the oral cavity and can be used before or after oral or periodontal surgery. Chlorhexidine in gel form allows it to be placed inside the socket, providing a more direct and long-term action compared to chlorhexidine mouthwash. The use of 0.2% of chlorhexidine gel and the super-oxidized solution Dermacyn® is effective and efficient in improving post-operative healing after extraction of the lower third molars [10].

Water has major advantage of being accessible and very cost effective with no adverse effects. Post-operative irrigation of the socket with drinking tap water reduces the risk of inflammatory complications following surgical removal of third molars. Cleaning of surgical wounds with water is an old and common procedure to prevent infections in extremities and drinking tap water is thought to be as good as saline or sterilized water for this purpose [37]. Aaline mouth rinse effected postoperative complications following routine dental extractions [38]. A significant lower incidence of AO was found in the saline rinsing group compared to no rinsing. In this study, all subjects used prophylactic antibiotics and only healthy patients acquiring non-surgical routine dental extractions where included. The risk of alveolar osteitis following surgical removal of mandibular third molars can be significantly reduced by postoperative irrigation with plain drinking tap water [11].

Conclusion

All studies found that complications invariably occur following the surgical removal of third molars. Attention to the basic principles of surgery, including proper preparation of the patient, asepsis, and hemostasis, use of controlled force, thorough debridement, and meticulous management of both bone and soft tissues can reduce the number and severity of complications. Prophylactic antibiotics do not have statistically significant effects on postoperative infections. Therefore, there is no justification for using antibiotics routinely for third molar surgery. However, we need a safe and effective analgesic and anti-inflammatory combination after third molar surgery to prevent post-operative pain. Analgesic and inflammatory effects of the combination of Ibuprofen and Paracetamol were found to be clinically effective in the management of postoperative morbidity following surgical extraction of mandibular third molars. Both CHX and SOS are effective at improving the postoperative period after third molars surgery.

The findings in this review can be applied for the dental practice and can be used to comprehend the treatment of odontectomy management and prevention, especially for mandibular third molar teeth in attempts to prevent the minor complication. The recommendation for future research is to review more studies on prevention and management of complication of third molar surgery in order to get deeper understanding. For policy makers, it is suggested that they should design policy to improve and update knowledge.

Limitation

The limitation of this review is the scope, which focused on prevention and management of third molar surgery complication.

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