Comparison of different regimens for the prevention of alveolar osteitis

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Summary

Alveolar osteitis is an important postoperative problem that is especially prevalent after the removal of mandibular third molars. Many methods have been sought to prevent or to manage this complication. In this study we compared effects of different regimens for the prevention of alveolar osteitis. For this purpose five groups - a chlorhexidine solution alone group, a chlorhexidine and antibiotic combination group, a sterile saline group, a sterile saline and antibiotic combination group and an antibiotic alone group - were formed after the extraction of mandibular third molars. The results of this study showed that there was a significant reduction in the incidence of alveolar osteitis when chlorhexidine was used in combination with an antibiotic. We concluded that it is more beneficial to use chlorhexidine solution with a ß-lactamase-containing antibiotic to decrease the risk of alveolar osteitis.

Key words: alveolar osteitis, third molar, chlorhexidine, antibiotic.

Introduction

One of the most common postoperative complications after the tooth extraction is alveolar osteitis (AO) or in other terms dry socket. The incidence of AO has been reported as 3-4% following routine dental extractions and 1-45% after the removal of mandibular third molars. The peak ages of occurrence are from 20 to 40 years, with an increased incidence among female patients. Aetiology of AO is not fully elucidated, but it is multifactorial and its pathogenesis is still unclear. Some of the etiological factors are: compact structure of the bone, amount of vasoconstrictor substance in the local anaesthetic agents, presence of systemic problems, oral contraceptive use, smoking, age, gender, and surgical trauma (impaction level of the tooth and experience of surgeon). Fibrinolysis with subsequent loss of blood clotting is believed to be the general cause of AO [1-5].

There is not a true method for preventing the development of AO. Various methods have been tried perioperatively and different success rates have been implicated. Antibiotics and antibacterial rinses have been used with some effectiveness, the rationale being that infection is the etiologic factor in the genesis of AO.

Chlorhexidine (CHX) is effective against both aerobic and anaerobic, Gr (+) and Gr (-) organisms and yeast. It has a high affinity for the cell wall of microorganisms and induces changes in the surface structures, resulting in the loss of osmotic equilibrium and precipitation of the cytoplasm. Oral rinsing with CHX has been shown to reduce the quantity of oral microbial populations and thus, may be effective in reducing the incidence of AO [6, 7].

Amoxicillin has enhanced penetration into Gr (-) bacilli and enterococci, but, like penicillin V, it is inactivated by ß-lactamase. Clavulanic acid is a naturally occurring ß-lactam compound with little intrinsic antibacterial activity, but it binds irreversibly to ß-lactamases, inactivating these enzymes [8, 9].

The aim of this study was to compare the effects of different regimens for the prevention of alveolar osteitis following mandibular third molar extractions.

Patients and methods

This study was carried out on a total of 192 patients (74 male, 118 female; mean age 26.1 years). To be eligible, patients had to be in good general health and have at least one mandibular third molar to be extracted. Patients who had pericoronitis or were taking antibiotics for other infections were excluded. Women who were pregnant, breast-feeding, or using oral contraceptives were also excluded from the study. The patients were referred for the removal of these teeth and were randomly allocated into five groups. Only one tooth was removed in one session for this study. We obtained informed consent from all participants.

The patients of group 1 (CHX group, n = 47) first rinsed with 15 ml of CHX solution (Klorhex; Drogsan) for 30 seconds just before tooth removal. Either normal or surgical extraction was done because of the characterization of tooth. All extractions were performed under local anaesthesia with Ultracaine DS forte (Articaine HCL: 40 mg/ml, epinephrine HCL: 0.012 mg/ml); and standard surgical procedures were used. Intraoperatively, 15 ml of CHX diluted with 15 ml of sterile saline was used for irrigation. The soft tissue was closed with 3/0 silk suture for transalveolar procedures. The day after surgery, the patients began daily use of the CHX solution (15 ml for 30 seconds) twice daily for seven days. The second group (CHX + antibiotic group, n = 30) was treated similarly to group 1, but in addition to CHX solution, the patients of group 2 were prescribed Augmentin BID (500 mg amoxicillin trihydrate, 125 mg clavulanic acid; SmithKline Beecham) twice daily for five days postoperatively. The third group (sterile saline group, n=49) was treated similarly to group 1 except for the substitution of sterile saline solution (0.09 % NaCl) for CHX. The forth group (sterile saline + antibiotic group, n = 27) was treated similarly to group 2 except for the substitution of sterile saline solution (0.09% NaCl) for CHX. The fifth group (Antibiotic alone group, n = 39) was only given Augmentin BID postoperatively without a rinse. Only intraoperative irrigation with 30 ml sterile saline solution was performed in this group.

Tooth removal was performed by the same experienced senior oral and maxillofacial surgery specialists. To blind the surgeons, solutions in identical bottles were labelled by another resident who was not participating in the study. The postoperative medications were also prescribed by this resident to prevent any bias of the surgeons. All five groups were instructed to use only 500 mg paracetamol (Minoset; Roche) for postoperative pain relief. A postoperative examination was performed on the third and seventh days to evaluate the presence of AO. The definition of AO is somewhat unclear; therefore, we preferred to use the diagnostic criteria by Bloomer [10] (i.e., patients were encouraged to return sooner if they began to have symptoms of pain and discomfort). If the patient reported pain

Table 1. Patients in each group

		Group 1	Group 2	Group 3	Group 4	Group 5
Sex	Male	15	11	17	14	17
	Female	32	19	32	13	22
Mean age (y)		23.70	24.6	24	30.1	28.3
Smoking	Yes	11	6	14	11	14
	No	36	24	35	36	25

Table 2. Characterization of the teeth in each group

	Group 1	Group 2	Group 3	Group 4	Group 5
Erupted	9	7	9	6	7
Soft tissue impaction	14	4	15	6	9
Partial bony impaction	13	9	13	8	15
Full bony impaction	11	10	12	7	8
Total	47	30	49	27	39

unrelieved by analgesics and if exposed bone or necrotic debris was present, the diagnosis of AO was made clinically.

Student's t test and Pearson chi-square test were used for statistical analysis and $p < 0.05$ was considered to be significant.

Results

The five groups were well balanced with respect to number of patients ($p = 0.58$), sex ($p = 0.45$), age ($p = 0.54$), smoking ($p = 0.33$), and the characterization of the teeth ($p = 0.93$) *(Table 1* and *Table 2)*. Erupted and soft tissue-impacted teeth accounted for 44.7% and partial and full bone impactions accounted for 55.3% of all extractions *(Table 2)*. The overall average AO rate was 15.6%. The incidence of AO in group 1, group 2, group 3, group 4, and group 5 was 19.1%, 0%, 32.4%, 17.3%, and 14.7% respectively. There was a significant reduction in the incidence of AO in the second group ($p = 0.05$).

Discussion

AO is one of the most frequent post-extraction complications, and many different ways have been tried to manage this problem. Dealing with this complication can cause considerable loss of time from work for patients and disruption of normal schedules for dentists [1]. It results from disturbed healing of the extraction wound and particularly related to a complex interaction between excessive localized trauma, bacterial invasion and their association to plasmid and subsequently, the fibrinolytic system [3, 4]. Prevention of AO can be divided into non-pharmacological and pharmacological measures. Non-pharmacological preventive measures include a comprehensive history of the patient and elimination of risk factors associated with increased risk to develop AO. The pharmacological measures include antibacterial agents, antiseptic agents and lavage, antifibrinolytic agents, anti-inflammatory agents, obtruding dressings, clot support agents [3]. So far, no single method has gained worldwide acceptance. Inserting some dressings is not a proper method because of the side effects and unnecessary additional costs to the patient. Support in the literature for and against the effectiveness of antimicrobial solutions for irrigation or rinsing as a preventive measure in AO formation is questionable. For example, Legarth [11] found a reduction from 13.7% to 7.5% when twice-daily postoperative rinses with 0.2% CHX were used after third molar surgery. However, Berwick and Lessin [6] reported that CHX is no more effective than postoperative irrigation with normal saline. Krekmanov and Nordenram [12] found that the decreased incidence of AO with penicillin V used in combination with CHX was no more significant than that seen with CHX alone, and the incidence of AO seen with both of these regimens was significantly less than that seen in the control group. The proposed reason for why CHX alone may not be effective for the prevention of AO is that although mouth rinse with CHX reduces salivary bacteria counts up to 95%, the saliva still contains numerous bacteria. The bacterial levels after rinsing may still be high enough to initiate bacterial fibrinolysis and thus AO [13].

Prophylactic antibacterials, either given systemically or used locally, are considered to reduce the incidence of AO. Systemic antibacterials reported to be effective in the prevention of AO include, penicillin, clindamycin, erythromycin, amoxicillin and metronidazole [3, 14]. In this study we found a significant reduction in the incidence of alveolar osteitis when antimicrobial solution was used with a ß-lactamase-containing antibiotic.

The routine use of systemic antibacterials is highly disputed and considered to be controversial because of the development of resistant bacterial strains and possible systemic side effects, such as hypersensitivity and unnecessary destruction of host commensals. The emergence of resistant strains of pathogenic organisms has been noted. Hunt et al. [14] reported increasing resistance of Streptococci to erythromycin (53%), Staphylococcus aureus to penicillin and erythromycin (50%), and an increasing number of penicillin-resistant Bacteroides organisms isolated from dental infections. The high prevalence of ß-lactamase-producing bacteria is an important reason for the increase in bacterial resistance. Considering this, we preferred to use a ß-lactamase-containing antibiotic in this study. Our results suggest that it is beneficial to use an antibiotic with an antimicrobial rinse rather than use it alone.

Although various researches have been carried out for many years, there is still quite a long way to overcome this painful condition. Further studies with well-controlled results are necessary to draw firm conclusions, which can lead the most beneficial method for the prevention of alveolar osteitis.

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