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Do antibacterial mouthrinses affect bacteraemia in third molar surgery? A pilot study

A Tuna,* C Delilbasi,† A Arslan,* Y Gurol,‡ Z Tazegun Tekkanat‡

*Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Yeditepe University, Istanbul, Turkey.
†Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Istanbul Medipol University, Istanbul, Turkey.
‡Department of Microbiology and Clinical Microbiology, Faculty of Medicine, Yeditepe University, Istanbul, Turkey.

ABSTRACT

Background: The aim of this pilot study was to evaluate the effects of mouthrinses containing 7.5% povidone iodine and 0.2% chlorhexidine on bacteraemia following impacted third molar surgery.
Methods: Thirty-four patients were enrolled in this study. Patients in the first group were asked to rinse their mouth with the mouthrinse containing 7.5% povidone iodine, patients in the second group were asked to rinse with the mouthrinse containing 0.2% chlorhexidine and patients in the third group were asked to rinse with 0.9% NaCl (sterile saline) solution. All rinses were used for one minute preoperatively. Peripheral venous blood samples were collected at baseline (preoperatively), 1 and 15 minutes after the completion of surgical tooth removal. Each blood sample was divided in two, placed in aerobic and anaerobic culture bottles and processed for microbiological examination.
Results: Bactaeremia was detected in 33% of the povidone iodine group, 33% of the chlorhexidine group and 50% of the control group. Isolated bacteria were 58% anaerobes and predominantly 92% *Streptococcus* species. Incidence of bacteraemia was reduced with chlorhexidine and povidone iodine mouthrinses in third molar surgery, although the difference was not statistically significant ($p > 0.05$).
Conclusions: Bacteraemia was reduced with antibacterial mouthrinses in third molar surgery. The results of this study should be confirmed with further studies conducted on a larger patient population and with different antibacterial mouthrinses.

Keywords: Bacteraemia, chlorhexidine, oral surgery, povidone iodine, third molar surgery.

Abbreviations and acronyms: AHA = American Heart Association; BSAC = British Society for Antimicrobial Chemotherapy; CHX = chlorhexidine; GB = gingival bleeding; GBI = gingival bleeding index; PI = povidone iodine.

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INTRODUCTION

Focal infection is a localized or general infection caused by the dissemination of microorganisms or toxic products from a focus of infection. Focal oral infection can be defined as infections occuring in different locations of the human body which are caused by microorganisms (or their products) inhabiting the oral cavity. Bacteraemia constitutes an essential step in the pathogenesis of some local infections of oral origin such as bacterial endocartitis, prosthetic joint infections and brain abscesses.[1]

It has been a long time since the presence of bacteria in the bloodstream following dental extractions was first demonstrated. Many authors have studied the occurrence of bacteraemia associated with dental extractions,[2] but few papers have been published the frequency and aetiology of bacteraemia following third molar extractions.[3–6] Under normal conditions, these bacteria move from the bloodstream to the tissues and are rapidly eliminated by the reticulo-endothelial system. In patients with heart disorders associated with an increased risk of endocarditis, antibiotic prophlaxis is recommended prior to dental treatments.[1] The side effects of the antibiotics and difficulty in using them in routine dental treatment have led researchers to look for other ways of preventing bacteraemia. It is claimed that antibiotics may cause 2.9% of all adverse drug reactions, such as skin reactions (82%), gastrointestinal alterations (7%), liver problems (1%) and haematological complications (1%).[7] Thus, the greater the indiscriminate use of antibiotics, the greater the probability

that adverse reactions could outweigh the risk of bacterial endocarditis.

Previous studies have shown that antibacterial mouthrinse products – chlorhexidine, iodophors and phenolics – can effectively decrease the overall quantity of oral bacteria and reduce their negative effects (such as periodontitis), as well as the incidence of bacteraemia induced by various dental procedures.[8,9] Third molar surgery is one of the most commonly performed procedures in oral surgery. It can entail minor and major complications which can affect the patient's quality of life.

The aim of this pilot study was to evaluate the effects of mouthrinses containing 0.2% chlorhexidine and 7.5% povidone iodine on bacteraemia following impacted third molar surgery.

METHODS

The study group comprised 38 patients who underwent surgical removal of impacted mandibular third molar under local anaesthesia at Yeditepe University, Faculty of Dentistry, Istanbul, Turkey. Informed consent was obtained from all participants.

The inclusion criteria for the study were: patient aged over 18 years requiring surgical removal of a third molar, with neither any systemic disorder nor any signs or symptoms of pericoronitis at the time of surgery nor during the previous month, with no known risk factor for bacterial endocarditis, who had received no antibiotic treatment during the previous 30 days, was not using routine oral antiseptic mouthrinse nor suffering any type of congenital or acquired immunodeficiency and had no other disease or condition which could predispose to infections or bleeding. Patients with an oral hygiene index and gingival bleeding index (GBI) higher than 10% were also excluded from the study.

In order to determine the patients' oral health status, intraoral and radiological examinations to gather information on plaque deposits,[10] the presence of gingival bleeding (GB)[11] and the presence of periapical lesions associated with the third molars were conducted. The indications for extractions were pericoronitis reported by the patient and/or the dentist (excluding patients who had experienced some episode in the month prior to enrolment) and extractions for non-infective reasons.

Grade of inclusion, depth of impaction, level of insertion, relationship with the ascending ramus and the lower second molars were recorded according to the Pell and Gregory classification.[12] Elapsed time for the surgical procedure was regarded as the time span between the first incision and the last suture. All surgical procedures were performed with local anaesthesia and under conditions considered aseptic. The third molars were exposed by elevating a buccal mucoperiosteal flap. Osteototomies were implemented by using handpieces under sterile saline irrigation. Only one tooth was removed in each session for the study.

To determine the prevalence of bacteraemia following surgical removal of the third molars, peripheral venous blood samples were collected from each patient at baseline (before the injection of local anaesthesia with articaine and adrenaline), 1 minute and 15 minutes after completion of the extraction. Every blood sample comprised 20 ml of blood which was divided into two bottles with anaerobic culture medium (10 ml) and aerobic culture medium (10 ml) (BACTEC, Becton Dickinson, Franklin Lakes, NJ, USA). Altogether, 60 ml of blood was obtained from each patient by a researcher who was blind to details of the study. Participants (n = 38) were randomly allocated into three groups via drawing lots by the same blinded researcher. Patients in the first group were asked to rinse the mouth with 15 ml 7.5% povidone iodine (PI) mouthrinse for 1 minute following the initial blood collection, before the surgical procedure. The second group was asked to rinse the mouth with 15 ml 0.2% chlorhexidine (CHX) mouthrinse for 1 minute following the blood collection, before the surgical procedure. The third group was designated the control group and was asked to rinse the mouth with 0.9% NaCl (sterile saline) solution. Patients were supervised during mouthrinsing to ensure they were using the mouthrinse appropriately. For blood culture collections, a large-bore (18–22 g) angiocath needle was inserted in the antecubital fossa or dorsum of the hand, after cleansing the skin in the usual manner with alcohol for 30 seconds. Three blood samples of 20 ml each were drawn from each participant and divided into two aliquots of 10 ml, one for aerobic culture and one for anaerobic culture. After each sample was drawn, the angiocath needle and the line were flushed with 3 ml of saline. This procedure was repeated three times (baseline, 1 minute and 15 minutes postoperatively). The bottles were transported immediately to the microbiology laboratory. The collection, handling and transport of the blood samples for blood cultures were performed according to the literature and using the methods described in other studies on bacteraemia following dental procedures.[4–6]

All the blood culture bottles were processed in the BACTEC 9120 system (Becton Dickinson, NJ, USA) in the microbiology laboratory. At the end of the seventh day of incubation, samples which showed no production were subcultured on 5% sheep blood agar and chocolate agar; those which did not show any production were designated negative. Positive samples were subcultured on 5% sheep blood agar and chocolate agar. At the end of 24 hours of incubation, these samples were subjected to further biochemical tests using the mini API kit (Biomerieux, Marcy-L'Etoile,

France) in accordance with the recommendations of the American Society for Microbiology[13] and bacteria were isolated. Samples which were identified as positive by BACTEC 9120, but no microorganism detected with the Gram stain were accepted as false positives. *Streptococcus viridans* were classified into five groups: *mitis, anginosus, salivarius, mutans* and *bovis*.[12,14]

Statistical tests were performed using NCSS 2007 programme for Windows. Descriptive statistics (mean, standard deviation) are presented and the Kruskal–Wallis test was used to compare multiple groups. For two sample comparisons, the Mann–Whitney U test was used and for comparisons of qualitative data the chi-square test and McNemar's test were used. Statistical significance was set at $p \leq 0.05$.

RESULTS

Four patients were excluded from the study. Two were excluded from the control group due to injury of the venous pathway during the insertion of the angiocath and the other two patients were excluded from the CHX group because of the presence of bacteraemia discovered in the preoperative blood culture. The remaining group consisted of 34 patients (14 males, 20 females) with mean age 26.8 (SD 4.8, range 18–58 years). They were divided into three groups: the PI group (5 males, 7 females); the CHX group (4 males, 8 females); and the control group (5 males, 5 females). The distribution of the impacted third molars according to the groups is shown in Table 1. The three groups were similar for age, gender balance, mean plaque index, gingival bleeding index and duration of the operation, there being no significant differences between groups ($p > 0.05$) (Table 2). Table 3 presents data on the prevalence of bacteraemia in the PI, CHX and control groups overall and at 1 and 15 minutes; no differences were found between groups or with time ($p > 0.05$).

The positive blood cultures displayed 58% anaerobic bacteria and 42% aerobic bacteria. Most of them were *Streptococcus* bacteria (92%). Among them, *Streptococcus viridans* was most frequently observed; 38% of the 24 bacteria were *S. anginosus*, 13% were *S. salivarius* and 13% *S. mitis*.

A total of nine species of bacteria were isolated from surgical third molar post-extraction blood cultures. The distribution of bacteria regarding the groups and time intervals are presented in Table 4.

Table 1. Distribution of the impacted third molars by study group

Position of the impacted third molars	PI group n = 12	CHX group n = 12	Control group n = 10
Full bony impaction	8	9	7
Partial bony impaction	0	0	0
Soft tissue impaction	4	3	3
Mesioangular	4	4	3
Distoangular	0	0	0
Vertical	5	4	5
Horizontal	3	4	2
Buccolingual	0	0	0
Inverted	0	0	0

DISCUSSION

The basic role of healthcare providers is to increase human life span and quality of life. Infections originating from oral and dental sources decrease the quality of life of patients and sometimes cause life-threatening complications. Bacteraemia is transient in healthy subjects and may be asymptomatic. On the other hand, in subjects with a congenital cardiac disorder or carrying heart valve prosthesis, bacterial endocarditis may occur.

The American Heart Association (AHA) recommends prophylactic antibiotic regimes for patients who are at risk of developing endocarditis resulting from transient bacteraemia associated with invasive dental procedures.[8] However, the current guidelines of the British Society for Antimicrobial Chemotherapy (BSAC) and AHA both question the use of antibiotic prophylaxis due to the risk of severe allergy. The BSAC states that there is a lack of supporting evidence that dental treatment leads to infective endocarditis and the administration of antibiotics may lead to other serious complications such as anaphylaxis or antibiotic resistance. Therefore, it was agreed to recommend propylaxis only for those patients in whom the risk of developing endocarditis is high and, if infected, would cause a particularly high mortality.[15] The BSAC recommends prophylaxis for dental and non-dental procedures (including gastrointestinal and genitourinary), whereas AHA recommends prophylaxis for dental and respiratory procedures only, and not gastrointestinal or genitourinary procedures. While these two guidelines differ in their details, they all point toward a general trend against empiric use of antibiotic prophylaxis for infective endocarditis. There are also some side effects or adverse reactions against antimicrobial rinses. Gastrointestinal complaints, taste alterations, staining and allergic reactions may be seen although not common.[16] The prophylactic regimens are currently under discussion and are largely successful, although bacterial endocarditis following dental manipulation has not been completely eliminated.[9] Durack[17] reported that 92% of failed prophylactic, systemic antibiotic regimens were associated with dental procedures in susceptible patients. Of these failures, 75% were specifically related to orally derived *streptococci*. Fine *et al.*[8] stated that pre-procedural subgingival irrigation and rinsing with an antiseptic mouthrinse resulted in a dramatic reduction of blood-borne

Table 2. Age, gender, average plaque index, gingival bleeding index (GBI) and duration of the operation among the groups

	Males (n)	Females (n)	Age years	SD	Plaque Index	SD	GBI	SD	Operation duration, minutes	SD
PI group	5	7	24.8	4.49	0.38	0.04	0.20	0.05	20.6 mins	8.40
CHX group	4	8	27.7	10.01	0.40	0.01	0.22	0.02	23.1 mins	9.05
Control group	5	5	27.0	8.30	0.35	0.03	0.23	9.06	20.0 mins	13.30
$X^{2:}$1.90 p = 0.451	F:0.01		p = 0.971		p = 0.647		p = 0.539		p = 0.670	

Table 3. Bacteraemia occurrence according to the three groups (n = number of the participants)

		PI group		CHX group		Control group		P
		n	%	n	%	n	%	
Bacteraemia present		4	33%	4	33%	5	50%	p = 0.510
Bacteraemia at 1st min		4	33%	3	25%	4	40%	p = 0.612
Bacteraemia at 15th min		0		2	17%	3	30%	p = 0.079
McNemar's	p	0.985		0.250		0.810		

Table 4. Types of bacteria isolated from blood cultures in PI, CHX and control groups

	Povidon iodine (PI) group		Chlorhexidine (CHX) group		Control group	
	1st min	15th min	1st min	15th min	1st min	15th min
Aerobic	*Streptococcus anginosus* *Streptococcus intermedius* 2 *Streptococcus oralis*		*Streptococcus constellatus* *Streptococcus mitis* *Streptococcus salivarius*		*3 Streptococcus anginosus*	*Streptococcus salivarius*
Anaerobic	*2 Streptococcus anginosus*		*Streptococcus anginosus*	*Staphylococcus capitis*	*Streptococcus gordonii* *Streptococcus oralis*	*2 Streptococcus anginosus* *Streptococcus oralis*
	Streptococcus sabrinus		*Streptococcus mitis*	*Staphylococcus epidermidis*	*Streptococcus salivarius* *Streptococcus mitis*	*Staphylococcus epidermis*

anaerobic and aerobic bacteria provoked by ultrasonic scaling. It is known that irrigation of the gingival sulcus with PI and CHX mouthrinses entails a decreased level of bacteraemia after extraction of molar teeth.[9] Kosutic *et al.*[18] recommended CHX mouthrinse for oral surgical procedures lasting longer than one hour, while PI is suggested for procedures lasting up to one hour. Although Rahn *et al.*[9] showed that CHX was less effective than PI in the prevention of bacteraemia, our results demonstrated that they have similar effects.

In the literature, the prevalence of bacteraemia associated with third molar extractions varies between 40% and 60%.[6,19] In the present study, the prevalence of bacteraemia in the control group was 50%, which is in the same range. Although 33% of the CHX and PI group showed bacteraemia, this was not statistically significantly different from the control group.

In the literature, time for blood sample collection varies from 30 seconds to 24 hours postoperatively.[3,4,19] We decided to take the blood samples 1 and 15 minutes after the extractions.

The AHA announced that bacteraemias of oral origin are of a transient nature as they do not continue to exist for more than 15 minutes after completion of the dental procedure.[6,20] We took the second blood sample after 15 minutes and found positive blood cultures in the control group, as reported in previous studies (25–40%).[4,19] However, in the PI group, all blood cultures were negative after 15 minutes whereas 17% of patients had bacteraemia in the CHX group. Although these comparisons between the mouthrinses were not statistically significant, it seems reasonable to conclude that PI worked better than CHX to prevent the occurence of bacteraemia after impacted third molar extractions.

According to some authors, *S. viridans* were most frequently isolated in third molar post-extraction blood cultures.[3,6] Like these studies, we also observed mostly *S. viridans*.

Staphylococcus spp. are considered microorganisms of the skin and they are ignored in some studies since their presence may indicate contamination.[21] In the present study, these bacteria were the second most common genus, being isolated from 13% of the positive blood cultures, a frequency similar to that observed by other authors.[6]

Heimdahl *et al*.[19] demonstrated that bacteraemia was not related to the extent of surgery, as a single conventional dental extraction could produce a higher occurrence of bacteraemia than unerupted third molar surgery. For some authors, a possible explanation might be the rich bacterial flora present on the tooth surface and in the gingival sulcus of erupted teeth.[4,5,19] It is reported that the rate of bacteraemia is higher when extracting a totally erupted tooth versus a partially erupted tooth.[19] The prevalence of bacteraemia following impacted third molar surgery in the present report was similar to that from simple dental extraction of third molars reported in the literature.

CONCLUSIONS

In our study most patients for whom surgical extraction of impacted third molars was performed developed post-extraction bacteraemia, but its frequency may depend upon the use of mouthrinse. The results of this study should be confirmed with further studies conducted on a larger patient population and with different antiseptic mouthrinses.

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Address for correspondence:
Dr Cagri Delilbasi
Department of Oral and Maxillofacial Surgery
School of Dentistry
Istanbul Medipol University
Unkapanı
Atatürk Bulvarı No. 27
Fatih–Istanbul 34083
Turkey
Email: cdelilbasi@yahoo.com