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The Efficacy of Using Mouthwash after Dental Extraction— A Systematic Review

1. Meshari Saeed Alzahrani, Resident in Pediatric Dentistry (Saudi Board), Al Hada Armed Forces Hospital, Taif, At`Taif, Kingdom of Saudi Arabia.
Email: m.alzahrani@tudent.org
2. Bhari Sharanesha Manjunatha, Professor (Associate), Basic Oral Medicine and Allied Dental Sciences, Faculty of Dentistry, Taif University, Taif, Kingdom of Saudi Arabia.
Email: drmanju26@hotmail.com
3. Omar Ibrahim Alotaibi, Resident in Pediatric Dentistry (Saudi Board), King Abdulaziz Medical City for National Guards, Jeddah, Kingdom of Saudi Arabia.
Email: omaribrahim@tudent.org
4. Mohammed Saeed Alghamdi, Resident in Restorative Dentistry, College of Dentistry, King Abdul Aziz University, Jeddah, Saudi Arabia. themshg@gmail.com

CORRESPONDING AUTHOR:

Dr. Bhari Sharanesha Manjunatha
Professor (Associate) in Oral Biology, Dept. of Basic Oral Medicine and Allied Dental Sciences
Faculty of Dentistry, Prince Sultan Campus, Hawaiah, Taif University,
At`Taif, Kingdom of Saudi Arabia. E-mail; drmanju26@hotmail.com

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ABSTRACT

Background: There are over 700 bacterial species identified in the human oral cavity, of which 400 were located in the periodontal pocket next to the teeth. Besides, bacteremia following dental procedures was found to be a global problem. Methodology: This is a systematic review conducted from December 1, 2020, to January 26, 2021. The databases "PubMed", "Google Scholar" and "Medline" were searched, and the study included trials investigating the efficiency of mouthwash following dental extraction conducted on the adult population, without restrictions to the year of publication or language. Results were excluded based on stages of title, abstract, and full-text assessments. The risk of bias was assessed using Cochrane's risk of bias tool. Results: After searching PubMed, Google Scholar and Medline databases, 335 relevant studies were exported to Rayyan application, where duplicates were removed. Eight articles were closely related to the targeted topic and included for the qualitative data synthesis. Conclusion: We found that using 0.2% chlorhexidine (CHX) as a prophylactic mouthwash or as a supplement to habitual oral hygiene against post-extraction bacteremia (PEB) is significantly effective. However, SOS was found to be safer in some cases. Most of the literature reported no significant difference between cetylpyridinium chloride (CPC) and chlorhexidine. Povidone-iodine used as 1% mouthwash was found to be efficient in decreasing the incidence of dry sockets.

KEYWORDS: Mouthwash, chlorhexidine, post-extraction bacteremia, cetylpyridinium chloride, Povidone-iodine

INTRODUCTION

In the human oral cavity, over 700 bacterial species have been identified, of which 400 were located in the periodontal pocket next to the teeth [1]. Some of these species have the potential to cause local infections, such as periodontal disease (PD). However, many more species have been reported in bacteremia; others can induce distant-site infections (DSIs), such as infective endocarditis (IE) or prosthetic joint infections (PJIs), after entering the bloodstream [2, 3].

The first reference to mouth rinse as a systematic procedure is traced to Chinese medicine, around 2700 B.C.E., for the treatment of gums [4]. Gram-positive and Gram-negative bacteria that develop oral biofilms release several metabolites that cause gingival inflammation (i.e., gingivitis). Gingivitis may lead to periodontitis, a disease in which gingival tissues and bone tissues are damaged. Most of the population may not implement adequate mechanical removal of the plaque. Antimicrobial mouth rinses that enhance regular home hygiene may also provide an efficient way to remove or monitor bacterial plaque to diminish gingivitis and periodontitis [5].

Bacteremia is widespread after invasive dental operations as well as regular dental manipulations, including tooth brushing [6]. As a result, there has been a long-standing focus on the avoidance or reduction of bacteremia through the application of antibiotic prophylaxis (AP) prior to dental operations in patients at risk for DSIs [3, 7]. Several intraoral procedures cause bacteremia,as in 31-54% among the patients undergoing endodontic therapy [8], in 55% for third molar surgery, and in 100% of the patients who had tooth extraction [9].

Various procedures, antimicrobial agents, and materials have been suggested to reduce microbial cross-contamination in the dental clinics, including immunization of dental personnel, sterilizing of instruments, decontamination of surfaces, and using pre-procedural mouthwashes and personal protective barriers [10, 11].

Most of the emphasis on preventing infective endocarditis (IE) has concentrated on the hazard of dental and other non-dental procedures [12]. The American Heart Association (AHA) guidelines for antimicrobial prophylaxis for IE are uncertain due to a lack of conclusive proof of effectiveness and because they are primarily focused on studies using surrogate risk measures [13, 14]. Studies of prevalence, duration, type (species), and severity of dental bacteremia are frequently in dispute due to heterogeneity in the sample [15]. While numerous studies address dental bacteremia –known to be the most intrusive of dental office operations– there are few such statistics on normal day-to-day practices such as dental brushing [16].

In 2006, the British Society for Antimicrobial Chemotherapy (BSAC) recommended patients with IE use a single mouthwash with 0.2% chlorhexidine (CHX) gluconate (10 ml for 1 minute) prior to performing dental procedures [17]. However, in 2007, the AHA did not advise using any antiseptic prophylaxis protocol [12]. Later in the United Kingdom, in 2008, the National Institute for Health and Clinical Excellence (NICE) conducted a systematic review of the antimicrobial prophylaxis strategies for IE and found that CHX used as an oral rinse would not substantially decrease the level of bacteremia after dental procedures [18].

Due to factors such as heart rate, blood flow, the proximity of the blood collecting site to the bacteremia source, and accelerated bacterial clearance by the reticuloendothelial system, it is impossible to measure the magnitude of bacteria that are initially entering circulation after dental procedures. While animal model data have shown that the rate of infection of compromised cardiac valves is dependent on the inoculum size of the bacterial challenge, with greater inoculum producing higher rates of infection, there is no data on the range of inoculum that results in endocarditis in susceptible patients [5, 6].

We conducted a systematic review of randomized controlled trials (RCTs) to compare the effect of different mouthwashes on post-extraction bacteremia (PEB) after dental extraction.

MATERIALS AND METHODOLOGY

- **Study design:** Systematic review article.
- **Study duration:** The study was conducted from December 1, 2020, to January 26, 2021.
- **Selection criteria**

Inclusion criteria

We included studies conducted on the adult population, without restrictions to the year of publication or language.

Studies were included if they were trials investigating the efficiency of mouthwash following dental extraction.

Exclusion criteria

Studies were excluded if they did not assess the outcome of interest or if the mouthwash was not applied after dental extraction. No systematic reviews and meta-analyses were included in our data synthesis.

- **Search strategy**

The databases "PubMed", "Google Scholar" and "Medline"were searched for relevant literature without restrictions to language or year of publication. We used the search terms "Mouthwash", and "Dental extraction" in combination with "Efficiency", "Antiseptic", "Oral infection", "Chlorhexidine", "Antibiotics" and "PVP-iodine".

- **Study selection and quality assessment**

Search results were imported to Rayyan, a web and mobile app for systematic reviews [19]. After duplicate removal, publications were screened by title for the initial exclusion of irrelevant studies, and the remaining studies were enrolled for abstract screening. After excluding irrelevant studies were excluded based on abstracts, full texts of the remaining articles were assessed by two reviewers independently. Details of studies were extracted using a Microsoft Excel data extraction sheet, where the following items were collected: study ID, title, authors, study year, study design, study setting, country, population type, number of participants, age range, age mean ± standard deviation, males (n), males (%), condition, and findings. The quality of studies was assessed using the Cochrane risk of bias tool [20] by two reviewers. Disagreements between reviewers were discussed and resolved.

RESULTS

Search outcomes

After conducting a systematic search in PubMed, Google Scholar and Medline databases, 335 relevant studies came out. These 335 studies were filtered with title search, so we achieve maximum related search to our study, then eight articles were closely related to the targeted topic. Figure 1 summarizes the search process.

Qualitative data synthesis

A total of 8 studies was enrolled for the qualitative data synthesis. The listed detailed data of the eight studies are shown in table (1).

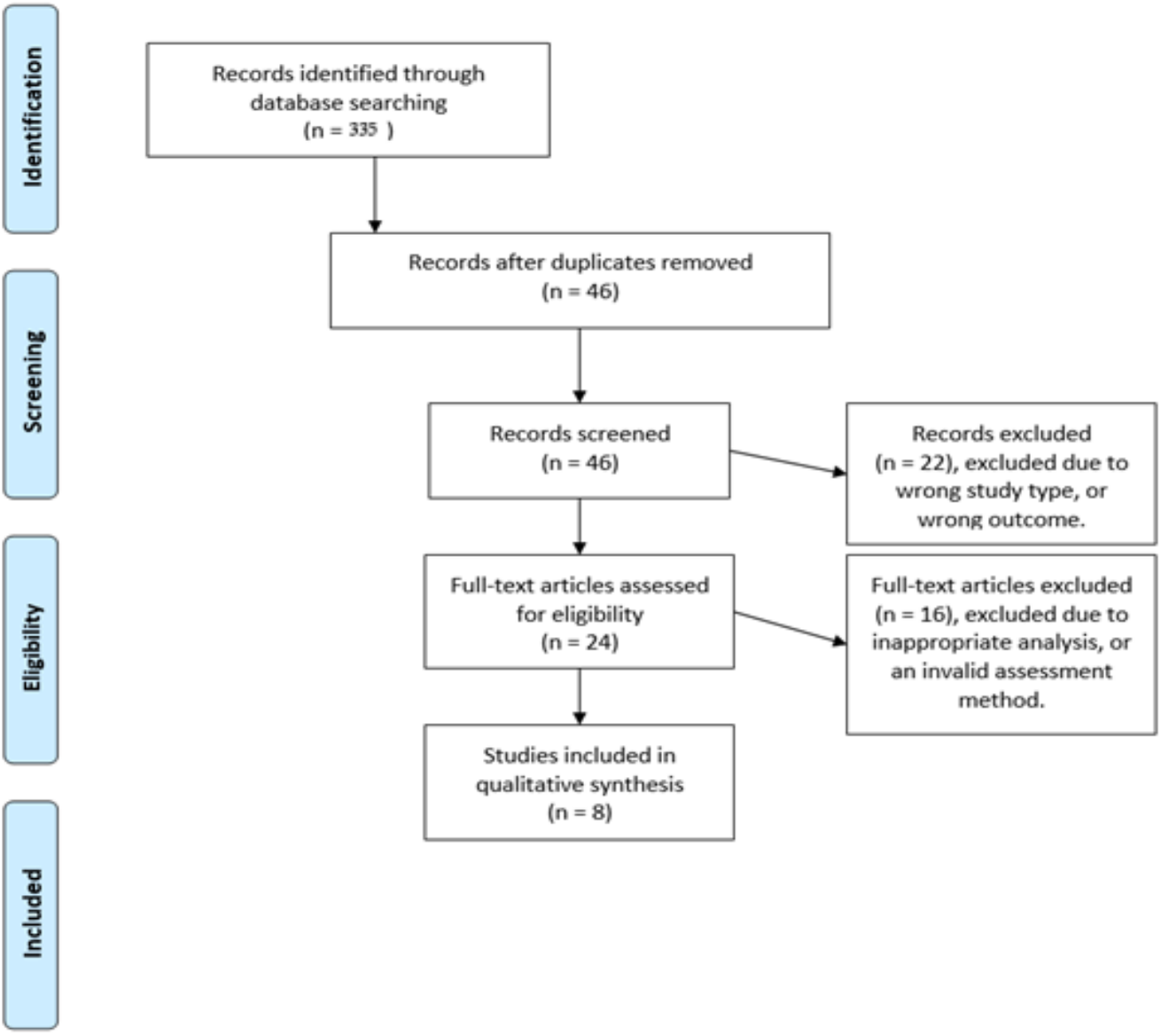

Figure (1): Flow diagram of article screening and selection process.

Table (1): Characters of included studies.

Study [Ref.]	Study year	Country	Study design	Study setting	Participants number	Age range	Age (Mean +-SD)	Males (n)	Males (%)
Arteagoitia et al. [21]	2014	Spain	Clinical trial	Hospital based	261	25-69	44.3±11.05		
Barbosa et al. [22]	2010-2012	Portugal	Randomized-control study	Hospital-based	201		46.7±16.7	87	43.3
Coello-Gómez et al. [23]	2016	Spain	A randomized, double-blind prospective study	Hospital-based	20		29.6±9.17	4	20
Hasheminia et al. [24]	2017	Iran	Unclear	Hospital based	189	22-46	31.3	80	42.3
Jenkins et al. [25]	1994	England	Double-blinded randomized crossover study	Hospital based	20	21-37	26	9	45
Netuschil et al. [26]	1995	Germany	Double-blinded randomized	Community based	40	16-31		17	42.5
Retamal-Valdes et al. [27]	2015	Brazil	Single blinded randomized clinical trial	Hospital-based	15	18-70	46.27±6.63	8	53.3
Tomás et al. [28]	2007	Spain	Unclear	Hospital-based	53		25.5±10.3	23	43

Quality assessment

The summary of quality assessment is shown in figures 2 and 3.

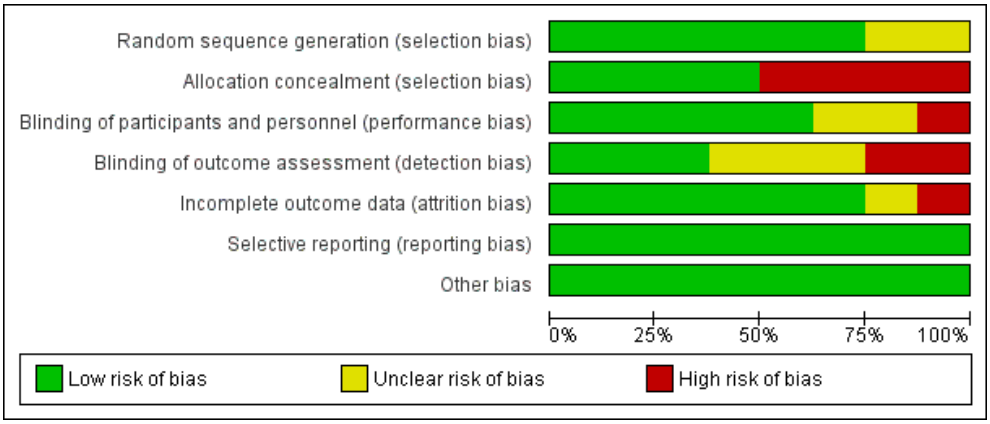

Figure (2) shows the estimated risk of bias forthe included studies.

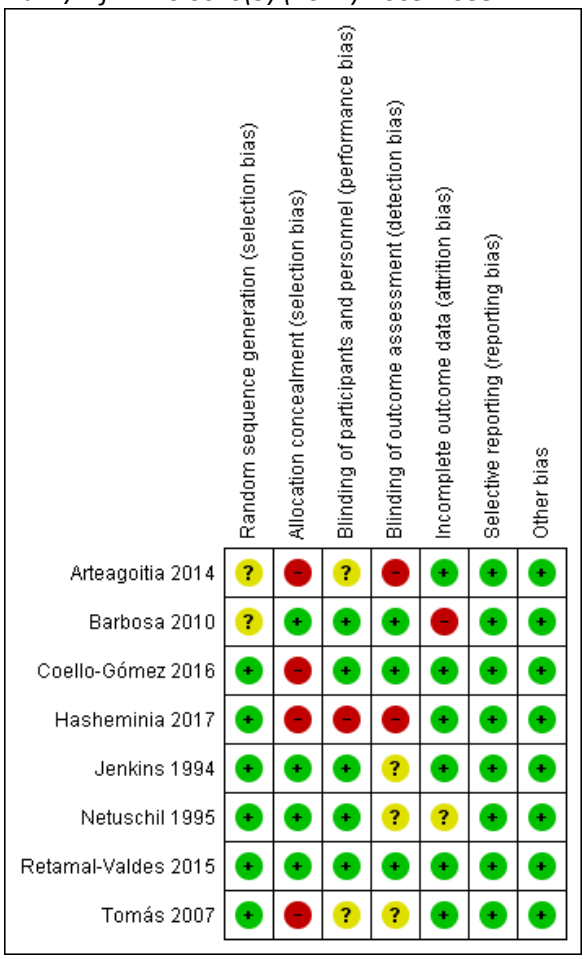

Figure (3) illustrates the review authors' judgment about each risk of bias item presented as percentages across all included studies.

DISCUSSION

Due to the recent debate about the use of antiseptics in preventing PEB, there has been an exploration of the efficiency of different mouthwashes and CHX was the most one of interest. This systematic review aimed to compare the effect of mouthwash on 897 participants after dental extraction.

Arteagoitia et al. **[21]** conducted a survey of 261 Spanish dentists on the receipt of antibiotics and antiseptics in procedures of impacted lower third molars. The study found that antibiotics and/ or CHX are frequently prescribed as prophylactic measures in clinical practice. Of these prescriptions, most cases had amoxicillin and amoxicillin/clavulanic acid for a week before the surgery.

Barbosa et al. **[22]** performed a randomized double-blinded clinical trial in Portugal, including 201 patients, to detect the effect of CHX on PEB. The study found that applying a 0.2% CHX

mouthwash significantly decreases the duration of PEB. Moreover, they established that subgingival washing with 1% CHX did not enhance the efficacy of the mouthwash. While the supragingival washing even reduced the efficiency, possibly as a result of the effect of these maneuvers on the bacteremia onset.

Coello-Gómez et al. **[23]** conducted a randomized double-blinded prospective study in Spain and included 20 patients who underwent lower third molars extraction. The study aimed to investigate the effect of the postoperative application of super-oxidized solution (SOS) versus 0.2% CHX gel and found that both CHX and SOS are efficient in enhancing the postoperative healing following the procedure.

Hasheminia et al. [24] conducted a study in Iran to detect the efficiency of 1% Betadine mouthwash on 189 patients who had dry sockets following mandibular third molar surgery. The study found that povidone-iodine 1% mouthwash decreases the incidence of dry sockets after mandibular third molar surgery.

Jenkins et al. [25] conducted a double-blinded randomized crossover study in England and included 20 patients with plaque regrowth. The study suggests that applying a lower concentration of CHX solutions may provide supplemental plaque inhibition of usual oral hygiene activities. A 0.05% CHX obtains a similar inhibition of plaque at the same concentration of cetylpyridinium chloride (CPC). They also recommended doing more experiments on lower concentrations of CHX solutions.

Netuschilet al. [26] conducted a double-blinded randomized clinical trial in Germany and included 40 patients to check the counts of plaque bacteria and vitality within CHX, Meridol, and Listerine mouth rinses. The study found that only dead and non-proliferating bacteria were detected on the teeth surfaces due to the significant antibacterial effect of CHX and Meridol usage. Consequently, only a thin plaque might develop. Clinically, both substances resulted in retardation of plaque development as reflected by remarkably decreased plaque indices.

Retamal-Valdes et al. [27] conducted a Single blinded randomized clinical trial in Brazil and included 60 volunteers who were classified into four groups (n= 15 per group. The first group tested mouthwash of 0.075% CPC, 0.28% zinc lactate, and 0.05% sodium fluoride (CPC+Zn+F), the second group had negative control with water, the third group had positive control with 0.12% CHX and 10% alcohol, and the fourth group had the standard care of no rising (negative control). In conclusion, the findings of this analysis revealed that a mouthwash containing 0.075% CPC, 0.28% zinc lactate, and 0.05% sodium fluoride as a pre-procedural mouthwash

was efficient in decreasing bacterial species present in viable oral aerosols within ultrasonic prophylaxis.

Tomás et al. [28] conducted a study on 106 patients with mental and behavioural disabilities who underwent dental manipulation general anesthesia, 53 patients of them were a control group and did not receive CHX prophylaxis. They propose the routine use of a 0.2% CHX mouthwash prior to dental extractions to decrease the risk of PEB.

It is reported that ***Tomás et al.*** [28], conducted a study on 106 patients with mental and behavioral disabilities who underwent dental manipulation general anesthesia. Reducing the bacterial load in the oral cavity is the principal objective of antiseptic prophylaxis within dental manipulation [29]. Furthermore, using a single wash of 0.2% CHX is demonstrated to have significantly effective on the salivary flora [25], which was also recommended by ***Tomás et al.*** [28].

Another RCT was conducted in India to evaluate the effectiveness of subgingival irrigation and found that the use of subgingival irrigations with 0.06% CHX has a promising ability to preserve oral health and results in lower staining relative to CHX oral rinsing. The regimen also may prevent the need for periodontal procedures in comprised medical subjects [30].***Barbosa et al.*** **[22],** found that applying a 0.2% CHX mouthwash significantly decreases the duration of PEB. Moreover, they established that subgingival washing with 1% CHX did not enhance the efficacy of the mouthwash. While the supragingival washing even reduced the efficiency, possibly as a result of the effect of these maneuvers on the bacteremia onset.

***Arteagoitia et al*.** **[21],** found that antibiotics and/ or CHX are frequently prescribed as prophylactic measures in clinical practice. Of these prescriptions, most cases had amoxicillin and amoxicillin/clavulanic acid for a week before the surgery. Another study reported that PEB was found in 10% of patients who had 3 g amoxicillin in comparison with 89% of the control group, besides, this difference was statistically significant [31]. In contrast, another randomized clinical trial established that CHX did not decrease the onset of PEB, as 40% of patients had cultured bacteria in the CHX group compared to cultured bacteria in 35% of the control group [32].

Coello-Gómez et al. **[23],** aimed to investigate the effect of the postoperative application of super-oxidized solution (SOS) versus 0.2% CHX gel and found that both CHX and SOS are efficient in enhancing the postoperative healing following the procedure. This implies that there is no significant difference between both substances in pain, swelling, or visual Analogue Scale (VAS). Comparing to CHX, the taste of SOS is better, it does not stain the teeth, and patients can

use it for up to 30 days or more as a mouthwash after surgeries or simple procedures. Additionally, SOS was reported to be a safe treatment of diverse wounds such as; diabetic foot, venous stasis, ulcers, and burns [33-35].

Jenkins et al. [25], suggest that applying a lower concentration of CHX solutions may provide a supplemental plaque inhibition of usual oral hygiene activities. A 0.05% CHX obtains a similar inhibition of plaque at the same concentration of cetylpyridinium chloride (CPC). They also recommended doing more experiments on lower concentrations of CHX solutions. Another clinical trial reported that adding CPC to CHX had no significant difference and even fewer adverse effects [36]. Moreover, ***Retamal-Valdes et al.*** [27], compared four different measures and found that mouthwash containing 0.075% CPC, 0.28% zinc lactate, and 0.05% sodium fluoride as a pre-procedural mouthwash was efficient in decreasing bacterial species present in viable oral aerosols within ultrasonic prophylaxis.

A study compared between CHX, Meridol, and Listerine mouth rinses and found that CHX is the strongest solution when used as a supplement to habitual oral hygiene. Meridol and Listerine were more favorable for plaque control [37]. ***Netuschilet al.*** [26], found that only dead and non-proliferating bacteria were detected on the teeth surfaces due to the significant antibacterial effect of CHX and Meridol usage.

Biradar et al. [38] and ***Sweet et al.*** [39] established the decreased occurrence of dry sockets following using a topical antimicrobial agent and emphasized the role of bacteria in developing the dry socket. They also found that povidone-iodine 1% mouthwash reduces the onset of dry socket. This supports ***Hasheminia et al***. [24], who found that povidone-iodine 1% mouthwash decreases the incidence of dry sockets after mandibular third molar surgery.

CONCLUSION

This study found that applying CHX as a prophylactic mouthwash against PEB is significantly effective CHX also showed powerful and positive results if used as a supplement to habitual oral hygiene. However, SOS was found to be safer in some cases. We also found that most of the literature reported no significant difference between CPC and CHX.Povidone-iodine 1% mouthwash has proved to be efficient in decreasing the incidence of dry sockets in most cases.

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Conflict of interest: None.

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Ethics statement: None. The current study is based on systematic review of a topic and doesn't involve any humans and animals.

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