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Preoperative antiseptics in clean/contaminated maxillofacial and oral surgery: prospective randomized study

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Abstract. In order to show the effectiveness of preoperative antiseptic mouthwash the authors undertook a prospective study in 120 patients who underwent elective surgery under general or local anesthesia. Patients were allocated toone of 4 groups, depending on whether the oral cavity was washed preoperatively with 1% cetrimide, chlorhexidine, povidon-iodine or sterilized normal saline solution (control group). Aerobic and anaerobic bacterial samples were taken from the inferior vestibulum mucosa before surgery, 5 min after the start of the operation and at the end of the procedure. The results show a statistically significant reduction in bacterial counts during procedures in which antiseptics are used to wash the oral cavity preoperatively. 1% cetrimide solution was the most successful in reducing intra-oral bacterial counts and produced the longest lasting antiseptic effect. Chlorhexidine is a good option for procedures longer than 1 hour, while povidon-iodine is recommended for procedures lasting up to 1 hour. Normal saline reduced bacterial counts in the specimen taken 5 min after washing but this short-lasting effect is due to mechanical cleansing rather than the antiseptic effect.

Keywords: preoperative oral cavity washing; antiseptics; bacterial counts reduction; intra-oral surgery; postoperative infections.

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Local postoperative infections are one of the main causes of morbidity in maxillofacial and oral surgery. The risk of infection is increased in intra-oral surgical procedures because it is practically impossible to attain aseptic conditions owing to the large number of bacteria in the normal mouth. Infections in this region are polymicrobial (caused by anaerobic and aerobic bacteria)[3]. Qualitative microbiological analyses show that local wound contamination by the intra-oral bacterial flora is the usual cause of infection[19,10]. The normal bacterial flora in the oral cavity is variable and consists of potentially pathogenic anaerobic (90%)[2] and aerobic bacteria at an average concentration of 10^7–10^8 colonies per 1 ml of saliva[14] or 10^{11}/cm[2,8]. According to Johnson et al.[13], 76% of intra-oral bacteria are *Bacteroides* spp., usually *B. melaninogenicus* and *B. oralis*. Temporary reduction of intra-oral bacterial counts can reduce the

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risk of postoperative infection[26,30]. Perioperative antibiotic prophylaxis has been used for several decades; usually intravenously, seldom topically or in combination, but almost exclusively for procedures performed under general, not local, anaesthesia. There is no generally accepted universal protocol for perioperative antimicrobial prophylaxis in maxillofacial and oral surgery[11]. The most frequently used antibiotic for perioperative, intravenous prophylaxis in maxillofacial surgery, cephasolin, does not affect postoperative intra-oral bacterial counts[30]. The preoperative use of antiseptics in maxillofacial and oral surgery is controversial. Many studies confirm they reduce intra-oral bacteria and decrease bacteraemia during intra-oral surgical procedures[21,27,31,35] but most surgeons are not convinced of their effect on intra-oral bacterial counts or reduction in postoperative infections[11]. The most frequently used antiseptic solutions in maxillofacial and oral surgery are 0.12%, 0.2% and 1% chlorhexedine solutions and 1% povidone-iodine solution. A few large reports compare the *in vivo* effect of these two antiseptics for preoperative use in intra-oral surgical procedures in maxillofacial and oral surgery[21,23]. A few studies investigate the effect of washing the oral cavity with antiseptic solution instead of using the antiseptics as a preoperative mouthwash[24,30], especially for surgical procedures under local anaesthesia. *In vivo* prospective studies using 1% cetrimide solution for preoperative decontamination of the oral cavity have not been published.

The purpose of this study was to compare preoperative oral cavity decontamination using 3 different antiseptic solutions (1% solutions of povidone-iodine, chlorhexidine-gluconate and cetrimide) and a sterilized physiological solution (control group) to reduce intra-oral bacterial counts during and at the end of clean/contaminated surgical procedures within the oral cavity and to determine the most efficient one.

Materials and methods

Study design

This single-blind, prospective, randomized clinical study included 120 patients who underwent elective surgery within the oral cavity. Only patients with exclusively elective intra-oral surgical procedures under local or general anesthesia were included in the study.

Inclusion and exclusion criteria

Exclusion criteria were: acute maxillofacial trauma; malignant tumor of the oral cavity, oropharynx or larynx; intra-oral surgical procedure within 2 weeks of the study; antibiotic therapy within 2 weeks of the study; active infection or open wound intra-orally; and allergies to any substance investigated in the study. All patients gave their informed consent before inclusion.

Hypotheses

The hypotheses were: mechanical cleansing or preoperative oral cavity washing with a solution that has no known bactericidal effect (sterilized physiological solution in the control group) will not reduce intra-oral bacterial counts during surgery in the oral cavity; and preoperative oral cavity washing with antiseptic solution can efficiently reduce intra-oral bacterial counts during surgery and decrease the incidence of local postoperative infections.

Bacterial sampling and timing

Patients were randomized into four groups, with 30 patients each, in which the oral cavity was washed preoperatively with: sterilized 0.9% NaCl solution (normal saline; control group); 1% chlohexidine-gluconate solution; 1% povidone-iodine solution; and 1% cetrimide solution. Six samples for quantitative microbiological analysis were taken from the inferior oral vestibulum in each patient: preoperatively before oral cavity washing with one of the study solutions (aerobic and anaerobic bacteria); preoperatively 5 min after oral cavity washing (aerobic and anaerobic bacteria); and at the end of the surgery (aerobic and anaerobic bacteria). Sampling was based on a personal modification of a Count-Tact range (bioMerieux, Marcy-l'Etoile, France) standardized method for surface biocontamination microbiological control. The original method uses sterile (previously irradiated) culture media plates that allow direct application to the test surface (walls, floors, skin, mucosa) as described by the manufacterer and has been quality control certified (ISO standard). For testing surface bacterial contamination, the agar plate is applied directly to the tested surface for 10 s and then incubated according to the indications. This idea of direct contact–transfer of bacterial sample from the oral cavity mucosa to the culture media via sterilized micropore tapes was used. Micropore tapes (3M″, St.Paul, MN, USA), 1 × 1 cm in dimension, previously sterilized under pressure (13 min/134 °C/202, 6 kPa), were used to take a 'print' from the mucosa of the inferior vestibulum for 5 s. The sample was transferred immediately to an appropriate culture media for aerobes (aerobic sheep blood agar plate) and anaerobes (anaerobic brucella agar enriched with 5% sheep's blood and supplemented with vitamin K and hemin) and taken to 37 °C in a thermostat. Anaerobic samples were cultivated under anaerobic conditions (Genbox anaer, bioMerieux, Marcy-l'Etoile, France). The number of bacterial colonies was counted after 48–72 h of incubation for aerobes and 5–7 days for anaerobes by an experienced microbiologist. A direct method of assessing the number of bacterial colonies was performed using the Zeiss-Micro-Videomat opto-electronic image analyzer (Carl-Zeiss, Jenna, Germany), which allowed accurate examination of the agar plate, counting of the bacterial colonies by continous magnification and illumination, and the detection and recording of differences in optical density between bacterial colonies and agar. The enumeration and surface evaluation was performed automatically and could be read immediatelly in analogue values, indicating absolute counts in parts per thousand of the area of the colonies in the observation field. Preoperative antiseptic oral cavity washing was performed with sterilized gauze soaked in 30 ml of study solution. Data on age, gender, diagnosis, type of and length of procedure, allergies, smoking, antiseptic solution used for preoperative oral cavity washing, and clinical evidence of local postoperative infection 7 days after intra-oral surgery were collected from every patient at a follow-up examination.

Statistical analysis

The statistical methods used for correlating changes in anaerobic and aerobic bacterial counts after the oral cavity had been washed with one of the study solutions in relation to preoperative and postoperative intra-oral bacterial counts were non-parametric sign and signed rank tests. The non-parametric Wilcoxon exact test for independent samples was used to correlate the changes in intra-oral anaerobic and aerobic bacterial counts and the occurence of local postoperative infection depending on the solution used. The same test was used to evaluate the connection between the length of surgery and postoperative infection as well as smoking and intra-oral bacterial counts. The connection between the type of surgery and intra-oral bacterial