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The Efficacy of Pre-Procedural Mouth Rinse on Bacterial Count in Dental Aerosol Following Oral Prophylaxis

Wpływ płukania jamy ustnej przez zabiegami stomatologicznymi na liczbę bakterii w aerozolu w następstwie stomatologicznych zabiegów profilaktycznych

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A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation;
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Abstract

Background. The aerosols produced by ultrasonic devices are heavily contaminated by microorganisms which pose a serious health threat to the clinician. Thus protection of the clinician against these microorganisms becomes mandatory. Dental handpieces, ultrasonic scalers, air polishers and air abrasion units produce visible aerosols.

Objectives. The study was performed to assess the efficacy of pre-procedural rinsing with chlorhexidine mouth wash in reducing bacterial aerosol contamination following oral prophylaxis.

Material and Methods. The study was designed to include 20 systemically healthy patients within the range of 25–40 years of age. The subjects were randomly assigned into two groups. Group I subjects were given saline mouth rinse and the patients of group II were given chlorhexidine mouth rinse prior to the treatment. The aerosol produced by the ultrasonic unit was collected at the 6 o'clock position on blood agar plates within a range of 3 feet in both of the groups and the samples were inoculated onto blood agar plates. The blood agar plates were incubated for 24 hours and the total number of colony forming units (CFUs) were counted.

Results. The results showed that CFUs decreased in patients who had a pre-rinse with chlorhexidine mouth wash when compared to patients with saline mouth rinse.

Conclusions. Pre-procedural use of mouth rinse using chlorhexidine can significantly reduce the viable microbial content of dental aerosols and protect the operator from the bacterial hazards (*Dent. Med. Probl.* 2016, 53, 1, 78–82).

Key words: aerosols, colony forming units (CFUs), ultrasonic scalers, scaling.

Słowa kluczowe: aerozole, jednostki tworzące kolonie (CFU), skalary ultradźwiękowe, skaling.

The oral cavity is one of the most complex parts of the human body. It consists of teeth, periodontium and mucosa as well as secretory organs and harbors a heterogeneous microbial community [1, 2]. The oral cavity remains highly prone to infectious diseases [3]. Mechanical plaque removal through tooth brushing and flossing has been the universally accepted method for maintaining oral health. However, numerous studies have shown that most patients do not effectively

clean interdentally to remove dental plaque. This further leads to calculus formation which cannot be removed only by mechanical brushing, due to which the patient calls upon a dentist. Ultrasonic scaling has become part of the daily task in a dentist's job for oral prophylaxis [4].

Ultrasonic scalers are combined with water spray, which generates substantial amounts of droplets known as aerosol and splatter, containing body fluids such as blood and saliva, including

microbes [5]. Aerosol is defined as minute particles, which are 50 μm or less in diameter, suspended in air. It is also capable of penetrating deep into the respiratory system and the pulmonary alveoli [6, 7]. The ultrasonic scaler generates aerosol, with bacteria peaking over 300 CFU/ft³ of the dental clinic [8]. A study demonstrated that aerosols remained detectable in the air for at least 10 minutes following the completion of a procedure and were detected at 2 feet or more from the dental chair [9]. Bacterial count in the air increased by 30 fold during ultrasonic scaling [10]. Such data indicates that it is important to control the production of aerosol and splatter during ultrasonic scaling to prevent cross contamination in the dental office.

Antiseptic mouth rinse solutions are used in many clinical situations for different therapeutic and prophylactic purposes, many of which are recommended for home care practice [11, 12]. The main indications are either the improvement of dental health (plaque and gingivitis elimination in particular) or the prevention of infections caused by bacteria of the oral cavity in specific situations such as extractions, intraoral surgical procedures or transplantation [13].

One study shows the combination of pre-procedural mouth rinsing and a high-volume evacuator attachment is more effective in reducing the number of viable aerosols produced during ultrasonic scaling [14]. The present study was carried out to compare the efficacy of pre-procedural rinsing with a mouth rinse containing chlorhexidine and saline in reducing the viable bacteria in dental aerosol following oral prophylaxis in comparison to subjects who did not undergo pre-procedural rinsing, to determine the quantity of microorganisms present in the dental aerosol.

Materials and Method

Selection of Sample

The study was comprised of 20 subjects between 25 and 40 years of age who visited Saveetha's private dental college. The subjects were randomly distributed into two groups of ten subjects each. Group I: Pre-procedural mouth rinse with saline and Group II: Pre-procedural mouth rinse with 0.2% chlorhexidine mouthwash for 1 minute. The number of subjects was determined based on a power analysis at a confidence interval of 95% and power of the study at 80%. The subjects were included in the study if a minimum of 20 permanent teeth were present in the oral cavity, they had a lack of any dental treatment for the preceding 8 months and had a plaque index between 1 and 3.

Patients with any other systemic disorder like hypertension, rheumatic disorders, pregnancy and under any antibiotic or immunosuppressive treatment were also excluded from the study. Informed consent was obtained from the patients and the study was initiated.

Estimation of Pre-Procedural Bacterial Count

The subjects were asked to rinse their mouth and a salivary sample was collected prior to the study. The group I subjects were then asked to rinse with normal saline and group II with chlorhexidine mouth wash. At the end of 5 minutes another sample was taken and the salivary samples were diluted in normal saline in a test tube and the sample was inoculated onto blood agar plates using an inoculation loop. The agar plates were incubated at 37°C for 24 hours and the CFU were counted.

Estimation of Bacterial Count Following Scaling

The patients were rested in the supine position in the dental chair and the waterline and the bottles were disinfected. Ultrasonic scaling was done by qualified dental professionals. While the patients were undergoing scaling, aerosols were collected using the previously-mentioned criteria on blood agar plates placed at a distance of 3 feet away from the patient's mouth. The blood agar plates were incubated for 24 hours at 37°C and were inspected for the number of bacterial colony forming units (CFUs).

Independent sample t test and test of significance were performed to assess the mean bacterial load between the two groups using SPSS software. The level of statistical significance was set at $p < 0.05$.

Results

The mean of colony forming units on blood agar plates for the two groups at a standardized location is depicted in Fig. 1. There was no statistical significance in the reduction of the bacterial count when saline was used as a pre-procedural rinse before oral prophylaxis ($p > 0.05$). However, a statistical significance was observed when chlorhexidine was used as a mouth wash ($p < 0.005$) (Table 1). The bacterial count in aerosol was almost four times less in subjects who had a pre-procedural rinse with chlorhexidine mouth rinse, suggesting chlorhexidine reduces the bacterial load in the aerosol (Table 2).

Table 1. Number of colony forming units between pre-procedural and post-procedural use of saline and chlorhexidine mouth wash

		Number	Mean $\pm$ SD	t-value	p-value
Group I	Pre-procedural microbial assessment	10	909.22 $\pm$ 646.7	0.2832	0.390121*
	Post-procedural microbial assessment following saline	10	891.1 $\pm$ 595.19		
Group II	Pre-procedural microbial assessment	10	667.9 $\pm$ 380.42	3.0174	0.0037**
	Post-procedural microbial assessment following chlorhexidine mouth wash	10	222.7 $\pm$ 117.8		

*p > 0.05 suggesting no significance between the CFU in group I.

**p < 0.05 suggesting a significant decrease in CFU following the use of chlorhexidine mouth wash in group II.

Table 2. Test of significance to determine the CFU following post-procedural use of saline and chlorhexidine mouth wash

		Number	Mean $\pm$ SD	t-value	p-value
Group I	Post-procedural microbial assessment following saline	10	891.1 $\pm$ 595.19	2.8822	0.0049*
Group II	Post-procedural microbial assessment following chlorhexidine mouth wash	10	222.7 $\pm$ 117.8		

*p < 0.05 suggesting a significant decrease in CFU following the use of chlorhexidine mouth wash.

Fig. 1. Graph depicting the CFU formed between the two groups

Discussion

The aerosols produced by ultrasonic devices are heavily contaminated by microorganisms which pose a serious health threat to the clinician and his surroundings in the form of systemic conditions like the common cold, influenza, tuberculosis, HBV, HIV, etc. [15]. Thus, protection

of the clinician against these microorganisms becomes mandatory. Several studies have shown that ultrasonic procedures are associated with increased levels of bacteria in the aerosol, thus leading to airborne contaminants in the dental environment. Numerous studies have been published in the past which have analyzed the aerosol concentration in treatment rooms following scaling procedures. Chlorhexidine has also been shown to reduce the bacterial contamination in the aerosol and hence its use as a pre-procedural rinse will enable the reduction of bacterial load. Chlorhexidine-based mouthwash was the first clinically effective and demonstrated mouthwash that inhibited supragingival plaque formation [16]. Apart from the broad antimicrobial spectrum it covers, chlorhexidine mouth rinses also have a good substantivity, and that is why it is aptly recognized as the gold standard for chemical plaque control [17]. Thus this study aimed to determine the efficacy of chlorhexidine as a pre-procedural rinse in reducing aerosol contamination during oral prophylaxis procedures.

In this study we have exposed a non-selective medium, blood agar plate, before and during oral prophylaxis for 30 minutes and the total number of colony forming units were counted. The blood agar plates were used as it is an enriched media supporting the growth of fastidious organisms. Salivary samples were collected before and after oral prophylaxis to assess the reduction in bacterial load after the use of the mouth rinse and to determine the proportionate reduction in the bacterial load in the aerosol.

The results of this study showed that a rinse with chlorhexidine mouth rinse statistically decreases colony forming units during the oral prophylaxis procedure. The bacterial load was reduced by 93% following the use of chlorhexidine mouth wash when compared to the saline. Chlorhexidine is a bisbiguanide molecule which binds strongly to the hydroxyapatite of enamel and organic pellicle, salivary proteins, bacteria and oral mucosa, thereby being released after rinsing and sustaining release for a long time [16].

Studies have shown that ultrasonic scaling in conjunction with various plaque control agents used as a pre-procedural rinse have been found to be more effective in reducing bacterial loads when compared to distilled water or saline [17, 18]. The results of this study show that the CFUs in group II were significantly reduced when compared to that of group I.

The limitation of this study is that the CFUs counted here are values that represent the bacteria capable of growing on a blood agar plate. No at-

tempts were made to identify the type of bacteria, either pathogenic or nonpathogenic. The extent of this potential hazard due to aerosols is difficult to estimate since there is no evidence in literature that a specific disease has been caused in dental personnel by contaminated aerosol. Nevertheless, such contamination must be considered as undesirable and aerosol control measures such as pre-procedural rinse should be strictly implemented in periodontal clinics. Implementation of this study in clinical practice would prevent the transmission of disease through aerosols and should be made mandatory in those patients who are known to have infectious diseases.

Thus, the present study concludes that chlorhexidine has a significant effect as an antimicrobial pre-procedural mouth rinse in reducing the number of CFUs in the aerosol produced by the ultrasonic scaling units. Thus it is advisable for dental practitioners to use pre-procedural mouth rinses to protect themselves from bacterial hazards produced in the form of dental aerosols.

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