

Contamination of Toothbrushes after Use – A Randomized Control Trial & Pilot Study

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Abstract

Introduction: Tooth brushes have a significant role in disease transmission, and increase the risk of infection since they can serve as a reservoir for microorganisms. It has been reported that use of a plastic cap may provide a wet environment and lead to the growth of microorganisms like *Pseudomonas aeruginosa*, a gram negative aerobe and opportunistic pathogen.

Objective: To determine the level of contamination in used toothbrushes that were kept open and toothbrushes the heads of which were covered with a plastic cap.

Methodology: After full mouth oral prophylaxis, subjects were provided with toothbrush and asked to brush twice daily using Modified Bass method. At the end of one week, toothbrushes were collected in sterile pouches. Microbial culture was done and microbial count was recorded. After that, crossover was done and same procedure was carried out after which comparison of microbial counts with and without lid was done.

Results: Microbial count was higher in the toothbrushes covered with plastic cap

Conclusion: Regularly covering the toothbrush with a plastic lid may prevent complete drying of the toothbrush and provide moisture for the growth of microorganisms.

Keywords: toothbrush, contamination, sanitization, microbial load

Introduction

One of the main contributors of gingivitis and periodontitis is dental plaque, owing to poor oral hygiene maintenance. Use of oral hygiene aids like toothbrush and dental floss is essential for removal of dental plaque, thereby maintaining a healthy oral environment.

Although various types of toothbrushes and methods of tooth brushing are described, procedures required for maintaining the cleanliness of the toothbrush is very often overlooked.¹The concept of toothbrush contamination after use was proposed as early as 1920 by Cobb, who said that contaminated toothbrush was one of the causes for repeated infections in the mouth.²

Toothbrushes may become contaminated with microorganisms from the oral cavity, environment, and toilet aerosol contamination as well as from storage

containers.³ Micro-organisms that survive on toothbrushes may be transmitted to the individual, which in turn can further cause diseases.⁴ Toothbrushes of both healthy and diseased individuals have been shown to contain opportunistic and pathogenic microorganisms which might induce respiratory, gastrointestinal, cardiovascular and renal disturbances.⁵

Although various toothbrush manufacturers claim that use of a plastic cap for covering the toothbrush head is effective in reducing/preventing contamination, literature is scarce in this aspect. It has been shown that use of a plastic cap to cover the head of the toothbrush may help in the retention of moisture that promotes growth of microorganisms.¹

Therefore, the present study was conducted to determine the level of contamination in used toothbrushes that were kept open and toothbrushes the heads of which were covered with a plastic cap.

Subjects And Methods

Since the only publication on determination of the level of contamination in used toothbrushes that were kept open and toothbrushes whose heads were covered with a plastic cap does not have the information required to calculate the sample size, this study was conducted as a pilot study with a sample size of 10 patients in each group.

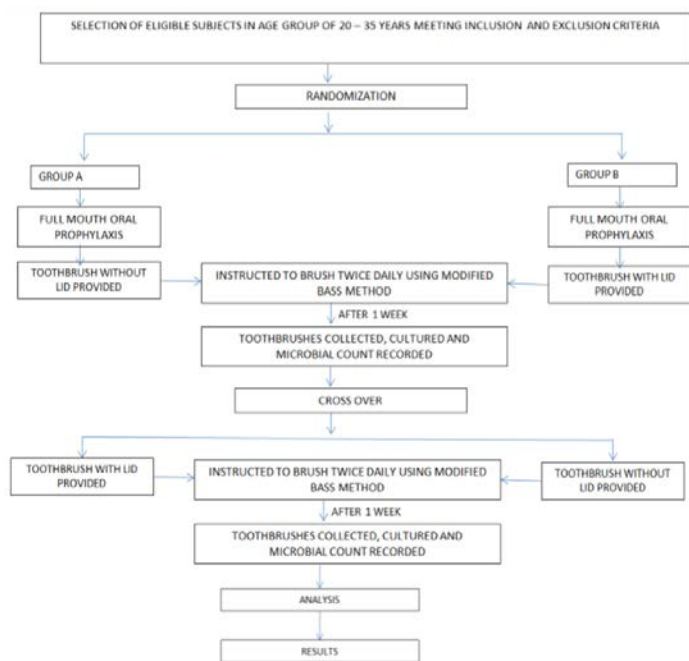
A total of 20 patients (10 males and 10 females) in the age range of 20-35 years (mean age 27.5 years) were selected from the out-patient Department of Periodontics, Amrita School of Dentistry, Kochi. All study subjects were given a detailed verbal and written description of the study and signed a consent form before commencement of the study. The study protocol was approved by the Institutional Ethical committee.

The trial was registered under the Clinical trials registry of India number- **CTRI/2018/09/015637**

The study population consisted of 20 clinically healthy subjects or subjects with mild gingivitis with good general health and atleast 20 natural teeth per arch. Subjects with systemic disease or infection, periodontal disease, endodontic or any oral infection, pregnant or lactating mother and subjects with deleterious habits like smoking, tobacco chewing etc. were excluded from the study.

Full mouth oral prophylaxis was done. Subjects were first randomized whether to receive toothbrush with or without lid by lottery method so as to avoid bias. They were provided with toothbrush (soft bristle) and dentrifice and asked to brush twice daily using Modified Bass method. At the end of one week, toothbrushes were collected in sterile pouches. Microbial culture was done and microbial count was recorded as the number of bacterial cells/ml. After that, crossover was done and subjects were provided with toothbrush (soft bristle) and dentrifice and same procedure was carried out after which comparison of microbial counts with and without lid was done. (Fig 1) – Summary of methodology employed

Figure 1: Summary of methodology employed



Statistical Analysis

To test the statistical significance of the level of contamination in used toothbrushes that were kept open and toothbrushes whose heads were covered with a plastic cap, Wilcoxon sign rank test was applied

Results

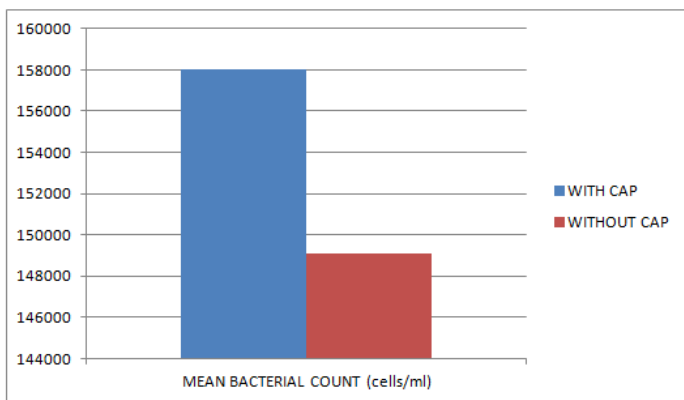
The study was conducted among 20 participants, who consented and fulfilled the inclusion and exclusion criteria, and were considered for clinical oral examination. In both cases, bacterial contamination was found in all the toothbrushes. Mean cell count/ml in toothbrushes with cap was higher ($15.8 \times 10^4 \pm 4.8 \times 10^4$) as compared to toothbrushes not covered with a plastic cap ($14.9 \times 10^4 \pm 4 \times 10^4$). There was a statistically significant difference seen between the two groups. (p value 0.005)

Table 1: Number of bacteria in used toothbrushes that were kept open and toothbrushes whose heads were covered with a plastic cap

Toothbrush	N	Mean (cells/ml)	Std. Deviation	p Value
With cap	10	158000.00	48488.257	0.005
Without cap	10	149100.00	44745.453	

P value < 0.05 is considered significant

Figure 2: Graphical representation of the Number of bacteria in used toothbrushes that were kept open and toothbrushes whose heads were covered with a plastic cap



Discussion

Toothbrush is the most common oral hygiene aid used to improve the oral health of an individual. Microorganisms infiltrate a toothbrush from the oral cavity or from the external environment, such as contaminated fingers, aerosols from toilet flushing and bacteria present in moist, humid conditions found in the bathroom.¹ Contaminated toothbrushes may cause disease transmission as well as increase the risk of an infection since they can serve as a reservoir for microorganisms in healthy or systemically diseased individuals or adults with poor oral health.⁴

Glass⁵ (1992) observed that injuries to oral tissues are aggravated by the use of contaminated toothbrushes when compared with sterile ones, and may even cause septicemia after brushing. After a single use for duration ranging from 30 s to 4 min, however, toothbrushes may become contaminated by a wide array of bacteria, viruses, yeasts, and fungi, which are present both in the oral cavity and in the external environment.⁶

Microorganisms can remain viable on toothbrush bristles for periods ranging from 24 h to 7 days. Long term use of a toothbrush can lead to its contamination by microorganisms like Streptococcus, Staphylococcus, and Lactobacilli. These micro-organisms have been shown to affect both oral and general health of an individual, causing dental caries, gingivitis, stomatitis and even infective endocarditis.⁷ Svanberg found that toothbrushes can be heavily infected by mutans streptococci after 24 h. Mutans streptococci cells are present in moist dental plaque that can adhere to and remain on the toothbrushes.⁸

In a study by Mehta et al¹, microbial contamination was seen in 7 out of 10 toothbrushes (70%), whereas some other studies found microbes on all of the tested toothbrushes.⁹⁻¹¹ Predominant microorganisms isolated in these studies were Acinetobacter spp, S. aureus, S. epidermidis and Viridans streptococci. The bacteria were

present in count >10⁵ cfu / ml, which is the infective dose for many bacteria.

Use of a plastic cap can lead to the growth of microorganisms like *Pseudomonas aeruginosa*, a gram negative aerobe and opportunistic pathogen as shown in the study by Mehta et al.¹

The results of this study showed the presence of bacterial cells in toothbrushes that were covered with a plastic cap as well as those which were not kept covered. Retention of moisture and the presence of organic matter that has come from the mouth may promote growth of microorganisms on the toothbrush bristles. This is probably the reason why there was significantly higher number of bacterial cells in used toothbrushes which were kept covered with a plastic cap (p value – 0.005). Such contamination may lead to colonization of microorganisms in the mouth and possibly infection.

As public health policies emphasize the importance of prevention, it is important to create awareness about the contamination, storage and disinfection of toothbrushes. However, there are only few studies on toothbrush contamination and disinfection.⁹ Thus, further studies should be conducted on a larger scale so as to emphasize on the contamination and need for disinfection of toothbrushes.

Conclusion

Within the limits of the present study, it can be concluded that keeping a wet toothbrush covered with a plastic cap can lead to retention of moisture and thus, propagate the growth of microorganisms.

Limitations

Since the present study was conducted as a pilot study, a very small sample size of 20 subjects (10 in each group) was taken for the study. Also, the number of viable bacterial cells were also not estimated.

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