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REVIEW ARTICLE

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How clean is the toothbrush that cleans your tooth?

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Abstract: Until recently, little attention has been directed towards the role the toothbrush may play in human health, even though a report of toothbrush as a significant factor in the infection appeared in 1920. It is common knowledge that the human mouth harbours a wide variety of microorganisms, some of which, at any given time, can be assumed to be potential pathogens. This was not known when toothbrushes were originally designed, yet the common toothbrush has been used in basically the same form for about 200 years. In today's world of organ transplantation and alteration of the immune system, it is important to consider the toothbrush as a source of potential pathogens. Given the fact that very often people will traumatize themselves with their toothbrush, this trauma may become a potential portal of entry for organisms. In this article, we have attempted to demonstrate the importance of toothbrush disinfection, given tips on home toothbrush care and hope to motivate the dentists to educate the patients on the importance of toothbrush disinfection.

Key words: bristles; disinfection; home care; microorganisms; toothbrush

Introduction

Oral hygiene was in practice as early as 3000 BC by Sumerians; Chinese were amongst the earliest people to use chew stick made of plant limbs or roots for brushing teeth. Bristled toothbrush appeared about year 1600 AD. Toothbrush is most commonly used means of maintaining good oral hygiene. Today, the market is flooded with various brand names of toothbrushes, toothpastes and mouth washes each claiming superiority over the other. But little do we think that instead of cleaning the teeth, the brush could be possibly contaminating them (1).

Tooth brush gets contaminated with microorganisms present in the oral cavity. Depending on storage conditions, the toothbrush can therefore serve as a reservoir for reintroduction of potential pathogens such as *Mutans* streptococci. As early as 1920, Cobb (2) reported the toothbrush to be cause of repeated infections of mouth.

Microorganisms on toothbrush:

Streptoccous mutans – dental caries.

β haemolytic streptococcus – sore throat.

Candida albicans – thrush in babies.

Coliform bacteria – found in bathroom.

Herpes simplex virus 1 – in cold sores (2).

The existence of intra-oral translocation of bacteria was first examined by Edmund *et al.* in 1975. Many of studies by Svanberg 1978, Kozai *et al.* 1989, Malberg *et al* in 1994, Caudry *et al.* in 1995 and S. S. Taji and Rogers in 1998 have demonstrated that oral hygiene aids and periodontal instruments can harbour a wide range of microorganisms including viruses (3–7).

Svanberg found that toothbrushes can be heavily infected by mutans streptococci after 24 h (4). According to Glass and Lare (8), microorganisms not only adhere to and reproduce on used toothbrushes but also have the ability to transmit organisms responsible for both local and systemic diseases. Caudry *et al.* reported that in spite of millions of toothbrushes sold each year, there is little public awareness regarding contamination of toothbrushes (4, 6, 8).

Toothbrush contamination can be through direct or indirect contacts. Indirect contact can occur through fomites, such as spoons, toys, cups or contaminated toothbrush (7). Various studies have reported toothbrush contamination and recommended methods of disinfection such as somification, shaking with glass beads and vortex mixing (7).

Glass and Lare suggested that toothbrushes could be an important means of transmission of pathogenic microorganisms to patients submitted to organ transplantation or with immunological depression, via gingival lesions. Glass found that HSV – 1 can remain viable on a dried toothbrush for at least 48 h and in moist conditions for 1 day. Under usual conditions of storage, tooth brushes can be a source or a vector for transmission or reinfection of diseases such as herpes or periodontopathogenic microorganisms and coliforms from bathroom environment (8).

Svanberg (4) examined tooth brushes and tooth paste tubes used by persons infected with *S. mutans* 15 min after brushing. More than 10^6 *S. mutans* were isolated from tooth brush and after ordinary storage for 24 h, 10^4 were recovered. Therefore, it was suggested that inter individual transmission of *S. mutans* could occur via contaminated tooth brush and paste.

Microorganisms from storage environments can also be introduced. These include enteric bacteria dispersed via aerosols from toilet flushing or from contaminated fingers and skin commensals and pseudomonas emanating from bathroom and other wet areas. The single act of flushing the toilet releases millions of bacteria into atmosphere (9). The most fertile breeding substrate in bathroom is the toothbrush. Over the past three decades, many authors have demonstrated that microbial load on toothbrushes also contributes to bacteremia, often encountered after brushing especially in patients with periodontitis (10).

Over the past decades, some interest has been elicited in the area of disinfection of toothbrushes due to articles appearing in several journals.

Toothbrush storage ideas

1. Use cup hooks to hang the brushes, placing them 1 inch apart.
2. Cut a hole in carton box on the top and store the brush.
3. Closed containers for brush head.
4. Vented containers with protective collars.
5. Use of brush box.

Modes of disinfection (11)

Basically four practical options available for disinfection (11).

1. Chemical disinfectants.
2. Brush sprays.
3. UV light tooth brush sanitizers.
4. Modified brushes.

Need for toothbrush disinfection

As clinicians, one must take utmost care in our daily disinfection procedures for our instruments and working environment. However, one often neglects to disinfect the one that is used to clean our mouth daily, that is, toothbrush. Retention of microorganisms on toothbrushes has received little attention (12). This is probably the result of consideration of toothbrush only as a caries control device for removal of particulate matter from between teeth and control of plaque buildup on teeth. There are many potential sources of microorganisms, which were found on toothbrushes. The variety of microorganisms on a toothbrush will be, in part, a reflection of microorganisms in the mouth of the user (13).

Chemical disinfectants

Nelson *et al.* (3) in 1994 compared the disinfection capability of 1% sodium hypochlorite and 0.12% chlorhexidine gluconate conclusively proved that soaking brush for 20 h showed no microorganism growth on culture media.

Caudry *et al.* (6) compared 1% Virkon, Listerine, Cepacol, Scope and Plax and their bactericidal effects on microorganisms sedimented from toothbrush bristles and proxabrushes and on various test species including *C. albicans*, *Mycobacterium Smegmatis*, *M. Bovis* and *Streptococcus mitis*. Virkon and Listerine killed all the test species and virtually all microorganisms on toothbrush bristles. Soaking toothbrush in Listerine for 20 min is sufficient to eliminate bacterial contamination.

Brush sprays (brushtox)

Brushtox is a disinfecting or decontaminating solution, consisting of activated ethanol (40%) with biocide parabens. It is used by spraying onto brush before and after every use and claimed that it kills most of the pathogens especially because of wetting abilities which helps to penetrate between bristles (6).

Ultra violet toothbrush sanitizers

Many sanitizers are available in the market (purebrush, germ terminator and essensia) along with clinical studies proving their efficacy. These products eliminate the pathogens by a constant stream of UV light for 3 min. They utilize two methods.

1. Steam cycle.

2. Dry heat cycle.

Steam cycle starts automatically when you add water. Your toothbrush is being sanitized when you see and hear steam filling the chamber.

Dry heat cycle follows automatically and keeps your toothbrush sanitized in the clean chamber until your next brushing. However, costs are a little prohibitive. Pure brush purifier has proven 99% effective in eliminating harmful bacteria and viruses which are found to incubate on toothbrushes (14).

Modified brushes

To date, two ideas have been worked on to make toothbrush disinfection more practical by modifying the toothbrush itself. These are by modifying the brush design itself or coating the bristles with some antibacterial agents, they are:

Ozone toothbrush

Ozone toothbrush (ozonex in London) was designed by Jonathan Savitt and Dr Charles Taylor in 1995. The general dimension of brush is similar to that of standard brushes. The novel aspect of this brush is that the head is perforated. Conventional nylon bristles are arranged around the perforation and are available in ultra soft, soft, medium and hard stiffness. The perforation of the head of the brush was designed to achieve improved brush hygiene and dosing of fluoride containing toothpastes. This brush possess an open centre, this allows water to flush through the opening, removing plaque and toothpaste sediment. Moreover, head may be cleaned from both sides (15).

Coated toothbrush filaments

Another way is incorporating some disinfectant into brush design itself. This resulted in the development of two prototypes:

1. *Zeolithic crystals*: In this prototype, there is a coating of Zeolithic crystals with silver and zinc ions, which are incorporated in the filaments during manufacturing. This antiseptic formula, also used as a preserving agent in food industry, is stable and has a long-term contact antimicrobial activity, which is significantly reduced after 45 days. Sixou and coworkers tested these zeolithic crystals impregnated bristles and found a 40-fold reduction in anaerobic and 10-fold reduction in aerobic flora when coated filaments were used for 30 days (16).

2. *Chlorhexidine coatings*: Yokosuka and coworkers investigated the bacterial contamination of chlorhexidine coated and uncoated nylon filaments on toothbrushes. They demonstrated that chlorhexidine coated filaments reduced the bacterial load and that the antibacterial activity of the tip and the base of the filament remained for 8 and 20 days of use respectively. Both designs are under trial (16).

Conclusion

The literature has shown that toothbrushes can be a reservoir for direct transmission of microorganisms, as well as a source for inoculation or reintroduction of microorganisms from infected to non-infected tissues. In this day of organ transplants and alterations of immune system, it is important to consider the toothbrush as a source of potential pathogens. Given the fact that very often people will traumatize themselves with their toothbrush, this trauma may become a portal of entry for microorganisms. In this regard, more studies of the microorganisms on used brushes, the total number and the

type of organisms involved are needed. Studies should include both toothbrushes from infected and healthy mouths. The effect of short- and long-term use of various mouthwashes and toothpastes should be examined. Maintaining the oral cavity is not only the procedure in maintaining oral hygiene. The oral hygiene devices should also be kept clean.

References

1 Navneet G, Kau S. A study of toothbrush contamination at different time intervals and comparative effectiveness of various disinfecting solutions in reducing toothbrush contamination. *J Indian Soc Pedo Prev Dent* 1996; **14:** 10–13.

2 Cobb CM. Toothbrush as a cause of repeated infections in the mouth. *Boston Med J* 1920; **183:** 263–269.

3 Nelson P, Macari S, Faria G, Assed S, Ito IY. Microbial contamination of toothbrush and disinfection. *Pediatr Dent* 2000; **22:** 381–384.

4 Svanberg M. Contamination of toothpaste and toothbrush by *Streptococcus mutans*. *Scand J Dent Res* 1978; **86:** 412–414.

5 Kozai K, Iwai T, Miura K. Residual contamination of toothbrushes by microorganism. *J Dent Child* 1989; **56:** 210–214.

6 Caudry SD, Klitorinos A, Chan EC. Contaminated toothbrushes and their disinfection. *Pediatr Dent* 2000; **22:** 381–384.

7 Taji SS, Rogers AH. The microbial contamination of toothbrushes: a pilot study. *Aust Dent J* 1998; **43:** 128–130.

8 Glass RT, Lare MM. Toothbrush contamination a potential health risk? *Quintessence Int* 1986; **17:** 39–42.

9 McCauly HB. Toothbrushes: toothbrush materials and design. *J Am Dent Assoc* 1946; **33:** 283–293.

10 Glass RT. *Your Toothbrush may be a Biohazard*. USA Today Health news reports (27 April 2000).

11 *Health and Safety in Child Care Setting Promoting Children's Oral Health: a Curriculum for Health Professionals and Child Care Providers*. California Child Care Health Programs 2005. http://www.ucsfchildcarehealth.org/pdfs/Curricula/oral_health_11_v6b.pdf (accessed 21 January 2009).

12 Sconyers JR, Crawford JJ, Moriaty JD. Relationship of bacteremia to toothbrushing in patients with periodontitis. *J Am Dent Assoc* 1973; **87:** 616–622.

13 Silver JG *et al.* Experimental transient bacteremias in human subjects with varying degrees of plaque accumulation and gingival inflammation. *J Clin Periodontol* 1977; **4:** 92–99.

14 Glass RT, Jenson HG. The effectiveness of UV toothbrush sanitizing device in reducing the number of bacteria, yeasts and viruses in toothbrushes. *Acta Odontol Scand* 1994; **52:** 93–98.

15 Dunne SM. Initial evaluation of the Ozone toothbrush. http://www.Ozonetoothbrush.com.

16 Donna P, Goldschmidt MC, Mathew B, Karen A, Harris K. The effects of toothpastes on the residual microbial contamination of toothbrushes. http://www.purebrush.com/clinicalstudies.