The Effect of Using Dettol, Salt and Hot Tap Water in Elimination of Toothbrush Contamination

Farah Rami Saleh
Department of Medical Laboratory Techniques, Shaqlawa Technical Institute, Erbil, Iraq
E-mail: Leona200971@yahoo.in

ABSTRACT:
Regularly used toothbrushes can be heavily contaminated with microorganisms, while inappropriate storage may increase microbial load on these toothbrushes. Toothbrushes Microbial contamination can help transmitting many diseases, especially for people with mouth and/or Gum problems. This study aims to find the easiest and most available way to sterile toothbrushes at home. 24 adult volunteers were divided into four groups, the first three groups were asked to sterilize their toothbrushes with Dettol, water salt and hot water, while the fourth group toothbrushes were the positive control.Results showed that toothbrushes sterilized with Dettol gave the least contamination rate of 12.5%, toothbrushes sterilized with salt came next with 37.5%, while toothbrushes sterilized with hot tap water were the next with 50%. The toothbrushes of the fourth group which was used as the positive control were totally contaminated with different types of bacteria. Six bacterial agents were isolated; they are Staphylococcus Sp., Streptococcus Sp., Bacillus Sp., E.coli, Pseudomonas Sp., and Salmonella Sp. It was concluded that the use of Dettol were very effective in reducing the number of contamination of toothbrushes but it's unacceptable flavor limiting its use. Other volunteers were comfortable with the use of salt and hot water as it was almost effective. The research suggests a group of recommendations to avoid the transmission of pathogens through toothbrushes and ensure healthy usage.

Key words:*Toothbrushes, Contamination, Gums, Dettol, Salt, Hot water*

Access this article online	
Quick Response Code:	**Website:** www.innovativepublication.com
	DOI: 10.5958/2394-5478.2015.00019.9

INTRODUCTION

Brushing teeth is the primary mode of oral hygiene practice. In earlier days, chewing sticks like Miswak, Neem and Babul were the sole oral hygiene aids used by different populations [1] .

The first nylon toothbrush was produced by DuPont company in 1938 to improve the toothbrush invented by William Addis' in 1780 and was made of animal hairs. Today, toothbrushes are in all kinds of designs and forms to provide better comfort while brushing teeth. Many designs are being made to encourage younger children to brush their teeth [2]. While patient preference is an important factor in toothbrush selection, equally integral is the ability of a given toothbrush - manual or power - to improve oral health through efficient plaque removal and reduce signs of gum disease such as inflammation and gingival bleeding. Many patients are also interested in a brush's capacity to target cosmetic concerns, such as stain removal and whitening, and unsightly supragingival calculus [3]. As the mouth is the home for millions of microorganisms and germs, removing plaque and other soft debris from teeth can contaminate toothbrushes with bacteria, blood, saliva, oral debris, and toothpaste [4].However, there are evidences to support the fact that toothbrushes in regular use can become heavily contaminated with microorganisms [5]. In addition, the storage of a toothbrush in an inappropriate place may increase microbial load on toothbrushes[6]. This contamination may lead to the transmission of many diseases, especially for people with other mouth and Gums problems, such as periodontal disease which is known to be associated with other serious illnesses [7].

Contaminated toothbrushes can also be a source of bacterial and viral re-infection[8]. Furthermore Sexual transmitted diseases STD can be transmitted through a toothbrush.[9] One of the diseases transmitted by toothbrush is Bloodborne Pathogens which produces viruses carried by the blood. Bloodborne pathogens like Hepatitis B (HBV), Hepatitis C (HCV), and Human Immunodeficiency Virus (HIV) can spread by direct contact with infected blood and/or body fluids. These Blood borne diseases can be transmitted by sharing personal care items, such as toothbrushes, which may have come in contact with another person's blood [10]. Infective endocarditis (IE) is an uncommon but life-threatening infection. Despite advances in diagnosis, antimicrobial therapy, surgical techniques and management of complications, patients with IE still have substantial morbidity and mortality related to this condition. The large majority of published studies have focused on dental procedures as a cause of IE and the use of prophylactic antibiotics to prevent IE in patients in risk [11]. There is a need for standardized guidelines to prevent toothbrush contamination. This study aims to find the most available and easy way to sterile toothbrushes used by all family members without high costs or difficulties in practice.

MATERIAL AND METHOD

This study was carried out with the help of 24 adult volunteers who were neither under dental treatment nor using antibiotics or antiseptic mouthwashes. These volunteers were given same dentifrice brand as well as similar toothbrushes brand, then they were divided into four groups and each group was asked to manage their regular toothbrush hygiene. The first group had to put their toothbrushes in Dettol once a day for five minutes then it must be washed thoroughly with water and kept as usual. The second group had to put their toothbrushes in a cup containing two teaspoons of sodium chloride (which is approximately 14gm of table salt) in 240ml of water once a day for five minutes. The volunteers of this group were given a special cup and spoon in order to control the weight. The third group had to put their toothbrushes in hot tap water once a day for five minutes. Finally, the fourth group was using their toothbrushes in a normal way without the use of any kind of sterilization. This group was considered as the positive control. After 21 days toothbrushes were collected and transported to the laboratory in sterile bags, according to Sammons et al. (2004) handle of brushes.

Toothbrush heads were immersed in nutrient broth for 1 hour, and then tubes were put into slow vortex for 5 minutes. Afterwards, samples were reinoculated into Nutrient agar, Blood agar and MacConkey Agar and incubated aerobically for 24 hours. The identification of the bacteria isolated from toothbrushes was performed through the standard techniques described by cheesbrough [2006].

RESULT

After 21 days, the 24 toothbrushes were examined and the results were as follows: The first group which was using Dettol was showing the least contamination rate with 12.5%. The second group which was using salt came next with 37.5% contamination ratio. The third group who had to use hot tap water had the next ratio of 50% of positive growth. Finally, the fourth group which was used as the positive control was totally contaminated. Fig.1 shows the percentage ratios of toothbrush contamination.

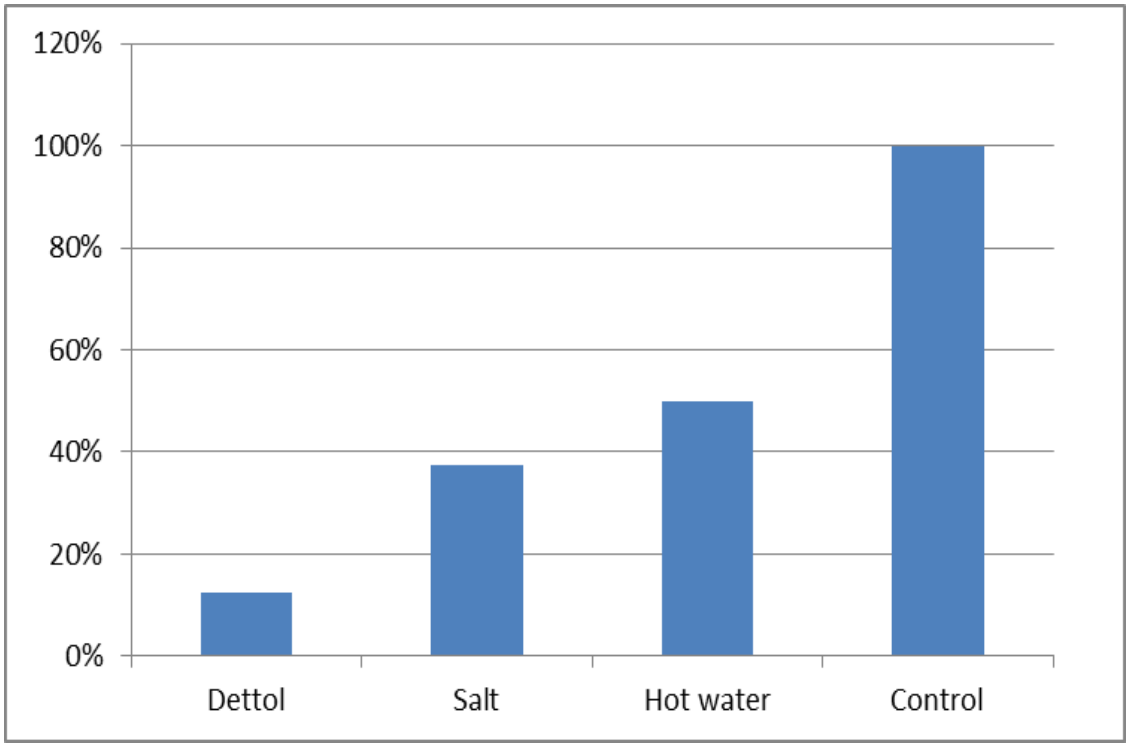

Fig. 1: The percentage of toothbrush bacterial contamination after the use of Dettol, salt and hot water for sterilization, compared to the bacterial contamination of unsterilized toothbrushes (The Control).

Growth of microorganisms recovered from toothbrushes of volunteer groups show that one of the toothbrushes of the first group which had to use Dettol were contaminated with Staphylococcus Spp. Further investigation proved that this type belongs to MRSA. Two of the toothbrushes of second group which had to use salt were shown to be contaminated with three types of bacteria: Staphylococcus Spp., Pseudomonas Spp. and Salmonella Spp. The toothbrushes of the third group which had to use hot tap water were contaminated with Bacillus Spp. only, while all the toothbrushes of the control group were extensively contaminated with variety of microorganisms as described in Fig. 2.

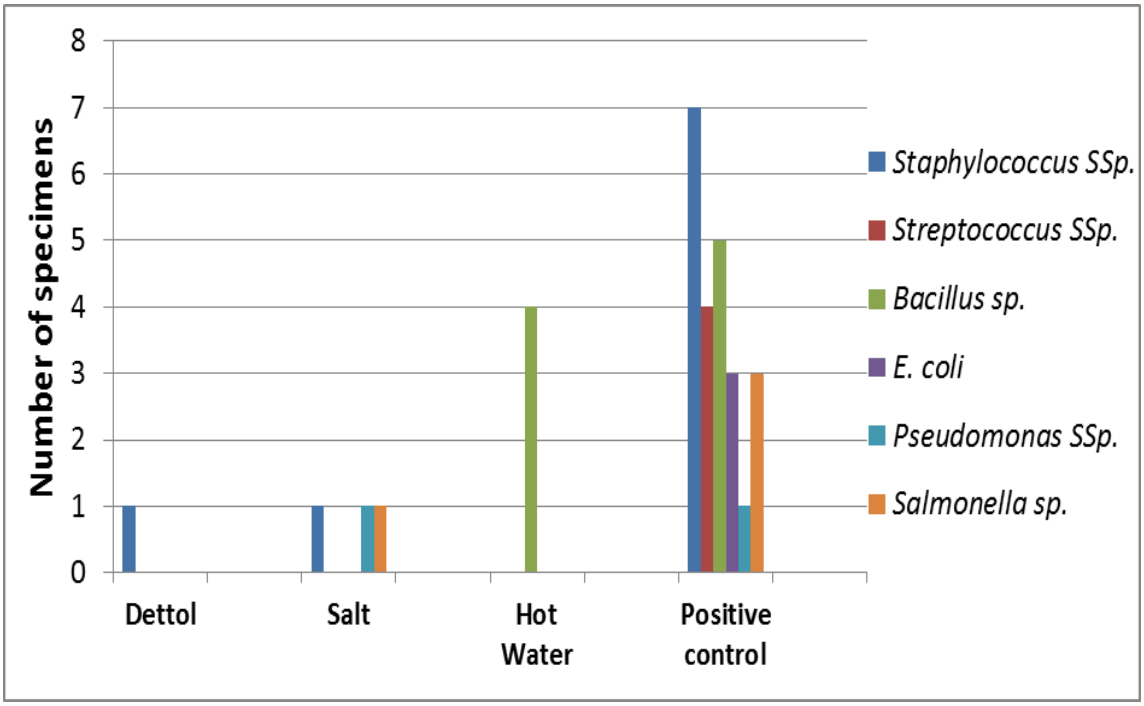

Fig. 2: Microorganisms isolated from toothbrushes sterilized with Dettol, salt and hot water, as compared to the Microorganisms isolated from unsterilized toothbrushes (The Positive Control).

CONCLUSION

The results of this study come in agreement with previous studies in showing the great contamination in all toothbrushes used as a positive control, underscoring the importance of finding a simple way to sterilize these tools. According to Indian Medical Association (IMA), a good disinfectant should be capable of killing the germs by 99.99% within 60 seconds [12]. Therefore, putting toothbrushes for five minutes in disinfectant should be more than enough to sterilize them. Dettol is widely used in homes and healthcare settings for various purposes including disinfection of skin, objects and equipments, as well as environmental surfaces. With prior cleaning, the number of microorganisms colonizing the skin and surfaces are greatly reduced [13]. The active ingredient in Dettol is Chloroxylenol confers its antiseptic property. Chloroxylenol which comprises 4.8% of Dettol's total admixture is a membrane active agent that is absorbed into the bacterial cell, and depending on the quantity absorbed, results in growth inhibition or loss of viability. Bactericidal activity results in rapid disruption of the membrane structure and function as well as the general loss of cytoplasmic constituents from the cell. This membrane damage is irreversible and the cell is thus becomes unable to overcome the loss of essential metabolites [14]. Other reports clarified that Dettol's active ingredient can also block the production of adenosine triphosphate, i.e. effectively starving the cells. Dettol works by attacking multiple points on bacteria, this means that there is little or no way for bacteria to grow resistant to it [15]. Dettol is more effective against Staphylococcus aureus, Salmonella typhi and E. coli than against Shigelladysenteriae and Klebsella Sp. [16]. Although the use of Dettol was very effective in reducing the number of contaminated toothbrushes, it was unacceptable by volunteers because of its strong flavor that remain on toothbrushes even after washing them thoroughly. This is one of the limitations that reduce the acceptability of using Dettol for toothbrush sterilization.

Sodium chloride (NaCl) inhibits microbial growth by increasing osmotic pressure as well as decreasing the water activity in the micro-environment [17]. Salt is not only a natural disinfectant, but is also recommended by dentists to extend toothbrush life by soaking toothbrushes in salt water before using it first time; in order to last longer [18]. Dentists also recommend treating recurring strep throat by gargling with salt water [19]. Some bacteria, however, are adapted to living in salty environments, such as Staphylococcus Sp. which is a common skin inhabitant. Skin usually tends to be salty as a way to protect the body against bacteria living on the skin. But even Staphylococcus Sp. can't live in highly salty surroundings, such as salted foods like ham [20]. Other bacteria, such as E. coli, can tolerate small amounts of salt in their growth medium. E. coli may have optimal growth in the absence of salt, but in the presence of salt it will grow, just at an attenuated rate [21]. The entire adaptive response of the bacteria to a considerable increase in the salinity of the environment can be separated into two components: acclimatization and a selection of those cells with the widest range of potentialities [21]

Salt is available in every house, easy to use, recommended by dentists and it does not have any annoying flavors.

The third method for sterilization of toothbrushes in this study was hot water. The safe temperature of hot water taps should be 49 degrees Celsius (120 degrees Fahrenheit) [22], but the lethal temperature varies in microorganisms and the time required to kill depends on the number of organisms, species, nature of the product being heated, pH, and temperature [23]. A 2007 WHO report on legionella prevention and water safety plans recommends that to balance out the risks of tap water scalds and legionella, water heating units should be set at approximately 60° Celsius, and the water exit point (the tap) be set at 50° Celsius. The report further indicates that although legionella can survive for a few hours at 50° Celsius, exit point (the tap) temperatures can safely be kept even as low as 45° Celsius if a thermostatic mixing valve is installed [22]. Reports showed that populations of bacteria exposed 50 and 60°C were completely prevented to grow after 90 and 60 min of exposure, respectively. Bacterial populations exposed to 45°C for 2 hours were reduced by 105 or 106 CFU/ml. Increasing the incubation temperature to 45°C concomitantly increased the rate of bacterial inactivation and there was a 4-log10 reduction in viable bacteria after 2 hours of incubation. Raising the experimental incubation temperature to either 50°C, 55°C or 60°C reduced the amount of time required for totally inactivate [24].

This study recommends changing toothbrushes routinely every one month, which is very short period, but enough for the microbial load to increase with the consumption of the toothbrush. It also recommends the use of simple methods to sterilize toothbrushes like embedding them in Dettol or salt water for five minutes daily. Warm and moist environment of surroundings provide optimum conditions for the growth of common micro flora. That is why keeping toothbrushes in such places should be avoided.

REFERENCES:

1. Toothbrush then and now. Present toothbrush. https://sites.google.com/site/toothbrushesthennow/present-toothbrush (accessed 4 April 2015).
2. The danger of tap water scalds. http://www.childsafetyeurope.org/publications/positionstatements/info/tap-water-scalds-backgrounder.pdf (accessed 1 May 2015).
3. Ginger B. Mann, Bettina Wick-Urban. Power Toothbrushes: Everything You Need to Know to Make Informed Recommendations for Your Patients. http://www.dentalcare.com/media/en-us/education/ce89/ce89.pdf (accessed May 1 2015).
4. The Use and Handling of Toothbrushes. http://www.cdc.gov/OralHealth/infectioncontrol/factsheets/toothbrushes.htm (accessed 5 March 2015).
5. Kozai, K., Iwai, T., & Miura, K. . Residual contamination of toothbrushes by microorganisms. ASDC J Dent Child 1989; 3(56):.
6. Taji, S., Rogers, A.. The microbial contamination of toothbrushes. Australian Dental Journal 1998; 2(34)
7. Nelson Filho, P., Macari, S., Faria, G., Assed, S., Yoko Ito, I. . Microbial contamination of toothbrushes and their decontamination. American Academy of Pediatric Dentistry 2000; 5(22):.
8. Glass, R., Lare, M. . Toothbrush contamination: a potential health risk?. Quintessence Int. 1986; 1(17):.
9. Kimberly A. Workowski, Stuart Berman. Sexually Transmitted Diseases Treatment Guidelines', Morbidity and Mortality Weekly Report. undefined: 2-3.
10. Bloodborne Pathogens. http://www.nj.gov/health/cd/documents/bloodborne_pathogen.pdf (accessed 17 July 2015).
11. Wilson, W., A. Taubert, K., Gewitz, M., B. Lockhart, P., M. Baddour, L., Levison, M.,et al.. Prevention of infective endocarditis: Guidelines from the American Heart Association. JADA 2008; 3(24):.
12. Disinfectant. https://en.wikipedia.org/wiki/Disinfectant (accessed June 30 2015).
13. Saha, A.K., Haque, M.F., Karmaker, S., &Mohanta, M.K.. Antibacterial Effects of Some Antiseptics and Disinfectants. J. Life Earth Sci 2009; 3(4):.
14. Hugo WA, Bloomfield SF. Studies on the mode of action of phenolic antibacterial agent fenticlor against Staphylococcus aureus and Escherichia coli 1. Adsorption of fenticlor by the bacterial cell and its antibacterial activity. . J. Appl. Bacteriol. 1971; 34(3.) :
15. Dettol. https://en.wikipedia.org/wiki/Talk%3ADettol (accessed April 21, 2015).
16. 46smart uses for salt. http://www.mnn.com/your-home/at-home/stories/46-smart-uses-for-salt (accessed June 11 2015).
17. Anbalagan, M., Ganesh Prabu, P., Krishnaveni, R., &Manivannan, S.. Effect of Sodium Chloride (NaCl) on the Bacterial Load in Chicken, Mutton and Beef Meat Samples in Relation to Meat Spoilage.. J International Journal of Research in Zoology 2014; 1(4):.
18. How to Clean and Store a Toothbrush. http://www.breathmd.com/how-to-clean-and-store-atoothbrush.php (accessed May 12 2015).
19. Dr. Wassenaar. Sodium Chloride(NaCl)and Bacteria. http://www.stabiitb.org/newtonmirror/askasci/mole00/mole00093.htm (accessed 30 April 2015).
20. Mac, R... The Effects of Salt Concentration on Bacterial Growth. http://www.ehow.com/facts_5924409_effects-salt-concentration-bacterial-growth.html (accessed 30 April 2015.)
21. Doudoroff, M.. EXPERIMENTS ON THE ADAPTATION OF ESCHERICHIA COLI TO SODIUM CHLORIDE. . The Journal of General Physiology (1940).
22. Hot tap water burns. http://www.winnipeg.ca/waterandwaste/water/hotWaterBurns.stm (accessed April 11 2015).
23. Kenneth Todar. Todar's Online Textbook of Bacteriology. www.WearMask.org:;2012.http://www.textbookofbacteriology.net/ (accessed 30 April 2015).
24. Yamfang, M., Kongkiattikajorn, J., &Thepa , S. . The Effect of Sublethal Heat Treatment and Hot Water on the Growth of Soil-Borne Pathogen. . International Journal of the Computer, the Internet and Management 2013; 1(21.:)

How to cite this article: Farah Rami Saleh, The Effect of Using Dettol, Salt and Hot Tap Water in Elimination of Toothbrush Contamination. Indian J Microbiol Res 2015;2(4):227-230.