



Assessment Of Awareness Of Tooth Brush Disinfection Amongst Dental Surgeons

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ABSTRACT

Aim: General public should be made more aware on the relevance of oral hygiene aid disinfection, since dental practitioners are the guiding post for educating the public. The study was conducted to evaluate awareness and knowledge of oral hygiene aids disinfection of the dental practitioners.

Materials and methods: From the total 350 participants, there were 139 general dentists, 110 postgraduates and 101 masters.. The questionnaire consisted of questions assessing the participants' fundamental understanding of the use of oral hygiene products, their storage, and disinfection techniques and also on the significance of oral hygiene disinfection and if it should be recommended to the general public. Data were compiled and subjected to statistical analysis using SPSS- 21 version.

Results: 79% of participants were aware of the oral hygiene aids disinfection among which 31% disinfect their toothbrushes with plain water, 45% using several methods of disinfection, and just 3% using solely chemicals to disinfect their toothbrushes. However, there were no statistically significant differences between the three groups in terms of knowledge.

Conclusion: The present study indicated a gap in knowledge among the dental communities, so the first and foremost step to be taken up is to increase awareness on oral hygiene aids disinfection and disinfectants.

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INTRODUCTION

The survival, growth and perseverance of any microbial organisms requires a suitable environment and our oral cavity is one such environment that helps the microbes in the formation of dental plaque biofilm. The oral cavity alone houses a profound number of bacterial species with the tongue serving as a reservoir for microbial bacteria than any other oral tissue thus making it the greatest contribution of bacteria in saliva and dental plaque.¹

The term dental plaque is commonly in association with the bacterial population that is responsible for invading the oral cavity leading to a series of concerning health issues. It is believed that the pellicle layer is responsible for oral diseases such as periodontal disease and dental caries but its transition into plaque is inevitable and is considered normal. The pellicle layer plays a role in interfering with the adherence of oral pathogens to the mucosal surfaces. Various microenvironments are found in the oral cavity which holds different biofilm communities and when the volume and complexity of the biofilms in the crevicular area of the gingiva

increases, periodontal diseases such as chronic gingivitis and periodontitis can happen.^{1,2} In an experimental study (Loe *et al.* in 1965), gingivitis is induced to demonstrate that consistent plaque build-up causes gingival inflammation but the process can be reverse by removing the accumulated plaque. This study indicated the primary role of supragingival plaque as a causative agent in the progression of gingivitis and also suggested that the inflammatory process can be reverse through mechanical plaque control by performing adequate oral hygiene practice.³ Knowing that there is a direct connection between dental plaque and development of gingivitis, and the most efficient way of preventing the development of periodontal disease is to practice strict oral hygiene measures, it will be appropriate to consider the temporal influences. Thus, for an oral environment to be healthy, appropriate plaque removal and reducing its effects is necessary.⁴

Through the ages, toothbrushes have been constantly modified to achieved good oral health. The toothbrush has been proven more effective in cleaning teeth as compared to fingers, twigs and sticks but the general public have yet to understand the importance of tongue cleaning even though tongue brushing and scraping was known for 100 of years.^{2,5}

In the oral cavity, toothbrushes can transmit diseases and infection to medically compromised individuals including

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healthy person as they get contaminated from the mouth, hands, external environment, storage containers and aerosols becoming a reservoir for various microbes.^{6,7}Hence, the general public should be made more aware of the relevance of oral hygiene aid disinfection or lack thereof. With this in mind, this survey was conducted to evaluate the awareness and knowledge of oral hygiene aids disinfection of the dental practitioners as they are the guiding post who will educate and motivate the general public.

MATERIALS AND METHODS

From October to November 2021, a cross-sectional research was performed among dental practitioners, which include general dentists, postgraduates students, and master in dentistry. Protocol of the present study was presented to the college ethical committee and ethical clearance was obtained. Permission was obtained from the principal of the college after explaining the purpose and procedure of the survey to be conducted. The participant’s permission was obtained at the outset of the study, and a 15-item closed-ended questionnaire

Table 1 Questionnaire evaluating the awareness and knowledge of oral hygiene aids disinfection of the dental practitioners evaluate the awareness and knowledge of oral hygiene aids disinfection of the dental practitioners

Questions	General dentist (139%)	Postgraduate (110%)	Master of dental surgery (101%)	Total (350%)
1. How many times do you brush your teeth?				
a. Once in the morning	31(8.9%)	36(10.3%)	34(9.7%)	101(28.9%)
b. Morning and evening	108(30.9%)	74(21.1%)	67(19.1%)	249(71.1%)
				(p value- 0.089)
2. When do you usually replace your toothbrush?				
a. 3 months	111(31.7%)	87(24.9%)	69(19.7%)	267(76.3%)
b. 6 months	28(8.0%)	23(6.6%)	32(9.1%)	83(23.7%)
				(p value- 0.082)
3. Where do you usually store your toothbrush after brushing?				
a. in the sink or bathroom with a separate holder	75(21.4%)	81(23.1%)	55(15.7%)	211(60.3%)
b. in the sink or bathroom with a shared holder	64(18.3%)	29(8.3%)	46(13.1%)	139(39.7%)
				(p value – 0.003)
4. Do you put toothbrush covers?				
a. Yes	48(13.7%)	40(11.4%)	29(8.3%)	117(33.4%)
b. No	91(26.0%)	70(20.0%)	72(20.6%)	233(66.6%)
5. Do you have the habit of cleaning your tongue after brushing?				
a. Yes	132(37.7%)	103(29.4%)	92(26.3%)	327(93.4%)
b. No	7(2.0%)	7(2.0%)	9(2.6%)	23(6.6%)
6. If yes, which do you prefer?				
a. Toothbrush	58(16.6%)	41(11.7%)	48(13.7%)	147(42.0%)
b. Tongue scraper	75(21.4%)	62(17.7%)	43(12.3%)	180(51.4%)
7. For tongue scraper				
a. Plastic	42(12.0%)	34(9.7%)	17(4.9%)	93(26.6%)
b. Steel	34(9.7%)	29(8.3%)	26(7.4%)	89(25.4%)
8. Do you know anything about oral hygiene aids disinfection or toothbrush sterilization?				
a. Yes	106(30.3%)	93(26.6%)	78(22.3%)	277(79.1%)
b. No	33(9.4%)	17(4.9%)	23(6.6%)	73(20.9%)
				(p value- 0.238)
9. Do you have the habit of disinfecting your own toothbrush and other oral hygiene aids				
a. Yes	109(31.1%)	95(27.1%)	82(23.4%)	286(81.7%)
b. No	30(8.6%)	15(4.3%)	19(5.4%)	64(18.3%)
10. If yes, the methods of disinfection used?				
a. Plain water	47(13.4%)	33(9.4%)	29(8.3%)	109(31.1%)
b. Chemical	11(3.1%)	6(1.7%)	12(3.4%)	29(8.3%)
c. Multiple	55(15.7%)	60(17.1%)	44(12.6%)	159(45.4%)
11. For chemical method of disinfection, the chemical preferred is				
a. Hexidine	50(14.3%)	46(13.1%)	40(11.4%)	139(39.7%)
b. Hydrogen peroxide	13(3.7%)	14(4.0%)	7(2.0%)	110(31.4%)
c. White vinegar	3(0.9%)	4(1.1%)	7(2.0%)	101(28.9%)
12. For disinfection by radiation, the method employed are				
a. UV sanitizer	32(9.1%)	31(8.9%)	24(6.9%)	87(24.9%)
b. Microwave oven	2(0.6%)	2(0.6%)	2(0.6%)	6(1.7%)
c. None of the above	12(3.4%)	14(4.0%)	11(3.1%)	37(10.6%)
13. Do you advice your patients about toothbrush disinfection?				
a. Yes	82(23.4%)	77(22.0%)	70(20.0%)	229(65.4%)
b. No	57(16.3%)	33(9.4%)	31(8.9%)	121(34.6%)
				(p value-0.219)
14. If so, whom do you recommend it to				
a. Everyone	57(16.3%)	55(15.7%)	42(12.0%)	154(44.0%)
b. Special patients such as medically compromised, hospitalized and young kids.	25(7.1%)	21(6.0%)	28(8.0%)	74(21.1%)
15. Is toothbrush disinfection impractical/ pointless?				
a. Yes	32(9.1%)	16(4.6%)	22(6.3%)	70(20.0%)
b. No	107(30.6%)	94(26.9%)	79(22.6%)	280(80.0%)

was drawn up and forwarded to 10 experts for validation. The content validity ratio was 0.91, suggesting that all of the questions were deemed essential by the experts. The Cronbach's alpha value was 0.81 indicating high reliability of the questionnaire.

The questionnaire consisted of questions designed to assess the participants' fundamental understanding of the use of oral hygiene products, their storage, and disinfection techniques. Participants were also polled on the significance of oral hygiene disinfection and if it should be recommended to the general public. Data were compiled in MS sheet and statistical analysis was done using SPSS- 21 version (IBM® SPSS® Statistics) with descriptive statistics, chi-squared tests, as appropriate. Differences with a p-value of less than 0.05 were considered statistically significant.

RESULTS

There were 139 general dentists, 110 postgraduates, and 101 masters among the 350 participants (Table 1). The first section of the questionnaire concentrated on hygienic practices and maintenance. The majority of participants (76%) replaced their toothbrush after 3 months, whereas just 23% replaced it after 6 months. 71% brushed their teeth every morning and evening, 28% brushed just once daily, and 93% cleaned their tongue after brushing. Some individuals chose to clean their tongues using toothbrushes (42%), while others preferred to use tongue scrapers (51%), implying that half of the participants did not have the habit of using tongue scrapers.

About 60% said they kept their toothbrush in a separate sink, whereas 39% said they kept their toothbrush in a shared holder, indicating a high degree of awareness (p value 0.003). Only 33% of those participants liked to use toothbrush covers, while 66% did not.

The remainder of the questionnaire was designed to examine individual's awareness of methods of oral aids decontamination and whether patients should be informed about toothbrush disinfection.

From the entire number of participants, 79% had knowledge, with 31% disinfecting their toothbrushes with plain water, 45% using several methods of disinfection, and just 3% using solely chemicals to disinfect their toothbrushes.

Many participants (65%) agreed that correct toothbrush disinfection methods should be advised to patients, and 44% believe that everyone should be informed, while 21% believe that only specific patients, such as medically compromised, hospitalised, and small children, should be recommended.

65% of the dentists assessed recommended toothbrush disinfection to their patients and even feel that it plays an essential role in preserving oral health. However, majority were still ignorant of the proper techniques for disinfecting oral hygiene equipment.

However, there were no statistically significant differences between the three groups in terms of knowledge of toothbrush disinfection and various disinfection methods.

DISCUSSION

Daily family practices for avoiding contamination mostly include washing and drying toothbrushes. However, when brushing one's teeth, the toothbrush becomes contaminated with various bacteria, which can function as a source of

inoculation or reintroduction of microorganisms from infected to uninfected tissues, resulting in recurring infections in the mouth.⁸ It can also introduce bacteria that are not native to the oral cavity, disrupting the oral flora. The better option is to disinfect the toothbrushes using antimicrobial agents. According to Dayoub *et al*, a damp environment is excellent for the growth of germs, and the application of a disinfectant at regular intervals is required.⁸

The purpose of this study was to evaluate the awareness and degree of awareness regarding toothbrush disinfection among the various dental groups, i.e., general dentists, postgraduates and masters in dentistry. The three categories were given special consideration to check whether there were any gaps in their knowledge. The majority of the 79% competent dentists utilised various techniques to disinfect their toothbrushes, including plain water, chemical, and radiation methods.

Among the chemical agents, Chlorhexidine gluconate (0.2 percent), a component of Hexidine, is frequently used as a toothbrush disinfectant, and a study by Grewal and Kaur revealed that immersion in Hexidine for 20 minutes was sufficient to disinfect the toothbrushes.^{9,10} Other studies took immersion duration into account and found that soaking toothbrushes in chlorhexidine (0.12%) for 2 hours and 20 hours, and in chlorhexidine (0.2%) for 24 hours, was sufficient to disinfect them.⁸

Grewal, Kaur and Sogi *et al* also approved the use of 3.0% hydrogen peroxide as toothbrush disinfectant, soaking the toothbrush for 30 minutes. This toothbrush can be used without harm for 3 months.^{9,10}

Another chemical agent that can be taken into consideration as a toothbrush disinfectant is white vinegar. In dentistry, fewer studies have been conducted on the utilization of white vinegar. A concentration of 50% and 100% white vinegar have been approved for acrylic resins and toothbrush disinfection.¹¹ According to Silva *et al*, 100% white vinegar has shown good antimicrobial effect against *C. albicans* and *S. aureus* for disinfecting acrylic resins.¹² Salvia *et al*, also supported the effectiveness of 100% white vinegar as a disinfectant and its actions are comparable to even 1% NaOCl and 2% chlorhexidine gluconate against *E. coli*, *S. mutans* and *C. albicans*.¹³ However, Komiyama *et al* reported the effectiveness of 50% white vinegar as a toothbrush disinfectant against *Streptococcus pyogenes*, *S. mutans*, *S. aureus* except for *C. albicans*.¹⁴

Thus, these three chemical agents were taken into account for the survey due to their similar levels of effectiveness as disinfectants. However, out of the three, more emphasis should be given on white vinegar as a toothbrush disinfectant, the reason being its ease of availability and affordable by every household.

Radiation process can be used as a toothbrush disinfection and some of the methods include microwave oven and UV sanitizer. Microwave irradiation (MW) for 6-10 mins have been used to decontaminate removable dentures and have demonstrated good antimicrobial action against *Klebsiella pneumoniae*, *S. aureus*, *Streptococcus epidermidis*, *C. albicans* and *Bacillus subtilis*. In a study by B'elanger-Gigu'ere *et al*, MW irradiation was used with high power for disinfecting *S. mutans* contaminated toothbrush for 5 mins and noted that MW irradiation was efficient but the entire microorganism's population cannot be completely eliminated.¹⁵ Another

drawback of using high power MW radiation method was that the toothbrushes were unusable after the irradiation. In another study, Spolidorio *et al* reported the effectiveness of MW irradiation as a toothbrush and tongue scraper disinfectant contaminated with microbes such as *S. aureus*, *S. mutans* and *C. albicans* when used at 650 watts for a minute. After the irradiation, the study reported that there was no detectable microbial growth.¹⁶ MW radiation method as a toothbrush disinfectant was found to be notably effective in reducing the total number of microorganisms being tested especially *L. rhamnosus*.¹⁵

Some studies on UV sanitizer efficacy against viruses and bacteria have been conducted.¹⁵ Berger *et al* employed two very different UV sanitizers (VIOLight and HIGHIDENT) targeting gram-negative and gram-positive bacteria, respectively, and the appliances reduced the quantity of microbes by 83 percent and 100 percent.¹⁷ According to Belanger-Giguere *et al* using the DenTek UV toothbrush sanitizer lasting 10 minutes proved ineffective against *S. mutans*. They claimed that a prolonged UV exposure would have killed more bacteria, however the machine they utilised shut off after 10 minutes. Furthermore, the author stressed that toothbrushes cannot be disinfected using UV radiation.¹⁸ In a study, Peker *et al* used the Dental Total Status Vio Manual sanitizer for about 20 minutes by adjusting the device manually as per the manufacturer's instructions and the device considerably reduced the quantity of microbes. When compared to other bacteria, this device was proven to be the most efficient against *S. mutans*. The UV sanitizer utilised in the study was not just designed for toothbrush disinfection but also for common usage. Previous research, on the other hand, employed equipment designed specifically for toothbrush disinfection. Variances in findings between studies may be due to various branded goods and/or technique differences. In our survey, 62% of participants were unaware that radiation may also be used to disinfect toothbrushes.¹⁵

The survey also determined whether or not the participants were knowledgeable about the correct storage and use of oral hygiene products. In 1996, the American Dental Association advised changing toothbrushes every three months.⁸ According to Glass and Jenson, patients receiving chemotherapy should change their toothbrushes every 3 days while those undergoing major surgery needs to keep changing their toothbrushes on a daily basis and for someone who is ill, they need to replace their toothbrushes at the start of the disease, once they start feeling better and when they have fully recovered.¹⁹ As per Glass and Jensen, owing to the tenacity of virus, toothbrushes should be replaced every two weeks while for those who are medically challenged toothbrushes should be changed every three to seven days.¹⁹

In the current study, majority of the participants (76%) replaced their toothbrush after 3 months and reported of brushing their teeth twice daily. Also, majority of them lacked the knowledge on how to store their toothbrush. According to the American Dental Association, the proper method to care for our toothbrush after brushing is to rinse it well, give it a good shake to remove excess water, and then keep it upright in a cup or holder so that it does not come into contact with any other toothbrushes. ADA even suggests leaving the toothbrush out in the open (rather than storing it in a cupboard) so that it may be exposed to air and sunshine and dry naturally before being used again that night or the next morning. "A wet

environment, such as a closed container, is more favourable to the development of germs than open air," according to the ADA's website. As far as tongue cleaning was concerned half of the participants did not have the habit of using tongue scraper. This signifies a lack of awareness in oral hygiene care as tongue is an ecological niche for bacterial multiplication and most of the cases of bad breath originates from improper tongue cleaning.

The cost of maintaining oral hygiene increases when toothbrushes are changed frequently, which become a nuisance for the average person. As a result, rather than replacing toothbrushes, sanitizing them with a disinfectant seems more cost effective. Hence, it is critical for everyone to decontaminate their toothbrush regularly in order to ensure proper oral hygiene maintenance.⁸

Even if toothbrushes are infested with microbes shortly after their initial usage, and this exposure intensifies with continuous usage, there are currently no approved guidelines on toothbrush disinfection for healthy people. Additionally, it is unclear whether this exposure is relevant.²⁰

Overall, the vast majority of the participants (80%) accept that toothbrush disinfection is a very important aspect in our day-to-day life and its awareness should be increased among the dental communities who in turn will guide the general population.

Future recommendations

- No current standards on toothbrush disinfection have been made so further studies should be conducted for validation.
- A topic on toothbrush disinfection should be added to the BDS curriculum to increase knowledge and awareness from the ground level.
- CDE/ Webinars/ Seminars/ live demo can be conducted to educate people on a larger scale about the different methods of disinfection of various oral hygiene aids.

CONCLUSION

In the present study, 79% of the participants irrespective of the dentist's title were aware of the oral hygiene aids disinfection while 21% were not aware. But this aware dentist utilizes multiple methods of sterilization without knowing which will be the most efficient. Thus, indicating a gap in knowledge among the dental communities, so the first and foremost step to be taken up is to include a chapter on oral hygiene aids disinfection and various methods of disinfection and disinfectants that can be used in the dental syllabus and this will in turn help the dentist to educate and motivate the public population.

Reference

1. Lazar V, Ditu LM, Curutiu C, Gheorghe I, Holban A, Popa M, Chifiriuc C. Impact of dental plaque biofilms in periodontal disease: Management and future therapy. *Periodontitis: A Useful Reference*; Arjunan, P., Ed.; InTech Open: London, UK. 2017; 1:11-42.
2. Mandal A, Singh DK, Siddiqui H, Das D, Dey AK. New dimensions in mechanical plaque control: An overview. *Indian J Dent Sci* 2017; 9:133-139.

3. Loe H, Theilade E, Jensen SB. Experimental gingivitis in man. *J Periodontol* 1965; 36: 177–187.
4. Claydon NC. Current concepts in toothbrushing and interdental cleaning. *Periodontol 2000* 2008; 48: 10–22.
5. Jacob KC, Yashoda R, Puranik MP, Bano A. Effects of tongue cleaning on plaque and salivary mutans streptococci levels: A randomized controlled trial. *J Assoc Public Health Dent* 2015; 13:378-383.
6. Sowmya KR, Puranik MP, James JM, Sabbarwal B. Perceptions about toothbrush contamination and disinfection among dental students in Bengaluru City: A cross-sectional study. *Indian J Dent Res* 2017; 28:646-649.
7. Frazelle MR, Munro CL. Toothbrush contamination: a review of the literature. *Nurs Res Pract* 2012; 2012: 420630.
8. Konidala U, Nuvvula S, Mohapatra A, *et al.* Efficacy of various disinfectants on microbially contaminated toothbrushes due to brushing. *Contemp Clin Dent* 2011; 2: 302-307.
9. Grewal N, Swaranjit K. 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.
10. Sogi SH, Subbareddy VV, Kiran SN. Contamination of toothbrush at different time intervals and effectiveness of various disinfecting solutions in reducing the contamination of toothbrush. *J Indian Soc Pedo Prev Dent* 2002; 20:81-5.
11. Basman A, Peker I, Akca G, *et al.* Evaluation of toothbrush disinfection via different methods. *Braz Oral Res* 2015; 30.
12. da Silva FC, Kimpara ET, Mancini MNG, *et al.* Effectiveness of six different disinfectants on removing five microbial species and effects on the topographic characteristics of acrylic resin. *J Prosthodont Off J Am Coll Prosthodont* 2008; 17: 627–633.
13. Salvia AC, dos Santos Matilde F, Rosa FC, Kimpara ET, Jorge AO, Balducci I, Koga-Ito CY. Disinfection protocols to prevent cross-contamination between dental offices and prosthetic laboratories. *J Infect Public Health* 2013; 6:377-82.
14. Komiyama EY, Back-Brito GN, Balducci I, *et al.* Evaluation of alternative methods for the disinfection of toothbrushes. *Braz Oral Res* 2010; 24: 28–33.
15. Peker I, Akca G, Sarikir C, *et al.* Effectiveness of alternative methods for toothbrush disinfection: an in vitro study. *SciWorldJ* 2014; 2014: 726190.
16. Spolidório DM, Tardivo TA, dos Reis Derceli J, Neppelenbroek KH, Duque C, Spolidorio LC, Pires JR. Evaluation of two alternative methods for disinfection of toothbrushes and tongue scrapers. *Int J Dent Hyg* 2011; 9:279-283.
17. Berger JR, Drukartz MJ, Tenenbaum MD. The efficacy of two UV toothbrush sanitization devices: A pilot study. *N Y State Dent J* 2008; 74:50-52.
18. Bélanger-Giguère K, Giguère ST, Belanger M. Disinfection of toothbrushes contaminated with *Streptococcus mutans*. *Am J Dent* 2011; 24:155-158.
19. Glass RT, Jensen HG. More on the contaminated toothbrush: the viral story. *Quintessence Int Berl Ger* 1985 1988; 19: 713–716.
20. Peker I, Akarslan Z, Basman A, *et al.* Knowledge and behavior of dentists in a dental school regarding toothbrush disinfection. *Braz Oral Res* 2015; 29: 1–8.

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