Perceptions about Toothbrush Contamination and Disinfection among Dental Students in Bengaluru City: A Cross-sectional Study

Abstract

Introduction: Toothbrushes are vital to remove dental biofilm and to prevent dental caries and periodontal disease. Repeated use of toothbrushes leads to contamination; hence, disinfection is essential in the maintenance of a brush. Current understanding and perception among dental students about toothbrush contamination and disinfection are essential. Aim: The aim of this study was to assess the perceptions about toothbrush contamination and disinfection among postgraduates and interns in Bengaluru city. Materials and Methods: A cross-sectional study was conducted using self-administered questionnaire among 400 postgraduates and interns from five dental colleges in Bengaluru. The statistics were computed with the Statistical Package of Social Sciences (SPSS) version 22 software and Chi-square test was used. A P < 0.05 was considered statistically significant. Results: There was a statistically significant difference regarding the source of information on toothbrush contamination (P = 0.008) and common mode of transmission of contamination (P = 0.01) between the two groups. The difference was found to be statistically significant (P = 0.01) regarding sharing of toothpaste. Only less than half of the participants, in both the groups practiced disinfection. Conclusion: There was a statistically significant difference in the perceptions about toothbrush contamination and disinfection among postgraduates and interns that might be attributed to their higher academic knowledge and clinical experience.

Keywords: Contamination, dental students, disinfection, toothbrush

Introduction

Toothbrushes play a significant role in disease transmission and increase the risk of infection since they serve as a reservoir for microorganisms in healthy, diseased, or medically ill individuals. They become contaminated from the oral cavity, environment, hands, aerosol, and storage containers. Bacteria attach, accumulate, and survive on toothbrushes and may be transmitted to the individual causing disease.[1] Glass et al. observed that injuries to oral tissues are aggravated by the use of contaminated toothbrushes when compared with sterile ones and may even cause septicemia due to microbial transmission.[1]

In recent years, the issue of toothbrush disinfection has gained importance.[2] Toothbrush disinfection should be recommended as a routine practice to the patients.[3] The manner in which microorganisms are removed from a toothbrush is a critical factor of concern.[4] Some of the recommended methods are soaking in alcohol, immersion in a disinfecting solution, spraying of antimicrobial solutions on bristles, washing of the toothbrush in a dishwasher, and using of microwave oven and ultraviolet light. In addition, drying of toothbrushes in sunlight, using of table salt to absorb moisture, and keeping the brush inside a closed container with a preparation containing formaldehyde gas are suggested.[3]

Dental health professionals promote better oral hygiene in the society and their duty is to integrate preventive procedures as well as to motivate and educate their patients about the preventive oral health behaviors. They are the role models for the patients and are considered to have adequate knowledge to practice appropriate oral hygiene, dental care, and oral health behavior.[3] Few studies in the literature have reported perception of dentists on toothbrush contamination and disinfection. However, it is important to know current perception of dental students about the toothbrush contamination and disinfection that might reflect their future
practice. Hence, this study aimed to assess the perceptions about toothbrush contamination and disinfection among dental students in Bengaluru city.

Materials and Methods

A cross-sectional study was conducted among postgraduate students and interns from February to March 2016 in Bengaluru city. A protocol of the intended study was submitted to the Institutional Ethical Committee and ethical clearance was obtained. Permission was obtained from the head of the institutions after explaining the purpose and procedure of the study. The study participants were informed about the study and assured that their participation was purely voluntary. Written informed consent was obtained from the study participants.

A 14-item questionnaire was developed from previous literature. Internal consistency was checked using Cronbach’s alpha which was found to be 0.78. A pilot study was conducted among sixty postgraduates and interns to check the feasibility of the study. Sample size was calculated using the formula $SS = \frac{z^2 \cdot pq}{d^2}$. Considering the prevalence of knowledge 50%, 95% confidence level, and 80% power, sample size of 384 was obtained, which was rounded off to 400.

List of dental colleges was obtained from the website of Rajiv Gandhi University of Health Sciences (www.rguhs.ac.in). From this list, five dental colleges were selected by simple random sampling and 400 postgraduates and interns were recruited from these colleges. Data were collected using a structured pro forma that consisted of two parts. First part included the general information regarding the demographic profile, level of education, and specialty. Second part included assessment of knowledge, attitude, and practice regarding toothbrush contamination and disinfection. Questionnaires were distributed to the study participants at their respective colleges and collected on the same day after checking the correctness and completion. Response rate was 100%.

Data were entered in a MS Excel sheet. Descriptive and inferential statistics were computed with the Statistical Package of Social Sciences (SPSS) version 22 software (SPSS Inc., Chicago, IL, USA). Chi-square test was used to find the difference between the groups. A $P < 0.05$ was considered statistically significant.

Results

Of 400 study participants, 195 were postgraduates and 205 were interns and two-third were female [Table 1]. Postgraduates were nearly equal to all specialties of dentistry. Nearly three-fourth of them belonged to upper middle class in both the groups.

Most of them used toothbrush and toothpaste, followed either vertical or horizontal toothbrushing methods, once daily before meals. The number of postgraduates sharing the toothpaste was found to be significantly lower when compared to interns ($P = 0.01$). Majority of postgraduates (60%) and interns (66%) rated their oral hygiene as good [Table 2].

There was a statistically significant difference regarding the source of information on toothbrush contamination and disinfection between the two groups ($P = 0.008$) with curriculum being the major source in both the groups [Table 3].

Majority of the study participants in both the groups chose bacteria as the common causative agent for toothbrush contamination. A statistically significant difference was observed regarding their knowledge about common mode of transmission of infection from toothbrush ($P = 0.02$) [Table 4]. Majority of them ranked chlorhexidine followed by plain water as the method of toothbrush disinfection.

About 50%–53% did not feel that it is necessary to practice disinfection. Nearly equal number of participants from each group used brush cap and stored it in a toothbrush holder either separately or along with other toothbrushes. Majority of them in both the groups stored toothbrush inside the

| Table 1: Distribution of study participants according to gender and level of education |
|---|---|---|
| Gender | Postgraduates ($n=195$) | Interns ($n=205$) |
| Males | 157 (39.25) | 195 (49.75) |
| Females | 243 (60.75) | 102 (49.23) |

| Table 2: Self-rating of own oral hygiene among study participants |
|---|---|---|---|
| Rating | Postgraduates ($n=205$) | interns ($n=195$) |
| Excellent | 49 (23.90) | 40 (20.51) |
| Good | 122 (59.51) | 130 (66.66) |
| Fair | 28 (13.65) | 20 (10.25) |
| Poor | 2 (0.99) | 5 (2.56) |
| Can’t say | 4 (1.95) | 0 |

| Table 3: Distribution of study participants according to their source of information on toothbrush contamination and disinfection |
|---|---|---|---|
| Options | Postgraduates ($n=205$) | Interns ($n=195$) |
| Curriculum | 135 (65.85) | 126 (64.61) |
| Scientific journals | 102 (49.75) | 71 (36.41) |
| CDE | 77 (37.56) | 62 (31.79) |
| Media | 67 (32.68) | 96 (49.23) |

$P=0.008$
bathroom either covered or not with cap. The practices related to disinfection of toothbrush and patient advice regarding storage and disinfection are summarized in Table 5.

**Discussion**

The increased awareness of the need for good oral health and the emphasis on preventive procedures by dental professionals have prioritized toothbrush as the most common oral hygiene aid to promote oral health and prevent dental diseases. Toothbrush may get contaminated with microorganisms present inside and outside the oral cavity.\textsuperscript{[7,8]} The area of toothbrush in which the tufts are anchored is especially prone to heavy contamination.\textsuperscript{[9,10]} Fluids and food debris can be drawn into the spaces between tufts by capillary action; this may lead to bacterial growth. The bristles also split longitudinally, further increasing the bacterial contamination.\textsuperscript{[9]} Therefore, disinfection of toothbrush plays an important role in prevention of bacterial growth.

The present study assessed the perceptions regarding toothbrush contamination and disinfection among dental postgraduates and interns. Not many studies have been done in this regard. Therefore, comparisons were made wherever possible. The current study included 400 study participants, comprising postgraduates and interns with nearly equal distribution from five dental colleges. The gender-wise distribution of study participants is comparable to that in another study.\textsuperscript{[6]}

In both the groups, 65% of the study participants stated curriculum as their source of information on toothbrush contamination and disinfection. The groups differed with respect to other options available which may be attributed to higher frequency of exposure to scientific journals and CDE programs in their postgraduation career when compared to interns.

Almost all the study participants were aware of causative microorganisms for toothbrush contamination and most of

### Table 4: Knowledge regarding toothbrush contamination and disinfection among study participants

| Options                                      | Postgraduates (n=205), n (%) | Interns (n=195), n (%) |
|----------------------------------------------|-----------------------------|------------------------|
| Microorganisms capable of causing toothbrush contamination* |                             |                        |
| Bacteria                                     | 182 (88.78)                 | 175 (89.74)            |
| Fungi                                        | 81 (39.51)                  | 66 (33.84)             |
| Virus                                        | 34 (16.58)                  | 31 (15.89)             |
| Do not know                                  | 14 (6.82)                   | 11 (5.64)              |
| Common mode of transmission of infection from toothbrush† |                             |                        |
| Sharing the toothbrush                       | 154 (75.12)                 | 155 (79.48)            |
| Sharing the same toothbrush holder           | 69 (33.65)                  | 36 (18.46)             |
| Sharing the tooth paste                      | 17 (8.29)                   | 23 (11.79)             |
| Use of frayed bristled toothbrush            | 71 (34.63)                  | 63 (32.30)             |
| Most common source of toothbrush contamination‡ |                             |                        |
| Oral cavity                                 | 97 (47.31)                  | 88 (45.12)             |
| Skin contacts                                | 23 (11.21)                  | 29 (14.87)             |
| External environment                         | 98 (47.80)                  | 103 (52.82)            |
| Contact with other toothbrush               | 117 (57.07)                 | 105 (53.84)            |

*P=0.54, †P=0.02, ‡P=0.62

### Table 5: Distribution of study participants according to their practice regarding toothbrush contamination and disinfection

| Options                                           | Postgraduates (n=205), n (%) | Interns (n=195), n (%) |
|---------------------------------------------------|-----------------------------|------------------------|
| Place of storage of toothbrush?**                 |                             |                        |
| Inside the bathroom with brush head not being covered | 68 (33.17)                 | 81 (41.53)             |
| Inside the bathroom with brush head covered with a cap | 50 (24.39)                 | 36 (18.46)             |
| Outside the bathroom with brush head not being covered | 54 (26.34)                 | 42 (21.53)             |
| Outside the bathroom with brush head covered with a cap | 33 (16.09)                 | 36 (18.46)             |
| Disinfection of toothbrush†                      |                             |                        |
| Yes                                              | 65 (31.70)                  | 61 (31.28)             |
| No                                               | 110 (53.65)                 | 94 (48.20)             |
| Sometimes                                       | 30 (14.63)                  | 40 (20.51)             |
| Do you advise your patients regarding toothbrush storage and disinfection‡ |                             |                        |
| Yes                                              | 81 (39.51)                  | 62 (31.79)             |
| No                                               | 46 (22.43)                  | 44 (22.56)             |
| Sometimes                                       | 78 (38.04)                  | 89 (45.64)             |

*P=0.18, †P=0.27, ‡P=0.21
them reported bacteria as the causative agent. Prolonged use of the toothbrush facilitates contamination by various microorganisms such as *Streptococcus*, *Staphylococcus*, *Lactobacilli*, *Pseudomonas*, *Klebsiella*, *Escherichia coli*, and *Candida*.\(^1,7-9\)

External environment and contact with other toothbrush were cited as the most common source of contamination by majority of postgraduates and interns, respectively. Less than half of the study participants admitted that they shared toothpaste with others which was found to be lesser than 60% that reported in a study.

In the present study, about two-fifth of the study participants reported that they stored their toothbrush inside the bathroom in an open environment, which is comparable to another study.\(^6\) Studies have shown a practice of rinsing a toothbrush in plain water and storing in bathrooms or toilet often after brushing. This practice favors harboring of millions of microorganisms and dispersal of enteric bacteria through aerosols from toilet flushing or from contaminated fingers and skin commensals and pseudomonas from the bathroom and other wet areas which subsequently results in toothbrush contamination.\(^4\)

The study participants in both the groups either used toothbrush with or without cap and stored in the toothbrush holder along with other brushes or separated from other brushes. Previous studies have reported that the number of bacteria is higher in toothbrushes that are stored in closed containers compared to those left open to air. The use of a toothbrush cap has also been reported to increase bacterial survival on toothbrushes.\(^1\)

In the current study, about half of them felt that it is necessary to disinfect toothbrush, which was found to be lower as compared to another study (55%–75%). More than half of the study participants in this study neither followed nor advised the practice of toothbrush disinfection which is a clear indicator of inadequate knowledge or its practical application in daily life. As budding dentists, more attention should be paid by the postgraduates and interns in practicing appropriate toothbrush disinfection methods and also advise their patients as a part of oral hygiene instructions.

The study has certain limitations. Biases inherent in the questionnaire design and social desirability bias limit the generalizability of this study. Further studies are suggested for a better understanding of perspectives and practices of postgraduates and interns in a wide geographical area.

Toothbrush disinfection should be recommended for children, elderly people, high-risk patients, and vulnerable populations in a hospital setting.\(^3\)

**Conclusion**

Statistically significant difference regarding the perceptions about toothbrush contamination and disinfection was observed among postgraduates and interns which might be attributed to the difference in academic knowledge, exposure to a wide range of information, and clinical experience over the years between the groups.

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**Conflicts of interest**

There are no conflicts of interest.

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