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# Knowledge, Attitude and Practice of Undergraduate Students Regarding Toothbrush Contamination and Disinfection

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## Abstract

**Background:** Toothbrushes play a significant role in disease transmission as they act as a reservoir for microorganisms and aid in increasing the risk of infection in any individual. In recent years, the necessity of toothbrush disinfection has gained importance. Toothbrush disinfection should be recommended as a routine practice for all individuals. This study aimed to assess the knowledge, attitude, and practice of undergraduate students regarding toothbrush contamination and disinfection.

**Materials and methods**: This study involved 446 undergraduate students between the age group of 18 to 23 years. A validated questionnaire was used to assess the knowledge, attitude, and practice of undergraduate students regarding toothbrush contamination and disinfection. The study showed that 24.89% of the students disinfected their toothbrushes and 75.11% did not use any disinfectant. 78.92% of the students feel that bacteria as the main mode of toothbrush contamination. 84.40% of the students feel that the disinfection of the toothbrush is necessary whereas 15.69% feel that toothbrush disinfection is not necessary. 61.29% of students did not know toothbrush disinfection.

**Conclusion**: Fewer students have sufficient knowledge about toothbrush contamination and practice the disinfection methods, whereas the majority of the students are unaware of the contamination of toothbrushes and the use of disinfectant methods.

***Keywords*** *– Knowledge, Practice, Toothbrush, Disinfection, Contamination*

## Introduction

Toothbrushes are essential for the removal of dental plaque and for maintaining oral hygiene, but the remnants on their bristles may encourage the growth of numerous microorganisms.[1] Toothbrush after the use may be contaminated with several bacteria and viruses. The toothbrush thus contaminated can play a vital role in the transmission of many oral diseases.[2] *Glass et. al.,* observed that the use of a contaminated toothbrush aggravates the injuries of oral tissues when compared with a germ-free toothbrush and may lead to septicemia due to microbial transmission.[3] Few studies also stated that toothbrushes of both healthy individuals and patients with illness contain both opportunistic and pathogenic microorganisms, in significant numbers which might induce cardiovascular, respiratory, and renal problems.[3]

*Taji et.al.,* in his study reported that toothbrushes stored in bathrooms show higher contamination, levels, as the environment is contaminated highly by aerosol dispersion.[4] Many studies have recommended the need for disinfection of toothbrushes using different methods to prevent various diseases.[5,6] Disinfection of

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toothbrushes should be suggested as a regular practice to the patients.[5] Some of the recommended methods of disinfection methods are immersing in a disinfecting solution like Chlorhexidine gluconate, Listerine, Sodium hypochlorite 1%, spraying of antimicrobial solutions like Cetylpyridinium chloride on bristles, immersion in alcohol, and using microwave irradiation and ultraviolet light.[7] As contamination of toothbrushes occurs after repeated use, hence it is recommended to disinfect the toothbrush every time prior to brushing.[8] Thus the our study aimed to assess the knowledge, attitude and practices of undergraduate students regarding toothbrush contamination and disinfection.

## Materials and Methods

A cross-sectional survey was conducted after obtaining ethical approval from the Institutional Ethical Committee. The participants were explained in detail regarding the importance of the survey and written informed consent was obtained from all the students who were willing to participate in the study. A total of 446 undergraduate students between the age group of 18 to 23 years, from Melaka Manipal Medical College, Manipal, participated in this study. The sample size was calculated based on the prevalence rate of a previous study.[9] A closed-ended questionnaire containing 15 items was modified from the previous literature[10] and distributed to the students. The questionnaire consisted of basic questions regarding the knowledge and practices regarding toothbrush contamination and disinfection. The responses from each student were collected and tabulated. The tabulated data were statistically analyzed using SPSS-15.0 with descriptive statistics and the Chi-square test. Differences with $P < 0.05$ were considered statistically significant.

## Results

A total of 446 students, including 318 females (71.30%) and 127 males (28.48%) filled the questionnaire. Students ranged in age from 18 to 23 years (mean age ± standard deviation: 20.42 ± 1.75 years). Of the participants, 24.88% were dental students, 47.75% medical students, and 27.35% of students from the foundation course as seen in table 1.

A total of 24.89% of students disinfected their toothbrush and 75.11% of students did not disinfect their toothbrushes. A statistically significant difference between the two groups was seen (P-value <0.05*). A statistically significant (P<0.05) difference was also seen between the students who had and who did not have sufficient knowledge about toothbrush contamination and disinfection. Only 38.79% (n=173) of the students had prior knowledge regarding toothbrush contamination and disinfection. About 54.04% (n=241) of students did share their toothpaste with other individuals and 45.96 % (n=205) of students did not share their toothpaste with other individuals [Table 2]

The majority of the students (84.30%, n= 376) felt that the disinfection of toothbrush was necessary, and there was a statistically significant difference observed (P <0.05) between the students who felt the need for disinfecting the toothbrushes and who felt disinfection not necessary. Around 64.57% (n= 288) of students felt that every individual need to disinfect their toothbrushes and 23.99% (n=105) of the students felt that disinfection was required only for hospitalized and immunocompromised patients [Table 2].

About 86.55% (n=386) of the students believed that contact between toothbrushes was the main concern and 13.45% (n=60) of the students did not feel it important, and there was statistically significant difference observed (P <0.05). Most of the students reported that they stored their toothbrushes in open contact with the surroundings inside the bathroom (n = 311, 69.73%) and in a closed cabinet inside the bathroom (n =106, 23.77%), outside the bathroom in closed cabinet (n =14, 3.13%), outside the bathroom in open contact with the surroundings (n = 15, 3.36%). About 86.32% (n=385) of the students felt that sharing the toothbrushes was the normal mode of infection transmission from a toothbrush and 78.92% (n=352) felt that bacteria were capable of causing toothbrush contamination [Table 2].

The majority of the students (68.16% n=304) rated their oral hygiene to be good and 11.66% (n=52) of the students as excellent [Table 3]. The difference in self-rating of oral hygiene between the student was also statistically significant (P <0.05). The majority of the students (n=396, 88.79 %) brushed their teeth twice daily and 50.22 % (n=224) changed their toothbrushes once in three months [Table 4].

**Table 1: Distribution of Study participants based on Age, Gender and Study Course**

| **Age: Mean (SD)** | **20.42( 1.75)** | |
|---|---|---|
| **Gender (n=446)** | **n(%)** | **P value** |
| Male<br>Female<br>Transgender | 127 (28.48)<br>318 (71.30)<br>1 (0.22) | <0.05* |
| **Study participants (n=446)** | | |
| BDS<br>MBBS<br>FIS | 111 (24.88)<br>213 (47.75)<br>122 (27.35) | 0.0000000201<br><0.05* |

* Level of Significance <0.05*

**Table 2: Knowledge regarding toothbrush contamination and disinfection among study participants**

| Questions | Yes<br>n ( %) | No<br>n(%) | P value |
|---|---|---|---|
| Do you disinfect your toothbrush | 111(24.89) | 335 (75.11) | <0.05* |
| Do you have any knowledge about toothbrush cleaning and disinfection | 173 (38.79) | 273 (61.21) | 0.00000213<br><0.05* |
| Do you share your toothpaste with other individuals | 241 (54.04) | 205(45.96) | 0.0975<br>ns |
| In your opinion is toothbrush disinfection necessary | 376 (84.30) | 70 (15.69) | <0.05* |
| If Yes, Everyone<br>Special patient groups such as immunosuppressed individuals, hospitalized patients and children<br>Not sure | 288 (64.57)<br>107 (23.99)<br>51 (11.43) | | <0.05* |
| In your opinion is the contact between toothbrushes an important issue | 386(86.55) | 60(13.45) | <0.05* |
| In your opinion which microorganism causes toothbrush contamination | | | |
| Bacteria<br>Fungi<br>Virus<br>No Idea | 352 (78.92)<br>43 (9.64)<br>3 (0.67)<br>48 (10.76) | | <0.05* |

***Cont...*** **Table 2: Knowledge regarding toothbrush contamination and disinfection among study participants**

| | | |
|---|---|---|
| What is the common mode of transmission of infection from a toothbrush | | |
| Sharing the same toothbrush holder<br>Sharing the tooth paste<br>Sharing the toothbrush<br>Using frayed bristled toothbrush | 25(5.61)<br>20 (4.48)<br>385(86.32)<br>16 (3.59) | <0.05* |
| Where do you store your toothbrush? | | |
| In the bathroom - in a closed cabinet | 106 (23.77) | <0.05* |
| In the bathroom - in open contact with the surrounding | 311(69.73) | |
| Outside the bathroom - in a closed cabinet | 14 (3.13) | |
| Outside the bathroom - in open contact with the surrounding | 15 (3.36) | |

* Level of Significance <0.05*, ns- Not significant

**Table 3: Self –Rating of oral Hygiene by the study participants**

| How do you rate your oral hygiene | n( %) | P value |
|---|---|---|
| Excellent<br>Good<br>Fair<br>Poor | 52 (11.66)<br>304 (68.16)<br>88 (19.73<br>2 (0.45) | <0.05* |

* Level of Significance <0.05*,

**Table 4: Distribution of study participants according to on their practice regarding toothbrush care**

| How do you store your toothbrush | n( %) | P value |
|---|---|---|
| In a toothbrush holder shared with others<br>Separately from the toothbrushes of others | 177 (39.69)<br>269 (60.31) | 0.0000164 (<0.05*) |
| **How often do you brush your teeth** | | |
| Once a day<br>Twice or more a day | 50 (11.21)<br>396 (88.79) | <0.05* |

***Cont...*** **Table 4: Distribution of study participants according to on their practice regarding toothbrush care**

| How often do you change your toothbrush | | |
|---|---|---|
| Once every 3 months | 224 (50.22) | |
| Once a month | 72 (16.14) | 0.934 |
| Bimonthly | 74 (16.59) | ns |
| After 3 months or more | 76(17.04) | |

* Level of Significance <0.05*, ns- Not significant

## Discussion

The survey was done to assess the knowledge, attitude, and practices of undergraduate students about toothbrush contamination and disinfection. Approximately 61.21% of students had no knowledge about the disinfection of toothbrush and 75.11% of students did not disinfect their toothbrushes. However, 84.30% of students indicated that toothbrush disinfection was necessary. A statistically significant difference was found between students having knowledge about toothbrush disinfection and not having knowledge about disinfection.

Around 24.89% of the students disinfected their toothbrushes and statistically significant differences were found between the students who had knowledge of disinfecting the toothbrush, with a significantly higher number of students responding positively to whether toothbrush disinfection was needed. Many studies have assessed the oral health attitude and practices among undergraduates in different countries, found that most students brush their teeth at least twice a day.[11] In the present study, approximately 88.79% of the students brushed their teeth twice daily or more and 50.22% of the students felt that replacement of the toothbrushes should be done once in every 3 months. However, most of the previous studies are done only on the dental undergraduate, postgraduate students, and dentists.[9,10,13] In our study, medical undergraduate students are also included so the results cannot be directly compared.

Contamination of the toothbrushes occurs due to several factors like storage conditions, toothbrush location, sharing of toothpaste, microbes in the oral cavity, and cross-infection. Recommendations for storage of toothbrush include using cup hooks for hanging the brushes, using a brush box, using closed and vented containers.[12] In the present study 86.32% of the students felt that sharing the toothbrushes was the usual mode of infection transmission from a toothbrush and 78.92% felt that bacteria were capable of causing toothbrush contamination. The results of this study are similar to the previous studies, which also reported bacteria as the main causative agent for toothbrush contamination. [9, 10, 13] Earlier studies have observed a higher number of bacteria in toothbrushes stored in closed containers compared to those open environments.[10,12,14] Increased chances of bacterial survival on toothbrushes are observed with the use of a toothbrush cap. Generally, contamination may occur when toothpaste and brushes are shared, or when toothbrushes are stored with the toothbrushes of other individuals. Toothbrushes are made of nylon synthetic resin bristles, which reduces bacterial growth as they absorb less water and dries faster. However, if the bristles are not dried, water gets collected at the lowest portion of the bristles, and increases the humidity, thereby creating a conducive environment for bacterial growth. Storage of toothbrushes in a humid environment after use without disinfection can contaminate the toothbrush with microorganisms from the oral cavity or from the surrounding air.[13] In the present study most of the students reported that they stored their toothbrushes in open contact with the surroundings inside the bathroom and few students stored in a closed cabinet in the bathroom and outside the bathroom.

At present, no standard guidelines on toothbrush disinfection for healthy individuals are available even though contamination of toothbrushes with microorganisms may occur right after use, and increased contamination is seen with repeated use. Approximately 64.57% of the students in this study believed that the disinfection of toothbrushes should be done by every

individual. Only 23% of students thought that the disinfection of toothbrush was essential only for special patient groups.

## Conclusion

The majority of the students surveyed had no knowledge about toothbrush contamination and never disinfected their toothbrushes. Some students had knowledge about disinfection but did not practice any disinfection methods. Fewer numbers of students practiced disinfection methods. Increased awareness has to be created about this topic for the adoption of toothbrush disinfection as a routine practice, among the public. The dentists need to spread awareness not only about maintaining oral hygiene but also on toothbrush disinfection.

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