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Exploring public awareness and practices regarding toothbrush contamination and disinfection: A cross-sectional survey

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ABSTRACT

BACKGROUND: Oral hygiene plays a pivotal role in maintaining overall health, with toothbrush being a fundamental tool in daily dental care. However, little attention has been given to critical issue of toothbrush contamination and its implications for public health. This study aims to understand the knowledge, attitude and practice regarding toothbrush contamination and disinfection among public.

MATERIALS AND METHODS: This was a cross sectional questionnaire study consisting of 15 questions which covers points of knowledge, attitude and practice towards contamination and disinfection of toothbrush reporting was developed in Google form format among 350 participants who gave the consent to participate in this study. The collected data was analysed using SPSS version 26 software package.

RESULTS: There was a statistically significant gap regarding toothbrush contamination, mode of storing the toothbrush, and various practice used for toothbrush disinfection among each participant. It was also seen that general awareness and practice of toothbrush disinfection was higher among female participants in the study, which was also statistically significant result.

CONCLUSION: Understanding these aspects is essential in promoting healthier oral hygiene practices and subsequently improving public health. This study underscores need for targeted educational campaigns and emphasises the role of individuals in safeguarding their oral wellbeing.

KEYWORDS: Contamination, Disinfection, Frequency of changing toothbrush, Storage.

I. INTRODUCTION

Oral hygiene is a cornerstone of overall health, with a direct impact on one's quality of life. The toothbrush is an indispensable tool in the daily maintenance of oral health. However, the significance of proper toothbrush hygiene, including contamination and disinfection, has received limited attention in public discourse. Unknown to many, toothbrushes can harbour harmful microorganisms and become a source of potential infections and health risks. Over 700 bacterial species, as well as fungi, viruses, and transient microorganisms, are present in the oral cavity that may or may not cause various diseases [1]. The use of toothbrushes and/or dental floss is essential to removing dental biofilm and for preventing dental caries and periodontal diseases [2]. While toothbrushes play a pivotal role in the mechanical method of plaque control, they also act as reservoirs of microorganisms in healthy, diseased, or medically ill patients [3]. The microorganisms which contaminate the toothbrushes are known to maintain their viability ranging from 1 day to 1 week [4], these along with other factors like storage circumstances, toothbrush location, placing the toothbrushes in close proximity with toothbrushes of other family members, and the survival time of microorganisms cause the reintroduction of potential pathogens and cross-infection in the oral cavity [5]. A few popular methods of disinfection of toothbrush are soaking in alcohol and in disinfecting solution and the use of antimicrobial rinses, washing toothbrush in dishwasher, using of a microwave oven, and also ultraviolet light, also drying in sun, using table salt to absorb moisture and placing the brush in a closed cabinet containing formaldehyde gas are suggested [6]. This questionnaire study was initiated to shed light on the knowledge, attitudes, and practices of the public regarding toothbrush contamination and disinfection [7]. Recognizing the importance of such a study is pivotal as it can pave the way for effective strategies to safeguard public health. The survey was designed to encompass a diverse range of participants, ensuring a representative cross-section of the population [8]. Keeping this in mind the aim of this study is to assess the knowledge, attitude and practice regarding toothbrush contamination and disinfection among public.

II. MATERIALS AND METHODS

This study employed a cross-sectional survey design, conducted among public utilizing a self-administered questionnaire as the primary data collection method. The study was conducted between April to September 2023. A detailed protocol of the study design was presented to the Institutional Review Board before starting the research, and its approval was procured. The study received ethical approval from the Institution's ethics review board. Informed consent was obtained from every participant and their privacy was safeguarded. The research work aim was described to the participants, and all the questions were read out and clearly described by the interviewer to avoid any uncertainty. The study participants were asked to provide suitable responses, being guaranteed anonymity and privacy. The sampling method was a non-probabilistic convenient sampling, in which all the participants who met the inclusion criteria were involved. A target sample size of 350 participants was determined based on considerations of statistical significance and feasibility within the study's resources. The study involved participants from the public aged 16 and above. No specific exclusion criteria were applied, and participation was voluntary. The choice of a questionnaire was deemed appropriate as it allowed for a cost-effective and efficient means of gathering data from a diverse and representative sample of the public. A pilot study was conducted with 350 individuals to assess the clarity and comprehensibility of the questionnaire. The questionnaire was developed and validated through a multi-stage process involving literature review and expert consultation. The questionnaire comprised three sections, focusing on knowledge, attitudes, and practices related to toothbrush contamination and disinfection. The final version was distributed online via a secure survey platform. Participants were assured of the anonymity of their responses, and data was collected and stored securely. Participants were recruited through a combination of convenience sampling and online dissemination of the questionnaire. The collected data were coded and analysed using IBM.SPSS Version 26 software package. Descriptive statistics will be used to analyse toothbrush usage patterns, contamination concerns, and disinfection practices among the dental patient population. Inferential statistics may be employed to identify significant associations between variables. Descriptive statistics, including means and frequencies, were used to summarize the responses. Pearson's Chi-square test was used to assess the statistical significance, which was kept at $p < 0.05$.

III. RESULTS

A total of 350 participants took part in the study. The demographic profile of respondents is summarised as follows: Table 1 reveals the ages of participants which displayed a diverse range with a mean value of 25 years from a minimum age of 16 to a maximum age of 51. The sample cast a spotlight on predominantly female participated (56%) of respondents and male consisting of (37.1%) of respondents and 6.9% preferred not to say. Various kinds of qualifications are reported by the participants of which the majority falls under medical categories which is of 49.5% and 24.6% of them falls under engineering and 24.4% of arts and science students.

The questionnaire administered to respondents aimed to assess the knowledge, attitude and practice regarding toothbrush contamination and disinfection. The response reveals various insights: TABLE 2 reveals All the study participants reported using toothbrush as their primary cleaning aid also reveals majority of participants brush once a day (56%) and a substantial portion brush twice or more a day (30%). Majority of participants opted for medium toothbrushes (54%) or soft bristled (32.9%). It also shows that nearly half of the participants store their toothbrushes in shared spaces with others (48%). Participants store their toothbrush with notable proportion storing them outside the bathroom in open contact with surrounding (34.3%) while (24%) of them store in bathroom open contact with surrounding. Majority reported changing their toothbrushes (50%) once every 3 months while smaller percentage change the toothbrush more frequently once a month (15.1%). The majority identified bacteria as potential contaminants (53.7%), while a notable percentage was unsure (11.7%). A significant percentage believe that sharing toothbrushes is the most common mode while others mentioned sharing same toothbrush holder (24.6%). A significant percentage favoured tap water (37.7%) while other methods like anti-microbial rinse (20.3%) as their toothbrush disinfecting method.

Table 3 reveals Majority of participants (84%) perceive contact between toothbrushes as an issue, while smaller percentage (16%) do not consider it an issue. Majority of the participants (80.6%) do not share their toothbrushes with other individuals. Majority of participants (86.6%) believe that toothbrushes can act as a medium for transmission of infection. Majority reported that slightly more than half of the participants (53.7%) disinfecting their toothbrushes. Majority of the participants (63.1%) do not have knowledge about toothbrush cleaning and disinfection and (72.3%) believe that toothbrush disinfection is necessary.

IV. DISCUSSION

This study aimed to investigate the knowledge, attitudes, and practices of the public regarding toothbrush contamination and disinfection. The survey responses provided valuable insights into these aspects, shedding light on public awareness and behaviours related to oral hygiene. The awareness of need for good oral health emphasis on preventive procedures by public have been increased and prioritised toothbrushes as their common mode of oral hygiene aid. According to ADA, for sound oral hygiene, appropriate toothbrush care and maintenance are important considerations and a person should change their toothbrush every 3 to 4 months [9,10]. In terms of gender, response given by most of the participants agreed that toothbrushes were changed in period of 3 months. The common issue for toothbrush hygiene is storing the toothbrush in holder, most people staying in families store their toothbrush in same toothbrush holder [11]. This study also states that half the participants placed separately from others practicing the more preferable method of toothbrush placement to avoid contamination by contact of different toothbrushes and bit less than half the participants share same holder. Commonly after use toothbrushes are rinsed with plain water and stored in bathroom [12] and there is high chance of cross infection by sharing or keeping them in proximity. [13]

In this study most of the people reveals that they store their toothbrushes in open contact with environment which in turn becomes the ideal method of storing their toothbrush, not storing in any closed cabinet or staying away from aerosols. Recommendations for toothbrush storage include using cup hooks to hang the brushes, cutting a hole in the top of a carton box to store the brush, using closed and/or vented containers, and using a brush box.[7] Previous studies have reported that the number of bacteria is higher in toothbrushes that are stored in closed containers compared to those left open in air. The use of a toothbrush cap has also been reported to increase bacterial survival on toothbrushes.[7] In this study most of them have knowledge about the toothbrush contamination and they also believe that bacteria will be major reason for it. In general, sharing toothbrushes and toothpastes can result in contamination.[11] It was also seen that most of them are aware that sharing toothbrushes might lead to toothbrush contamination irrespective of their gender. This result was highly significant and shows value of $p=0.008$. For optimal oral health, toothbrushing should be carried out more than once a day. Several studies investigated about oral health behaviour and attitudes among different countries reporting that most people brush their teeth atleast twice a day [11]. In this study, most of them brush their teeth once a day. This difference in the result might be because the study was conducted at dentistry level at university students and the current study is among public. Yet the frequency showed significant results. When asked about their knowledge in toothbrush disinfection most of them replied like it is necessary but having less knowledge for proper disinfecting techniques. This result is similar to the study conducted by Peter et al [11]. Nascimento et al investigated the effectiveness of three antimicrobial mouth rinses for toothbrush disinfection under in vivo conditions [14]. Most of the participants responded that tap water is a method for disinfecting their toothbrushes. This clearly shows the lack of awareness among public regarding the methods which can be used for toothbrush disinfection at home as people agreed that toothbrush disinfection is necessary.

This study assessed the perceptions regarding toothbrush contamination and disinfection among various range of people under different type of qualifications and varying ages. In this regard, very few studies have been conducted, yet the difference in answers might be due to ideal answers given by everyone participated in the study.

V. CONCLUSION

This study highlights the need for improved awareness and education regarding toothbrush contamination and hygiene. While many participants were aware of potential contamination, misconceptions persisted. Concerns about toothbrush contamination were prevalent. Practices varied, with room for enhancement in storage and disinfection methods. Education was shown to influence awareness and practices. Public health campaigns and educational initiatives are essential to address misconceptions and promote evidence-based hygiene practices for better oral health and overall well-being.

VI. ACKNOWLEDGEMENT

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VII. CONFLICT OF INTEREST

None declared.

VIII. REFERENCE

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Table1. Distribution of subjects based on Demographic details

		Mean	SD
Age group	16 to 51	25.21	5.081
		Frequency	Percentage (%)
Gender	Female	196	56.0
	Male	130	37.1
	Prefer not to say	24	6.9
Qualification	Medical	173	49.5
	Engineering	86	24.6
	Arts and science	85	24.4
	Commerce	6	1.8
Total		350	100

Table 2. Descriptive results of questionnaire analysis in respect to attitude and practice regarding toothbrush contamination and disinfection

Questions	Options	Male (%)	Female (%)	Prefer not to say (%)	p value
What type of cleaning aid are you using?	Toothbrush	127(97.7)	196(100)	24(100)	0.077
	Finger	3(2.3)	0(0)	0(0)	

How often do you brush your teeth?	Once a day	78(60)	105(53.6)	13(54.2)	0.000*
	Twice a day	6(4.6)	43(21.9)	0(0)	
	Twice or more a day	46(35.4)	48(24.5)	11(45.8)	
What type of toothbrush do you use?	Extra hard	2(1.5)	2(1)	2(8.3)	0.113
	Hard	18(13.8)	18(9.2)	4(16.7)	
	Medium	69(53.1)	107(54.6)	13(54.2)	
	Soft	41(31.5)	69(35.2)	5(20.8)	
How do you store your toothbrush?	Shared with other	60(46.2)	100(51)	8(33.3)	0.227
	Separately from others	70(53.8)	96(49)	16(66.7)	
How often do you change your toothbrush?	After 6 months	30(23.1)	35(17.9)	4(16.7)	0.015*
	Bimonthly	19(14.6)	27(13.8)	7(29.2)	
	Once a month	23(17.7)	29(14.8)	1(4.2)	
	Once every 3months	58(44.6)	105(53.6)	12(50)	
Which microorganism is capable of contaminating the toothbrush	Bacteria	64(49.2)	115(58.7)	9(37.5)	0.057
	Fungi	33(25.4)	39(19.9)	7(29.2)	
	Virus	15(11.5)	20(10.2)	7(29.2)	
	Don't know	18(13.8)	22(11.2)	1(4.2)	
According to you which is the common mode of transmission of infections from toothbrush	Sharing same toothbrush holder	34(26.2)	45(22.9)	7(29.1)	0.008*
	Sharing toothbrush	64(49.2)	129(65.9)	13(54.2)	
	Sharing toothpaste	14(10.8)	9(4.6)	1(4.2)	
	Using frayed bristled toothbrush	18(13.8)	13(6.6)	3(12.5)	
According to you which is the best method to disinfect toothbrush	Anti microbial rinse	26(20)	41(20.9)	4(16.7)	0.518
	Vinegar	10(7.7)	16(8.2)	3(12.5)	
	Mouthwash	27(20.8)	40(20.4)	3(12.5)	
	Sunlight	12(9.2)	30(15.3)	6(25)	
	Tap water	55(42.3)	69(35.2)	8(33.3)	

*Statistically significant, Pearson's Chi square test

Table 3: Descriptive results of questionnaire analysis in respect to knowledge regarding toothbrush contamination and disinfection

Question	Gender	Yes (%)	No (%)	p value
In your opinion is the contact between toothbrushes an important issue?	Female	169(86.2)	27(13.8)	0.419
	Male	105(80.8)	25(19.2)	
	Prefer not to say	20(83.3)	4(16.7)	
Do you share your toothbrush with other individuals?	Female	35(17.9)	161(82.1)	0.627
	Male	27(20.8)	103(79.2)	
	Prefer not to say	6(25)	18(75)	
In your opinion can toothbrush act as medium for transmission of infection?	Female	170(86.7)	26(13.3)	0.102
	Male	109(83.8)	21(16.2)	
	Prefer not to say	24(100)	0(0)	
Do you disinfect your toothbrush?	Female	104(53.1)	92(46.9)	0.670
	Male	69(53.1)	61(46.9)	
	Prefer not to say	15(62.5)	9(2.6)	
Do you have any knowledge about toothbrush cleaning and disinfection?	Female	74(37.8)	122(62.2)	0.459
	Male	49(37.7)	81(62.3)	
	Prefer not to say	6(25)	18(75)	
In your opinion is toothbrush disinfection necessary?	Female	141(71.9)	55(28.1)	0.227
	Male	98(75.4)	32(24.6)	
	Prefer not to say	14(58.3)	10(41.7)	

Pearson's Chi square test