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Assessment of Knowledge, Attitude, and Practices among the undergraduate students from Dental, Medical, Nursing and Pharmacy colleges toward Toothbrush Maintenance and its Replacement in Qassim Province - A Cross-Sectional Questionnaire Based Study

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ABSTRACT

Aim: The present study aimed to evaluate the knowledge and behavior of undergraduate students regarding toothbrush disinfection and to evaluate the attitude of undergraduate students toward toothbrush replacement.

Materials and Methods:A questionnaire-based cross-sectional study was piloted with a sample size of 1120 undergraduate students from medical, dental, nursing, and pharmacy colleges in Buraidah, Al- Qassim. A validated and self-administered questionnaire was distributed among the students which consisted of questions on the sociodemographic aspect and 19 questions on toothbrush hygiene maintenance and replacement. The data was analyzed using the statistical package SPSS version 19.0.

Results: In the present research a total of 1,120 undergraduates had participated of which 427 undergraduates were studying dentistry, 311 were medical undergraduates, 198 were undergraduates studying nursing, and 194 were students studying pharmacy. The knowledge of oral health was fair among the medical, nursing, and pharmacy but good among the dental students.

Conclusion: There is a need to promote oral health and educate the young population regarding toothbrush maintenance and hygiene as this affects the general health of the individual. The dearth of knowledge holds back their attitude and practices towards the maintenance of toothbrushes consistently.

Keywords: toothbrush, fraying, bristles, contamination, wear – out, cross-infection, mechanical plaque removal.

1. Introduction

Toothbrush is the most common device used across the globe for the maintenance of oral hygiene. Toothbrush is made up of a head, shank and handle. The head contains bristles which

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are the main cleaning surfaces of a toothbrush. The bristles are packed compactly and embedded in the head of the brush.[1]Toothbrush bristles mechanically disrupt plaque accumulation and aid in cleansing of food debris wedged in the interdental spaces.[2]In the process, toothbrushes retain microorganisms that thrive and multiply in the toothbrush.Toothbrushes can also get contaminated by hands, aerosols in the environment, and storage containers.[3]If pathogenic, these microorganisms can cause and transmit harmful diseases from one individual to another.[4]Various methods of disinfection like ultraviolet disinfection, chemical disinfection, and microwave disinfection have been reported but these methods have not proven to be successful.[5]

Toothbrush bristle splaying is another common problem where the toothbrush bristles wear out and the efficacy of plaque removal decreases.[6]When bristles splay it is an indication that the toothbrush needs to be replaced.[7] Toothbrush bristle splaying is also an indication that excessive force is being applied during brushing which may lead to non-cariouslesions due to toothbrush abrasion.[7]All toothbrushes, irrespective of their manufacturer and design, need to be replaced after a certain period. Since toothbrushes are over – the – counter products, they are not provided with any instructions manual, or guidelines regarding maintenance and replacement of toothbrushes.[8]

It is cumbersome to decide when a toothbrush should be discarded and replaced with a new one. According to the American Dental Association toothbrushes must be replaced once bristles become frayed or after 3 or 4 months of use.[9]Few toothbrush manufacturer's print a piece of advice on the package that toothbrushes must be replaced every 3 months.[10]

Though dentists and hygienists are aware of toothbrush maintenance, and that they must be replaced every 3 months, the knowledge and information is not shared with patients for unreported reasons.[11]An in-depth knowledge is necessary for the performance of an act like tooth brushing and maintenance of the toothbrush.[12]Oral health promotion and education regarding toothbrush hygiene increases an individual's knowledge, changes his attitude, and brings about an improvement in behavior.[13]This education can be provided by various health professionals like dentists, medical doctors, nurses, and pharmacists.

The present study aimed to compare and evaluate the knowledge and behavior of undergraduate students studying dentistry, medicine, nursing, and pharmacy regarding toothbrush maintenance and disinfection and to evaluate the attitude of undergraduate students toward toothbrush replacement.

2. Materials and Methods

A questionnaire-based, cross-sectional, descriptive survey was planned for a duration of 3 months to assess the knowledge, attitude, and practices concerning toothbrush hygiene maintenance and its replacement amongst the undergraduate students studying medicine, dentistry, nursing, and pharmacy in Buraidah, Al- Qassim. The inclusion criteria was all students must be undergraduates and could read and write English. Simple random sampling was done to select the samples.

Ethical approval was obtained from Regional Research Ethical Committee – Qassim Province Kingdom of Saudi Arabia with the number 1442-327762. A pilot study was conducted among n 120 undergraduate students. Absolute precision was found to be 5%. 95% confidence level was attained. Sample size was determined using the formula:

$$n = \frac{(Z_{\alpha/2} + Z_{1-\beta})}{l^2}$$

Where,

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n is the sample size
l= Precision= 5%
Zβ = standard normal variate power = for 80% power it is 0.84
Zα/2 = standard normal variate for level of significance = 1.96
The formula for a minimum value of n resulted in 1120.

A total of 417 dental students, 311 medical students, 198 nursing students, and 194 pharmacy students participated in the study. The study was piloted over 2 months. Informed consent was taken from the subjects. Students who were not interested to participate in the survey were excluded. The questionnaire was sent to the participants by google forms. The participants answered the questionnaire on their mobiles or laptops and submitted them. Incompletely answered questionnaires were excluded from the study.
A self – administered and validated questionnaire was given to eligible candidates who participated in the study. The questionnaire encompassed two sections. One section consisted of questions related to sociodemographicdata and the second section had questions related to Knowledge, Aptitude, and Practices about toothbrush hygiene and maintenance.
The questionnaire was comprised of 19 questions framed in English. This questionnaire was distributed among the interns posted the college to test the face validity of the questionnaire. The time taken by the interns to answer the questionnaire was recorded and modifications were done in the questionnaire accordingly. Content validation of the questionnaire was done by the researchers who have already used this questionnaire.[14]
The finalized questionnaire had 6 questions based on knowledge domain numbered 1 to 6. Similarly, 7 questions were based on attitude domain numbered 7 to 13 and 6 questions based on practice domain numbered 14 to 19. For the ease of statistical analysis, the correct answers were given a "one" mark and wrong answers were given "zero" marks. Chi Square test was used for data analysis.

3. Results

From the data analysis of the present study, it could be observed that 1,120 undergraduates participated in the study. Out of the total sample, 427 were undergraduates studying dentistry, 311 were medical undergraduates, 198 were undergraduates studying nursing, and 194 were students studying pharmacy.
A diverse response was witnessed about toothbrush maintenance and replacement among the undergraduates studying different courses. Statistically significant outcomes were attained with questions based on the knowledge of the sample units about oral hygiene maintenance, frequency of visiting dentists, sharing toothbrushes, and period of brushing. (Table 1). Similarly, when the attitude of the undergraduates was analyzed, significant results were found on how they came to know about toothbrushes, efficiency of the toothbrush to clean teeth is for how many months, and factors that affect the longevity of toothbrushes. (Table 2). When the responses to questions based on practices were analyzed, it was seen that most undergraduates irrespective of their specialty, believed that toothbrushes gave protection from bacteria. The majority of the sample felt that the best method to store a toothbrush is to clean it after brushing and keep it covered. Most of them agreed that oral health affected the general health. (Table-3)

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Table 1- Response for Knowledge based questions

			Speciality				Total
			Dentistry	Medicine	Nursing	pharmacy	
Q1. Do you know the meaning of tooth brush	yes	Count	417	311	198	194	1120
		% within speciality	100.0%	100.0%	100.0%	100.0%	100.0%
Total		Count	417	311	198	194	1120
		% within speciality	100.0%	100.0%	100.0%	100.0%	100.0%
			Dentistry	Medicine	Nursing	pharmacy	
Q2. How many times do you brush your teeth?	Never	Count	0	21	3	3	<0.001
		% within speciality	0.0%	6.8%	1.5%	1.5%	
	once	Count	56	93	73	71	
		% within speciality	13.4%	29.9%	36.9%	36.6%	
	Thrice	Count	126	40	32	35	
		% within speciality	30.2%	12.9%	16.2%	18.0%	
	Twice	Count	235	157	90	85	
		% within speciality	56.4%	50.5%	45.5%	43.8%	
Total		Count	417	311	198	194	
		% within speciality	100.0%	100.0%	100.0%	100.0%	
			Dentistry	Medicine	Nursing	pharmacy	
Q3. For how much time do you brush your teeth?	1-2 min	Count	204	201	103	126	<0.001
		%	48.9%	64.6%	52.0%	64.9%	
	2-3 min	Count	172	80	77	64	
		%	41.2%	25.7%	38.9%	33.0%	
	2-4 min	Count	0	5	0	0	
		%	0.0%	1.6%	0.0%	0.0%	
	More than 3 min	Count	41	25	18	4	
		%	9.8%	8.0%	9.1%	2.1%	
Total		Count	417	311	198	194	
		%	100.0%	100.0%	100.0%	100.0%	
			dentistry	Medicine	Nursing	pharmacy	
Q4. When do you go for regular dental check-up?	Never	Count	71	180	100	92	<0.001
		% within speciality	17.0%	57.9%	50.5%	47.4%	
	Once a month	Count	31	11	7	4	
		% within speciality	7.4%	3.5%	3.5%	2.1%	

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	Once a year	Count	98	55	52	39	
		% within speciality	23.5%	17.7%	26.3%	20.1%	
	Once in 3 months	Count	6	9	8	17	
		% within speciality	1.4%	2.9%	4.0%	8.8%	
	Once in 6 months	Count	211	56	31	42	
		% within speciality	50.6%	18.0%	15.7%	21.6%	
Total		Count	417	311	198	194	
		% within speciality	100.0%	100.0%	100.0%	100.0%	

			dentistry	Medicine	Nursing	pharmacy	
Q5. Do you forget to brush?	no	Count	253	147	105	97	<0.001
		% within speciality	60.7%	47.3%	53.0%	50.0%	
	yes	Count	164	164	93	97	
		% within speciality	39.3%	52.7%	47.0%	50.0%	
Total		Count	417	311	198	194	
		% within speciality	100.0%	100.0%	100.0%	100.0%	

			dentistry	Medicine	Nursing	pharmacy	
Q6. Do you share your tooth brush?	no	Count	415	311	198	194	0.337
		% within speciality	99.5%	100.0%	100.0%	100.0%	
	yes	Count	2	0	0	0	
		% within speciality	0.5%	0.0%	0.0%	0.0%	
Total		Count	417	311	198	194	
		% within speciality	100.0%	100.0%	100.0%	100.0%	

Table 2- Response for Attitude based questions

Q 7. Efficiency of the toothbrush to clean teeth is for how many months?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
2 months	Count	90	83	25	28	<0.001
	%	21.6%	26.7%	12.6%	14.4%	
3 months	Count	292	162	131	127	
	%	70.0%	52.1%	66.2%	65.5%	
Month	Count	35	66	42	39	
	%	8.4%	21.2%	21.2%	20.1%	
Total	Count	417	311	198	194	

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	%	100.0%	100.0%	100.0 %	100.0%	
Q8. How do u know about tooth brushes?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
I saw in pamphlets	Count	51	19	3	7	<0.001
	%	12.2%	6.1%	1.5%	3.6%	
I saw it on social media	Count	39	20	6	12	
	%	9.4%	6.4%	3.0%	6.2%	
I saw it on TV	Count	43	44	39	12	
	%	10.3%	14.1%	19.7%	6.2%	
my parents told me	Count	284	228	150	163	
	%	68.1%	73.3%	75.8%	84.0%	
Total	Count	417	311	198	194	
	%	100.0 %	100.0%	100.0 %	100.0%	
Q9. What is an indicator that tells you you need to change the tooth brush?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
The tooth brush will preset	Count	198	160	114	86	<0.001
	%	47.5%	51.4%	57.6%	44.3%	
The toothbrush will slay/ bend	Count	150	149	45	80	
	%	36.0%	47.9%	22.7%	41.2%	
there will be buildup of dirt in the tooth brush	Count	69	2	39	28	
	%	16.5%	0.6%	19.7%	14.4%	
Total	Count	%	311	198	194	
	%	100.0%	100.0%	100.0 %	100.0%	
Q10. Do you feel tooth brush wear affects dirt removal from teeth?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
no	Count	39	35	26	26	0.376
	% within speciality	9.4%	11.3%	13.1%	13.4%	
yes	Count	378	276	172	168	
	% within speciality	90.6%	88.7%	86.9%	86.6%	
Total	Count	417	311	198	194	
	% within speciality	100.0%	100.0 %	100.0 %	100.0%	
Q11. What factors affect the longevity of toothbrush?		speciality				
		dentistry	Medicine	Nursing	pharmacy	
All the above	Count	371	266	161	181	<0.001
	%	89.0%	85.5%	81.3%	93.3%	

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Duration of brushing	Count	8	30	9	3	
	%	1.9%	9.6%	4.5%	1.5%	
Force of brushing	Count	18	5	21	6	
	%	4.3%	1.6%	10.6%	3.1%	
Frequency of tooth brushing	Count	20	10	7	4	
	%	4.8%	3.2%	3.5%	2.1%	
Total	Count	417	311	198	194	
	%	100.0%	100.0%	100.0 %	100.0%	
Q12. Does tooth brushing affect bacterial growth on teeth?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
no	Count	98	62	55	29	0.013
	% within speciality	23.5%	19.9%	27.8%	14.9%	
yes	Count	319	249	143	165	
	% within speciality	76.5%	80.1%	72.2%	85.1%	
Total	Count	417	311	198	194	
	% within speciality	100.0%	100.0 %	100.0 %	100.0%	
Q13. Do you replace your tooth brush?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
no	Count	18	47	28	27	<0.001
	% within speciality	4.3%	15.1%	14.1%	13.9%	
yes	Count	399	264	170	167	
	% within speciality	95.7%	84.9%	85.9%	86.1%	
Total	Count	417	311	198	194	
	% within speciality	100.0%	100.0 %	100.0 %	100.0%	

Table 3- Response for Practice based questions

Q 14. Do toothbrushes give protection from bacteria?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
No	Count	93	49	54	52	0.005
	% within speciality	22.3%	15.8%	27.3%	26.8%	
Yes	Count	324	262	144	142	
	% within	77.7%	84.2%	72.7%	73.2%	

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	speciality					
Total	Count	417	311	198	194	
	% within speciality	100.0%	100.0%	100.0%	100.0%	
Q 15. Best method to store tooth brush is?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
clean after brushing	Count	95	78	83	38	<0.001
	%	22.8%	25.1%	41.9%	19.6%	
clean after brushing and keep in cover	Count	184	140	61	82	
	%	44.1%	45.0%	30.8%	42.3%	
clean after brushing and keep upside down	Count	21	10	3	24	
	%	5.0%	3.2%	1.5%	12.4%	
clean after brushing and store in water	Count	6	9	0	6	
	%	1.4%	2.9%	0.0%	3.1%	
Do not leave toothbrush in bathroom	Count	111	74	51	44	
	%	26.6%	23.8%	25.8%	22.7%	
Total	Count	417	311	198	194	
	%	100.0%	100.0%	100.0%	100.0%	
Q16. Do you clean the tooth brush before brushing?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
no	Count	36	19	42	23	<0.001
	% within speciality	8.6%	6.1%	21.2%	11.9%	
yes	Count	381	292	156	171	
	% within speciality	91.4%	93.9%	78.8%	88.1%	
Total	Count	417	311	198	194	
	% within speciality	100.0%	100.0%	100.0%	100.0%	
Q 17. Which type of tooth brush do you use?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
Extra hard	Count	52	35	19	17	<0.001
	%	12.5%	11.3%	9.6%	8.8%	
Hard	Count	0	11	5	9	
	%	0.0%	3.5%	2.5%	4.6%	
Medium	Count	163	152	114	93	
	%	39.1%	48.9%	57.6%	47.9%	
Soft	Count	202	113	60	75	
	%	48.4%	36.3%	30.3%	38.7%	
Total	Count	417	311	198	194	
	%	100.0%	100.0%	100.0	100.0%	

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				%		
Q 18. Does oral health affects general health?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
no	Count	12	15	0	4	0.012
	% within speciality	2.9%	4.8%	0.0%	2.1%	
yes	Count	405	296	198	190	
	% within speciality	97.1%	95.2%	100.0%	97.9%	
Total	Count	417	311	198	194	
	% within speciality	100.0%	100.0%	100.0%	100.0%	
Q 19. Which brand of tooth brush do you use?		speciality				p
		dentistry	Medicine	Nursing	pharmacy	
Banat	Count	0	0	0	2	<0.001
	%	0.0%	0.0%	0.0%	1.0%	
Colgate	Count	104	37	79	39	
	%	24.9%	11.9%	39.9%	20.1%	
Crest	Count	45	54	13	20	
	%	10.8%	17.4%	6.6%	10.3%	
Deffrint types	Count	0	5	0	0	
	%	0.0%	1.6%	0.0%	0.0%	
I do not know the name	Count	7	5	18	10	
	%	1.7%	1.6%	9.1%	5.2%	
Any types nothing specific	Count	0	5	0	0	
	%	0.0%	1.6%	0.0%	0.0%	
Meridol	Count	2	0	0	0	
	%	0.5%	0.0%	0.0%	0.0%	
Miswak	Count	4	4	0	0	
	%	1.0%	1.3%	0.0%	0.0%	
Oral B	Count	187	120	66	93	
	%	44.8%	38.6%	33.3%	47.9%	
Orex	Count	0	3	0	0	
	%	0.0%	1.0%	0.0%	0.0%	
Pepsodent	Count	29	25	12	12	
	%	7.0%	8.0%	6.1%	6.2%	
Philips	Count	2	0	0	0	
	%	0.5%	0.0%	0.0%	0.0%	
Sensodyne	Count	27	35	8	18	
	%	6.5%	11.3%	4.0%	9.3%	
Signal	Count	2	1	2	0	
	%	0.5%	0.3%	1.0%	0.0%	

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Sonic	Count	0	7	0	0	
	%	0.0%	2.3%	0.0%	0.0%	
Tat	Count	0	10	0	0	
	%	0.0%	3.2%	0.0%	0.0%	
Tresia	Count	8	0	0	0	
	%	1.9%	0.0%	0.0%	0.0%	
Total	Count	417	311	198	194	
	%	100.0%	100.0%	100.0 %	100.0%	

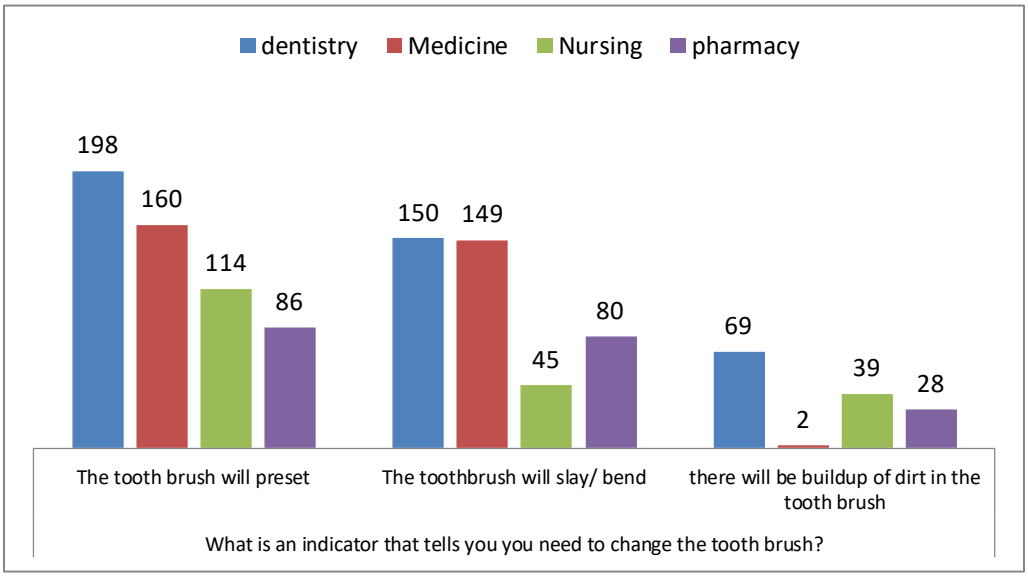

Figure 1: Graph depicting the responses for indicators to change the toothbrush

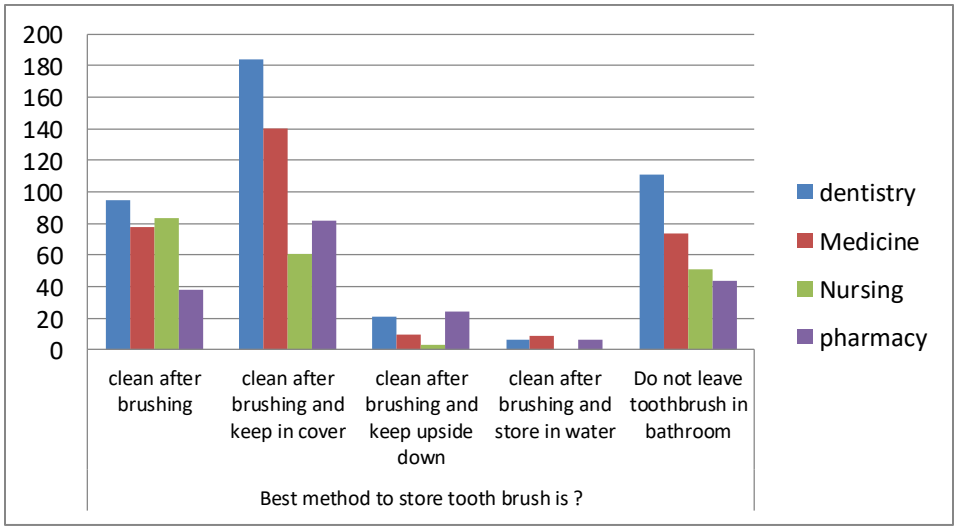

Figure 2: Graph depicting the responses for best method to store toothbrushes

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4. Discussion

Oral hygiene pertains to the cleaning of hard tissues like teeth and soft tissues like gums and tongue in the oral cavity. It also refers to the cleaning and maintenance of oral appliances, dentures and dental prosthesis.[15]A failure in maintenance of oral hygiene leads to oral diseases like dental caries and periodontal diseases which have been described as "Silent Epidemic" by the U.S. Department of Health and Human Services.[16]Poor oral hygiene has also been associated with life-threatening medical conditions like diabetes, stroke, pulmonary diseases and pre-term low birth weight babies.[17]Dental plaque is considered to be the main causative agent for the development of dental caries and periodontal diseases.[18]

Toothbrushes are considered to be an effective aid for the maintenance of oral health and hygiene.[2] Toothbrushes also need to be maintained and stored in hygienic conditions as they can be potent sources for transmission of harmful pathogens.[3]

In the present study, we compared and evaluated the knowledge and behavior of undergraduate students studying dentistry, medicine, nursing, and pharmacy regarding toothbrush disinfection and evaluated their attitude towards toothbrush replacement. This study was conducted for the first time in Saudi Sub Population about toothbrush hygiene and maintenance.

In the present study, a total of 1120 undergraduates had participated of which 70.5% were females and 29.5% were males. When the knowledge of the participants was assessed, it was observed that most of the participants had fair knowledge about toothbrushes. All the participants knew the meaning of toothbrushes and none of them shared their toothbrushes. More than 50% of the medical and dental undergraduates brushed twice a day but 6.8% of the medical undergraduates and 1.5% of the nursing and pharmacy undergraduates answered that they never brushed their teeth.It was also observed that more than 39.3% of dental students, 52.7% of medical students, 53% of nursing students, and 50% of pharmacy students did forget to brush their teeth. This behavior could be explained by the fact that oral hygiene practices are introduced to the Saudi children at a very later age which leads to their lack of interest and ignorance towards tooth brushing. This finding was similar to the findings of Meshari et al who reported about the oral health awareness among the Saudi Arabian population.[18]

Parents' knowledge also plays an important role in inculcating oral hygiene habits in children. In our study, it was seen that more than 60% of students were introduced to toothbrushes by their parents. Parents act as role models for children. In a study conducted by Wilson et al in Latino children, it was reported that a noteworthy association existed between the maternal oral health knowledge and their children's oral health outcomes.[19]This statement holds for our study.

It is generally recommended that tooth brushing must be done for 2 minutes with a fluoridated toothpaste twice every day.[20]In our study it was seen that more than 50% of all the undergraduates brushed their teeth for 1-2 minutes twice a day except for dental students wherein in only 48.9% of them brushed for 1-2 minutes and 41% brushed for 2 – 3 minutes. Although WHO commends regular dental check-ups every 6 months, in our study it was seen that 57.9% of medical students, 50% of nursing students, and 47.4% of pharmacy students never visited a dentist. This percentage is alarming and is similar to the findings of Alhabdan et al where he reported that his study subjects were apprehensive towards visiting a dentist.[21]

It is difficult to decide when to replace toothbrushes. There are very less scientific reports which emphasize on the time for replacement of toothbrushes.[22]According to the American Dental Association toothbrush must be replaced every 3 to 4 months or once they splay.[23] In our study it was seen that more than 50% of the students knew that the efficiency of toothbrushes reduces in 3 months but failed to understand the indicators for toothbrush replacement. Most of them

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thought that toothbrush will preset as it is used more and more. Less than 50% of the students answered that toothbrush will slay. More than 80% of the students knew that toothbrush wear will affect the cleaning action of the tooth and thus they replaced their toothbrushes.(Figure – 1)
There are different schools of thought about the stiffness of the bristles of the toothbrushes. In a study conducted by Ranzan et al, it was reported that soft toothbrushes and extra-soft toothbrushes were safer compared to the medium and hard bristle toothbrushes.[24] While in another study conducted by AlShehab et al it was reported that soft bristle toothbrushes caused more abrasion compared to the medium and hard bristle toothbrushes.[25] There is further research needed to confirm which type of bristles are safe for teeth. In the present study, the majority of the students used medium stiffness toothbrushes. Moreover, it was seen that students had less knowledge about the storage of toothbrushes. It has been reported by Metha et al that toothbrushes must be cleaned after use and stored in a cover.[26]But less 50% of the students practiced this in our study.(Figure -2)
Oral health acts as a window to the body's overall health. According to the ADA, most of the nutritional deficiencies and other infections in the body are reflected first in the oral cavity. Thus oral health directly or indirectly affects the overall health. In our study, more than 95% of the students agreed to the above statement and they realize how important it is to maintain oral health.

5. Conclusion

From the present study we conclude that there is a need to educate the children and teenagers concerning toothbrush hygiene and maintenance because toothbrushes are directly related to oral health which is in turn related to the general health and general well–being of the individual. Toothbrush manufacturers must present an instruction manual for the common public with regard to maintenance and replacement of worn toothbrushes. There is a major need to unceasingly educate and promote oral health and the benefits of the maintenance of good oral hygiene among the teenagers and students studying medical and paramedical courses so that they can further educate the population. There are very few articles published specifically about toothbrush hygiene and maintenance. Thus, in the future, there is a need for more studies to be conducted and published in this field for the common population to benefit from it.

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