

A Questionnaire Based Study on Awareness of Sanitization of Tooth Brushes in Indian Population and Their Disinfection with an Oral Hygiene Aid Sterilizer: A Clinical and In-Vitro Study.

Dr. Chitra Laxmikant Patil, Dr. Monali Ghodke , Dr. Gaurav Redkar , Dr. Maitri Dedhia,

Dr. Poulomi Pal, Dr. Maitri Dedhia, Dr. Poulomi Pal, Dr. Devi Jain

Government Dental College and Hospital Mumbai India

Abstract:

Oral diseases are a major public health concern, owing to their high prevalence and their relationship with systemic health. Oral health maintenance can only be accomplished with proper tooth brushing & tongue cleaning. Toothbrushes are kept in places which is a hub of contaminants. They should be correctly stored, disinfected and changed at regular intervals.

Aims: Our study focuses on awareness of disinfection of toothbrushes among general population and invention of a newer device that not only keeps the toothbrush moisture free but also germ free: Oral Hygiene Aid Sterilizer (OHA-S).

Methods and Material: A cross sectional questionnaire based study of sample size 100 was conducted in which samples were randomly selected and distributed with a questionnaire form. All the study participants were asked to brush their teeth with the tooth brush provided. After brushing, the contaminated bristles were disinfected in the newer device: OHA-S and were observed under phase contrast microscope.

Statistical analysis used: Randomized control trial

Results: Survey results showed that 61% of general population was unaware of sanitization of toothbrushes. The remaining being aware, almost 72% did not perform sanitization on daily basis. Also, there was a significant decrease in microbial flora of the bristles which were sanitized using OHA-S when observed under the phase contrast microscope

Conclusions: As majority of population failed at sanitizing oral hygiene aids daily, OHA-S was effective in not only making the oral hygiene aids moisture free but also in reducing the amount of microbial load which is the main causative factor for periodontal diseases .

Key-words: Toothbrush, ultraviolet radiation, oral hygiene aid, oral diseases, public health, sterilization, sanitization

Introduction: Oral health and systemic health is a two-way relationship, which makes maintenance of oral health of prime importance. Oral diseases are of major public health concern owing to their prevalence and their effects on the individual's quality of life. A large ratio of oral diseases can be prevented by providing oral health related education, thus improving the oral health attitude and practices among the general population. The maintenance of oral health cannot be accomplished without proper tooth brushing and tongue cleaning. Toothbrush, a thing with which our day starts and ends as well, is still kept in a place which is a house of microbes. Most of the time proper maintenance of the toothbrush is neglected by an individual.

Microorganisms that attach, accumulate, and survive on tooth brushes can further cause oral diseases [1]. These microorganisms are implicated to cause dental caries, gingivitis, stomatitis and even infective endocarditis in an individual, affecting both oral and general health [2].

Cobb (1920) reported toothbrush to be a cause of several repeated infections of the mouth [3]. After a single use for duration ranging from 30 seconds to 4 minutes, toothbrushes may become contaminated by a wide array of bacteria, viruses, yeasts and fungi which are present both in the oral cavity and in the external environment [4]. Oral hygiene aids maintain our oral health, but have we ever thought about their maintenance?

In 1920, soaking the toothbrush in alcohol was one of the first recommended procedures for toothbrush sterilization. Later in 1929, Kauffmann listed some methods such as sunlight and table salt to absorb the moisture and to keep the brush inside a closed container with a preparation containing formaldehyde gas for its disinfection. In the current times of pandemic like corona virus, care and maintenance of oral hygiene aid has strongly been emphasized which may directly lead to prevention of many diseases making it important of how we store, sterilize and change at regular intervals.

Concerns regarding instruments for oral cleaning such as toothbrushes, tongue cleaners, etc. have always existed. Although methods for tooth brushing are described in the literature, procedures for maintaining the cleanliness of the toothbrushes are rarely discussed [5]. Also, toothbrush disinfection should be quick, effective, cheap, non-toxic and easy to perform.

Therefore, the present study is conducted in Indian general population to analyze the awareness of oral hygiene aids and the effects of disinfection on the same using OHA-S.

Materials and Methods:

A cross sectional questionnaire-based study was conducted at Government Dental College and Hospital, Mumbai to check the awareness of oral hygiene aids sanitization and disinfection with newer device among patients. An ethical clearance was obtained from the institutional ethical committee reference number gdch /mds/ 399/2023 . A written informed consent was obtained from all the participants. This study included 100 patients in the age group of 18 – 60 years who were systemically healthy and having at least 20 natural teeth were selected randomly. A self-designed questionnaire was designed and distributed among the participants and data was 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.

50 participants who were included in the above study were given oral hygiene aids (tooth brush ,tongue cleaner ,dentifrice). All patients were given proper instructions regarding oral hygiene maintenance and were advised to brush once daily in the morning .After brushing they were advised to wash their tooth brush in running tap water and place it . All the toothbrush were collected after one week & stored in sterile plastic bag. The toothbrush was coded 1-50 which were then sent to laboratory. The bristle samples of each toothbrushes were divided into 2 groups out of which one group was sterilized under UV light OHA-S chamber.

Proposed model

A protocol-based rectangle model of size 20 x 6 x 5.5cm of weight 228gm with installation of various slot holders was constructed to demonstrate sterilization of oral hygiene aids using UV-C light to keep microbe free and dryer to keep moisture free.

Component - closed chamber contains a dryer, a source of UVC radiation, and slot holders for oral hygiene aids.

It is a chamber which is made up of acrylonitrile butadiene styrene material which offers a good balance of impact, heat, chemical and abrasion resistance, dimensional stability, tensile strength, surface hardness, rigidity and electrical characteristics. This plastic material plastic remains hard, rigid and tough even at low temperatures. It is available in fire-retardant, heat-resistant and palatable grades.

It allow light of wavelength greater than 375 nm to pass through the material, but will not allow UV-C wavelengths (100–290nm) to pass through it.

Intensity of UV C rays in the chamber is 1000 uW/cm^2 . Working environment $5\text{-}50^\circ\text{c}$. Power is 2W with current of 180mA.

The model runs on UV-C Germicidal Technology which kills upto 99.9% of bacteria on your toothbrush and tongue cleaners without chemicals, which provides clean toothbrushes for good oral hygiene.

The holder has a hanging slot with two holes 0.31 inches on the left and two holes 0.39 inches on the right to accommodate most common electric and manual toothbrushes as well as tongue cleaners. It accommodates toothbrush necks up to 0.39 inches wide.

Working– After tooth brushing and tongue cleaning, place the respective oral hygiene aids in the chamber ensuring its complete seal. The electric source is switched on and the start button is pressed enabling the dryer to make aids moisture free. This cycle takes place for around 1 minute. After this, UVC radiation cycle is started automatically for the next 1 hour after which it is turned off. Electric source is expected to be turned off by the user. The chamber is expected to be kept closed until further use to avoid cross contamination

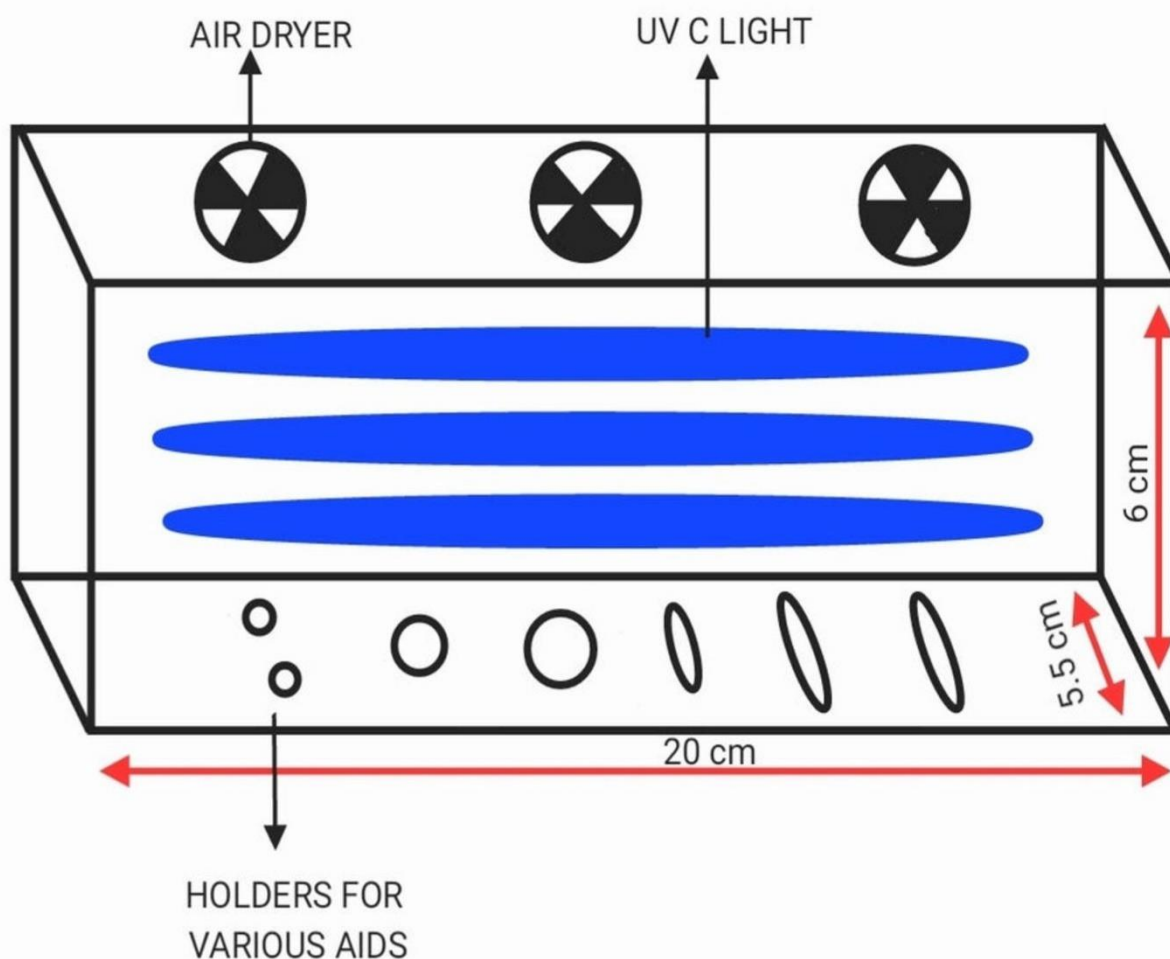


Figure 1 : Schematic representation of the OHA model

The samples were then fixed in Dibutylphthalate Polystyrene Xylene (DPX) mountant. After that these slides were observed under the phase contrast microscope . Photomicrographs were taken at $\times 100$ and were analyzed.

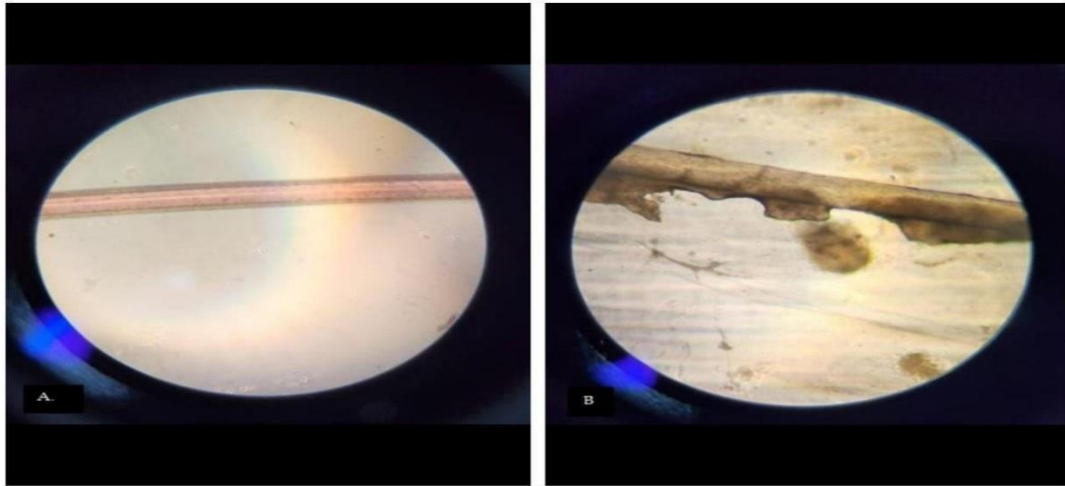


Figure 2 : Comparison of sterilized tooth bristle using UV-C radiation and contaminated tooth bristle

Statistical analysis

Data collected for the questionnaire was entered in a MS Excel sheet and descriptive and inferential statistics was computed. Chi-square test was used to find the difference between the groups. A $P < 0.05$ was considered statistically significant.

Results:

The demographic data was collected showing more number of males as compared to females [Table 2]. 39 % of them were not aware about the importance of sanitization of the toothbrush. Majority of them did not perform sanitization on a daily basis. Most of them were motivated and willing to perform sanitization everyday if given the correct knowledge and device for the same [Table 3]. Most of them sanitized the toothbrush with tap water [Table 4]. Second most common method was soap water followed by sanitizing agent and other solutions. A significant decrease in microbial flora using UV-C radiation when observed under a phase microscope.

Characteristics	Category	No.	Percentage
Gender	Male	56	56
	Female	44	44
Age	18-30years	46	46
	31-40years	22	22
	41-50years	14	14
	50-60years	18	18
Education	Non-Graduate	71	71
	Graduate	29	29
Income	<5000	22	22

	5000-20000	56	56
	>20000	22	22

Table 1: General characteristics of the patients

Table 2: Response to oral hygiene proforma

No. of participants	Response
72%	Do not perform
28%	Perform

Table 3: method of sanitisation of the participants

No. of participants	Method of sanitization
88%	Tap water
6%	Soap water
5%	Sanitizing agent (Alcohol)
1%	Other solutions

Discussion:

Dental professionals prioritize toothbrush as the most common oral hygiene aid for good oral health. Traditionally toothbrushes and tongue cleaners have been used in houses in India for oral hygiene. The toothbrush is mostly kept open in the environment after brushing. The bristles of the toothbrush get contaminated inside and outside of the oral cavity. Debris, fluids and other contaminants can be drawn between the bristles by capillary action and promote bacterial growth. Moisture gets entrapped within the tufts further promoting bacterial growth.

The present study assessed the awareness level in the general population for sanitization of the toothbrush and other oral hygiene aids. The current study included 100 participants with wide range in the age groups. The gender-wise distribution of study participants is comparable to that in another study.

In this study 69% participants stated lack of awareness and knowledge on toothbrush sanitization. The participants differed with respect to the options available for sanitization which may be attributed to low frequency of exposure regarding the same.

More than half of the participants are using tap water as cleaning agent, which removes the debris but doesn't inhibit or kill the microorganisms present on the tufts. It rather serves as a media for growth of microorganisms and also aids in more entrapment of contaminants when left in open environment.

Almost all the participants have shown their interest in disinfection of the oral hygiene aids. As dentists, more attention and emphasis should be made in practicing appropriate toothbrush sanitization methods among general people and healthcare professionals.

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 on the awareness of the oral hygiene aids sanitization.

If motivated, a large number of population may adapt to the habit of tooth brush sanitization indirectly decreasing the prevalence of the oral and systemic diseases. Proper education and motivation also becomes one major factor in disease prevention.

So, a need for a device to help attain maximum level of sanitization is necessary in today's time. Be it 1990, 2020 or 2050 oral hygiene was, is and will be of prime importance to the human race. As it is rightly said prevention is better than cure, OHA becomes a model being one step closer in preventing oral diseases. Thus, keeping toothbrush microbes and moisture free becomes equally important.

Oral hygiene aids sanitization should be recommended for any population age group, high risk patients and vulnerable populations in a hospital setting.

Conclusion:

Within the limitation of the study, we conclude that the majority are unaware of toothbrush sanitization and patients who are aware are not aware of proper methods. Knowledge about sanitization is below average but they have favorable attitude towards using such devices. UVC radiation shows considerable decrease in number of microbes on the tooth bristle. OHA is effective in attaining maximum level of sanitization making it microbe and moisture free.

Future scope: Similar surveys can be conducted on a large scale to check the awareness of the general population towards oral hygiene aid sanitization. At the same time various modifications can be made to the proposed model to attain maximum percentage of sterilization.

Possible modifications that can be incorporated in the chamber are '

Audiovisuals which would act as a reminder to the patient about their tooth brushing as well as it would be helpful to the Alzheimer and pediatric patients.-It can be used in a hospital setup where huge compartments can be made with multiple holders.

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Conflicts of interest ; There are no conflicts of interest.

References:

1. Frazelle MR, Munro CL. Toothbrush contamination: A review of the literature. *NursResPract*2012;2012:420630
2. Karibasappa GN, Nagesh L, Sujatha BK. Assessment of microbial contamination of toothbrush head: an in vitro study. *Indian J Dent Res* 2011;22:2-5.
3. Cobb CM. Tooth brushes as a cause of repeated infections of the mouth. *Boston Med Surg J*1920;183:263-4.
4. Nelson-Filho P, Faria G, da Silva RA, Rossi MA, Ito IY. Evaluation of the contamination and disinfection methods of toothbrushes used by 24 to 48 months old children. *JDent (Chic)*2006;73:152-8.
5. Sato S, Pedrazzi V, Guimaraes Lara EH, Panzeri H, Ferreirade Albuquerque RJr, ItoIY. Antimicrobials pray for toothbrushes disinfection: An in vivo evaluation. *QuintessenceInt*2005;36:812-6