

## Perception of a New Design of Toothbrush by Its Users

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### Abstract

**Background:** The correct position of bristles of a toothbrush requires them to be bent at an angle of 45 along with gums and teeth surfaces. This practice is quite difficult by many people especially disadvantage group of people.

**Aim:** The objective of this study was to evaluate the perception of users on a newly designed toothbrush with two brushing surfaces where bristles were prefabricated at an angle of 45°.

**Methodology:** The innovative toothbrush was provided to 500 voluntarily study participants in Malaysia, Pakistan, Egypt, Japan and Germany. The subjects cleaned their teeth for two weeks without oral hygiene instructions. The participants submitted their responses based on closed end questionnaire via hard and soft copy. Data was analyzed.

**Results:** There was a 57 percent (n= 285) response rate. The highest response was from Malaysian subjects (n=140, percent 49.12). Due to small number of data from Pakistan, Egypt, Japan and Germany, respondents were combined as International subjects (n=145, percent 50.88). Gender based response was Male (n= 128, percent 44.9) and female (n= 122, percent 42.8) and respondents (n=35, percent 12.3) left the column of gender blank. More than 30 % of the subjects were attracted by its blended colorful bristles. More than 50 % found the new shaped tooth-brush to be satisfactory.

**Conclusion:** The innovative toothbrush is friendly in cleaning teeth without knowing recommended brushing technique.

**KeyWords:** Design, Oral Hygiene, Toothbrush Perception, Teeth.

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### I. Introduction

A toothbrush is a basic tool for plaque removal which is manufactured in a variety of shapes, sizes and stiffness of bristles. Currently, all the commercially available toothbrushes require oral hygiene instructions for effective usage. Studies show that a regular use of tooth brush with proper oral hygiene instructions improves the plaque control and prevents gingival inflammation [1-3].

Various tooth-brushing techniques such as Bass, Stillman or Fone are advocated to ensure effective teeth cleaning [4]. However, modified Bass technique being a superior technique for supragingival plaque removal is recommended by many dental professionals [5].

The effectiveness of toothbrush is embraced with oral hygiene instructions. There are few toothbrush techniques which drive the users how to brush their teeth with a particular shaped toothbrush. The high prevalence of oral diseases indicates that many users fail to achieve adequate removal of plaque via normal tooth brush usage. Therefore, dental professionals continue to emphasize the importance of improving brushing habits with patients but behavior modification is still a big challenge.

A study has shown that the plaque removal with the help of a video (watch and follow) improves the plaque removal [6]. However, it is also estimated that over 90% of adults employ their personal brushing methods, usually a 'scrub' method [7-9]. Inadequate brushing technique, insufficient brushing duration and lack of interproximal cleaning are found to be the norm for a majority of users of manual toothbrush [10-12]. Most commonly used toothbrushes are flat surface. To get proper oral hygiene, users have to bend some part of the bristles at angle of 45 degree. Many users especially disadvantage groups & children face a difficulty to get 45 degree bristle position along with teeth.

In modern era, not all but at least, vulnerable group of people and children need such designed toothbrush which provides maximum cleaning without cleaning instructions from either a dentist or a dental hygienist. This study aimed to assess the perception of a new designed toothbrush having two cleaning surfaces where bristle were built in an angle of 45 degree to incorporate with the recommended brushing technique.

## **II. Materials And Methods**

The newly designed toothbrush having two brushing surfaces with bristles at angle of 45 degree was distributed, free of charge, to 500 volunteers in Malaysia (Penang, Kedah, and Selangor states), Egypt, Germany, Japan and Pakistan. Both genders of ages from 10 to 70 years participated voluntarily. It was a cross section study where the subjects brushed their teeth for minimum two weeks without having oral hygiene instructions from dentists / hygienists.

The subjects used the study toothbrush minimum 2 weeks before they returned the questionnaires by hand, email or by post. Out of 500 questionnaires, the returned responses were 285 from Malaysian, Pakistani, Arab, Japanese, and German nationals. The contents of questionnaire were associated with tooth brushing habits, design of the new toothbrush and its friendly usage. Children responses were obtained by their parents where needed. Before the perception survey, Industrial design (ID) and patent of the toothbrush were filed in Malaysia and planned to file in surveyed countries as future commercialization of the product.

**Product:** Toothbrush, having 5 bristles rows in its head, was manufactured by Fulijaya Sdn Bhd (Malaysian company) by using silicone material. The nylon threads were added to increase the stiffness of the bristles which were soft, medium and hard. The head of toothbrush had two step ladder surfaces where bristles were prefabricated at approximate 45 degree angle. Bristles were cut in three different lengths, outmost row as the shortest row whereas the centre row was having the longest bristles as shown in Fig.1 & 2. The measurements of size of head and bristle were such as 26.1 mm, five rows of 12, 10 and 8 mm length of bristle respectively by giving an inclined shape of bristles.

## **III. Results**

The total distributed questionnaire were 500 and returned responses were 285 (response rate 57 percent). The demographic distribution based on nationalities is shown (Tables 1 & 2). The highest response was from Malaysian subjects (n=140, percent 49.1). Due to small number of data from Pakistan (n=67, percent 23.5), Egypt (n=28, percent 9.8), Japan (n= 27, percent 9.4) and Germany (n=23, percent 8.1), they were combined as international respondents. Thus response from international subjects (Pakistan, Egypt, German, and Japan) was (n=145, percent 50.9). Respondents between age of 10 to 14 years and above 14 years were grouped as children (n= 62, percent 21.8) and adult (n= 223, percent 78.2) respectively (Table 2). Subjects brushing their teeth twice a day were highest (52.5 %) and brushing either one or three times a day were almost equal. Majority of subjects (percent 44.2) found the new toothbrush friendly in usage. More than 30 percent agreed by its colorful blended bristles (Table 3).

## **IV. Discussion**

The design of a conventional manual toothbrush, consisting of multitufted, flat trimmed and end rounded nylon filament brush, was developed by US periodontologist [13]. The effectiveness of a toothbrush depends on the toothbrush design, brushing technique, frequency and time spent while brushing [4]. The new toothbrush of this study was manual. It minimized the risk of periodontal diseases by providing user's friendly attitude. Users could use it without having oral hygiene instructions from a dental health professional.

Several designs of toothbrushes are available in markets and used by consumers with the help of instructions given by dental health professionals. The salient feature of this toothbrush was to be used without oral hygiene instructions. Study participants used the toothbrush two to three weeks without having proper oral hygiene instructions and found friendly in terms of cleaning process. Most of the users (80%) brush their teeth 1-2 times a day [14]. We found also similar results i.e., more than fifty percent participants brushed their teeth twice a day. The commonly used brushes have four rows. However, toothbrushes having five rows of bristles are also available in the market [15]. The study toothbrush had five rows and its bristles were cut at 45 degree giving two brushing surfaces and ultimately a wider space for toothpaste. Having different lengths of bristle made it unique and it made people to use only up and down way rather than back and forth direction which is commonly a cleaning process (Fig 1).

High global levels of gingivitis and inter-proximal caries suggest the fact that many consumers are lacking the skill and or motivation to adequately and consistently remove or disrupt enough pathogenic plaque to stave off dental / oral diseases using solely a standard, flat trimmed toothbrush and their usual brushing method [8, 9, 16]. In spite of the tooth brushing benefits, consumer research has shown that larger head size has more benefit in terms of cleaning. Additionally, many value their manual brushing experience a predisposition to the amount of toothpaste customarily applied, the ability to brush several teeth at once. The innovative toothbrush provided a larger surface area having two inclined surfaces to fulfil the benefits mentioned above.

Dental professionals often prescribe twice daily, 2 minute oral hygiene sessions that include flossing. The research has revealed that participants regularly skip interproximal cleaning and overestimate brushing duration fail to achieve plaque free tooth surface through their normal efforts [17-20]. Our study participants

followed the pattern of cleaning 'twice a day'. The design of toothbrush having 45 degree angled bristles, making two brushing surfaces is good for children and vulnerable group of community who have less oral health care facilities and make a bulk of community. We encourage other researchers and manufacturers to focus on the bacterial plaque control aspect by this design of toothbrush.

## V. Conclusion

The toothbrush having 45 degree angled bristles provides a convenient way of cleaning by automatically fulfilling the requirement of recommended brushing techniques. The users easily adopted the new shaped toothbrush and found friendly product. The present tooth brush is a need for those especially who are hesitated in knowing the toothbrush instructions. Study on other aspects of the toothbrush such as amount of plaque removal aspect would be much beneficial and recommended.

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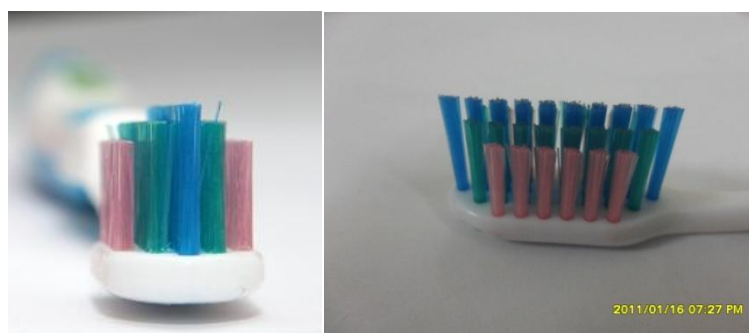
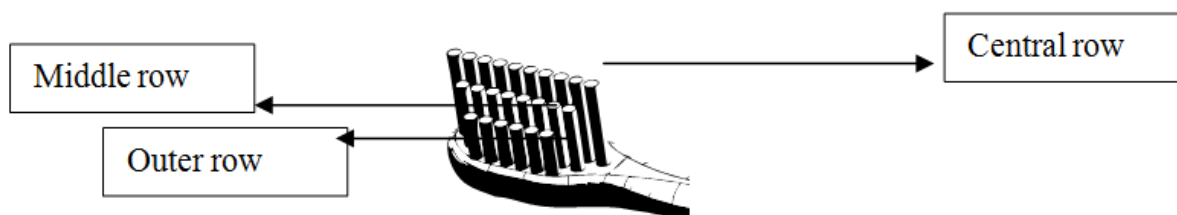


Fig.1 A. Front view

Fig.1. B. Lateral view

(Toothbrush with five rows - outermost row shortest and innermost row with longest bristle having two brushing surfaces thus providing two brushing surfaces and bristles are prefabricated at 45 degree angle.)



**Fig 2.** Innermost row 12mm, middle row 10 mm and outermost row 8 mm. The Industrial design / Patent of toothbrush had been filed in Malaysia.

**Table 1. Demographic data on perception of new designed toothbrush in five countries (N= 285)**

Total Population N= 285	Country				
	Malaysia n= 140	Pakistan n= 67	Egypt n= 28	Japan n= 27	Germany n=23
Male n= 128	63 (45%)	28 (41.8%)	11 (39.3%)	14 (51.8%)	12 (52.2%)
Female n= 122	70 (50%)	24 (35.8%)	04 (14.3%)	13 (48.2%)	11(47.8%)
Unspecified n=35	07 (5%)	15 (22.3%)	13 (46.4%)	---	---

**Table 2. Demographic data between children and adults.**

Total Population N= 285	Country				
	Malaysia n= 140	Pakistan n= 67	Egypt n= 28	Japan n= 27	Germany n=23
Children n= 62	30 (21.4 %)	20 (29.8 %)	6 (21.4 %)	6 (22.2 %)	---
Adult n=223	110 (78.6 %)	47 (70.1 %)	22 (70.5 %)	21 (77.7 %)	23 (100 %)

**Table 3. Features of New Design of Toothbrush.**

Which feature of the toothbrush remarkable	Item	Percentage
Which feature of the toothbrush remarkable	Bristle softness	12.5
	Attractive color of bristles	31.4
	Handle grip	16.4
	Design of brush head	29.3
	No specific requirement	10.4
Compared to other brands of tooth brush, new toothbrush is	Much better	44.2
	Somewhat better	29.7
	About the same	10.2
	Somewhat bad	2.1
	Don't know	13.8
In your opinion, toothbrush is	More than satisfactory	22.6
	Satisfactory	51.5
	Do not know	12.6
	Probably	7.8
	Definitely no	5.6
How often do you use toothbrush	Once a day	17.3
	Twice a day	52.5
	Thrice a day	16.1
	Not regularly	13.0
	Do not use	1.1

Majority of users (51%) found toothbrush to be satisfactory in terms of its usage. Colored bristles were the most attractive feature of the toothbrush. The new toothbrush was better than other brands of toothbrush in its usage.