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Knowledge about Brushing Simulator Among Dentists - A Survey

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ABSTRACT

Brushing is an important activity in a day to day life. It helps to keep our oral cavity healthy. A brushing simulator is a machine that holds the toothbrush and helps to check various activities done with it. Brushing helps to clean the teeth, tongue, gums, and place a major role in maintaining dental hygiene. Dental plaque is removed by this process. This is a computer program mission where everything is done using the software. The aim of the survey was to assess the knowledge about the brushing simulator among dentists in Chennai. When comparing the awareness of brushing simulator with gender, it was shown that females had a higher level of awareness about the brushing simulator when compared with males ($p = 0.029$), which was statistically significant. When comparing the knowledge about the uses of brushing simulators with gender, it was shown that females had a higher level of knowledge about the uses of brushing simulators when compared with males ($p = 0.013$), which was statistically significant. When comparing the knowledge about the types of brushing simulator movements with gender, it was shown that females had a higher level of knowledge when compared with males.($p= 0.034$), which was statistically significant. The knowledge and view varied for each question. Brushing force is usually higher for sonic toothbrush and with manual toothbrush dentin face the highest abrasion when compared to the enamel. People are aware of the simulation of brushing, but not about the brushing simulator machine.

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INTRODUCTION

Good oral hygiene is very important to prevent bad odor, improve aesthetics, and also improve oral health (Teja and Ramesh, 2019). But for maintenance, brushing is very important (Ali *et al.*, 2019). Brushing helps to clean the teeth, tongue, gums, and place a major role in maintaining dental hygiene. Chlorhexidine is usually used as a mouthwash to maintain oral health (Noor, 2016; Siddique *et al.*, 2019). Dental plaque is removed by this process. Fluoridated toothpaste must be used for brushing. So regular brushing with a fluoridated dentifrice is recommended globally for controlling

plaque (Chung *et al.*, 2017). The brushing techniques may vary between individuals. The factors like pressure, speed, timing, the angulation of pressure will vary from person to person. So a brushing simulator was introduced, it is a machine that holds the toothbrush. The number of holders-type available are 4, 8 and 12 (Bizhang *et al.*, 2017). It has many uses like to simulate tooth brushing, to check the effects of brushing on the tooth surface, to check the effects of brushing on the restorative surface, to check abrasion and also used for pre-clinical testing-brushing effectiveness (Ledder *et al.*, 2019).

This is a computer program machine where everything is done using the software. The machine produces varied movements like linear, zigzag, and circular. This toothbrushing simulator helps in studying various parameters like the assistance of the substrate to operation (Körner *et al.*, 2020), the abrasiveness of the abrasive, the effects of different kinds of movements, movements of different kinds of the toothbrush. The different pressure and its effects over-brushing can also be studied using this brushing simulator machine (Warren *et al.*, 2002). All the veneer's stability and strength can also be checked with this machine (Ravinthar and Jayalakshmi, 2018) This simulated toothbrush and technique, using a simulator, helps to check the gloss, roughness, and even color change of the tooth due to continuous contact of the bristles with the tooth surface (Lai *et al.*, 2018). In brushing force, a minimum of 3N pressure is required to provide for abrasion (Litonjua *et al.*, 2004). Therefore the purpose of this study is to check the knowledge and awareness of brushing simulators among dentists in Chennai.

MATERIALS AND METHODS

The population considered here are the dentists in Chennai. It is a university setting – where the collection of data is easier and the occupation, i.e., the population taken is the same - dentists. But sometimes the opinion may vary outside the university and also between different universities. The approval was obtained from the institution (SRB). Here the sample size was considered to be 135, with reference to sample size 196 (Ahmad *et al.*, 2017). The sampling method used here is stratified random. Steps taken to minimize bias is that the survey is digital, so no paper was used in this survey (eco world), a proper questionnaire was created with easily understandable questions.

A questionnaire was prepared with the help of online tools like Google forms and the data was collected. Excel sheet was used to transfer the data and tabulate it. A total of 13 questions were cre-

ated (Lang *et al.*, 2014). Validity checking was done by three internal experts from the institution and three external experts outside the institution. The method of representations here is pie chart. In the statistical test used for descriptive analysis, the statistics software used was SPSS. Chi-square test and pearson correlation analysis were used, with p-value less than 0.05 to be statistically significant.

RESULTS AND DISCUSSION

A total of 135 responses were received out of which 52% were male and 46% were female. From the results obtained, from that the following conclusions were made and was expressed with the help of pie charts. In the age group, 37% were between the age of 18–20, 35.6% –21 to 25 years, 17.8% were between 26–30 years and 9.6% were above the age of 30. The majority of the people who took up the survey were between 18 to 20 (Figure 1).49.6% of them who took up the survey were UG students, 23% – PG students, 15.6% – BDS practitioners, 4.4% were MDS practitioners, and 7.4% of the people who were researchers. Here the majority of people who took up the survey were UG students (Figure 2). 64.4% of the people knew that brushing can be simulated and 35.6% didn't know that it can be simulated (Figure 3). 17.8% say that it is a robot that helps to brush the teeth, 41.5% responded that it is an electronic toothbrush and 40.7% knew that it is a machine that holds the toothbrush. More than the manual toothbrush and the powered toothbrushing helps in reducing plaque (Yaacob *et al.*, 2014) (Figure 4). 16.4% say that the use of brushing simulator is to simulate tooth brushing, 15.7% says it is to check the effects of brushing onto the surface, 11.2% choose the option, to check the effects of brushing on the restorative surface, 51.5% said all the above, 5.2% went for the options none of above.

Mechanical brushing simulator is used for cleaning the occlusal surfaces with the help of water and dentifrices (Ledder *et al.*, 2019) (Figure 5). Based on the movements provided, 10.4% said linear motion, 14.1% went for a zigzag motion option, 31.1 % opted for circular motion, 5.9% – none of the above, and 38.5% said all the above (Figure 6). Passive brushing, the duration is more with the moment slick circling and horizontal strokes (Ganss *et al.*, 2018). Based on the parameters varied answers were obtained. 9.6% choose the option resistance of the substrate to abrasion, the same percentage 9.6%-abrasiveness of the abrasive. Based on the version of the toothbrush bristle, the abrasion varies. This is high with a feathered toothbrush which also causes lesions (Nasim *et al.*, 2018; Turssi *et al.*,

Table 1: Table depicting the association between gender and awareness of brushing simulator (P value = 0.029, which is statistically significant)

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact sig. (2-sided)	Exact sig. (1-sided)
Pearson Chi-square	4.756[a]	1	0.029		
Continuity Correction[b]	4.002	1	0.045		
Likelihood Ratio	4.827	1	0.028		
Fisher's Exact Test				0.032	0.022
Linear-by-Linear Association	4.721	1	0.030		
Number of valid cases	135				

[a] 0 cells (.0%) have expected count less than 5. The minimum expected count is 22.04.
[b] Computed only for a 2×2 table

Table 2: Table depicting the association between gender type and the uses of brushing simulator (P-value = 0.013, which is statistically significant)

Chi-Square Tests		
Value	df	Asymptotic Significance (2-sided)
Pearson Chi-square	12.720[a]	4	0.013
Likelihood Ratio	13.225	4	0.010
Linear-by-Linear Association	5.176	1	0.023
Number of valid cases	135		

[a] 2 cells (20.0%) have expected count less than 5. The minimum expected count is 3.21.

Table 3: Table depicting the association between gender and type of simulator movement (P-value = 0.034, which is statistically significant)

Chi-Square Tests		
Value	df	Asymptotic Significance (2-sided)
Pearson Chi-square	10.394[a]	4	0.034
Likelihood Ratio	11.085	4	0.026
Linear-by-Linear Association	4.863	1	0.027
Number of valid cases	135		

[a] 2 cells (20.0%) have expected count less than 5. The minimum expected count is 3.67.

2019). 14.8% – effects of different kinds of movements, 11.9% say different kinds of toothbrush, 5.2%-effects of varying pressure, 45.2% say all the above and the remaining 3.7% choose the options none of above (Park *et al.*, 2018). Showed almost similar results with the study (Figure 7). 23.1% say that the tooth surface can be used as a substrate. Whereas 14.2% – restorative material as the substrate, 56.7% – the majority of the people say all the above and 6% choose the options none of the above this is most similar to Weignands research (Wiegand *et al.*, 2013) (Figure 8). 33.3% say that they have used a brushing simulator for a previous study and 66.7% of them have not used it previously (Figure 9). 25.2% have the idea of using it in the future and 43.7% have said no that they will not be using it in the future, 31.1% may have the idea of using it. Brushing force is usually higher for sonic toothbrush and with manual toothbrush dentin face the highest abrasion when compared to the enamel (Wiegand *et al.*, 2013) (Figure 10).

When comparing the awareness of brushing simulator with gender, it was shown that females had a higher level of awareness about the brushing simulator when compared with males (p= 0.029), which was statistically significant. (Table 1 and Figure 11). When comparing the knowledge about the uses of brushing simulator with gender, it was shown that
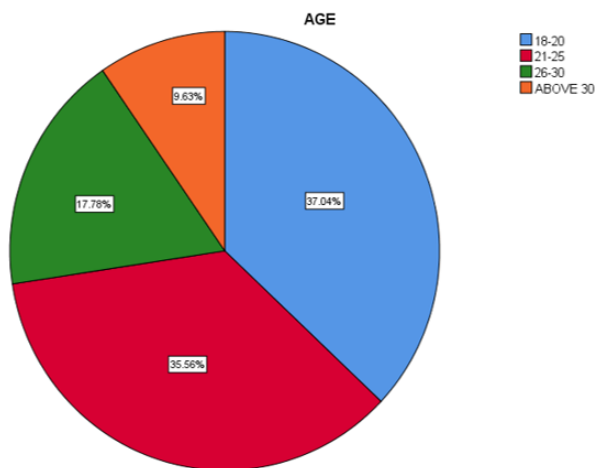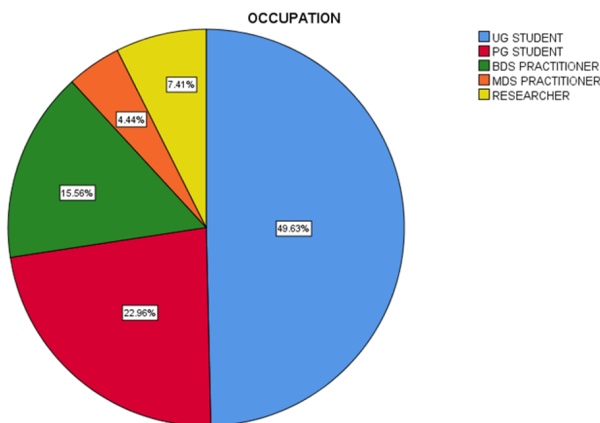
Figure 1: Response showing the age of the participants.

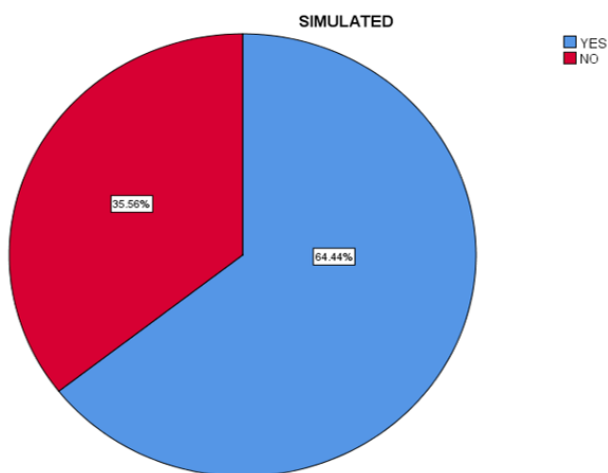**Figure 2: Showing response of occupation of the participants.**

Figure 3: Showing response to whether brushing can be simulated or not.
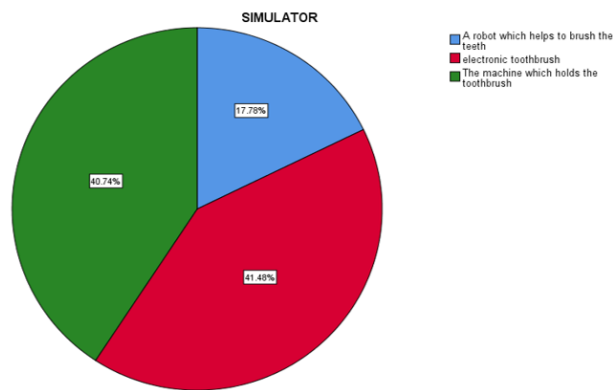

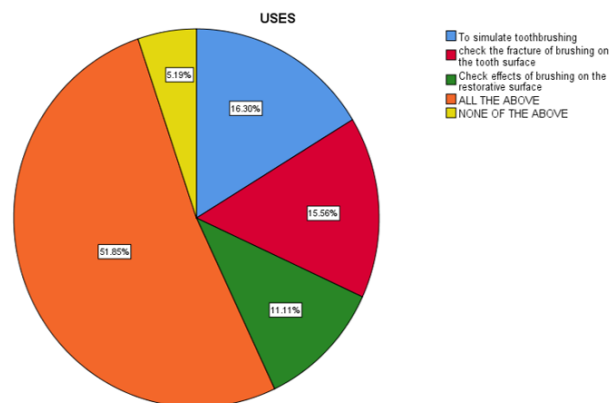**Figure 4: Showing response for what is a brushing simulator.**

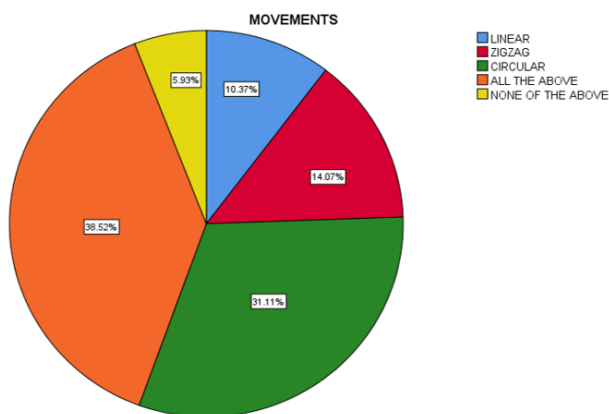**Figure 5: Showing response for the uses of brushing simulator.**

Figure 6: Showing response for the movements provided by this machine.

females had a higher level of knowledge about the uses of brushing simulator when compared with males. (p= 0.013), which was statistically significant. (Table 2 and Figure 12). When comparing the knowledge about the types of brushing simulator movements with gender, it was shown that females had a higher level of knowledge when compared with males.(p= 0.034), which was statistically significant. (Table 3 and Figure 13).
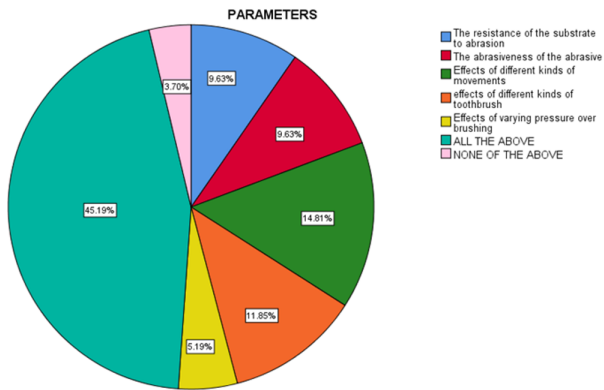
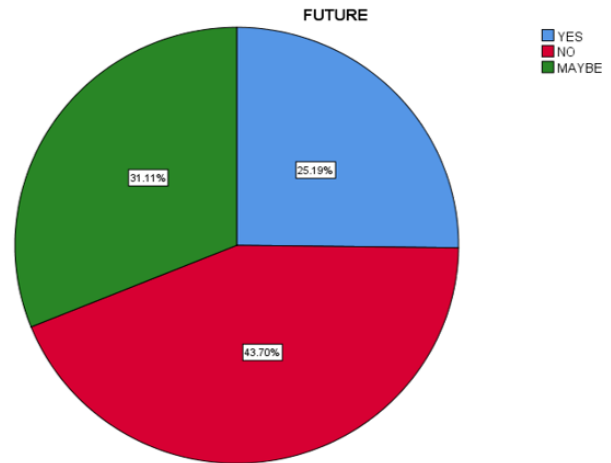**Figure 7: Showing response to the parameters which can be studied using a toothbrush simulator.**

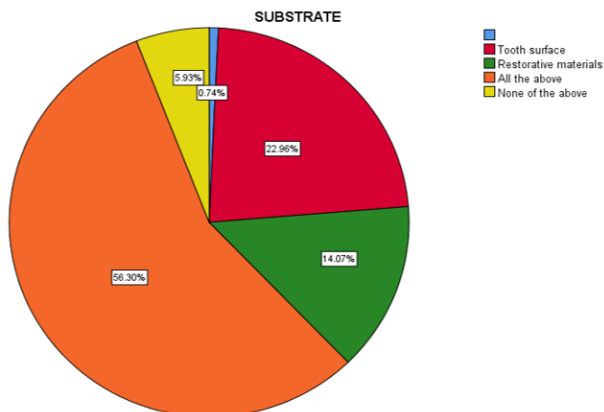**Figure 10: Showing response for the idea of using a brushing simulator in future.**

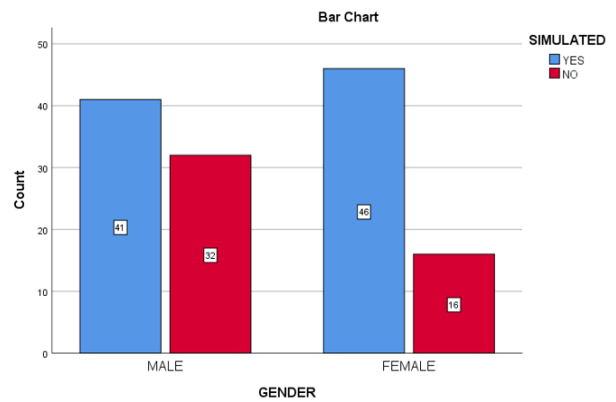**Figure 8: Showing response for what can be tested as substrates.**

Figure 11: Bar graph depicting the association between gender and awareness of brushing simulator.
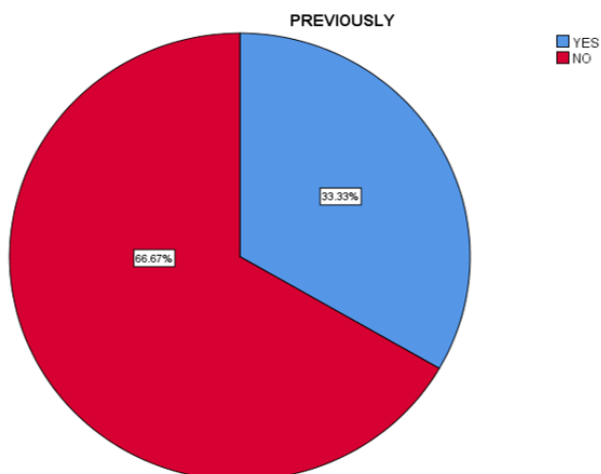

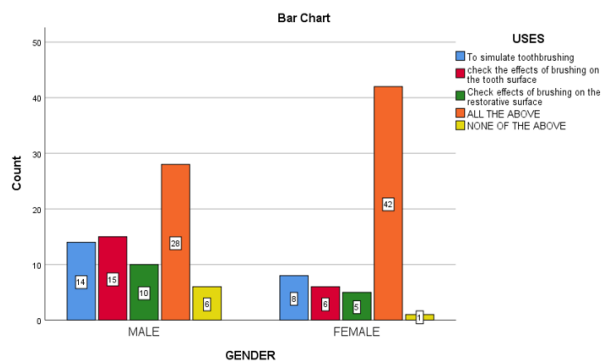**Figure 9: Showing response for the use of brushing simulator for any study previously?**

Figure 12: Bar graph depicting the association between gender type and the uses of brushing simulator.
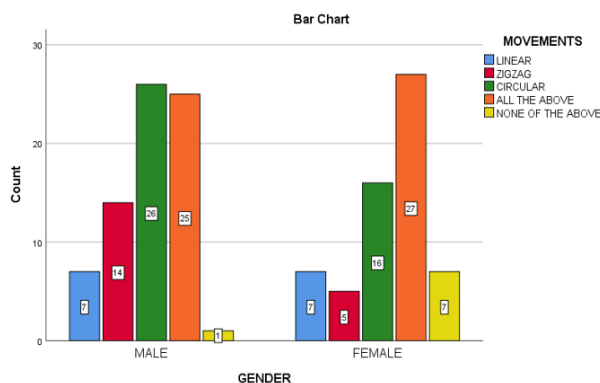
Figure 13: Bar graph depicting the association between gender and type of simulator movement.

Previously many surveys (Manohar and Sharma, 2018; Jose et al., 2020), reviews (Kumar and Antony, 2018; Rajakeerthi and Nivedhitha, 2019), in-vitro studies (Ramanathan and Solete, 2015; Rajendran et al., 2019; Janani et al., 2020), molecular and clinical studies (Nasim and Nandakumar, 2018; Ramamoorthi et al., 2015; Ramesh et al., 2018; Teja and Ramesh, 2019) were done by our team to get better knowledge and awareness in dentistry. Based on these, many kinds of research are being conducted and the present study is one of the first in literature to be done among chennai dentists. Finally, in the present study the people were asked what they wanted to study using a brushing simulator, different responses were received, some of them were like to check the effect of enamel, their assistance, the operation, and also to check the strength of restoration. The limitations of the present study is less sample size. Data presented in the study can be self-reported and also active involvement of participants is required. The scope is that it can be used in research and also in creating knowledge among the people.

In Figure 11, (X-axis represents gender and Y-axis represents no.of respondents; Chi-Square test done. P-value = 0.029, which is statistically significant). In Figure 12, (X-axis represents gender with response and the Y-axis represents no.of respondents; Chi-Square test done. P-value = 0.013, which is statistically significant). In Figure 13, (X-axis represents gender with response and Y-axis represents no.of respondents; Chi-Square test done. P-value = 0.034, which is statistically significant)

CONCLUSION

The findings in the study state that the majority of the people are aware of the simulation of brushing but the awareness and knowledge about the brushing simulator machine is quite less and people are mostly not aware of the uses, parameters, the movements, and other purposes of this machine. The people need to be educated about the brushing simulator as it is an important machine that helps in enhancing dentistry.

Conflict of interest

The authors declare that they have no conflict of interest for this study.

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