

Comparative plaque removal efficacy of new chewable toothbrush with Powered and Manual toothbrush in 4-6 Year Old Children: A Pilot study

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Abstract

Aims: To compare the effectiveness of chewable, powered and manual toothbrush for plaque removal in 4-6 year old children

Settings and Design: This pilot study was conducted in Zillah. Parishad School, Amarnagar, Nagpur, Maharashtra, India.

Methods and Material: 21 children of 4-6 years were randomly divided into 3 groups based on inclusion and exclusion criteria as: Group A- Chewable toothbrush,

Group B- Powered toothbrush, Group C- Manual toothbrush. Study was conducted in 3 visits. In each visit, children were instructed to brush their teeth with randomly assigned toothbrushes. Prebrushing and postbrushing plaque and OHI-S score were recorded after the application of disclosing agent in each visit.

Statistical analysis used: student's paired t test, one way ANOVA and Multiple comparison tukey test

Results: By using one way ANOVA test no significant difference was observed in PI score (0.388) and OHI-S score (0.942) in all the three groups no significant difference was observed in PI score (0.388) and OHI-S score (0.942) in all the three groups

Conclusions: CB was found to be as effective as manual and powered brush by significantly removing plaque. Thus CB can be used as an appropriate oral hygiene adjunct for children

Key-words: Chewable toothbrush, Manual toothbrush, Powered toothbrush, Plaque removal

Introduction:

Dental plaque is defined as the soft tenacious material found on tooth surfaces. The unhindered deposition of plaque occurs on all surfaces of the teeth and is recognizable clinically within 24 hours.¹ Tooth brushing has been reported as the most efficient method of plaque removal out of numerous chemical and mechanical methods of plaque control.²

Manual tooth brushing requires certain degree of manual dexterity, which varies among individuals and increases only with age.³ Since 1980s, powered toothbrushes have been rapidly developed to become an established alternative to manual tooth brushing. According to some reports- powered toothbrushes are better than manual ones in maintaining good oral hygiene⁴. Powered toothbrush operates by rotating, oscillating or vibrating motion which does not require any

action from individual other than to turn it on. The movements of manual toothbrush depend on action of individual. The determining factor lies more in method than on the type of toothbrush.⁵

The chewable toothbrush (CB) (Fuzzy brush, Fuzzy Brush Ltd, London, UK)- is disposable, all-in-one brush comprised of xylitol, flavouring aqua, and polydextrose.⁶ Many studies have been done to compare manual toothbrush to chewable or electric toothbrush, but to our knowledge no studies have been done till date comparing all three brushes in four- six year age group. So the aim of current study was to compare the effectiveness of chewable, powered and manual toothbrush for plaque removal in 4-6 year old children.

Materials and Method

Ethical Approval: All the procedures performed in the study involving human participants were in accordance with ethical standard of Institutional ethical committee of VSPM DCRC, Nagpur (Ref No. IEC/VSPMDCRC/43/2018)

Informed consent: Study was conducted in the Zillah Parishad School Amarnagar, Nagpur and prior permission was taken from school as well as their parents before conducting the study.

Participants: All the children of four- six year age group were screened and a total of 21 children were selected for the study based on inclusion and exclusion criteria.

Inclusion criteria: children willing to participate in study and children free from any systemic disease were included in the study.

Exclusion Criteria: Children with the history of intake of antibiotics for the last three months, children with oral soft-tissue lesions, having three or more carious lesions requiring treatment, with severe malocclusion or orthodontic appliances were excluded from study.

Methodology: Before commencement of the study the children were familiarized with the disclosing agent, chewable toothbrush, manual toothbrush as well as electric toothbrush with the help of live demonstrations. The disclosing agent was used to aid in identifying plaque. The children were instructed to refrain from brushing 24 hr prior to the first visit. All the visits were carried out between 9 am to 10:30 am. On first visit, participants were divided into three groups, consisting of seven members in each group. Randomization was carried out using lottery method.

3 groups were:

Group A: Chewable toothbrush

Group B: Powered toothbrush

Group C: Manual toothbrush

After randomization, the disclosing agent was applied to the tooth surfaces to aid in recording the supragingival Plaque and OHI-S score. Then the children were instructed to brush their teeth for two min with either randomly assigned manual, powered, chewable toothbrush. Premeasured quantity of dentifrice was used along with manual and powered toothbrush whereas no dentifrice was used with chewable brush as per manufactures recommendations. The children were instructed to chew the CB similar in the way they chew a chewing gum. To prevent the accidental ingestion of CB dental floss was tied to the CB Again after brushing disclosing agent was applied and plaque index (PI) and OHI-S score were calculated.

Children were then instructed to resume their normal oral hygiene routine and brush twice daily for two min in between the visits. Each visit was carried out after a period of one week and children were refrained from brushing for 24 hr prior to each visit. On second visit one of the children from each group was allowed to randomly select a chit amongst two given chits containing

toothbrush not previously tested. Brushing and scoring procedure as described above was repeated for each subject with the toothbrush allotted to each group on second visit. On third visit also brushing and scoring procedure as described above was repeated for each subject with the toothbrush not previously tested. All clinical examinations and scoring procedure were performed by same examiner blinded to type of toothbrush tested and previously recorded score.

Statistical analysis

Statistical analysis was done by using descriptive and inferential statistics using student's paired t test, one way ANOVA and Multiple comparison tukey test and software used in the analysis were SPSS 22.0 version and GraphPad Prism 7.0 version and $p < 0.05$ was considered as level of significance

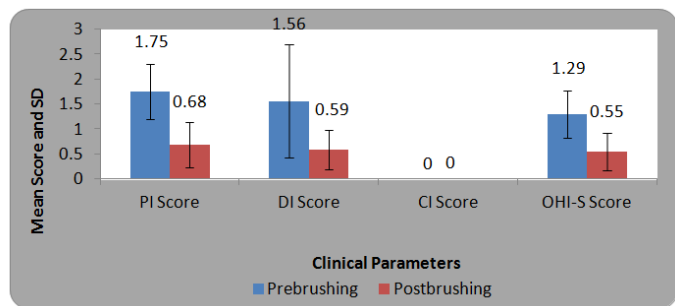
Results

In this single blinded cross over study 21 children were included (11-male and 9-female) with the mean age of 5.65 ± 0.56 (4-6 yrs).

Student's paired t test showed statistically significant difference in pre and post brushing PI and for OHI-S score of all the three groups ($p=0.0001$) (Table 1) & (Table 4) By using **one way ANOVA** statistically no significant variation was found in PI score ($p=0.388$) and OHI-S score ($p=0.942$) difference in three groups. (Table 2)

On comparing mean difference of PI score in three group no significant difference was found between chewable toothbrush and powered toothbrush ($p=0.653$), between chewable toothbrush and manual toothbrush ($p=0.879$) and between powered toothbrush and manual toothbrush ($p=0.365$) (Table 3) . Comparison of mean difference in OHI-S score in three groups showed no significant difference between chewable toothbrush and powered toothbrush ($p=0.997$), between chewable toothbrush and manual toothbrush ($p=0.942$), between

powered toothbrush and manual toothbrush (p=0.965).
(Table 5)



Graph 1: Comparison of clinical parameters in chewable toothbrush group pre and post operatively

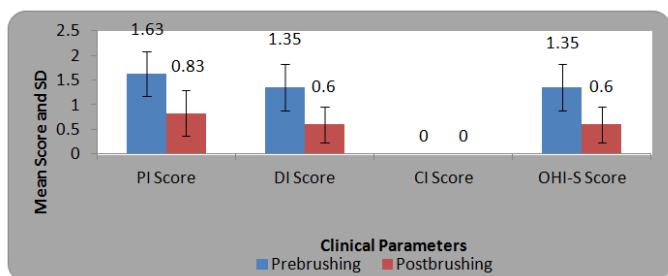


Table 1: Comparison of clinical parameters in chewable, powered and manual toothbrush group pre and post operatively Student's paired t test

Groups	Index	Prebrushing Score	Postbrushing Score	mean difference	t- value	p- value
Chewable toothbrush	PI	1.75±0.56	0.68±0.45	1.07±0.42	11.23	0.0001,S
	OHI-S	1.29±0.47	0.55±0.38	0.73±0.30	10.86	0.0001,S
Powered toothbrush	PI	1.63±0.45	0.83±0.46	0.79±0.36	9.72	0.0001,S
	OHI-S	1.35±0.47	0.60±0.36	0.74±0.42	7.89	0.0001,S
Manual toothbrush	PI	1.81±1.56	0.59±0.47	1.22±1.62	3.37	0.003,S
	OHI-S	1.29±0.53	0.51±0.44	0.77±0.47	7.25	0.0001,S

Table 2: Comparison of mean difference in PI score in three groups (One way ANOVA (PI score))

Source of variation	Sum of Squares	Df	Mean Square	F	p-value
Between Groups	1.90	2	0.951	0.962	0.388,NS
Within Groups	56.37	57	0.989		
Total	58.27	59			

Table 3: Multiple comparison: Tukey Test (PI score)

Group		Mean Difference (I-J)	Std. Error	p-value	95% Confidence Interval	
					Lower Bound	Upper Bound
Chewable Toothbrush	Powered Toothbrush	0.27	0.31	0.653,NS	-0.47	1.03
	Manual Toothbrush	-0.15	0.31	0.879,NS	-0.90	0.60
Powered Toothbrush	Manual Toothbrush	-0.43	0.31	0.365,NS	-1.18	0.32

Table 4: One way ANOVA (OHI-S Score)

Source of variation	Sum of Squares	Df	Mean Square	F	p-value
Between Groups	0.020	2	0.010	0.060	0.942, NS
Within Groups	9.493	57	0.167		
Total	9.513	59			

Table 5: Multiple Comparisons: Tukey Test (OHI-S)

Group		Mean Difference (I-J)	Std. Error	p-value	95% Confidence Interval	
					Lower Bound	Upper Bound
Chewable Toothbrush	Powered Toothbrush	-0.009	0.12	0.997 NS	-0.32	0.30
	Manual Toothbrush	-0.042	0.12	0.942 NS	-0.35	0.26
Powered Toothbrush	Manual Toothbrush	-0.033	0.12	0.965 NS	-0.34	0.27

Discussion

This randomized single blinded cross over study was conducted to assess the plaque removal efficacy of three different types of toothbrushes in four- six year old children. In this study oral hygiene status of children aged four-six years was assessed using OHI-S index and plaque Index. The children of year were selected as they lack manual dexterity which is an important factor required for effective hand brushing.³ To prevent the accidental ingestion of CB dental floss was tied to the CB and brushing procedure was carried out under supervision only. Both OHI- S and Plaque index were recorded for better accuracy in detecting the effectiveness of

toothbrush tested.⁷ Toothbrush effectiveness is typically tested following 24 hr (12- 48 h) of oral hygiene abstinence. This is because; the unhindered deposition of plaque occurs on all surfaces of the teeth and is recognizable clinically within 24 hours. Thus the participants in this study were refrained from brushing for 24 hr prior to each visit. Since the time of arrival and invention of electric toothbrush, there has been continuing controversy whether or not it is more efficacious than manual toothbrush. Some reports seems to indicate that powered toothbrush are better that manual ones in maintaining good oral hygiene. However, Crawford found no significant difference in plaque and gingival score

when electric and manual toothbrushes were compared 8. Effective Manual toothbrushing depends on various patient related factors such as use of proper toothbrush, toothpaste, adequate brushing technique and presence of proper motivation. Owing to the inability of children to brush their teeth properly due to decreased manual dexterity, the effectiveness of CB (Fuzzy brush), a recent innovation for plaque removal was investigated in the present study. In present study, prebrushing and postbrushing comparison of PI score and OHI-S score revealed that there was significant reduction in plaque score and oral hygiene status of children has been improved in all the three groups. On intergroup comparison statistical no significant difference was observed between CB and powered toothbrush between CB and powered toothbrush and between powered and manual toothbrush. In this study it was found that there was significant improvement in the oral hygiene status of the children after using chewable toothbrushes. This result was comparable to study done by Bezgan T et al. which showed significant reduction in the overall plaque scores, proposing chewable toothbrush to be an appropriate oral hygiene adjunct in the children⁶. Results were also found to correlate with study done by Myoken et al in elderly population⁷. Also Govindaraju et al reported that CB is an effective mode of plaque removal among children of six-nine years⁹. These findings suggest that chewable brush can be used as an effective alternative to the manual brushing in all kinds of population. It has been suggested that daily exposure to xylitol may be beneficial to child's dental health by reducing caries and assisting remineralization. 10- 11. Xylitol exhibits dental health benefits which are superior to other polyols in all areas where polyols have been shown to have an effect. In addition, xylitol's specific effects on oral flora and especially on certain strains of mutans streptococci add to

its caries-preventive profile and give it unique role in preventive strategies for dental health. The CB used in this study contained xylitol, thus it has added advantages of anticariogenic action on child's oral health.¹² Also there was significant reduction in plaque score of CB prebrushing and postbrushing which was comparable to manual and powered toothbrush, thus it can be suggested that CB may be used as an appropriate oral hygiene adjunct.

Conclusion

According to result obtained, the Chewable brush was found to be as effective as manual and powered brush by significantly removing plaque. Thus it can be suggested that CB be used as an appropriate oral hygiene adjunct for children.

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