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Original Research Article

Comparative evaluation of novel tooth brushing with reminder therapy with conventional brushing techniques in children

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ABSTRACT

Background: Dental caries and periodontal diseases are the most prevalent oral diseases in the children. Dental plaque is the main contributing agent for these oral diseases. Tooth brushing is considered to be one of the most efficient ways of maintaining the oral hygiene. Often, it is noted that certain areas of oral cavity and surfaces of the teeth are brushed more, while the other areas are neglected. With this background, we have designed a novel technique of tooth brushing with reminder therapy.
Methods: Oral examination of 180 children aged between 6-12 years was done and Oral Hygiene Index Simplified, Turesky-Gilmore-Glickman modification of Quigley-Hein Plaque Index, Modified Gingival Index were recorded. The children were randomly divided into three groups; Control group; Tooth brushing using Fones technique; Tooth brushing along with a reminder therapy (dantharaag: the tooth tune). Each group was taught their respective techniques and follow up was done at 15 and 45 days interval and all the indices were recorded. The data, thus collected was tabulated and subjected to analysis.
Results: The results showed a reduction in the scores of OHI-S, TMQH and MGI in all the three groups during follow up visits. However, this difference was statistically significantly between the groups where, Group 2 was better than Group 1 and Group 3 was better than Group 1 and 2 by 45 days.
Conclusions: In conclusion, Dantharaag: the tooth tune was readily accepted by children and showed better results in plaque reduction and oral hygiene improvement.

Keywords: Tooth brushing, Reminder therapy, Fones technique, Dantharaag, Paediatric patient, Oral hygiene index

INTRODUCTION

Dental caries and periodontal diseases are the most prevalent oral diseases in children. Dental plaque is the common causative agent for most of the oral diseases. Removing plaque from the tooth surface plays a significant role in preventing dental caries and other oral diseases. There are two ways of removing plaque i.e., chemical plaque control measures and physical plaque control measures. The chemical plaque control measures include use of chemical agents in removing and controlling the growth of the plaque whereas, in physical plaque control measures, the plaque is removed mechanically. Tooth brushing is a physical plaque control measure most commonly used worldwide.[1,2] Tooth brushing is considered to be one of the most effective ways of maintaining the oral hygiene. Effectiveness of

tooth brushing depends on the use of proper tooth brushing technique, which is often difficult in children. Oral hygiene practices are not performed up to the mark in most of the children because of various reasons leading to dental caries and other periodontal diseases. There are various brushing techniques specially designed for children which help them to perform proper tooth brushing.

The popular tooth brushing technique in children are horizontal scrub and Fones technique. Though these are regularly used by the children, they still lack in providing an 100% effective oral hygiene maintenance. Children who are above 5 years and are school going may not always get proper supervision or guidance for toothbrushing as parents do not always consider toothbrushing to be of great importance and so they leave children unattended during the same.[3] An essential element in a preventive dental program, for both the individual and the group, is a well-organized plaque control program.[4] Often, it is noted that certain areas of the oral cavity are brushed more while the other areas are neglected and this is one of the main reason for the occlusal and proximal caries in the primary dentition. A child's mind is mouldable and training a child's mind in proper tooth brushing can in turn improve their oral hygiene and their general health. With this background, we have designed a novel technique of tooth brushing with reminder therapy. This is a pilot study comparing a tooth brushing technique combined with reminder therapy with other standard techniques in paediatric dentistry.

METHODS

A randomized control clinical study was done on Devangha Sangha primary and high school children aged 6-12 years by conducting a school dental camp. A total of 180 study participants were selected from an educational institution and categorized into three groups depending on inclusion and exclusion criteria. The study was conducted from 4 January 2023 to 19 January 2023. The study was registered under the clinical trials registry-India.

Inclusion criteria

Inclusion criteria were; Subjects aged between 6-12 years, Subjects with no physical and systemic illness and Subjects willing to take part in the study.

Exclusion criteria

Exclusion criteria were; Medically compromised children and children with special care needs, Subjects undergoing any surgical treatment, Children below 6 years and above 12 years, Subjects who are not physically and mentally fit and Patients whose parents/guardian/head of institution did not agree for the inclusion of their ward in the study.

An informed consent was obtained from the parents/guardians and an assent form was obtained from patients before the commencement of the study. The study participants were selected from a public school in Bengaluru. The study included 180 participants who were regular to their classes. The study began with the oral examination of the participants, a disclosing agent Alpha Plac® was used to disclose the plaque and Oral Hygiene Index Simplified (OHI-S), Turesky-Gilmore-Glickman modification of Quigley-Hein Plaque Index (TMQH), Modified Gingival Index (MGI) were recorded. The participants were randomly divided into three groups of 60 each, Group 1: Control group, Group 2: Tooth brushing using Fones technique, Group 3: Tooth brushing along with a reminder therapy (Dantharaag: The tooth tune). The above groups were further subdivided into two groups of 30 each depending on the age; Subgroup 1: children aged between 6-9 years, Subgroup 2: children aged between 10-12 years.

A standard toothpaste and tooth brush was distributed among the participants after recording the indices. Group 1 participants were asked to perform brushing in the same way and were reinforced to brush twice daily with the tooth paste and tooth brush provided to them. No new technique of tooth brushing was taught to them. Group 2 participants were shown a video of tooth brushing using the Fones technique and the same was demonstrated live on a model. Group 3 participants were shown the video of our technique, "Dantharaag- The Tooth Tune", where children were taught to brush starting from the buccal surface of the right posterior region continuing to the anteriors and the left posterior region in circular motion. They were also instructed to brush on the occlusal surface in back-and-forth motion. The bristles are held at 70 -90^{o} to the long axis of the tooth while brushing on the buccal surface and perpendicular to the long axis of the tooth when brushing on the occlusal surface. The participants were instructed to brush the lingual surface starting from the right posterior region, then the anteriors continuing to the left posterior region, where they were asked to brush the posterior regions in circular motion and the anteriors with in and out motion. The participants were taught the phrase, "on the tooth in the spaces", and were asked to recite the phrase while brushing their teeth. The same was also demonstrated live on a model to reinforce the technique in these children.

Follow up was done at 15 days and 45 days and the brushing technique of the respective groups were reinforced at the time of follow up. The data collected was tabulated and subjected to statistical analyses using SPSS statistical software package Version 22.0. Friedman's test followed by Wilcoxon's post hoc test was used to compare the mean OHIs, modified PI & GI scores between 3 study groups at baseline, 15 days and 45 days. Kruskal Wallis test followed by Dunn's post hoc test was used to compare the mean OHIs, modified PI & GI scores between different time intervals in each study group. The level of significance was set at $p<0.05$.

RESULTS

The present study was conducted on 180 school children out of which 108 were boys and 72 girls. Comparison was done between the Oral Hygiene Index-Simplified, Turesky-Gilmore-Glickman modification of Quigley-Hein Plaque Index, Modified Gingival Index at baseline, 15 days and 45 days follow up and the results were analysed. The mean age of the participants in Group 1 was 9.35, and in Group 2 and Group 3 was 9.83 (Table 1). The study result showed that, at baseline the mean score of OHIS, Modified Plaque index and Modified Gingival index were not statistically significant (Table 2).

Table 1: Mean age and gender distribution among different study groups.

Variables	Category	Group 1		Group 2		Group 3		P value
		Mean	SD	Mean	SD	Mean	SD	
Age	Mean	9.35	1.99	9.83	1.90	9.83	1.78	0.61[a]
	Range	06-12		06-12		06-12		
Gender	Males	N	%	N	%	N	%	0.65[b]
		14	60.9	13	56.5	16	69.6	
	Females	9	39.1	10	43.5	7	30.4	

Table 2: Comparison of mean values of different indices b/w 3 groups at baseline period using Kruskal Wallis test.

Indices	Groups	N	Mean	SD	Min	Max	P value
OHIs	Group 1	23	1.793	0.619	1.00	2.82	0.11
	Group 2	23	1.427	0.635	0.33	3.10	
	Group 3	23	1.479	0.917	0.00	3.40	
MPI	Group 1	23	2.224	0.794	0.71	3.50	0.13
	Group 2	23	2.592	1.066	0.71	4.00	
	Group 3	23	2.095	0.802	1.25	4.60	
MGI	Group 1	23	0.487	0.638	0.00	1.64	0.58
	Group 2	23	0.235	0.398	0.00	1.00	
	Group 3	23	0.537	0.532	0.00	1.50	

Table 3: Comparison of mean values of different indices b/w 3 groups at 15 days period using Kruskal Wallis test followed by Dunn's post hoc test.

Indices	Groups	N	Mean	SD	P value[a]	Sig. Diff	P value[b]
OHIs	Group 1	23	1.534	0.674	0.003*	1 vs 2	0.04*
	Group 2	23	1.210	0.675		1 vs 3	0.003*
	Group 3	23	0.912	0.611		2 vs 3	0.51
MPI	Group 1	23	1.665	0.795	<0.001*	1 vs 2	0.02*
	Group 2	23	1.190	0.413		1 vs 3	<0.001*
	Group 3	23	0.864	0.479		2 vs 3	0.15
MGI	Group 1	23	0.579	0.567	0.01*	1 vs 2	0.04*
	Group 2	23	0.265	0.359		1 vs 3	0.02*
	Group 3	23	0.217	0.327		2 vs 3	0.92

*Statistically Significant; [a]Kruskal Wallis Test & [b]Dunn's Post hoc Test

During the 15 days follow up, statistically significant reduction in the mean score of OHI-S, TMQH, MGI was noted. This difference was better in Group 2 compared to Group 1 and the difference was statistically significant. The difference in mean scores of the indices were better in Group 3 compared to Group 2 and Group 1 but it was statistically significant only between Group 3 and Group 1 (Table 3).

There was statistically significant reduction in mean score of all the indices noted at 45 days follow up as well. Group 2 and Group 3 showed better results compared to Group 1 which was statistically significant. Even though, Group 3 showed better results than Group 2 it was not statistically significant (Table 4).

Thus, the baseline score of all three indices of the three groups were comparable but were not statistically significant. The mean score of OHI-S index, Modified Plaque index and Modified Gingival index reduced in all the three group in the two follow ups showed statistically significant difference and Group 3 showed the highest reduction in the score of all indices when compared to the other two groups.

Table 4: Comparison of mean values of diff. Indices b/w 3 groups at 45 days period using Kruskal Wallis test followed by Dunn's post hoc test.

Indices	Groups	N	Mean	SD	P value[a]	Sig. Diff	P value[b]
OHIs	Group 1	23	1.452	0.601	<0.001*	1 vs. 2	0.02*
	Group 2	23	1.017	0.760		1 vs. 3	<0.001*
	Group 3	23	0.490	0.450		2 vs. 3	0.03*
MPI	Group 1	23	1.595	0.743	<0.001*	1 vs. 2	0.02*
	Group 2	23	1.119	0.557		1 vs. 3	<0.001*
	Group 3	23	0.406	0.294		2 vs. 3	<0.001*
MGI	Group 1	23	0.547	0.547	<0.001*	1 vs. 2	0.005*
	Group 2	23	0.196	0.267		1 vs. 3	<0.001*
	Group 3	23	0.086	0.164		2 vs. 3	0.56

*Statistically Significant; [a]Kruskal Wallis Test & [b]Dunn's Post hoc Test

DISCUSSION

The present study was conducted on 180 school children out of which 108 were boys and 72 girls. Comparison was done between the Oral Hygiene Index-Simplified, Turesky-Gilmore-Glickman modification of Quigley-Hein Plaque Index, Modified Gingival Index at baseline, 15 days and 45 days follow up and the results were analysed. The mean age of the participants in Group 1 was 9.35, and in Group 2 and Group 3 was 9.83 (Table 1). The study result showed that, at baseline the mean score of OHIS, Modified Plaque index and Modified Gingival index were not statistically significant (Table 2).

During the 15 days follow up, statistically significant reduction in the mean score of OHI-S, TMQH, MGI was noted. This difference was better in Group 2 compared to Group 1 and the difference was statistically significant. The difference in mean scores of the indices were better in Group 3 compared to Group 2 and Group 1 but it was statistically significant only between Group 3 and Group 1 (Table 3). There was statistically significant reduction in mean score of all the indices noted at 45 days follow up as well. Group 2 and Group 3 showed better results compared to Group 1 which was statistically significant. Even though, Group 3 showed better results than Group 2 it was not statistically significant (Table 4). Thus, the baseline score of all three indices of the three groups were comparable but were not statistically significant. The mean score of OHI-S index, Modified Plaque index and Modified Gingival index reduced in all the three group in the two follow ups showed statistically significant difference and Group 3 showed the highest reduction in the score of all indices when compared to the other two groups.

In the present study, we aimed at evaluating the efficacy of tooth brushing with reminder therapy compared to the other tooth brushing technique in children. The means of tooth brushing, i.e., the tooth paste and tooth brush were same in all the groups. In the present study, similar scores of the indices were observed at baseline and this difference was significant only after the intervention during follow-up periods. Children most often do not brush in the recommended manner and miss a few areas in the oral cavity like the proximal areas and the occlusal surfaces. A study by Ilyas et al found that people usually do not brush the lingual and interdental surfaces as they are considered to be hidden spots and difficult to approach.[5] Thus, this study planned on implementing a reminder therapy when the child is brushing, asking them to concentrate on the tooth and in the spaces between the teeth with help of a jingle. "dantharaag-the tooth tune" was taught to children where, they were asked and stressed/ reinforced on brushing in the spaces between the teeth and on the tooth surface by teaching them a jingle "on the tooth, in the spaces". In the present study, children between the age of 6-12 years were included as these age groups are expected to have the manual dexterity required for tooth brushing and more often perform toothbrushing independently. This age selection criteria is in accordance to Unkel et al who suggested that manual tooth brushing skills are learned after four to five years.[6] Mentes et al evaluated the tooth brushing skills in 75 children aged 3-11 years in a private dental clinic in Istanbul and concluded that there is higher efficiency of tooth brushing in the age group 9-11 years.[7] Tooth brushing skills and the required manual dexterity for tooth brushing are developed in children aged eight years and above.[8-11]

In the present study, along with a video demonstration, all the brushing techniques were also demonstrated on a model, this was in accordance with a study done by Nikhil et al suggesting that individual cast instructions are more effective than audio visual instruction.[8] The current study which shows reduced plaque in Group 2 (Fones technique) and Group 3 (dantharaag: the tooth tune). The observation is similar to a 6 week follow up study, conducted by Harnacke et al concluded that Fones technique of tooth brushing has a superior plaque removal efficacy compared to the other groups.[9] Chirshantha et al found that both Fones method and modified Bass method were very useful in improving oral hygiene.[10] However, the present study showed that when brushing technique is combined along with reminder therapy, the results are remarkable. This is probably due to the fact that the children are already very well accustomed to reciting rhymes or songs and using this as

reminder was very efficient in implementing proper brushing technique as per our results. This technique (dantharaag: the tooth tune) is performed best among children for plaque reduction and in improving the gingival health of the child.

Implications

Tooth brushing with reminder therapy was most effective compared to the traditional tooth brushing techniques in reducing the plaque. The children readily accepted the new technique as they were accustomed to reciting rhymes and the jingle acted as a reminder, helping the children not to miss a spot during brushing.

Limitations

The present study was conducted for a short duration of 45 days and evaluated only for the plaque and the gingival status of the oral cavity. Further, long term studies can be conducted to evaluate the efficacy of the novel tooth brushing technique in prevention of dental caries.

CONCLUSION

In conclusion, Dantharaag- The tooth tune was readily accepted by children and showed a significant result by reducing plaque and improving the oral hygiene in children. Brushing technique when coupled with a reminder therapy, can be a game changer in improving oral hygiene of the child. This new technique "dantharaag-the tooth tune" can be easily implemented in children for the greater effectiveness of tooth brushing in children.

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