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Efficacy of Rolly Brush and Pro-Expert Oral B Toothbrush for Dental Plaque Removal in Children

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Abstract: *Background and Objectives: Toothbrushing is the most commonly used, most-effective and safest method of plaque removal. But, regular toothbrushing may not be feasible under some circumstances. This study aimed to compare the efficacy of Rolly brush and Pro-Expert Oral B toothbrush for plaque removal in 8 to 12-year-olds. Materials and Methods: Twenty children between 8 to 12 years who met the inclusion criteria were enrolled in this cross-over study. Scaling and root planing were performed in the first session, and the baseline plaque index (PI) was recorded 24 hours later (no oral hygiene during 24 hours) using Turesky modification of Quigley-Hein index and Tepe solution. Next, 10 children were provided with chewable Rolly brush while the remaining 10 were provided with a manual toothbrush and toothpaste (Pro-Export Oral-B) and were instructed to brush their teeth using the modified Stillman technique. The PI was then measured again. After a two-week wash-out period, the PI was decreased to zero and the group assignments were switched. The PI was then measured again. Data were analyzed using the Mann-Whitney U test and Fisher's Exact test. Results: The overall mean PI in the Rolly brush group was significantly higher than that in Oral-B toothbrush group (P=0.001). The difference in PI of the anterior maxilla was not significant between the two groups (P=0.188). The mean PI of the posterior region was significantly higher in Rolly brush group (P=0.0001). Conclusion: The Rolly brush can be used as an aid for oral hygiene but cannot replace manual toothbrushing.*

Keywords: *Dental Plaque, Chewable Rolly Brush, Turesky modification of Quigley-Hein index*

INTRODUCTION

Dental caries is an oral health problem worldwide and remains the most common infectious disease in children. Removal of supragingival plaque is an important measure for oral health promotion and has the greatest effect on prevention of caries, gingivitis and periodontitis (Selwitz et al., 2007). Toothbrushing is the most commonly used physical method of plaque removal. Several types of toothbrushes are available in the market (Rosing et al., 2016). Evidence shows that irregular toothbrushing is associated with endothelial dysfunction and increased thickness of the carotid artery. Moreover, daily toothbrushing decreases the risk of type 2 diabetes mellitus, hypertension and dyslipidemia (Jeong et al., 2017). Correct technique of toothbrushing and patient compliance are important factors regarding efficient toothbrushing.

Effective manual toothbrushing requires some hand skills, which vary among different individuals and decrease by aging (Rosing et al., 2016). Under some circumstances such as no access to water or toothpaste or hospitalization, oral hygiene may be compromised. The children and the elderly do not often have adequate motivation and skills required for efficient toothbrushing (Kuwabara et al., 2016). Thus, chewable toothbrushes were introduced to the market for easier oral hygiene practice. Evidence shows that chewable toothbrushes are effective for dental plaque removal in the elderly, school children and the disabled individuals. However, the efficacy of chewable toothbrushes in children with high risk of active caries is in need of further investigation (GovinDaraju et al., 2017). A new generation of chewable toothbrushes were recently introduced to the market, which are made of soft polyamide. They can be used in situations where toothpaste and water are not available. They are small toothbrushes that should not be swallowed and contain different essences such as mint. They contain at least one type of flexible material and high number of bristles (Kuwabara et al., 2016). Chewable toothbrushes increase the saliva flow and consequently lead to enamel remineralization. Due to small size, they can access and clean the interproximal surfaces as well as other hard to reach areas. They massage the gingiva and promote gingival health as well. However, they are contraindicated for use in children ≤7 years (Kuwabara et al., 2016).

Search of the literature by the authors revealed no previous study on the efficacy of chewable toothbrushes conducted in Iran. Thus, this clinical study aimed to assess the efficacy of plaque removal by Rolly brush, a new generation of chewable toothbrushes, in comparison with Pro-Expert Oral-B toothbrush in 8 to 12-year-olds.

Materials and Methods

This cross-over single-blind study was performed on 20 children between 8 to 12 years presenting to the Pediatric Dentistry Department of our university. Sample size was calculated to be 20 in each group according to previous studies (GovinDaraju et al., 2017; Montevecchi et al., 2015; Nightingale et al., 2014). Participants were selected using convenience sampling.

The inclusion criteria were good oral hygiene and presence of a minimum of 20 teeth in their mouth with minimal crowding (<5 mm). The exclusion criteria were chronic use of antibiotics, chronic oral lesions, having fixed orthodontic appliances, advanced periodontal disease and having more than 4 unrestored severe carious lesions (GovinDaraju et al., 2017; Nightingale et al., 2014; About Rollybrush, 2015). Patients were thoroughly informed about the study and written informed consent was obtained from them. In the first treatment session, all patients underwent scaling and root planing as well as dental prophylaxis to decrease the plaque index (PI) to zero. The patients were then randomly divided into two groups of Rolly brush (group A) and regular tooth brush (Pro-Expert Oral-B) control group (group B). The participants were then requested to refrain from toothbrushing and dental flossing (or any other measure for mechanical plaque removal) for 24 hours. On the second session 24 hours later, the examiner measured the primary PI with the Turesky modification of Quigley-Hein index using Tepe disclosing solution (T epeMunhygienprodukter) (Montevecchi et al., 2015). The scoring system of Turesky modification of Quigley-Hein index is as follows:

0: Absence of dental plaque
1: Isolated areas of dental plaque at the gingival margin
2: A thin band of dental plaque at the gingival margin with ≤1 mm width
3: Dental plaque covering one-third of the tooth surface
4: Dental plaque covering one-third to two-thirds of the tooth surface
5: Dental plaque covering two-thirds or more than two-thirds of the tooth surface

The buccal and lingual dental surfaces were scored from 0 to 5 in three segments of mesial, middle and distal. The sum of all values was then divided by the number of surfaces.

Patients in group A were provided with Rolly brush and were instructed to chew it for 2 to 3 minutes and guide it to contact all dental surfaces with rotational movements of the tongue without biting on it (Kuwabara et al., 2016). The remaining 10 patients (group B) were provided with Pro-Expert Oral-B (stage B) toothbrush and Pro-Expert Oral B toothpaste and they were requested to conventionally brush their teeth with modified Stillman technique, which is a combination of vibration and stroke by bristles along the longitudinal axis of the tooth (in order not to damage the teeth) (Garcia et al., 2001). The PI in the two groups was assessed by the same examiner using the Turesky modification of Quigley-Hein index (GovinDaraju et al., 2017; Montevecchi et al., 2015; Myoken et al., 2005). The examiner was blinded to the group allocation of patients. The third session was scheduled after two weeks and scaling and root planing as well as dental prophylaxis were performed as in the first session to decrease the PI to zero. During the two-week wash-out period, patients resumed their old method of oral hygiene (GovinDaraju et al., 2017; Montevecchi et al., 2015; Mazza et al., 2014). In the second phase of this cross-over study (fourth session, which was scheduled 24 hours after the third session), the group assignments were switched and the 10 patients in group A were provided with Pro-Expert Oral-B (stage 4) toothbrush and toothpaste while the remaining 10 patients in group B were provided with Rolly brush. PI was measured again as explained earlier (GovinDaraju et al., 2017; Montevecchi et al., 2015).

Data were analyzed using the Mann Whitney U test and Fisher's exact test. Statistical analyses were carried out using SPSS version 24 (SPSS Inc., IL, USA) and $P<0.05$ was considered statistically significant.

Results

A total of 20 children including 15 males (75%) and 5 females (25%) between 8 to 12 years of age were evaluated in this study. The mean age of patients was 8.77±1.24 years. In this study, 13 children (65%) did not have crowding while 7 children (35%) had crowding (<5 mm).

The PI was the same in the two groups at baseline with no significant difference ($P<0.05$). No significant difference was noted between the first and second phase either in this respect ($P>0.05$, Table 1).

Table 1: Baseline plaque index in 8 to 12 year olds

Baseline plaque			Mean	Standard deviation	Normality test		Comparison
					Statistic	P value	P value
First phase	Maxillary anterior teeth	R-O	3.8060	.2642	.934	.487	U=-1.55 P=0.121
		O-R	4.0290	.3249	.813	.021*	
	Mandibular anterior teeth	R-O	3.8030	.5065	.953	.701	t=-0.872 P=0.395
		O-R	3.9860	.4288	.884	.143	
	Maxillary posterior teeth	R-O	3.8770	.5072	.941	.567	U=-0.983 P=0.326
		O-R	3.6910	.4042	.829	.032*	
	Mandibular posterior teeth	R-O	3.8560	.4922	.876	.117	t=0.217 P=0.831
		O-R	3.8110	.4329	.926	.410	
	Maxillary teeth	R-O	3.8415	.3290	.891	.175	t=-0.242 P=0.812
		O-R	3.8738	.2636	.907	.259	
	Mandibular teeth	R-O	3.8247	.3700	.911	.285	U=-0.907 P=0.364
		O-R	3.9122	.3016	.816	.023*	
	Entire mouth	R-O	3.8373	.3211	.224	.167	t=-.273 P=0.788
		O-R	3.8716	.2348	.195	.200	
Second phase	Maxillary anterior teeth	R-O	3.7670	.1877	.281	.025*	U=-1.404 P=0.160
		O-R	3.9220	.2641	.373	.000*	
	Mandibular anterior teeth	R-O	3.8480	.4470	.299	.012*	U=-0.531 P=0.595
		O-R	3.9550	.3940	.273	.033*	
	Maxillary posterior teeth	R-O	3.8200	.5200	.221	.183	t=.943 P=0.363
		O-R	3.6500	.2335	.250	.076	
	Mandibular posterior teeth	R-O	3.7460	.4641	.236	.120	t=-0.195 P=0.848
		O-R	3.7850	.4317	.167	.200	

	Maxillary teeth	R-O	3.7959	.3157	.229	.147	t=.043
		O-R	3.7912	.1552	.257	.060	P=0.967
	Mandibular teeth	R-O	3.8011	.3334	.293	.015*	U=-1.36
		O-R	3.8825	.2798	.319	.005*	P=0.173
	Entire mouth	R-O	3.7948	.2954	.297	.013*	U=-.151
		O-R	3.8157	.1664	.284	.022*	P=0.880

Table 1 shows the mean PI at baseline and Table 2 presents the mean PI in Rolly brush and Pro-Expert Oral B groups after the interventions. As shown, the mean PI of the maxillary anterior teeth in Rolly brush group was higher than that in Pro-Expert Oral B group but this difference was not statistically significant (P=0.188). The mean PI of mandibular anterior teeth in Rolly brush group was significantly higher than that in Pro-Expert Oral B group (P=0.004). The mean PI of maxillary posterior teeth in Rolly brush group was significantly higher than that in Pro-Expert Oral B group (P=0.029). The mean PI of mandibular posterior teeth was also significantly higher in Rolly brush group compared to Pro-Expert Oral B group (P=0.0001).

The overall PI of maxillary teeth in Rolly brush group was significantly higher than that in Pro-Expert Oral B group (P=0.048). The overall PI of mandibular teeth in Rolly brush group was significantly greater than that of Pro-Expert Oral B group as well (P=0.0001).

The overall PI of the entire mouth in Rolly brush group was also higher than that in Pro-Expert Oral B group (P=0.001, Table 2).

Table 2: Plaque index after the intervention in the two groups

Group		Minimum	Maximum	Mean	Standard deviation	Change		P value
						Difference	Percentage	
Maxillary anterior teeth	Rolly brush	2.160	4.320	3.348	.482	0.186	5.88%	t=1.366 P-Value=0.188
	Oral-B	2.000	4.080	3.162	.471			
Mandibular anterior teeth	Rolly brush	1.690	4.200	3.403	.608	0.292	9.39%	t=3.301 P-Value=0.004**
	Oral-B	2.000	4.140	3.111	.536			
Maxillary posterior teeth	Rolly brush	1.500	4.370	3.339	.598	0.238	7.67%	t=2.368 P-Value=0.029*
	Oral-B	2.560	3.980	3.101	.362			
Mandibular posterior teeth	Rolly brush	2.500	3.990	3.402	.444	0.322	10.45%	t=6.745 P-Value=0.0001**
	Oral-B	1.920	4.100	3.080	.484			
Maxillary teeth	Rolly brush	1.830	4.142	3.346	.480	0.226	7.24%	t=2.116 P-Value=0.048*
	Oral-B	2.456	3.540	3.120	.304			
Mandibular teeth	Rolly brush	2.126	3.845	3.409	.404	0.313	10.11%	u=-3.77 P-Value=0.0001**
	Oral-B	2.248	3.542	3.096	.356			
Entire mouth	Rolly brush	1.984	3.996	3.372	.411	0.267	8.60%	t=3.97 P-Value=0.001**
	Oral-B	2.453	3.528	3.105	.271			

Discussion

This study assessed the efficacy of plaque removal by a regular toothbrush and toothpaste compared to a chewable Rolly brush in 20 children between 8 to 12 years of age. Reduction in dental plaque on buccal and lingual surfaces of the teeth was evaluated using the Turesky modification of Quigley-Hein index. The results showed that the mean PI in the maxillary anterior teeth was not significantly different in the two groups. The greatest difference was noted in PI of mandibular posterior teeth, where Oral-B toothbrush showed significantly higher efficacy. In other areas, the efficacy of Oral-B toothbrush for plaque removal was significantly higher than that of Rolly brush as well. The difference in PI of the mandible between the two groups was greater than that in the maxilla. Thus, the Rolly brush can be used as an adjunct for oral health but cannot replace manual tooth brushing.

Myoken et al. (2005) performed a similar study on an elderly population and showed that chewable Rolly brush can remove considerable amounts of dental plaque. In another study, Bezgin et al. (2015) stated that chewable toothbrushes are effective aids for oral hygiene in schoolchildren and the disabled individuals. Jeong et al. (2017) compared chewable and regular toothbrushes in terms of their efficacy for dental plaque removal. They showed that regular toothbrushes are more effective than chewable types in plaque removal. In non-rolling technique of toothbrushing, no significant difference has been noted between the two types of toothbrushes. Thus, chewable toothbrushes can be used by individuals who have difficulty in performing the rolling toothbrushing technique as an alternative to regular toothbrush (Jeong et al., 2017). Saha et al. (2012) evaluated the efficacy of traditional chewing sticks or Miswak and concluded that the gingival index in patients using Miswak was lower than that in patients using regular toothbrush and toothpaste. The lowest PI was noted in group using both Miswak and regular toothbrush and toothpaste. Spivakovsky et al. (2006) evaluated the efficacy of dental plaque removal by Rolly brush and showed that its plaque removal efficacy was superior to that of mouthwashes and chewing gums but it was not superior to regular toothbrush. They concluded that Rolly brush is a suitable oral hygiene aid for use in-between meals.

In contrast to our findings, some studies reported similar efficacy of Rolly brush and regular toothbrush and stated that it can be used as an alternative to conventional toothbrush. GovinDaraju and Gurunathan (2017) assessed the efficacy of chewable toothbrushes and reported that they caused a significant reduction in debris index, oral hygiene index, plaque index, saliva pH and level of Streptococcus mutans but the calculus index remained the same. They concluded that chewable toothbrush is an effective alternative to conventional toothbrush.

One limitation of this study was the Hawthorne effect, which is defined as the alteration of behavior of patients due to their awareness of being observed (GovinDaraju et al., 2017). Malik et al. (2014) revealed that chewing sticks had similar or even superior efficacy to the conventional toothbrush for dental plaque reduction and showed superior chemical and mechanical cleaning efficacy.

Studies comparing these two types of toothbrushes are limited and clinical evidence regarding the superiority of oral hygiene aids such as chewing sticks and Rolly brush is lacking. Moreover, the available studies on this topic have been conducted in developing countries with limited resources and oral health care services. Thus, they have limited generalizability to the general population of the world.

Cross-over design was the main strength of our study and all patients used both types of toothbrushes. Allocation of intervention to patients was random. The baseline PI was decreased to zero and then the secondary PI was measured. The two groups were matched in terms of PI at baseline. The wash-out period in our study was 14 days, which was similar to that in many previous studies (Arici et al., 2007).

PI was evaluated using the Turesky modification of Quigley-Hein index, which is widely used for assessment of plaque index and is more accurate than other indices (Sripriya et al., 2007). This index is more accurate, more applicable and easier to use in children compared to other indices (Nightingale et al., 2014; Bezgin et al., 2015; Sripriya et al., 2007; Kurtz et al., 2016).

Small sample size and scheduling the second treatment session after 24 hours were among the limitations of this study. Some previous studies allowed 48 hours before the second session in order to allow formation of a thick layer of solid plaque with 30 to 50 μ thickness on all dental surfaces. Some previous studies also measured the plaque thickness using the Silness-Loe index and qualitatively evaluated the plaque as well (Rosing et al., 2016). However, this index is highly time consuming and difficult to perform in children but is valuable to use in studies on adults along with the Turesky modification of Quigley-Hein index. Similar future studies are required on a larger sample size with a wider age range. The efficacy of newer generations of chewable toothbrushes needs to be investigated as well.

Conclusion

Within the limitations of this study, the results showed superior efficacy of Oral-B toothbrush for removal of dental plaque. However, the difference between Oral-B and Rolly brush was not significant in the anterior maxilla. The greatest difference between the two toothbrushes was noted in the posterior mandible. The difference in the efficacy of the two toothbrushes was greater in the mandible compared to the maxilla.

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