

<https://doi.org/10.48047/AFJBS.6.6.2024.6758-6764>



### **Comprehensive Assessment of Abrasive Potential of Three Commonly Utilized Pediatric Toothpastes on New Millennium Crowns: An (In Vivo) Original Research Study**

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## Article History

Volume:6,Issue6,2024

Received:28 April 2024

Accepted:19 may 2024

doi:10.48047/AFJBS.6.6.

2024.6758-6764

**Abstract**

**Background and Aim:** Abrasion on the crown is commonly seen with usage of toothpastes since many of them contain active abrasive components. The exclusive aim of this in-vivo study was to assess the abrasive potential of three commonly utilized pediatric toothpastes on new millennium crowns used in pediatric dentistry.

**Materials & Methods:** Both male and female pediatric patients were included in this study in the range of 9-12 years. Total thirty teeth were selected for study in which New Millennium Crowns were placed. Three commonly used popular toothpastes were chosen for study. First study group (Group 1) included 10 patients in which Kidodent Bubble Fruit Flavour Kids Toothpaste were used. Group 2 included 10 patients in which Baby Organo Herbal Kids Toothpaste Strawberry was used. Group 3 included 10 patients in which Himalaya Kids Bubble Gum Toothpaste was used. The extent of abrasion was measured by Non Contacting Laser Profilometry. P value less than 0.05 was considered significant ( $p < 0.05$ ).

**Statistical Analysis and Results:** In this study, all 3 study groups have 10 teeth each. After 2 months, p value was highly significant in group III (0.020). Mean abrasion (measured in micron) was 1.41, 1.98 and 2.21 respectively for group I, II, III. After 4 months, p value was highly significant in group III (0.010). Mean abrasion (measured in micron) was 1.69, 2.12 and 2.31 respectively for group I, II, III. One-Way ANOVA analysis exhibited highly significant p value (0.002). Estimations of Two Sample T- Test also exhibited highly significant p value (0.001).

**Conclusion:** It was concluded that abrasion was maximum on the New Millennium Crowns subjected to Himalaya Kids Bubble Gum Toothpaste. Likewise, abrasion was found minimum on the New Millennium Crowns subjected to Kidodent Bubble Fruit Flavor Kids Toothpaste. This pattern was recognized in the estimations made at 2 months and 4 months timings among all three tested toothpastes.

**Key Words:** Abrasive, Kidodent Bubble Fruit Flavour Kids Toothpaste, Baby Organo Herbal Kids Toothpaste Strawberry, Himalaya Kids Bubble Gum Toothpaste, New Millennium Crowns, Pediatric Toothpastes, Non Contacting Laser Profilometry

**Introduction**

Pediatric dentistry has been extensively researched by several researchers in the recent past. Most common clinical pediatric dental problem is caries involving occlusal surface of posterior teeth.<sup>1-4</sup> Teeth are saved by circumstantial indicated type of intervention like pulpectomy or pulpotomy. After these interventions, crown of teeth is further strengthened by giving crown.<sup>5-7</sup> There are number of esthetic crowns being practiced in the pediatric dentistry.<sup>8,9,10</sup> New Millennium Crowns are latest innovation in the field of pedodontics. The New Millennium Crowns are fabricated by laboratory-improved composite resin material. New Millennium Crowns are also analogous to strip crowns. Their benefits are superior aesthetics and parental agreement. New Millennium Crowns may be adjusted by remodeling them with a high-speed bur. Disadvantages of New Millennium Crowns include fragile configuration, requirement of moisture free restoration environment, potential staining of the crown by any blood contact. Applications of rubber dam are comparatively difficult since New Millennium Crowns resist any crimping. Preparation for New Millennium crowns is similar to strip crown preparation in pediatric dentistry. Other clinical dilemmas of New Millennium Crowns include its technique sensitive nature, frequent inflammation gingiva, brittleness structure which makes it more susceptible fracture under light forces also. Proper isolation is compulsory with usage of New Millennium Crowns. New Millennium Crowns are primarily advised in discolored tooth, widespread caries and broken tooth. New Millennium Crowns is usually contraindicated in deep overbite and present periodontal problems. Pediatric tooth pastes have a clear abrasive effect on the crown surface. These abrasive activities are undesired and frequently alter the overall functioning of crowns. Therefore, considering all these significant facts, this in-vivo study was conducted to assess the abrasive potential of three commonly utilized pediatric toothpastes on new millennium crowns used in pediatric dentistry.

**Materials & Methods**

This study was planned and executed on in vivo basis in which total 30 subjects participated. Both male and female pediatric patients were included in this study. The age range of all patients

was in the range of 9-12 years. Total thirty teeth were selected for study in which New Millennium Crowns were placed after endodontic therapy/pulp therapy. Only one crown per patient was included in the study. Inclusion criteria were 1) single teeth indicated for New Millennium Crowns 2) cooperative pediatric patient. Exclusion criteria was 1) patients exhibiting tantrum 2) kids with limited or insufficient mouth opening 3) physically challenged patients 4) mentally compromised kids. All, fractured, malformed, teeth with iatrogenic damage, heavily restored teeth, congenitally defected, developmentally defected teeth were excluded from the study. Moreover, teeth with grounded enamel or dentine were also not taken for study. Three commonly used popular toothpastes were chosen for study. These abrasive were, Kidodent Bubble Fruit Flavour Kids Toothpaste, Baby Organo Herbal Kids Toothpaste Strawberry, Himalaya Kids Bubble Gum Toothpaste. For categorization and analysis, samples were studied into three groups of ten each. Basic normalization was followed for all samples to have consistency in results. First study group (Group 1) included 10 patients in which Kidodent Bubble Fruit Flavour Kids Toothpaste were used for 2 month period and 4 months period. Group 2 included 10 patients in which Baby Organo Herbal Kids Toothpaste Strawberry was used for 2 month period and 4 months period. Group 3 included 10 patients in which Himalaya Kids Bubble Gum Toothpaste was used for 2 month period and 4 months period. These samples teeth were recognized intra-orally by cemented New Millennium Crowns. Then they were rinsed well with distilled water and cleaned. The extent of abrasion created by different tooth pastes on New Millennium Crowns was measured by Non Contacting Laser Profilometry (Tinius Olsen Ltd., Honeycrock Lane, Redhill, UK). Testing was based on the present American National Standard/American Dental Association Specifications. Data thus received was compiled in table and subjected to basic statistical analysis. P value less than 0.05 was considered significant ( $p < 0.05$ ).

### **Statistical Analysis and Results**

In this study, all noticeable results and data were sent for statistical analysis using statistical software Statistical Package for the Social Sciences version 22 (IBM Inc., Armonk, New York, USA). The source data was subjected to appropriate statistical tests to obtain p values, mean, standard deviation, chi-square test, standard error and 95% CI. Table 1 shows that Group I, II and III have commercially available pediatric toothpastes, Kidodent Bubble Fruit Flavor Kids Toothpaste, Baby Organo Herbal Kids Toothpaste Strawberry, Himalaya Kids Bubble Gum Toothpaste. All 3 study groups have 10 teeth each. Table 2 is illustrating about the Basic Statistical Representation with Level of Significance Evaluation Using Pearson Chi-Square Test [For Group I, II, III] including mean abrasion in microns, standard deviation, standard error, level of significance and 95% CI, Pearson Chi Square Value (after 2 months). Here p value was highly significant in group III (0.020). Mean abrasion (measured in micron) was 1.41, 1.98 and 2.21 respectively for group I, II, III. Table 3 demonstrated about the Basic Statistical Representation with Level of Significance Evaluation Using Pearson Chi-Square Test [For Group I, II, III] including mean abrasion in microns, standard deviation, standard error, level of significance and 95% CI, Pearson Chi Square Value (after 4 months). Here p value was highly significant in group III (0.010). Mean abrasion (measured in micron) was 1.69, 2.12 and 2.31 respectively for group I, II, III. Table 4 showed about the Comparison of Abrasion levels among the 3 Study Groups Using One-Way ANOVA [For Group I, II, III] and Two Sample T- Test For Comparison of Variables Between Group I, Group II And Group III (after 2 months). One-Way ANOVA analysis exhibited highly significant p value (0.002). Estimations of Two Sample T- Test also exhibited highly significant p value (0.001). Table 5

showed about the comparison of Abrasion level among the 3 Study Groups Using One-Way ANOVA [For Group I, II, III] and Two Sample T- Test For Comparison of Variables Between Group I, Group II And Group III (after 4 months). One-Way ANOVA analysis exhibited highly significant p value (0.001). Estimations of Two Sample T- Test also exhibited highly significant p value (0.001).

**Table 1:** Sample Allocation of Toothpastes and Groups

Group	n	Toothpaste
I	10	Kidodent Bubble Fruit Flavor Kids Toothpaste
II	10	Baby Organo Herbal Kids Toothpaste Strawberry
III	10	Himalaya Kids Bubble Gum Toothpaste

**Table 2:** Basic Statistical Representation with Level of Significance Evaluation Using Pearson Chi-Square Test [For Group I, II, III] including mean abrasion in microns, standard deviation, standard error, level of significance and 95% CI, Pearson Chi Square Value (after 2 months)

Groups	Mean Abrasion (Microns)	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
Group I	1.41	0.930	0.290	1.96	1.025	1.0	0.086
Group II	1.98	0.682	0.636	1.43	1.183	2.0	0.500
Group III	2.21	0.029	0.927	1.09	1.376	1.0	0.020*
<b>*p&lt;0.05 significant</b>							

**Table 3:** Basic Statistical Representation with Level of Significance Evaluation Using Pearson Chi-Square Test [For Group I, II, III] including mean abrasion in microns, standard deviation, standard error, level of significance and 95% CI, Pearson Chi Square Value (after 4 months)

Groups	Mean Abrasion (Microns)	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
Group I	1.69	0.839	0.478	1.96	1.025	1.0	0.938
Group II	2.12	0.621	0.603	1.82	1.849	2.0	0.521
Group III	2.31	0.939	0.912	1.01	1.312	1.0	0.010*
<b>*p&lt;0.05 significant</b>							

**Table 4:** Comparison of Abrasion levels among the 3 Study Groups Using One-Way ANOVA [For Group I, II, III] and Two Sample T- Test For Comparison of Variables Between Group I, Group II And Group III (after 2 months)

Variables	Degree of Freedom	Sum of Squares	Mean Sum of Squares $m\sum$	F	Level of Significance
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		$\Sigma$				(p value)	
<b>Between Groups</b>	3	4.049	1.541	4.671		0.002*	
<b>Within Groups</b>	36	12.039	0.870			-	
<b>Cumulative</b>	571.43	19.847	-				
<b>Two Sample t- test</b>							
<b>Variables</b>	<b>Group I</b>		<b>Group II</b>		<b>Group III</b>		<b>p Value</b>
	<b>Mean</b>	<b>S.D.</b>	<b>Mean</b>	<b>S.D.</b>	<b>Mean</b>	<b>S.D.</b>	
<b>Frictional Resistance (Microns)</b>	1.41	0.930	1.98	0.682	2.21	0.029	0.001*
<b>*p&lt;0.05 significant</b>							

**Table 5:** Comparison of Abrasion level among the 3 Study Groups Using One-Way ANOVA [For Group I, II, III] and Two Sample T- Test For Comparison of Variables Between Group I, Group II And Group III (after 4 months)

<b>Variables</b>	<b>Degree of Freedom</b>	<b>Sum of Squares <math>\Sigma</math></b>	<b>Mean Sum of Squares <math>m\Sigma</math></b>		<b>F</b>	<b>Level of Significance (p value)</b>	
<b>Between Groups</b>	3	4.329	1.939		4.838	0.001*	
<b>Within Groups</b>	36	12.429	0.823			-	
<b>Cumulative</b>	592.13	19.927	-				
<b>Two Sample t- test</b>							
<b>Variables</b>	<b>Group I</b>		<b>Group II</b>		<b>Group III</b>		<b>p Value</b>
	<b>Mean</b>	<b>S.D.</b>	<b>Mean</b>	<b>S.D.</b>	<b>Mean</b>	<b>S.D.</b>	
<b>Frictional Resistance (Microns)</b>	1.69	0.839	2.12	0.621	2.31	0.939	0.001*
<b>*p&lt;0.05 significant</b>							

## Discussion

Abrasion of enamel is an unavoidable dental phenomenon which decreases the overall performance of teeth in terms of mastication and esthetics.<sup>11-12</sup> Most of the commercially available toothpastes have integrated abrasive agents which creates surface roughness of greater extent.<sup>13,14,15</sup> Literature has well evidenced about the studies conducted on these clinical issues.<sup>16-19</sup> Philpotts and colleagues have evaluated a silica whitening toothpaste containing blue covarine on the color of teeth containing anterior restoration materials. They concluded that tooth pastes do have potential deleterious effect on the surface morphology of teeth and prosthetic crowns. Their results were in agreement with our inferences.<sup>20</sup> Tao and other coworkers have studied in detail about the optical tooth whitening toothpastes. They stated and recommended that tooth paste with minimum abrasive content must be prescribed in pediatric patient.<sup>21</sup> Al-Ankily and other pioneer workers studied about the influence of different types of whitening tooth pastes on

the tooth color, enamel surface roughness and enamel morphology of human teeth. Their results were in agreement with our inferences.<sup>22</sup> Shamel and colleagues experimented about the influence of different types of whitening tooth pastes on the tooth color, enamel surface roughness and enamel morphology of human teeth. Their recommendations were highly significant and clinically applicable in pediatric setups.<sup>23</sup> Oliveira and other researchers has checked the optical dental whitening efficacy of blue covarine toothpaste in teeth stained by different colors.<sup>24</sup> Other researchers also experimented comprehensively in these prospective and recommended useful guidelines.<sup>25-26</sup>

### Conclusion

Within the limitation of the study authors concluded that abrasion was maximum on the New Millennium Crowns subjected to Himalaya Kids Bubble Gum Toothpaste. Similarly, abrasion was found minimum on the New Millennium Crowns subjected to Kidodent Bubble Fruit Flavor Kids Toothpaste. Abrasion on New Millennium Crowns subjected to Baby Organo Herbal Kids Toothpaste showed moderate levels of abrasion. This pattern was identified in the estimations made at 2 months and 4 months timings among all three tested toothpastes. Therefore, Kidodent Bubble Fruit Flavor Kids Toothpaste is appearing promising and clinically acceptable with teeth restored by New Millennium Crowns in pediatric patients. Selection of suitable Toothpaste should be based on overall evaluation of all contributing factor. Our study outcomes must be perceived as suggestive for similar clinical circumstances.

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