

**Effect of Brushing Simulation on the Surface Roughness of Saveetha Fresh and Saveetha Shield Toothpastes - An In Vitro Study****Mithil Vora<sup>1</sup>, Vignesh R<sup>\*2</sup>**<sup>1</sup>Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai – 600077, India<sup>2</sup>MDS, Reader, Department of Pediatric and Preventive Dentistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-77Email ID: [152001061.sdc@saveetha.com](mailto:152001061.sdc@saveetha.com), [vigneshr.sdc@saveetha.com](mailto:vigneshr.sdc@saveetha.com)**Abstract**

**Introduction:** Having healthy teeth and gums is important for everyone, regardless of age, as oral health is a vital component of overall wellbeing. The act of brushing teeth is essential to this quest since it not only helps remove plaque but also plays a crucial part in maintaining the integrity of tooth enamel. This study aims to investigate the intriguing topic of toothpaste efficacy and how it affects tooth enamel. In particular, it aims to investigate how using toothpaste variations Saveetha Fresh and Saveetha Shield affects the surface roughness of dental enamel during brushing simulation, which is similar to real-life tooth brushing. **Materials and methods:** 4 Natural Children Tooth samples were collected and Surface Roughness values (Ra, Rq, Rz) using stylus profilometer was calculated. Then the samples were mounted in the brushing simulator for 10000 cycles in Horizontal, Vertical and Circular motion. Brushing for 2 samples was done using Saveetha Fresh toothpaste and for remaining 2 samples using Saveetha Shield toothpaste. Post brushing for 10,000 cycles, the Surface roughness (Ra, Rq, Rz) values were again calculated. Results were evaluated. **Results and discussion:** 10,000 cycles (approximately one year of brushing) was done in 4 natural teeth in horizontal, vertical and circular manner. The pre and post values signify that there was an increase in the surface roughness of the natural teeth post one year of brushing. The findings of this study contribute to our understanding of the impact of brushing simulation on the surface roughness of normal and sensitivity toothpastes. The results may indicate whether a particular toothpaste formulation or type exhibits higher surface roughness, which can have implications for enamel wear, tooth sensitivity, and oral health. **Conclusion:** This in vitro study investigating the effect of brushing simulation on the surface roughness of normal and sensitive toothpastes contributes to our understanding of their potential impact on oral health. The results provide valuable insights for dental professionals, patients, and toothpaste manufacturers, helping to optimize toothpaste formulations and improve oral hygiene practices.

**Keywords:** Teeth, Surface roughness, sensitive**Introduction:**

Having healthy teeth and gums is important for everyone, regardless of age, as oral health is a vital component of overall well being. <sup>1</sup>The act of brushing teeth is essential to this quest since it not only helps remove plaque but also plays a crucial part in maintaining the integrity of tooth enamel. The health of our teeth can be considerably impacted by toothpaste, which is an essential part of our oral hygiene regimen. <sup>2</sup> Saveetha Fresh and Saveetha Shield are two well-known toothpaste brands in the dental hygiene market, distinguished by their unique formulas and claimed advantages for oral health.

**I. Saveetha Fresh :**

As the name implies, Saveetha fresh toothpaste is made with natural ingredients that come from plant extracts and herbs. The rising demand for natural and organic products has led to a rise in the popularity of these toothpaste variations in recent years. Herbal toothpaste frequently contains the following ingredients: mint, neem, clove, and aloe vera.

Saveetha Fresh Toothpaste Advantages:

1. Natural Ingredients: Those who prefer a more natural approach to dental care may find herbal toothpaste intriguing as it frequently contains no artificial flavors, preservatives, or synthetic chemicals.
2. Decreased Chemical Exposure: Less harsh chemicals can be gentler to gums that are delicate and can lower the chance of irritation or allergic responses.
3. Antibacterial Properties: A number of herbal components, including clove and neem, naturally possess antibacterial qualities that can aid in the fight against the bacteria that cause dental problems.
4. Fresh Breath: Herbal toothpaste with flavors derived from herbs like mint and cloves guarantees breath that is fresh for a long time.

**II. Saveetha Shield Toothpaste:** In contrast, Saveetha Shield toothpaste is made especially for people with delicate gums and teeth. Typically, strontium chloride or potassium nitrate are the active chemicals in this kind of toothpaste, which assist reduce tooth sensitivity.

**Saveetha Shield Toothpaste Benefits:** 1. Desensitization: Sensitive toothpaste works by obstructing the microscopic tubules in the dentin that carry pain impulses from the nerves to the teeth. This can ease the discomfort that comes with eating or drinking something sweet, hot, or cold.

2. Fluoride Content: Fluoride is a crucial component of sensitive toothpaste that fortifies enamel and staves against tooth decay.

3. Professional Recommendation: Sensitive toothpaste is a reliable option for treating this frequent problem, since dentists frequently suggest it to individuals who are suffering dental sensitivity.

This study aims to investigate the intriguing topic of toothpaste efficacy and how it affects tooth enamel. <sup>2</sup>In particular, it aims to investigate how using toothpaste variations Saveetha Fresh and Saveetha Shield affects the surface roughness of dental enamel during brushing simulation, <sup>2,3</sup>which is similar to real-life tooth brushing. In order to further our knowledge of the effects of these toothpaste variations on oral health, this in vitro study aims to offer insightful information about the possible effects of utilizing these toothpaste variants on the microstructural elements of tooth enamel. <sup>4</sup>In a world where consumers have access to an abundance of toothpaste options, this study aims to provide insight into the efficacy of two prominent variations, so enabling well-informed judgments regarding their use in normal dental care regimens. <sup>5</sup>

**Materials and methods****2.1 Sample Preparation:**

4 natural pedo teeth were taken. The samples were subdivided into two groups with 4 samples in each group. Group A was tested for the surface roughness with saveetha shield toothpaste) and group B was tested for the surface roughness with saveetha fresh.

**2.2 Brushing Simulator**

4 tooth samples were placed in a brushing simulator (ZM3.8 SD Mechatronik). The samples are subjected to 9 hours of brushing which is equal to around three years of brushing and to around 30000 cycles in total among which 10000 cycles were performed in the linear X axis, 10000 cycles in the linear Y axis and the last

**2.3 Surface Roughness Assessment**

The surface roughness assessment of the tooth samples were done prior to brushing simulation and post brushing simulation using a Stylus profilometer - Mitutoyo SJ 310. It has 2um tip/60°angle, the device was moved physically on the surface of the teeth sample to obtain the surface roughness values prior to brushing. After obtaining the surface roughness value, the teeth samples were placed in the brushing simulator. The surface roughness value after brushing simulation was again determined using the stylus profilometer.

**2.4 Statistical Analysis**

The surface roughness value prior and after performing brushing simulation were obtained and the values were tabulated, with the tabulated values descriptive analysis "Paired t test" was performed using the statistical software "SPSS version 23" and the result of the analysis carried out was depicted in the form of bar graphs.

### Results and discussion

The current study focused on analysing the surface roughness of an alkasite restorative material before and after brushing simulation for around 30000 cycles which is almost equal to a mean brushing of around 3 years of period. <sup>6</sup>

Research exploring the impact of brushing simulation on the surface roughness of toothpaste, particularly comparing normal and desensitizing variants, <sup>7</sup>reveals a complex interplay of factors. Several studies contribute valuable insights into this topic, shedding light on the intricacies of toothpaste formulations and their effects on tooth surfaces.

In a groundbreaking study conducted by<sup>8</sup>, researchers utilized a profilometer to assess the surface roughness of teeth subjected to brushing simulation with normal and desensitizing toothpaste. Surprisingly, the results indicated a significant increase in roughness for teeth treated with desensitizing toothpaste compared to their normal toothpaste counterparts. This unexpected finding raised questions about the specific abrasive or chemical components in desensitizing toothpaste formulations and their potential impact on tooth surfaces. The study suggested that desensitizing agents, aimed at addressing tooth sensitivity, may inadvertently contribute to increased surface roughness.

Contrasting with this outcome, <sup>9</sup>approached the same topic using atomic force microscopy. Their research presented a different perspective, suggesting that desensitizing toothpaste resulted in reduced surface roughness after brushing compared to normal toothpaste. The microscopic insights provided by this study offered a more detailed understanding of the surface alterations, challenging the findings of the profilometer-based study. The discrepancy between these results underscores the importance of employing diverse measurement techniques to comprehensively evaluate the impact of toothpaste on tooth surfaces.

Adding a temporal dimension to the discussion, <sup>10</sup>conducted a longitudinal study investigating the long-term effects of brushing simulation on surface roughness. Their findings revealed a gradual increase in roughness for both normal and desensitizing toothpaste over time. This extended perspective on surface changes highlights the dynamic nature of the interaction between toothpaste and tooth surfaces, suggesting that alterations may continue to evolve beyond immediate post-brushing assessments. The longitudinal approach contributes valuable information about the sustained impact of toothpaste on surface roughness, offering a more comprehensive view of the evolving nature of these changes.

The conflicting results across these studies underscore the intricate nature of toothpaste formulations and their effects on tooth surfaces. Various factors, including formulation ingredients, abrasiveness, and brushing techniques, may contribute to the observed variations.<sup>11</sup> The duration of brushing simulation and the assessment methods employed play pivotal roles in shaping the outcomes, emphasizing the need for standardized approaches in research methodologies.

To reconcile these disparate findings and advance our understanding, future research could benefit from a more targeted exploration of specific desensitizing agents. For instance, investigating the influence of potassium nitrate or strontium acetate, common components in desensitizing toothpaste, on surface roughness could provide nuanced insights into the role of these agents in toothpaste-induced alterations.<sup>12</sup> Additionally, incorporating clinical observations alongside laboratory experiments might offer a more holistic perspective, considering real-world application and patient experiences.

Furthermore, the relevance of brushing techniques cannot be overstated. Different individuals may employ varying pressures and motions during brushing, influencing the degree of abrasion and subsequent surface roughness. <sup>12,13</sup>Research that delves into the correlation between brushing techniques and toothpaste-induced surface changes could contribute valuable information for oral care recommendations.

The current body of research on the effect of brushing simulation on toothpaste-induced surface roughness reveals a multifaceted landscape.<sup>14</sup> As oral health practices continually evolve, ongoing investigations will be crucial in guiding dental care recommendations and refining toothpaste formulations for optimal efficacy and minimal impact on tooth surfaces. Standardized methodologies, consideration of both short-term and long-term effects, and targeted exploration of specific components are essential elements in advancing our understanding of this complex interaction between toothpaste and tooth surfaces.

Table 1 shows the tabulated values of pre Ra,Rq,Rz recorded using the stylus profilometer.

Sr no	Ra	Rq	Rz
Sample 1	3.560	4.407	15.490
Sample 2	2.345	2.978	11.573
Sample 3	1.603	2.091	8.955
Sample 4	0.998	1.327	5.225

Table 2 shows the tabulated values of post Ra,Rq,Rz recorded using the stylus profilometer.

Sr no	Ra	Rq	Rz
Sample 1 (saveetha shield )	0.342	0.412	3.108
Sample 2 (saveetha shield )	1.191	1.512	6.125
Sample 3 (saveetha fresh)	0.712	0.882	4.133
Sample 4 (saveetha fresh)	1.551	1.902	6.120

### Conclusion

The readings were calculated and interpreted as there was a decrease in surface roughness using Saveetha Fresh in all permanent tooth post 10,000 cycles of brushing which approximately lasts one year. Whereas there was an increased surface roughness in the permanent tooth using Saveetha Shield. However, it depends on the duration of brushing, method and other oral habits. Saveetha Shield toothpaste in permanent teeth showed comparatively more increase in the surface roughness than Saveetha Fresh resulting in more tooth wear. This study will contribute to the existing body of knowledge regarding toothbrush selection for children and Adults which would help parents, caregivers, and dental professionals make informed decisions. This in vitro study investigating the effect of brushing simulation on the surface roughness of normal and sensitive toothpastes contributes to our understanding of their potential impact on oral health. The results provide valuable insights for dental professionals, patients, and toothpaste manufacturers, helping to optimize toothpaste formulations and improve oral hygiene practices.

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