



COMPARATIVE EVALUATION OF SURFACE ROUGHNESS OF FLOWABLE COMPOSITE RESIN AFTER BRUSHING SIMULATION WITH FLUORIDATED AND REMINERALISING TOOTHPASTE - AN IN VITRO STUDY

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Abstract:

Introduction: Composite resin is the material of choice for anterior tooth restorations in adult and pediatric patients. Surface roughness is a crucial property in the success of dental restoration. Toothbrushing may influence the wear and surface roughness of different types of composite resins. The aim of this study is to evaluate the surface roughness of flowable composite resin after brushing simulation with fluoridated and remineralising toothpaste. **Materials and Methods:** The in vitro study was carried out in White Lab, Saveetha Dental College and Hospital, Chennai, India. Eight disc shaped samples of flowable composite resin restorative material with 2 mm of thickness were prepared using a customised mould. After obtaining the surface roughness value prior to brushing, the flowable composite resin samples were subjected to brushing simulation. (ZM3.8 SD Mechatronik brushing simulator). 4 flowable composite resin samples were brushed with colgate fluoridated toothpaste (group 1) and another 4 flowable composite resin samples were brushed with enafix remineralising toothpaste (group 2). The surface roughness value after brushing simulation was again determined using the stylus profilometer. **Results:** Mean Ra for Colgate and Enafix group was 0.00050 and 0.00000 respectively, Mean Rq for Colgate and Enafix group was 0.00075 and 0.00050 respectively, Mean Rz for Colgate and Enafix group was 0.00775 and 0.00700 respectively. Independence sample T test was used p value of less than or equal to 0.05 is considered significant. P value for Rq and Rz parameters was 0.356 and 0.506. Hence, not statistically significant. **Conclusion:** There was no variation in the surface roughness of flowable composite resin samples after brushing simulation with Colgate and Enafix toothpaste.

Key words: composite resin, surface roughness, brushing simulator, stylus profilometer, innovative measurement

INTRODUCTION:

Dental composites are artificial substances that integrate polymeric matrices with a dispersion of glass, mineral or resin filler via means of coupling agents. Just like dental amalgam, they are used to repair tooth shape and structure affected by trauma and dental caries(1,2). Composites also can



be used to cement crowns and veneers. While the amalgam is phasing out in dentistry, composites have grown to be one of the maximum extensively used esthetic restorative substances(3). It is the material of choice for anterior tooth restorations in adult and pediatric patients(4).

Composite resin polymerization can change from viscous liquid to viscoelastic solid. These modifications occur when composite resin monomers react to external energy to form polymers. Surface roughness is a crucial property in the success of dental restoration(5). The resin composite structure and the characteristics of the resin particles have a direct impact on the smoothness and the susceptibility of the material to extrinsic staining. The surface roughness of the composite is usually dictated by size, hardness and quantity of load particles, which influence the mechanical properties of composites, the flexibility of organic matrix, hardness and size of the abrasive

Toothbrushing may influence the wear and surface roughness of different types of composite resins. Toothbrushing plays a prime role in maintaining the oral hygiene of the individual. Dentifrices can damage the surface of composite resin restoration, thereby making it rougher and more prone to dental plaque accumulation, staining of restoration, soft tissue inflammation and development of recurrent dental caries. To achieve cleaning, the abrasive systems in dentifrices have to provide a certain degree of abrasiveness with respect to the surface of the teeth. The amount of surface wear due to tooth brushing depends on certain parameters such as brushing habits, usage of hard, medium or soft toothbrush and abrasive types seen in dentifrice(6,7). The surface wear and roughness can have an impact on the life of the dental restoration. The aim of this study is to evaluate the surface roughness of flowable composite resin after brushing simulation with fluoridated and remineralising toothpaste.

MATERIALS AND METHODS:

The in vitro study was carried out in White Lab, Saveetha Dental College and Hospital, Chennai, India. Eight disc shaped samples of flowable composite resin restorative material with 2 mm of thickness were prepared using a customised mould. (Figure 1) The surface roughness prior to brushing of the prepared flowable composite resin circular discs were determined using a Stylus profilometer - Mitutoyo SJ 310, 2 μ m tip/60°angle, device was moved physically on the surface of the flowable composite resin material to obtain the values prior to brushing. The values of Ra (Roughness average), Rq (Root mean square) and Rz (Roughness height) were recorded for each sample. After obtaining the surface roughness value prior to brushing, the flowable composite resin samples were subjected to brushing simulation. Samples were placed in a brushing simulator (ZM3.8 SD Mechatronik). (Figure 2) The samples are subjected to 8-9 hours of brushing which is equal to around three years of brushing and around 30000 cycles. 4 flowable composite resin samples were brushed with colgate fluoridated toothpaste (group 1) and another 4 flowable composite resin samples were brushed with enafix remineralising toothpaste (group 2). The surface roughness value after brushing simulation was again determined using the stylus profilometer. The



surface roughness values before and after brushing simulation were obtained and tabulated. The results were then analysed using SPSS software version 22.0 and were graphically represented.



Figure 1: Flowable composite resin samples



Figure 2: Composite resin samples subjected to brushing simulator

RESULTS:

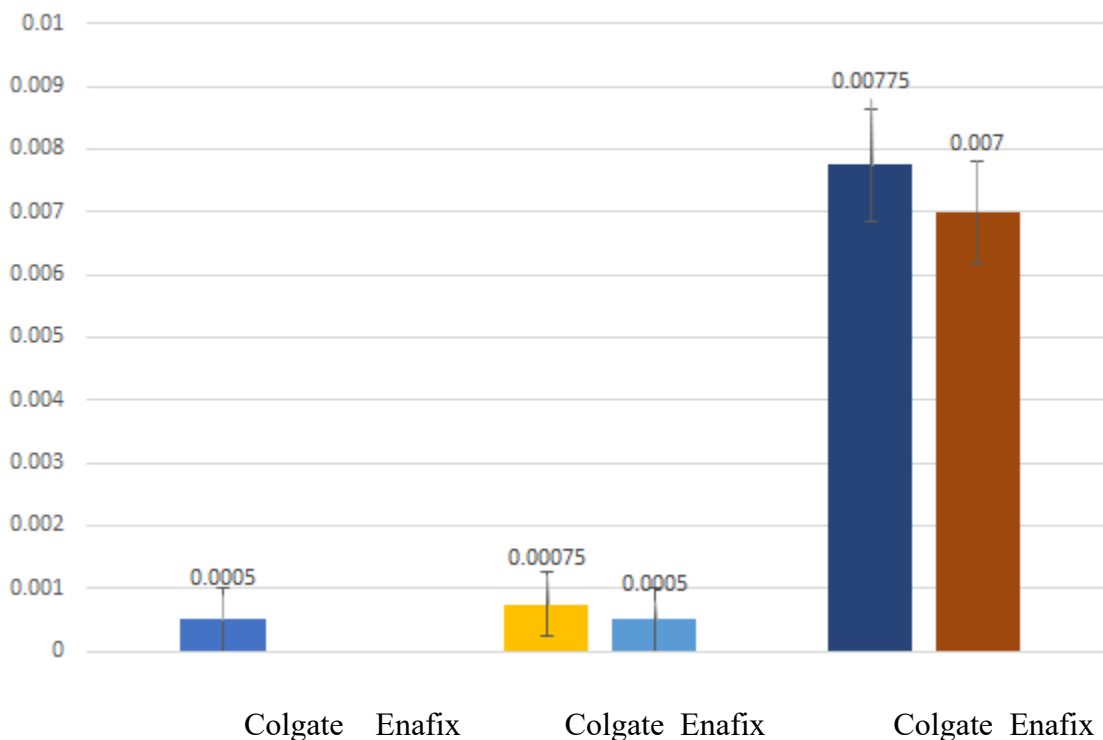
Ra, Rq and Rz values of the flowable composite resin samples before and after brushing simulation was analysed. Independent T test was done for comparison between the groups.(Table 1, figure 3) Mean Ra for Colgate and Enafix group was 0.00050 and 0.00000 respectively, Mean Rq for Colgate and Enafix group was 0.00075 and 0.00050 respectively, Mean Rz for Colgate and Enafix group was 0.00775 and 0.00700 respectively. Independent sample T test was used p value of less



than or equal to 0.05 is considered significant. P value for Rq and Rz parameters was 0.356 and 0.506. Hence, not statistically significant.

Table 1 : Mean. std. deviation and significance testing between groups

Parameters	Groups	N	Mean	std.deviation	Significance
Mean diff Ra	Colgate	4	0.00050	0.000577	-
	Enafix	4	0.00000	0.000000	
Mean diff Rq	Colgate	4	0.00075	0.000500	0.356
	Enafix	4	0.00050	0.000577	
Mean diff Rz	Colgate	4	0.00775	0.000957	0.506
	Enafix	4	0.00700	0.000816	





Ra

Rq

Rz

Figure 3: This bar graph depicts the association between the type of paste used and the mean difference in surface roughness. In Ra Blue denotes the mean value of Colgate respectively, in Rz yellow and sky blue denote the mean value of Colgate and Enafix, in Rz dark blue and brown denote the mean value of Colgate and Enafix. Rq and Rz values were decreased in enafix group.

DISCUSSION:

Our team has extensive knowledge and research experience that has translated into high quality publications (8–17),(18–21),(22–26),(27). The effect of brushing simulation with various dentifrices on surface roughness of various types of resin composites has been investigated in many studies. However, no studies have compared the surface roughness of composite resin after brushing simulation with fluoridated and remineralising toothpaste. Hence we did this novel study. In the colgate and enafix toothpaste group, surface roughness values before and after brushing simulation did not show any deviation. The results were statistically not significant. In a study, 60 disk-shaped specimens were made of microfill, nanofill, minifill hybrid and nanohybrid composite resins. They were subjected to brushing simulation with Colgate Total, Colgate baking soda & peroxide whitening Colgate tartar control and whitening toothpastes. They found a significant increase in surface roughness of composite resin after brushing with all dentifrices. In our study we did not find any changes in surface roughness values before and after brushing simulation of flowable composite resins.(28)

Thirty six samples of Z350XT and Empress Direct composite resin material subjected to brushing simulation using dentifrices such as Oral-B Pro-Health Whitening, Colgate Sensitive Pro-Relief and Colgate Total Clean Mint. The samples were subjected to 5000, 10000 and 20000 cycles of simulated toothbrushing in a brushing simulator. The higher the brushing simulation time cycles used, greater was the surface roughness of the composite resin samples. The dentifrice Oral-B Pro-Health Whitening caused an increased surface roughness in the composite resins samples when compared to the other groups. Another study investigated the alteration of surface roughness of the nanofill composite was caused by simulated brushing associated with the use of mouthrinses. It was concluded that the surface roughness of the nanofilled composite resin tested can be influenced by the mouthrinse associated with toothbrushing(29).

The surface roughness (Ra), the morphology and composition of filler particles of different composites submitted to toothbrushing and water storage was analysed in a study. Finishing and polishing resulted in similar Ra for all the composites, while toothbrushing and water storage increased the Ra of all the tested composite resin materials(30,31). The current study has limitations such as small sample size, we did not use multiple toothpastes and no comparison was done with soft, hard and medium toothbrushes. In the future, randomized control clinical studies



which deal with multiple parameters in different types of composite resin restorative materials are also required to prove the clinical efficacy of the various toothpastes.

CONCLUSION:

There was no variation in the surface roughness of flowable composite resin samples after brushing simulation with Colgate and Enafix toothpaste. This indicates that brushing simulation does not have any effect on the surface roughness property of flowable composite resin restorative material.

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CONFLICT OF INTEREST:

The author declares that there was no conflict of interest in the present study.

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