

Comparative analysis of effect of fruit juices on surface roughness of bulk fill and flowable composite material

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ABSTRACT

Resin-based composites have been widely used to reconstruct anterior and posterior teeth, as dentistry has progressed and there has been an increasing interest in the creation of suitable materials to replace damaged tooth tissue. The aim of the study is to compare the effect of fruit juices on the surface roughness of bulk fill and flowable composite restorative material. A total of 8 bulk fill composite and flowable composite resin disc samples were made. These eight samples were tested for surface roughness following immersion in three juices which were pineapple juice, lime juice, orange juice, and distilled water as the control group. They were immersed at room temperature for 7 days. Surface roughness was evaluated by the Mitutoyo SJ-310 contact profilometer. It showed that there was a decrease in the Ra value of flowable composite when compared to bulk fill composite. Rq and Rz values were more for the flowable composite resin group. Flowable composite resin samples had more surface roughness than bulk fill dental composite restorative material after exposure to pineapple, lime, and orange juices.

Key words: Contact profilometry, dental composite, fruit juices, roughness

INTRODUCTION

The restorative materials should be able to tolerate difficult situations, such as an acidic environment because the low pH of acidic beverages in the oral cavity can cause an erosive attack on the restorative materials. Aside from caries impacting the tooth, a variety of undesirable operations might result in an irreversible loss of enamel form from the outside floor.^[1] Hydrochloric acid, nitric acid, and sulfuric

acid are examples of powerful acids that are exceedingly corrosive and can cause skin burns. Mineral or inorganic acids are other names for strong acids. There have been numerous studies that suggest a link between acidic beverages and tooth surface loss. Erosion is the loss of tooth surface that is commonly associated with the consumption of acidic beverages.^[2] People who have tooth erosion may also experience pain or sensitivity when eating or drinking cold or hot beverages.^[3]

Resin-based composites have been widely used to reconstruct anterior and posterior teeth as dentistry has progressed and there has been an increasing interest in the creation of suitable materials to replace damaged tooth tissue.^[4] Composite resin materials have become increasingly popular among dentists, and they are being used in more direct restoration methods. They have

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the ability to address the needs of both patients and professionals to be successful.^[5]

Color, polymerization depth, and mechanical strength of composite resin are affected by filler content.^[6] Higher filler loading reduces watersorption, resulting in reduced surface deterioration.^[7] The higher filler content could lead to greater surface roughness, which could help bacteria stick to the restorative surfaces, which is a favorable habitat for secondary caries and periodontitis initiation.^[8,9] The aim of the study is to compare the effect of fruit juices on the surface roughness of bulk fill and flowable composite restorative material.

MATERIALS AND METHODS

Two esthetic composite materials that are bulk fill composite and flowable composite with shade A-2 were analyzed on exposure to three different fruit juices (pineapple juice, orange juice, and lemon juice). A total of 16 samples (eight in each group) of predefined dimensions were prepared using additional silicone molds. The two restorative materials were used to create discs of a specific size and form. The surface roughness of these eight samples was measured before and after immersion in three distinct citric acid juices: pineapple juice, lime juice, orange juice, and distilled water. Filling a prepared putty mold with the suitable composite material and pressing a glass slide against it was done. It was then light cured for 30 s. All specimens were subjected to profilometry examinations before being exposed to the experimental protocol to establish initial surface roughness. After that, the samples were separated into subgroups of two for each of the fruit juices and kept at room temperature for 7 days. For the control group, two samples of each composite disc were kept in distilled water. Mitutoyo SJ-310 contact profilometer was the machine utilized for surface roughness analysis.

RESULTS

The surface roughness of composite resin samples before and post immersion in pineapple juice, lime juice, orange juice, and control group distilled water are expressed as Ra, Rq, and Rz values. The mean difference in surface roughness parameters between the groups Ra Rq Rz showed the significance of 0.024, 0.356, and 0.638, respectively [Table 1]. An Independent *t*-test was used for intergroup comparison analysis. It showed that there was a significant decrease in the Ra value of flowable composite when compared to bulk fill composite. The mean and standard deviation for Ra value in the bulk composite group were 0.00100 ± 0.00000 and 0.00075 ± 0.00050 in the flowable composite group. Ra value changes were statistically significant (independent *t*-test; $P = 0.024$) Rq and Rz values were more for the flowable composite resin group [Figure 1].

Table 1: Surface roughness value comparison of the composite groups

Group	Roughness parameter	Mean	SD	SEM	Significance
Bulk	Ra	0.00100	0.000000	0.000000	0.024
Flowable		0.00075	0.000500	0.000250	
Bulk	Rq	0.00440	0.000577	0.000289	0.356
Flowable		0.00440	0.000500	0.000250	
Bulk	Rz	0.00875	0.004856	0.002428	0.638
Flowable		0.00900	0.005598	0.002799	

SD: Standard deviation, SEM: Standard error of mean

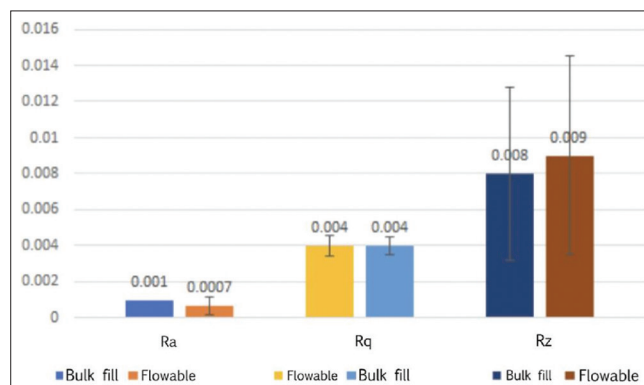


Figure 1: The association between the composite resin and surface roughness parameters is shown in graph. It showed that there was a significant decrease in the Ra value of flowable composite when compared to bulk fill composite. It was statistically significant (independent *t*-test; $P = 0.024$)

DISCUSSION

Our team has produced high-quality articles as a consequence of their extensive research and understanding.^[10-29] Alcohol concentrations and low pH have an effect on the surface characteristics of composite resin material. This study explains how changes in the surface roughness of composite materials are caused by the absorption of acidic chemicals from beverages into composite resins, which causes the matrix of the composite resin to soften.^[30,31] In addition, in our research also we had a reduction in surface roughness of bulk and flowable composite material after exposure to fruit juices.^[32] When composite resins are exposed to oral environment circumstances, their esthetic features, as well as their physical and mechanical characteristics, might change.^[33] According to the manufacturer, composite disc thickness can be 2 mm, as this is the approved thickness for the progressive composite material application procedure. Furthermore, in terms of direction, force, and duration per stroke, finishing and polishing techniques for all composite discs cannot be standardized.^[34]

After an aging simulation, four types of bulk-fill resin composites and three nanocomposites were evaluated for color stability and surface roughness. Filtek Ultimate, on

the other hand, was shown to be more stain-prone. Higher filler concentrations in microhybrid X-tra fil and nanohybrid SonicFill exhibited increased surface degradation.^[35] In a similar study, the surface roughness of flowable esthetic restorative materials was examined after being immersed in sports and alcohol-containing drinks. They concluded that flowable composite had the lowest surface roughness, whereas the flowable compomer had the greatest.^[36] The study has some drawbacks, including a small sample size and limited immersion techniques. In addition, larger-scale investigations will be done on this topic.

CONCLUSION

Flowable composite resin samples had more surface roughness than bulk fill composite resin samples after exposure to pineapple, lime, and orange juices. Thus, fruit juices can influence the surface roughness of composite resin restorative materials.

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Conflicts of interest

There are no conflicts of interest.

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