



EFFECTS OF MULTIVITAMIN SYRUP ON THE SURFACE ROUGHNESS OF FLOWABLE COMPOSITES - AN *IN-VITRO* STUDY.

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ABSTRACT

Background: Nutritional supplements in the form of syrups and tablets are used on a regular basis by humans as an alternative to dietary supplements. The sugar content in these preparations which are added to nullify the bitter taste have been known to cause various oral health problems such as dental caries. They may have a significant effect on the restorative dental materials too. The study is designed to assess the variations in surface roughness of flowable composite resin material after the exposure to multivitamin syrups and ascorbic acid tablets.

Materials and methods: 14 disc shaped specimens of flowable composite were divided into 2 groups. Group 1 contains ascorbic acid suspension and group 2 contains multivitamin syrup. The specimens were immersed for 2 minutes everyday for 28 days. The mean Ra, Rq, Rz values were calculated using the stylus profilometer and results were evaluated.

Results And And Discussion: The mean and standard deviation values were calculated and the results showed that the samples which were immersed in syrup showed a huge significant difference than the tablets. The mean and standard deviation values were calculated and the results showed that the samples which were immersed in syrup showed a huge significant difference than the tablets. The p value of Ra, Rq, Rz for tablets were 0.041, 0.03, 0.0039 respectively and for tablets it was 0.0687, 0.0035, 0.3344 respectively. According to older studies, the hydrolysis of the silane interface and loss of chemical bonds between filler particles, which ultimately leads to the material's degradation, can change and reduce the mechanical and physical properties of resin-based restorations.

Conclusion: The roughness significantly increased when the samples were immersed in multivitamin syrup and showed erosive effects of the restorative material whereas there was a minimal increase in the surface roughness when the specimens were exposed in the tablet suspension.

Keywords: Composite, Multivitamin syrups, Stylus profilometer, Surface roughness, Vitamin C tablets.

INTRODUCTION

For growth and development as well as proper organ function, humans need a sufficient amount of vitamins and minerals in their bodies. The nutrition can be via natural sources or via artificial sources in the form of syrups, tablets, lozenges, gummies, chewable tablets (1). Today, a sizable portion of the population uses vitamin and nutritional supplements on a daily basis since they are thought to be safe. Vitamins C and E have demonstrated antioxidant actions against cancer, reducing atherosclerotic plaque development, as well as a number of other benefits. But these supplements can also be harmful; for example, dental caries is known to be brought on by the syrups' sugar content, and vitamin C has been shown to have erosive effects on natural tooth materials (2). Over a wide range of restorative materials, composites are widely used as they last longer than other cements. Application of nanotechnology to flowable composites has enabled the development of a composite with the mechanical properties, wear resistance, strength, improved polishability, excellent polish retention, and translucency of a conventional resin composite. This material reduced polymerization shrinkage by almost 20% while retaining the flowable composite's elasticity, adaptability, and advantageous handling qualities (3). Composites are mainly preferred in preventive resin restorations, Class 1,2,4,5 cavity lesions regularly, bonding of orthodontic brackets, emergency reattachment of anterior tooth segment, denture repair and show enamel like strong morphology (4,5). Flowable composite on the other hand shows high strength and fracture toughness, wear resistance and polishability, has less polymerisation shrinkage, can be used as a restorative in Class II restorations, pit and fissure sealants, and less invasive occlusal cavity preparations. But all these properties depend upon the individual's hygiene and maintenance of the teeth, better aesthetics and comes in various shades according to the patient's natural teeth (6,7) All metabolic reactions that require proteins, lipids, and carbohydrates for energy, cell growth, and maintenance are catalysed by vitamins. Vitamins are typically administered through food supplements because meals only contain very little amounts of these necessary components. Vitamin deficiency can result in a number of non-specific oral conditions, including glossitis, stomatitis, and mucosal ulcers. Nutritional status and subsequent vitamin deficiency during the growth phases have a substantial impact on the hard tooth tissues (8). Primary dentition caries, enamel hypoplasia, and malnutrition were all believed to be positively correlated. Although multivitamin syrup is the most practical way to consume these dietary supplements, research has revealed that factors that contribute to dental caries may also have an impact on composites, such as surface microhardness and colour stability (9–18). The study is designed to assess the variations in surface roughness of flowable composite resin material after the exposure to multivitamin syrups and ascorbic acid tablets.

MATERIALS AND METHODS

The study consisted of flowable composite (3M Espe Filtek Supreme Flowable Restorative) of shade A2. 14 disc shaped specimens of 8mm X 2mm were prepared and these specimens were divided into two groups. Group 1 contained ascorbic acid chewable tablet solution and Group 2 consisted of A to Z adult multivitamin syrup solution. The specimens were divided and were dipped in both the groups for 2 minutes everyday and in deionised water simultaneously. The mean Ra, Rq, Rz values were calculated for surface roughness using a stylus profilometer (Mitutoyo SURFTEST SJ-310 surface roughness analyser). Ra is defined as the average roughness of a surface. Rq as the root mean square of the roughness and Rz is the average maximum peak to valley of five consecutive sampling lengths within the measuring length. The entire study was conducted in the White lab, Saveetha Dental

College Chennai. The mean and standard deviation values were calculated with the help of SPSS v2.0 software with the p value. The results were analysed and further evaluation was done.



Image 1



Image 2

Images showing the disc made of flowable composite (Image 1) and immersed in multivitamin syrup and ascorbic acid chewable tablet solution (Image 2).

RESULTS

The Ra, Rq, Rz values were calculated on Day 0 and Day 28 for surface microhardness and mean and standard deviation was calculated. The results show that there was a significant difference seen when the specimens were immersed with the multivitamin syrups than with the tablets ($p < 0.05$) which denotes that the prolonged use of multivitamin syrups have a negative effect on the physical properties of flowable composite. The p value of Ra, Rq, Rz for tablets were 0.041, 0.03, 0.0039 respectively and for tablets it was 0.0687, 0.0035, 0.3344 respectively [Table -1]. Though tablets also showed a slight increase in the surface roughness whereas only minute increase was found from which we can tell that the tablet supplements are a better way of consuming alternative nutrients than the syrups.

	Mean and Standard Deviation for Tablets (N=7)		Mean and Standard Deviation for Syrup (N=7)	
	Day 0	Day 28	Day 0	Day 28
Ra	0.29786±0.20	0.60143±0.40	0.38843±0.34	1.15143±0.61
p Value	0.0687		0.0041	
Rq	0.32943±0.29	0.99471±0.45	0.52886±0.43	1.34714±0.53
p Value	0.0035		0.03	
Rz	2.16357±1.81	2.58857±1.24	3.30986±2.00	7.76871±1.50
p Value	0.3344		0.0039	

Table 1: The above table represents mean, standard deviation and significance values of composite resin samples

DISCUSSION

The most frequent definition of surface roughness is the change in height of the surface in relation to a reference plane. Most widely employed Ra stands for "Arithmetic Average Roughness," Rq for "Geometric Average Roughness," RMS for "Root Mean Square Value," and Rz for "Ten Point Height" are the surface roughness parameters. The average values of the ordinates from the mean line are referred to as the arithmetic average. The square root of the arithmetic mean of the values of the squares of the ordinates of the surface measured from a mean line is known as the root mean square value. A line parallel to the mean line is used to measure the ten point height, which is the average

difference between the surface texture's five highest peaks and five lowest troughs (19). Because flowable composites have the capacity to reduce stresses at adhesive interfaces and have a stress-breaking effect in reducing thermal and occlusal stresses as well as polymerization shrinkage, it has been proposed that the use of flowable composites in non-cancerous cervical lesions is advantageous. When compared to traditional paste-like composites, flowable composites have a lower modulus of elasticity, which accounts for this ability (20). Nanotechnology has enabled the development of new generations of flowable composites that minimise polymerization shrinkage while maintaining the elasticity, flexibility, and favourable handling properties of flowable composites. This enhanced the flowable composites' mechanical and physical qualities and allowed for their usage in minimally invasive posterior restorations (21). For dental materials, colour stability and physical characteristics are connected because restorations with high mean Ra values are more likely to stain. Discoloration results from plaque accumulation, which is attracted to rougher surfaces. Any restoration's surface texture also influences the colour of the restoration, which enhances its aesthetic appeal because smooth surfaces tend to reflect more light than rough surfaces. The impact of multivitamin syrups on the various composites on the market must be assessed in order to determine their durability and resistance to wear (19). According to previous studies, resin-based restorations' mechanical and physical qualities can change and be reduced when water is absorbed because of the hydrolysis of the silane interface and the loss of chemical bonds between the filler particles, which ultimately results in the material's degradation (22). Deionized water was observed in another investigation to have increased the surface roughness of the resin specimen, which was attributed to water absorption and material solubility. According to the findings of a different study, effervescent pills had a worse impact than syrup on the microhardness and surface roughness of restorative materials (23). Knowledge about surface roughness and other physical properties of certain restorative materials are very essential as it presents us with durability, stability, resistance and longevity after a certain use which could help in the selection of the most appropriate material and can be used in the treatments. The sample size considered was very small. Similar studies can be done for checking other physical properties such as colour stability, microhardness. Different types of restorative materials also can be used for the selection of most appropriate material. The study can be conducted on cavities and natural tooth surface to measure the erosion with multivitamin syrups containing ascorbic acid. Scanning electron microscopy can be done for further evaluation.

CONCLUSION

The surface roughness significantly increased when the samples were immersed in multivitamin syrups containing ascorbic acid which shows erosive effects of the restorative material, although there was a minute increase in the surface roughness in association with effervescent tablets too.

CONFLICT OF INTEREST

The article has been read and approved by all the contributors and there isn't any conflict of interest.

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