RESEARCH PAPER

Effect of Fruit Juices on Surface Roughness of Nano Zinc Oxide Composite, Nano Calcium Oxide Composite and Conventional Composite

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ABSTRACT

INTRODUCTION: Zinc oxide (ZnO) and Calcium oxide are inorganic compounds widely used in everyday applications. High intake of acidic drinks, fruits and liquid medications may constitute possible etiological and aggravating factors for severe dental erosion. Erosion is characterized as the procedure whereby the surface of subject is being worn away as the after effect of activity of something that is grating.

AIM: The aim of the present study is to assess the effect of fruit juices on surface roughness of nano zinc oxide composite, nano calcium oxide composite and conventional composite.

MATERIALS AND METHOD: Preparation of the specimen: Commercially available conventional composite were selected. Nano-synthesised GIC was prepared by mixing 0.2 gram (10 percent by weight) of ZnO nanoparticles was reinforced with 2 grams of commercially available conventional type I GIC for the study. Five disc-shaped samples of each type II, type VI, and Nano-synthesised GIC which were prepared using a stainless mold of standard dimensions measuring around 10 mm in diameter and 2 mm in height.

CONCLUSION: According to the present study fruit juices consumption pattern of an individual, which predisposes the surface roughness of conventional composite. Thus, it can be concluded that frequent exposure to low pH fruit juices is directly related to the surface roughness and surface texture of the materials studied. Such a process may be presumed to occur clinically, which indicates that it is ultimately the patient's fruit beverage consumption habit that may affect the longevity of the restoration materials.

Keywords: Zinc oxide, calcium oxide, erosion, fruit juices.

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INTRODUCTION:

Zinc oxide (ZnO) and Calcium oxide are inorganic compound widely used in everydayapplications.High intake of acidic drinks, fruits and liquid medications may constitute possible etiological and aggravating factors for severe dental erosion.Erosion is characterized as theprocedure whereby the surface of subject is being worn away as the after effect of activity of something that is grating. (1)Then again, dental erosion is characterized as irreversible loss of tooth structure because of chemical disintegration by acids and not as a result of bacterial inception (2). There are two reasons for dental erosion, which are extrinsic and intrinsic.Extrinsic causes are usually from acidic sustenance's and beverages, for example, orange juices and sodas. Intrinsic causes are from inside, for example, gastric juices(3).

The most widely recognized reason for disintegration is the con- sequence of utilization of acidic squeezes and acrid nourishments, for example, pickles(4) Individuals these days particularly adolescents want to eat less and expend more foods grown from the ground This incorporates the admission of fruits and juices which are acidic. Acid can be divided into two types,

which are strong and weak acid . First are strong acids which are very corrosive and can cause burns on skin, examples of strong acids are hydro- chloric acid, nitric acid, and sulfuric acid(2,5). Strong acids also known as mineral or inorganic acids.The cases of weak acids are acidic corrosive which for the most part in vinegar, citrus extract that are for the most part in citrus organic product juice acid, and tartaric acid. Weak acids are additionally called as characteristic or natural acids(3,6) .

Different forms of destructive processes other than caries affecting the teeth and leading to an irreversible loss of tooth structure from the external surface are described in the literature. They are referred to as abrasion, demastication, attrition, abfraction, resorption and erosion.(7) The effect of the beverages may be stronger, depending on their intrinsic features, such as chemical composition of the restorative materials or external features, such as finishing/polishing of restoration. Moreover, the impact of a beverage on the materials may be directly related to the amount and frequency of its intake.(8)The aim of the present study is to assess the effect of fruit juices on surface roughness of nano zinc oxide composite,nano calcium oxide composite and conventional composite.

MATERIALS AND METHOD:

Preparation of the specimen:

Commercially available conventional composite were selected. Nano-synthesised GIC was prepared by mixing 0.2 gram (10 percent by weight) of nO nanoparticles was reinforced with 2 grams of commercially available conventional type I GIC for the study.Five disc-shaped samples of each type II, type VI, and Nano-synthesised GIC which were prepared using a stainless mold of standard dimensions measuring around 10 mm in diameter and 2 mm in height. The respectivecements were manipulated as per the guidelines provided by the manufactures and loaded into the mold, which were then compressed between two glass plates lined to remove the excess cement and obtain smooth and flat surfaces. As soon as the materials were set, the discs were removed from the mold and all the samples were evaluated for craze line and irregularities and the samples were stored in distilled water for 24 hours to achieve rehydration. The discs were divided randomly in two subgroups for immersing in the test solutions

Preparation of the test solutions:

The test solutions were tropical mango juice (nano calcium oxide), tropical mango juice (nano zinc oxide), mango juice (conventional composite).Each set was immersed in the respective test solution in a paper glass. Duration of the test was 7 days. The test solutions were changed every day to prevent fungal contamination. After seven days of immersion regime in test solutions ,we
have done test to check surface roughness

RESULTS :

Significance testing of roughness parameter of different composites:

Roughness parameter & groups		Mean	Std. Deviation	95% Confidence Interval for Mean		F	Sig.
				Lower Bound	Upper Bound		
Ra	Nano Zinc oxide composite	0.07825	0.040795	0.01334	0.14316	4.025	**0.056**
	Conventional composite	0.49675	0.203233	0.17336	0.82014		
	Nano calcium oxide composite	0.42175	0.324810	-0.09510	0.93860		
Rq	Nano Zinc oxide composite	0.12150	0.056459	0.03166	0.21134	6.538	**0.018**
	Conventional composite	0.80525	0.170727	0.53359	1.07691		
	Nano calcium oxide composite	0.56825	0.434646	-0.12337	1.25987		
Rz	Nano Zinc oxide composite	0.95900	0.407788	0.31012	1.60788	7.384	**0.013**
	Conventional composite	5.07175	1.420621	2.81122	7.33228		
	Nano calcium oxide composite	3.07675	2.165520	-0.36908	6.52258		

The present study evaluated the effect of fruit juice exposure on the surface roughness of nano zinc oxide composite, nano calcium oxide composite, and conventional composite restorative materials using the roughness parameters Ra, Rq, and Rz. The mean surface roughness values were consistently lowest for the nano zinc oxide composite across all parameters (Ra = 0.07825, Rq = 0.12150, Rz = 0.95900), indicating superior resistance to surface degradation following exposure to acidic fruit juices. In contrast, the conventional composite exhibited the highest roughness values (Ra = 0.49675, Rq = 0.80525, Rz = 5.07175), suggesting greater susceptibility to erosive changes. The nano calcium oxide composite demonstrated intermediate roughness values between the two groups.

Statistical analysis revealed significant differences among the groups for the roughness parameters Rq ($F = 6.538$, $p = 0.018$) and Rz ($F = 7.384$, $p = 0.013$), indicating that the type of restorative material had a significant influence on surface texture after fruit juice exposure. Although the Ra parameter showed a similar trend, the difference was not statistically significant ($F = 4.025$, $p = 0.056$). The lower roughness values observed in the nano zinc oxide composite may be attributed to the uniform distribution of nanoparticles, which enhances the structural integrity of the material and improves its resistance to acidic dissolution.

These findings suggest that exposure to acidic fruit juices adversely affects the surface characteristics of restorative materials, with conventional composites being more vulnerable to surface deterioration. Nano zinc oxide composite demonstrated the best performance by maintaining a smoother surface profile, which may contribute to improved longevity, reduced plaque accumulation, and better clinical

outcomes. Therefore, nanoparticle-reinforced restorative materials may offer enhanced resistance to erosive challenges commonly encountered in the oral environment.

DISCUSSION:

In addition, zinc oxide nanoparticles (ZnONPs) and copper oxide nanoparticles (CuONPs) are well known for their antimicrobial and UV-light barrier properties . Incorporation of small amounts of ZnONPs or CuONPs in biopolymers has improved the films properties and showed strong antimicrobial and UV barrier properties of biopolymer-based films . For these reasons, ZnONPs and CuONPs have been used in the biomedical and cosmetics industries in the forms of wound dressing, facial mask, sunscreen, and toothpaste

Moreover, ZnONPs and CuONPs have been applied for an active food packaging. ZnONPs have been added to LDPE and PVC packaging films to improve the microbial stability and to prolong the shelf life of orange juice, cut apple, and cheeseIn the present study, ZnONPs, CuONPs, and their combinations were used as nanofillers for the preparation of carrageenan-based nano-hydrogel with multifunctional properties. The effects of nanofillers on the morphology, mechanical, thermal, optical, swelling, and antibacterial properties of the hydrogel were tested. The properties of carrageenan-based nano-hydrogels were evaluated with both hydrogel and dried film forms.

CONCLUSION :

According to the present study fruit juices consumption pattern of an individual, which predisposes the surface roughness of conventional composite. Thus, it can be concluded that frequent exposure to low pH fruit juices is directly related to the surface roughness and surface texture of the materials studied. Such a process may be presumed to occur clinically, which indicates that it is ultimately the patient's fruit beverage consumption habit that may affect the longevity of the restoration materials

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