Effect of Citric Acid on Microhardness and Surface Roughness of Different Composite Resin Formulations

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List of Abbreviations

AUDMA	Aromatic urethane dimethacrylate.
Bis-EMA	Ethoxylated version of Bis-GMA
Bis-GMA	Bisphenol A-glycidyl methacrylate
HA	Hydroxyapatite
TEGDMA	Tri Ethylene glycol dimethylacrylate
UDMA	Urethane dimethacrylate
RBC	Resin based Composite
VHN	Vicker's Hardness number.
Ra	Surface roughness value.
AFM	Addition fragmentation monomers
µm	Micrometer
ESEM	Environmental Scanning electron microscope

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The use of light-cured resin-based composite restorations has recently become popular, including their use on teeth in the posterior region, due to their suitable mechanical behavior and their attractive aesthetic features. The growing interest in nanotechnology and its use in resin composites was based on the desire to utilize the ability of nano-sized particles to alter the structure of the composite. This in turn may improve mechanical, chemical and optical properties and develop a resin composite that can perform optimally in all parts of the mouth [(1)]. Consequently, **Mitra et al., 2003** [(2)] introduced novel nanofillers and then utilized various methacrylate resins and curing technologies to develop nanocomposites, that served too much in modern dentistry especially in the posterior region.

The bulk-fill resin based composites, has been introduced in the past few years. They were an attempt to speed up the restoration process by enabling up to 4- or 5-mm thick increments to be cured in one step, thus skipping the time-consuming layering process. Bulk-fill resin based composites were also marketed as restoratives that are well suited for patients with limited compliance. Moreover, the rheology of these materials is thought to have changed, thus allowing a better adaption to the cavity walls and resulting in a self-leveling effect [(3, 4)].

One of the most important properties that determine the durability of dental materials in the oral cavity is their resistance to dissolution or disintegration. Acid erosion has a clinical significance because acidic conditions can occur orally either due to the ingestion of acidic foods or the degradation of polysaccharides to acids in stagnant areas of the mouth [(5)]. This quality is strongly influenced not only by the intrinsic characteristics of the materials, but also by the environment to

which they are exposed to. It's known that the oral cavity is a complex, aqueous environment where the restorative material is in contact with saliva. In addition to low pH conditions that influence the material's mechanical and physical characteristics [6].

The erosive activity of citric, malic, phosphoric, and other acids as ingredients of beverages and foodstuffs has been demonstrated in many in vitro, in situ, and in vivo studies [7-9]. Most of the acidic foodstuff contain citric acid as the main ingredient [10], denoting the importance to select different ranges of pH values of this acid and study their effects on the Microhardness and the surface roughness of dental resin composite restorations.

Regarding the surface hardness, it represents the material's strength to its surface plastic deformation. A material's hardness is the result of interaction of the properties such as strength, ductility, malleability, to cutting and abrasion. A decrease in the microhardness value may indicate a superficial degradation, and therefore a change in its roughness, which collaborates with the accumulation of plaque and consequently the deposition of lactic acid, hence jeopardizing the restoration's longevity [11].

Roughening can be a consequence of the chemical dissolution of restorative materials by exposure to chemicals from acidic drinks and acidic food items. Residual surface roughness of restorations encourages plaque accumulation and consequently causes damage of the periodontium. Also, roughness of the surface of the restoration increases its susceptibility to discoloration [11, 12].

Both the surface roughness as well as the hardness of the composite resin are affected by its characteristics, such as the type of