The Effect of Modified Zinc Oxide Nano Fillers Addition on Some Properties of Heat Cured Acrylic Resin Denture Base Material

A thesis

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Abstract

The polymethylmethacrylate (PMMA) is the most reliable material for the construction of removable prosthodontic appliances, but unfortunately this material is far from ideal in fulfilling the mechanical and physical requirements, it has shown to be lacking of two important properties which are strength and radiopacity.

The aim of this study was to evaluate the effect of modified zinc oxide (ZnO) nano filler addition on some mechanical and physical properties of heat cure acrylic denture base material (PMMA). These properties were impact strength, transvers strength, surface hardness and surface roughness, in addition to the radiopacity.

ZnO nano particles were coated with a layer of trimethoxy sily propyl methacrylate (TMSPM) before dispersed and sonicated in monomer (MMA) in different percentages 0.5%, 1%, 1.5% and 2% by weight, then mixed with acrylic powder as general conventional method. Two hundred fifty (250) specimens were prepared for this study where they divided into (5) groups according to the used tests, for each test five subgroups according to the percentage of modified ZnO nano filler (one control and four with modified ZnO nano filler).

Fourier Transform Infra-red spectrophotometer (FTIR) confirmed that TMSPM reacted with the nano ZnO particles and bonded with PMMA matrix. Significant increase in impact strength (9.44 KJ/m^2) and non-significant increase in transverse strength (114.97 N/mm^2) occur in acrylic reinforced with 0.5wt%, while highly significant increase occur in both of them at 1wt% and 1.5wt%, but non-significant decrease was observed in both of them at 2wt% when compared with the control groups. Non-significant increase in surface hardness (85.99) appear at 0.5wt%, while highly significant increase occur at 1wt%, 1.5wt% and

2wt% ZnO. Non-significant increase in surface roughness appear with addition of modified nano ZnO at different percentages. For radiopacity, highly significant increase had occurred with the addition of modified nano ZnO in all percentages .

Finally, within the limitations of this study, we can conclude that the maximum increase in impact and transverse strength was observed in acrylic resin nano composite containing 1.5wt% of modified nano ZnO, but this strengths decrease with further increase of modified ZnO nano fillers content. Also, the addition of modified nano ZnO highly increases the surface hardness and slightly increases surface roughness with increase the concentration of modified nano ZnO. The addition of modified nano ZnO particles highly increase the radiopacity of heat cure acrylic (PMMA), this increase was proportional to the concentration of modified nano ZnO.