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Evaluating Some Physical and Mechanical Properties and Candida albicans Adherence Inhibition of New Polymer Nanocomposite (PMMA /ZrO_2-TiO_2)

A Thesis

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Abstract

***Background*:**

Polymethyl methacrylate (PMMA) is still the most common denture base material owing to its desirable properties including low cost, ease of processing and repair, superior aesthetic and stability in the oral environment. However, it doesn't fulfil the entire ideal requirements of denture base materials for its poor impact resistance, increase water sorption, poor thermal conductivity and lack of anti-fungal effect.

Aim of the study:

The purpose of this study was to produce a new modified polymer nanocomposite (ZrO_2-TiO_2/PMMA) and evaluate some physical, mechanical, *Candida albicans* adherence properties of the new polymer nanocomposite including: impact strength, transverse strength, thermal conductivity, water sorption and solubility and *Candida albicans* adherence.

Materials and Methods:

Both ZrO_2 and TiO_2 nano fillers were first silanized with TMSPM (trimethoxysilyl propyl methacrylate) silane coupling agent then they were added by ultrasonication with the methylmethacrylate (monomer) to achieve good dispersion of the nanoparticles before being mixed with the polymer.2% of modified (ZrO_2:TiO_2) nano fillers in (1:1) ratio was selected as the best reinforcing concentration and proportion according to the pilot study. Five different isolates of *Candida albicans* were obtained

from fifteen patients suffering from oral candidiasis, all isolates were identified by standard microbiological methods.

180 specimens were constructed by conventional water bath processing technique and divided into 2 groups: 90 specimens for control group 0% nanofillers and 90 specimens for experimental group then each group was subdivided into 5 groups according to the test conducted with 10 specimens for impact, transverse, thermal conductivity and water sorption and solubility and 50 specimens for candida adherence test which was further divided into five sub-groups with 10 specimens for each isolate.

Results:

The interaction of TMSPM silane and the nanofillers was confirmed by FTIR (Fourier Transform Infra-red spectrophotometer). Independent t-test showed a highly significant increase in impact strength (9.838) Kj/m^2 and transverse strength (101.705) N/mm^2 and non-significant increase in thermal conductivity (0.286) W/m.C° of the new polymer nanocomposite. In addition, a non-significant decrease in water sorption and significant decrease in solubility also a high significant decrease in the adherence of *Candida albicans* for all of five different strains was observed.

Conclusions:

The addition of 2 wt.% of modified (ZrO_2:TiO_2) in (1:1) ratio considerably improved the impact and transverse strength, had a positive effect on the thermal conductivity and water sorption and solubility. In addition, it was highly effective in reducing the adhesion of *Candida albicans* to the surface of heat cured acrylic resin.