Abstract

The complete dentures are made from different acrylic resins by various technologies. These materials are fragile and frequently appear cracks that lead to fractures of prosthetic dentures.

In the present thesis, many studies are done to develop the properties of PMMA resin that is used for upper and lower complete denture base materials, by using composite materials consists of poly methyl methacrylate (pour PMMA) resin as reference material, reinforced by two different types of particles, which included: nano-hydroxyapatite (nHA) particles and micro-zirconia (ZrO_2) particles that were added selectively with different volume fractions of (1%, 2% and 3%), followed by another addition of woven glass fiber and woven Kevlar fiber with a fixed volume fraction of (5%) to PMMA composites. Specimens' consist of a six groups where prepared by using (Hand Lay-Up) method from the composites materials and hybrid laminated composites materials.

FTIR, DSC and AFM, in addition to morphological test, where done by (SEM), to conform the characterization of the materials miscibility.

The experimental part of this study included performing many mechanical tests which, includes (Tensile, Compression, Impact, Flexural, Maximum Shear Stress, Hardness, Surface Roughness and Fatigue) tests. And some of the physical tests which, includes (Density, Water Absorption and Thermal Properties).

The results of this study showed that using different types of reinforcing materials had a great effect on the properties of prepared composite for denture base material. And showed the values of most properties increased with increasing of the volume fraction of (nHA and ZrO_2) particles in polymer composite materials. While, the (elongation, impact strength, surface roughness, water absorption and specific heat)

properties were decreased. The ZrO_2 particle and woven mat Kevlar fiber had shown greater values for the most composite materials properties.

Also the results showed the maximum values for hybrid laminated composite properties (tensile strength, modulus of elasticity, flexural modulus, impact strength, fracture toughness, surface roughness and water absorption) were obtained in hybrid laminated composite materials for sixth group specimens. While, the maximum value for properties (compression strength, flexural strength, max shear stress, hardness, density, thermal conductivity and thermal diffusivity) were obtained in hybrid laminated composite materials for fourth group specimens.

The fatigue test results showed that the fatigue strength of the hybrid laminated composite materials (PMMA-5% K.F-3% nHA) was higher than fatigue strength of hybrid laminated composite materials (PMMA-5% G.F-3% nHA) and (Pure PMMA) resin. The fatigue strength values at (10^6) loading Cycle for above specimens were (52, 38 and 15 MPa).

The lower value of the surface roughness was obtained in the hybrid laminated composite materials (PMMA-5% G.F-3% nHA) specimen.

The results in DSC test, showed that the maximum value of glass transition temperature was obtained in hybrid laminated composite materials for (PMMA-5% K.F-3% ZrO_2) specimen.

The theoretical part included calculations the values of theoretical safety factor and Poisson's ratio. While the numerical part based on finite element method (F.E.M), which was performed by using program (ANSYS-15) to analyze the prepared of denture composite materials and evaluate its characteristics which represent total deformation distribution, equivalent stress and equivalent elastic strain. This was performed by obtaining twenty one models for the PMMA composite dental prostheses which were treated as three dimension structure. The numerical results of the F.E.A showed coincided with some of the experimental results.