DOI : 10.35124/bca.2019.19.2.3245

Biochem. Cell. Arch. Vol. 19, No. 2, pp. 3245-3250, 2019 | www.connectjournals.com/bca | *ISSN 0972-5075*

EVALUATION THE EFFECTS OF TWO METHODS OF INCORPORATION OF SILICA NANOPARTICLES INTO MICROWAVE TREATED AND UNTREATED POLYMETHYL METHACRYLATE POWDER ON IMPACT STRENGTH AND SURFACE HARDNESS

Makarem M. Abdulkareem

University of Karbala, College of Dentistry, Department of Prosthodontics, Iraq.

(Received 16 April 2019, Revised 29 June 2019, Accepted 2 July 2019)

ABSTRACT : Despite being low in mechanical properties, polymethyl methacrylate (PMMA) is the most commonly used material in construction of removable dentures. The aims of this study were to investigate the effects of addition of two concentrations and methods of dispersion of Silicon Dioxide Nano Particles (SiO_2 NP) into microwave treated and untreated PMMA powder on impact strength and surface hardness.Materials and Methods:Polymethyl methacrylate powder were treated with microwave irradiation at a power level of 360watt for ¾ hr. Two concentrations (0.05 %and 0.1%) of SiO_2NP were added separately into microwave treated and untreated PMMA powder. Also the same two concentrations of SiO_2NP were added to the methyl methacrylate (MMA) monomer then mixed with microwave treated and untreated PMMA powder. The total samples were 90 samples, the samples were divided into nine groups; each one contains five samples for impact strength test and surface hardness test. The collected data were analyzed using analysis of variance t- test, the results have considered significant at P≤0.05. Results: the highest impact strength value and surface hardness was observed in group containing 0.1% silica nanoparticles added to MMA monomer then mixed with microwave treated PMMA powder (G9). Also the results revealed that (G5, G7, G8 and G9) groups showed statistically significant increase in impact strength and surface hardness when compared with the control group.Conclusion: the incorporation of (SiO_2NP) into acrylic resin improves the impact strength and surface hardness of denture base resin. Moreover, the addition of nanoparticles to the monomer showed better results than the addition to the polymer powder. The addition of SiO_2NP to microwave treated PMMA showed better results than the addition to untreated PMMA powder.

Key words **:** Silica, nanoparticles, impact strength, polymethyl methacrylate.

INTRODUCTION

One of the main problem of polymethyl methacrylate (PMMA) material, which is mostly used for the fabrication of removable dentures, is considered to be its weak mechanical properties. Recently many efforts to enhance the low mechanical properties of polymethyl methacrylate material. In general, there are three methods that have been considered to improve the mechanical properties of the denture base material; seeking for or development of a new substitute material to polymethyl methacrylate material; chemical modification of PMMA; and the strengthening of the polymethyl methacrylate (Mumcu *et al*, 2011; Alla *et al,* 2013).

More attention has directed toward the addition of nanoparticles into PMMA to improve its properties. The nanofillers are expected to scatter more evenly than large micro fillers within a polymer mass, this interface between polymer and nano filler lead to the properties of the composite materials(Safi, 2014). Both microwave irradiation of PMMA powder and the addition of Al_2O_3 and Ag nanoparticles is effective in increasing the flexural strength of denture base resin. Also the reduction in the particle size of the PMMApowderby using microwave and this outcome lead to a substantial improvement in the thermal conductivity and hardness of the acrylic samplesprepared from that powder (Abdulkareem and Hatim, 2015; Abdulkareem and Hatim, 2016).

Crystalline silica is the scientific term for a group of minerals consist of silicon and oxygen atoms that are arranged in a three dimensional repeating form (Lujan, 1992).The hybrid structures of silica and polymer is the most studied material as it shows excellent physical reinforcement, high thermal resistance, high flexibility, high gas permeability and low surface energy. Moreover,