The effect of addition of untreated and oxygen plasma treated polypropylene fibers on some properties of heat cured acrylic resin

(A comparative study)

A thesis

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Abstract

Background: Polymethyl methacrylate (PMMA) had been the most popular material of dentures bases since 1937 because of its advantages including good aesthetic, accurate fit, easy clinical and laboratory manipulation and inexpensive equipments. Since the introduction of (PMMA) as a denture base material, it suffered from having relatively unsatisfactory properties like low impact and transverse strength to overcome these limitations, polymer reinforced by adding materials such as polypropylene fibers. Improvement adhesion between the fibers and the matrix by using different techniques such as plasma result in a greater strength, as well as in great loading capability.

Aim of the study: This study was performed to evaluate the effect of adding untreated and oxygen plasma treated polypropylene fibers to heat cured acrylic resin on some physical and mechanical properties such as (impact strength, transverse strength, surface hardness, surface roughness, water sorption and solubility).

Materials and methods: One hundred fifty (150) prepared specimens were divided into 5 groups according to the tests, each group consisted of 30 specimens and these were subdivided into 3 groups (unreinforced heat cured acrylic resin as control group, reinforced acrylic with untreated polypropylene fibers group and reinforced acrylic with oxygen plasma treated polypropylene fibers group).

Results: Chemical tests and Fourier Transform Infrared Spectrophotometer (FTIR) for different time oxygen plasma treated polypropylene fibers (1,2,3 and 4 minutes) revealed that four minutes oxygen plasma treatment produced chemical changes by inducing new oxygen containing functional groups to the treated surface.

The results of addition of untreated polypropylene fibers to heat cured acrylic resin revealed a highly significant increase in impact strength (9.705 Kj/m^2), surface hardness (86.447), water sorption (0.386mg/cm^2) and significant increase

in water solubility (0.02mg/cm^2); while non- significant difference in transverse strength (96.801 N/mm^2) and surface roughness (0.908 µm) compared with the control groups. On other hand, the results revealed that the addition of plasma treated polypropylene fibers to heat cured acrylic resin lead to a highly significant increase in impact strength (10.986 Kj/m^2), surface hardness (86.517), surface roughness (0.915 µm), and water sorption (0.409 mg/cm^2); while non significant difference in transverse strength (97.523 N/mm^2) and water solubility (0.019 mg/cm^2) compared with control groups.

Scanning Electron Microscope (SEM) for fracture surface of impact strength test specimen reinforced with plasma treated polypropylene fibers showed improved adhesion between treated fibers and matrix compared with specimen reinforced with untreated polypropylene fibers.

Conclusion: Finally within the limitation of this study it can be concluded that polypropylene fiber reinforcement is an effective method to increase fracture resistance of denture bases; while reinforcement with four minutes oxygen plasma treated polypropylene fibers further increase the fracture resistance.