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Comparison of Denture Base Adaptation and Some Mechanical Properties among Conventional, CAD-CAM and 3-D printer denture base materials.

A Thesis

submitted to the Council of the College of Dentistry / University of Baghdad in partial fulfillment of the requirement for the degree of master of science in prosthodontics

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ABSTRACT

Background: Heat cured polymethylmethacrylate (PMMA) resin is the most widely used material for the construction of removable prostheses due to its superior physical and chemical characteristics, ease of processing and reasonable cost. However, there are a few limiting properties, most importantly is the release of residual methyl methacrylate monomer (MMA) which affects the dimensional stability, the adherence of oral bacteria such as *Candida albicans* to the resin indicate the increase in surface roughness and the prolonged chair side appointments required for the fabrication of the prostheses.. The study emphasized the digital technologies of Computer aided design- Computer aided manufacturing (CAD-CAM) and three-dimensional (3D) printing.

Aims: This study investigates the effect of technologies for denture base fabrication and compare the mechanical properties (denture base adaptation, surface roughness and surface hardness). Compare of some mechanical properties and denture base adaptation between three types of acrylic resins; conventional heat-cured acrylic, CAD-CAM acrylic and 3-D printer acrylic by digital superimposition.

Materials and Methods: Ninety poly methyl methacrylate (PMMA) study specimens divided into three groups (for each 30 sample) which were fabricated by conventional, CAD-CAM and 3-D printer. Each group was subdivided to other three group (10 in number) for evaluating of denture base adaptation, surface hardness and surface roughness. Denture base adaptation test including record base fabrication by the reference base in which it designed by EXOCAD and saved as Standard Transformation Language (STL) files, after fabrication of 30 record base the digital superimposing with the best fit by EXOCAD was done and measuring the gap in 60 points in

which it distributed over the whole anatomical landmark. The hardness and roughness tests specimens were fabricated by Computer Numerically Controlled (CNC) machine with dimension (length=65mm, width=10mm and thickness=2.5mm) and tested by shore D durometer and profilometer respectively. The data were statistically analyzed using ANOVA, and Tukey's multiple comparisons test (P=0.05).

Results: the mean values between three main groups (CAD-CAM, 3-D printer) should be different from conventional acrylic resin. CAD-CAM acrylic resin significantly improved the denture base adaptation, surface roughness and surface hardness over the conventional and 3-D printer acrylic resin. One way ANOVA test is the selected test for the results.

Conclusion: By comparing CAD-CAM fabrication with conventional heat-cure and 3-D printer denture base processing techniques, the most accurate and repeatable fabrication technology was proved to be CAD-CAM.

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رسالة

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