Biomaterials 2017 - The use of silica nano-particles and microwave irradiation in dental PMMA repairs: Experimental investigation into the mechanical properties and dimensional stability of the repaired PMMA after aging - Nour El Houda Kharbech - University of Monastir, Tunisia

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Abstract

Statement of the Problem: Despite ceaseless evolutions in the dental practice, PMMA resin has managed to keep a prime position in the panoply of dental materials. Yet, this material is far from being perfect. Concerns are constantly reiterated throughout literature about its lack of mechanical resistance which results in frequent fracture and fatigue failures of dentures. This fracture creates inconvenience to both the patient and the dentist thus it could be considered as a failure of the executed treatment, in addition to further frequently unnoticed consequences regarding the incurred costs to the community of the dentures' repair. Despite the wide range of solutions suggested to repair the damaged denture and to avoid its further fracture, a consensus seems not to be established yet. Recently, the use of microwave irradiation and nanofillers including silica nanoparticles with PMMA denture-resin has attracted researchers' attention thus it showed encouraging results in different studies but their efficiency for repairs need to be further investigated.

Methodology & Theoretical Orientation: An in vitro study was carried out to investigate the flexural strength, fracture toughness and dimensional stability of 120 repaired PMMA samples after aging in artificial saliva. Autopolymerizing resin was used to repair them following four methods. For the first group, autopolymerizing resin was used alone. In the second, samples were post-treated with microwave irradiations. In the third, the autopolymerizing resin was filled with 2% nanosilica. For the fourth group, the second and the third approaches were combined.

Findings: The investigated mechanical properties showed higher mean-values when silica nanoparticles and/or microwave irradiation were used compared to the repair with autopolymerizing resin alone. The dimensional variation rates were under 0.03% for all the groups.

Conclusion & Significance: The combination of autopolymerizing resin filled with 2% silica nanoparticles and post polymerization treatment with microwave irradiation showed the highest mechanical properties without affecting the dimensional stability of the repaired samples.

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