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ORIGINAL ARTICLE

The efficacy of reinforcement of glass fibers and ZrO_2 nanoparticles on the mechanical properties of autopolymerizing provisional restorations (PMMA)

Abstract:

Objective: to investigate and compare the reinforcing effects of glass fibers (GFs) and ZrO2 nanoparticles at different ratios on the Flexural Strength (FS), Microhardness (MH), and Surface Roughness (SR) of autopolymerizing provisional PMMA.

Methods: A total of one hundred and twenty specimens of autopolymerizing PMMA were prepared for FS, MH, and SR tests and grouped as follows: no additives (control group), for the tested groups, different ratios of GFs and ZrO2 at 5% of autopolymerizing PMMA were incorporated. The ratios of GFs/ZrO2 nanoparticles were 0%-5%, 1%-4%, 2%-3%, 2.5%-2.5%, 3%-2%, 4%-1% and 5%-0% (n = 5). The FS was evaluated using the three-point bending test, MH was evaluated using the Vickers microhardness tester and SR was evaluated using a contact-type profilometer. Data were analyzed using ANOVA, Tukey's test, and Person correlation at 0.05 level of significance.
Results: The unreinforced group had the lowest FS, MH, and SR mean values followed by (0% GFs+5%ZrO2), (1% GFs+4%ZrO2), (2% GFs +3%ZrO2), (2.5% GFs+ 2.5% ZrO2), (3% GFs+2%ZrO2), (4% GFs+1%ZrO2) and (5% GFs+0%ZrO2) which had the highest values.

Conclusion: Hybrid reinforcement with GFs, ZrO2 nanoparticles, or a combination of them effectively improved flexural strength and microhardness of autopolymerizing provisional PMMA that would create provisional restorations with extended clinical service. GFs demonstrated superior reinforcing effects compared to ZrO2 nanoparticles. However, reinforcement with 2.5–5% GFs increased the surface roughness for provisional restoration.