Evaluation of push out bond strength in calcium enriched mixture cement (CEM Cement) mixed with Ag/ZnO/ZSM-5 and TiO2/ZnO/ZSM-5 nanoparticles in furcation perforations

Abstract

Intruduction: Calcium-enriched mixture cement (CEM cement) is a calcium silicate cement with antimicrobial properties, which is used in the endodontic field, including vital pulp therapy, repairing various perforations. When CEM cement is used in the repair of furcation and root perforations, this material is subjected to pull-out forces, so this cement should have sufficient push-out bond strength against such forces. In recent studies, silver-zinc oxide (Ag/ZnO) and titanium-zinc oxide (Ti/ZnO) nanoparticles in a scaffold of zeolite have been considered to improve the physicochemical and antibacterial properties of calcium silicate cements such as MTA. The aim of present study was to evaluate the effect of incorporating the mentioned nanoparticles to CEM Cement on the push out bond strength in furcation perforations.

Material and Metods: The crown of 30 extracted mandibular first molar teeth was decoronate from the CEJ. Then, perforations with a diameter of 1.3 mm were simulated. The teeth were divided into five groups (CEM without nanoparticles, CEM containing 5-Ag/ZnO/ZSM with 3 and 6% by weight and CEM containing 5-TiO2/ZnO/ZSM with 3 and 6% by weight). By using the universal test machine, push bond strength of was measured with Megapascal unit. The data obtained from the study were analyzed using the statistical software "SPSS V.27" and One way ANOVA ($P<0.05$)

Results: The mean of bond strength in CEM cement containing 5-Ag/ZnO/ZSM nanoparticles 3 and 6% by weight and 5-TiO2/ZnO/ZSM 3 and 6% by weight was significantly higher than CEM cement without nanoparticles ($P>0.001$). value). Also, there was no significant difference between the mean of bond strength in groups containing the same nanoparticles but with different weight percentages (P-value <0.05).

Conclusion: According to the results obtained from this study, the addition of zinc oxide-titanium oxide and zinc oxide- silver nanoparticles into the ZSM-5 zeolite scaffold, increases the push-out bond strength of calcium-enriched cement.

Key words: CEM cement, push out bond strength, zeolite, nanoparticle