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## **Investigating the Alkaline Potential of Mineral Trioxide Aggregate Repair Using Selenium Nanoparticles**

## Abstract

This study aimed to determine the effect of adding selenium nanoparticles (SeNPs) to mineral trioxide aggregate (MTA HP) concerning alkalinizing potential. Additionally, it examined the set material after SeNPs incorporation using Field Emission Scanning Electron Microscopy with Energy Dispersive X-ray analysis (FE-SEM/EDX) for characterizing the elemental composition and morphological alterations resulting from the integration of SeNPs. Cement samples, both before and after SeNPs incorporation, were examined using FE-SEM/EDX. The pH level was also measured with a pH-meter previously calibrated with solutions of known pH, to evaluate the alkalinizing activity of the integrated substance at different concentrations of nanoparticles: Group 1 (control): 0% w/w SeNPs, Group 2: 0.5% w/w SeNPs, Group 3: 1% w/w SeNPs, Group 4: 1.5% w/w SeNPs and Group 5: 2% w/w SeNPs after 1, 7, 14, and 30 days in distal water. The data were analyzed by one-way ANOVA and Tukey tests ( $P \leq 0.05$ ). According to FE-SEM/EDX, the morphological characteristics indicate that SeNPs were successfully dispersed and integrated into the MTA repair matrix. EDX examination validates the presence of Selenium, confirming successful integration. The findings confirmed that the MTAHP showed a high pH level with a discernible reduction in the alkalinizing activity with each incorporated concentration of (SeNPs) that significantly differed from the control group across various periods at ( $P \leq 0.05$ ). Consequently, the findings indicate that the addition of SeNPs to MTA HP has a notable impact on the pH of the storage solution, leading to a significant decrease in pH values for all concentrations and periods when compared to the control group. The alkalinizing action of MTA HP is highly affected by the incorporated SeNPs, making it more suitable for application in pulpal tissue. This study contributes to our understanding of the morphological alterations and elemental composition of SeNP-incorporated MTA HP, enhancing its potential applications in dental and tissue regeneration.