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Premixed Calcium Silicate and Resin Sealers: Physicochemical and Mechanical Characteristics

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Introduction

The oral surgeon recorded each patient's non-opposition to the use of their tooth in their chart after informing them of the study's procedure and goals. For transport to the laboratory, alveolar ligaments were kept in complete medium with 0.5 mg/mL amphotericin B. A standard method was used to isolate PDLs: Alveolar ligaments are first washed three times in five minutes with PBS. After that, they are digested for two hours at 37ºC in an enzymatic solution containing dispase at 4 mg/mL and collagenase at 2.5 mg/mL, making sure to manually mix the solution every 15 minutes. In 50 mL of digestion solution, one to four ligaments from the same patient are treated simultaneously. A 70 m cell sieve is used to filter the solution after the ligament has completely dissipated. After that, the suspension of cells is centrifuged at 200 g for 5 minutes. In a 25 cm^2 flask, cells are resuspended in 5 mL of complete medium and incubated at 37ºC and 5% CO_2. Every three days, the medium is changed. Flow cytometry was used to check the cells for CD_{90}, CD_{73}, CD_{34}, CD_{45}, HLA-DR, CD_{105}, and CD_{11b} before using them. A specific medium (GibcoTM-MEM, Thermo Fisher Scientific, Waltham, MA, USA) containing 10% fetal bovine serum and 1% penicillin–streptomycin was used to cultivate the cells. AHP, AHPB, and WRST specimens were incubated for eight days at 37°C in 500 L of complete medium to create activated media. Every two days, the culture switched out its medium. After eight days, the specimens were fixed using a solution of 0.05 M glutaraldehyde in 4% cacodylate buffer for two hours, as described in a previous study. After that, the specimens were rinsed three times with 4% cacodylate buffer for five minutes each, and then they were dehydrated in a graded series of ethanol (35%, 50%, 70%, 95%, and 100%) for three minutes each. Hexamethyldisilazane (HMDS), a drying agent, was used to finally dry these. After being placed in a 1:1 HMDS solution for ten minutes, the specimens were then placed twice in 100%HMDS for ten minutes each. Using a Hummer JR sputtering device (Technics, CA, USA), all specimens were sputter-coated with gold–palladium (20/80) in a layer 20 nm thick. At a working distance of 10 mm, the specimens were examined and analyzed at a magnification of 600. high vacuum), and a Quanta 250 FEG scanning electron microscope (“FEI Company, Eindhoven, The Netherlands”) was used to take images of each sample for its morphological characteristics.

Discussion

A contact angle test was used to measure the absorption of a 5 mL drop of distilled water on the surfaces of the tested AHP, AHPB, and WRST; this was done to find out how hydrophilic the tested materials were. To ensure proper material setting, all specimens were kept in the dark at 37ºC for 48 hours. The samples were then placed in the fume hood for the night to remove any remaining water from their surfaces. The hydrophilicity (90º) and hydrophobicity (>90º) of materials' surfaces have been defined using a 90º cutoff. The surface hydrophilicity of both CS materials and AHP (epoxy resin) was higher. Additionally, these materials' porosity was clearly visible, whereas AHP lacked any obvious pores. As a result, the fact that AHP has a higher contact angle than AHPB and WRST could be due to the differences in their porosity and chemical composition.

Conclusion

When the AHPB sealer-created specimens were tested, the lowest compression modulus and strength were found. In general, the flexibility of CS sealers is inversely proportional to the amount of calcium silicate present. Additionally, the mechanical properties of the cements are influenced by the calcium silicate hydrate, which is the most important phase in cement paste. Morejon-Alonso, et al. demonstrated that the addition of tricalcium silicate to apatite cements might enhance the bioactivity and mechanical properties. Therefore, the fact that AHPB contains only 5-15 percent tricalcium silicate in comparison to conventional CS, which contains dicalcium silicate (7-15 percent) and tricalcium silicate (20-35 percent), may account for the decrease in AHPB's mechanical properties compared to WRST (both are CS sealers).

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