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Calcium Hydroxide-Releasing Materials on Long-Term Collagen Degradation

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Objectives Collagen degradation in dentin is influence by the activation of host-derived enzymes under varying pH conditions. This study investigated the effects of calcium hydroxide-releasing or S-PRG-containing alkaline materials on host-derived enzymatic degradation and elastic modulus of coronal dentin.
Methods Sound human molar dentin beams (0.3×3×7mm) were demineralized in 0.5 M ethylenediaminetetraacetic acid (EDTA) and rinsed in distilled water at 4 °C for 2 hours under constant stirring. Following drying in a vacuum desiccator for 72 hours, beams were distributed into five groups (n=10/group) based on dry mass. Mimiciking a clinical scenario, occlusal surfaces were placed in contact with material blocks (1×3×7mm) prepared from four materials: (1) Bio-C Repair, (2) S-PRG sealer (3) Orbis MTA, and (4) TheraCal. Untreated beams served as control. Specimens were incubated in 0.5 ml artificial saliva and aged in a water-shaking bath (37°C with 60 rpm speed) for up to 6 months. Dry mass and elastic modulus (E) were reassessed, and aliquots of incubation media were analyzed for hydroxyproline (HYP) to quantify total collagen degradation. Data were analyzed using Kruskal-Wallis tests (α=0.05).
Results Bio-C exhibited the highest cumulative HYP release (23.3 µg HYP/mg dry dentin), representing a nine-fold increase compared to the control group (2.5 µg). Additionally, Bio-C showed the highest dry mass loss, reaching 62% at 6 months, significantly differing from the control, S-PRG, and TheraCal groups ($p<0.05$). Elastic modulus values followed a similar trend. At three weeks, Bio-C showed a dramatic decrease in E, showing a significant difference from control and TheraCal groups ($p<0.05$). By the end of the experiment, both Bio-C and Orbis showed significant differences between initial and final E values ($p=0.002$).
Conclusions Calcium hydroxide-releasing materials were associated with increased degradation of the collagen matrices. This could potentially compromise the long-term treatments.