

Surface Modification of Polycaprolactone and Hydroxyapatite Endosseous Implant Fixture Coatings

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Over 4.4 million Americans have at least one internal fixation device (dental or orthopedic implant) susceptible to implant loosening post-surgery. Biointerlocking implant coatings often degrade and release toxic residual monomers. The project investigates the design and fabrication of a bioinert textured implant coating for an endosseous fixture to promote osseointegration and component adhesion. Two scaffold simulations with osteoconductive topographies were developed using a new approach. Coating components were synthesized using four varying concentrations of hydroxyapatite mineral vortex mixed into 0.2 mL sets of 12% and 15% polycaprolactone and acetone solutions. Solutions were pipetted into 40 total cylindrical moulds (diameter 0.6 cm, depth 0.4 cm), stippled onto 16 total aluminum slides, and set at room temperature for 72 hours. Cylindrical samples were submerged at 37 degrees Celsius in a Modified PBS solution and periodically massed based on concentration (4, 7, 14, 28 days). The 26% HA concentration in a 12% solution and a 66% HA concentration in a 15% solution had the largest mass difference over a 28-day period, indicating surface osteoconductivity by successful increase in the nucleation of crystals. SEM images and X-Ray Spectroscopy indicate hydroxyapatite remained in samples over the 28-day period and the bioinert surface held positive bond strength. Coating components would be particularly helpful to the osteoporotic population and could be resized for the application of the interface to various implant surfaces. Final procedures require lower fabrication temperatures and thus are less extensive and equipment, time, and energy intensive than plasma-spraying alternatives.