Development and Testing of 45S5 Bioglass via Acid and Base Sol-Gel Polymerization and Fusing onto Gallus gallus domesticus Cervical Bones for Bone Grafting Treatment

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As needs for different implant materials in the surgical field rise, bioceramics, specifically bioglass are proving to be more effective than traditional graft materials. Bioceramics are ceramic materials used in medical implants to replace hard tissue in vivo. Bioglass is beneficial in that it eventually reabsorbs and prevents harmful byproducts and genotoxicity sometimes onset by other implants. This research created a bone-bioglass complex to test biocompatibility, tensile strength, and hydroxyapatite regeneration of gels formed in acidic and basic environments. The sol-gel procedure was used to create a gel-like substance containing silica chains found in 45S5 bioglass. Gel synthesis was altered by adding hydrochloric acid or ammonium hydroxide. Differences in pH resulted in different lattice structures being created at the molecular level, with acidic gel forming linear, cross-linked silica chains, and basic gel forming clustered silica groups. After 2 and 3 days of gel formation, chicken neck bones divided into four groups based on size were coated with acid or base gel. Bones were tested for tensile strength to determine endurance in vitro, and biocompatibility using simulated body fluid (SBF) to assess biological responses. Base gel bioglass coated bones held the most weight compared to acidic bones regardless of grouping or treatment day ($p<0.001$). In addition, the masses of both acidic and basic coated bones increased when immersed in SBF, indicating fluid absorption.

Awards Won:

Third Award of $1,000

Society for Experimental Mechanics, Inc.: Third Award of $1,000