The study of a light-activated albumin protein solder to bond layers of porcine small intestinal submucosa.

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Abstract:

This study investigated the feasibility of bonding layers of porcine small intestinal submucosa (SIS, Cook Biotech, Inc.) with a light-activated protein solder. SIS is an acellular, collagen-based extracellular matrix material that is approximately 100 mum thick. The solder consists of bovine serum albumin and indocyanine green dye (ICG) in deionized water. The solder is activated by an 808 nm diode laser, which denatures the albumin, causing the albumin to bond with the collagen of the tissue. The predictable absorption and thermal energy diffusion rates of ICG increase the chances of reproducible results. To determine the optimal condition for laser soldering SIS, the following parameters were varied: albumin concentration (from 30 - 45% (w/v) in increments of 5%), the concentration of ICG (from 0.5 -2.0 mg/ml H<inf>2</inf>O) and the irradiance of the laser (10 - 64 W/cm²). While many of the solder compositions and laser irradiance combinations resulted in no bonding, a solder composition of 45% albumin, ICG concentration of 0.5mg/ml H<inf>2</inf>O, and a laser irradiance of 21 W/cm² did produce a bond between two pieces of SIS. The average shear strength of this bond was 29.5 +/- 17.1 kPa (n=14). This compares favorably to our previous work using fibrin glue as an adhesive, in which the average shear strength was 27 +/- 15.8 kPa (n=40).