BIOENGINEERING & BIOMEDICAL ENGINEERING

RESEARCH SEMINAR

IMPROVING CORROSION PROPERTIES AND MICRO-CRACKING OF COATED BIO-ABSORBABLE STENTS

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Coronary stents are commonly used to improve vessel healing following angioplasty. Traditionally, bare metal stents have been used, but they commonly result in restenosis, thrombosis, or stent fractures. Bio-absorbable stents are designed to hold the vessel open, allowing it to remodel properly, as the stent corrodes over the following 12-24 months. Current bio-absorbable stents require further development to improve the biocompatibility or mechanical and corrosion properties. We have developed a stent that amalgamates iron with stainless steel 316L in a unique way, through cold gas dynamic spraying (CGDS). Preliminary results revealed that the corrosion rate was higher than anticipated, and complete degradation in vivo would occur within 12-24 months. Micro-cracking and early mechanical losses are an issue, therefore adding a thin coating has been proposed. The coating will be added using plasma-assisted physical vapour deposition (PVD). It has also been hypothesized that PVD coatings can create a thicker more stable passivation layer and may affect the dominant corrosion mechanism. Additionally, PVD coatings have a micros-moothing effect on materials; filling cracks and crevices, which would otherwise be exacerbated upon stent deployment. The aim of this project is to investigate the effect PVD coatings have on the micro-cracks and corrosion characteristics of samples made through CGDS. These will be measured using scanning electron microscopy and mass-loss static corrosion tests.

IN VITRO ANALYSIS OF POLYMERIC MICROSPHERES CONTAINING HUMAN VOCAL FOLD FIBROBLASTS FOR REGENERATION OF VOCAL FOLD LAMINA PROPRIA

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It is estimated that among 3 to 9% of the general population has a voice problem at any given point in life. The most common disorders occur in the Vocal Fold Lamina Propria (VF-LP), specifically in the superficial layer. Injecting scaffolds is the most used strategy to regenerate this area. But recent work has shown that scaffolds may be rapidly cleared by the mononuclear phagocyte system (MPS) after injection, hampering their regeneration function. It has been previously demonstrated that microspheres (Ms) with diameter around 500µm are able to reduce foreign body response. Thus, Ms can stay in the system for a longer post-injection time. The aim of this study was the fabrication and characterization of Ms to expedite VF-LP regeneration. Electrospraying was used to fabricate alginate Ms. Taking advantage of the electronegative surface of alginate, Layer-by-layer (LBL) assembly of polyelectrolytes was used to fabricate different Ms configurations including Alginate-Poly-L-Lysine-Alginate(APA) and Alginate-Chitosan(AC). The optimal load cell concentration in the Ms was evaluated based on the morphology and integrity of the Ms. The mechanical properties were determined following two methods: 1) mechanical stability at 37°C and 2) Osmotic pressure test. The thickness of the membrane was characterized using genipin as a fluorogenic marker, and confocal laser scanning microscopy. Ms of homogeneous size distribution with a diameter of 552.74±7.72µm were obtained. Further results will be discussed during the seminar session. Viability and more mechanical studies are in progress to confirm the feasibility of Ms to support collision during phonation.

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