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Bioengineering MS Thesis Defense

Measuring the Elution of Vancomycin from a Novel Implant Surface Treatment

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Implant infections are a critical concern in the biomedical field, particularly when treating open fractures. The modification of implant surfaces to impart an infection-resistant layer has been done previously, most often through the addition of an antibiotic to the surface. The release of the antibiotic is critical to the coating's success, as the antibiotic concentration in the body must maintain at or above the drug's minimum inhibitory concentration long enough to prevent bacteria in the wound from adhering to the implant. This study investigated the release of the antibiotic vancomycin from a novel ^{3}H-vancomycin and chitosan coating to determine its elution rate and antimicrobial effectiveness.

The coating was deposited on titanium coupons and limited-contact dynamic compression plates via ENBIO's patented plasma deposition process, BioDep™. Surface and antibacterial characteristics of these samples were analyzed via gravimetric analysis, surface profilometry, and SEM imaging. The elution of vancomycin from the coating was analyzed via an animal model, consisting of seven female New Zealand white rabbits. Tissue and blood samples were analyzed via histology and liquid scintillation analysis to determine the presence of vancomycin in the samples as well as the effect of the coating on tissue morphology and bacterial presence in the wound area.

This study was able to successfully create a ^{3}H-vancomycin and chitosan antibacterial coating, apply it to implants, and measure surface and *in vitro* antibacterial characteristics. However, low radioactivity measurements in blood and tissue samples prevented vancomycin elution from being quantified by liquid scintillation analysis. Thus, no conclusion could be made about the elution of vancomycin from this coating.

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