Polymer Surface Manipulation for reduced thrombogenicity

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Strategies for improving the non-thrombogenicity of implanted polymer surfaces are reviewed. Such strategies include chemical modification, physical modification, heparin immobilization and coatings. In our recent work we have focussed on nano-topographical modification of biodegradable polymer surfaces, using templating and lithographic techniques, as well as by incorporation of multi-walled carbon nanotubes. The templating involves the use of anodized alumina modified with colloidal silica; this is followed by e-beam or deep UV lithography, and then by inductively-coupled plasma-deep reactive ion etching (ICP-DRIE). PLGA solution is then cast on the template, dried and peeled off to create physical pillars of specified dimensions (diameter, spacing and height). These modified surfaces are then incubated with platelets to quantify platelt attachment and quantification with respect to unmodified surfaces of the same polymer. Results show that the surface features influence the attachment of plasma proteins, and hence the eventual adhesion of platelets. Both platelet attachemnt density and activation are quantified for various surfaces with pillars of differing aspect ratio. Our work shows that simple topographical modification of a thrombogenic surface, such as that of a biodegradable polymer (PLGA) is sufficient to decrease platelet adhesion and activation (1). We rationalize the behaviour in terms of fibrinogen adsorption on these surfaces. We believe that such surface modification methods may lead to reduced clot formation on blood-contacting devices. References: 1. Li Buay Koh, Isabel Rodriguez, Subbu Venkatraman, Effect of topography of polymer surfaces on platelet adhesion, Biomaterials (2009) http://dx.doi.org/10.1016/j.biomaterials.2009.11.022