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Blood-biocompatible materials via plasma processing

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Biocompatible materials, e.g. vascular grafts made of polymers have successfully replaced large-diameter blood vessels, but the long-term performance of small-diameter (< 6 mm) vascular grafts is still disappointing. The main problem is insufficient biocompatibility of polymer surface with blood, which causes complications after implementation; such as thrombosis or restenosis. These complications immediately lead to an additional surgical procedure, which is expensive and unpleasant (or sometimes even fatal) for the patient. Many efforts have been done to improve surface biocompatibility of vascular grafts, mainly by coating the surface with bioactive substances such as gelatin, albumin, collagen and heparin. However, successful results have not yet been reported for small-diameter vascular grafts. A promising way to modify surface properties of vascular grafts is by plasma treatment, as this method enables modification of surface properties in terms of surface roughness, surface chemistry, wettability and crystallinity, without alternating the bulk attributes. Because these surface properties play a key role in biocompatibility of materials, we studied effects of plasma processing on polymer surfaces and correlated them with proliferation of endothelia cells and adhesion of platelets in order to achieve direct protection of vascular grafts with self-controlled bio-surface. The *in vitro* biological response of plasma processed polymers showed that more significant changes in biological response can be obtained on oxygen treated surfaces. These surfaces enabled improved proliferation of endothelia cells and reduced adhesion of platelets. This can mainly be attributed to newly formed oxygen functional groups, which seem to have remarkable influence on adhesion of platelets. And more, the platelet adhesion is also a function of polymer crystallinity, since as much lower platelet adhesion is observed on semicrystalline polymers in comparison to amorphous. Interestingly there is no significant correlation between platelet adhesion and surface wettability. So, we can conclude that low temperature oxygen plasma processing is promising method to improve proliferation of endothelia cells and to reduce adhesion of platelets from blood, and improve hemocompatible properties of vascular grafts made of polymers like PET.