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Plasmachemical grafting of RGD peptides onto cyclo olefin polymer foils to improve the proliferation of cells

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The aim was to graft RGD peptides onto plasma-modified cyclo-olefin polymers in a way that immobilization and proliferation of mammalian stem cells is promoted. For analytical reasons in medical applications, polymer foils from cyclic olefins as substrate material are advantageous due to their optical transparency. In order to overcome their surface inertness, glow discharge plasma as a straightforward method to functionalize polymeric surfaces is used. The capability of this method to create carboxylic groups was demonstrated by using acrylic acid as a precursor. This plasma results in the deposition of a carbohydrate layer containing carboxylic groups, which are detectable by XPS. This functional group is serving as an anchor group for the consecutive wet chemical grafting of the RGD peptide. To realize this aim, two reaction pathways with different bi-functional spacer chemistries were examined:

- The first attempt for coupling of RGD was done by using Diamino-PEG. This spacer was covalently bound with one of its two NH₂ groups onto the carbodiimide-activated carboxylic groups of the surface via an amide bond.
- The second one was carried out by using a heterobifunctional spacer (N-ε-Maleimidocaproic acid hydrazide, EMCH), which does contain on the one end a sulfhydryl reactive maleimide group and on the other one a carbonyl reactive hydrazide group.

All modification steps were controlled carefully by surface physico-chemical analysis methods: XPS was used to ensure covalent grafting after each step of the surface functionalization, contact angle measurements to characterize the wettability, and ellipsometry to measure the thickness of the functional layer. It could be demonstrated that the coupling of both types of spacer was successful, but only with the EMCH spacer a coupling of the RGD peptide a conservation of its bioactivity was realized as is shown by the proliferation tests of cells.

Keywords
surface functionalization
bioactive surface
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