

Influence of GO coatings as bio-active platform for tissue regeneration

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Osteo-integration and tissue regeneration are vital for the longevity, durability, and unremitting functionality of medical implants/scaffolds implanted in vivo. It's essential for biomaterials used for in vivo implantation to induce the cellular secretion of growth factors, necessary for the desired tissue generation, since the administration of artificial growth factors, in vivo, is largely prohibited.

Bioactive coatings made of GO and aC/DLC hybrid functionalized with O₂ and N₂ were successfully used to induce favorable cellular secretion of growth factors important for osteo-integration of medical implants. More precisely, stabilized Graphene Oxide (GO) thin layers in a hybrid with amorphous carbon (aC) induced the expression of vascular endothelial growth factor (VEGF) and osteoprotegerin (OPG) growth factors in fibroblasts (hGF) and, more remarkably, in osteoblasts (hOB) cells. We also observed a negative trend between hGF fibroblasts, but not hOB osteoblasts, cellular viability and GO presence in the hybrid films that might indicate the phenomenon of oxidative stress. We traced that back to the presence of higher concentrations of carboxyl and the carbonyl groups on the surface of the GO rich coatings.

The presence of GO, at certain configuration, induced bio selectivity by inducing a negative effect on hGF viability while showed no clear trend with hOB cells. The above described properties provided by GO coatings might be desirable for bio-selectivity applications and for the reduction of the undesired fibrosis process that is associated with medical implants in vivo environment. Moreover, novel plasma functionalized GO/polymer hybrid thin coating hybrid compositions are promising candidates for tissue engineering and bioengineering applications as excellent antimicrobial and anticancer platforms.