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# Graphene as a coating to induce osteogenesis on titanium

Titanium is widely used for biomedical implants and devices. Nonetheless, the time needed for the osseointegration is deemed too long. Graphene films present unique superficial properties that can overcome these limitations. Graphene is a single layer lattice of carbon atoms. It induces spontaneous osteogenic differentiation of mesenchymal stem cells (MSC). We have shown that surfaces coated with graphene increases the number of MSC expressing the bone markers osteopontin. osteocalcin and mineralization without the use of chemical inducers. Although the material holds great potential to increase osteogenesis, the successful deposition of graphene onto three-dimensional and orthopaedical devices remain a challenge due to the high shape complexity of these parts. The traditional the wet transfer of graphene onto rigid substrates employs hazardous chemicals and often damages the film, limiting the scalability and possible clinical applications. Alternatively, dry transfer techniques have been developed. Here, a dry transfer technique based on a hot-pressing method allowed to coat titanium substrates with high quality graphene and coverage area >90% with a single transfer. The graphene-coated titanium induced human osteoblast maturation (gene and protein level) and increased the mineralized matrix deposition compared to titanium alone. The graphene-coated prosthetic parts present great potential to decrease healing time and enhance bone formation in in several clinical scenarios.