Over two decades of graphene as biomaterial

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Graphene is regarded as one of the most debatable nanomaterials in modern scientific research, particular when it comes to biomedical applications due to the concerns arisen in regard to the graphene potential toxicity, particularly at higher concentrations (ranges of 50-300 mg/L). Conversely, understanding the potential relevance to risk of the graphene is much more complex particular in the hypothesis that engineered nanoparticles are dangerous until shown otherwise. One of the furthermost challenges to use graphene in the biomedical field being impossibility to prove through research that is utterly safe.
Contemporary scientific discoveries demonstrated that graphene has a wide array of potential applications due to its unique properties in both technology and medicine i.e. drug delivery, biosensors, tissue engineering, antimicrobial coatings or conductive inks. Each of the aforementioned applications is exploiting different features of this outstanding nanomaterial demonstrating its versatility and potential to revolutionize multiple fields.
The high mechanical strength have made graphene also a promising material for scaffolds in bone tissue engineering and regenerative medicine. Later findings demonstrated that graphene improves the mechanical properties to an extent never seen before and also can induce well-defined new functionalities i.e. osteoconductive and osteoinductive properties which are well beyond the initial anticipation.
Later discovery of 3D printing fabrication technique open new avenues also in the field of bone tissue engineering however the development of inks capable of producing scaffold with high biocompatibility, mineralization capabilities, and adequate mechanical properties remains a significant challenge.
Once again graphene demonstrated to be an effective solution for the development of functional formulations for bone regeneration. Graphene based formulations are foreseen as very promising and able to help to go beyond the limitations of the 3D printing technique i.e. resolution or dimensional accuracy and thus related to bone regeneration i.e. need for osteoconductive and osteoinductive features.

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