Recent advances in personalized solution for bone regeneration

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Bone health is critically important to overall health and quality of life, representing a burgeoning problem for the demographics of an ageing society [1]. Conversely, multiple myeloma (MM) is characterized by bone marrow colonising neoplastic clonal plasma cells that produce organ damage including lytic bone lesions, fractures or spinal compression contributing to poor life quality causing bone lesion even more difficult to heal. On the other hand no bone substitute has proven to be fully clinically feasible, concerns regarding complex hierarchical constructs or lack of microvascular network still being important challenges [1]. In the current work we aim to improve implementation of existing cellular / acellular bone substitutes for the serious complication of non-union bone fractures, but also aim to devise new regenerative medicine products for prompt remediation for a donor-specific hBMSC osteogenic deficiency and alleviate MM complication. Functionalized nanostructured scaffolds fabricated by coupling 3D printing / bioprinting with novel biopolymer/ graphene-based inks modified / bioconjugated with ASOs are explored for local delivery of antisense oligonucleotides (ASOs) targeting favourable biodistribution and ncRNA inhibition. Our findings provide insights into the potential of GO-reinforced biopolymer composites as promising biomaterials for 3D printing sophisticated architectures for bone tissue engineering and emphasize the importance of GO concentration, material architecture, and biomimetic design in developing effective and clinically relevant regenerative therapies for bone regeneration and bone regeneration in MM conditions [2].

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References

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