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New class of biodegradable polymeric implants for bone regeneration

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The explantation surgery of an implanted prosthesis often causes clinical complications and the patient suffers from the countless post-surgical symptoms such as infection and the lack of mobility. This issue has been clinically addressed using biodegradable polymers such as poly (lactic acid) with favourable physical and biological properties. However, the acidic degradation of these polymers causes delays in the tissue regeneration process and necrosis. We attempted to address this issue by developing new classes of biomaterials. For example, we introduce a biodegradable material based on poly (propylene carbonate) (PPC) and starch with benign degradation by-products that is only water and carbon dioxide. This polymer has superior characteristics compared with other polyesters. The results of *in vitro* and *in vivo* studies endorsed the biocompatibility of this polymer blends. In addition, we observed *in vivo* osseo integration effects of this implant in a rat hemiarthroplasty model. Therefore, this product is superior for orthopaedic fixation implantation. In yet another study, we synthesized a thermo-responsive hydrogel with the capacity to chemically bond with primary amine groups of proteins. This hydrogel has favourable gelation time that can be used as an injectable material for delivery of active compounds. The results of *in vitro* and *in vivo* studies show that this hydrogel is biocompatible with tenable mechanical properties and adhesiveness that make them suitable for broad tissue range of musculoskeletal repair. Our recent clinical study demonstrates that this hydrogel can be used successfully for socket preservation. We have also developed new class of elastic hydrogels with superior properties that can be used for 3D printing.

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