Summary

A promising new smart scaffold with potential for clinical use was prepared during our experiments. The biocompatible, biodegradable, osteoconductive and also osteoinductive 3D scaffold contains 0.5% type I collagen and 50% of hydroxyapatite with pore size around 400 um suitable for cell ingrowth and vascularization. Subsequently added poly-ε-caprolactone nanofibers improved the mechanical properties of the scaffold. The scaffold was enriched with mesenchymal stem cells and thrombocyte rich solution. The functionalized scaffold promoted new bone tissue formation throughout the defects, with uniform distribution of the newly-formed bone *in vivo* in a rabbit model, while the scaffold gradually degraded and was replaced by newly-formed bone tissue. In addition, we have found a fabrication process and materials which meet the European medicines agency requirements and can be developed for human applications. Hydroxyapatite-coated coaxial poly-ε-caprolactone/polyvinylalcohol nanofibers have been developed as a promising novel drug-delivery system suitable for bone tissue engineering.