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3D printed biodegradable stents with enhanced radiopacity for improved cardiovascular care

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Abstract

Stents are essential implantable devices that play a crucial role in maintaining the luminal patency of blood vessels, and their effectiveness determines the success of cardiovascular disease treatment. The metal stents were widely used in the past, remain permanently implanted in blood vessels and may lead to late thrombosis. To overcome this drawback, the biodegradable stents (BRS) are proposed that naturally degrade and disappear after a certain period of time following implantation in the human body. However, monitoring stents in vivo is critical to avoid misplacement and improper expansion, which can lead to complications and treatment failure. Polymer-based BRSs are radiolucent by nature and, therefore, have poor X-ray visibility. In this study, we developed a polycaprolactone (PCL) composite-based biodegradable stent using a 3D printing technique and improved its biocompatibility and radiopacity by incorporating an iodine-based biodegradable contrast agent into the PCL composite. This composite-based biodegradable stent shows improved X-ray visibility compared to bare BRS, which is essential for proper monitoring of the stent during and after implantation. The proposed biodegradable stent based on the PCL composite is expected to be medically applicable and can potentially reduce the risk of complications associated with metal stents.

Keywords: Bioresorbable Stent, Radiopacity, 3D printing

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