00300 Novel Nanocomposite Material for Bioresorbable Stents

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Aims: The concept of bioresorbable stent/scaffold (BRS) offers potential benefits over current metallic stents such as promoting positive remodeling, natural healing of vessel and allowing future reintervention. Current generation of BRS have significantly thicker struts (compared to metallic stents) due to the poor mechanical strength of resorbable polymers, which have led to large profile, affecting deliverability and increasing prevalence of scaffold thrombosis. Polymeric BRS are also radiolucent, making the assessment of scaffold expansion and lesion coverage difficult. The next generation of BRS are focusing on reducing strut thickness. Hence, the aim of this project is to develop a novel material with improved material properties and evaluating it for BRS application.

Methodology: Nanocomposite materials were extruded with the incorporation of customized nanofillers in PLLA. Mechanical testing (MTS Systems, MN, USA) was conducted to characterize the strength (which affects the strut thickness) of the nanocomposites, compared to pristine PLLA. Transmission electron microscopy (TEM) (Libra 120 Plus, Carl Zeiss, Germany) was employed to evaluate the dispersion of the nanoparticles in PLLA. Radiopacity of the nanocomposite were imaged using X-ray (Philips Clarity FD20) and examined qualitatively and quantitatively through image analysis.

Result: It was found that increasing loading of nanofillers in PLLA led to enhancement of tensile modulus (~44%) and strength (~120%) at the expense of ductility. By functionalizing the nanofillers, the nanocomposite system was able to achieve ~390% improvement in ductility. TEM images also showed that functionalized nanofillers have a better dispersion as compared to non-functionalized ones, which showed pronounced agglomeration. At higher loading of the nanofillers, the material also became more radiopaque as seen in the X-ray images.

Conclusion: With improved mechanical properties and radiopacity, this nanocomposite materials can potentially be used as a BRS material with reduced strut thickness.