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24.09. – 25.09. 2025

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Biocompatibility of NiTi stents produced by Laser Powder Bed Fusion

Nickel–Titanium shape memory alloys (NiTi-SMA) are of biomedical interest due to their unusual range of pure elastic deformability. These characteristics enable NiTi stents to be compressed for minimally invasive insertion and subsequently self-expand to their functional diameter upon deployment. Despite their composition of approximately 50% nickel and 50% titanium, a stable titanium oxide layer effectively inhibits nickel ion release, making NiTi a highly suitable biomaterial.
Conventional manufacturing of complex stent geometries, however, is both costly and time-consuming, and typically limited to tubular designs. As a result, traditional stents offer limited efficacy in the treatment of complex aneurysms. Additive manufacturing via Laser Powder Bed Fusion (LPBF) offers a promising alternative, enabling the fabrication of complex geometries. However, the process may affect the integrity of the passivating oxide layer, potentially impairing biocompatibility.
The purpose of this study was to evaluate the biocompatibility of NiTi stents fabricated using LPBF. Therefore, human endothelial cells (HUVEC) were cultured on stents produced by LPBF. After 24 hours and 7 days, cell viability and proliferation were assessed using two-color fluorescence staining. Viable cells were observed on all samples at both time points, and cell proliferation was confirmed.

These findings indicate that the biocompatibility of NiTi is maintained following LPBF processing. Nevertheless, further optimization of manufacturing and post-processing procedures is recommended before in vivo application.

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