

PROCEEDINGS

Adhesive Non-Fibrotic Interfaces for Long-Term Human-Machine Integration

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ABSTRACT

Biomaterial or device is implanted into tissue in vivo, it induces an inflammatory response known as the foreign-body reaction. The implanted biomaterials and devices face compromised functionality and efficacy in the long-term by foreign body responses and the subsequent formation of the fibrous capsule at the implant-tissue interface. Numerous approaches, including drugs, biomaterials and devices, have been developed to try to prevent fibrous-capsule formation at the implant-tissue interface. However, preventing this process across various organs remains a major challenge. Here, we demonstrate that an adhesive implant-tissue interface can avoid fibrous capsule formation by minimizing infiltration of inflammatory cells at the implant-tissue interface. Histological analysis shows that the adhesive implant can preserve the implant-tissue interface without fibrous capsule formation in diverse organs including abdominal wall, colon, stomach, lung, and heart over 12 weeks in rat models in vivo. Immunofluorescence analysis, RNA sequencing, and quantitative PCR are further performed to validate the hypothesis. We further demonstrate 1) long-term bidirectional electrical communication enabled by implantable electrodes with an adhesive interface over 12 weeks in a rat model in vivo. 2) non-fibrotic bioelectronic interfaces on diverse peripheral nerves for functional neuromodulation. These findings may offer a promising strategy for long-term anti-fibrotic implant-tissue interfaces [1,2].



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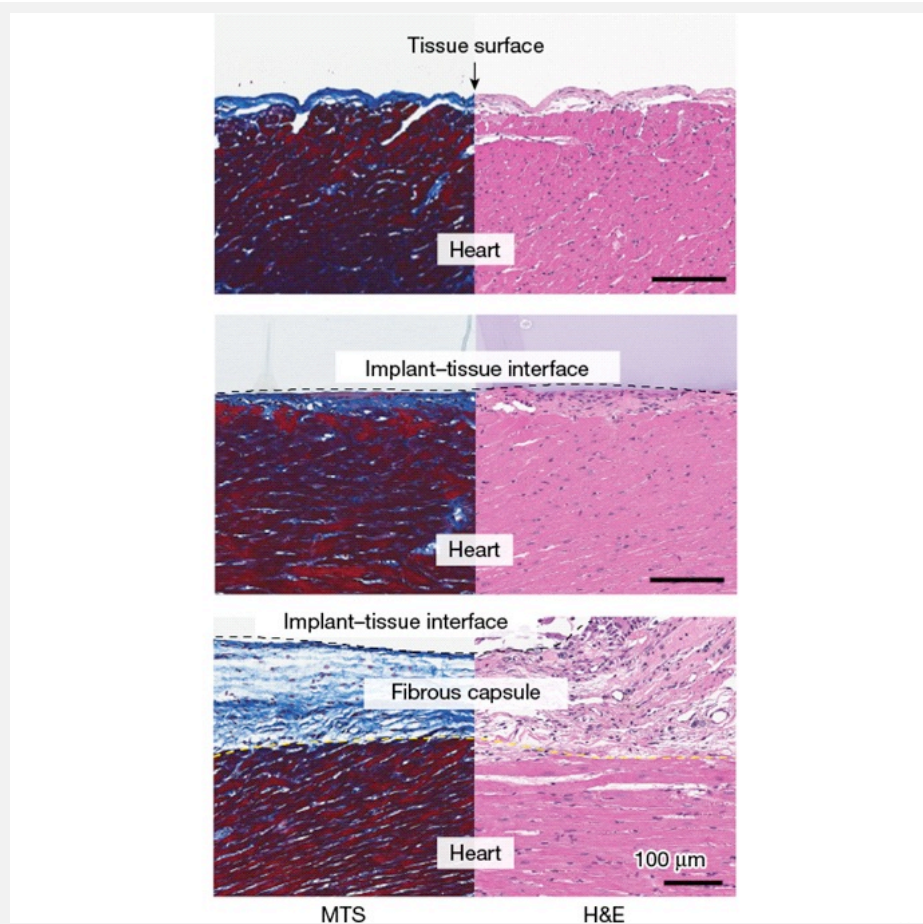


Fig. 1. An adhesive coating prevents the formation of a fibrotic capsule at the implant–tissue interface [1,2].

KEYWORDS

Soft materials; adhesive; hydrogel; anti-fibrosis

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