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Flexible Smart Bandage for Treating Infection and Initiating Wireless Wound Healing in a Closed-Loop Manner

Stanford researchers developed a novel flexible smart bandage capable of delivering precise electrical stimulation as part of an early response to wound infections.

Wound infections represent a major complication of wound injuries, occurring in 15-25% of all wounds. There remains an unsolved problem in developing a therapeutic device to rapidly detect and treat local wound infection before it becomes clinically apparent. Prior research has shown that electrical stimulation can reduce bacterial colonization and restore normal wound healing in vivo. Stanford researchers have developed a novel closed-loop wireless smart bandage that can detect early infection and deliver precise electrical stimulation via a flexible circuit. Sensors embedded in the smart bandage detect early wound infection by measuring impedance and temperature. Soft and elastic hydrogel-based microelectrodes placed around the wound form a flexible circuit capable of real-time spatially localized electrical stimulation based on the sensor signals. Overall, this biocompatible soft system could be applied to initiating wireless wound healing in a closed-loop manner without imposing any mobility restrictions to the patient.

Applications

- Closed-loop smart bandage for closed-loop wound healing
- Non-invasive wound monitoring

Advantages

- Wireless, non-bulky device for improved patient quality of life
- Reversible adhesion to skin
- Polymer-based hydrogel has lower impedance across frequency domain for more effective electrical sensing (compared to traditional ionically conducting hydrogels)
- Closed-loop control of wound healing compared to other interventions that require external monitoring (i.e., by a physician)

Publications

- Jiang, Y., Trotsyuk, A., Niu, S., Henn, D., Chen, K., Shih, C. C., ... & Bao, Z. (2022). Wireless closed-loop smart bandage for chronic wound management and accelerated tissue regeneration. bioRxiv.

Patents

- Published Application: WO2023028349
- Published Application: 20240350797

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