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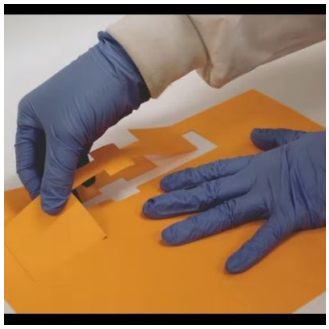
Sealing Internal Injuries with Origami-like Patch



Today minimally invasive surgery is a widely adopted format in clinical practice due to its better efficiency in terms of pain management and recovery time compared to open surgery. However, the sealing of internal injuries remain a challenge under such procedures. A new medical patch designed by MIT researchers might be a solution to this problem (Wu et al. 2021).

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The new patch, whose design was inspired by the Japanese paper-folding art origami, can be fixed around surgical tools and applied to seal the injured site. In its dry form, the patch is similar to a paper-like film, but a contact with wet internal tissue turns it into a gel that patches the wound.

In their research, the MIT engineering team aimed to satisfy several requirements. The patch should allow to be transported to the injured site without reacting with external environment on the way. It also should resist biofouling and inflammation. These were achieved by creating a synergistic combination of three layers. The main middle layer is a bioadhesive made from a hydrogel material, which reacts with a wet surface of the tissue, moulds to its contours and creates a tight seal. At the bottom there is a dynamic, blood-repellent hydrophobic fluid layer with allows the patch to be safely delivered to the injured site. The top layer is an antifouling nonadhesive elastomer film that creates a water-based barrier around the patch to protect it from contamination.

As such, the patch has some major advantages to other surgical sealants. It is resistant to contamination from bacteria and bodily fluids, which may prevent adherence to the wound and cause inflammation or scar tissue formation. It is also biodegradable.

The new patch is suitable for procedures performed directly by surgeons but also for remote robotic surgeries. Moreover, it can be used to also repair injuries from invasive diagnostic procedures, such as colonoscopy, or those caused by a trauma. The patch can be folded, like origami, to fit around surgical instruments used both in minimally invasive procedures and in robotic surgery. In the future, the engineers hope to see the new bioadhesive integrated into robotic surgery platforms as well as the overall wider clinical adoption of such materials.

You can watch a video presentation about the patch here.

Source and image credit: MIT

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