

Handheld 3-D skin printer demonstrates accelerated healing of large, severe burns

February 4 2020, by Liz Do



The handheld 3D skin printer developed by U of T Engineering researchers works like a paint roller, covering an area with a uniform sheet of skin, stripe by stripe. Blue dye was used for this photo shoot for visibility purposes. Credit: Daria Perevezentsev / U of T Engineering

A new handheld 3-D printer can deposit sheets of skin to cover large

burn wounds—and its "bio ink" can accelerate the healing process.

The device, developed by a team of researchers from the University of Toronto Engineering and Sunnybrook Hospital, covers wounds with a uniform sheet of biomaterial, stripe by stripe.

The bio ink dispensed by the roller is composed of mesenchymal stroma cells (MSCs)—stem cells that differentiate into specialized cell types depending on their environment. In this case, the MSC material promotes [skin](#) regeneration and reduces scarring.

The project is led by Ph.D. candidate Richard Cheng, under the supervision of Professor Axel Guenther, and in close collaboration with Dr. Marc Jeschke, director of the Ross Tilley Burn Centre, and his team at Sunnybrook Hospital. Their successful in-vivo trials on full-thickness wounds are reported in the journal *Biofabrication*.

The paper is a major step forward for the team, which unveiled the first prototype of the skin [printer](#) in 2018. The device was believed to be the first device of its kind to form tissue in situ, depositing and setting in place in two minutes or less.

"Previously, we proved that we could deposit cells onto a [burn](#), but there wasn't any proof that there were any wound-healing benefits—now we've demonstrated that," says Guenther.

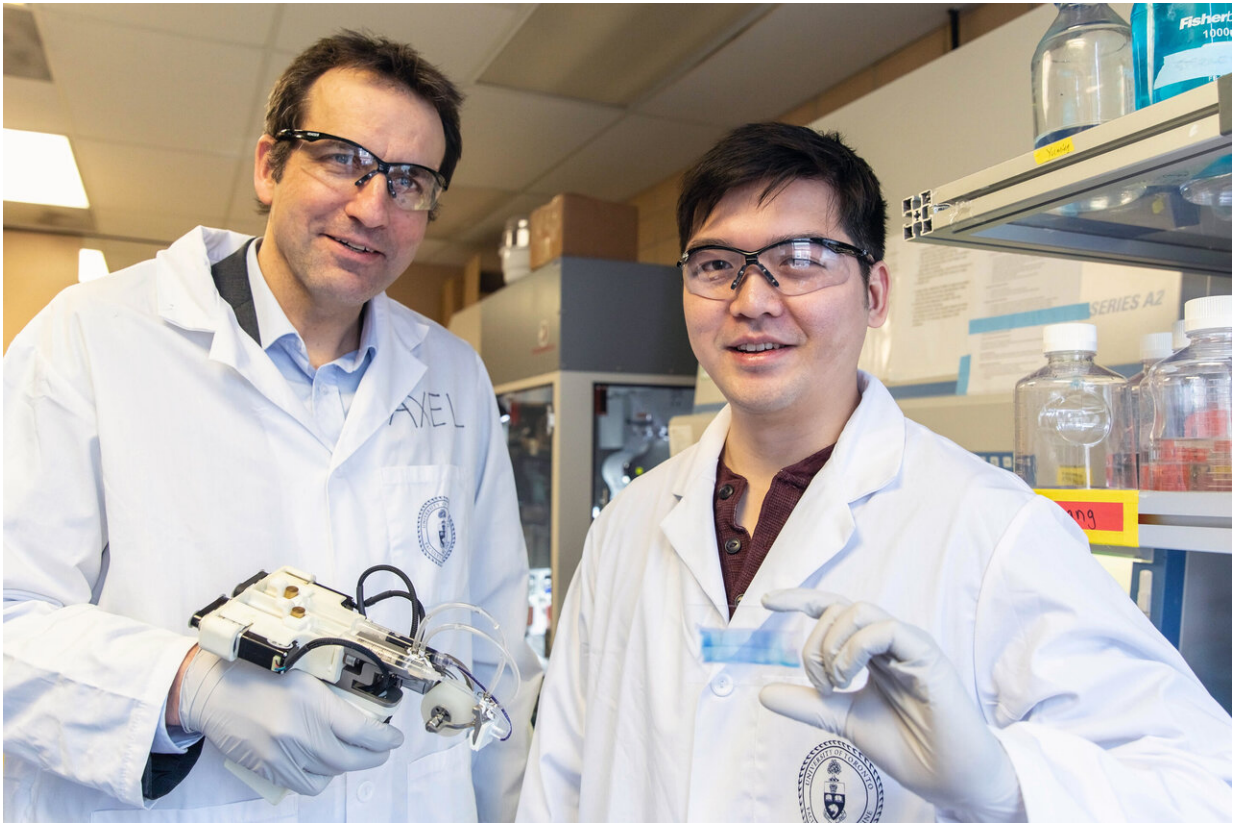
The current method of care for burns is autologous skin grafting, which requires transplantation of healthy skin from other parts of the body onto the wound.

But large, full-body burns pose a greater challenge. Full-thickness burns are characterized by the destruction of both the outermost and innermost layers of the skin; these burns often cover a significant portion of the

body.

"With big burns, you don't have sufficient healthy skin available, which could lead to patient deaths," says Jeschke.

Since 2018, the printer has gone through 10 redesigns, as the team moves towards a design they envision surgeons using in an operating room. The current prototype includes a single-use microfluidic printhead to ensure sterilization, and a soft wheel that follows the track of the printhead, allowing for better control for wider [wounds](#).



From left: Professor Axel Guenther and PhD candidate Richard Cheng. Credit: Daria Perevezentsev / U of T Engineering

Next, Cheng says that they ultimately want to "further reduce the amount of scarring, on top of helping with wound healing. Our main focus moving forward will be on the in-vivo side."

Jeschke believes the handheld skin printer could be seen in a clinical setting within the next five years. "Once it's used in an operating room, I think this printer will be a game changer in saving lives. With a [device](#) like this, it could change the entirety of how we practice burn and trauma care."

More information: Richard Y Cheng et al, Handheld instrument for wound-conformal delivery of skin precursor sheets improves healing in full-thickness burns, *Biofabrication* (2020). [DOI: 10.1088/1758-5090/ab6413](#)

Provided by University of Toronto

Citation: Handheld 3-D skin printer demonstrates accelerated healing of large, severe burns (2020, February 4) retrieved 8 August 2024 from <https://techxplore.com/news/2020-02-handheld-d-skin-printer-large.html>

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