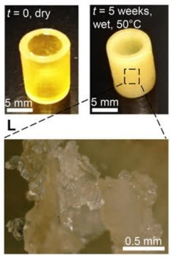
Novel Airway Stents Created with 3D DLP Printing



A new type of biodegradable airway stent has been developed at ETH Zurich using 3D printing with more advanced characteristics than existing technologies.

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Airway stents, usually metal or silicone, are implanted through a surgical procedure to ensure sufficient supply of oxygen to patients with central airway obstruction. They provide immediate relief, but come with some disadvantages, i.e. they are prone to migration and at a later stage have to be surgically removed. A new type of stent developed by a team of researchers at ETH Zurich eliminates both complications (Paunovic et al. 2021).

To manufacture these novel stents, the researchers used a 3D printing process known as digital light processing (DLP) with specifically-created light-sensitive resins that dissolve after the implantation.

To create a stent, the researchers start with getting a CT image of the respective part of the airways and use it to build a digital 3D model of the future device. This model is then fed into a 3D DLP printer that builds the stent layer by layer by exposing the needed parts of resin to UV light, which makes resin harden.

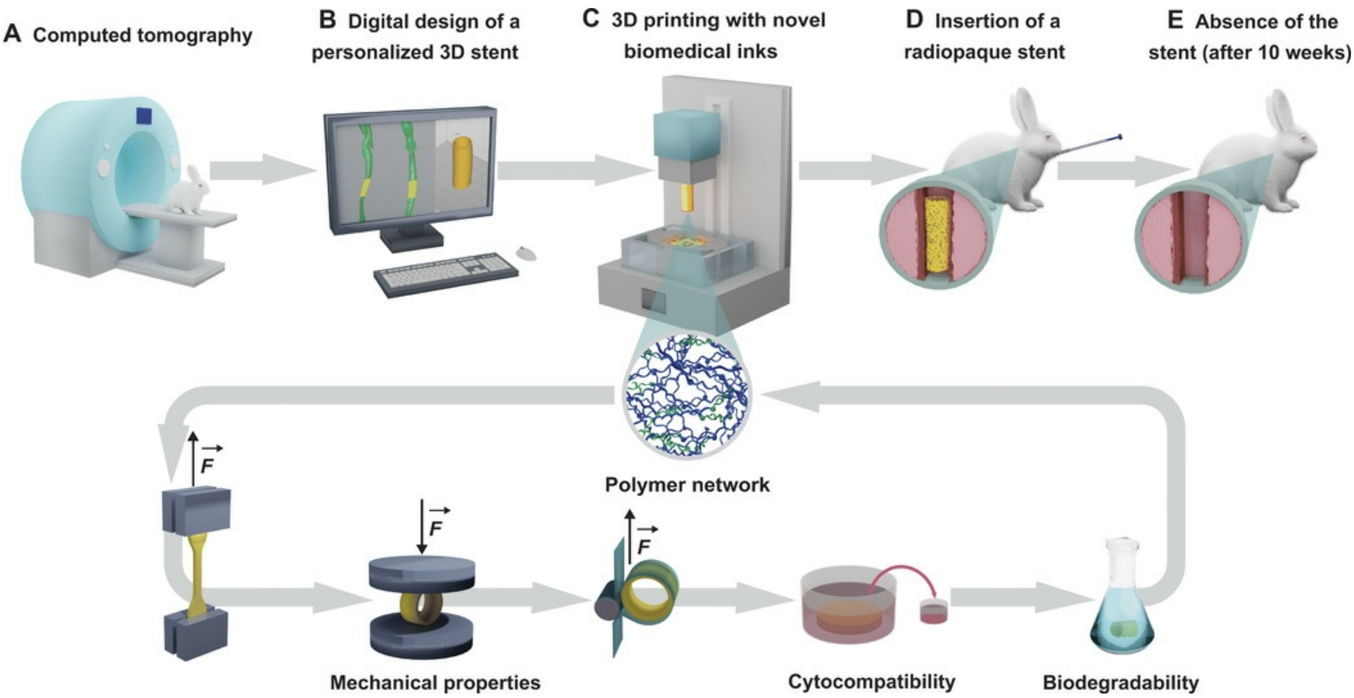

Figure. Schematic workflow for manufacturing and testing of bioresorbable, biocompatible, and customized airway stents by DLP 3D printing (Paunovic et al. 2021).

This process allows to create stents that are of high precision and do not require another surgery to be removed.

The dual-polymer DLP biomedical inks used for stent printing are suitable for 3D printing of bioresorbable elastomers. Unlike existing biodegradable materials used in DLP printing, the novel resin demonstrates much higher levels of elasticity. The team tested several resin prototypes for biocompatibility, biodegradability, elasticity and mechanical properties. To be able to track with imaging a stent's location during implantation, the researchers added gold to the device's structure.

The novel stents were tested on rabbits and showed no signs of rejection. They did not migrate from the insertion site and were completely absorbed by the body in a six or seven weeks' time.

The researchers note that this technology looks promising in terms of producing medical devices – not only stents but of other types too – that are customised, elastic and biodegradable. It also allows for rapid manufacturing of the devices, at the point of care or at least involving short supply chains.

Source: ETH Zurich

Image credit: Paunovic et al. (2021)

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