

Cartilage made easy with novel hybrid printer

November 21 2012



The printing of three-dimensional tissue has taken a major step forward with the creation of a novel hybrid printer that simplifies the process of creating implantable cartilage.

The printer has been presented today, 22 November, in IOP Publishing's journal *Biofabrication*, and was used to create cartilage constructs that could eventually be implanted into injured patients to help re-grow cartilage in specific areas, such as the joints.

The printer is a combination of two low-cost fabrication techniques: a traditional [ink jet printer](#) and an electrospinning machine. Combining these systems allowed the scientists to build a structure made from natural and synthetic materials. Synthetic materials ensure the strength of the construct and natural gel materials provide an environment that

promotes cell growth.

In this study, the hybrid system produced cartilage constructs with increased [mechanical stability](#) compared to those created by an ink jet printer using gel material alone. The constructs were also shown to maintain their functional characteristics in the laboratory and a real-life system.

The key to this was the use of the electrospinning machine, which uses an electrical current to generate very fine fibres from a [polymer solution](#). Electrospinning allows the composition of polymers to be easily controlled and therefore produces [porous structures](#) that encourage cells to integrate into surrounding tissue.

"This is a [proof of concept](#) study and illustrates that a combination of materials and [fabrication methods](#) generates durable implantable constructs," said James Yoo, M.D., Ph.D., Professor at the Wake Forest Institute for Regenerative Medicine, and an author on the study. "Other methods of fabrication, such as robotic systems, are currently being developed to further improve the production of implantable tissue constructs."

In this study, flexible mats of electrospun [synthetic polymer](#) were combined, layer-by-layer, with a solution of [cartilage cells](#) from a rabbit ear that were deposited using the traditional ink jet printer. The constructs were square with a 10cm diagonal and a 0.4mm thickness.

The researchers tested their strength by loading them with variable weights and, after one week, tested to see if the cartilage cells were still alive.

The constructs were also inserted into mice for two, four and eight weeks to see how they performed in a real life system. After eight weeks

of implantation, the constructs appeared to have developed the structures and properties that are typical of elastic cartilage, demonstrating their potential for insertion into a patient.

The researchers state that in a future scenario, cartilage constructs could be clinically applied by using an MRI scan of a body part, such as the knee, as a blueprint for creating a matching construct. A careful selection of scaffold material for each patient's construct would allow the implant to withstand mechanical forces while encouraging new cartilage to organise and fill the defect.

More information: Hybrid printing of mechanically and biologically improved constructs for cartilage tissue engineering applications, Xu et al 2013 *Biofabrication* 5 015001.

iopscience.iop.org/1758-5090/5/1/015001

Provided by Institute of Physics

Citation: Cartilage made easy with novel hybrid printer (2012, November 21) retrieved 11 July 2024 from <https://phys.org/news/2012-11-cartilage-easy-hybrid-printer.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.