Biological Joints Could Replace Artificial Joints Soon

University of Missouri researchers are part of team that has successfully regenerated complete shoulder joint surfaces using the patient's own cells.

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Artificial joint replacements can drastically change a patient's quality of life. Painful, arthritic knees, shoulders and hips can be replaced with state-of-the-art metal or ceramic implants, eliminating pain and giving a person a new lease on life. But, what if, instead of metal and plastic, doctors were able to take a patient's cells and grow an entirely new joint, replacing the old one with a fully functional biological joint? A team of University of Missouri and Columbia University researchers have found a way to create these biological joints in animals, and they believe biological joint replacements for humans aren't far away.

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In a study published this fall in The Lancet, James Cook, a researcher in the MU College of Veterinary Medicine and Dept of Orthopaedic Surgery participated on a research team that created new cartilage in animals using a biological "scaffold" in the animals' joints. Cook assisted with the implant design and performed the surgeries to implant the biologic joint replacements. The study was led by Jeremy Mao of Columbia University.

The scaffold was implanted in rabbits with a surgical technique currently used for shoulder replacement in humans. The surgery removes the entire humeral head, or the ball part of the ball-and-socket shoulder joints. The scaffolds are infused with a growth factor, which encourages the host's own cells, including stem cells, to become cartilage and bone cells. The advantage to this technique is that it avoids the need to harvest and implant cells, which requires multiple surgeries.

“The device was designed with both biological and mechanical factors in mind,” Cook said. “It is unique in design and composition and in how it stimulates the body’s own cells. This is the first time we have seen cartilage regeneration using this type of scaffold. ”

The study found that the rabbits given the infused scaffolds resumed weight-bearing and functional use of their limbs faster and more consistently than those without. Four months later, cartilage had formed in the scaffolds creating a new, functional cartilage surface for the humeral head. The team observed no complications or adverse events after surgery; the new tissue regeneration was associated with excellent limb use and shoulder health, indicating the procedure is both safe and effective.

Cook, who also was involved in the study design and data analysis, said the next step toward FDA approval and clinical use is to study the technique in larger animals.

“If we continue to prove the safety and efficacy of this biologic joint replacement strategy, then we can get FDA approval for use of this technology for joint replacements in people,” Cook said. “We are still in the early phases of this process, but this study gives a big boost to its feasibility.”

“We are continuing our concerted efforts in this arena,” Cook said. “Our goal at Mizzou’s Comparative Orthopaedic Laboratory is to do away with metal and plastic joints, and instead, regenerate a fully functional biologic joint for everyone who needs one. We think this is the future of orthopaedics and we hope that future is starting here and now.”

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