Knee Cartilage Repair Success With New Biomaterial

In a small study, researchers reported increased healthy tissue growth after surgical r [1]epair of damaged cartilage if they put a " [2]hydrogel" scaffolding into the wound to support and nourish the healing process. The s [3]quishy hydrogel material was implanted in 15 patients during standard microfracture surgery, in which tiny holes are punched in a bone near the injured cartilage. The holes stimulate patients' own specialized stem cells to emerge from bone marrow and grow new cartilage atop the bone.

Results of the study, published in the January 9 issue of *Science Translational Medicine*, are a proof of concept that paves the way for larger trials of the hydrogel's safety and effectiveness, the researchers say. "Our pilot study indicates that the new implant works as well in patients as it does in the lab, so we hope it will become a routine part of care and improve healing," says J [4]ennifer Elisseeff, Ph.D., Jules Stein Professor of Ophthalmology and director of the Johns Hopkins University School of Medicine's Translational Tissue Engineering Center (TTEC).

Damage to cartilage, the tough-yet-flexible material that gives shape to ears and noses and lines the surface of joints so they can move easily, can be caused by injury, disease or faulty genes. Microfracture is a standard of care for cartilage repair, but for holes in cartilage caused by injury, it often either fails to stimulate new cartilage growth or grows cartilage that is less hardy than the original tissue.

Tissue engineering researchers, including Elisseeff, theorized that the specialized stem cells needed a nourishing scaffold on which to grow, but demonstrating the clinical value of hydrogels has "taken a lot of time," Elisseeff says. By experimenting with various materials, her group eventually developed a promising hydrogel, and then an adhesive that could bind it to the bone.

After testing the combination for several years in the lab and in goats, with promising results, she says, the group and their surgeon collaborators conducted their first clinical study, in which 15 patients with holes in the cartilage of their knees received a hydrogel and adhesive implant along with microfracture. For comparative purposes, another three patients were treated with microfracture alone. After six months, the researchers reported that the implants had caused no major problems, and MRIs showed that patients with implants had new cartilage filling an average 86 percent of the defect in their knees, while patients with only microfracture had an average of 64 percent of the tissue replaced. Patients with the implant also reported a greater decrease in knee pain in the six months following surgery, according to the investigators.

The trial continues, has enrolled more patients and is now being managed by a company called Biomet. The trial is part of efforts to win European regulatory

approval for the device. In the meantime, Elisseeff says her team has begun developing a next-generation implant, one in which the hydrogel and adhesive will be combined in a single material. In addition, they are working on technologies to lubricate joints and reduce inflammation.

Other authors on the study were Blanka Sharma, Sara Fermanian, Matthew Gibson, Shimon Unterman, Daniel A. Herzka, Jeannine Coburn and Alexander Y. Hui of the Johns Hopkins School of Medicine; Brett Cascio of Lake Charles Memorial Hospital; Norman Marcus, a private practice orthopedic surgeon; and Garry E. Gold of Stanford University.

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