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Bone implants could speed healing after tooth removal

BY JADE BOYD
Rice News staff

A new five-year research program at Rice University is pioneering regenerative medicine techniques that could help millions of Americans heal faster after dental surgeries.

Researchers in Rice's J.W. Cox Laboratory for Biomedical Engineering will conduct the research under a new five-year, \$1.4 million grant from the National Institutes of Health.

More than 10 million Americans undergo surgical tooth extractions every year, and the procedure invariably involves some loss of bone from the tooth socket. This bone loss is problematic for dentists because it can compromise both the functional and aesthetic outcomes of treatment involving dentures and bridges. Significant losses of bone also make it difficult for surgeons to properly fit dental implants to the ridge of the jawbone without requiring additional surgical procedures.

The body's natural powers to regenerate bone are also hindered by the soft tissue of the surrounding gums, and in severe cases following trauma or cancer surgery, wide gaps called "critical-size defects" are created in the jawbone that the body is unable to bridge with replacement bone. To overcome these problems, oral surgeons may graft new bone into the gap. However, this bone must be either harvested from deceased donors or animal sources or taken from elsewhere in the patient's body.

"Our goal is to induce the formation of critical-size bone tissue in bone defects by the implantation of a biologically active, biodegradable polymer scaffold," said Antonios Mikos, the principal investigator of the project and the John W. Cox Professor in Bioengineering and director of Rice's Center for Excellence in Tissue Engineering.

In previous work on rabbits, Mikos' research group isolated the growth factors that are released by the body in order to stimulate bone growth in the tooth socket after a tooth extraction. Their new research initiative will use this information to design methods that can aid the body in healing defects that are normally too large for it to heal on its own.

This will be accomplished by the fabrication of a biodegradable implant capable of releasing these healing factors in a controlled manner so that the proper amounts are released over the right time period at the site of interest. The implant will enable healing by stabilizing the gap and offering a welcome environment for the body's own bone cells. The implant will break down over time as the patient's own bone cells move in and produce replacement bone.

Like other technologies involving tissue engineering or regenerative medicine, the researchers hope to stimulate and aid the body's own powers of regeneration. The approach offers advantages over existing treatments because it eventually ends up giving the patient exactly what they lost: their own tissue. It also eliminates the risk of tissue rejection and disease transfer from donor grafts, and it requires no additional surgery to harvest grafts from the patient.

"The development of a method for healing critical-size defects in the bone of the jaw would benefit not only those who have teeth pulled but also accident victims who've lost large amounts of bone due to injury and cancer patients who have had large bony lesions in the jaw surgically removed," Mikos said.

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