Medical Xpress

Synthetic bone graft recruits stem cells for faster bone healing

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Scientists have developed a material for bone grafts that could one day replace the 'gold standard' natural bone implants.

A new study shows how particles of a ceramic called calcium phosphate have the ability to stimulate promising bone regrowth by attracting stem cells and 'growth factors' to promote healing and the integration of the grafted tissue.

"The rate of bone repair we see with these materials rivals that of traditional grafts using a patients' own bone," said Professor Joost de Bruijn from the School of Engineering and Materials Science at Queen Mary, University of London. "And what sets it apart from other synthetic graft substitutes is its ability to attract stem cells and the body's natural growth factors, which coincide to form new, strong, natural bone around an artificial graft."

The researchers tested natural bone grafts against ceramic particles with varied structural and chemical properties. They found that micro-porous ceramic particles composed of calcium phosphate, the primary component of bone ash, induced stem cells to develop into bone cells in the test tube and stimulated bone growth in live tissue in mice, dogs and sheep.

Bone injuries packed with the ceramic particles healed similarly to implants constructed from the animals' own bone, reports Professor de Bruijn along with collaborators from the University of Twente,

Netherlands, in the journal Proceedings of the National Academy of Sciences. The study also shows how it also matches a commercially available product that contains artificial growth factors and has the undesirable side-effect of causing bone fragments to form in nearby soft tissue, such as muscle.

Although the researchers have not yet identified the mechanism that drives bone growth in the synthetic implants, they note that variations in the ceramic material's chemistry, micro-porosity, micro-structure, and degradation influence the graft's performance.

The study suggests that biomaterials-based bone grafts can manipulate cell behaviour in order to repair injury, and one day may be used to repair bone injuries in humans.

More information: "Osteoinductive ceramics as a synthetic alternative to autologous bone grafting," by Huipin Yuan, Hugo Fernandes, Pamela Habibovic, Jan de Boer, Ana Barradas, Ad de Ruiter, William Walsh, Clemens van Blitterswijk, and Joost de Bruijn is published in PNAS doi:10.1073/pnas.1003600107

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