Bioactive Glass-Polymer Composite Bone Scaffolds

A composite scaffold using bioactive silicate glass and a biodegradable polymer offers a safer and more beneficial alternative for bone defect repair, potentially replacing current surgical options and growth factors.

A broken bone unable to heal on its own is considered to have experienced a critical size defect; 5 to 10 percent of breaks fall into this category. The use of one's own bone tissue is currently the best available option, except it requires two surgeries, the material available is limited, and there is a risk of donor-site morbidity. The other option is to use bone tissue from a donor or a cadaver; these offer more material, but there is a risk of disease transmission, reduction of osteoinductive properties, and lack of osteogenic cellular components. In addition, bone morphogenetic proteins (BMPs) are sometimes used to improve osteoinductivity, but these proteins have a short half-life and must be added in supraphysiological doses. Without BMPs, there is a risk of ectopic bone formation. There is a need for a safer, more beneficial approach to bone regeneration.

Researchers at Purdue University have developed a technology for healing bone defects using bioactive silicate glass (BSG) and a 3D osteomimetic composite porous scaffold containing microspheres comprised of poly(lactide-co-glycolide) (PLGA). Unlike other bioactive glasses which increase local pH, this demonstrates fast dissolution and ion release without impacting local pH; in addition, this BSG also contains higher calcium and phosphorous content. The beneficial mechanical properties of PLGA are combined with the bioactivity of the BSG, introducing the possibility of BSGs replacing autografts, allografts, and BMPs.

Advantages:

-Requires fewer surgeries

-Displays minimal risk for disease transmission

-Retains the osteoinductive properties

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-Retains the osteoinductive cellular components

-Eliminates the need for BMPs

Potential Applications:

-Bone regeneration

-Fixing critical size bone defects

-Elimination of ectopic bone formation

TRL: 2

Intellectual Property:

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