Tissue Repair Devices and Scaffolds

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Technology description

Background

In orthopedics, it is often necessary to repair or replace damaged or degenerating bone. Multiphasic, three-dimensionally printed, tissue repair device (M3DRD) scaffolds have emerged as a replacement to current bone grafting techniques, all of which have serious drawbacks and cannot be produced in the elaborate designs and shapes necessary to repair complex bone defects. M3DRDs can be custom produced for every type of orthopedic bone repair. The scaffolds facilitate the regeneration of bone by providing a structure for cells to attach to and an environment conducive to new tissue formation. There are drawbacks to current M3DRD scaffolds, however: they lack a stable, strong internal structure (mechanical integrity), do not promote the necessary exchange of nutrients needed to support new tissue growth, and hinder new bone cells' movement throughout the scaffolds. The ideal bone repair scaffold must be able to stimulate bone repair in the body, dissolve over time leaving only regenerated bone, and be customizable to closely fit complex defects in the bone.

Summary

OSU researchers have utilized 3D-bioprinting techniques to create a scaffold for bone repair of fractures and defects through the promotion of bone growth. The scaffold's design enhances the mechanical integrity of the entire scaffold. Additionally, the scaffold material can be filled with a soluble filler that contains antibiotics, growth factors, differentiation factors, cytokines, drugs, or a combination of these agents. The new scaffold design promises improved treatment for a wide variety of orthopedic defects.

Application area

· Repair bone damaged by injury or disease

Advantages

· Improved mechanical integrity
· Can be modified to further promote cell proliferation

· Up to 3 materials can be used to print a single structure at the same time
· Can incorporate a soluble filler containing any combination of antibiotics, growth factors, differentiation factors, cytokines, drugs
· Resorbent - after 8 weeks at least 25% of the scaffold is resorbed
· Encourages bone growth - after 8 weeks at least 25% of the scaffold is replaced by bone

Institution

Oklahoma State University

Inventors

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