Docket #: S20-447

HyTEC: Hybrid Tissue Engineering Construct

Researchers at Stanford have developed a porous biologics-loaded multimaterial construct, called Hybrid Tissue Engineering Construct (HyTEC), with applications in regenerative medicine and therapeutic delivery. The new strategy enables incorporation of biologics (e.g., biomolecules, drugs or cells) through a uniform thick hydrogel layer onto porous scaffolds while retaining interconnected open pores, or onto non-porous implants. Existing coating techniques, including layer-by-layer coating and adhesive coating, have been used to load biomolecules on the surface of porous implants. However, these techniques restrict loading to a limited amount of biomolecules. Loading a large or tunable dose of biomolecules on implants is particularly important since the effective dose of biomolecules is often high in vivo and could be different for various indications. For the HyTEC proof of concept, the researchers loaded model proteins and cells on 3D printed biodegradable polycaprolactone and ?-tricalcium phosphate (PCL-TCP) as a model polymer-ceramic porous scaffold, a PCL-TCP rod as a model polymer-ceramic non-porous implant, and stainless steel needles as a model metal.

Related Technology
Stanford docket **S20-459**: Learn how the HyTEC platform is being used to develop a bioactive intramedullary implant for reconstruction of bone defect, deformity and nonunion.

Applications

- HyTEC is used for delivery of therapeutics including cells and/or biomolecules along with a structural support for applications in regenerative medicine. Some examples:
    - Delivery of osteo-inductive proteins and osteogenic cells along with osteo-conductive 3D printed constructs for treatment of bone defects

    - Delivery of proteins and/or cells along with 3D printed constructs for treatment of soft tissue defects
    - Delivery of antibiotics or painkillers along with 3D printed scaffolds
    - Delivery of proteins along with metallic implants
    - Delivery of vasculo-inductive proteins or cells to induce vascularization in regenerative medicine
    - Local delivery of therapeutics in cancerous tissues
    - Local delivery of ? cells for insulin secretion in diabetic patients

Advantages

- A large dose, or a broader spectrum of dose of therapeutics can be loaded on porous (or non-porous) constructs unlike methods based on thin coatings
- Cells can be encapsulated in HyTEC
- Existing methods based on multimaterial printing require long fabrication time and a specialized 3D printer

Patents

- Published Application: WO2023114103

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