Group #33

Biological Joint Resurfacing

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Abstract:

Synthetic osteochondral grafts for large osteoarthritic defects have the potential to help millions of patients, but they have proven extremely difficult to produce. Previous project teams have tried, but issues with cell viability, calcium double-diffusion bioreactor function, and material sourcing have persisted. This project's goal was to create an osteochondral graft with cell density, compressive strength, and biochemical composition similar to immature cartilage. The project split into three distinct parts: optimizing raw material extraction from bovine calf cartilage, forming cell-laden collagen hydrogels, and improving the preexisting double diffusion bioreactor. Preliminary results showed that existing methods of extraction produced high extraction efficiency, new protocols for hydrogel formation improved cell viability, and a new threaded reaction chamber localized the hydroxyapatite reaction. Next steps for the project include improving the cell density further, reducing the potential allergen content of extraction, and simplifying the bioreactor. Successful integration of these three parts brings the large osteochondral graft one step closer to improving patients' lives.