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3D hybrid scaffolds for engineering functional tissue replacements

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Abstract

Osteoarthritis is painful and debilitating joint disease that is characterized by pain and degenerative changes in the articular cartilage and other joint tissues. While a number of techniques have been developed over the years for the treatment of small cartilage defects, there have been few attempts at tissue-engineered therapies for end-stage osteoarthritis. Some of the major considerations for this approach include the identification and characterization of an abundant and accessible cell source as well as the design of biologically and mechanically functional scaffolds that can withstand joint loading. Here we describe the engineering of large, anatomically-shaped cartilage constructs using different stem cell sources (adipose stem cells, mesenchymal stem cells, or induced pluripotent stem cells), combined with mechanically functional cell-instructive scaffolds based on three-dimensional weaving of biocompatible fibers. These textile processing techniques allows site-specific delivery of proteins or genes to facilitate the formation of complex inhomogenous tissues from a single cell source.

Biography

Farshid Guilak, Ph.D. is the Laszlo Ormandy Professor and Vice-Chair of Orthopaedic Surgery at Duke University Medical Center and is the Director of Orthopaedic Research. His research focuses on tissue engineering and stem cells to develop new regenerative medicine approaches to treat osteoarthritis, a painful and debilitating disease of the synovial joints. He has published over 240 articles in peer-reviewed journals and has co-edited three books. He is the Editor-in-chief of the *Journal of Biomechanics*, Associate Editor for *Osteoarthritis & Cartilage*, and serves on the editorial boards of several other journals. He has won numerous national and international awards for his research and mentorship. Dr. Guilak is the Founder and President of Cytex Therapeutics, an early stage startup company focusing on tissue engineering for musculoskeletal diseases.