Fabrication of PCU/UHMWPE Polymeric Blends and 3D Printing using Same

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Technology description

A method for 3D printing PCU / UHMPE polymeric blends
The American Physical Therapy Association reports that around 700,000 Americans undergo knee surgery due to meniscus injury every year. The meniscus has a vital role in functioning and protecting the knee by dispersing contact pressure and lowering the coefficient of friction. Joint stability, force transmission and lubrication are also provided by the meniscus. Currently, molded artificial meniscus implants have solid structures that impair the joints ability to permit its natural lubrication mechanism. A new fabrication method has been invented to create porosities that can retain lubricants and allow synovial joints natural lubrication mechanisms to occur, increase cell adhesion, stimulate tissue regeneration, and add design freedom for making patient specific implants to save time and cost.
Technology:
Fabrication and 3D printing of polymeric blends.(PCU / UHMWPE)

Application area

Our methods of fabrication of PCU / UHMWPE polymeric blends and using FDM 3D printing to fabricate porous, PCU / UHMWPE polymeric blend samples can be applied to fabricating soft load-bearing tissues such as intervertebral disc, meniscus, and articular cartilage to enable native lubrication mechanisms. Our methods can also be applied to a wide range of other applications where the porosity can change surface properties such as wetting and cell adhesion properties.

Advantages

The lubrication mechanisms of synovial joints combine full fluid film lubrication, elastohydrodynamic, micro-elastohydrodynamic, and importantly “weeping” lubrication, i.e., under dynamic load, the porous, natural meniscus absorbs interstitial synovial fluid with depressurization and releases it upon loading, contributing to keeping the opposed surfaces apart and thus reduces friction and wear. 3D printing not only can provide the porosity, but also provide the flexibility of patient-specific design of the meniscus. PCU / UHMWPE blend is a promising material for meniscus implant. It has excellent mechanical properties: toughness and flexibility and it is also bio-compatible and bio-stable.

Furthermore, the molded, non-anchored PCU / UHMWPE meniscus has been approved in Europe and is in clinical trials in the U.S. Since 3D printing PCU / UHMWPE meniscus does not need a mold, it will shorten the meniscus manufacturing time and reduce the cost.

Institution

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