Repair of incurable meniscal injuries using an aligned electrospun nanofibrous scaffold combined with mesenchymal stem cells

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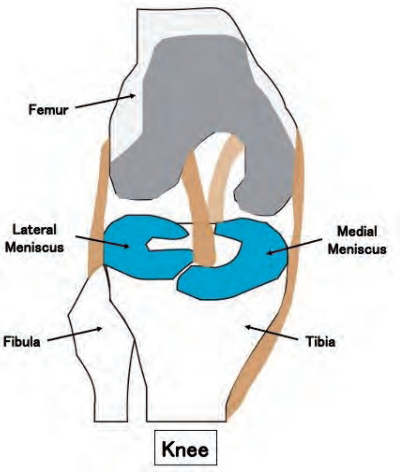
Project Outline

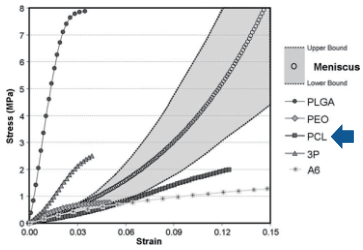
The meniscus plays important roles in the knee joint. Meniscal tears are the most common injury in the knee regardless of age and effective treatments remain challenging. Part of this challenge is due to the meniscus having limited healing potential, owing to its hypocellularity, hypovascularity as well as its complex structure. It is recognized that damaged menisci lose function in the absence of adequate treatment and such knees are at high risk of development of osteoarthritis. However, there have been no established, effective treatments for meniscal tears. As a result, meniscectomy has been commonly advocated for such injuries. Recently, we reported the feasibility of mesenchymal stem cell-seeded electrospun nanofibrous scaffolds to repair the incurable damaged meniscus along with the prevention of subsequent cartilage degeneration using a rabbit model. Thus, the aim of this project is to develop a new meniscal repair technique using our novel tissue engineering method.



Electrospun nanofibrous scaffold

- Aligned fiber
- Biocompatibility
- Slow bioabsorbability
- High tensile strength

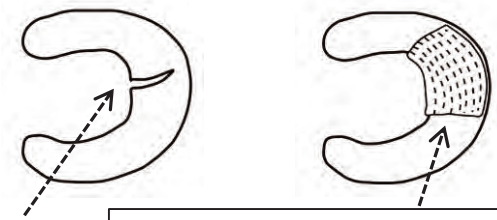
SEM image of poly(ε-caprolactone) (PCL)-based electrospun scaffold



Similar tensile strength w/ meniscus

Target

- Meniscal tear:
  07'-14' No. of meniscal surgery in Japan: 83,105
- Knee osteoarthritis:
  Estimated No. of Pts. in Japan: 25 million



Meniscal tear

Cell-seeded aligned nanofibrous scaffold
- Reinforcement for meniscal injured site
- Enhancement of meniscal repair

References

Mauck R, Tissue Eng Part B 2009.
Shimomura K, Tissue Eng Part A 2015.
Shimomura K, Biomaterials 2019

The preclinical POC study aim to be completed until March 2023.