(Equine) in vitro Tendinopathy Model

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SCOPE OF THE METHOD

The Method relates to	Animal health
The Method is situated in	Basic Research, Translational - Applied Research
Type of method	In vitro - Ex vivo

DESCRIPTION

Method keywords

3D in vitro model

Biofabrication

mechanical stimulation

tendon cells

endothelial cells

inflammation

Scientific area keywords

Tendinopathy

Equine

mesenchymal stromal cells

Regenerative treatments

Method description

Overuse tendon injuries are a major cause of musculoskeletal morbidity in both human and equine athletes. Despite the big burden, there is no effective treatment to restore tendon's natural composition, due to a lack of understanding of fundamental cell biology. Additionally, translation of novel regenerative therapies from basic research findings into clinical therapies has been hampered. In this *in vitro* tendinopathy model, primary isolated equine cells (tendon and endothelial cells), chemically modified gelatin, additive manufacturing techniques (such as 3D bioprinting and electrospinning), and mechanical stimulation are combined to generate new fundamental insights in tendon pathophysiology and to study novel therapies in a controlled and representative environment. Protocols for isolation of the cells and generation of gelatin derivatives are established and the best manufacturing technique is currently investigated. As the horse is recognized as animal model for orthopedic research, both human and equine veterinary medicine will benefit from the gained insights.

Lab equipment

- Laminar air flow
- Centrifuge
- Incubator
- FACS Cell Sorter
- Freeze-dryer
- UVA-light source
- Spectrophotometer for polymer evaluation
- Rheometer for polymer evaluation
- 3D bioprinter or electrospinning set-up

- Mechanical stimulation bioreactor (e.g. TC3 EBERS)
- Inverted (fluorescence) microscope for evaluation

Method status

Still in development

PROS, CONS & FUTURE POTENTIAL

Advantages

- Mimicking the hierarchical composition of tendon extracellular matrix with clear fibre alignment
- Incorporation of elongated tendon cells organized in a parallel fashion and endothelial cells as angiogenic cues
- Disease mimicking through mechanical (over-)stimulation (uniaxial stretching)
- Representative, reproducible and controllable

Challenges

- Low throughput at this moment
- Still in optimization process
- Complex

Modifications

Optimization of the model is still ongoing.

Future & Other applications

As the horse is recognized as animal model for orthopedic research, both human and equine veterinary medicine will benefit from the gained insights. Moreover, the equine cells can be easily replaced by human cells. With further modifications, the model can be used to study other diseases such as enthesopathy.

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

Meeremans et al., Front. Cell Dev. Biol. 2021, 9. (2) (DOI: 10.3389/fcell.2021.651164)

Meeremans et al. Polymers. 2021, 13, 747. (DOI: 10.3390/polym13050747)

Associated documents

Meeremans et al.(2021) The Lack of a Representative Tendinopathy Model Hampers Fundamental Mesenchymal Stem Cell Research.pdf

Meeremans et al.(2021) Equine tenocyte seeding.pdf

Links

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