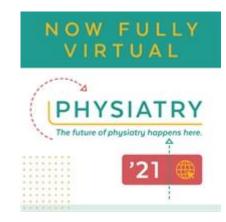


Loss of Tissue Regenerative Capacity in Aging – the Tendon

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1. Introduction

- ✓ Tendon aging is a complicated process following similar mechanisms of other tissues¹
- ✓ Tendon structure and cellular composition is also unique, which makes scientific research a very specific and select task
- ✓ Tendon cells include²



- Tenocytes differentiated tendon cells
- Mesenchymal Stem Cells (MSCs), which include Tendon/Stem Progenitor Cells (TSPCs) capable of clonogenicity, multipotency and self-renewal according with stimuli and respective cellular adaptation³

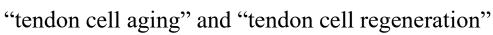
2. Objectives

- ✓ Discuss the current evidence on tendon aging and its treatment
- ✓ Identify potential targets to be considered for future therapies

3. Design



Analytical review conducted through *PubMed* database





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4. Results

- Moderate exercise ameliorates the depletion of TSPCs and it is beneficial for delaying the undesirable effects of age⁴
- Mechanical stretching improved the tenogenic differentiation of both induced pluripotent stem cells (iPSCs) and pre-MSCs³
- When tenocytes are exposed to a certain amount of NSAIDs, the differentiation of MSCs to tenocytic lineage gets impaired and drawn toward adipocytic lineage⁵
- Different concentrations of ascorbic acid have been used in tenocyte cultures to enhance collagen synthesis⁵
- Ultrasonication and shock wave were experimentally confirmed to be beneficial for promoting the differentiation and proliferation of MSCs⁶
- An important role for increased Rho has been reported, associating coiled-coil forming protein kinase (ROCK) activity in accelerating the ageing progress of aged TSPC⁷



A changing back to a morphology similar to young TSPCs

Upon treatment with Y-27632, a common ROCK inhibitor⁷

5. Conclusions

- ✓ In tendon injuries there is no optimal treatment strategy till this day
- ✓ Limited studies have been done to explore all the elaborate cell repair mechanisms in the tendon

Tendon aging can be correlated with TSPC aging



Tendon MSCs may be the main orchestrators directing tendon-regenerative processes

References

- 1. López-Otín C, Blasco MA, Partridge L, Serrano M, Kroemer G. The hallmarks of aging. Cell. 2013;153 (6):1194–1217.
- 2. Costa-Almeida R, Calejo I, Gomes M. Mesenchymal Stem Cells Empowering Tendon Regenerative Therapies. Int. J. Mol. Sci. 2019, 20, 3002; doi:10.3390/ijms20123002.
- 3. Dai GC, Li YJ, Chen MH, Lu PP, Rui YF. Tendon stem/progenitor cell ageing: Modulation and rejuvenation. World J Stem Cells 2019 September 26; 11(9): 677-692 DOI: 10.4252/wjsc.v11.i9.677.
- 4. Zhang J, Wang JH. Moderate Exercise Mitigates the Detrimental Effects of Aging on Tendon Stem Cells.; PLoS One 2015; 10: e0130454; DOI: 10.1371/journal.pone.0130454.
- 5. . Chiu CH, Chen P, Chen AC, Chan YS, Hsu KY, Rei H, and Lei KF. Real-Time Monitoring of Ascorbic Acid-Mediated Reduction of Cytotoxic Effects of Analgesics and NSAIDs on Tenocytes Proliferation. Dose-Response: An Interna DOI: 10.1177/1559325819832143.
- 6. Chen et al. Effect of Low-Intensity Pulsed Ultrasound After Autologous Adipose-Derived Stromal Cell Transplantation for Bone-Tendon Healing in a Rabbit Model. The American Journal of Sports Medicine; 2019;47(4):942–953 DOI: 10.1177/036354651882032.
- Kohler J, Popov C, Klotz B, Alberton P, Prall WC, Haasters F, Müller-Deubert S, Ebert R, Klein-Hitpass L, Jakob F, Schieker M, Docheva D. *Uncovering the cellular and molecular changes in tendon stem/progenitor cells attributed to tendon aging and degeneration*Aging Cell 2013; 12: 988-999; DOI: 10.1111/acel.12124.

