Age-related changes in the ultrastructure of the quadriceps tendon

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Faculty Disclosure Information

Nothing to disclosures.

—Type of tendon graft on ACLR—

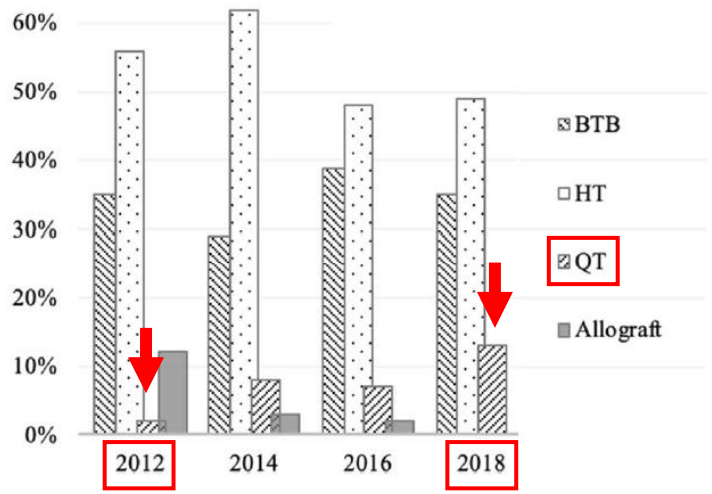
- ✓ QT has superior biomechanical properties compared to other tendon grafts

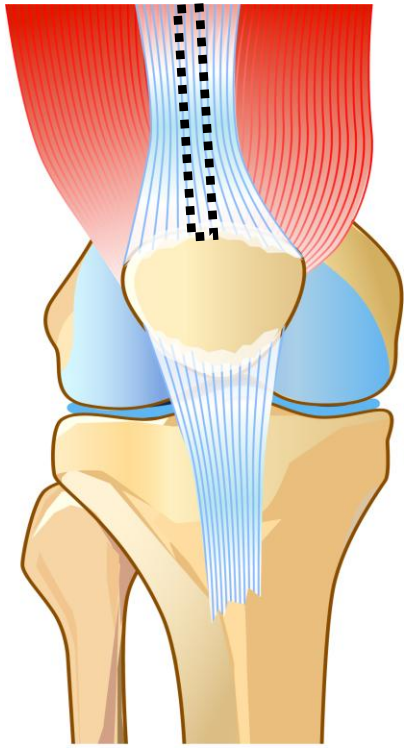
T Diermeier, et al. Knee Surg Sports Traumatol Arthrosc. 2020

RH Shani, et al. Arthroscopy. 2016

- ✓ QT graft has increased in frequency since 2014 and become a more common graft choice

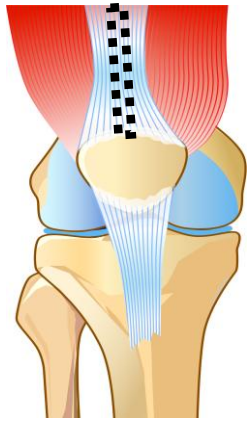
ld, et al. KSSTA. 2021

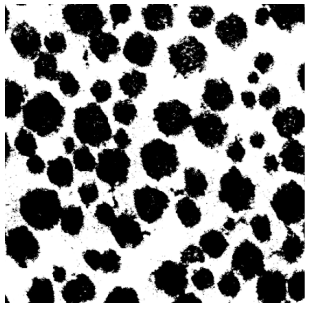




quadriceps tendon:**QT**

✓ Collagen fibril diameter is an important histological property related to strength





Rigozzi S, et al. J Anat. 2010

It is unclear how fibril diameter changes with age.

Purpose

✓ **To investigate age-related changes in collagen fibril diameter in the quadriceps tendon**

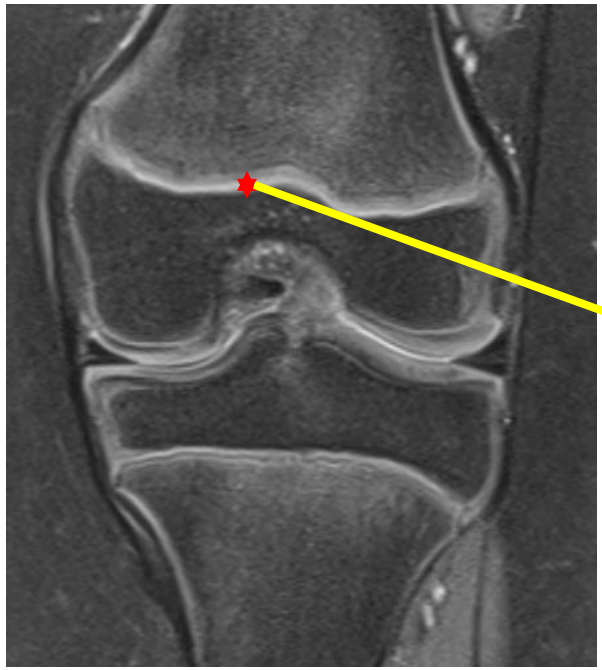
Hypothesis :

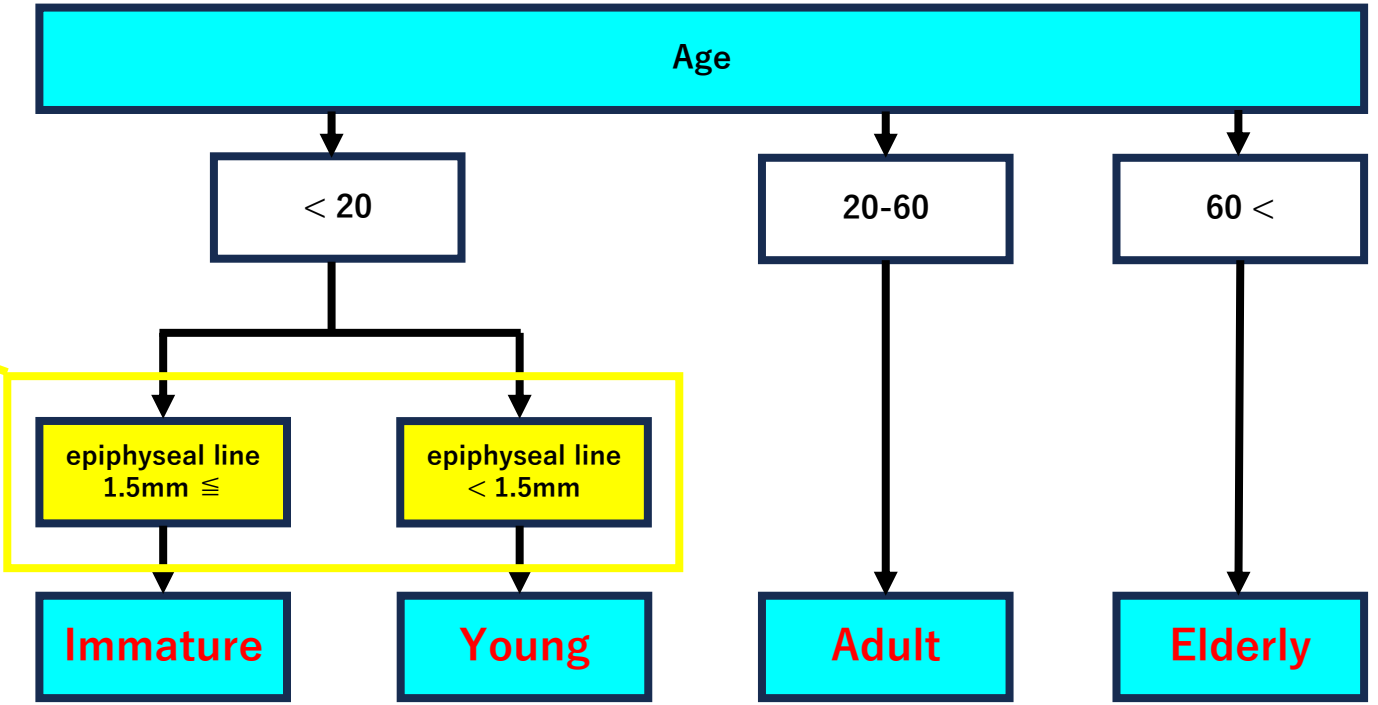
Fibril diameter decreases with age after adulthood.

Methods

- ✓ Cases: 24 patients who underwent ACL reconstruction or knee joint surgery using the QT technique between 2021 and 2023 were divided into four age groups

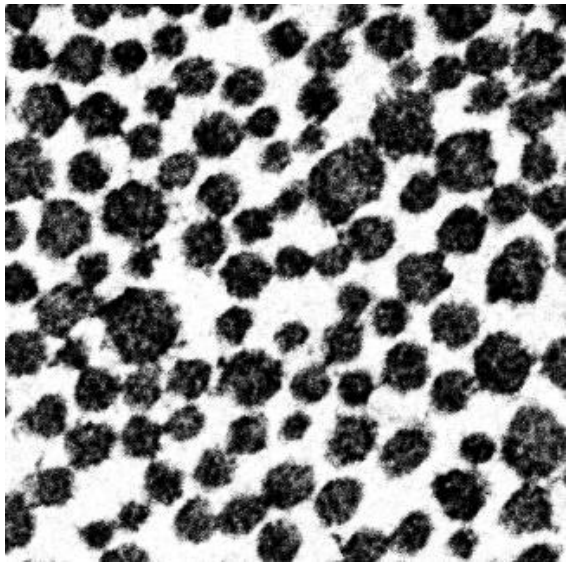
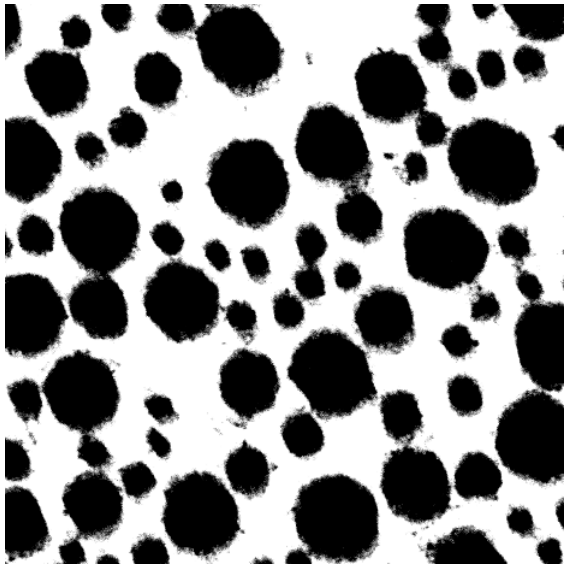
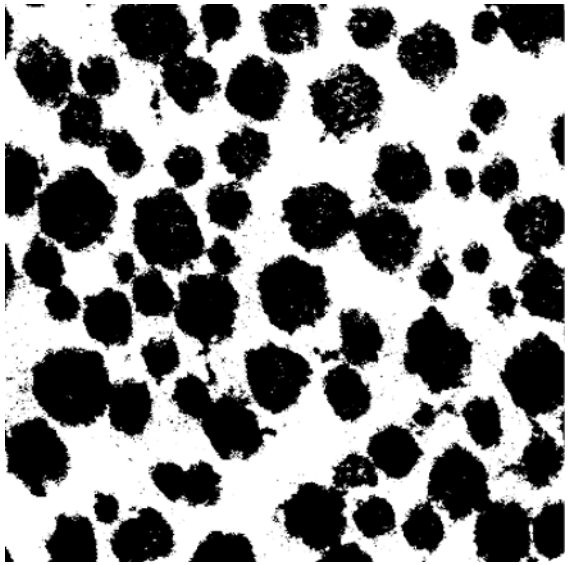
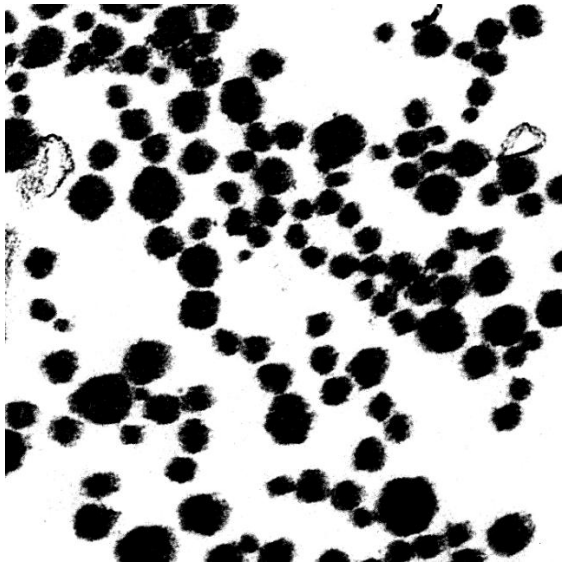
- ✓ The collagen fibril diameter of QT samples taken during surgery was observed under an electron microscope for each age group





Dedouit F, et al. Forensic Science International. 2012

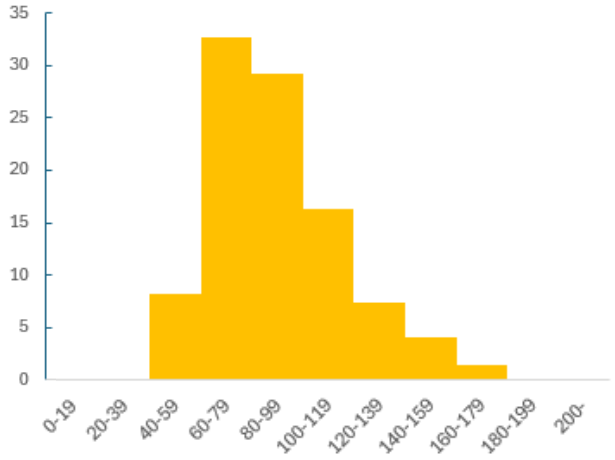
Results

Immature	Young	Adult	Elderly
			
			500 nm
Age(years)			
11.5 ± 1.6	15.8 ± 1.0	29.8 ± 11.3	73.0 ± 7.0
Fibril diameter(nm)			
89.7 ± 14.4	94.8 ± 16.4	107.2 ± 12.1	73.0 ± 9.7

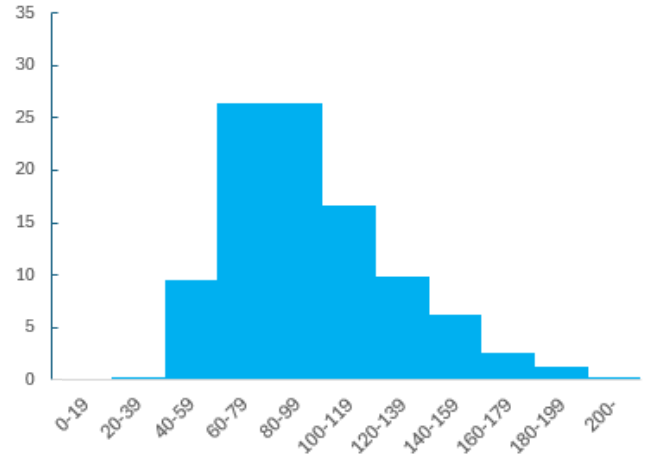
Results

Group			P
Immature	vs	Young	0.607
Immature	**vs**	**Adult**	**0.001**
Immature	**vs**	**Elderly**	**0.001**
Young	**vs**	**Adult**	**0.019**
Young	**vs**	**Elderly**	**0.001**
Adult	**vs**	**Elderly**	**0.001**

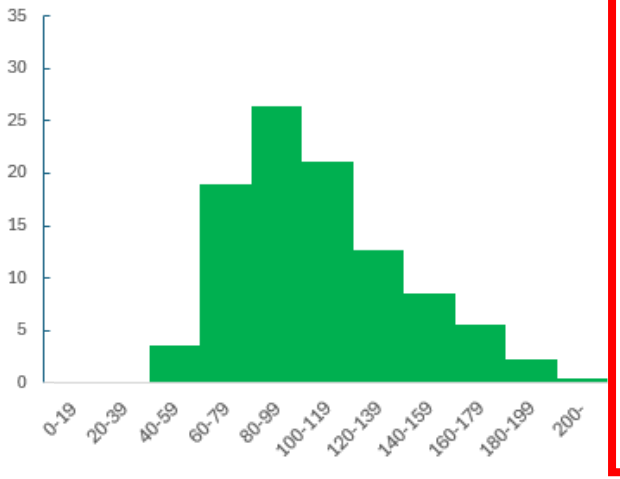
Immature



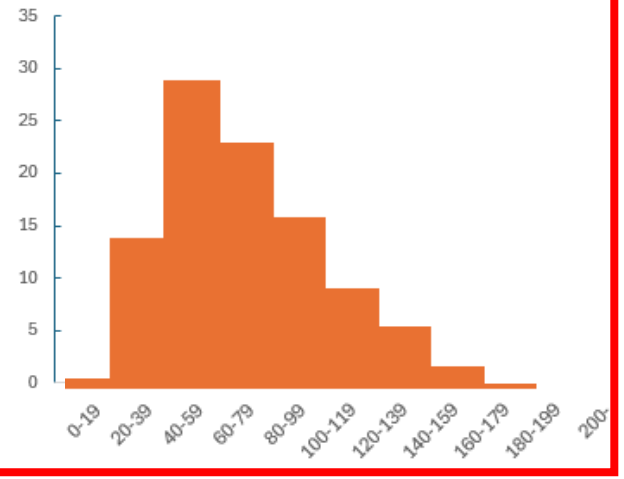
Young



Adult



Elderly



In the elderly, the fibil diameter distribution shifted lower

Discussion

- ✓ In humans, loss of mechanical stimulation of tendons reduces cross-links within the collagen structure

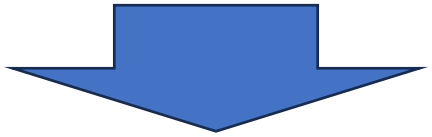
Makris EA, et al. Proc Natl Acad Sci. 2014

Pan XS, et al. Philos Trans R Soc Lond B Biol Sci. 2018

- ✓ Tendon cell density decreases with age in rabbits and rats

Zs-Nagy I, et al. Gerontologia. 1969

Nakagawa Y, et al. Eur J Appl Physiol Occup Physiol. 1999



- ✓ In elderly people, decreased physical activity and intracellular and extracellular age-related changes may cause changes in the collagen structure of tendons

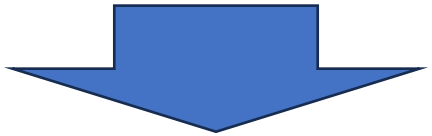
Clinical significance

✓ There is a positive correlation between collagen fibril diameter and tendon stiffness

Rigozzi S, et al. J Anat. 2010

→ Ageing may decrease the stiffness of tendon graft
→ Increasing the risk of re-rupture

✓ There is no clear consensus regarding the appropriate age for ACL reconstruction and the choice of graft tendon



✓ Orthopedic surgeons need to consider the mechanical and histological properties of grafted tendons, and the results of this study will be useful in making decisions

Conclusion

The average collagen fibril diameter of the quadriceps tendon in the elderly group was significantly smaller than that in the immature, young, and adult groups.

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