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Knee extensor strength after anterior cruciate ligament reconstruction in young patients

-a comparison of quadriceps and hamstring tendons-

Takuya Sengoku[1)], Yasushi Takata[2)], Yoshihiro Ishida[2)],
Naoki Takemoto[2)], Manase Nishimura[2)], Yushin Mizuno[1,2)], Junsuke Nakase[2)]

1) Section of Rehabilitation, Kanazawa University Hospital
2) Department of Orthopaedic Surgery,
Graduate School of Medical Science, Kanazawa University

International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine

COI disclosure of the authors

We declare that there is no COI

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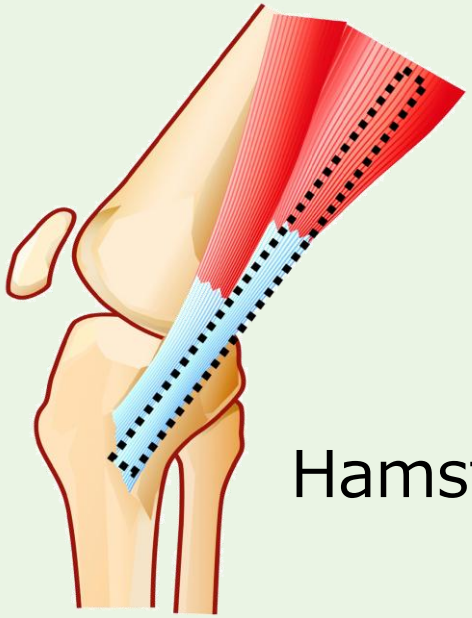
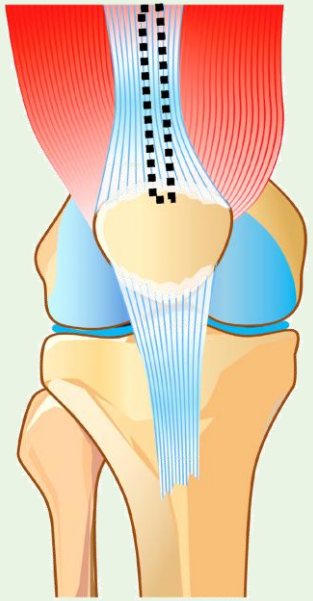
Introduction

In recent years, the quadriceps tendon has become popular worldwide as a graft tendon for anterior cruciate ligament (ACL) reconstruction.

(Arnold MP, et al. KSSTA. 2021)



Hamstring tendon (HT)



Quadriceps tendon (QT)

QT has a lower re-tear rate than HT

(Brinkman JC, et al. Am J Sports Med. 2022)
(Hurley ET, et al. J ISAKOS. 2022)

Introduction

Poor recovery of knee extensor strength after ACL reconstruction with QT (QT-ACLR) is a major problem.

At 7 months postoperatively, knee extensor strength was approximately 20% lower than with ACL reconstruction using HT.

In previous studies, the subjects ranged from young to middle-aged athletes with low to high activity levels.

(Bram JT, et al. Arthroscopy. 2023)
(Holmgren D, et al. Am J Sports Med. 2024)

Characteristics of knee extensor strength in young athletes undergoing QT-ACLR are unknown.

Introduction

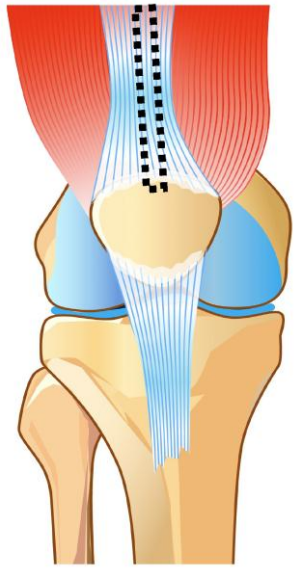
Aim

To clarify the characteristics of knee extensor strength in young athletes who have undergone QT-ACLR

※ This study was conducted with the approval of the Kanazawa University Medical Ethics Review Committee (114017)

Methods -subjects-

2015-2024, primary ACL reconstruction, all-soft tissue, 18 years old or younger, Tegner activity scale (TAS) ≧7



122 patients

QT group

n=22

male : 12, female : 10

HT group

n=100

male : 35, female : 65

Methods -measurement-

Knee extensor

Timing		instruments	Contraction	Velocity
Post	3M 6M	BIODEX	Isokinetic	60°/s

(Cited: SAKAImed)

- Peak torque
- Time to peak torque (TTPT)

→ **Limb symmetry index (LSI) compared by graft and time**

Statistical analysis

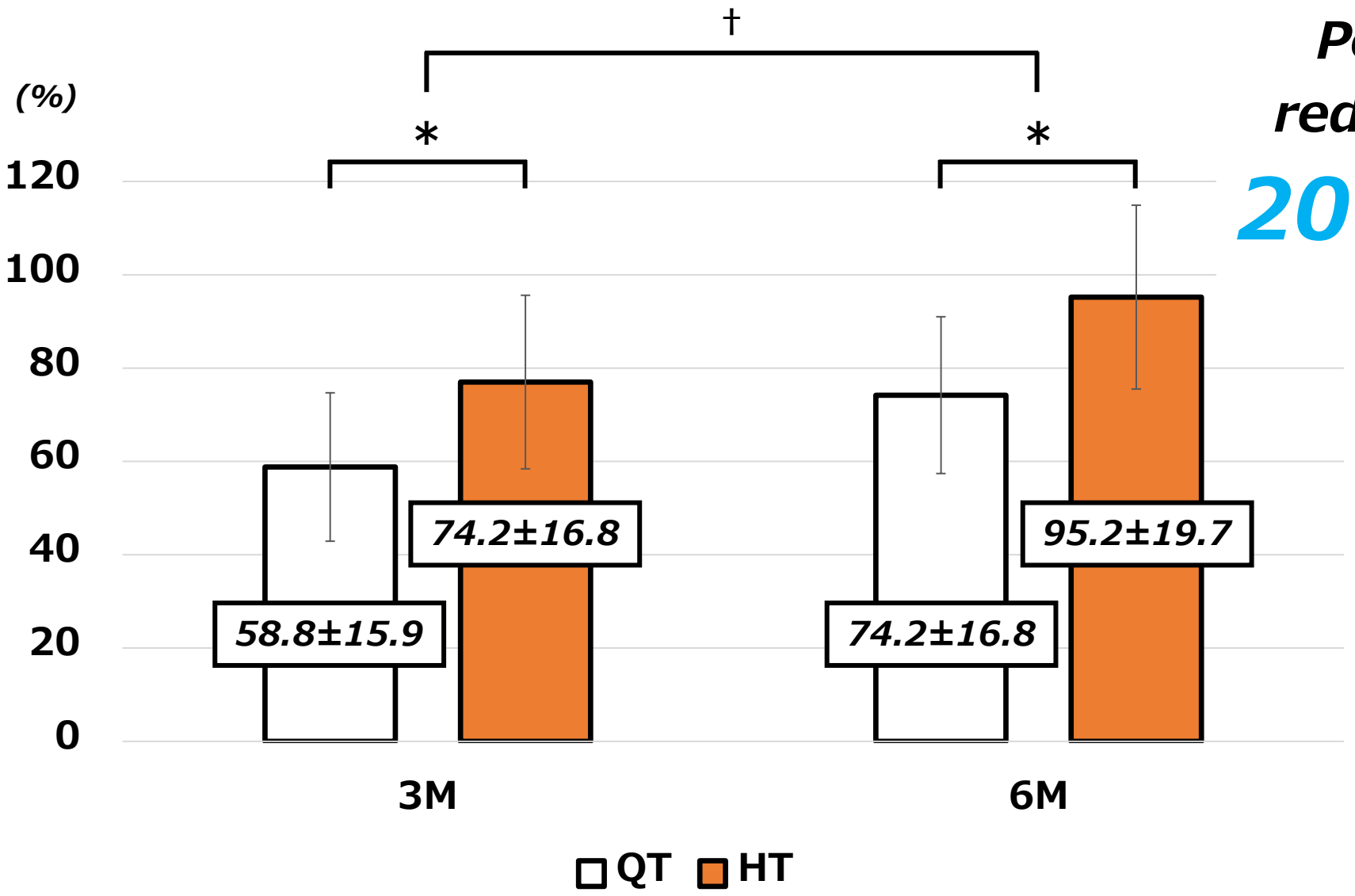
- Student's t test
- Wilcoxon test
- Pearson's chi-square test
- two-way repeated measures ANOVA

Results

	QT group	HT group	p value
Sex (male:female)	12:10 (54.5%)	35:65 (35%)	0.10
Age (year)	14.5±1.5	15.7±1.5	0.01
Height (cm)	164.3±7.4	164.0±8.4	0.91
Weight (kg)	58.1±1.5	60.2±11.8	0.31
BMI (kg/m²)	21.4±2.6	22.3±3.3	0.26
Waiting time (日)	43.6±17.8	60.8±42.1	0.09
TAS	9 (7-9)	9 (7-9)	0.84

Mean ± standard deviation, median (min-max)

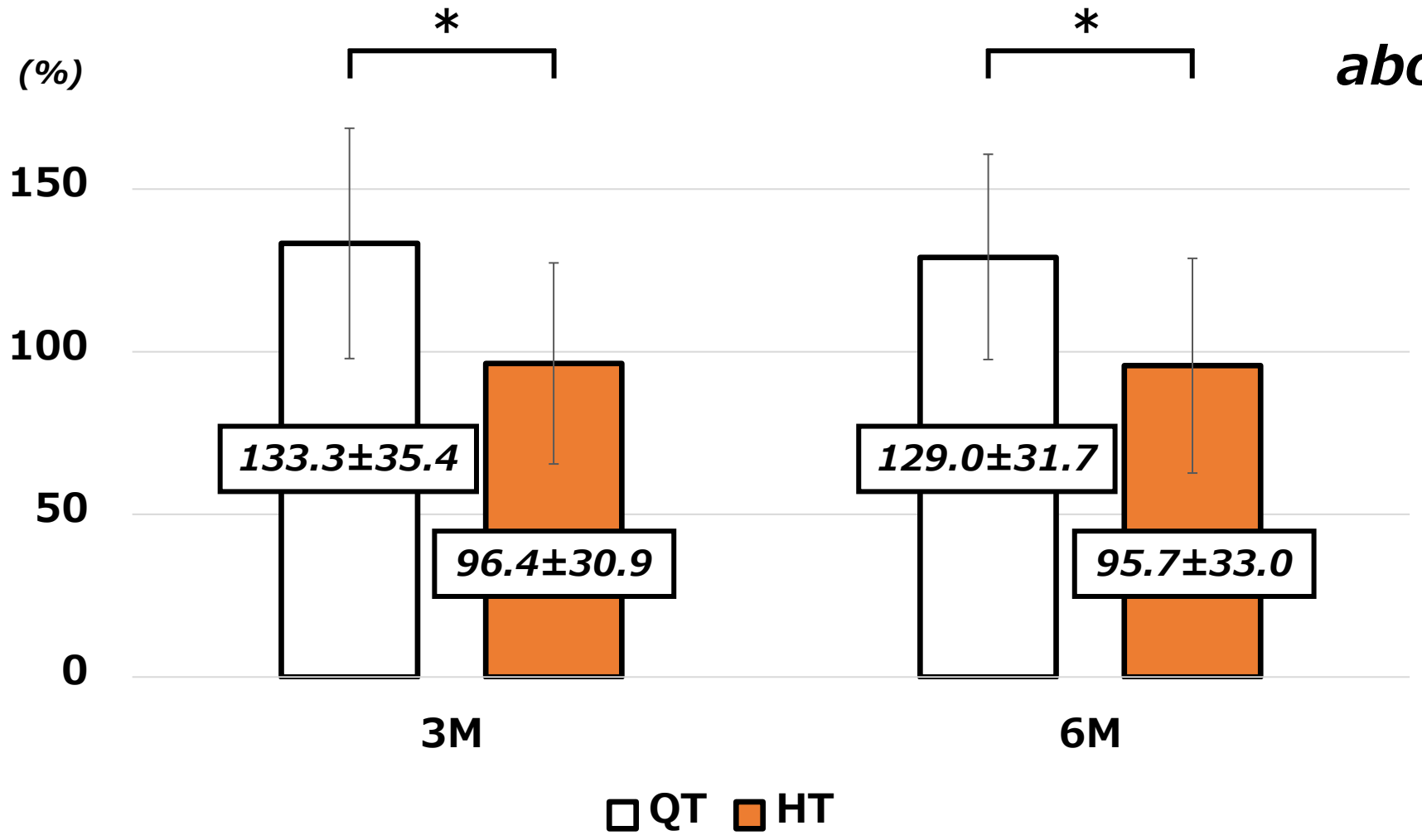
Results LSI of peak torque



Peak torque is reduced by about 20% by using QT

*	: Graft
†	: Time

Results LSI of TTPT



TTPT delayed by about 1.3 times by using QT

* : Graft

Discussion

Poor recovery of knee extensor strength and delayed TTPT

Tendon suture and healing after graft tendon harvesting

Morphological changes in muscle length and kinematics

Affect on contractile function

(Breitfuss H, et al. KSSTA. 1996)
(Horteur C, et al. Eur J Orthop Surg Traumatol. 2022)

QT width in teens

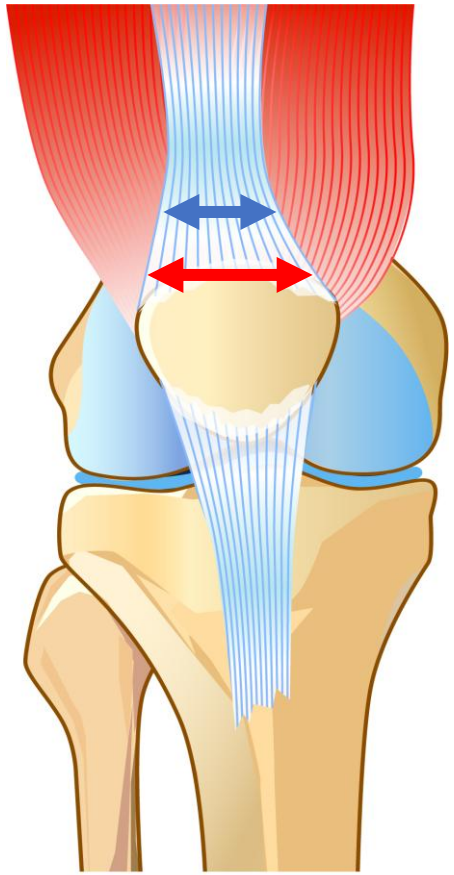
about ***18*** mm at proximal 5 cm

about ***20*** mm at patellar attachment

(Kanayama T, et al. Japanese Society of Orthopaedic Ultrasonics. 2023)

Generally, a 10 mm wide grafted tendon is harvested for QT-ACLR

(FinK C, et al. Arthrosc Tech. 2018)



Conclusion

- In young athletes, ACL reconstruction with QT was associated with a significant decrease in knee extensor strength at 3 and 6 months postoperatively.

- Time to peak torque was delayed by the use of QT and did not improve over time.

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