Morphological evaluation of the quadriceps tendon using preoperative ultrasound in anterior cruciate ligament injured knee

Satoshi Takeuchi [1,2], Kevin J. Byrne [2],
Ryo Kanto [2,3], Kentaro Onishi [2,4]

1. Department of Orthopaedic Surgery, Toyohashi Medical Center, Japan
2. Department of Orthopaedic Surgery, University of Pittsburgh, USA
3. Department of Orthopaedic Surgery, Hyogo College of Medicine, Japan
4. Department of Physical Medicine and Rehabilitation, University of Pittsburgh, USA

COI Disclosure

Presenter's name(s): Satoshi Takeuchi, Kevin J. Byrne, Ryo Kanto, ◎Kentaro Onishi （◎= representative)

There are no COI with regard to this presentation.

Introduction

- ✓ **Quadriceps tendon (QT) for anterior cruciate ligament reconstruction (ACLR):** Good clinical results[1]
  - Problems: Too short and/or narrow QT in some cases[2]

Preoperative morphological evaluation of the QT may be useful to avoid harvesting an **inadequately sized graft**

Purpose

- ✓ To investigate the morphological characteristics of the QT using preoperative ultrasound (US) in ACL injured knees.

Material and Methods

✓ **33 knees of 33 patients** with unilateral complete ACL tear

   – 17 males and 16 females

   – Mean age: 26.0 ± 11.5 years

✓ Patient position

– supine with $20°$ of knee flexion

✓ US transducer position

– anterior aspect of the knee
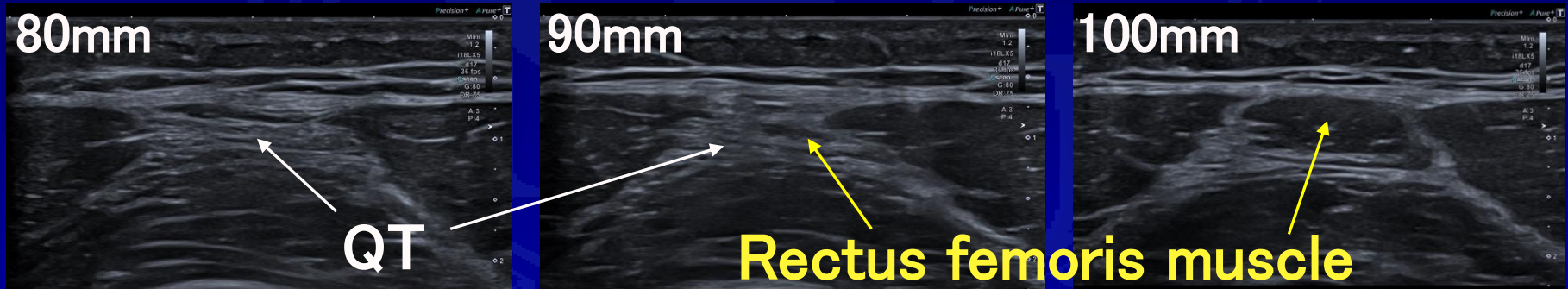

Anterior

Distal

Morphological evaluation of the QT

✓ **Short axis image:** perpendicular to the QT

✓ **30, 50, 60, 70, 80, 90 and 100 mm** proximal to the patella
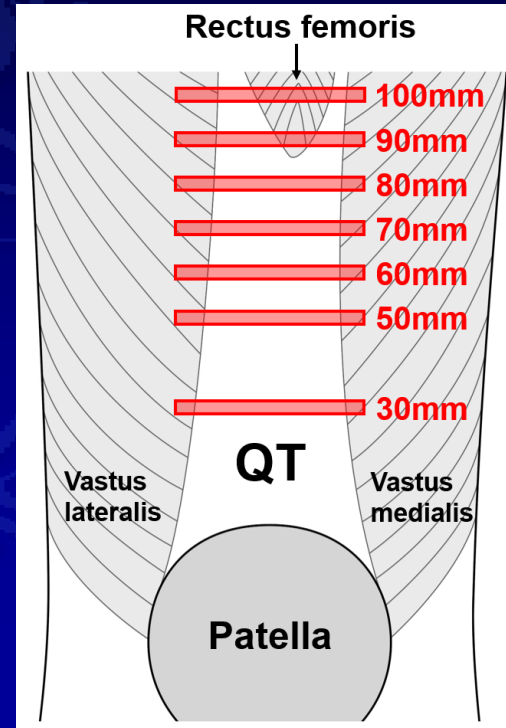
Assessment items

1) Length:

determined by the two contiguous images that
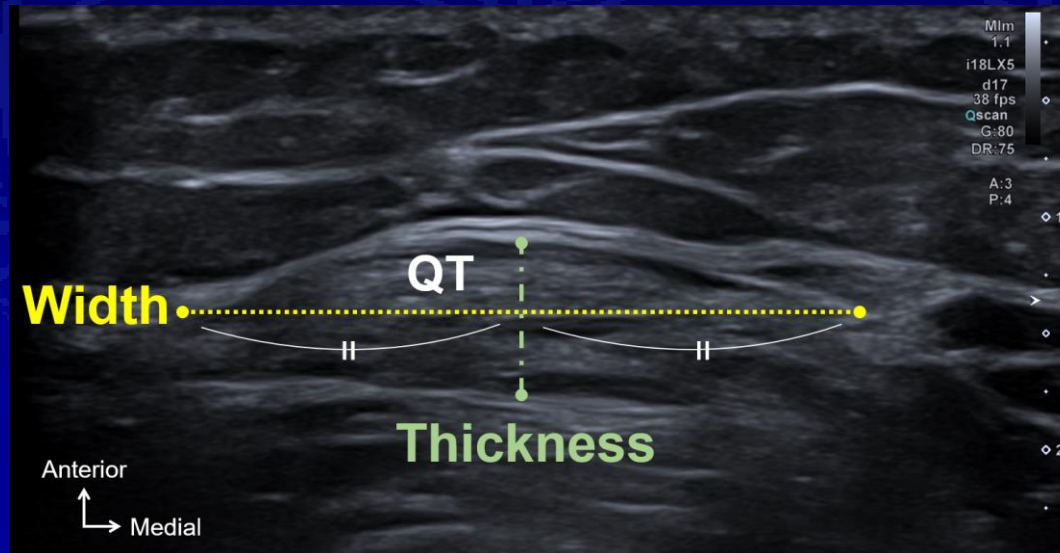did and did not contain rectus femoris muscle

➡ Length: 80–90 mm

Assessment items

2) <u>Width</u>: superficial part of the QT

3) <u>Thickness</u>: central part of the QT

Statistical analysis

✓ <u>Length:</u> Classified into 8 groups
　　　　　(0–30, 30–50, 50–60, 60–70, 70–80, 80–90,
　　　　　90–100, and 100 mm <)

→ one-way ANOVA or Fisher exact test to compare
the demographic data among groups

✓ <u>Width and Thickness:</u>

→ one-way ANOVA among assessment locations

✓ Statistical significance: P<0.05

Results: Length

≤ 70mm

15 patients (45.5%)

Length	Number of patients (*Number of male*)	Demographic data (Mean ± standard deviation)			
		Age, years	Height, cm	Weight, kg	BMI, kg/m^2
0 - 30 mm	0 patients				
30 - 50 mm	0 patients				
50 - 60 mm	4 patients (*1*)	29.0 ± 12.5	172.1 ± 3.8	68.7 ± 14.5	23.1 ± 4.2
60 - 70 mm	11 patients (*6*)	30.0 ± 12.0	171.3 ± 12.3	70.7 ± 14.1	23.9 ± 3.2
70 - 80 mm	10 patients (*5*)	26.3 ± 13.0	174.0 ± 10.1	75.9 ± 17.3	24.8 ± 3.8
80 - 90 mm	6 patients (*3*)	19.3 ± 5.3	172.7 ± 13.1	72.5 ± 16.1	24.0 ± 2.3
90 - 100 mm	1 patient (*1*)	20	195.6	81.6	21.3
100 mm <	1 patient (*1*)	14	190.5	74.8	20.6

✓ No difference in any demographic data among groups.

Results: Width and Thickness

	Assessment location from the superipr pole of the patella (number of included images)							P value
	30mm (n=33)	50mm (n=33)	60mm (n=29)	70mm (n=18)	80mm (n=8)	90mm (n=2)	100mm (n=1)	
Width, mm	25.7 ± 4.3* (17.0-35.4)	21.7 ± 4.4* (12.6-27.9)	18.5 ± 5.0* (7.0-25.8)	18.0 ± 4.9* (9.1-25.4)	16.5 ± 4.2* (11.5-23.5)	13.6 ± 4.5* (10.5-16.8)	14.7	<0.001
Thickness, mm	6.5 ± 1.3* (4.3-9.4)	5.9 ± 1.5 (3.8-9.4)	5.5 ± 1.4 (3.4-7.6)	5.0 ± 1.5* (2.8-7.8)	4.7 ± 1.0* (3.8-6.6)	4.2 ± 1.0 (3.5-4.9)	1.7	<0.001

* Significant difference compared to 30mm (P<0.05)

✓ Significantly greater at 30 mm than 70 mm.

✓ Width <10 mm at 60 and 70 mm in 2 patients

Discussion

✓ 65–70 mm of graft length and 10 mm of width are typically recommended in ACLR with QT autograft.[3]

<u>This study</u>

✓ Length ＜ 70 mm: 15 patients (45.5%)

✓ Width ＜ 10mm: 2 patients (6.1%)

➢ Inadequate size for all soft tissue QT autograft
➢ Preoperative US may be useful to avoid harvesting an inadequately sized graft

Discussion

<u>This study</u>

✓ Width, Thickness, CSA, and Estimated diameter

  – Significantly greater at 30mm than 70mm

  – Estimated diameter: clinically significant difference
of 0.6 mm

➢ Size of the proximal part of the QT autograft may be
smaller than distal part if the QT autograft is
harvested to 70 mm

Conclusion

✓ The QT length was shorter than 70 mm in 45.5% of patients.

✓ The width, thickness, CSA, and estimated diameter of the QT were significantly greater at 30 mm than 70 mm proximal to the superior pole of the patella.

✓ Preoperative assessment of the morphological characteristics of the QT using ultrasound may help to avoid inadequately sized grafts.

References
1) Hunnicutt, et al. OJSM 2019 2) Lind, et al. BJSM 2019 3) Fujimaki, et al. AJSM 2016