

Length of Semitendinosus and Gracilis Tendons and the Relationship of Graft Length and Leg Length

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Background: Hamstring tendon has been more popularly used in anterior cruciate ligament reconstruction. Quadruple semitendinosus graft had some benefits and decreased the donor site morbidity.

Objective: This study presented the length of semitendinosus and gracilis in Thai people and used the leg length to estimate the tendon graft length.

Material and Method: Eighty five knees of adult cadaver in both sexes were measured length of semitendinosus and gracilis. The leg length was measured and calculated the correlation between graft length and leg length.

Results: The length of semitendinosus in male and female were 24.33 and 21.89 centimeters. The length of gracilis in male and female were 17.98 and 16.55 centimeters respectively. There were moderate correlation between grafts length and leg length.

Conclusion: Thai people should use both of semitendinosus and gracilis in ACL reconstruction and leg length can effectively use as the predictor of graft length.

Keywords: Semitendinosus, Gracilis, Graft length

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Semitendinosus and gracilis tendons have been commonly used as autografts in ligamentous reconstructions of the knee^(1,2). In anterior cruciate ligament reconstruction, the strength of the quadruple strands of semitendinosus and gracilis was greater than of bone patella bone grafts; there were no difference results between two graft types⁽³⁾. Quadruple semitendinosus graft can decrease the donor site morbidity⁽⁴⁻⁶⁾. The quadruple semitendinosus (ST) graft also had some advantages over the double semitendinosus and gracilis (STG) graft⁽⁷⁻¹²⁾. Tashiro and et al⁽¹⁰⁾ reported a significant decrease of hamstring strength in both groups when studied at 70 degrees or more in knee flexion. Furthermore, the double tendon group (STG) had considerably less strength than the single tendon harvest group. Using ST alone can minimize the morbidity related to the harvest of whole

hamstring graft⁽¹³⁾. The length of ST is very important in creating the adequate quadruple ST graft.

In this study, we measured the length of semitendinosus and gracilis in Thai people with an aim to create the quadruple ST graft. In addition, we will examine if the leg length can estimate the graft length pre-operatively in order to prevent complications from smaller graft during the ligament reconstruction.

Material and method

Subjects

We collected data in total 85 patients (43 male and 42 female). There were then eighty-five adult cadaveric knees collected and dissected. None of the knees had evidence of significant degenerative or deterioration on physical examination.

Cadaveric dissection technique

The cadaver leg length was measured in 4 aspects: (1) from ASIS to upper pole of patella, (2) from ASIS to tip of tibial tubercle, (3) from ASIS to tip of

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medial malleolus, and (4) from lower pole of patella to tip of medial malleolus

The tibial insertion of gracilis and semitendinosus were identified after the creation of longitudinal incision. The semitendinosus and gracilis were dissected from tibia to their musculo-tendinous junction of each tendon. Their insertions were the point that the tendons was firmly attached the proximal tibia and then changed into periosteum. We measured the length between their insertions and musculotendinous junction in centimeter.

Statistical analysis

We used mean and standard deviation to describe the average of graft length. Two-Sample t-test was used to compared between groups

The strength and relationship between graft length and the leg length was calculated with Pearson's correlation method

Results

The length of semitendinosus tendon and gracilis were 23.1 and 17.27 centimeters respectively. The length of semitendinosus and gracilis in male were 24.33 and 17.98 centimeters respectively. The lengths of semitendinosus and gracilis in female were 21.89 and 16.55 centimeters. The lengths of semitendinosus and gracilis tendon were different between male and female but the significant difference was found only in semitendinosus length (Table 1). We also found the length between ASIS to apex of patella had moderate correlation with the length of semitendinosus tendon. The detail showed in the Table 2.

Discussion

The different of semitendinosus and gracilis tendon length was statistically significant among male and female. For male subjects, the length of semitendinosus and gracilis was longer than female subject around 3 cm and 1 cm respectively. Gracilis was shorter than semitendinosus in both genders. In Anterior cruciate ligament reconstruction, the recommended graft length should be more than 60 mm and the diameter should around 7 to 10 mm⁽¹⁴⁾. From this study, the length of semitendinosus was 24 cm and 22 cm in male and female respectively. If we use the quadruple ST graft alone, we will have inadequate graft length. Thus for Thai patient, we should use the double semitendinosus and gracilis (STG) grafts rather than quadruple ST graft in order to prevent the insufficient graft length.

In the present study, the diameter of the graft cannot be measured because the cadavers were shrunken and the tendon appearance was smaller than their actual fresh specimen resulting in the possibly inaccurate value measured.

There were the moderate correlations between graft length and leg length in semitendinosus graft (the length from ASIS to medial malleolus is the highest correlation at about 0.615). Gracilis had the correlation with leg length also but it was not similar to a strong correlation found in semitendinosus. To make these correlations more reliable, we suggested having more subjects to collect data on other possible factors affecting these correlations *i.e.* height included in the future study. The limitation of this study is preserved cadaver. The tendon was shrunken and we then could

Table 1. Measurement of the length of semitendinosus and gracilis tendon

	Total, mean (SD)	Male, mean (SD)	Female, mean (SD)	p-value
Semitendinosus tendon length	23.10 (2.91)	24.33 (2.35)	21.88 (2.93)	<0.01
Gracilis tendon length	17.27 (3.00)	17.98 (2.68)	16.59 (3.18)	0.01

Table 2. Correlations of graft length and the part of leg length

	Semitendinosus tendon length	Gracilis tendon length
ASIS to lower pole of patella	0.53	0.31
ASIS to apex of tibial tubercle	0.57	0.32
ASIS to apex of medial malleolus	0.62	0.34
Lower pole of patella to medial malleolus	0.49	0.38

not measure the height of the cadaver due to the abnormal posture of some cadavers. The study in fresh cadavers or in a timing subject that could receive more precise information about graft length and diameter of quadruple graft should be further done.

Conclusion

The use of quadrupled ST graft potentially offers good benefits and good clinical results rather than use gracilis and semitendinosus if the graft length is adequate. To obtain a better surgical result, we recommend using double ST/G graft for soft tissue graft in Anterior cruciate ligament reconstruction. Leg length may be the one of the predictors for graft length but it should be considered in combination with other factors.

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การศึกษาความยาวของเส้นเอ็น Semitendinosus และ gracilis และความสัมพันธ์ระหว่างความยาวขาและความยาวของเส้นเอ็น

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ภูมิหลัง: ปัจจุบันการรักษารูปร่างที่ผิดปกติของเอ็นไขว้หน้าขา (ACL) มีการใช้เอ็นข้างเข่าด้านใน (semitendinosus and gracilis) เพื่อใช้ในการสร้างเส้นเอ็นแทนเข่ากำลังได้รับความนิยมมากขึ้น การสร้างเอ็นแทนเข่าขึ้นมาใหม่นั้น หากมีการใช้เส้นเอ็นข้างเข่าด้านในเพียงเส้นเดียว (semitendinosus) หากมีความยาวเพียงพอที่จะนำมาพับ 4 ทบนั้น จะมีโอกาสเกิดภาวะแทรกซ้อนจากการผ่าตัดเพื่อนำเส้นเอ็นออกมาน้อยกว่าการใช้เส้นเอ็น 2 เส้น (semitendinosus and gracilis)

วัตถุประสงค์: เพื่อวัดความยาวของเส้นเอ็นข้างเข่าด้านใน และวัดความยาวขาเพื่อหาความสัมพันธ์ระหว่างความยาวขา และความยาวเส้นเอ็นว่าสามารถใช้ในการทำนายความยาวของเส้นเอ็นได้หรือไม่

วัสดุและวิธีการ: วัดความยาวเส้นเอ็นและความยาวขาจากศพทั้งหมด 85 ขา

ผลการศึกษา: ความยาวเส้นเอ็นsemitendinosus มีค่าเฉลี่ย 24.33 เซนติเมตร ในเพศชาย และ 21.89 ในเพศหญิง ความยาวของเส้นเอ็น gracilis มีค่าเฉลี่ย 17.98 เซนติเมตร ในเพศชายและ 16.55 เซนติเมตรในเพศหญิง และพบว่ามีความสัมพันธ์ปานกลางของความยาวขาและความยาวของเส้นเอ็น

สรุป: ค่าเฉลี่ยของความยาวเส้นเอ็นsemitendinosus ในคนไทยนั้นไม่พอที่จะนำมาใช้สร้างเอ็นแทนเข่า จึงมีความจำเป็นต้องใช้เอ็น semitendinosus และ gracilis ในการรักษารูปร่างที่ผิดปกติของเอ็นไขว้หน้าขา และความยาวขานั้นสามารถใช้ในการทำนายความยาวเส้นเอ็นได้แต่ต้องใช้ปัจจัยอื่นร่วมด้วยเพื่อที่จะได้ค่าที่แน่นอนมากขึ้น
