

# Graft size, Semitendinosus and Gracilis Length among Primary ACL Reconstruction Patients in Hospital Sultan Ismail

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**Abstract:** ***Introduction:** Previous studies demonstrated that factors such as gender and height correlate with the diameter of hamstring autograft. We conducted this study to get local data on hamstring graft length, size and factors determined it. **Material and Methods:** We included 32 patients underwent primary ACL reconstruction using hamstring autograft from January 2017 to November 2020. We recorded gracilis and semitendinosus graft length, graft size, and its associated factors. **Result:** The average length for semitendinosus and gracilis tendon were  $285.9 \pm 28.95$ mm and  $263.8 \pm 27.33$ mm. The mean graft diameter was  $8.8 \pm 0.67$ mm. Height had significant correlation with gracilis length ( $r=0.466$ ) and graft size ( $r=0.568$ ). **Conclusion:** The average hamstring graft size was  $8.8 \pm 0.67$ mm. Height is the strongest correlating factor.*

**Keywords:** Hamstring graft, length, diameter, height

## 1. Introduction, Literature Survey

Anterior cruciate ligament (ACL) is the most reconstructed ligament in the knee joint [1]. Hamstring graft has become popular choice for ACL reconstruction since 1990 owing to its biomechanical strength, favourable clinical outcome and low complication rate [2].

Graft diameter is one of the most important factor that determine the successful of ACL reconstruction. In year 2012, Magnussen et al reviewed on a total of 26 patients and concluded that graft size less than 8mm are at greater risk of ACL reconstruction failure [3]. Another multicentre study also reported a 0% failure rate in graft size more than 8mm [4]. However, hamstring graft size is often variable. Previous studies demonstrated that factors such as gender and height correlate with the diameter of hamstring autograft [1, 5, 6]. Anthropometric study among Singaporean demonstrated strong correlation between height, female and hamstring autograft size in which female often had a smaller graft size as compared to male [7].

To our knowledge, there is no local data of hamstring graft in ACL reconstruction patient. This study is designed to get further information on hamstring graft size and factors determined it. These information is important for us in future to discuss with patient alternative graft choices especially in those patients at risk of smaller graft.

## 2. Methods/ Approach

We retrospectively reviewed the clinical data of all patients underwent primary single bundle ACL reconstruction using gracilis and semitendinosus autograft from January 2017 to November 2020 in Hospital Sultan Ismail. Patients 18 year-old and above with/without associated meniscus and cartilage injury were included. We excluded 21 patients with multiligamentous injuries, revision surgery, bone patella tendon bone graft, and incomplete clinical data.

We recorded their age, gender, time of injury to operation, gracilis and semitendinosus graft length, number of strand, final graft size, height, weight and BMI.

The hamstring autograft was harvested at the pes anserinus using a longitudinal anteromedial incision. A L-shape incision was made at the sartorial fascia near to the insertion of semitendinosus and gracilis tendon. Both tendons were separated from the fascia and its band. It was sutured with Ethibond 5 in whip stitch method and harvested separately using tendon stripper. Each tendon length was measured on the graft preparation table, CONMED (Figure 1). The number of strand for each graft was determined by the surgeon to achieve a maximum graft diameter.

Statistical analysis was performed using SPSS software version 16.0. Hamstring graft size, semitendinosus and gracilis tendon were tested for correlation to each other and to age, gender, duration of injury, height, weight and BMI

using the Spearman correlation coefficient and Kruskal Wallis test.



**Figure 1:** Each end of the semitendinosus tendon was whip stitched with Ethibond 2 suture. The tendon length was measured on graft preparation table, CONMED.

### 3. Result

A total of 32 patients fulfilled the inclusion criteria of this study. Our patients demographic was illustrated in table 1. The mean age was  $28.4 \pm 8.45$  year-old. 90.6% of our patients were male and 9.4% were female. The median time from injury to operation is 28.5 months (IQR=33months). The average length for semitendinosus and gracilis tendon are  $285.9 \pm 28.95$ mm and  $263.8 \pm 27.33$ mm respectively. The mean diameter for the graft is  $8.8 \pm 0.67$ mm, in which 3 were 4 strands, 17 were 5 strands, and 12 were 6 strands. Their average height was 169cm ( $\pm 8.1$ ), weight was  $77.7 \pm 1.47$ kg, BMI was  $27.1 \pm 4.48$ .

Patient's height had significant positive correlation with gracilis length ( $r=0.466$ ) and graft size ( $r=0.568$ ). However, the age, time of injury to operation, weight and BMI did not affect the semitendinosus, gracilis length and graft size.

**Table 1:** Patient demographic

Age (mean, sd)	28.4(8.45) years old
Gender (n)	Male – 29 (90.4%) Female – 3 (9.6%)
Ethnic (n)	Malay – 30 (93.75%) Chinese – 1 (3.12%) Indian – 1 (3.12%)
Injury time to operation (median/IQR)	28.5 (33) months
SemiT length (mean, sd)	285.94 (28.945)
Gracilis length (mean, sd)	263.75 (27.327)
No of strand	4 – 3 5 – 17 6 – 12
Final graft size (mm) (mean, sd)	8.78 (0.671)
Height (m) (mean, sd)	1.69 (0.081)
Weight (kg) (mean, sd)	77.74 (1.468)
BMI	27.07(4.477)

### 4. Discussion

Hamstring graft has been the main graft of choice for primary ACL reconstruction in our center due to good clinical outcome and low complication rate [2]. Graft failure rate is greatly reduced when graft size is more than 8mm [3, 4]. The average graft size for our patients since January

2017 was 8.78mm, attributed to modification in different number of strand to achieve maximum graft diameter.

Our study did not show any significant correlation between age and semitendinosus, gracilis length and graft diameter. However, Moghamis et.al found out that age had positive correlation with the graft diameter[8]. Meanwhile, another study demonstrated a negative correlation with age and final hamstring graft diameter[9].

Anthropometric study among Singaporean demonstrated hamstring graft size had strong correlation with height and female in which female had a smaller graft size [7]. Our study also showed that height had significant positive correlation with gracilis length and graft size. We could not consider gender into our factor as our patients were predominantly male. On the other hand, multiple studies also showed strong correlation between height and graft length and diameter[8-11]. Meanwhile, W.Loo et.al showed no correlation between height and final graft size [1]. Previously study showed weight and BMI could not predict the final graft size [1, 9]. It supported the result of our study.

Graft preparation technique had been much improved over the years focusing in getting largest graft diameter. One of the technique is by increasing the number of strand. However, Yasunari et.al showed that semitendinosus length has no correlation with the graft strand number[12]. We also found out that the number of strand does not correlate with the graft diameter, mainly because this was based on our surgeon preference.

There is limited evidence correlating the interval from injury to operation to the length of semitendinosus and gracilis tendon. We consider this is an important factor as failure to compliance to pre-operative rehabilitation may result in atrophy of the hamstring and hence the graft diameter.

### 5. Conclusion

The average autologous hamstring graft size for our primary ACL reconstruction patients was  $8.8 \pm 0.67$ mm which can be modified by number of strand. Height is the strongest predicting factor for gracilis length and final graft size.

### 6. Future Scope

There are several limitations in our study. Our study sample size is small due to the covid-19 outbreak since March 2020 and is single center. Measurement of the hamstring graft length is challenging as the tension applied during graft preparation might not be the same. The number of strand for the prepared hamstring graft was different. Further prospective study include larger number of patients shall focus on different type of strand as this play an important role in getting maximum graft size.

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