

Original Article

Variability in quadrupled hamstring tendon autograft diameter in North Indian population and its impact on anterior cruciate ligament (ACL) reconstruction outcomes

Ravi Kumar Gupta¹ , Nabin Poudel¹ , Vishal Dudeja¹, Himanshu Bansal¹, Anil Kapoor²

¹Department of Sports Medicine, Fortis Hospital, ²Department of Orthopedics, IVY Hospital Mohali, Punjab, India.

ABSTRACT

Objectives: This study aimed to see the mean quadruple hamstring tendon (HT) graft in the North Indian population and the effect of height and gender on graft diameter.

Materials and Methods: Three hundred and twelve patients who underwent anterior cruciate ligament reconstruction using quadruple HT graft with preserved insertions were included in the study. Quadruple graft diameter is calculated using a sizing tube and its correlation with height, gender, and body mass index was calculated. All patients were followed up for a minimum of 2 years, and the incidence of graft failure was calculated.

Results: The mean graft diameter in the present study was 7.6 mm; taller patients and male gender have thicker grafts. About 63% of patients had graft diameters <8 mm. The incidence of graft failure rate was 2.5% and 0.8% in patients with graft diameters <8 mm and ≥8 mm, respectively.

Conclusion: In the present study, the average quadruple HT graft diameter in the Indian population was 7.6 mm, and graft diameter depends on the height and gender of the patient.

Keywords: Anterior cruciate ligament (ACL), Sports injuries, Hamstring tendon graft

INTRODUCTION

Arthroscopic anterior cruciate ligament reconstruction (ACLR) remains the mainstay of treatment for anterior cruciate ligament (ACL) tear.^[1] Hamstring tendon (HT) graft and bone patellar tendon bone graft (BPTB) are commonly used autografts for ACLR.^[2] Till now, the BPTB graft is considered a superior graft for ACLR.^[3] However, in the past two decades, HT graft has become more popular due to fewer donor site morbidities, but the downside of HT graft is the variable diameter of the graft. Recent studies suggested that a graft diameter of 8 mm is associated with a higher graft failure rate and inferior functional outcomes.^[4-7] To counter this problem, many surgeons have now even shifted to peroneus longus graft;^[8,9] However, some surgeons still believe that peroneus longus graft should be reserved for multi-ligamentous injury.

HT graft diameter depends on the height, gender, and ethnicity of the patient.^[10-13] HT graft of 8 mm or more is common among the Western population; however, in the Asian population where the average height is relatively

shorter, it is expected to have a smaller diameter graft. In the present study, it was hypothesized size of 8 mm or more graft size will not be feasible to achieve in the majority of the patients using quadruple HT graft, and the graft failure rate will be higher in patients with graft size <8 mm.

MATERIALS AND METHODS

Three hundred twelve patients (252 males and 60 females) with ACL injury were included in the study. Consent for participation in the study was received from all the patients. Both professional and recreational were enrolled in the study. Patients age <16 years, undergoing revision ACL surgery, suffering from inflammatory arthritis, or having a premature graft amputation while harvesting were excluded from the study. HT graft with preserved tibial insertion was used in all the patients.^[14] Sizing tubes calibrated to 0.5 mm (Smith and Nephew Ltd., Mumbai, India) were used to measure the diameter of quadrupled hamstring autograft [Figure 1]. The minimum diameter allowing smooth graft passage was recorded as the graft diameter for the study. Fiber tape is

*Corresponding author: Anil Kapoor, Department of Orthopedics, IVY Hospital Mohali, Punjab, India. anil88gmch@gmail.com

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not used in any of the cases. Depending on the diameter of the graft, patients were categorized into two groups: <8 mm and ≥8 mm. Patient anthropometric measurement (height, weight, and body mass index) was taken. A minimum follow-up of 24 months was achieved in all the patients.

RESULTS

A total of 312 patients were included in the study, with a mean age of 24.7 ± 3.6 years. There were 252 males and 60 females

in this study. The HT graft diameter was 7.6 ± 0.6 mm (females 7.1 ± 0.4 mm and males 7.7 ± 0.5 mm). One hundred and ninety-seven patients had graft diameters <8 mm, and 115 patients had graft diameters ≥8 mm [Figure 2]. It was observed that graft size depends on the height and gender of the patient [Table 1]. 6/312 (2%) patients had graft rupture; all these patients underwent revision ACLR using BPTB graft. 5/197 patients with graft diameter ≥8 mm and 1/115 patients with graft diameter <8 mm had graft failure at a mean follow-up of 34 ± 6.3 months.

DISCUSSION

The mean graft diameter in this study came out to be 7.6 ± 0.6 mm. 63% of patients are unable to achieve a diameter of 8 mm or more. Previous studies suggested that the mean graft diameter in the Indian population varies from 7.5 mm to 8 mm.^[11,15,16]

The present study suggested that graft diameter depends on the height and gender of the patient. These results are in agreement with previous literature, which suggested that graft diameter is higher in taller and male patients.^[10-12]

Graft diameter is a topic of concern among arthroscopic surgeons, especially for the Asian population. To achieve the magical number of 8 mm, many innovative techniques have been adopted by surgeons, such as the use of five or six-stand HT grafts, the use of fiber tape, or alternative grafts (peroneus longus or BPTB graft). Although most of the previous studies that suggested the magical number of 8 mm for ACL graft are from the Western population, there is limited data on the Indian population.

In this study, the graft failure rate at two years of follow-up was 2% (6/312). The graft failure rate was 2.5% and 0.8% in patients with graft diameters <8 mm and ≥8 mm, respectively. The total number of patients with graft failure is few; therefore, the effect of graft size on graft rupture cannot be established. Park *et al.* observed a 4% graft failure rate at a minimum 2-year follow-up.^[17] In previous studies, it was observed that graft size <8 mm is associated with higher graft

Table 1: Anthropometric comparison of patients with graft size <8 mm and ≥8 mm.

	<8 mm (n=197)	≥8 mm (n=115)	P-value
Mean age (years)	24.9±5.2	24.5±5.1	n.s.
Gender	139:58	113:2	0.0001
Height (cm)	168.8±5.4	179.8±6.9	0.0001
Weight (kg)	67.3±7.3	77.2±10.5	0.0001
Body mass index	23.5	23.9	n.s
Graft rupture	5/197(2.5%)	1/115 (0.8%)	

n.s.: Not significant



Figure 1: Quadrupled hamstring autograft measured using 0.5-mm incremented sizing tubes.

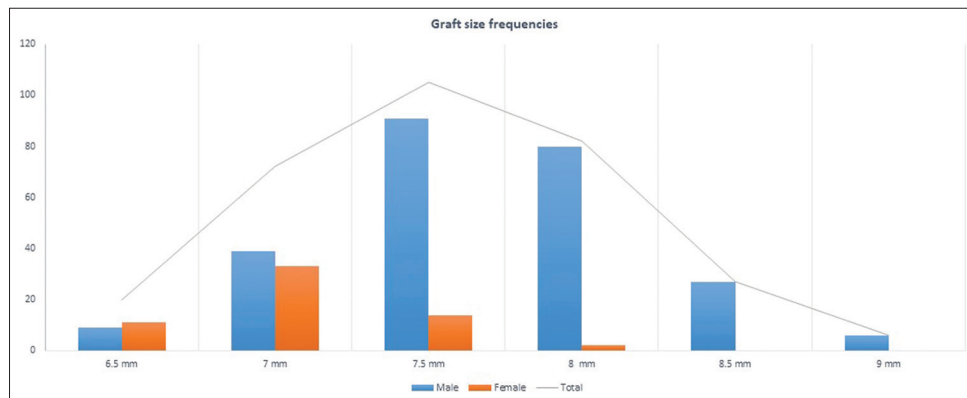


Figure 2: Variation of graft size among male and female patients.

failure.^[18,19] A study of a large cohort with graft rupture is required to establish the relationship between graft diameter and graft failure rate among the Indian population.

The results of the present study suggested that a size of 8 mm could not be achieved in the majority of the patients. It is also still unclear whether this magical number of 8 mm is required for all ACLRs. In native knee, ACL cross-sectional diameter is variable and depends on age, sex, and anthropometric measurement of the patient.^[20,21] If a graft of 8 mm or more is used in a knee whose native ACL volume is less, it can cause overstuffing of the knee. ACL graft diameter is still a controversial topic, and there is a need for further research before we adopt the policy of a minimum of 8-mm graft diameter in all ACLR surgery for the Indian population.

CONCLUSION

In the present study, the average quadruple HT graft diameter in the Indian population was 7.6 mm, and graft diameter depends on the height and gender of the patient.

Ethical approval

Institutional Review Board approval is not required as it is an observational study.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

Dr. Ravi Gupta is on the Editorial Board of the Journal.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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