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Research Article

An In-Vivo Study of the Accesory Bands of Hamstring Tendons

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ABSTRACT
Background. The objective of our study is to determine the characteristics of accessory bands of hamstring tendons and their implications for a successful graft harvest during Arthroscopic ACL reconstruction
Method. 30 middle-aged patients,17 males and 13 females with Anterior cruciate ligament injuries posted for arthroscopic ligament reconstruction were included in this study. Both semitendinosus and gracilis graft were harvested in all patients. The number of bands in each tendon and their location from the tendon insertion is measured and recorded
Results. The majority of patients in the study had two accessory bands of semitendinosus (66.67%). Other enrolled patients either had one accessory band (20%) or three accessory bands (13.33%). On the other hand, the majority patients (76.67%) had no accessory bands of gracilis, while the remaining had one accessory band. Of all the gracilis tendons, a single accessory band was observed in 7 tendons. They were found arising at a distance ranging from 4-6 cm from the tendon insertion at the tibial crest. For the semitendinosus, there was always a constant distal band arising at distance ranging from 3-7 cm. 13% of semitendinosus had a 3 accessory band with the most proximal band arising at 9-11 cm. 66.67% had only 2 accessory bands with the proximal band found at a distance of 8-10 cm measured from the insertion point
Conclusion Although accessory bands are highly variable in their location, we have observed that none of the bands were located more than 11 cm from the tendon insertion point. Tendon stripper can be safely advanced beyond this point

Keywords. Hamstring tendon, anterior cruciate ligament, arthroscopic reconstruction, accessory bands.

INTRODUCTION

The native anterior cruciate ligament has limited biological healing potential and Arthroscopic reconstruction has been widely accepted as a successful technique for the treatment of such injuries. It has been shown that surgical reconstruction not only restores knee stability, it also prevents early degenerative process[1.] Although a variety of graft types have been described, a conundrum still exists regarding the ideal graft choice for each patient. Commonly used autograft sources are the hamstring tendons, bone patella bone graft and the quadriceps graft. Bone-tendon-bone grafts have been preferred in high-level athletes, but are often associated with complications such as anterior knee pain, patella fractures, patella tendon ruptures, and extensor mechanism weakness[2,3]. Reconstruction with hamstring tendons has gained popularity with the advent of newer fixation devices, allowing surgeons more flexibility regarding graft length and diameter. Reconstruction with hamstring grafts has shown little donor site morbidity, lower revision rates with excellent clinical results[4.] Biomechanically, four-fold hamstring graft have been demonstrated to achieve greater tensile strength, stiffness, and cross-sectional area than both BTB autograft and the native ACL[5.] Although Flexion strength and peak torque deficits have been demonstrated with hamstring grafts, they have not been proven to be clinically or functionally significant[6]

Tendons of semitendinosus and gracilis lies deep to the saratorial fascia and course

anteromedially to insert at the tibial crest. Several accessory bands arise from the distal end of these tendons passing inferiorly to attach at the gastrocnemius fascia. Failure to identify and release all accessory bands can lead to diversion of the tendon stripper and hence premature amputation of the graft [7]. Hamstring Grafts lesser than 8 cm in diameter have been demonstrated to cause higher failure rates requiring patients to undergo further revision surgery[8]

MATERIALS AND METHODS

Study Design

This prospective study involved 30 consecutive patients who were scheduled for arthroscopic anterior cruciate ligament (ACL) reconstruction using a hamstring tendon autograft. The study was conducted at [Name of Institution/Center] from [Month/Year] to [Month/Year]. Approval was obtained from the Institutional Ethics Committee, and written informed consent was provided by all patients prior to participation.

Patient Selection

Inclusion Criteria

- Patients aged 18 to 40 years.
- Clinically and radiologically confirmed ACL-deficient knee.
- Indication for primary arthroscopic ACL reconstruction using hamstring tendon autograft.
- No history of ipsilateral knee surgery.

Exclusion Criteria

- Concomitant severe knee injuries requiring extensive additional surgical procedures (e.g., significant chondral lesions, multi-ligamentous injuries other than ACL).
- Pre-existing inflammatory arthropathy or advanced osteoarthritis of the knee.
- Any medical condition contraindicating surgery or anesthesia.
- Revision ACL reconstruction cases.

Demographic Data

The mean age of the patients was 26.5 years (range: 18–37 years). All patients presented with ACL insufficiency confirmed through clinical examination and magnetic resonance imaging (MRI).

Surgical Procedure

All surgeries were performed under spinal or general anesthesia with the patient in supine position. A pneumatic tourniquet was applied, and the limb was prepared and draped in a sterile fashion.

A standard arthroscopic examination was performed to confirm the ACL tear and assess any associated intra-articular lesions. Once the diagnosis was established, attention was shifted to graft harvesting.

An oblique skin incision, approximately 2 cm in length, was made 2 cm below and 2 cm medial to the tibial tuberosity (Figure 1). Dissection was carried down through the subcutaneous tissue to expose the sartorial fascia. The gracilis tendon, palpable deep to the fascia, served as a key landmark. The sartorial fascia was then incised transversely just below the gracilis tendon, allowing direct visualization of the semitendinosus and gracilis tendons.

Each tendon was isolated and bluntly dissected free from surrounding soft tissues. The tendons were detached from their tibial insertions, ensuring care to avoid injury to the underlying superficial medial collateral ligament. A non-absorbable suture (Ethibond) loop was placed around the detached end of each tendon to prevent slippage during the harvesting procedure.

Accessory bands were identified and dissected free. Slight knee flexion (approximately 30°) facilitated identification and division of these bands, which were typically found arising from the inferior surface of the tendon. A tendon stripper was then advanced proximally towards the ischial tuberosity to harvest the tendons (Figure 2). If resistance was encountered, the stripper was withdrawn, and any remaining bands were further dissected. The number of accessory bands and their distances from the distal end of the tendon grafts were recorded.

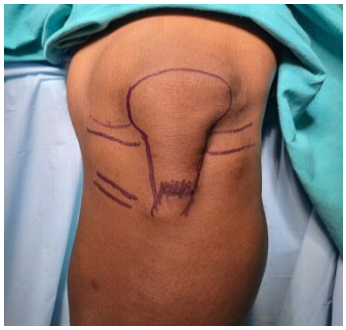


Figure 1. 2 Cm Oblique Incision over Anteromedial Aspect of Tibia 2 Cm Medial and 2 Cm Medial to Tibial Tuberosity

FIGURE 2

A. Dissection Of An Accessory Band Arising From Semitendinosus With Mixter Right Angle Artery Forceps
B. Tendon Harvester Is Advanced Proximally While Counter Traction Is Applied To Tendon End
C. Accessory Bands Are Identified. Numbers Of Bands Dissected And Their Distance From The Distal End Of Tendon Is Measured

Data Collection and Outcome Measures

ntraoperative data included graft length, number of accessory bands, and their location. Postoperative assessments included clinical knee stability tests (Lachman and pivot-shift), patient-reported outcome measures, and any perioperative complications. All data were recorded in a standardized format.

Statistical Analysis

Descriptive statistics were used to summarize patient demographics, intraoperative findings, and postoperative clinical assessments. Continuous variables were expressed as means with standard deviations, while categorical variables were expressed as frequencies or percentages. Statistical analyses were performed using [Name of Statistical Software]. A p-value <0.05 was considered statistically significant.

RESULTS

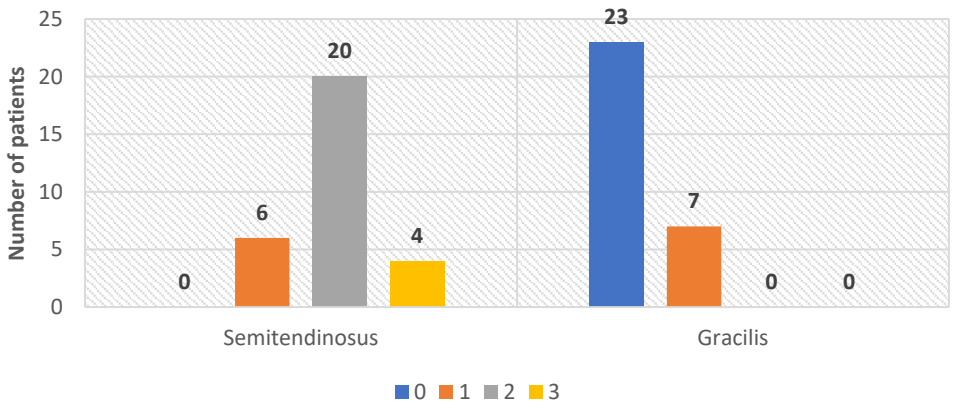
Of the 30 patients enrolled in this study, 17 were males and 13 were females. 21 of them were actively involved in sports prior to their injuries. On evaluating the correlation between age with number of accessory bands of semitendinosus and gracilis, no significant correlation was found ($p>0.05$). However, the height and BMI were both found to have a statistically significant positive correlation with number of accessory bands of both semitendinosus and gracilis ($p<0.05$) (Table 1)

Table 1: Correlation between Accessory Bands and Patient Characteristics

Correlated patients characteristic	Correlation coefficient	P value
Accessory bands of Semitendinosus		
Age	0.03	0.84
Height	0.54	<0.01*
BMI	0.42	<0.01*
Accessory bands of Gracilis		
Age	-0.05	0.75
Height	0.46	<0.01*
BMI	0.44	<0.01*

Majority of patients in the study had two accessory bands of semitendinosus (66.67%). Other enrolled patients either had one accessory band (20%) or three accessory bands (13.33%). On the other hand, majority patients (76.67%) had no accessory bands of gracilis, while the remaining had one accessory band (Figure 3).

Figure 3: Number of Accessory bands of Semitendinosus and Gracilis



Of all the gracilis tendons, a single accessory band were observed in 7 tendons. They were found arising at a distance ranging from 4-6 cm from the tendon insertion at the tibial crest

For the semitendinosus, there was always a constant distal band arising at distance ranging from 3-7 cm. 13% of semitendinosus had a 3 accessory band with the most proximal band arising at 9-11 cm. 66.67% had only 2 accessory bands with the proximal band found at a distance of 8-10 cm measured from the insertion point.The mean distance between the distal end and the accessory bands were evaluated and have been mentioned below in table 2.

Table 2: Mean Distance of Accessory Bands from the Distal End

Accessory band number	Mean distance from distal end (cm)
Accessory bands of Semitendinosus	
First Band (n=30)	5.07 ± 1.22
Second band (n=20)	8.28 ± 1.35
Third band (n=4)	10.03 ± 0.93
Accessory bands of Gracilis	
Single band (n=7)	5.14 ± 0.8

Distance expressed as mean ± SD

DISCUSSION

Arthroscopic reconstruction has gained widespread acceptance for the treatment of ACL injuries. Tendon strippers have allowed for safe graft harvest of maximum length using smaller incisions with few complications[9]. However, one major concern with such instruments is the premature amputation of

graft necessitating harvest from other graft sites to compensate for insufficient graft material. If accessory bands are not released, the tendon stripper can divert and inadvertently ampute the graft leading to a shorter and insufficient graft[10].

Although there are previous cadaveric studies describing the anatomy of accessory bands, there are fewer that were conducted in vivo. Candal-Couto and Deehan[11] in their cadaveric study observed the presence of a constant accessory band in all semitendinosus originating at a distance of 5-9 cm. Most of gracilis tendons had 2 accessory bands. 80% of semitendinosus and 20% of gracilis had bands arising 10 cm proximal to their insertion. Pagnani et al[12] performed dissection in 31 fresh cadaveric knees and observed the presence of a constant accessory band in 71% of semitendinosus tendons and none were found arising more than 8 cm from the insertion point. Tuncay et al[13] studied 23 fresh cadavers and accessory bands arising between 6-8 cm were observed in 95% of all semitendinosus. Difference in their findings when compared to our study can be attributed to factors such as soft tissue shrinkage and embalming process in cadavers which is not seen in vivo[14]

In a clinical study conducted by Yasin et al[15] in 25 patients, 24 gracilis tendon had at least one accessory band. Most garcilis had 2 accessory bands. 56% of semitendinosus had 3 or more bands (3-4) and 20% of tendons had accessory bands originating greater than 10-cm proximal to the tibial crest insertion ranging from 10.5 cm to 11.0 cm. The findings of our study showed that 76.67% of gracilis had no accessory band while the remaining gracilis tendons had only one accessory band. For the semitendinosus, 66.7% had 2 accessory bands with proximal bands ranging 8 to 10 cm from the insertion point. It was further observed that of all patients, only 4 semitendinosus had a third accessory band ranging 9-11 cm. We noted that accessory bands are uncommon beyond 11 cm for both the semitendinosus and the gracilis. The location and number of bands is highly inconsistent and variations may be due to difference in ethnicity of studied population and low sample size of both studies

CONCLUSION

Harvest of hamstring tendons is a successful procedure provided proper care is given to the exploration and division of all accessory bands. We conclude that although these bands are highly variable in their number and location, they are uncommon to be found beyond 11 cm from the tibial crest. Tendon strippers can be safely advance proximal to this point to obtain graft of maximum length for ACL reconstruction

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