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Posteromedial Hamstring Tendon Harvest for All-Inside Anterior Cruciate Ligament Reconstruction: Graft Characteristics, Technical Considerations, and Donor-Site Outcomes

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Abstract

Background: Hamstring autografts are commonly harvested through an anteromedial (AM) incision over the pes anserinus, an approach associated with visible anterior scarring, premature tendon transection, and injury to branches of the saphenous nerve. Posteromedial (PM) harvest through the popliteal crease provides an alternative route to the semitendinosus and gracilis tendons and may be particularly suited to ligament reconstruction procedures that require little or no AM tibial exposure.

Case presentation: Six consecutive patients undergoing primary all-inside anterior cruciate ligament (ACL) reconstruction underwent PM hamstring tendon harvest through a transverse popliteal crease incision. Both the semitendinosus and gracilis tendons were harvested and prepared as quadrupled graft constructs. Harvest time, incision length, tendon length, graft diameter, donor-site morbidity, and postoperative clinical outcomes were evaluated.

Results: PM harvest was successfully completed in all six patients without conversion to an AM approach or premature tendon transection. Mean harvest time was 14.0 minutes (range: 8-25 minutes), and mean incision length was 3.08 cm (range: 2.0-5.5 cm). Semitendinosus and gracilis tendon lengths ranged from 24 to 28 cm and 22 to 28 cm, respectively. Mean final graft diameter was 8.9 mm (range: 8.5-9.5 mm), with all grafts measuring at least 8.5 mm. Five patients reported no donor-site or neurological symptoms. One patient developed transient PM harvest-site pain and persistent medial leg paraesthesia. No wound complications, infection, or haematoma occurred.

Conclusion: PM hamstring harvest provided graft dimensions sufficient for all-inside ACL reconstruction in all six patients while avoiding a conventional harvest incision over the pes anserinus. The approach may be useful when minimal or no AM tibial exposure is otherwise required, including all-inside ACL and isolated medial patellofemoral ligament reconstruction. Saphenous nerve-related sensory disturbance remains possible, and careful tendon identification and controlled stripper advancement are required. Larger comparative studies are needed to establish the relative benefits and risks of this approach.

Categories: Sports Medicine, Orthopedics
Keywords: anterior cruciate ligament (acl), donor-site morbidity, gracilis tendon, posteromedial hamstring harvest, semitendinosus tendon

Introduction

The semitendinosus and gracilis tendons remain among the most commonly used autografts for ligament reconstruction [1]. Conventionally, these tendons are harvested through an anteromedial (AM) approach over the pes anserinus at the proximal tibia. Although this is well established and widely adopted, it has been associated with several potential donor-site complications. These include iatrogenic injury to the infrapatellar and sartorial branches of the saphenous nerve, premature tendon transection from unrecognized accessory fascial bands, visible anterior knee scarring, and inadvertent gracilis harvest when an isolated semitendinosus graft is intended [2,3].

The posteromedial (PM) approach offers an alternative method of hamstring tendon harvest that may avoid some of these limitations [4]. A small transverse incision within the popliteal crease provides direct access to the midportion of the hamstring tendons, proximal to their convergence at the pes anserinus. At this level, the individual tendons can be identified and the intertendinous vincula or accessory fascial bands released under direct visualization. The incision also allows for a more concealed scar. By avoiding dissection over the AM aspect of the knee and maintaining the tendon stripper beneath the sartorial fascia during distal release,

the PM approach may reduce injury to the saphenous nerve and its branches [4-6].

Graft length, however, may be a concern with PM harvesting. Unlike the conventional AM approach, the distal tendon attachment is released blindly from the tibial insertion, potentially resulting in a shorter harvested graft. Earlier comparative studies reported shorter semitendinosus grafts with PM harvesting [5,7]. More recent matched data, however, have shown only a small difference in tendon length between the two approaches, with graft length remaining adequate for ligament reconstruction [8].

This case series describes our experience with PM hamstring tendon harvesting technique in six consecutive patients undergoing all-inside anterior cruciate ligament (ACL) reconstruction. The primary objectives were to evaluate graft yield based on the harvested semitendinosus and gracilis tendon lengths and final graft diameter, and to assess technical feasibility through harvest duration, incision length, and intraoperative harvest-related difficulties or complications. The secondary objectives were to assess donor-site morbidity, including postoperative pain, wound complications, and sensory disturbances, and functional recovery, looking at knee range of motion and return to activity.

Materials And Methods

Study design and patient selection

This retrospective case series includes six consecutive patients who underwent primary all-inside ACL reconstruction using autologous hamstring tendons harvested through a PM approach between January and June 2024. All procedures were performed by the same surgeon using a standardized harvesting technique.

Patients who underwent primary ACL reconstruction using both the semitendinosus and gracilis tendons harvested through the PM popliteal approach were included. Patients who underwent revision ACL reconstruction or hamstring tendon harvest through a conventional AM approach were excluded. Concomitant meniscal or chondral pathology was not an exclusion criterion.

Medical records and operative documentation were retrospectively reviewed. Data collected included patient demographics, associated intra-articular pathology, concomitant procedures, harvest characteristics, graft dimensions, postoperative donor-site morbidity, complications, and clinical outcomes.

All ACL reconstructions were performed as part of routine clinical care, without experimental interventions or additional research-related procedures. Written informed consent for publication of the relevant clinical information and images was obtained from all six patients.

Surgical technique

Patients were positioned supine with the operative limb in a modified figure-of-four position, with the hip externally rotated and the knee flexed to approximately 60°. A transverse incision was made within the popliteal crease over the palpable hamstring tendons. Following subcutaneous dissection, the deep crural fascia was divided to expose the semitendinosus and gracilis tendons.

Each tendon was identified individually and delivered into the surgical field using a right-angled haemostat. Intertendinous vincula and accessory fascial bands, particularly those tethering the semitendinosus to the medial head of the gastrocnemius, were released under direct visualization before introduction of the tendon stripper.

The tendon was then secured with a non-absorbable looped traction suture. An open tendon stripper was advanced proximally toward the ischial tuberosity under gentle counter-traction to release the tendon at its proximal myotendinous junction. After retrieval of the proximal tendon stump and removal of residual muscle fibres (Figure *1*), a closed tendon stripper was advanced distally toward the pes anserinus under inline traction until the tendon was released from its tibial insertion. The same sequence was repeated for the second tendon.



FIGURE 1: The proximal semintendinosus tendon delivered through the wound with a looped traction suture around the tendon

The semitendinosus and gracilis tendons were subsequently prepared as a quadrupled autograft for all-inside ACL reconstruction. The incision length was measured prior to skin closure using a sterile ruler (Figure *2*).



FIGURE 2: The incision site measured with a sterile ruler after completion of posterior hamstring tendon harvest

Outcome measures

The primary outcomes were graft characteristics and technical feasibility of the PM hamstring harvesting approach. Graft characteristics were assessed using the harvested semitendinosus and gracilis tendon lengths and final quadrupled graft diameter. Technical feasibility was evaluated based on harvest time (time from incision to removal of both grafts), incision length, intraoperative technical difficulties, and harvest-related complications, including premature tendon transection.

Secondary outcomes included donor-site morbidity and postoperative functional recovery. Postoperative sensory disturbances were assessed clinically on the first postoperative day. Subsequent sensory symptoms, including their distribution, duration, and persistence, were documented during follow-up where available. Donor-site morbidity was further evaluated through recorded postoperative pain and wound complications. Knee range of motion was estimated clinically, while return to activity was based on patient report. Postoperative follow-up was generally scheduled at two weeks, six weeks, three months, six months, and nine months, with further reviews as clinically indicated. The minimum recorded follow-up was nine months (range: 9-24 months).

Statistical analysis

Descriptive statistics were used to summarise the data. Continuous variables were expressed as mean ± standard deviation (SD) and median with interquartile range (IQR). The 25th and 75th percentiles were calculated using the inclusive quartile method (QUARTILE.INC in Microsoft Excel, Microsoft® Corp., Redmond, WA). Categorical variables were presented as frequencies and percentages. Given the small sample size and descriptive nature of the study, no inferential statistical analyses were performed.

Results

Patient cohort and outcomes

Six consecutive patients underwent primary all-inside ACL reconstruction using autologous hamstring tendon grafts harvested through the PM approach. Both semitendinosus and gracilis tendons were harvested in all patients and prepared as quadrupled grafts. Associated intra-articular pathologies were treated as indicated. The individual clinical presentation, relevant examination and imaging findings, intraoperative harvest characteristics, and postoperative outcomes are described below and summarised in Tables *1*-*2*.

Case	Age (years)	Sex	Side	BMI (kg/m²)	Associated intra-articular pathology	Concomitant procedure	Follow-up (months)
1	21	M	R	23.5	Medial meniscus bucket-handle tear; lateral meniscus longitudinal tear	Meniscal repair	12
2	18	M	R	19.7	None	None	14
3	22	M	R	21.2	Medial meniscus bucket-handle tear	Meniscal repair	9
4	26	M	L	42.0	Medial meniscus flap tear; medial femoral condyle cartilage injury	Meniscal debridement; chondral procedure	16
5	22	F	R	24.8	Lateral meniscus tear	Lateral meniscus repair	9
6	34	M	R	25.1	Posterior horn medial meniscus tear; lateral meniscus bucket-handle tear	Medial meniscus repair; partial lateral meniscectomy	24

TABLE 1: Patient characteristics, associated procedures, and duration of follow-up

BMI: body mass index; M: male; F: female; L: left; R: right

Case	Harvest time (min)	Incision (cm)	ST length (cm)	Gracilis length (cm)	Graft diameter (mm)	Donor-site/neurological symptoms	Final ROM	Return to activity
1	13	3.0	24	25	9.0	None	0°-135°	Yes
2	18	2.5	28	24	9.5	None	0°-140°	Yes
3	8	2.5	24	22	8.5	None	0°-135°	Yes
4	25	5.5	28	28	9.5	None	0°-120°	Partial
5	10	2.0	24	24	8.5	None	0°-140°	Yes
6	10	3.0	27	25	9.0	Posteromedial harvest-site pain for 6 weeks; persistent medial leg numbness to ankle	5°-120°	No
Mean ± SD	14.00 ± 6.42	3.08 ± 1.24	25.83 ± 2.04	24.67 ± 1.97	8.92 ± 0.38	-		
Median (Q1-Q3)	11.50 (10.00-16.75)	2.75 (2.50-3.00)	25.50 (24.00-27.75)	24.50 (24.00-25.00)	9.00 (8.62-9.38)			
Range	8-25	2.0-5.5	24-28	22-28	8.5-9.5	-		

TABLE 2: Hamstring harvest characteristics and clinical outcomes

Continuous variables are presented as mean ± standard deviation (SD), median (Q1-Q3), and range. Q1 and Q3 represent the 25th and 75th percentiles, respectively.

ST: semitendinosus; SD: standard deviation; ROM: range of motion; IQR: interquartile range

Case 1

A 21-year-old man presented with right knee instability and occasional locking following a twisting injury to his knee while playing badminton four months prior to presentation. Clinical examination revealed a preoperative range of 0°-135°, a positive anterior drawer test (ADT), and a Lachman test with tenderness over the medial and lateral joint lines. Magnetic resonance imaging (MRI) demonstrated a complete ACL tear (Figure *3A*), with a medial and lateral meniscus tear. Intraoperatively, the ACL was torn with a medial bucket-handle tear and a lateral meniscus tear. The patient underwent ACL reconstruction with meniscus repair. Hamstring harvest was completed in 13 minutes through a 3.0-cm incision. The semitendinosus and gracilis measured 24 cm and 25 cm, respectively, producing a final quadrupled graft diameter of 9.0 mm. There were no harvest-related, wound, or neurological complications. At 12 months, knee range of motion was 0°-135°, and he had returned to playing badminton and football.



FIGURE 3: Preoperative sagittal magnetic resonance imaging (MRI) images in the six patients who underwent ACL reconstruction

A-F: Corresponding to Cases 1-6. Panels A, B, D, E, and F demonstrate ACL tears. Panel C demonstrates the double PCL sign, indicating a bucket-handle tear of the medial meniscus.

ACL: anterior cruciate ligament; PCL: posterior cruciate ligament

Case 2

An 18-year-old man presented with right knee instability after a pivoting injury during football three months prior. On examination, he had a 0°-140° range of motion with a positive ADT and a positive Lachman test. MRI confirmed an ACL tear (Figure *3B*). We proceeded with an ACL reconstruction. The hamstring harvest was completed in 18 minutes via a 2.5 cm incision. The semitendinosus and gracilis measured 28 cm and 24 cm, respectively, producing a final graft diameter of 9.5 mm. No harvest-related, wound, or neurological complications were observed. At 14 months, the patient had regained full knee range of motion of 0°-140° and had returned to playing football for his club.

Case 3

A 22-year-old man came with complaints of right knee instability and pain following a twisting injury to the knee while playing football two months ago. Preoperative examination demonstrated full range of motion of 0°-135°, tenderness over the medial joint line, and positive ADT, Lachman, and McMurray tests. MRI revealed complete ACL tear with medial meniscus bucket-handle tear (Figure *3C*). An ACL reconstruction with concomitant medial meniscus repair was performed. Both hamstring tendons were harvested within eight minutes using a 2.5-cm incision. The semitendinosus measured 24 cm and the gracilis 22 cm, producing an 8.5-mm quadrupled graft. There was no harvest-related, wound, or neurological complication. At nine months, he had a knee range of motion of 0°-135° and had returned to playing recreational sports.

Case 4

A 26-year-old man with a BMI of 42 kg/m² presented with left knee instability and pain after falling off his skateboard and landing on the side of his knee three months prior to presentation. Clinical examination revealed minimal effusion, tenderness over the medial joint line and medial femoral condyle, and positive ADT, Lachman, and McMurray tests. MRI demonstrated a complete ACL tear (Figure *3D*), medial meniscus tear, and medial compartment chondral injury. A medial meniscus flap tear and medial femoral condyle chondral injury were identified intraoperatively. We proceeded with an ACL reconstruction, medial meniscus

debridement, and chondral procedure. Hamstring harvest was technically more demanding in this patient because of the large soft-tissue envelope. Adequate exposure required extension of the incision to 5.5 cm, and harvest of both tendons required 25 minutes. The semitendinosus and gracilis each measured 28 cm and produced a 9.5-mm graft. Despite the more difficult exposure, there was no premature tendon transection, wound complication, or neurological deficit. At 16 months, the patient had full knee range of motion of 0°-120° with partial return to activity.

Case 5

A 22-year-old woman came with worsening right knee instability and pain for the past six months after recently being active in futsal. She had a history of a knee injury from a triple jump at the age of 16. Examination revealed tenderness over the lateral joint line and a positive ADT and a positive Lachman test, which coincided with MRI findings of a complete ACL tear (Figure *3E*) and lateral meniscus tear. We proceeded with an ACL reconstruction with lateral meniscus repair. The hamstring harvest was completed in 10 minutes through a 2.0 cm incision. Both semitendinosus and gracilis measured 24 cm, producing a quadrupled graft diameter of 8.5 mm. No harvest-related, wound, or neurological complications were seen. She regained full knee range of motion of 0°-140° at nine months.

Case 6

A 34-year-old man, known to have a right ACL tear from a football injury in 2012, sustained another twisting injury to the knee during football and developed worsening instability and pain for two months. Examination suggested an ACL and meniscus tear confirmed by an MRI, which revealed complete ACL tear (Figure *3F*), with medial meniscus lateral meniscus tear. We proceeded with an ACL reconstruction, medial meniscus repair, and partial lateral meniscectomy. Hamstring harvest was done via a 3.0 cm incision in 10 minutes. The semitendinosus and gracilis tendons measured 27 cm and 25 cm, respectively, producing a 9.0-mm quadrupled graft. There was no premature tendon transection, wound complication, haematoma, or infection. Postoperatively, he developed pain at the PM harvest site extending towards the posterior thigh, which resolved within six weeks. He also reported numbness over the medial leg extending to the medial ankle, which persisted at the latest follow-up. The postoperative course was complicated by knee stiffness requiring arthroscopic adhesiolysis and manipulation under anaesthesia done eight months after primary surgery. At 24 months, knee range of motion was 5°-120°, and he had not returned to his previous activity level.

Intraoperative harvest measurements and graft yield

PM hamstring tendon harvest was successfully completed in all six patients. Both the semitendinosus and gracilis tendons were harvested in every case. Mean harvest time, measured from skin incision to complete tendon retrieval, was 14.0 minutes (range: 8-25 minutes), and mean incision length was 3.08 cm (range: 2.0-5.5 cm). Notably, Case 4 had both the longest harvest time (25 minutes) and the largest incision (5.5 cm). This patient had a body mass index of 42.0 kg/m², corresponding to class III obesity. Harvested semitendinosus tendon length ranged from 24 to 28 cm, while gracilis tendon length ranged from 24 to 28 cm. All grafts were prepared as quadrupled constructs. Mean final graft diameter was 8.9 mm (range: 8.5-9.5 mm), and all six grafts measured at least 8.5 mm in diameter. No premature tendon transection occurred during graft harvest.

Functional outcomes and donor-site complications

Patients were evaluated postoperatively with a minimum follow-up of nine months (range: 9-24 months). Four patients had returned to sporting or recreational activities by the latest follow-up, while one had partially returned, and one had not returned. Reported activities included football, running, and badminton. Five of the six patients regained full knee range of motion.

No wound-related complications, infection, haematoma, or premature tendon transection were observed. Five patients reported no donor-site or neurological symptoms following PM hamstring harvest. One patient (Case 6) experienced pain at the PM harvest site radiating into the posterior thigh, which was resolved by six weeks. The same patient developed medial leg paraesthesia extending to the ankle, which persisted at the latest follow-up.

Case 6 also developed postoperative knee stiffness requiring arthroscopic adhesiolysis and manipulation under anaesthesia. The final documented range of motion was 5°-120°. This complication was considered separate from the donor-site symptoms associated with hamstring tendon harvesting.

Discussion

The main findings of this case series are that the PM hamstring harvest provided grafts of adequate length and diameter for all-inside ACL reconstruction in all six patients. Harvest was completed without conversion to a conventional AM approach, and there was no premature tendon transection. Mean harvest time was 14.0 minutes (range: 8-25 minutes), and the mean incision length was 3.08 cm (range: 2.0-5.5 cm). Five

patients reported no donor-site or neurological symptoms; one developed transient PM harvest-site pain and persistent medial leg paraesthesia.

Graft yield in our series supports previous evidence that the tendon length associated with PM harvesting does not compromise graft preparation. Yau, in an exact-matched comparison based on sex and body height, reported mean semitendinosus lengths of 256 ± 28 mm following posterior harvest and 263 ± 29 mm following anterior harvest, while gracilis lengths were 223 ± 29 mm and 226 ± 29 mm, respectively. These differences were not statistically significant [8]. In our cohort, semitendinosus and gracilis lengths ranged from 24 to 28 cm and 22 to 28 cm, respectively. All harvested tendons were sufficient to produce quadrupled graft constructs, with a mean diameter of 8.9 mm (range: 8.5-9.5 mm). All grafts in our series measured at least 8.5 mm, indicating that adequate graft diameter was achievable despite the potential loss of distal tendon length inherent to blind tibial release.

Sensory disturbance is a well-recognized complication of the conventional AM hamstring harvest, most commonly involving the infrapatellar or sartorial branches of the saphenous nerve. At the level of the knee, the infrapatellar branch of the saphenous nerve courses anteriorly towards the AM aspect of the knee, while the sartorial branch pierces the sartorial fascia and continues distally along the medial leg [2,9]. Their proximity to the pes anserinus places them at risk during AM exposure and tendon harvest. Reported rates of postoperative sensory disturbance vary widely, from 8.3% to 74%, reflecting the differences in incision orientation, surgical technique, and methods of postoperative sensory assessment likely contributing to the wide variation between studies [5,9-11].

The PM approach has been proposed as a means of reducing this risk. The hamstring tendons are approached proximal to the pes anserinus, and distal release is performed with a closed tendon stripper advanced beneath the sartorial fascia. Because the sartorial branch of the saphenous nerve lies superficial to this fascial layer, preservation of the fascia may afford some protection during distal graft release [4]. A recent systematic review reported saphenous nerve injury in 10.2% of patients following AM harvest compared with 0.4% following PM harvest, with significantly greater odds of injury using the AM approach [7]. Other PM series have likewise reported few or no postoperative sensory disturbances [12-15].

This protection, however, is not absolute. Case 6 developed medial leg paraesthesia extending to the ankle after PM hamstring harvest. The sensory distribution was compatible with possible involvement of the saphenous nerve or one of its branches, but a specific nerve injury could not be confirmed in the absence of formal electrophysiological assessment. The patient also experienced PM harvest-site pain radiating into the posterior thigh. The pain resolved within six weeks; the medial leg paraesthesia persisted at the latest follow-up.

The exact mechanism of nerve injury is uncertain. Anatomical studies have demonstrated a close relationship between the saphenous nerve and the gracilis tendon in the distal thigh [10,16]. Neural irritation or injury could therefore have occurred during proximal advancement of the open tendon stripper toward the myotendinous junction, particularly through traction or deviation of the stripper from the longitudinal axis of the tendon [17]. Distal stripping provides another possible mechanism. Traction on adjacent soft tissues, inadvertent violation of the protective sartorial fascia, or anatomical variation in the course of the saphenous nerve and its branches could expose the nerve during blind advancement toward the tibial insertion. Without electrophysiological assessment, the site and mechanism of injury in this patient cannot be determined.

The neurological advantage of PM harvesting should therefore be viewed as a reduction in risk rather than elimination of that risk. The occurrence of a single sensory deficit in a six-patient series cannot be meaningfully compared with complication rates from larger cohorts. It does, however, underscore the need for careful stripper advancement and systematic assessment of postoperative sensory symptoms when evaluating this technique.

Body habitus may affect the technical ease of PM hamstring harvest. The patient with the highest body mass index (42 kg/m^2) required both the longest harvest time (25 minutes) and the largest incision (5.5 cm). Technical descriptions of hamstring harvest in patients with obesity have emphasised the need for a more generous incision and deeper soft-tissue retraction to obtain adequate tendon exposure [18]. BMI has also been examined as a potential predictor of incision length during PM hamstring harvest, although no significant association has been demonstrated [13]. The evidence may not be directly applicable to patients with more substantial obesity, as the study population was predominantly adolescent and did not include patients with a degree of obesity comparable to that observed in our series. Prodromos in his paper recommended this approach for large or obese patients [15]; however, we do not share the same recommendation.

In our experience with this patient, the thick soft tissue envelope over the thigh made palpation and exposure of the hamstring tendons more challenging. Assistance was required to displace the surrounding soft tissues during tendon localization and skin incision. The thicker subcutaneous adipose tissue also required a larger incision and greater retraction to permit adequate visualization and safe isolation of the

tendons.

One case cannot establish an association between BMI and technical difficulty. Local soft-tissue thickness may also be more relevant than BMI alone. Studies incorporating a broader range of body habitus and direct measures of PM soft-tissue depth would be required to determine whether either factor predicts incision length or harvest duration. For the operating surgeon, however, a substantial PM soft-tissue envelope should be anticipated as a potential technical challenge.

The mean harvest time in our series was 14.0 minutes (range: 8-25 minutes). Studies that have examined the duration of PM harvest separately from overall operative time are limited. Franz et al. reported a mean PM harvest time of 1 minute 23 seconds, whereas García Hernández et al. reported 5 minutes 25 seconds [5,6]. Both are considerably shorter than the mean in our series. The harvesting procedures, however, are not directly comparable. Both studies predominantly examined isolated semitendinosus harvest through the PM approach, whereas both the semitendinosus and gracilis were harvested in our patients. Timing methodology also differed. García Hernández et al. measured harvest time from skin incision until placement of the tendon on the surgical table; the timing method used by Franz et al. was not clearly specified. Harvesting a second tendon requires additional identification, release of accessory bands, and separate proximal and distal stripping, all of which may contribute to a longer procedure.

Four harvests in our series were completed within 8-13 minutes and one within 18 minutes. The 25-minute harvest occurred in the patient with the largest soft-tissue envelope, illustrating its influence on procedural duration. Familiarity with tendon palpation, tendon exposure, accessory-band release, and the trajectory of the tendon stripper may improve efficiency with experience. Our six sequential cases, however, are insufficient to define a formal learning curve or predict the harvest time achievable after a larger operative experience.

PM harvest is particularly advantageous when the reconstructive procedure itself requires little or no AM tibial exposure. In all-inside ACL reconstruction, retrograde socket preparation and suspensory tibial fixation require only limited access to the AM tibia. Harvesting the hamstring tendons through the popliteal crease therefore avoids the larger incision over the pes anserinus that would otherwise be required primarily for graft retrieval. The harvest incision is also relocated to the less conspicuous popliteal crease.

The same rationale applies to isolated medial patellofemoral ligament (MPFL) reconstruction using hamstring autograft, where AM tibial exposure is not otherwise required [13]. PM harvest avoids creating a separate incision over the pes anserinus solely to obtain the graft and may offer a cosmetic advantage. Other ligament reconstructions requiring a free hamstring autograft, but no surgical exposure of the pes anserinus, may provide similar indications for this approach.

The limitation of this case series is its small sample size and the absence of a comparative AM harvest group. It cannot establish superiority or quantify the relative safety of the PM technique. Concomitant intra-articular pathology and procedures also varied between patients and may have influenced postoperative function. Follow-up was relatively short and differed between patients. Additionally, sensory deficits were assessed clinically and through patient-reported symptoms rather than formal quantitative sensory or electrophysiological testing. The anatomical origin of the persistent medial leg paraesthesia in one patient therefore remains uncertain. Furthermore, knee range of motion was estimated clinically, while return to activity was based on patient report after undergoing a return to play assessment. The small number of sequential cases also precludes meaningful assessment of a procedural learning curve or of the relationship between body habitus, incision length, and harvest duration.

Therefore, future larger prospective comparative studies should use standardized definitions of harvest time, objective neurological assessment, and longer follow-up. Inclusion of the number of tendons harvested and measures of local soft-tissue thickness would further clarify procedural efficiency and patient-specific technical considerations.

Conclusions

The PM approach is a feasible alternative for hamstring tendon harvest. It may be particularly useful when the reconstructive procedure requires minimal or no AM tibial exposure, including all-inside ACL reconstruction and isolated MPFL reconstruction, where an incision over the pes anserinus would otherwise be required primarily for graft harvest. Successful harvest was achieved in all six patients, with graft dimensions sufficient for the intended reconstruction. Direct exposure of the hamstring tendons proximal to their convergence at the pes anserinus also permits individual tendon identification and release of accessory bands before stripper advancement.

The technique has limitations. A substantial PM soft-tissue envelope may make tendon localisation and exposure more difficult, and saphenous nerve-related sensory disturbance remains possible. Given the small size of the study and absence of a comparative group, no conclusions can be drawn regarding the relative safety and superiority of this approach. Comparative studies with larger cohorts are needed to define the

relative benefits, risks, and reproducibility of PM harvesting compared with the conventional AM approach.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Sharifah Nor Amirah Alsagoff, Mohd Fairudz Mohd Miswan, Mohd Yusoff Yahaya

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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