International Journal of Research in Orthopaedics
Handralmath S et al. Int J Res Orthop. 2025 Jan;11(1):99-104
http://www.ijoro.org

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20243893

Original Research Article

Knee injury and osteoarthritis outcome score comparing functional outcome in 30 anterior cruciate ligament reconstruction patients with quadriceps, hamstrings and peroneus longus grafts

Sunil Handralmath, Akshay Dudhanale, Ravikumar Dadhaniya*, Manish Wasekar

Department of Orthopaedics, VMGMC and Civil Hospital, Solapur, India

Received: 08 September 2024
Revised: 14 November 2024
Accepted: 21 November 2024

***Correspondence:**
Dr. Ravikumar Dadhaniya,
E-mail: ravipatel8783@gmail.com

ABSTRACT

Background: Anterior cruciate ligament (ACL) tears are prevalent, affecting 30–78 per 100,000 individuals annually. Graft options include hamstring tendon, bone-patellar-tendon-bone, and quadriceps tendon. Hamstring tendon grafts offer advantages, including less patellofemoral crepitation, anterior knee pain, extension loss, reduced donor site morbidity, and smaller incisions. The peroneus longus tendon graft has gained favor due to fewer knee joint complications. Research shows studies comparing hamstring tendon (HT) and peroneus longus tendon (PLT) grafts revealed no significant differences in pre- and 1-year post-surgery outcomes. Recent randomized controlled trials (RCTs) comparing quadriceps tendon (QT) and HT clinical outcomes found no significant differences in functional outcomes, PROs, laxity testing, or revision rates, although two studies reported higher knee flexor strength in the QT group and greater knee extensor strength in the HT group.
Methods: Authors planned for prospective study in tertiary care government hospital, Solapur from 1 July 2023 to 1 July 2024 with Inclusion criteria of 20-50 years, Intact collateral ligaments, Intact Posterior cruciate ligaments, Playing sports as recreational activity.
Results: 30 cases operated for ACL reconstruction at our institute with three graft choices namely QT, HT, PL and knee osteoarthritis outcome score given at 3 months, 6 months, and 1 year with KOOS/symptoms, pain, daily living, sports, quality of life all noted separately and compared within the groups and outside the groups.
Conclusion: To compare functional scores in post operative ACL reconstruction with QT, HT, PL larger volume of sample, longer follow up and more detailed arthroscopy specific scoring system is required.

Keywords: Koos score, Quadriceps tendon, Hamstring tendon, Peroneus longus tendon, ACL reconstruction

INTRODUCTION

Anterior cruciate ligament (ACL) tears are a frequent orthopedic injury, occurring in 30–78 out of 100,000 individuals annually.[1] ACL reconstruction has shown to be an effective treatment, with elite athletes having an 83% chance of returning to their sport.[2] Various graft options are available for ACL reconstruction, including hamstring tendon (HT), bone-patellar-tendon-bone (BPTB), and quadriceps tendon (QT). QT was initially used for ACL reconstruction in the 1970s but did not gain widespread acceptance due to issues such as postoperative knee laxity, weakened extensor mechanism, and a high rate of positive pivot shift, reaching up to 20%.[3,4] Hamstring tendon autografts remain a popular choice for ACL reconstruction. While there are numerous autograft and allograft options available, hamstring tendon autografts offer benefits such as reduced postoperative knee pain and an easier recovery compared to bone patellar tendon bone autografts.

In the United States, over 200,000 ACL reconstructions are performed yearly.[5] With hamstring and patellar tendon autografts being among the most frequently used options.[6] Although all autograft choices for ACL reconstruction have their pros and cons, hamstring tendon grafts specifically offer advantages including less postoperative patellofemoral crepitation, anterior knee pain, and extension loss. They also result in reduced donor site morbidity and smaller incisions at the harvest site compared to patellar tendon autografts.[6] The peroneus longus tendon (PLT) graft has emerged as a preferred option due to the various knee joint complications associated with previously mentioned muscle grafts.

A key advantage of the PLT graft is that it doesn't cause secondary injury to the knee or surrounding structures.[8] Recent research has shown that PLT grafts have maintained potential as a superior ACL substitute due to their tensile strength and ability to regenerate after surgery.[7-9]

In this case, we utilized a PLT graft and assessed the clinical outcomes following the procedure. The patient provided informed consent for the publication of this case report and images for medical education purposes. This case has been reported in accordance with the SCARE criteria.[10]

Some studies have proposed the peroneus longus tendon as an alternative autograft option for ACLR.[11-13] The peroneus longus tendon is of adequate size, and biomechanical evaluations have shown it possesses sufficient strength for knee ACLR.[14-16] Rudy et al, found no difference in tensile strength between the peroneus longus tendon and hamstring tendon.[17]

Rhatomy et al, reported that ACLR using the peroneus longus tendon resulted in better functional scores compared to the hamstring tendon.[18]

In another study, Rhatomy et al, demonstrated that ankle eversion and first ray plantarflexion strength at the donor site were comparable to the contralateral healthy site, with no dysfunction observed at the donor site.[19] To compare functional outcome in ACL reconstruction patients with quadriceps, hamstrings and peroneus longus grafts.

METHODS

Study design

Authors planned for prospective study in VMGMC and civil hospital, Solapur from 1 July 2023 to 1 July 2024.

Inclusion criteria

This includes, age 20-50 years, intact collateral ligaments, intact posterior cruciate ligaments, playing sports as recreational activity.

Exclusion criteria

Age below 20 and above 50, torn collateral ligaments, torn posterior cruciate ligaments, any grade of osteoarthritis on plain radiograph.

Ethical approval

Ethical approval has been taken from the ethical committee of the college; verbal informed consent was taken from each participant.

30 cases between the age 20 to 50 years with 17 cases has associated meniscus injury and all cases has complete ACL tear, post operatively knee osteoarthritis outcome score is noted at 3 months, 6 months, and 1 year. Knee injury and osteoarthritis outcome score (KOOS)/ symptoms, KOOS/pain, KOOS/daily living, KOOS/sports, KOSS/quality of life all noted separately and compared within the groups and outside the groups.

ANOVA, which stands for analysis of variance, is a statistical test used to analyze the difference between the means of more than two groups

Operative technique overview

In all 30 cases, surgeons utilized a standard two-portal approach. A diagnostic arthroscopy was conducted before harvesting the graft. Meniscal damage was identified in 17 of the 30 patients. Across all three groups, notch preparation and removal of residual ACL were consistently performed.

Graft extraction methods

Quadriceps tendon

A 4-10 cm longitudinal skin incision was made. The all-soft tissue graft ranged from 6-10 cm in length, 8-12 mm in width, and 5-8 mm in thickness.

Hamstrings tendons

A 2-3 cm incision was created along the pes anserinus, situated between the tibial tubercle and the posteromedial tibial border. Care was taken to avoid harming the superficial medial collateral ligament and infrapatellar branches of the saphenous nerve. Using a no. 15 scalpel, a horizontal incision was made in the sartorial fascia, extending about 2 cm distally along the tibial crest. Tissue forceps and Metzenbaum scissors were used to separate the gracilis and semitendinosus tendons from the sartorial fascia. Each tendon was then detached from its proximal musculotendinous junction using a tendon stripper.

Peroneus longus tendon

The graft was obtained from the ipsilateral PLT through a 2 cm longitudinal incision posterior to the lateral

malleolus. The distal portion of the tendon was cut and sutured to the peroneus brevis (Figure 1). A tendon stripper was used to free the proximal end, extending 4-5 cm proximally from the fibular head to avoid peroneal nerve injury. The tendon was separated from muscle tissue to measure its length and diameter.

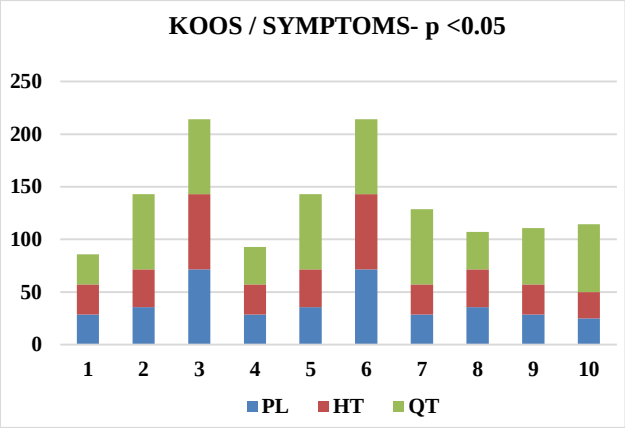

Figure 1: Comparison of KOOS symptoms-p value is <0.05, statistically not significant.

Femoral tunnel creation

The femoral tunnel was typically drilled using an inside-out technique. With the knee flexed between 90 and 120 degrees, a 6-8 mm offset guide was directed towards the native ACL footprint. In 24% of studies, the lateral intercondylar or bifurcate ridges were visualized before drilling. The tunnel diameter matched the graft diameter, with the graft length in the femoral tunnel varying from 10 to 25 mm.

Tibial tunnel formation

An outside-in technique was generally employed for creating the tibial tunnel. The tibial guide was angled at 45-55 degrees and aimed at the native ACL footprint. The tunnel was positioned medial to the anterior horn of the lateral meniscus and lateral to the medial tibial spine. The tunnel diameter corresponded to the graft diameter. During tibial graft fixation, the knee was flexed between 0 and 30 degrees.

Graft fixation techniques

For femoral-side graft fixation, a fixed suspensory fixation device was most commonly used. On the tibial side, a bio interference screw was the predominant fixation method, used in 61% of studies.

RESULTS

30 cases operated for ACL reconstruction at our institute with three graft choices namely QT, HT, PL and knee osteoarthritis outcome score given at 3 months, 6 months, and 1 year with KOOS/symptoms, KOSS/pain, KOSS/daily living, KOSS/sports, KOSS/quality of life all noted separately and compared within the groups and outside the groups. Results were compared on the basis of p value. Only KOSS/symptoms score turns out to be statistically significant with p value <0.05 with other KOSS/pain, KOSS/daily living, KOSS/sports, KOSS/quality of life were statistically not significant with p value >0.05.

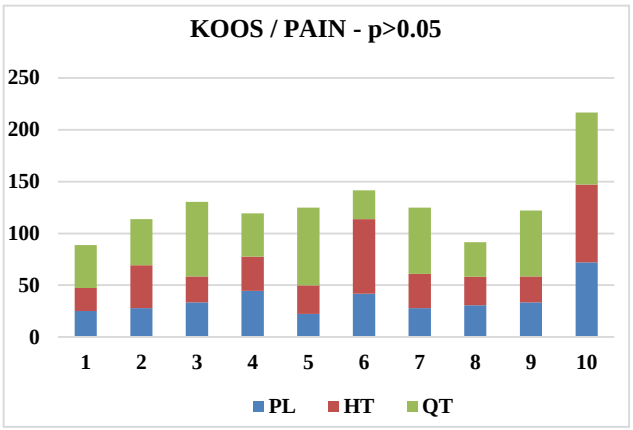

Figure 2: Comparison of KOOS pain-p value is >0.05, statistically significant.

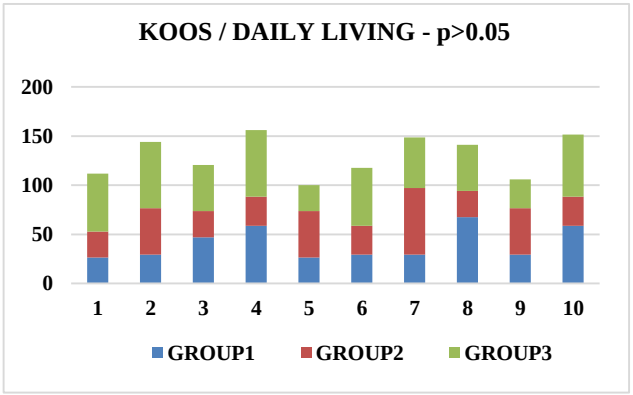

Figure 3: Comparison of KOOS Daily living-p value is <0.05, statistically not significant.

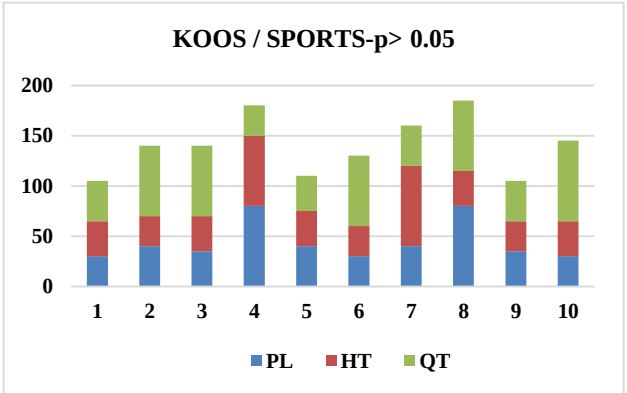

Figure 4: Comparison of KOOS sports-p value is <0.05, statistically not significant.

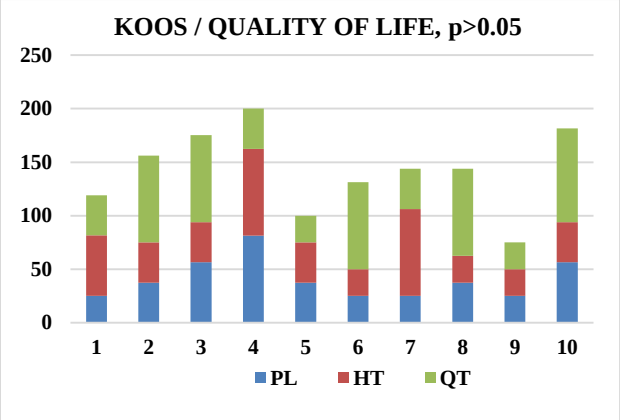

Figure 5: Comparison of KOOS quality of life. -p value is <0.05, statistically not significant.

Table 1: Demographics.

Age (in years)	M/f	Total patients	Graft
20-50	5/5	10	Peroneus longus
20-50	5/5	10	Hamstrings
20-50	5/5	10	Quadriceps tendon

DISCUSSION

Recent randomized controlled trials (RCTs) comparing QT and HT clinical outcomes have found no significant differences in functional outcomes, patient-reported outcomes (PROs), laxity testing, or revision rates. However, three of these studies lacked statistical power, with 51 or fewer patients in both groups combined. Two studies reported significantly higher knee flexor strength in the QT group and greater knee extensor strength in the HT group.[23,24]

A prospective randomized study comparing QT-B and BPTB groups found no differences in functional outcomes, PROs, or stability outcomes. However, significantly more patients in the BPTB group reported pain during kneeling and squatting.[25] Studies comparing HT and PLT grafts revealed no significant differences in pre- and 1-year post-surgery outcomes based on IKDC, modified Cincinnati, and lysholm knee scoring scale. The PLT graft was deemed superior due to its larger diameter, reduced thigh hypotrophy, and excellent ankle function as measured by AOFAS and foot and ankle disability index (FADI).[31,32]

Above discussion suggest that there is no significant difference between QT, HT, PL as a graft choice. The similar results were established in our studies as except KOOS/symptoms score all other KOOS sub scores were statistically not significant, this suggests that for comparison of all three QT, HT, PL sample size should be large enough and follow up for longer duration. Though significant outcome difference is not noted in various cases still there is advantage of each grafting technique over other, as patient profile, surgeon's technique, setup availability differs in each and every case Hamstring tendon grafts allow for autograft harvesting through a relatively small incision, resulting in minimal donor site morbidity and reduced extensor mechanism dysfunction compared to patellar tendon autografts. In a retrospective case series of 164 patients, Sanders et al reported concomitant injuries to the sartorial branch and infrapatellar branch in 32% of patients.[26] Isolated paresthesias were observed in 23% of the sartorial branch and 19% of the infrapatellar branch cases. Tuncay et al, suggested that premature division of hamstring tendons often occurs due to the variable size and placement of the fascial band between the semitendinosus and gracilis.[27] To avoid premature amputation, each tendon should have 10 to 12 cm of excursion. When encountering significant resistance while advancing the tendon stripper, it's advisable to pause, evaluate for additional bands, and then resume the stripping process.

One other study When utilized PLT grafts for ACL replacement. Interestingly, the PLT graft diameter measured 8.5 mm, exceeding the ideal size, which facilitated swift reconstruction. Magnussen et al proposed that a minimum graft diameter of 7 mm is optimal for avoiding revision surgery.[28] Additional studies suggest that an acceptable graft diameter for reconstruction should be at least 8 mm.[29,30] Rudy et al.'s biomechanical study found no significant difference in tensile strength between peroneus longus and hamstring tendons.[7]

Wiradiputra et al, suggested that the peroneus longus tendon could be considered the primary graft choice for ACLR, as it showed no significant postoperative morbidity related to biomechanical inconvenience at the donor site.[33] Recent literature indicates that autograft diameter significantly impacts re-rupture and revision rates.[4] Current studies argue that graft diameters below 8 mm are unacceptable.[34-36] In our study, the mean peroneus longus tendon diameter exceeded 8 mm (Table 3).

Despite the larger diameter in the peroneus longus group, the re-rupture rate was similar to the hamstring group, potentially indicating lower stability in the peroneus longus graft. Snaebjornsson et al's large cohort study reported that a 0.5 mm increase in graft diameter reduced the likelihood of revision surgery by 0.86 times.[37] This research demonstrated that the peroneus longus tendon diameter was larger than that of the hamstring tendon. Rathomy et al, noted minimal impact on foot and ankle function from peroneus longus tendon autograft harvesting.[38] Bi et al, expressed hesitation about complete removal of the peroneus longus tendon, fearing potential irreversible functional impairment.[39]

The mechanical evaluation of the quadriceps tendon (QT) presents challenges due to the varied insertion points of its components into the patella's proximal pole, making sectioning based on proximal-distal or medial-lateral references difficult.[20] Despite this, the QT graft possesses biomechanical qualities that make it an appealing choice

for anterior cruciate ligament reconstruction (ACLR). Research has reported ultimate failure loads of 1725–2160 N for the native ACL, 2977 N for patellar tendon grafts, 2119-2352 N for quadriceps tendon grafts, and up to 4090 N for hamstring tendon autografts.[21,22]

The QT graft's stiffness (466.2 N/mm) is nearly twice that of a native ACL (242 N/mm). Studies have shown significant differences in mechanical and microstructural properties among bone-patellar tendon-bone (BPTB), hamstring tendon (HT), and QT grafts. The QT exhibits the highest stiffness modulus and strongest collagen alignment, while single hamstring tendons demonstrate the lowest moduli and least aligned collagen.[20] This is likely due to the QT's composite nature, formed by the convergence of four musculotendinous units with variable fiber orientations, contributing to its strength across different force vectors. Consequently, the quadriceps tendon autograft demonstrates strong biomechanical properties and microscopic features, making it a reliable and safe option for both primary and revision ACL reconstruction procedures.

Intensity of sports activity of the included patient cannot be asses, KOOS scoring has subjective variation, KOOS originally used for osteoarthritis patients now we are using it for ACL reconstruction. Sample size was also limited.

CONCLUSION

To compare functional scores in post operative ACL reconstruction with QT, HT, PL larger volume of sample, longer follow up and more detailed arthroscopy specific scoring system is required.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Gans I, Retzky JS, Jones LC, Tanaka MJ. Epidemiology of recurrent anterior cruciate ligament injuries in national collegiate athletic association sports: the injury surveillance program, 2004-2014. Orthop J Sports Med. 2018;6:232.
2. Webster KE, Feller JA, Whitehead TS, Myer GD, Merory PB. Return to sport in the younger patient with anterior cruciate ligament reconstruction. Orthop J Sports Med. 2017;5:2325.
3. Stanish WD, Kirkpatrick J, Rubinovich RM. Reconstruction of the anterior cruciate ligament with a quadricep patellar tendon graft. Preliminary results. Can J Appl Sport Sci. 1984;9:21–4.
4. Yasuda K, Ohkoshi Y, Tanabe Y, Kaneda K. Quantitative evaluation of knee instability and muscle strength after anterior cruciate ligament reconstruction using patellar and quadriceps tendon. Am J Sports Med. 1992;20:471–5.
5. Mall NA, Chalmers PN, Moric M. Incidence and trends of anterior cruciate ligament reconstruction in the United States. Am J Sports Med. 2014;42:2363-70.
6. Goldblatt JP, Fitzsimmons SE, Balk E, Richmond JC. Reconstruction of the anterior cruciate ligament: Meta-analysis of patellar tendon versus hamstring tendon autograft. Arthroscopy. 2005;21:791–803.
7. Angthong C, Chernchujit B, Apivatgaroon A, Chaijenkit K, Nualon P, Suchao K. The anterior cruciate ligament reconstruction with the peroneus longus tendon: a biochemical and clinical evaluation of the donor ankle morbidity. J Med Assoc Thail. 2015;98(6):555–60.
8. Kerimoglu S, Kosucu P, Livaoglu M, Yukunc I, Turhan AU. Magnetic resonance imagination of the peroneus longus tendon after anterior cruciate ligament reconstruction. Knee Surg Sports Traumatol Arthrosc. 2009;17:35–9.
9. Phatama KY, Hidayat M, Mustamsir E, Pradana AS, Dhananjaya B, Muhammad SI. Tensile strength comparison between hamstring tendon, patellar tendon, quadriceps tendon and peroneus longus tendon: cadaver research. J Arthros Joint Surg. 2019;6(2):114–6.
10. 10 Agha R.A., Borrelli M.R., Farwana R., Koshy K., Fowler A., Orgill D.P., For the SCARE Group The SCARE 2018 statement: updating consensus surgical CAse REport (SCARE) guidelines. Int J Surg. 2018;60:132-6.
11. Liu CT, Lu YC, Huang CH. Half-peroneus-longus-tendon graft augmentation for unqualified hamstring tendon graft of anterior cruciate ligament reconstruction. J Orthop Sci. 2015;20(5):854–60.
12. Shi FD, Hess DE, Zuo JZ, Liu SJ, Wang XG, Zhang Y, et al. Peroneus Longus Tendon Autograft is a Safe and Effective Alternative for Anterior Cruciate Ligament Reconstruction. J Knee Surg. 2019;32(8):804–11.
13. Nazem K, Barzegar M, Hosseini A, Karimi M. Can we use peroneus longus in addition to hamstring tendons for anterior cruciate ligament reconstruction. Adv Biomed Res. 2014;3:15.
14. Magnussen R, Lawrence J, West R, Toth A, Taylor D, Garrett W. Graft size and patient age are predictors of early revision after anterior cruciate ligament reconstruction with hamstring autograft. Arthrosc. 2012;28: 526–31.
15. Marchand J, Ruiz N, Coupry A, Bowen M, Robert H. Do graft diameter or patient age influence the results of ACL reconstruction? Knee Surg Sports Traumatol Arthrosc. 2016;24(9):2998–3004.
16. Zhao J, Huangtu X. The biomechanical and clinical application of using the anterior half of the peroneus longus tendon as an autograft source. Am J Sports Med. 2012;40(3):662–71.
17. Rudy P, Mustamsir E, Phatama KY. Tensile strength comparison between peroneus longus and hamstring tendons: A biomechanical study. Int J Surg Open. 2017;9:41–44.
18. Rhatomy S, Asikin AIZ, Wardani AE, Rukmoyo T, Lumban-Gaol I, Budhiparama NC. Peroneus longus

autograft can be recommended as a superior graft to hamstring tendon in single-bundle ACL reconstruction. Knee Surg Sports Traumatol Arthrosc. 2019;27(11):3552–9.
19. Rathomy S, Wicaksono F, Roshadiansyah Soekarno NR, Setyawan R, Primasara S, Budhiparama N. Eversion and first ray plantarflexion muscle strength in anterior cruciate ligament reconstruction using a peroneus longus tendon graft. Orthop J Sports Med. 2019;7(9):23259.
20. Castile RM, Jenkins MJ, Lake SP, Brophy RH. Microstructural and mechanical properties of grafts commonly used for cruciate ligament reconstruction. J Bone Joint Surg Am. 2020;102:1948-55.
21. Urchek R, Karas S. Biomechanical comparison of quadriceps and 6-strand hamstring tendon grafts in anterior cruciate ligament reconstruction. Orthop J Sports Med. 2019;7:232596.
22. Ettinger M, Werner-Lebeda T, Calliess T, Omar M, Becher C, Ezechieli M, Klintschar M, Petri M. Femoral interference screw fixation of hamstring and quadriceps tendons for ACL reconstruction. Knee Surg Sports Traumatol Arthrosc. 2017;25:1241–8.
23. Martin-Alguacil JL, Arroyo-Morales M, Martín-Gomez JL, Monje-Cabrera IM, Abellán-Guillén JF, Esparza-Ros F, et al. Strength recovery after anterior cruciate ligament reconstruction with quadriceps tendon versus hamstring tendon autografts in soccer players: a randomized controlled trial. Knee. 2018;25:704–14.
24. Sinding KS, Nielsen TG, Hvid LG, Lind M, Dalgas U. Effects of autograft types on muscle strength and functional capacity in patients having anterior cruciate ligament reconstruction: a randomized controlled trial. Sports Med. 2020;50:1393-403.
25. Barié A, Sprinckstub T, Huber J, Jaber A. Quadriceps tendon vs. patellar tendon autograft for ACL reconstruction using a hardware-free press-fit fixation technique: comparable stability, function and return-to-sport level but less donor site morbidity in athletes after 10 years. Arch Orthop Trauma Surg. 2020;140:1465–74.
26. Sanders B, Rolf R, McClelland W, Xerogeanes J. Prevalence of saphenous nerve injury after autogenous hamstring harvest: An anatomic and clinical study of sartorial branch injury. Arthrosc. 2007;23:956–63.
27. Tuncay I, Kucuker H, Uzun I, Karalezli N. The fascial band from semitendinosus to gastrocnemius: The critical point of hamstring harvesting: An anatomical study of 23 cadavers. Acta Orthop. 2007;78:361–3.
28. Magnussen RA, Lawrence JT, West RL, Toth AP, Taylor DC, Garret WE. Graft size and patient age are predictors of early revision after anterior cruciate ligament reconstruction with hamstring autograft. Arthros. 2012;28:526–31.
29. Conte EJ, Hyatt AE, Gatt CJ, Dhawan A. Hamstring autograft size can be predicted and is a potential risk factor for anterior cruciate ligament reconstruction failure. Arthrosc. 2014;30:882–90.
30. Park SY, Oh H, Park S, Lee JH, Lee SH, Yoon KH. Factors predicting hamstring tendon autograft diameters and resulting failure rates after anterior cruciate ligament reconstruction. Knee Surg. Sports Traumatol. Arthrosc. 2013;21:1111–8.
31. Rhatomy S, Asikin AIZ, Wardani AE, Rukmoyo T, Gaol IL, Budhiparama N.C. Peroneus longus autograft can be recommended as a superior graft to hamstring tendon in single-bundle ACL reconstruction. Knee Surg. Sports Traumatol. Arthrosc. 2019;27(11):3552–9.
32. Ertogrul E, Varol A, Oc Y, Kilinc BE. Is peroneus longus allograft good alternative for anterior cruciate ligament reconstruction: a comparison study. Acta Chir. Orthop. Traumatol. Cechoslov. 2021;88(1):58–62.
33. Wiradiputra A, Febyan, Aryana G. Peroneus longus tendon graft for anterior cruciate ligament reconstruction: A case report and review of literature. Int J Surg Case Rep. 2021:106028.
34. Park SK, Oh H, Park S, Lee J, Lee S, Yoon K. Factors predicting hamstring tendon autograft diameters and resulting failure rates after anterior cruciate ligament reconstruction. Knee Surg Sports Traumatol Arthrosc. 2013;21(5):1111–8.
35. Conte EJ, Hyatt AE, Gatt CJ, Dhawan A. Hamstring autograft size can be predicted and is a potential risk factor for anterior cruciate ligament reconstruction failure. Arthroscopy. 2014;30(7):882–90.
36. Mariscalco M, Flanigan D, Mitchell J, Pedroza A, Jones M, Andrish J, et al. The influence of hamstring autograft size on patient-reported outcomes and risk of revision after anterior cruciate ligament reconstruction: a Multicenter Orthopaedic Outcomes Network (MOON) Cohort Study. Arthrosc. 2013;29(12):1948–53.
37. Snaebjörnsson T, Hamrin Senorski E, Ayeni OR, Alentorn-Geli Eduard, Krupic F, Norberg F, et al. Graft diameter as a predictor for revision anterior cruciate ligament reconstruction and KOOS and EQ-5D values: a cohort study from the Swedish national knee ligament register based on 2240 patients. Am J Sport Med. 2017;45(9):2092–7.
38. Rhatomy S, Hartoko L, Setyawan R, Soekarno NR, Zainal Asikin AI, Pridianto D, et al. Single bundle ACL reconstruction with peroneus longus tendon graft: 2-years follow-up. J Clin Orthop Trauma. 2020;11(3):332–6.
39. Bi M, Zhao C, Zhang Q, Cao L, Chen X, Kong M, et al. All-inside anterior cruciate ligament reconstruction using an anterior half of the peroneus longus tendon autograft. Orthop J Sport Med. 2021;9(6):2325967121991226.

Cite this article as: Handralmath S, Dudhanale A, Dadhaniya R, Wasekar M. Knee injury and osteoarthritis outcome score comparing functional outcome in 30 anterior cruciate ligament reconstruction patients with quadriceps, hamstrings and peroneus longus grafts. Int J Res Orthop 2025;11:99-104.