



COMPARISON BETWEEN PERONEUS LONGUS TENDON AUTOGRAFT VERSUS HAMSTRING TENDON AUTOGRAFT FOR ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION: A SYSTEMATIC REVIEW AND META-ANALYSIS

Anak Agung Ngurah Bagus Surya Darma^{1*}, I Gusti Ngurah Wien Aryana²

¹Resident of Orthopaedic and Traumatology Department, Faculty of Medicine, Universitas Udayana, Jl. Raya Kampus Unud, Jimbaran, Badung, Bali 80361, Indonesia

²Consultant of Orthopaedic and Traumatology Department, Faculty of Medicine, Universitas Udayana, Jl. Raya Kampus Unud, Jimbaran, Badung, Bali 80361, Indonesia

*suryadarma63@yahoo.com

ABSTRACT

Peroneus longus tendon (PLT) autografts offer a promising alternative to hamstring tendon (HT) autografts in ACL reconstruction, addressing limitations like donor site morbidity and insufficient graft material. This systematic review compares clinical outcomes, highlighting PLT comparable effectiveness and potential advantages, supporting its use as a viable option for ACL repair. **Material & Methods:** This systematic review compared PLT and HT autografts in ACL reconstruction, assessing clinical trials via PRISMA guidelines and robust statistical methods to evaluate outcomes, study quality, and heterogeneity. **Results:** Four studies met the inclusion criteria for qualitative and quantitative synthesis. The analysis revealed a statistically significant improvement in International Knee Documentation Committee (IKDC) scores for PLT autografts compared to HT autografts ($p < 0.0001$; MD=3.16; 95% CI=2.00, 4.32). Lysholm scores showed no significant difference between the two groups ($p = 0.95$; MD=1.56; 95% CI=0.03, 3.09). PLT autografts demonstrated similar knee laxity outcomes and graft survival rates to HT autografts, with minimal donor site complications. **Conclusions:** PLT autografts offer a promising alternative to HT autografts in ACLR, providing comparable functional outcomes and graft survival rates. The use of PLT may also mitigate potential donor site complications associated with intra-knee graft harvesting.

Keywords: ACL reconstruction; functional outcome; hamstring; peroneus longus; tendon graft

How to cite (in APA style)

Darma, A. A. N. B. S., & Aryana, I. G. N. W. (2025). Comparison between Peroneus Longus Tendon Autograft Versus Hamstring Tendon Autograft for Anterior Cruciate Ligament Reconstruction: A Systematic Review and Meta-Analysis. *Indonesian Journal of Global Health Research*, 7(2), 287-292. <https://doi.org/10.37287/ijghr.v7i2.5120>.

INTRODUCTION

With an estimated 200,000 injuries in the US each year, an anterior cruciate ligament injury is arguably the most well-known type of knee injury. The best course of action now available for restoring knee stability and lowering the risk of meniscal tears and osteo-joint discomfort is ACL repair (ACLR), which calls for an artificial, allograft, or autograft. Generally, the most well-known unite decision for ACLR is hamstring ligament (HT) autograft. There are several autografts that combine the patellar ligament with the quadriceps ligament, but there isn't a single, globally recognised optimal quality level of uniting choice for use in ACLR. The peroneus longus ligament (PLT) autograft has recently been studied as an optional autograft for ACLR. It is obtained only proximally and back to the sidelong lower leg.¹⁻³ All of the well-known autografts performed today come from the knee, which indicates a few potential complications, such as knee laxity or quadriceps-hamstring lopsidedness following harvest. Additionally, for chronic injuries, the HT autograft might not be sufficient to form a satisfactory union. Allograft and artificial graft options are unfeasible in many cases. Under these conditions, the PLT autograft may provide an even more sensible option. The Turkish group Kerimoglu et al. (2008) first described the use of PLT autograft in leg tendon

reconstruction. Zhao et al. began using it in 2012, and more recently, in 2019, the Indonesian group Rhatomy et al. accepted the PLT autograft.^{3–6}

While individual clinical trials have highlighted the potential of PLT autografts, they lack consistency in reporting and fail to provide a comprehensive synthesis of their relative efficacy and safety compared to HT autografts. By pooling data from multiple studies, this meta-analysis uniquely evaluates key metrics, including International Knee Documentation Committee (IKDC) scores, knee laxity, and donor site morbidity, establishing PLT autografts as a viable alternative to HT autografts. This study aims to analyse the available data on PLT autograft with respect to knee laxity, functional outcomes, pain or paraesthesia at the contributor site, and joint endurance, as well as clinical assessments comparing PLT autograft with HT autograft in leg tendon regeneration. Comparing PLT autograft to HT autograft for ACLR estimation, similar utilitarian outcomes and joint endurance rates are anticipated.

METHOD

Search Strategy

A systematic review was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Figure 1). A comprehensive literature search was performed to gather a full-length, peer-reviewed paper in English on the comparison of clinical outcomes between PLT autograft versus HT autograft for ACLR. We searched PubMed, Google Scholar, and Cochrane Library. PubMed is a premier database for biomedical and clinical research, providing access to high-quality, peer-reviewed articles, including clinical trials and systematic reviews, essential for evidence-based research. Google Scholar broadens the search by including grey literature, conference proceedings, theses, and preprints, ensuring the inclusion of less traditional but relevant studies. The Cochrane Library, known for its focus on systematic reviews and clinical trials, offers rigorously assessed, methodologically sound evidence with minimized bias. Together, these databases ensure a robust and comprehensive search strategy, capturing a wide range of high-quality studies while adhering to PRISMA guidelines. The focus of this systematic review and meta-analysis is to compare the clinical outcome between PLT autograft versus HT autograft for ACLR. Keywords in the search matched the MeSH rule and the terms used are (“ACLR reconstruction”), AND (“Peroneus Longus Tendon Autograft”), AND (“Hamstring Tendon Autograft”).

Inclusion Criteria

This study included unique articles providing details regarding (1) clinical investigations of ACLR (single-bundle or double-bundle) utilizing PLT autograft (anterior-half, posterior-half, or full-thickness); and (2) studies straightforwardly contrasting results of PLT versus HT. All strategies were essential tendon reproductions performed for indicative chronic ACL injury, without meniscal injury. Insignificant articles and studies that neglected to meet inclusion criteria, for example, reviews, articles with just biomechanical studies, or allograft endlessly studies investigating results after the recreation of different tendons outside the knee utilizing PLT autograft were rejected.

Quality Evaluation

Assessment of study quality and risk of bias assessed using criteria developed by the Oxford Center for Evidence-based Medicine, perspicacity defined by the Grades of Recommendation Assessment, Development and Evaluation (GRADE) Working Group, and sanction made by the Agency for Healthcare Research and Quality (AHRQ). While the class of evidence is categorized into "class I" for good quality RCT, "class II" for moderate to poor quality RCT

and good quality cohort, "class III" for moderate or poor-quality cohorts and case-control studies, "class IV" for the case series.

RESULT

Literature Search, Study Selection, and Study Characteristics

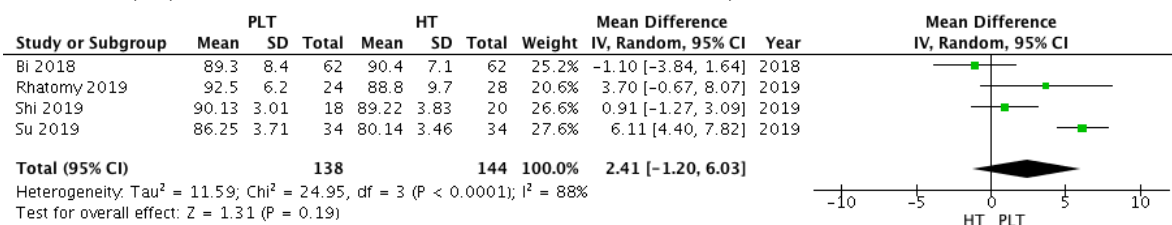
The electronic research resulted in 236 records from various databases. After the process of identification, screening, eligibility, duplication elimination, and exclusion, the remaining 4 studies were included in the qualitative and quantitative synthesis. The remaining articles were excluded due to a lack of mean and standard deviation data and did not meet the inclusion and exclusion criteria.

Statistical Analysis

We utilized the Review Manager version 5.3 software (RevMan; The Cochrane collaboration Oxford, England) to perform all statistical analyses. Based on the heterogeneity of the current study, we performed a sensitivity analysis to further assess the overall results. The heterogeneity across studies was examined through the I^2 statistic described as follows: low, 25% to 50%; moderate 50% to 75%; or high >75%. We applied the fixed-effect models to calculate the total MDs/ORs when low heterogeneity was seen in studies. In other cases, we used the random-effects model. Studies with a P value less than .05 were thought to have statistical significance. Forest plots showed the findings of out meta-analysis.

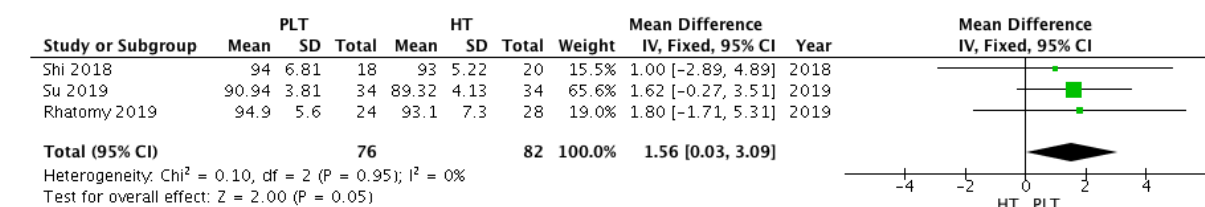
IKDC outcome

We performed a subgroup analysis to evaluate the IKDC score outcome between PLT versus HT autograft in ACLR.⁷⁻¹⁰ We found that there is significant difference statistically between these two groups in IKDC score outcome. (mean difference 0.60 (-0.99, 2.19) ; 95% CI, $P = <0.00001$); (mean difference 3.16; 95% CI, = 2.00, 4.32).



Lysholm Score outcome

We performed a subgroup analysis to evaluate Lysholm Score between PLT vs HT in ACLR. From three studies added in this subgroup analysis, we found no statistical difference in between those two groups for the Lysholm score. (mean difference 1.56; 95% CI, $P = 0.05$); (mean difference 1.56; 95% CI, 0.03, 3.09).^{11,13,14}



DISCUSSION

The primary conclusion of the current analysis was that PLT seemed to be a suitable elective choice for ACLR that could be obtained outside the knee. An analysis of clinical evaluations archiving PLT autograft reveals satisfactory outcomes for leg tendon reproduction, providing a stable and functional knee with minimal rates of infection and unit disappointment.

Research on close examinations revealed knee laxity and joint endurance rates for PLT autografts that were comparable to those of HT autografts, with PLT autografts demonstrating comparably higher detailed useful results in terms of tolerance (Lysholm score, IKDC anxiety score).

With 83.96% of instances demonstrating wonderful to astounding outcomes by Lysholm score and 75.82% of cases displaying usual or almost ordinary IKDC emotional score, the useful results using PLT autograft were satisfactory. The MOON group's and other people's scores were consistent with the mean IKDC abstract score. The modified Cincinnati score and Lysholm score were correlated with the IKDC emotional score. The results of knee laxity were comparable to those of other references that focused on using various autograft sources. In 80.7% of ACLR patients who received PLT autograft, the pivot shift test was negative. The anterior tibial translation mean differences were 1.82 mm, while 4.44% of patients experienced a side-to-side variance in anterior tibial translation greater than 3 mm. The PLT complications rates also resembled the recent distribution of other autograft sources. Just 4.35% of those treated with PLT autograft had givver site pain or paresthesia near the sidelong malleolus. With PLT autograft, graft failure was only observed in 1.68% of ACLR cases. A 2.7% equivalent amendment rate was explained by using HT autograft from the ACL registry in New Zealand. Since the other variable results were accounted for in a few series, they did not agree with a factual examination in our evaluation. Marx's movement score with PLT in ACLR was evaluated in just one review, and the results were revealed with 12.4 ± 3.7 post-activity compared to 5.4 ± 2.6 pre-activity. Marx movement scale also showed good correlations with current action rating measures: 0.67 and 0.66 Spearman connection coefficients for Cincinnati scales and Tegner scale, respectively. This data demonstrates the utility of PLT autograft in ACLR.^{14–17}

This study included four trials that provided direct connections between PLT and HT autografts. The Tegner movement scale, knee laxity (Lachman test grade 0, Lachman test grade 0 or 1), contributor site paresthesia or anguish, and failure rates between 138 PLT and 144 HT autografts did not differ significantly. It's interesting to note that the PLT bunch had considerably higher mean IKDC abstract scores ($p = 0.00001$) and Lysholm scores ($p = 0.05$). Rhatomy et al. considered the distance between 4-strand PLT and 4-strand HT in an uncomplicated manner, demonstrating that the mean width of PLT was 8.8 ± 0.7 mm, whereas the mean width of HT was 8.2 ± 0.8 mm. According to Spragg et al., with every 0.5 mm steady expansion in diameter between 7.0 and 9.0 mm, the likelihood of a patient needing revision ACLR was 0.82 times lower. Further research found a strong positive correlation between graft diameter and IKDC score.^{11–14}

Meanwhile, PLT graft harvest time is shorter than for HT. The PLT and surrounding components do not have a fibrous link. The PLT is clearly visible at the shallow region 2 cm proximal and 1 cm posterior to the lateral malleolus after a 2-cm incision. It takes around 5 minutes of surgery to harvest the PLT, indicating that these methods could be useful and time-saving. Reduction in thigh circumference was observed more often after HT collection than after PLT, which may result in an imbalance between the quadriceps and hamstrings and reduce dynamic knee stability. From now on, PLT as an extra-knee autograft may be a remarkable option.^{17–22} A few restrictions on this investigation should be mentioned. First off, populations with undetected contrast intolerances, demographic information (age, sex, surgery date, follow-up date), and concomitant injuries (medial collateral ligament, meniscus, or cartilage injuries) may have an impact on the helpful outcomes that follow as well as the incidence of complications. Furthermore, a variety of fixation techniques (endo button plus

bioscrew, tightrope, all-inside, interference screw), as well as a lack of standardised rehabilitation protocols, were employed in the included examinations. These strategies included single or double-bundle reconstruction, anterior half, posterior half, or full-thickness PLT, two-strand, three-strand, or four-strand grafts, transtibial or transportal femoral tunnel boring procedure, and non-anatomic or anatomic tunnel locations.

This meta-analysis has several limitations that may affect the generalizability of its findings. First, the inclusion of only four studies limits the sample size, potentially reducing the statistical power and representativeness of the results. The heterogeneity of the included studies, such as differences in graft preparation techniques, fixation methods, and rehabilitation protocols, introduces variability that may confound comparisons between PLT and HT autografts. Additionally, the studies lacked standardized demographic data, such as age, sex, and the presence of concomitant injuries, which could influence outcomes and complications. Variations in surgical techniques, including single- vs. double-bundle reconstruction and differing tunnel drilling methods, further complicate generalizability. The absence of standardized protocols for assessing PLT-specific harvesting outcomes also leaves room for variability in reporting donor site morbidity. Despite these limitations, this study summarizes that PLT is a viable autograft obtained extra-knee for ACLR in order to potentially prevent quadriceps-hamstring imbalance or serve as a backup source of autograft in the event of multiple ligament injury.

CONCLUSION

When compared to HT autograft, PLT autograft had significantly higher subjective Lysholm and IKDC scores. These findings guide surgeons to consider peroneus longus tendon (PLT) autografts as a viable alternative to hamstring tendon (HT) autografts, offering comparable outcomes with reduced donor site morbidity, while empowering patients with evidence-based options for ACL reconstruction.

REFERENCES

- Cristiani R, Forssblad M, Engström B, et al. Risk Factors for Abnormal Anteroposterior Knee Laxity After Primary Anterior Cruciate Ligament Reconstruction. *Arthroscopy - Journal of Arthroscopic and Related Surgery* 2018; 34: 2478–2484.
- Kerimoğlu S, Koşucu P, Livaoglu M, et al. Magnetic resonance image of the peroneus longus tendon after anterior cruciate ligament reconstruction. *Knee Surgery, Sports Traumatology, Arthroscopy* 2009; 17: 35–39.
- Mehran N, Damodar D, Shu Yang J. Quadriceps Tendon Autograft in Anterior Cruciate Ligament Reconstruction. *The Journal of the American Academy of Orthopaedic Surgeons* 2020; 28: 45–52.
- Musahl V, Karlsson J. Anterior Cruciate Ligament Tear. *New England Journal of Medicine* 2019; 380: 2341–2348.
- Rhatomy S, Wicaksono FH, Soekarno NR, et al. Eversion and First Ray Plantarflexion Muscle Strength in Anterior Cruciate Ligament Reconstruction Using a Peroneus Longus Tendon Graft. *Orthopaedic Journal of Sports Medicine*; 7. Epub ahead of print September 1, 2019. DOI: 10.1177/2325967119872462.
- Budhiparama NC, Rhatomy S, Phatama KY, et al. Peroneus Longus Tendon Autograft: A Promising Graft for ACL Reconstruction. *Video Journal of Sports Medicine* 2021; 1: 263502542110098.
- Nagahama K, Kanayama M, Togawa D, et al. Does alendronate disturb the healing process of posterior lumbar interbody fusion? A prospective randomized trial. *Journal of Neurosurgery: Spine* 2011; 14: 500–507.

- Park YS, Kim HS, Baek SW, et al. The effect of zoledronic acid on the volume of the fusion-mass in lumbar spinal fusion. *Clinics in Orthopedic Surgery* 2013; 5: 292–297.
- Venkatalaxmi A, Padmavathi BS, Amaranath T. A general solution of unsteady Stokes equations. *Dynamics Research* 2004; 35: 229–236.
- Chen F, Dai Z, Kang Y, et al. Effects of zoledronic acid on bone fusion in osteoporotic patients after lumbar fusion. *Osteoporosis International* 2016; 27: 1469–1476.
- Bi M, Zhao C, Zhang S, et al. All-Inside Single-Bundle Reconstruction of the Anterior Cruciate Ligament with the Anterior Half of the Peroneus Longus Tendon Compared to the Semitendinosus Tendon: A Two-Year Follow-Up Study. *Journal of Knee Surgery* 2018; 31: 1022–1030.
- Shi FD, Hess DE, Zuo JZ, et al. Peroneus Longus Tendon Autograft is a Safe and Effective Alternative for Anterior Cruciate Ligament Reconstruction. *Journal of Knee Surgery* 2019; 32: 804–811.
- Su J, Sun L, Tang Y. Clinical prognosis of arthroscopic reconstruction of anterior cruciate ligament with autogenous peroneus longus tendon. *Invest Clin* 2019; 60: 1744–1749.
- Rhatomy S, Hartoko L, Setyawan R, et al. Single bundle ACL reconstruction with peroneus longus tendon graft: 2-years follow-up. *Journal of Clinical Orthopaedics and Trauma* 2020; 11: S332–S336.
- Cox CL, Huston LJ, Dunn WR, et al. Are articular cartilage lesions and meniscus tears predictive of IKDC, KOOS, and Marx activity level outcomes after anterior cruciate ligament reconstruction?: A 6-year multicenter cohort study. *American Journal of Sports Medicine* 2014; 42: 1058–1067.
- Collins NJ, Misra D, Felson DT, et al. Measures of knee function: International Knee Documentation Committee (IKDC) Subjective Knee Evaluation Form, Knee Injury and Osteoarthritis Outcome Score (KOOS), Knee Injury and Osteoarthritis Outcome Score Physical Function Short Form (KOOS-PS), Knee Outcome Survey Activities of Daily Living Scale (KOS-ADL), Lysholm Knee Scoring Scale, Oxford Knee Score (OKS), Western Ontario and McMaster. *Arthritis Care and Research*; 63. Epub ahead of print November 2011. DOI: 10.1002/acr.20632.
- Razi M, Moradi A, Safarcherati A, et al. Allograft or autograft in skeletally immature anterior cruciate ligament reconstruction: A prospective evaluation using both partial and complete transphyseal techniques. *Journal of Orthopaedic Surgery and Research*; 14. Epub ahead of print March 21, 2019. DOI: 10.1186/s13018-019-1128-7.
- Kim DK, Park G, Kadir KBHMS, et al. Comparison of Knee Stability, Strength Deficits, and Functional Score in Primary and Revision Anterior Cruciate Ligament Reconstructed Knees. *Scientific Reports*; 8. Epub ahead of print December 1, 2018. DOI: 10.1038/s41598-018-27595-8.
- Rahardja R, Zhu M, Love H, et al. Effect of Graft Choice on Revision and Contralateral Anterior Cruciate Ligament Reconstruction: Results From the New Zealand ACL Registry. *American Journal of Sports Medicine* 2020; 48: 63–69.
- Spragg L, Chen J, Mirzayan R, et al. The effect of autologous hamstring graft diameter on the likelihood for revision of anterior cruciate ligament reconstruction. *American Journal of Sports Medicine* 2016; 44: 1475–1481.
- Zhao J, Huangfu X. The biomechanical and clinical application of using the anterior half of the peroneus longus tendon as an autograft source. *American Journal of Sports Medicine* 2012; 40: 662–671.
- Thomas AC, Wojtys EM, Brandon C, et al. Muscle atrophy contributes to quadriceps weakness after anterior cruciate ligament reconstruction. *Journal of Science and Medicine in Sport* 2016; 19: 7–11.