Tibial Suspensory Fixation Demonstrated Similar Functional Outcomes And Stability With Lesser Tunnel Widening And Better Graft Incorporation Compared To Tibial Interference Screw In Hamstring Graft ACL Reconstruction -A Systematic Review

- **Nayeem Z Hali, FRCS**[1]; Hersh Punjani, MBChB[1]; Muaaz Tahir, FRCS[2]; Jimmy Ng, FRCS[3]; Osama Aweid,FRCS[4]; Tarek Boutefnouchet, FRCS[5]; Jarret Woodmass, FRCS(C)[6]; Peter D'Alessandro, FRACS[7]; Shahbaz S Malik, FRCS[1]

1. *Worcestershire Acute Hospitals NHS Trust, Worcester, UNITED KINGDOM*
2. *The Royal Orthopaedic Hospital NHS Foundation Trust, Birmingham, UNITED KINGDOM*
3. *Nottingham University Hospitals NHS Trust, Nottingham, UNITED KINGDOM*
4. *Fortius Clinic, London, UNITED KINGDOM*
5. *University Hospitals of Birmingham NHS Foundation Trust, Birmingham, UNITED KINGDOM*
6. *Pan Am Clinic. Winnipeg, CANADA*
7. *Orthopaedic Research Foundation of Western Australia, Claremont, WA, AUSTRALIA*

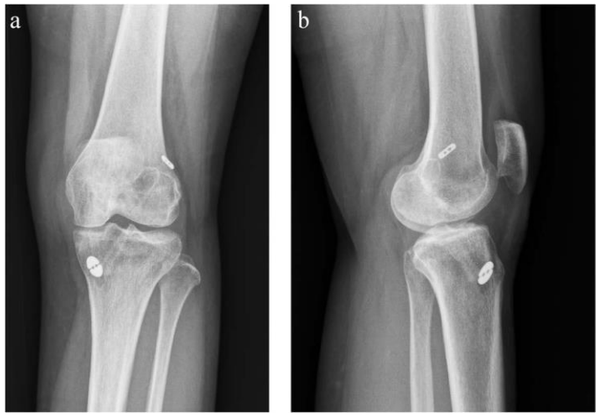
Faculty Disclosure Information

- No disclosure: Nayeem Z Hali, FRCS; Hersh Punjani, MBChB; Muaaz Tahir, FRCS; Jimmy Ng, FRCS; Osama Aweid,FRCS; Shahbaz S Malik, FRCS

- Tarek Boutefnouchet, FRCS :
  - Educational and Research Support Medacta
  - Consulting Brainlab
  - Educational agreement Arthrex
- Jarret Woodmass, FRCS(C)
  - Educational consulting for Smith & Nephew
- Peter D'Alessandro, FRACS[7]:
  - Consulting Medacta and Smith & Nephew
  - Speakers Bureau for Medacta, Smith & Nephew, Arthrex
  - Institutional / Education support from Smith & Nephew, Arthrex

Aim

- No consensus on optimal method of fixation of hamstring graft in ACL reconstruction on the tibial side compared to femoral side.
- The aim of this systematic review is to compare tibial suspensory fixation (TSF) with tibial interference screw (TIS) for clinical and radiological outcomes.



Methods

- A systematic review was conducted in accordance with PRISMA guidelines using MEDLINE, PubMed and Embase databases.
- The review was registered with the PROSPERO.
- Clinical comparative studies of ACL reconstruction with hamstring autograft with TSF and TIS were included.
- The studies were required to report either functional outcome, patient-reported outcomes measures, knee laxity, complications, or radiologic outcomes during follow-up for inclusion.
- Studies were appraised using the MINOR tool.

Results

- 17 clinical comparative studies
- TSF, n=4262; TIS, n=3085
- 72.9% (TSF) and 75.7% (TIS) were males.
- Mean follow up : Clinical outcome : 26.4 months (range 24 to 40 months)

  Radiological outcome 11.8 months (range 6 to 24 months)

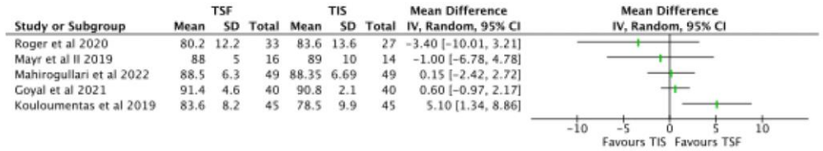
Results:

Knee Functional scores – IKDC/Lyhsolm/Tegner/VAS

Summary Forest Plots: TSF Versus TIS

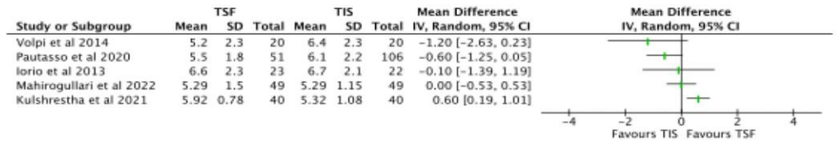
1. **IKDC score: No significant difference**
2. **Tegner score: No significant difference**
3. **Lysholm score: Significant difference in favour of TSF except one study**

IKDC



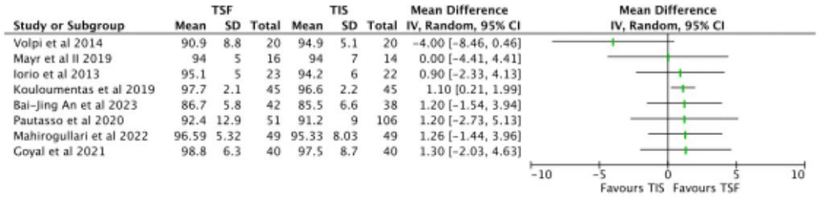
Heterogeneity: $I^2 = 45\%$ ($p = 0.12$)

Tegner



Heterogeneity: $I^2 = 70\%$ ($p = 0.009$)

Lysholm



Heterogeneity: $I^2 = 0\%$ ($p = 0.64$)

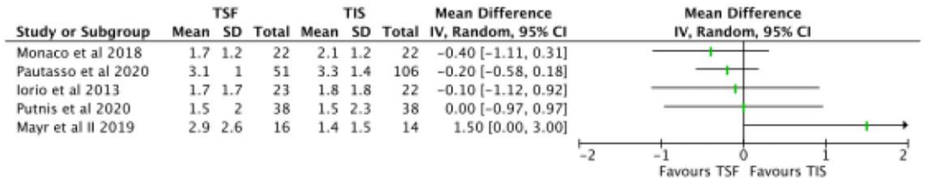
Results: Knee Laxity / Radiological Outcome

Summary Forest Plots: TSF Versus TIS

Knee Laxity on KT- 1000 arthrometer :

No significant difference

KT 1000

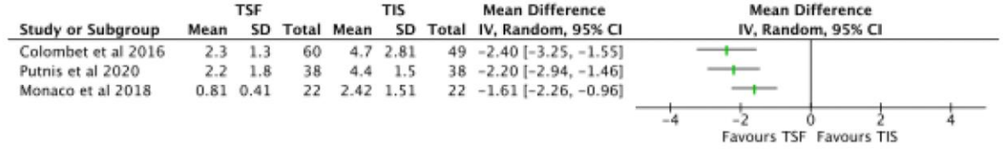


Heterogeneity: $I^2 = 25\%$ ($p = 0.26$)

Tibial tunnel widening:

Statistically significant tibial tunnel widening with TIS compared to TSF

Tunnel widening



Heterogeneity: $I^2 = 20\%$ ($p = 0.29$)

ISAKOS CONGRESS 2025 | MUNICH GERMANY June 8–11

Results

Complications:

- No major complications were reported in most of the clinical studies
- except one study which showed **higher revision rate with TIS (TSF 3.4% vs TIS 5.4%, p<0.001).**

Flexor strength:

- Two studies demonstrated **superior flexor strength at 2 years with TSF** compared to TIS

Limitations:

- Heterogeneity between the studies due to variations in study design, patient characteristics, sample size, reporting of outcomes, and postoperative protocol.
- Follow up period were short-term to mid-term.
- The MINORS score ranged from 15 to 24 which is less than the ideal score of 24 for comparative studies

Conclusion

- **Tibial Suspensory Fixation** demonstrated **similar functional outcome and knee stability** when compared to Tibial Interference Screw with the potential benefit of **lesser tibial tunnel widening and better graft incorporation** in ACL reconstruction using hamstring autograft.

References

1. Monaco E, Fabbri M, Redler A, et al. Anterior cruciate ligament reconstruction is associated with greater tibial tunnel widening when using a bioabsorbable screw compared to an all-inside technique with suspensory fixation. *Knee Surg Sports Traumatol Arthrosc*. 2019;27(8):2577-2584. doi:10.1007/s00167-018-5275-x
2. Colombet P, Graveleau N, Jambou S. Incorporation of Hamstring Grafts Within the Tibial Tunnel After Anterior Cruciate Ligament Reconstruction: Magnetic Resonance Imaging of Suspensory Fixation Versus Interference Screws. *Am J Sports Med*. 2016;44(11):2838-2845. doi:10.1177/0363546516656181
3. Volpi P, Bait C, Cervellin M, et al. No difference at two years between all inside transtibial technique and traditional transtibial technique in anterior cruciate ligament reconstruction. *Muscles Ligaments Tendons J*. 2014;4(1):95-99.
4. Iorio R, Di Sanzo V, Vadalà A, et al. ACL reconstruction with hamstrings: how different technique and fixation devices influence bone tunnel enlargement. *Eur Rev Med Pharmacol Sci*. 2013;17(21):2956-2961.
5. Roger J, Bertani A, Vigouroux F, et al. ACL reconstruction using a quadruple semitendinosus graft with cortical fixations gives suitable isokinetic and clinical outcomes after 2 years. *Knee Surg Sports Traumatol Arthrosc*. 2020;28(8):2468-2477. doi:10.1007/s00167-020-06121-2
6. Putnis SE, Oshima T, Klasan A, et al. Adjustable suspension versus hybrid fixation in hamstring autograft anterior cruciate ligament reconstruction. *The Knee*. 2021;28:1-8. doi:10.1016/j.knee.2020.10.014
7. Desai VS, Anderson GR, Wu IT, et al. Anterior Cruciate Ligament Reconstruction With Hamstring Autograft: A Matched Cohort Comparison of the All-Inside and Complete Tibial Tunnel Techniques. *Orthop J Sports Med*. 2019;7(1):232596711882029. doi:10.1177/2325967118820297
8. Kyriakopoulos G, Manthas S, Vlachou M, Oikonomou L, Papadakis SA, Kateros K. Anterior Cruciate Ligament Reconstruction With the All-Inside Technique: Equivalent Outcomes and Failure Rate at Three-Year Follow-Up Compared to a Doubled Semitendinosus-Gracilis Graft. *Cureus*. Published online December 18, 2021. doi:10.7759/cureus.20508
9. An BJ, Wang YT, Zhao Z, Wang MX, Xing GY. Comparative study of the clinical efficacy of all-inside and traditional techniques in anterior cruciate ligament reconstruction. *World J Clin Cases*. 2023;11(14):3195-3203. doi:10.12998/wjcc.v11.i14.3195
10. Kulshrestha V, Sood M, Kumar S, Kawale A. Original study: early patient-reported functional outcome of all-inside ACL reconstruction as compared to anteromedial portal technique. *Eur J Orthop Surg Traumatol*. 2021;31(7):1477-1483. doi:10.1007/s00590-021-02912-6
11. Goyal T, Das L, Paul S, Choudhury AK, Sethy SS. Outcomes of retro-drilled all-inside tibial tunnel vs complete tibial tunnel techniques in anterior cruciate ligament reconstruction—a comparative study. *Eur J Orthop Surg Traumatol*. 2022;32(3):523-532. doi:10.1007/s00590-021-03011-2
12. Kouloumentas P, Kavroudakis E, Charalampidis E, Kavroudakis D, Triantafyllopoulos GK. Superior knee flexor strength at 2 years with all-inside short-graft anterior cruciate ligament reconstruction vs a conventional hamstring technique. *Knee Surg Sports Traumatol Arthrosc*. 2019;27(11):3592-3598. doi:10.1007/s00167-019-05456-9
13. Rahardja R, Love H, Clatworthy MG, Monk AP, Young SW. Suspensory Versus Interference Tibial Fixation of Hamstring Tendon Autografts in Anterior Cruciate Ligament Reconstruction: Results From the New Zealand ACL Registry. *Am J Sports Med*. 2022;50(4):904-911. doi:10.1177/03635465211070291
14. Mayr R, Smekal V, Koidl C, et al. Tunnel widening after ACL reconstruction with aperture screw fixation or all-inside reconstruction with suspensory cortical button fixation. *The Knee*. 2017;24(5):1047-1054. doi:10.1016/j.knee.2017.06.007
15. Mayr R, Smekal V, Koidl C, et al. ACL reconstruction with adjustable-length loop cortical button fixation results in less tibial tunnel widening compared with interference screw fixation. *Knee Surg Sports Traumatol Arthrosc*. 2020;28(4):1036-1044. doi:10.1007/s00167-019-05642-9
16. Mahirogullari M, Kehribar L, Surucu S, Kayaalp ME, Yilmaz AK, Aydin M. Comparative Results of Anterior Cruciate Ligament Reconstruction with Full Tibial Tunnel: Quadrupled Semitendinosus Suspensory Femoral and Tibial Fixation versus Quadrupled Semitendinosus and Gracilis Suspensory Femoral and Tibial Screw and Staple Fixation. *J Knee Surg*. 2023;36(10):1069-1076. doi:10.1055/s-0042-1749396
17. Pautasso A, Capella M, Barberis L, et al. All-inside technique in ACL reconstruction: mid-term clinical outcomes and comparison with AM technique (Hamstrings and BpTB grafts). *Eur J Orthop Surg Traumatol*. 2021;31(3):465-472. doi:10.1007/s00590-020-02798-w