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All-Inside Versus Conventional Technique in Anterior Cruciate Ligament Reconstruction: A Randomized Clinical Trial

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Abstract **Original Research Article**

Anterior cruciate ligament (ACL) injuries significantly impact knee stability and function, especially in athletes. This randomized clinical trial compared the all-inside and conventional techniques for ACL reconstruction to determine differences in functional outcomes, surgical efficacy, and complication rates. Forty-eight patients with complete ACL tears were randomized into two groups: all-inside (n=24) and conventional (n=24). Functional outcomes were assessed using the Cincinnati and International Knee Documentation Committee (IKDC) scores at 6 and 18 months postoperatively. No significant differences in operative time or complication rates were observed. The mean Cincinnati scores at 6 months were 22.44 ± 5.20 (conventional) and 24.63 ± 7.10 (all-inside), while the 18-month scores were 34.84 ± 7.05 and 36.00 ± 7.62, respectively (p=0.325). IKDC scores showed similar trends, with no statistically significant differences at either interval (p=0.407). Subgroup analysis based on meniscal injury treatment (none, meniscectomy, or meniscal suture) also revealed no significant variation in functional outcomes. These findings suggest that both the all-inside and conventional techniques are effective and safe for ACL reconstruction, with comparable functional outcomes and low complication rates. While the all-inside method may offer theoretical advantages, further studies with larger sample sizes and longer follow-up are needed to establish long-term superiority.

Keywords: ACL reconstruction, all-inside technique, conventional technique, randomized clinical trial, knee function, Cincinnati score, IKDC score, meniscal injury, orthopedic surgery, sports medicine.

INTRODUCTION

Anterior cruciate ligament (ACL) injuries are common, particularly among athletes in high-impact sports. Effective ACL reconstruction is critical for restoring knee stability and function, enabling athletes to return to their pre-injury activity levels. Traditionally, the outside-in technique has been the gold standard for ACL reconstruction. However, the all-inside technique has emerged as a less invasive alternative, promising potential benefits like reduced soft tissue damage and shorter recovery times [6].

Despite growing interest, there is limited consensus on whether the all-inside method is superior to the conventional technique in terms of clinical outcomes, surgical efficacy, and complication rates. Previous studies comparing these two techniques have yielded mixed results, often lacking robust randomized clinical trials [1].

This study aims to fill this gap by directly comparing the clinical outcomes of ACL reconstruction using the all-inside and conventional techniques in a randomized clinical trial. A total of 48 patients with complete ACL tears were randomly assigned to undergo surgery using either technique. Outcomes were assessed over an 18-month follow-up period using the Cincinnati and International Knee Documentation Committee (IKDC) scores, as well as complication rates.

The significance of this research lies in its potential to provide valuable insights into the effectiveness and safety of the all-inside technique. By evaluating knee stability, function, and complications, this study offers a comprehensive comparison of both methods. The randomized trial design strengthens the

evidence base and provides clearer guidance for surgeons in choosing the optimal technique for ACL reconstruction [6, 7].

Materials and Methods

Hypothesis and Objectives

We hypothesized that the all-inside technique would present better functional results than the conventional technique in patients aged 18–50 years undergoing ACL reconstruction. The primary aim of this study was to evaluate functional outcomes measured by knee scores (Cincinnati and IKDC) and postoperative complications over an 18-month follow-up.

Design and Setting

This randomized, single-blind, controlled clinical trial was conducted at the Armed Forces Hospital in Lisbon, within the Orthopedics and Trauma Surgery Department, from March 2019 to September 2022.

Randomization

Randomization was performed using SPSS software. A statistician created a database containing ordered codes, which were randomly assigned to participants to ensure a 1:1 ratio. Investigators determined which intervention corresponded to codes A or B, ensuring that neither the statistician nor the follow-up observer knew which intervention was applied.

Masking Techniques

Due to the impossibility of blinding the surgeon, patients were blinded, as the incisions for both techniques appeared similar. Follow-up assessments were conducted by an independent orthopedic surgeon uninvolved in the surgeries. Patient names and assigned techniques were excluded from examination records to minimize detection bias.

Participants

Inclusion Criteria:

- Diagnosed ACL injury (Grade II or III) confirmed by clinical examination and MRI.
- Age 18–50 years.
- Surgery performed at least 21 days post-injury.
- Written informed consent provided.

Exclusion Criteria:

- Grade I ACL tears.
- Concomitant ligament injuries or chondral debridement.
- Radiological evidence of osteoarthritis.
- Previous ipsilateral knee surgeries.
- ACL tears in the contralateral knee.
- Medical contraindications to surgery.

Methods

A non-probabilistic, consecutive recruitment method was used. Forty-eight patients with Grade III ACL tears were randomly assigned to either the all-inside (n=24) or conventional (n=24) group. Knee functionality was assessed preoperatively, at 12 months, and at 18 months using the IKDC and Cincinnati scores [6, 8].

Surgical Techniques

Conventional Technique:

Semi-tendinosus and gracilis tendon autografts were doubled to create a four-stranded graft. A femoral closed socket was drilled via the medial arthroscopic portal, and an open tibial tunnel was created from the outside. Fixation involved suspensory fixation at the femur and interference screw fixation at the tibia.

All-Inside Technique:

A quadrupled semitendinosus autograft was used with suspensory fixation at both ends, secured into closed inside-out drilled sockets of the femur and tibia [8].

Results and Discussion

All patients completed an 18-month follow-up. There was no significant difference in operative duration between groups. The mean age of the all-inside group was 28.1 years, while the conventional group was 27.9 years. One participant in the all-inside group required a second-look procedure for a failed meniscal suture, resulting in a meniscectomy. No other complications, such as infections, loss of extension, or reconstruction failures, were reported [9].

Functional Outcomes

Scores by ACL Reconstruction Technique

Measure	Conventional Technique (Mean ± SD)	All-Inside Technique (Mean ± SD)
CINCINNATI (0–6 months)	22.44 ± 5.20	24.63 ± 7.10
CINCINNATI (0–18 months)	34.84 ± 7.05	36.00 ± 7.62
IKDC (0–6 months)	32.64 ± 10.23	29.21 ± 14.04
IKDC (0–18 months)	36.04 ± 10.21	33.92 ± 13.22

No significant differences were observed between groups for the Cincinnati (p=0.325) or IKDC scores (p=0.407) [7].

Scores by Meniscal Injury Treatment

Measure	No Injury	Meniscectomy	Meniscal Suture
CINCINNATI (0–6 months)	24.95 ± 7.61	24.83 ± 3.66	21.50 ± 4.84
CINCINNATI (0–18 months)	36.32 ± 7.61	35.17 ± 9.26	34.20 ± 6.57
IKDC (0–6 months)	29.91 ± 11.39	30.83 ± 14.36	32.55 ± 13.18
IKDC (0–18 months)	35.55 ± 10.59	32.83 ± 12.43	35.65 ± 13.11

No significant differences in functional outcomes were observed based on meniscal injury treatment [9, 10].

CONCLUSION

Both the all-inside and conventional techniques for ACL reconstruction provide effective and safe outcomes. This study found no significant differences in functional outcomes or complication rates between the two methods over an 18-month follow-up period. The all-inside technique, with its minimally invasive nature, offers theoretical benefits such as less soft tissue damage and quicker recovery times, but these advantages were not statistically supported in this trial [1, 3].

Given the comparable outcomes, the choice of technique should consider patient-specific factors, surgeon expertise, and resource availability. Further research is necessary to assess long-term outcomes, particularly regarding durability and patient satisfaction over extended periods. Large-scale, multicenter trials could provide more definitive evidence on whether the all-inside approach can deliver superior outcomes. Additionally, cost-effectiveness analyses would be valuable in determining the broader applicability of these techniques in diverse healthcare settings [4, 6, 7].

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