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FOOTPRINT OPTIMIZATION IN ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION: A SINGLE TUNNEL DOUBLE-BUNDLE APPROACH

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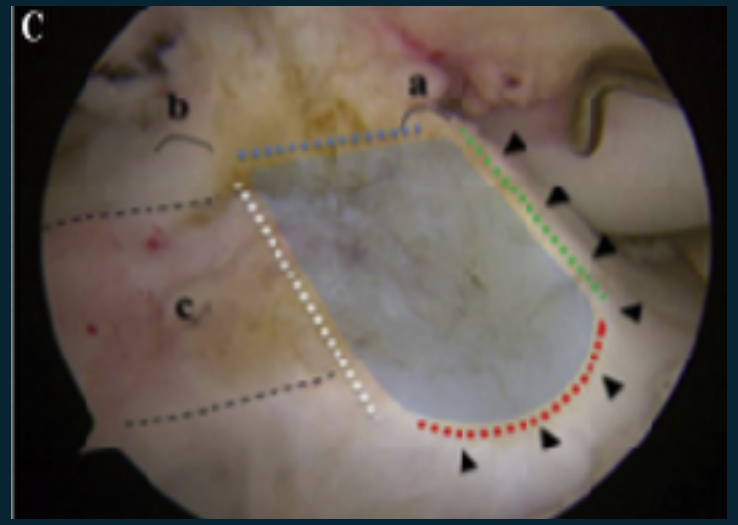
Disclosures:

Nothing to disclose

INTRODUCTION

- Anatomic ACL reconstruction aims to restore native anatomy of the ACL, for improved outcomes and reduced osteoarthritis risk (1,2).
- Double-bundle technique offers more anatomical reconstruction, restoring both anterior stability and rotational control (3-5).
- Interconnection between dimensions of graft and native ACL is important for optimal effectiveness (6).
- Rectangular graft and tunnel design were employed to mimic the native ligament's flat, ribbon-like shape, demonstrating superior performance of rectangular tunnels compared to round tunnels in ACL reconstruction with BPTB autograft (2).



Graft Size(mm)	Tunnel Size		Surface area covered		Percentage increase of Surface area coverage with FPE
	C	FPE	C	FPE	
8mm	8	7 * 9	50.24	63	25.39
9mm	9	8 * 10	63.58	80	25.82
10mm	10	9 * 11	78.5	99	26.11
11mm	11	10 * 12	94.98	120	26.34

C - Conventional Single Bundle Anatomical ACLR, FEP - Footprint Enhancing ACLR Technique, All Area calculations are in square mm

AIM & OBJECTIVE

To investigate the feasibility, efficacy, and potential benefits of utilizing foot print optimization single tunnel double-bundle approach in Anterior Cruciate Ligament reconstruction surgery.

MATERIALS AND METHODS

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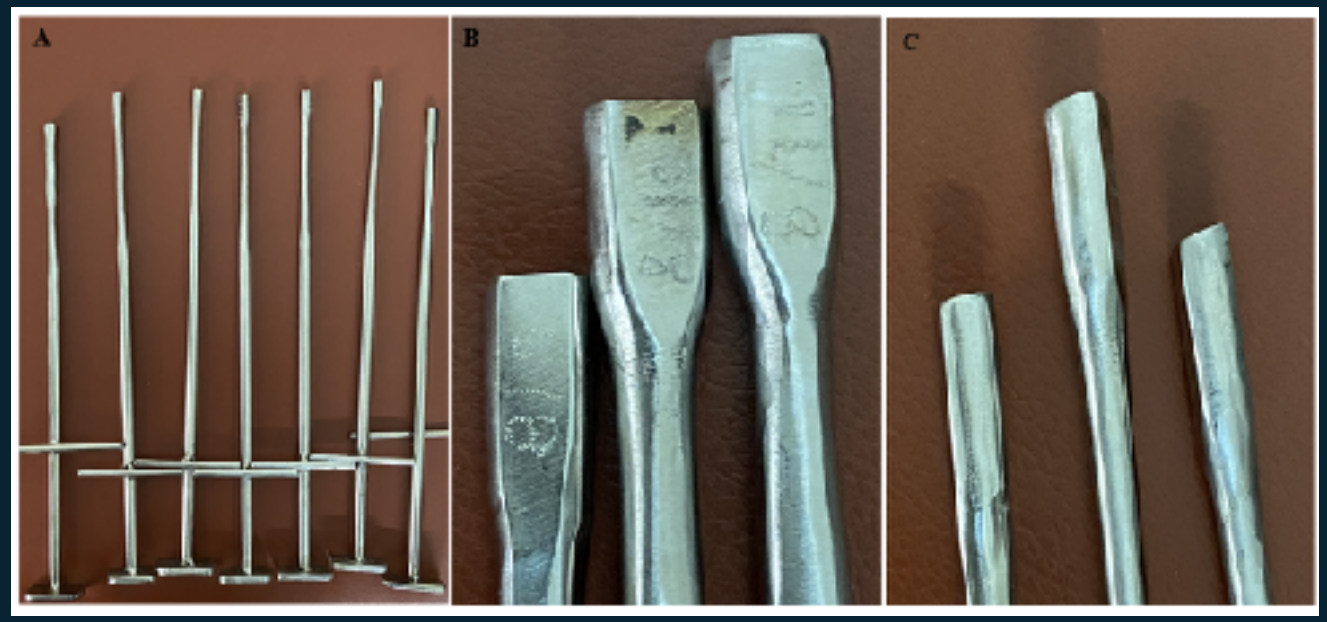
- Thirty five patients (24 male and 11 female) with a mean age of 30 years undergoing Anterior Cruciate Ligament Reconstruction were prospectively enrolled.
- Anterior cruciate ligament tunnel made using patented rectangular tunnel dilators.
- Soft tissue hamstring grafts used in all patients. Graft squeezing method used for graft passage and fixed with suspensory on femoral side and aperture fixation on tibial side.
- Patient outcomes were evaluated pre-operatively and 3-month, 6-month, 12-month, 24-month, and 36-month post-operatively :

  -passive knee range of motion (ROM),

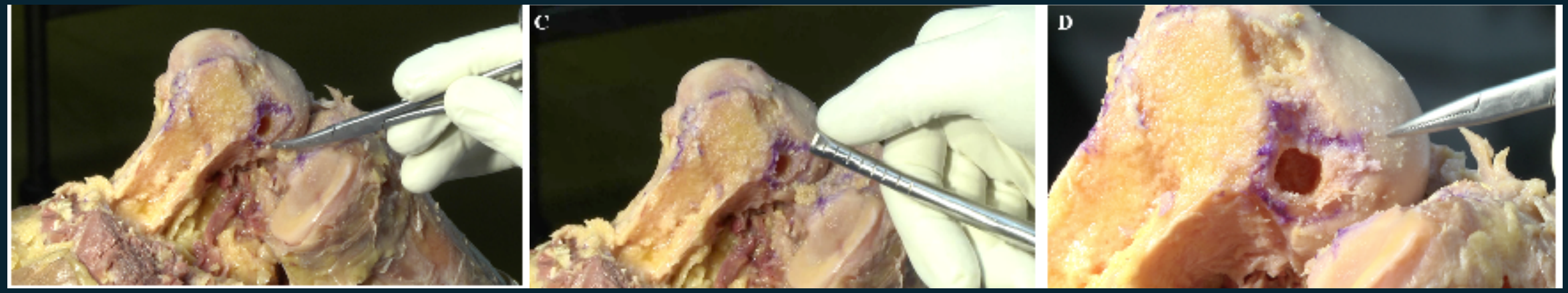
  - Lachman test for anteroposterior stability, and pivot-shift test for rotational stability,

  -Lysholm scores,

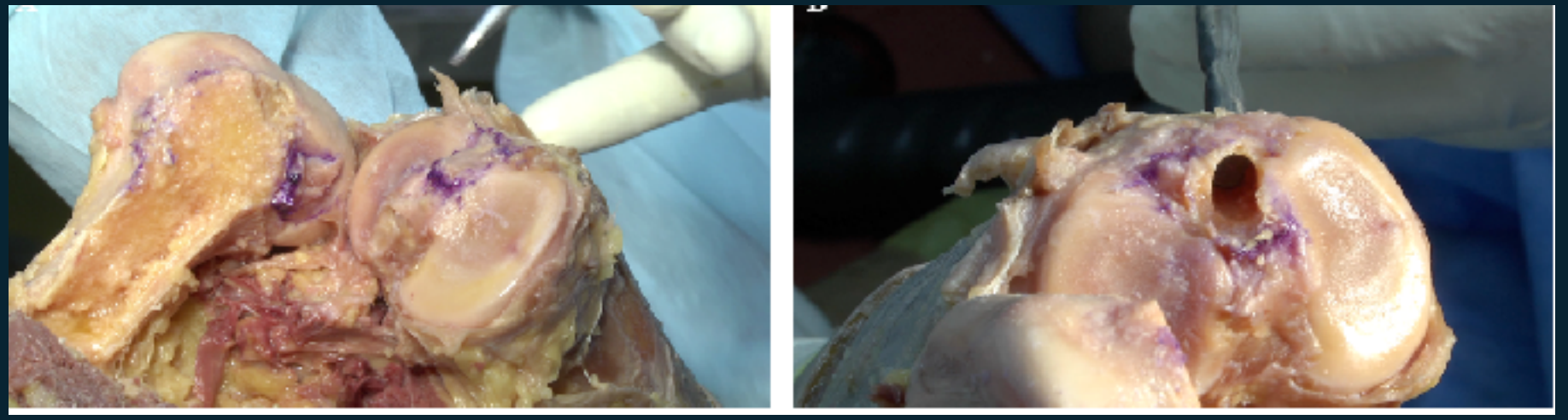
  - international knee documentation committee (IKDC) score



Rectangular Tunnel Dilators



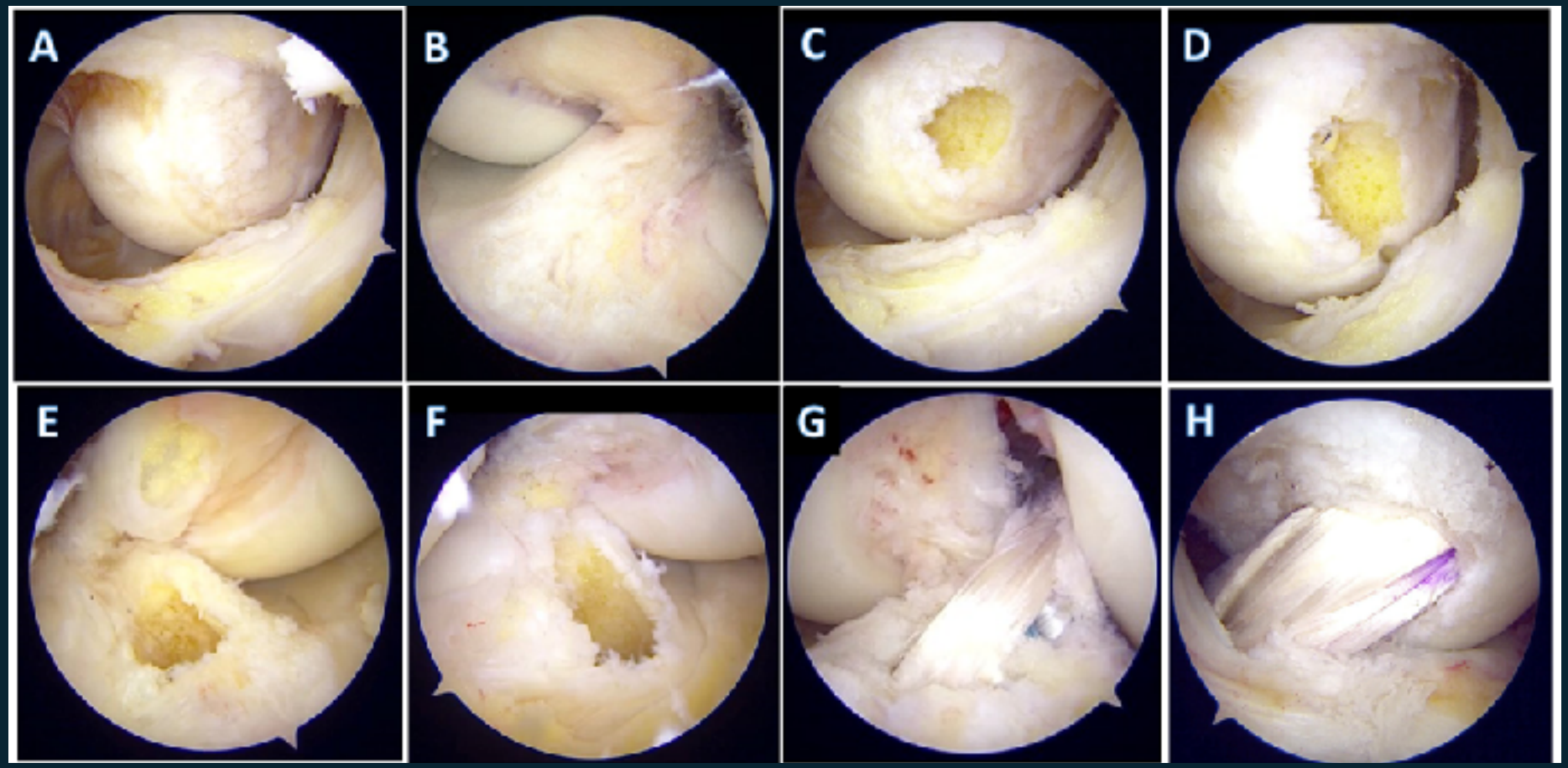
Femoral Tunnel Preparation



Tibial Tunnel Preparation

Graft Squeezing technique

Double-bundle-like effect



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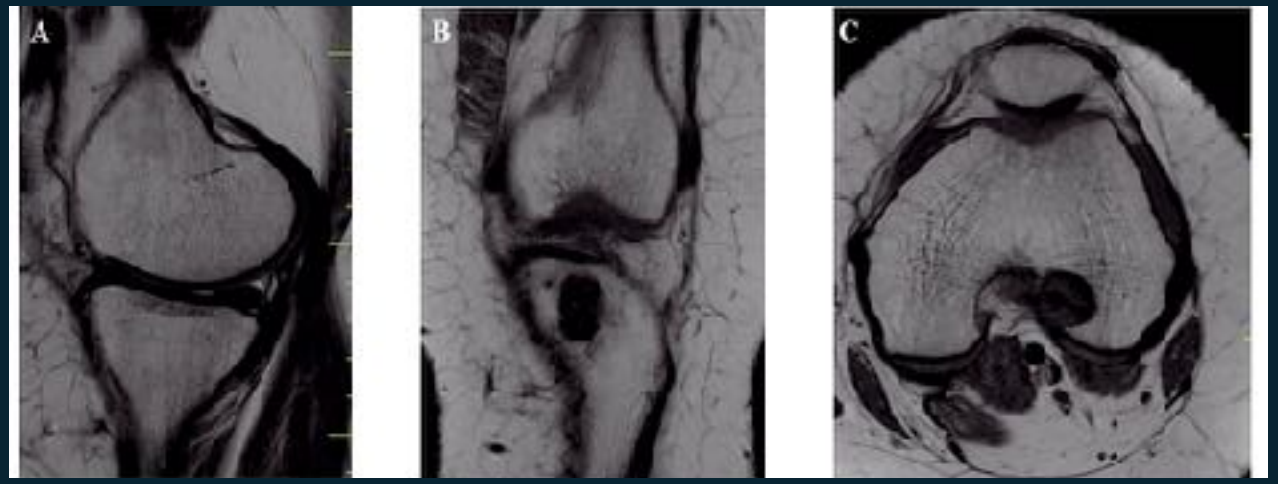
A) Arthroscopic view from Posteromedial portal showing femoral footprint. B) Arthroscopic view from the high anterolateral portal showing the rectangular tibial footprint. C) Circular tunnel in the oval femoral footprint. D) Oval tunnel covering maximum femoral footprint. E) Circular tunnel in rectangular tibial footprint. F) Rectangular tunnel in rectangular tibial footprint. G) Arthroscopic view from the anterolateral portal (after graft fixation) showing complete rectangular tibial footprint coverage nearing to the original footprint. H) Arthroscopic view from the posteromedial portal (after graft fixation) with the knee in extension showing differential tension in the graft.



Post-operative and follow-up at 7, 8, and 10 months

RESULTS

- The study observed encouraging results in terms of rehabilitation progress and return to activities of daily living (ADL).
- Passive Knee range of motion (ROM) exhibited a significant enhancement in knee flexion following surgery, as the average pre-operative ROM of 106 degrees increased to 134 degrees at the 36-month follow-up. ROM remained stable throughout the following years.
- The Lysholm knee score and IKDC scores, steadily improved from a pre-operative of 52.46±8.13 to 92.79±1.00 and 34.43±4.13 preoperatively to 86.43±0.61 respectively at final follow up of 36 months.
- Therefore, all evaluated parameters demonstrated positive outcomes.
- However, one complication, a Cyclops lesion, was identified.

Graft Diameter (mm), n(%)		Femoral Tunnel Diameter, n(%)		Tibial Tunnel Diameter (mm),	
8	10 (28.57)	7*9	10 (28.57)	7*9	10 (28.57)
9	20 (57.14)	8*10	20 (57.14)	8*10	20 (57.14)
10	05 (14.29)	9*11	5 (14.29)	9*11	5 (14.29)

Outcome Parameter, N=35	**Pre-Operative**	**Post-Op**				
		3 Months	**6 Months**	**12 Months**	**24 Months**	**36 Months**
Passive Knee range of motion	106.29±13.74	119.86± 4.11	126.71±4.19	131.14±3.45	134.86±3.53	136.00±3.16
Lysholm Knee Score	52.46±8.13	86.34±5.52	93.00±1.75	95.23±1.44	97.97±0.95	92.79±1
International Knee Documentation	34.43±4.13	65.91±6.78	81.83±1.36	83.20±1.08	85.20±0.83	86.43±0.61

CONCLUSION

- Single-tunnel technique aimed to achieve a footprint-enhancing effect, mimicking the double-bundle approach, and has shown promising outcomes
- At 3-year follow-up, patients exhibited favourable progress in terms of knee function.
- The single tunnel double-bundle technique promotes enhanced graft-bone interface and potentially facilitates optimal healing processes may improve long-term outcomes.
- Additionally, compared to conventional techniques, the rectangular tunnel has been shown to facilitate the creation of larger bone tunnels, which could potentially translate into superior clinical results

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