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RADIOLOGICAL OUTCOMES FOLLOWING ACL REPAIR WITH INTERNAL BRACING COMPARED TO RECONSTRUCTION WITH HAMSTRING AUTOGRAFT

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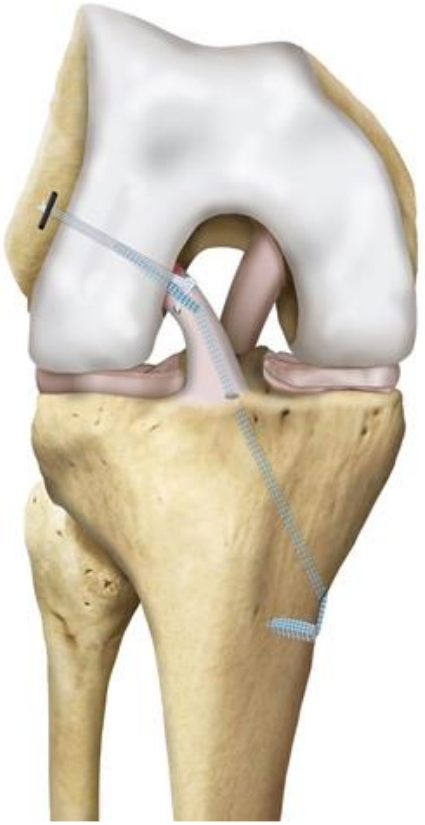
Disclosures

- G MacKay is a consultant for Arthrex and receives royalties for the Internal Brace™
- The other authors have no conflicts of interest to disclose

Introduction

- Anterior Cruciate Ligament (ACL) Reconstruction is the ‘gold standard’ operative treatment of ACL rupture. However, only 65% return to their pre-injury sport level and 10-15% have a graft failure after 10 years. There is a high prevalence of early onset osteoarthritis despite restoration of knee stability.
- Primary repair of ACL is an option for acute proximal tears augmented with a bio-compatible suture tape- InternalBrace™ (Arthrex)
- Short to medium term outcomes of this technique have been encouraging
- Functional benefits of ACL Repair with Internal Brace include improved strength & proprioception compared to traditional reconstruction
- MRI has been used to assess graft integrity and maturation following ACL recon, however there are limited reports with ACL repair



Aim **To use quantitative MRI (qMRI) to assess outcomes of ACL repair compared to reconstruction; Signs of ACL/graft integrity & progression of degenerative changes**

Methods- Recruitment

- Patients recruited post-op ACL surgery to undergo follow-up MRI scan
- 3 Tesla MRI scan at mean 6 years post-op
- Comparison to pre-op scan
- All measures recorded by 2 experienced MSK Radiologists who were blinded to treatment type

	n	Age	Tegner	Time post-op
ACL Repair (IB)	15	31	6	6 years
ACL Recon (Hamstring)	14	28	6	6 years

Table showing matched treatment group demographics

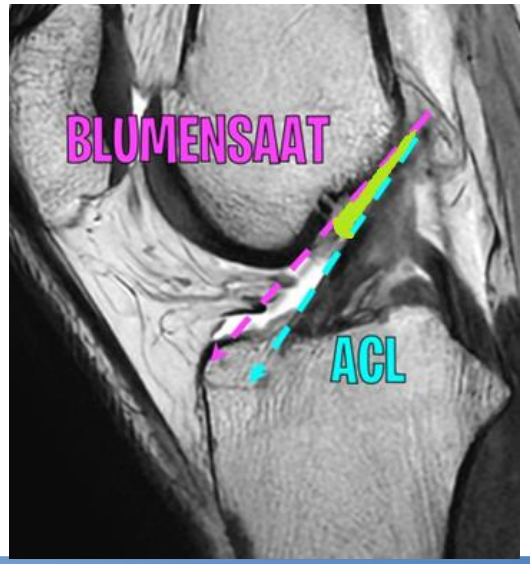
Methods- Measures of ACL/Graft

- **Figueroa score**: a scoring scale evaluating ACL based upon graft integration and maturation. Determined by signal intensity compared to intact PCL and presence or absence of fluid at the tunnel-graft interface.
- **Secondary signs of ACL rupture:** empty notch, anterior tibial translation, and PCL buckling
- **Blumensaat's - ACL angle** was measured as a surrogate marker for ACL integrity. This is the angle between the ACL/ACL graft fibres and Blumensaat's line (Normal 0-15°)
- **Tunnel diameter:** maximum diameter of the femoral and tibial tunnels
- **Donor site morbidity:** presence or absence of fluid at the pes anserinus

Figueroa Score

Item	Points
Integration: Synovial fluid at tunnel-graft interface	
Positive	1
Negative	2
Ligamentization: Graft signal pattern (> 50%)	
Hypointense	3
Isointense	2
Hyperintense	1
Characterization of graft	
Poor	2
Adequate	3-5

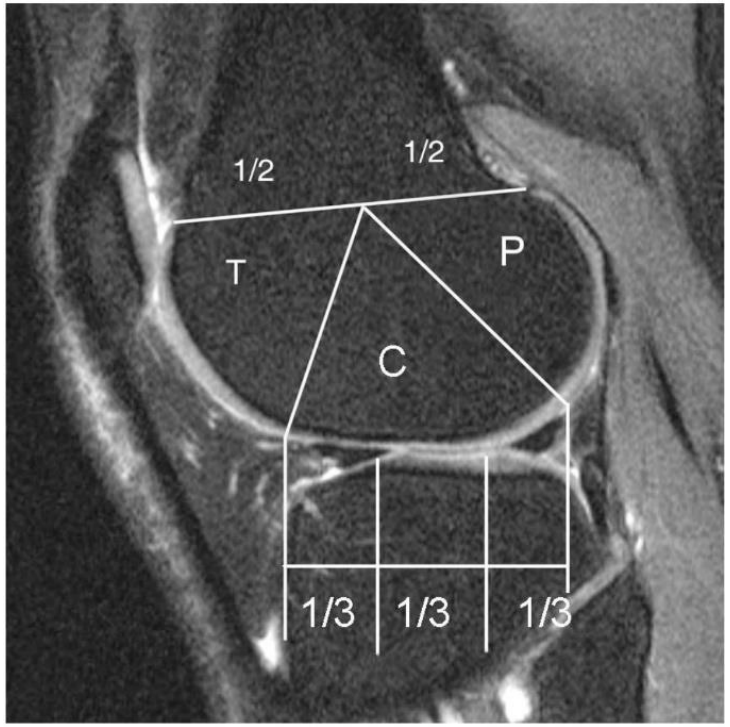
Blumensaat's - ACL angle, shaded green



Methods- MOAKS

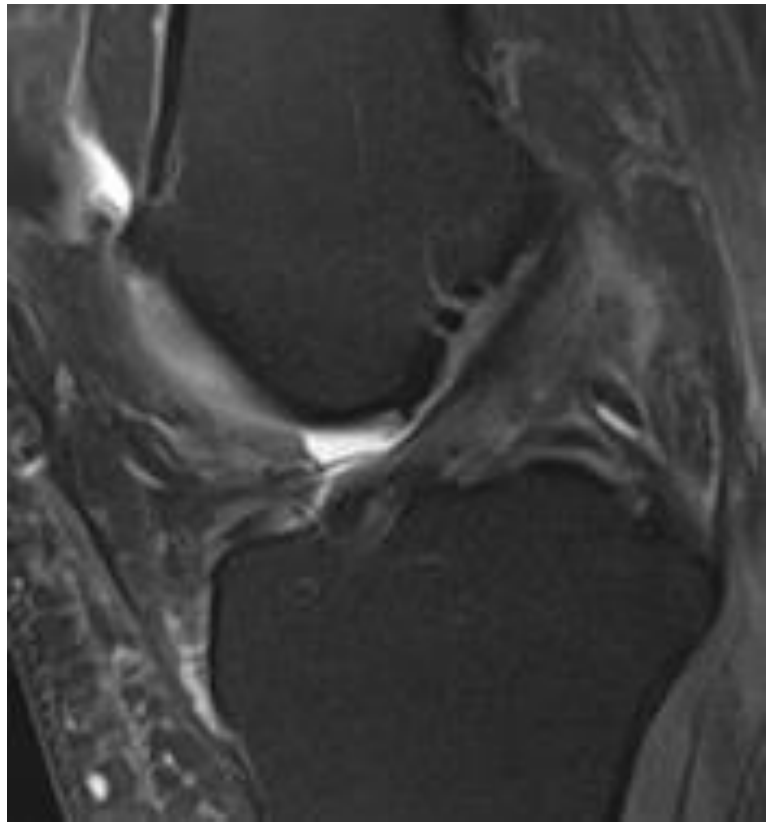
- **MRI Osteoarthritis Knee Score (MOAKS):** qMRI based scoring system, multifaceted and is scored in 14 different locations in the knee.
- Graded (0-3) in each zone for:
  - Bone marrow lesions
  - Cartilage defects (size/depth)
  - Osteophytes
  - Synovitis
  - Effusion
  - Meniscal tears/extrusion
- Calculated on both the follow-up study scan and pre-operative scan, using the same technique to calculate interval progression of degenerative change.

MOAKS Scoring zones



Results - ACL/Graft Integrity

- **Figueroa score** 5/5 for all repairs indicating normal radiointensity
- 1 reconstruction (7%) had Figueroa score 2/5 indicating graft failure
- **Blumensaat's – ACL angle**: group median
  - Reconstruction: 5°
  - Repair: 6°
  - No difference between groups
- One patient in each group had angle indicative of failure (recon 25°, repair 26°)
- **Secondary signs of re-rupture:** no others observed other than in the two cases noted above



Sagittal T2 MRI showing healed ACL following primary repair

Results - Morbidity

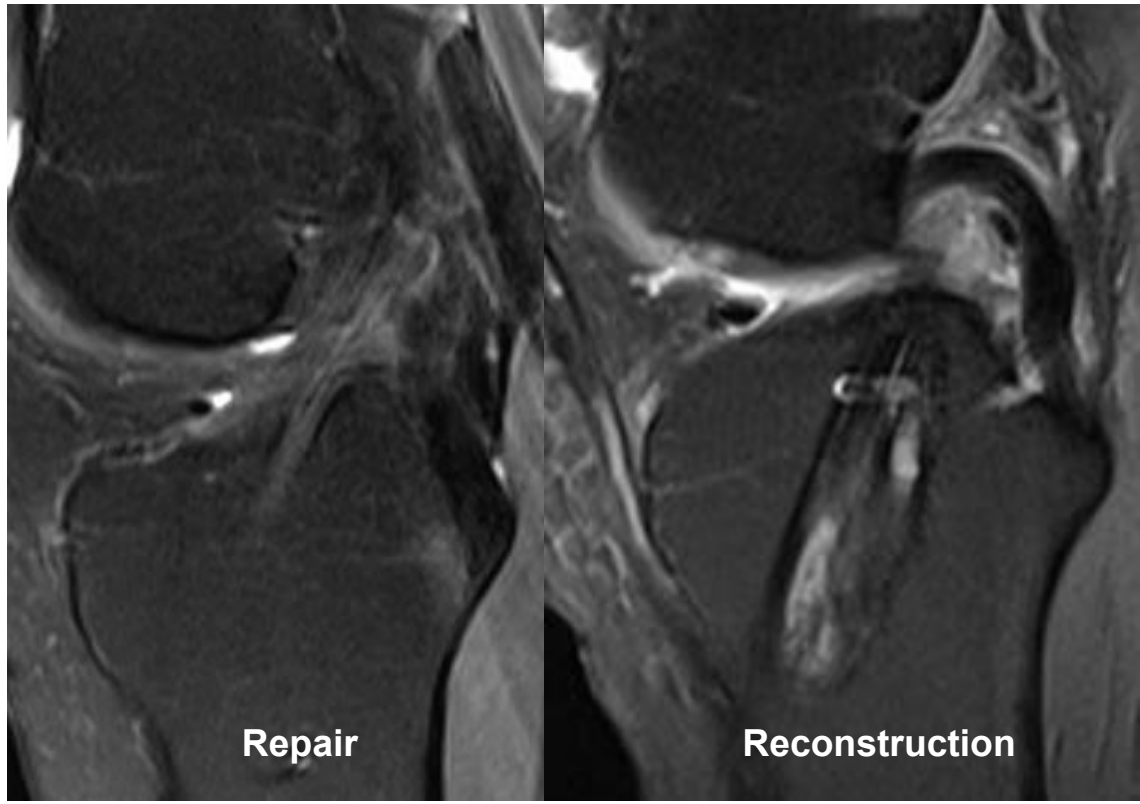
- **Tunnel diameter:** Significantly larger residual tunnels post-reconstruction than repair

	Repair	Recon	p-value
Tibia	3 (±1)	11 (±2)	<0.001
Femur	4 (±2)	9 (±1)	<0.001

Table showing mean tunnel diameter (mm)

- **Donor site morbidity:** Oedema around the pes area was observed in 5 reconstructions and 1 repair

Sagittal T2 MRI showing residual bone tunnels in repair (left) and reconstruction (right)



Results - MOAKS

- **Bone marrow lesions** worsened more in recon v repair (p=0.01)
- **Cartilage lesions** worsened in both groups (p<0.01). No difference between groups. PF, med & lat compartments affected equally
- **Osteophytes** worsened in recon but did not for repair (p<0.01)
- **Meniscus** worsened in recon but did not for repair (p=0.03). Medial & lateral equally affected
- **Overall MOAKS**: Both groups showed deterioration over time (p<0.001)
  - Recon change was significantly worse than repair (p=0.03)

Table showing MOAKS results

	Pre-op	Post-op	Change
Repair	1.2	1.4	0.2
Recon	0.3	1.8	1.5
Repair	5.1	9.9	4.8
Recon	4.5	10.7	6.2
Repair	0	0	0
Recon	0	2	2
Repair	0.87	0.87	0
Recon	0.79	1.57	0.78
Repair	7.1	12.3	5.2
Recon	5.8	16.0	10.2

Discussion

- The findings represent qMRI confirmation that a cohort of patients treated with ACL repair and Internal Bracing have a healed ligament with normal appearances
- The repair group is non inferior to reconstruction for MRI assessment of ACL integrity with one patient in each group demonstrating radiological signs of potential failure
- More inflammation around the pes anserinus evident with reconstruction, possibly reflecting chronic pain and weakness at donor site
- The significantly smaller residual bone tunnels with repair is important due to the amount of bone loss which may be relevant for revision surgery

Discussion

- MOAKS score showed a deterioration over time in both groups but the reconstruction group had more progression of degeneration
- Repair may be protective against premature osteoarthritis, possibly due to improved proprioception
- Longer term follow up and a prospective randomised trial is required to assess this fully.

Conclusions

- ACL repair with IB non-inferior to reconstruction for MRI assessment of ligament/graft integrity in this cohort study
- Lower morbidity with ACL repair
- More progression of OA with reconstruction than repair at 6 years
- qMRI results add support to the growing body of evidence for ACL repair as a safe and viable alternative to reconstruction in appropriate cases

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