# Peri-Operative Complications, Safety, and Early Outcomes of a Novel ACL & ALL Reconstruction Technique Using IT Band vs. Patellar Tendon ACLR:

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**Boston, MA**

***A Retrospective Pilot Study of the SATURN (Skeletally-Mature ACLR Technique Using Reinforcement) Study Group***


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# Disclosures

**Dr. Heyworth is a paid consultant for Arthrex, Inc. and Kairos Surgical.**

**Dr. Heyworth owns stock or stock options in Imagen Technologies, Inc.**

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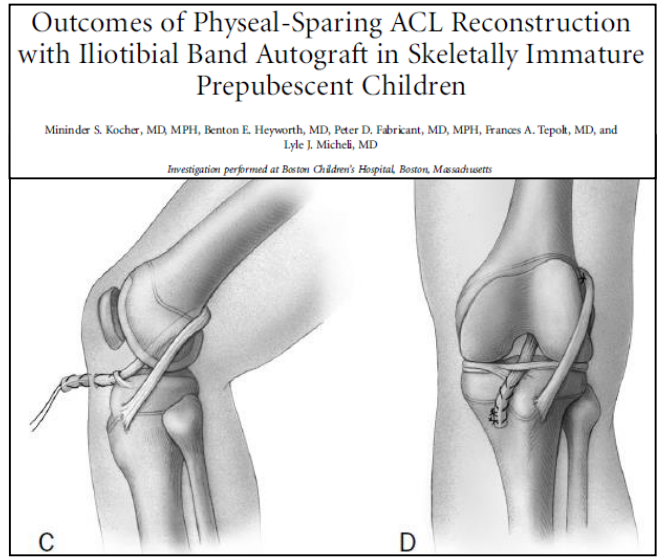
**Dr. Heyworth receives textbook royalties from Springer Science and Business Media.**

# SATURN Study Group: 15 Surgeons, 10 Centers

# Background

- **Outcomes of ACL Reconstruction (ACLR) in skeletally immature patients are being studied by the PLUTO group.**
- **The Modified Macintosh ACLR with IT Band autograft, developed by Dr. Lyle Micheli, has shown favorable results in prepubescent children**
- **Older adolescents with closing or closed physes are the *most* affected age group with the highest retear rates.**
- **Therefore, longstanding interest in application of the Micheli technique for older adolescents has led to modifications of the technique for this age group.**



Outcomes of Physeal-Sparing ACL Reconstruction with Iliotibial Band Autograft in Skeletally Immature Prepubescent Children

Mininder S. Kocher, MD, MPH, Benton E. Heyworth, MD, Peter D. Fabricant, MD, MPH, Frances A. Tepolt, MD, and Lyle J. Micheli, MD

*Investigation performed at Boston Children's Hospital, Boston, Massachusetts*

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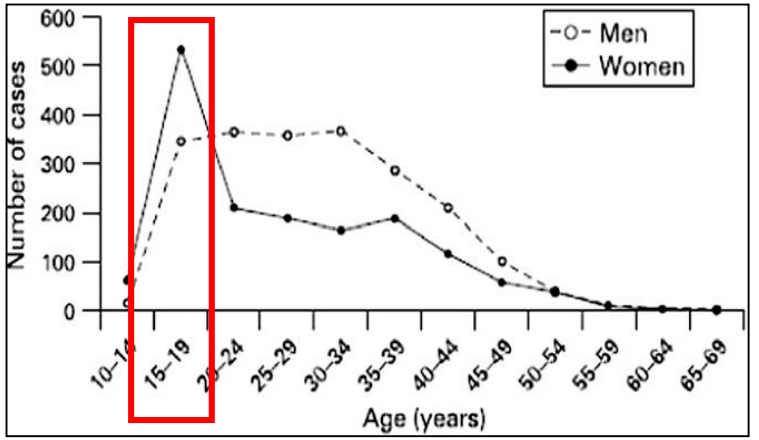
**ACL Injury by Age, Sex**

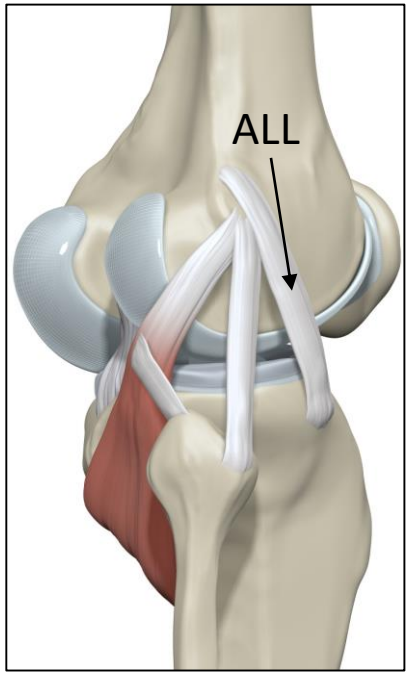



*Renstrom P, Ljungqvist A, Arendt E, et al. Non-contact ACL injuries in female athletes:an International Olympic Committee current concepts statement. Br J Sports Med. 2008;42(6):394–412.*

# Background

- **Similar to a technique described by the SANTI group, the SATURN technique utilizes a complete femoral tunnel from the ACL footprint (inside the notch) to the ALL footprint (just proximal/posterior to the lateral epicondyle).**

- **An RCT study investigating a similar technique in adults found no differences in re-rupture rates between ITB and BTB at 15-year follow-up.**




SANTI
Scientific ACL NeTwork International

**Iliotibial band autograft versus bone-patella-tendon-bone autograft, a possible alternative for ACL reconstruction: a 15-year prospective randomized controlled trial**

**Frederik Stensbirk · Kristian Thorborg · Lars Konradsen · Uffe Jørgensen · Per Hölmich**

Knee Surg Sports Traumatol Arthrosc (2014) 22:2094–2101
DOI 10.1007/s00167-013-2630-9

**Conclusion**

Using a randomized clinical trial design, we found no differences in re-rupture rates between ITB and BPTB reconstructed patients at 15-year follow-up. Thus, it seems that the ITB reconstruction can be recommended as an attractive and realistic alternative to the conventional methods, and could also be considered in relation to revision ligament surgery and multi-ligament reconstruction where additional graft material is needed.

# Purpose

**To investigate, in comparative fashion,**
**the peri-operative safety, post-operative complications, and**
**2-Yr Functional/Patient-Reported Outcomes (PROs) of**
**ITB-ACLR+ALLR vs. BTB-ACLR**
**in a large demographically and geographically diverse adolescent population.**

# Methods

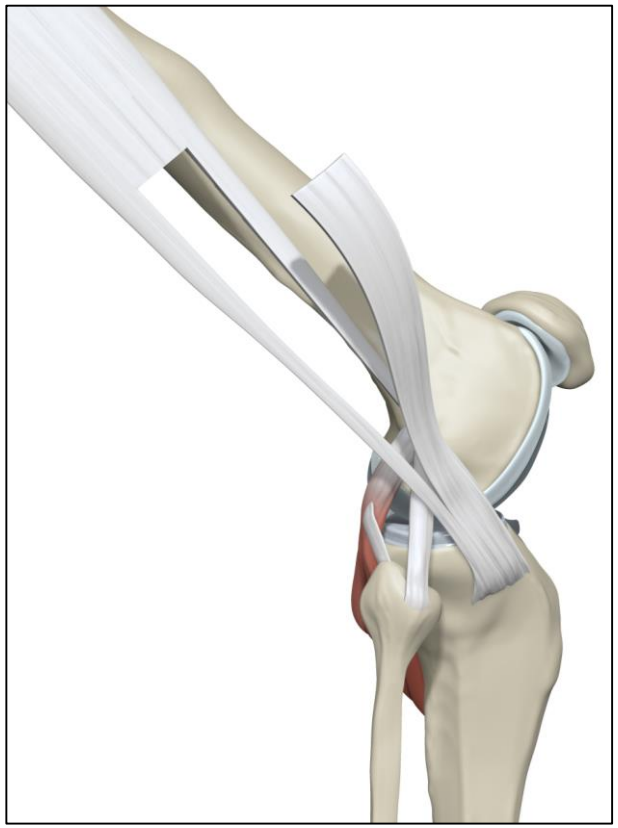
## BTB

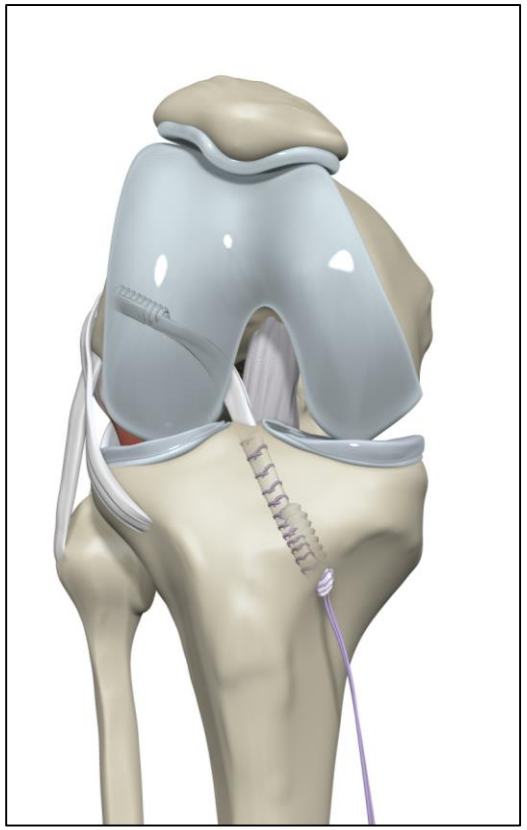
**Either**

- Suspensory fixation on femur
- Aperture fixation on femur

## SATURN ITB (Modified-Micheli)

**Femoral tunnel-based (outside in) graft passage**





# Methods – Data Collection, Forms

## Demographic Data

- Athletic status, activity

## Injury Data

- Injury activity (Sports vs. recreational play vs. other)
- MOI (contact vs. non-contact)

## Radiographic Measurements (AP, lateral XR; MRI)

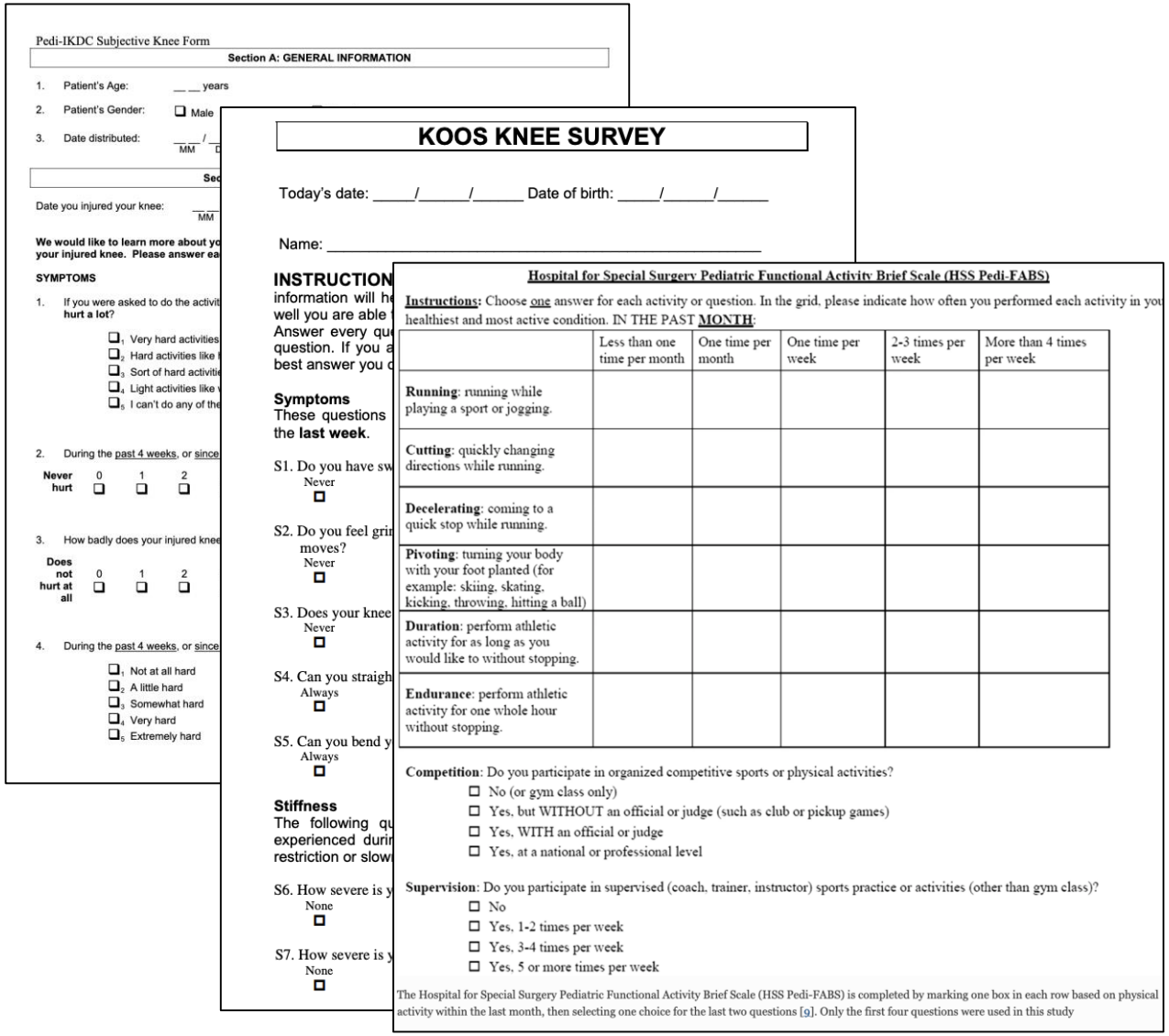
- Posterior slope
- Notch width

## Primary Outcome Measures (Validated PROs)

- Pedi-IKDC, KOOS, HSS Pedi-FABS

## Secondary Outcome Measures

- Pain, QOL (EQ5D)
- Satisfaction
- Complications
  - Arthrofibrosis
  - Re-tear
  - Meniscus tear



Pedi-IKDC Subjective Knee Form

Section A: GENERAL INFORMATION

1. Patient's Age: __ __ years
2. Patient's Gender: ❑ Male
3. Date distributed: ___/___ MM D

Date you injured your knee: ___ MM

We would like to learn more about yo your injured knee. Please answer ea

SYMPTOMS

1. If you were asked to do the activit hurt a lot?

❑1 Very hard activities
❑2 Hard activities like
❑3 Sort of hard activiti
❑4 Light activities like
❑5 I can't do any of the

2. During the past 4 weeks, or since

Never hurt 0 ❑ 1 ❑ 2 ❑

3. How badly does your injured knee

Does not hurt at all 0 ❑ 1 ❑ 2 ❑

4. During the past 4 weeks, or since

❑1 Not at all hard
❑2 A little hard
❑3 Somewhat hard
❑4 Very hard
❑5 Extremely hard

KOOS KNEE SURVEY

Today's date: _____/_____/_____ Date of birth: _____/_____/_____

Name: _____

INSTRUCTION
information will he
well you are able
Answer every qu
question. If you a
best answer you c

Symptoms
These questions
the last week.

S1. Do you have sw
Never ❑

S2. Do you feel grin
moves?
Never ❑

S3. Does your knee
Never ❑

S4. Can you straigh
Always ❑

S5. Can you bend y
Always ❑

Stiffness
The following qu
experienced durin
restriction or slow

S6. How severe is y
None ❑

S7. How severe is y
None ❑

Hospital for Special Surgery Pediatric Functional Activity Brief Scale (HSS Pedi-FABS)

Instructions: Choose one answer for each activity or question. In the grid, please indicate how often you performed each activity in you healthiest and most active condition. IN THE PAST MONTH:

| | Less than one time per month | One time per month | One time per week | 2-3 times per week | More than 4 times per week |
|---|---|---|---|---|---|
| **Running**: running while playing a sport or jogging. | | | | | |
| **Cutting**: quickly changing directions while running. | | | | | |
| **Decelerating**: coming to a quick stop while running. | | | | | |
| **Pivoting**: turning your body with your foot planted (for example: skiing, skating, kicking, throwing, hitting a ball) | | | | | |
| **Duration**: perform athletic activity for as long as you would like to without stopping. | | | | | |
| **Endurance**: perform athletic activity for one whole hour without stopping. | | | | | |

**Competition**: Do you participate in organized competitive sports or physical activities?
- ☐ No (or gym class only)
- ☐ Yes, but WITHOUT an official or judge (such as club or pickup games)
- ☐ Yes, WITH an official or judge
- ☐ Yes, at a national or professional level

**Supervision**: Do you participate in supervised (coach, trainer, instructor) sports practice or activities (other than gym class)?
- ☐ No
- ☐ Yes, 1-2 times per week
- ☐ Yes, 3-4 times per week
- ☐ Yes, 5 or more times per week

The Hospital for Special Surgery Pediatric Functional Activity Brief Scale (HSS Pedi-FABS) is completed by marking one box in each row based on physical activity within the last month, then selecting one choice for the last two questions [9]. Only the first four questions were used in this study

# Results – Demographic, Surgical Variables

| Table 1: Pre-Operative/Baseline Demographic & Peri-Operative/Early* Post-Operative Complications | | | |
|---|---|---|---|
| | **ITB-ACLR+ALLR (n = 37)** | **BTB-ACLR (n = 42)** | **p-value** |
| **Age** (*years; mean*) | 16.6 (+/- 3.0) | 17.4 (+/- 2.0) | 0.19 |
| **Sex** | | | 0.85 |
| Male | 15 (41%) | 19 (45%) | |
| Female | 22 (59%) | 23 (55%) | |
| **BMI** | 24.3 (+/- 6.2) | 24.5 (+/- 5.5) | 0.89 |
| **Tunnel diameter** | | | |
| Femoral (*mm; mean*) | 7.0 (+/- 0.2) | 9.7 (+/- 0.7) | <0.001 |
| Tibial (*mm; mean*) | 7.0 (+/- 0.2) | 9.8 (+/- 0.6) | <0.001 |
| **Operative time** (*minutes; mean*) | 135.5 (+/- 27.9) | 147.9 (+/- 33.3) | 0.14 |
| **Tourniquet time** (*minutes; mean*) | 113.6 (+/- 16.4) | 119.1 (+/- 12.4) | 0.19 |
| **RTS** (*months; mean*) | 9.2 (+/- 1.6) | 9.4 (+/- 1.4) | 0.45 |

**No significant differences in age, sex, BMI, PROs, operative time, tourniquet time, or RTS time between the two treatment groups.**

**The tunnel diameter in the ITB-ACLR group is significantly smaller compared to the BTB-ACLR group.**

# Results – Complications

| Table 1: Pre-Operative/Baseline Demographic & Peri-Operative/Early* Post-Operative Complications | | | |
|---|---|---|---|
| | **ITB-ACLR+ALLR (n = 37)** | **BTB-ACLR (n = 42)** | **p-value** |
| Graft Rupture/ACL Re-Tear | 2 (5.4%) | -- | -- |
| Meniscus Tear | 2 (5.4%) | 1 (2.4%) | -- |
| Arthrofibrosis | 1 (2.7%) | 6 (14.3%) | -- |
| Patellar Tendonitis | -- | 1 (2.4%) | |
| Superficial Infection | 1 (2.7%) | -- | -- |
| Quad Neuropraxia a/w Patellar Tendonitis | -- | 2 (4.8%) | |
| Tibial Biocomposite Screw, Foreign Body Reaction | 1 (2.7%) | -- | -- |
| **Contralateral ACL Tear** | 1 (2.7%) | 1 (2.4%) | -- |
| **Additional (Ipsilateral) Surgeries** | 5 (13.5%) | 7 (16.7%) | -- |

**2 graft ruptures in the ITB-ACLR group (one grossly noncompliant patient), none in BTB-ACLR group.**
**6 cases of Arthrofibrosis warranting intervention in the BTB group.**
**2 cases of clinically significant Quad Neuropraxia a/w Patellar Tendonitis affecting early rehab in BTB-ACLR group.**
**Overall, complications are similar between the two groups.**

# Results – Patient Reported Outcomes (PROs)

| Table 2: Patient Reported Outcome Questionnaires (PROs) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | ITB-ACLR+ALLR (n = 37) | | | BTB-ACLR (n = 42) | | | p-value |
| **6 month PRO follow-up time** (*months; mean*) | 6.7 (+/- 1.0) | | | 6.4 (+/- 1.1) | | | 0.18 |
| **PRO** | **n** | **Median** | **(IQR)** | **n** | **Median** | **(IQR)** | **p-value** |
| Pedi-IKDC | | | | | | | |
| Baseline | 33 | 60.9 | (45 – 73) | 30 | 53.8 | (43 – 67) | 0.29 |
| 6 Months | 23 | 87.0 | (81 – 94) | 28 | 80.4 | (74 – 87) | 0.02 |
| HSS Pedi-FABS | | | | | | | |
| Baseline | 33 | 11.0 | (5 – 27) | 28 | 6.5 | (5 – 27) | 0.98 |
| 6 Months | 22 | 14.5 | (9 – 18) | 25 | 12.0 | (8 – 19) | 0.59 |
| KOOS-Pain | | | | | | | |
| Baseline | 33 | 83.3 | (72 – 89) | 29 | 80.6 | (69 – 89) | 0.45 |
| 6 Months | 22 | 97.2 | (92 – 100) | 26 | 94.44 | (86 – 97) | 0.06 |
| KOOS-Symptoms | | | | | | | |
| Baseline | 33 | 75.0 | (61 – 82) | 30 | 70.7 | (54 - 82) | 0.53 |
| 6 Months | 22 | 92.9 | (87 – 93) | 25 | 85.7 | (79 – 95) | 0.09 |
| KOOS-Function, daily living | | | | | | | |
| Baseline | 33 | 92.7 | (82 – 99) | 29 | 86.8 | (81 – 96) | 0.50 |
| 6 Months | 22 | 100 | (99 – 100) | 27 | 100 | (98 – 100) | 0.39 |
| KOOS-Sport/Rec | | | | | | | |
| Baseline | 33 | 50.0 | (30 – 85) | 24 | 35.0 | (25 – 53) | 0.17 |
| 6 Months | 22 | 87.5 | (76 – 95) | 26 | 81.7 | (65 – 90) | 0.06 |
| KOOS-Quality of Life | | | | | | | |
| Baseline | 33 | 43.8 | (25 – 50) | 28 | 31.3 | (17 – 44) | 0.12 |
| 6 Months | 22 | 68.8 | (56 – 80) | 27 | 62.5 | (44 – 68) | 0.10 |
| EQ5D-5L | | | | | | | |
| Baseline | 30 | 0.86 | (0.75 – 0.94) | 25 | 0.72 | (0.62 – 0.94) | 0.20 |
| 6 Months | 21 | 0.94 | (0.94 – 1.00) | 24 | 1.00 | (0.88 – 1.00) | 0.91 |
| EQVAS | | | | | | | |
| Baseline | 30 | 90.0 | (76 – 95) | 24 | 85.0 | (70 – 91) | 0.33 |
| 6 Months | 21 | 92.0 | (85 – 95) | 24 | 85.0 | (80 – 90) | 0.39 |

**6 month PROs showed statistically significant superior Pedi-IKDC results in ITB group compared to BTB.**

**There were similar activity levels in both groups.**

**Not statistically significant superior KOOS Pain, Symptoms, and Sports scores in the ITB-ACLR group, although approached it.**

**All other baseline and 6 month scores were similar.**

# Conclusions

**Preliminary safety and early outcomes data suggests that a novel ACLR+ALLR technique may be:**

- **Safe, effective in restoring stability, allowing for return to sport**
- **Comparable, or possibly superior, to BTB-ACLR, in *early* PROs**
- **Comparable, in terms of overall complications**

**Given the potential advantages of the technique (preservation of flexor/extensor muscle groups, technically simple, small tunnels = revision-friendly), continued monitoring, comparative analysis is warranted**

- **ACL re-tear/graft ruptures – particular attention/monitoring**
  - **Early cases reported (between 9-15 months)**
  - **Monitoring over a longer post-operative period, in a larger cohort, performed by a larger number of surgeons.**

# References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