

Is it the ACL?

Diagnosing an ACL Injury

Individual Special tests

- + Lachman's (Sn 85, Sp 94)
- + Anterior Drawer (Sn 92, Sp 91)
- + Pivot Shift (Sn 24, Sp 98)

ACL Diagnostic Clusters

Clustering of special tests with subjective information can help to improve diagnostic accuracy

To rule IN

- (Sp 0.95, +LR 17.5)
- + Pivoting traumatic mechanism
 - + Effusion after trauma
 - + Lachman's

To rule OUT

- (Sn 0.93, -LR 0.08)
- No history of pivot mechanism
 - No popping sound
 - Lachman or Pivot shift negative MRI

Grade C evidence supports that diagnostic test, when conducted proficiently as a cluster, can be equal or more diagnostically accurate than MRI



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Surgical Management: The Approach Matters

In recent years, there has been renewed interest in preserving ACL tissue via a remnant-preserving and augmentation approach (rather than full tissue resection) when performing ACL-R to potentially improve proprioceptive function, vascular supply, and graft remodelling

International consensus that the preferred surgical technique for ACL reconstruction is a hamstring tendon autograft



Sport participation was found to influence graft choice at times preferring Bone-patellar tendon-bone (BPTB) graft technique over hamstring autograft.



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Different graft, different outcomes

**Bone-patellar tendon-bone
(BPTB) autograft**

vs

**Hamstring tendon
(HT) autograft**



~ Greater
loading
asymmetry?



**Injury to
contralateral
ACL**



**Met in ~7
months**

Early Phase Milestones

Full knee ROM, minimal or no knee effusion,
and quadriceps strength index of 80%

**Met in ~5.5
months**

**Met RTS criteria > 10
months after surgery
(up to 12 weeks longer)**

Return to Sport Testing

90% on: quadriceps strength
index, limb symmetry index for 4
hop tests, KOS-ADLS, and GRS

**Met RTS criteria
7.5 months post
surgery**

Goal for practitioners:

**Target graft-specific strength deficits while considering the
variability in timelines for recovery based on graft type**



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Surgery versus conservative management: Long-term outcomes

A systematic review and meta-analysis evaluating surgical vs non-surgical differences at a minimum of 10 years following injury suggested:

Following surgical ACL management:

- Risk of secondary meniscal injury ↓
- Risk of knee osteoarthritis ↑
- Degree of knee laxity ↓
- Patient reported outcome measures were similar to the non-surgical group



Optimizing mid-stage ACL rehabilitation

Inclusion of a high-quality early and mid-stage rehabilitation is paramount for recovery

Mid-stage rehabilitation ensures a solid foundation on which to build late-stage and RTS rehabilitation

Mid-stage is functionally significant as it transitions from walking through to normalized running mechanics.

Goals: Address deficits associated with neuromuscular function addressing strength imbalance and CKC strength, motor re-patterning, and fitness re-conditioning.



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Buckthorpe, M., & Della Villa, F.
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Optimizing mid-stage ACL rehabilitation

Unaddressed dysfunction during early and mid-stage rehabilitation will limit the ability to transition optimally through later stages.

Early-stage:
resolving pain
and swelling,
recovering range
of motion,
normalized gait



Mid-stage: begins
once goals of
early-stage are
met, focuses on
strength,
movement quality
and conditioning

Late-stage:
optimizing
performance,
sport-specific
training, return to
play



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3 Essential Pieces to Mid-Stage Rehabilitation

1

Muscle Strengthening (Closed kinetic chain strength, Knee extensor/flexor strength, Adjacent joint strength)

- Incorporating “isolated” open and closed chain strengthening (ex. knee extension/leg press) to develop capacity of muscle to produce force and create targeted muscle work

2

Movement Quality (Biomechanics, Motor control)

- Task progression (ie. bilateral squat -> goblet squat -> split squat -> lunge -> step down -> single leg squat)
- Muscle release techniques, flexibility training, and strengthening of weak muscles

3

Fitness Re-Conditioning (Cardiovascular fitness, Body composition)

- Non-load-bearing upper body strength exercises (shoulder press, bench press, pull ups, etc.) and low or no-load cardiovascular training (deep water running, stationary bike, cross-trainer, etc.)
- Goal to restore neuromuscular function and develop physical fitness



Return to Sport testing criteria: What does it tell us?

Specific RTS testing criteria = lacks consensus

<10% deficit in single leg plyometric activities is suggested
prior to return to sport

Typically includes a combination of:

Hop testing

(ie. single hop for
distance, triple
cross-over hop)

Jump/ landing tests

(ie. drop jump
test)

Strength testing

(quads, hamstrings) using
isokinetic or isometric
dynamometry and/or KT-
1000 ligament arthrometry



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Flagg KY, Karavatas SG, Thompson SJ, Bennett C. (2019). Ann
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Return to Sport testing criteria: What does it tell us?

Limb Symmetry Index (LSI) is often used as the main outcome measure however, there is evidence showing that **the contralateral leg may become weaker after ALC-R**, implying that the LSI **has questionable value**

Recent meta-analysis found that **a range of 23 to 73%** of athletes pass RTS criteria

Lacking evidence that these tests have the ability to **alter second ACL injury risk** or **predict** future knee injury

No association between **passing objective RTS criteria** and a **decreased risk** of second ACL injury

There is a **lack of evidence** regarding construct and predictive validity for specific 'Return to Sport' **testing sequences** and conventional assessment and rehabilitation protocols **lack sensitivity and specificity** and may give **false sense of readiness**



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Re-Injury: Influencing factors

Premature RTS without following and meeting specific criteria is suggested to increase risk of ACL graft rupture

70% of ACL ruptures occur during the first 6 months of RTS

Reported 50% reduction rate in risk of knee re-injuries for each month that RTS is delayed beyond 6 months

A risk factor for ACL rupture or re-rupture has been linked to impaired neuromuscular control and biomechanics (increased hip internal rotation, dynamic knee valgus or decreased knee flexion during landing)



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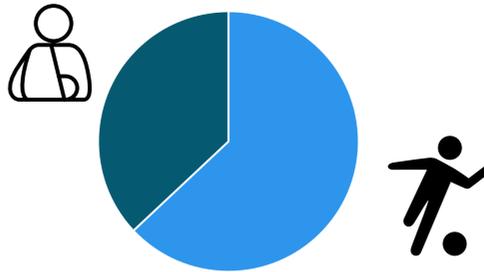
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Participation-based outcomes

One **systematic review** found that the return to preinjury sports participation rate was **63%**



ACLR has been advocated for patients intending to return to **physically demanding occupations** and where **recurrent episodes of instability** interfere with ADLs, regardless of intentions about returning to sport

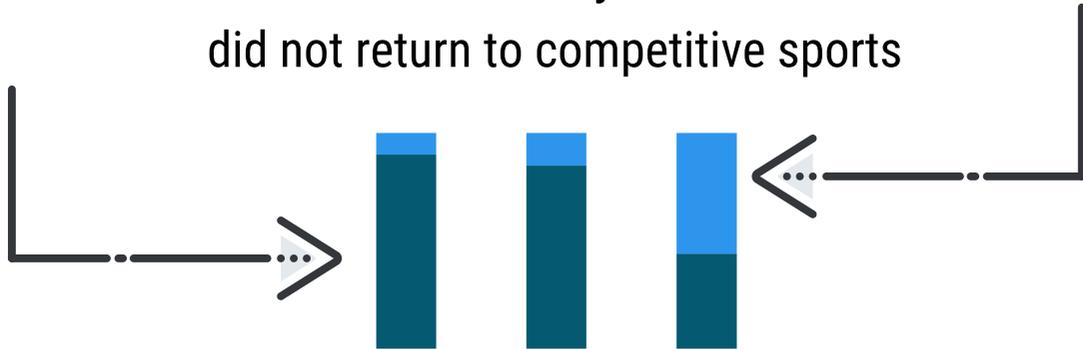


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Participation-based outcomes

90% of patients achieved **normal or near normal** knee function when assessed post-op using **impairment-based outcomes** and 85% when **activity-based outcomes**, but 56% did not return to competitive sports



Emphasis should be placed on use of participation-based outcomes to assess effectiveness of ACL reconstruction surgery rather than impairment-based outcomes



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Psychological Readiness

Fear and depression are seen after injury and varies depending on patient's level of competition, age, sex and athletic identity

ACL-RSI is a validated, 12-item questionnaire measuring athlete's emotion, confidence in performance and knee function, and risk appraisal for future injury

Pre- and post-operative ACL-RSI scores play an important role in RTS in post-ACLR patients



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Psychological Readiness



Pre-operative and early detection of problems may predict poor post-operative outcomes

Psychological interventions such as guided imagery and relaxation have been shown to improve post ACL-R fear and anxiety

It may be important to collaborate with psychological experts to support patients with low pre-operative ACL-RSI score to improve their psychological readiness to RTS



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Fear following ACLR: Factors that Influence Return to Sport

Undergoing surgery/ recovery again

- **Pain during surgery**
- **Lengthy rehabilitation process**
- **Inconvenience of restricted functional ability**
- **Inconvenience of time away from work**

Nature of specific sport individual returns to

- **Sports that involve pivoting or sidestepping**
- **Sports that could cause impact on area (ie. kickboxing: receiving strike to the knee)**
- **Belief that elite sports are accompanied by injury**



Fear following ACLR: Factors that Influence Return to Sport

Social Priorities

- **Fear that injury would cause individual to miss out on family commitments**
- **Advancing age as cause of reinjury**

Psychological/ Personality Traits

- **Worry of knee over-extension**
- **Small amounts of pain led to fear**

**Clinician Relevance:
Including EDUCATION and EMPATHY in the
management plan can improve the likelihood of
patients' returning to sport.**

