

# ACL Injury Management: Update in the competitive athlete



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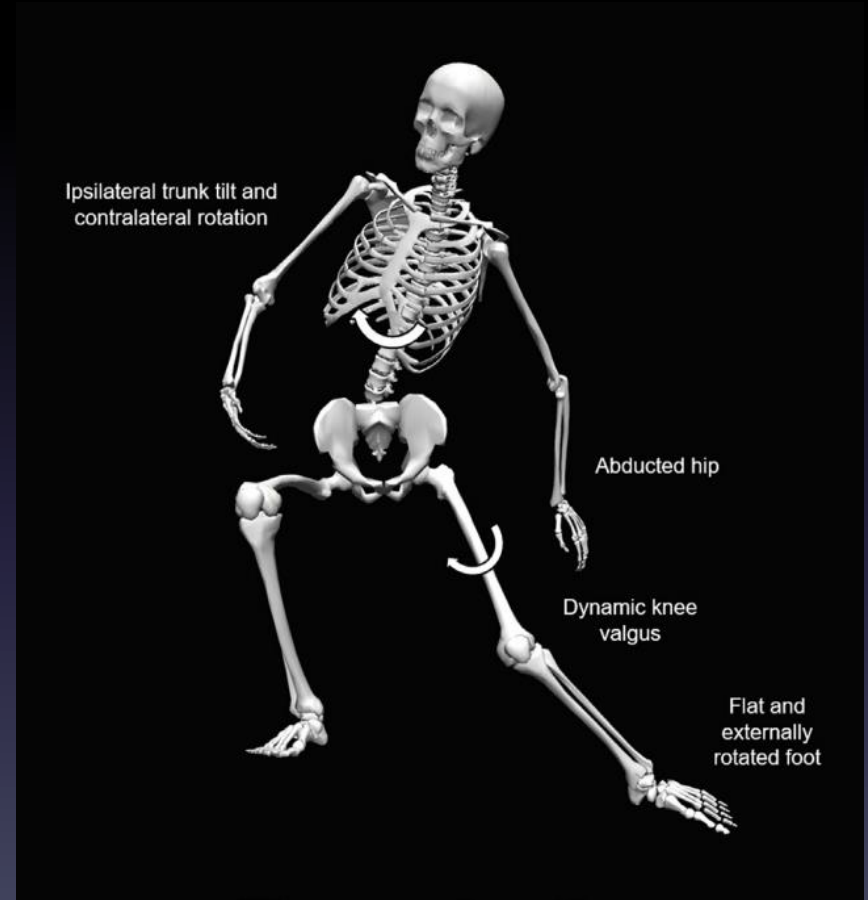


# ACL Injury Update

- Mechanism
- Management
  - Repair
  - Graft choice
  - Revision surgery
- Return to play

# Mechanism

- early-mid knee flexion  
(0-45 deg) with knee valgus
- hip flexion/abduction
- foot external rotation



From Della Villa, BJSM 2019



Right knee non-contact

# Mechanism

- How to categorize?
  - Contact
  - Non-Contact
  - Limited contact
    - “perturbation”





# Football

- 72.5% non or limited contact
  - Role for ACL prevention programs
- Increased incidence
  - on punt plays
    - 30 yd sprint then change of direction
  - 1st 3 years of career

**Video Analysis of Anterior Cruciate Ligament Tears in Professional American Football Athletes (AJSM 2018)**

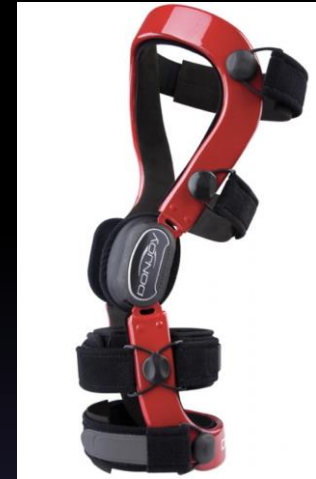
[Jeffrey T Johnston<sup>1</sup>](#), [Bert R Mandelbaum<sup>2</sup>](#), [David Schub<sup>3</sup>](#), [Scott A Rodeo<sup>4</sup>](#), [Matthew J Matava<sup>5</sup>](#), [Holly J Silvers-Granelli<sup>6</sup>](#), [Brian J Cole<sup>7</sup>](#), [Neil S ElAttrache<sup>2</sup>](#), [Tim R McAdams<sup>8</sup>](#), [Robert H Brophy<sup>5</sup>](#)

# Football

- 20% in offensive linemen
  - Bracing?



Titanium



Carbon fiber

From [www.djglobal.com](http://www.djglobal.com)

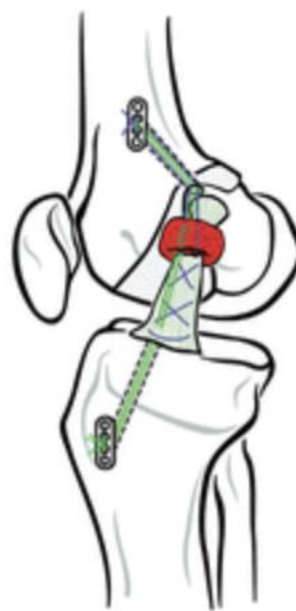
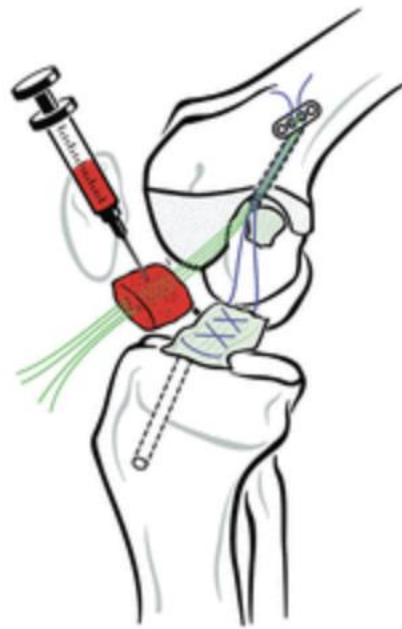
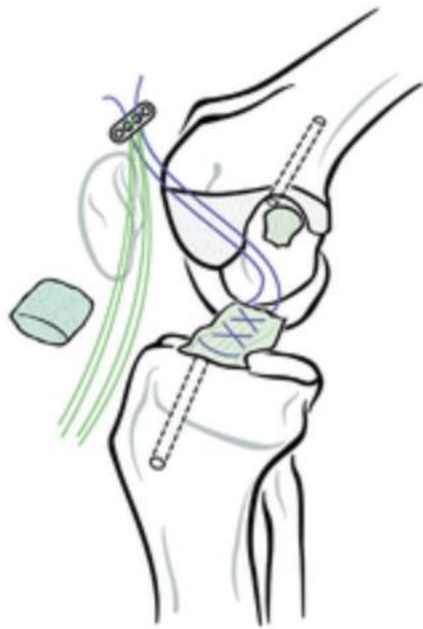
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# Management

- ACL “REPAIR”
  - Bridge-enhanced ACL repair (“BEAR”)
    - Murray M et al, AJSM 2020



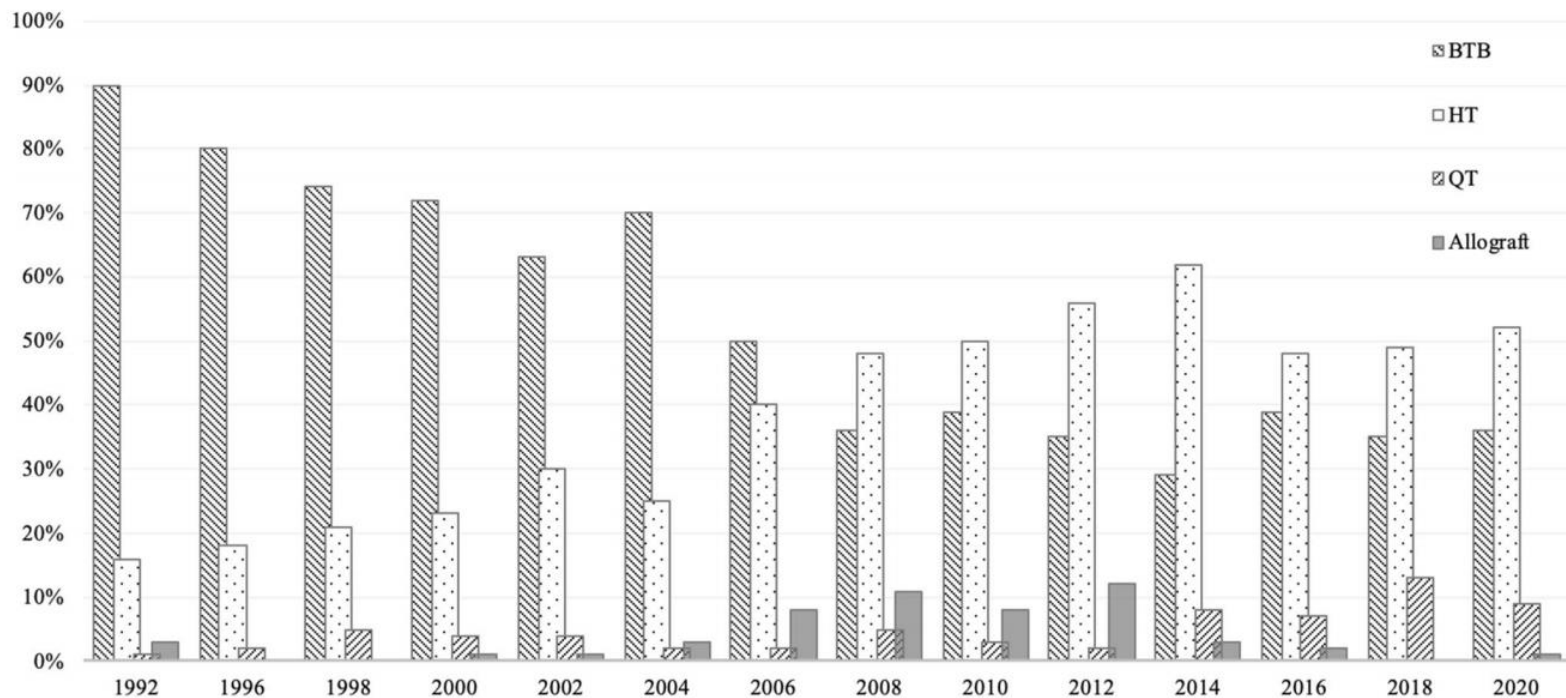
# ACL reconstruction

- Graft choice:
  - Autograft BTB higher RTS rates compared with autograft HT
    - DeFazio et al, OJSM 2020

# Arnold, Sherman et al, KSSTA

## 2021

Survey of about 150 members of ACL Study Group (Feagin)



# Graft Choice

- Quadriceps tendon
  - 20% more collagen fibrils per cross-sectional area than BTB
  - Thicker than BTB
  - No graft-tunnel mismatch
  - Decreased harvest pain, smaller incision than BTB
  - 4.2% failure rate (Xerogeanes, Arthroscopy 2019)

# Revision ACL

- Athlete: Autograft: Hamstring/BTB/Quad
  - NFL: contralateral BTB



# Revision ACL

- Single-stage

- >14mm?, 16mm?

- Diverge
    - Stacked screws
    - Single stage graft/dowel
    - Outside-in

- Outcome same with with tunnel widening < or >12 mm

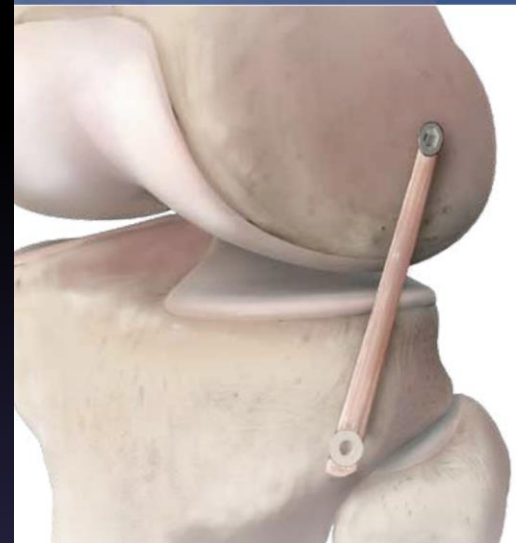
- » Pioger et al, AJSM 2021



From Bach B, Arthroscopy 2003

# Revision ACL

- Extra-articular Augmentation
  - Anterolateral ligament recon (ALL)
  - Lateral extra-articular tenodesis (LET)
    - Lemaire, Losee, MacIntosh



# Lateral extra-articular tenodesis (LET)

– Reduces failure of hamstring  
tendon autograft ACLR at 2 yrs

(“STABILITY Study”)

- Getgood et al, AJSM 2020

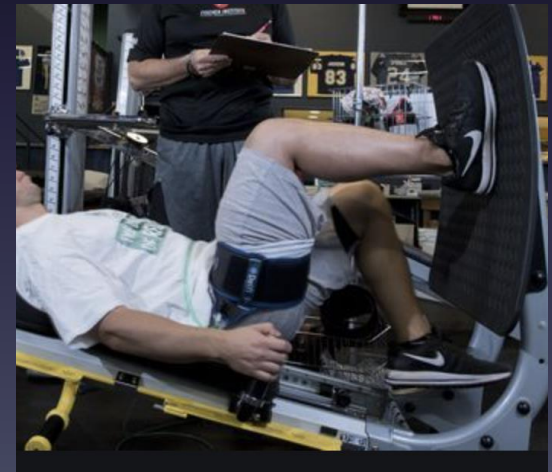


# Transexamic Acid (TXA)

- Often used in arthroplasty procedures
- Reduced drain output and hemarthrosis, improved pain scores
  - Johns et al, AJSM 2021
- Effect of TXA on joint inflammation and post-traumatic OA?
  - Chu C, et al, Stanford University, ongoing

# Post op protocol

- Criteria based rather than time based
- Blood-flow restriction training (BFRT)
  - Studies mixed for early low intensity quad strengthening after ACLR
- Helps:
  - Ohta et al, Acta Ortho Scand 2003
  - Roig M et al, BJSM 2009
- No help:
  - Iverson E et al, J Sports Health Sci 2016



From Fischer Institute,  
Phoenix, AZ

# Post op protocol

- BFRT
  - Not helpful for high intensity phase
    - 2x week for 8 weeks
      - Curren M et al, AJSM 2020
  - Elite athletic training rooms
    - 16 visits per week



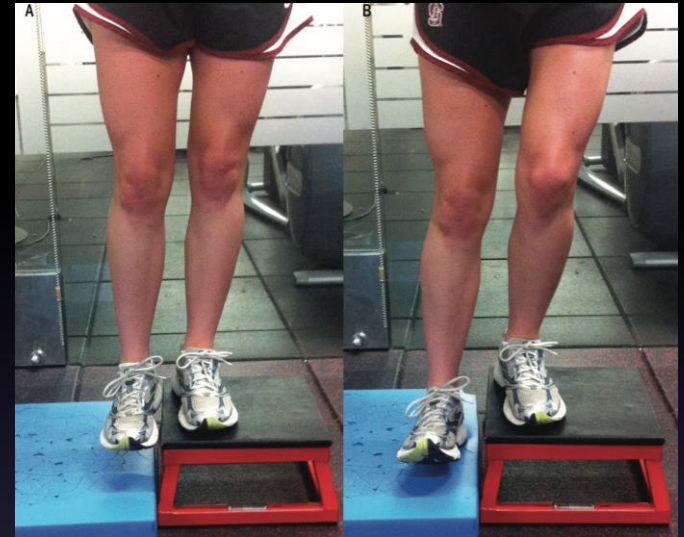
# Return to sport (RTS)

## Factors to consider:

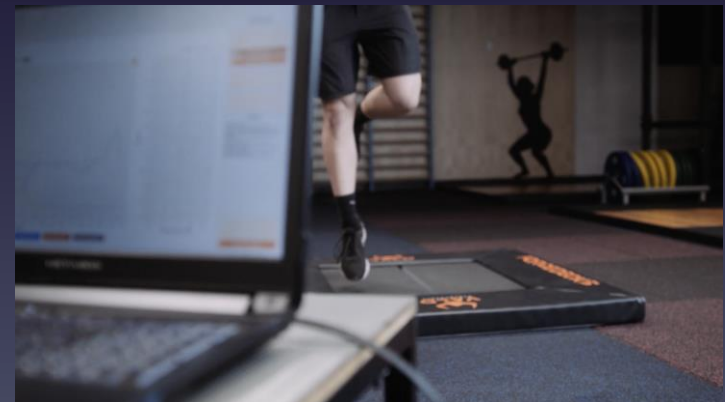
- Technical
- Biological
  - Bone bruises
  - Graft Maturation
    - “organized scar”
- Neuromuscular control
- Strength
- Psychological
  - Direct correlation to character of individual and stress influence

# RTS

- Isokinetic testing
- Thigh circumference
- Lateral step down
- Hop tests, Y-balance, FMS
- Force-plate
- Markerless video analysis



From valdperformance.com



# ACL Checklist



Player Name:

Phase 1 (Inflammation/Pain)	Phase 2 (ATR)	Phase 3 (Field-Build Intensity)
<ul style="list-style-type: none"> <li><input type="checkbox"/> 24-hours of rest post-surgery</li> <li><input type="checkbox"/> Previous Injury History Review</li> </ul> <p><b>Make Shapes/Change Shapes</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Pain score &lt; 3 w/ walking w/ crutches</li> <li><input type="checkbox"/> 0* Knee Extension</li> <li><input type="checkbox"/> 90* Knee Flexion</li> </ul>	<p><b>Make Shapes/Change Shapes</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> &lt; 5% Asymmetry Knee Flexion</li> <li><input type="checkbox"/> LT OH Stick March x 10yd</li> <li><input type="checkbox"/> RnR Get up to SL A-Stance</li> <li><input type="checkbox"/> LT Miniband Circuit x6</li> <li><input type="checkbox"/> Power/Speed w/ pain &lt; 3</li> </ul> <p><b>ISO Strength</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> SGL Knee Extension Iso @ 90*, 45*, and 20* x20sec/each @ 40% BW</li> </ul> <p><b>Dynamic Strength</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> &lt; 10% asymmetry w/ Timed Lateral Step Down Test</li> <li><input type="checkbox"/> 1 x 10 on primary squat exercise @ 1xBW w/ 3:3:3 Tempo</li> </ul>	<p><b>Field Work</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Archetype Screen</li> <li><input type="checkbox"/> 80% Top Speed</li> <li><input type="checkbox"/> 24 reps @80%; Pre-Planned</li> </ul> <p><b>ISO Strength</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> &lt; 15% asymmetry w/ Depth Drop off 24" Box</li> </ul> <p><b>Dynamic Strength</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> &lt; 10% asymmetry w/ hop testing (Single, Triple, Crossover)</li> </ul> <p><b>Ecc Strength</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> &gt;70% of PB on Front Squat</li> <li><input type="checkbox"/> &lt; 15% PB Nordbord x3 w/ 6:0:0 Tempo</li> </ul>
Phase 4 (Field-Sprint)	Phase 5 (Practice)	Phase 6 (Maintenance)
<p><b>Field Work</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Achieve &gt;90% of top speed</li> <li><input type="checkbox"/> 80% Practice Volume @ 90-100% Intensity</li> <li><input type="checkbox"/> Mock Indy w/ Position Coach</li> </ul> <p><b>Dynamic Strength</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> &gt;90% PB RSI (Skill/Combo) or CMJ (Bigs)</li> </ul> <p><b>Ecc Strength</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> &gt;90% of PB on Athletes primary eccentric exercise</li> </ul>	<p><b>First Practice Block</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Assign Individual to Watch Warm-up</li> <li><input type="checkbox"/> 60% Game Volume</li> </ul> <p><b>Second Practice Block</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Assign Individual to Watch Warm-Up</li> <li><input type="checkbox"/> 80% Game Volume</li> </ul>	<p><b>Monday</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Eccentric Training in WR</li> </ul> <p><b>Wednesday</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Field Prep in ATR; Pre-Practice</li> </ul> <p><b>Thursday</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Field Prep in ATR</li> <li><input type="checkbox"/> Iso Training in WR Post-practice</li> <li><input type="checkbox"/> Total Body Menu in RG; Post-practice</li> </ul>

# RTS testing

- Functional tests poor predictor of new knee injury
  - Faltstrom et al, AJSM 2021
- ACL-RSI index best predictor for RTS
  - 12 questions: emotions related to returning, confidence in sports performance, and appraisal of reinjury risk
    - Faleide et al, AJSM 2021

# What does RTS mean?

- Graft failure: 5%... Therefore 95% success!
- Return to college/high school football at same level: 43%
  - Spindler et al, AJSM 2012
- NFL: 63%
  - Andrews et al, AJSM 2010
- NFL: 61.8% in RB's and WR's
  - Manoharan et al, OJSM 2020

# Why not RTS if graft OK?

- Functional impairment/Pain
- \*\*Fear of reinjury: most common reason
  - Lentz et al, AJSM 2014
- Need time and reps, but how long?



# Timing for RTP

- 50% retears occur in first year
  - Webster et al, AJSM 2016
- Not any better if wait 1 year vs 6-9 months
  - Webster et al, AJSM 2021
- Wait 2 years (Hewitt, Sports Med 2016)
  - Significantly greater reinjury rate between year 1-2 compared to after year 2

# Thank You

