PEARLS AND TOOLS FOR EXPEDITED RETURN TO PLAY

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DISCLOSURE

I have no relevant financial or nonfinancial relationships to disclose.

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OBJECTIVES

- Inform on the general principles of return to play and the injury rehabilitation process for elite athletes
- Discuss rehabilitation techniques and tools for the most common injuries to elite soccer players
- Discuss emerging technology to manage risk in making return to play decisions

Sandy Gress, PT, DPT, OCS

- Worked in private practice in the east metro before coming to Allina in 2016
- Experienced with treatment of high level athletes including elite soccer players, state champion wrestlers, college track and field athletes, and innumerable recreational athletes
- Recognized as an Orthopedic Clinical Specialist in 2016
- Provides rehabilitation services for MNUFC players

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Robby Bershow, MD
Aimee Klapach, MD
Joseph Bellamy, MD

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Stacey Hardin, PT, DPT, ATC

Injury Incidence in Professional Soccer Players

- Muscle injury
  - Strains and contusions
  - Hamstring, quadriceps, adductors, gastroc complex
- Sprains, tendon, and joint Injury
  - Ankle, knee
- Fractures

Photo credit: mnufc.com

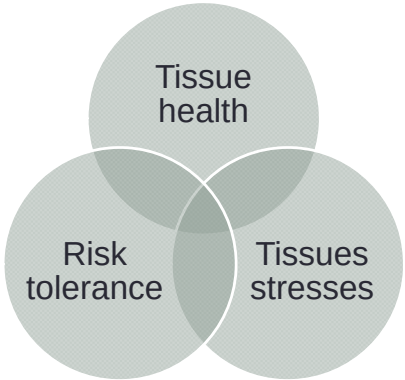
Pfirrman et al. 2016

Return to Sport Continuum

Ardern et al. 2016

StARRT Framework

- **St**rategic **A**ssessment of **R**isk and **R**isk **T**olerance framework
- Tissue health: the load that tissue can absorb before injury
- Tissue Stresses: expected cumulative load on tissue
- Risk tolerance: contextual factors that influence RTS decision-maker's tolerance for risk



Ardern et al. 2016

HAMSTRING STRAIN

Balancing tissue healing with optimal tissue loading

Hamstring muscle strain

- Large and powerful two-joint muscle controlling knee flexion and hip extension
- Strains to hamstring are the most prevalent injury in team sports accounting for 12-16% of all injuries
- Eccentrically contraction to deceleration the lower limb during terminal swing phase or kicking
- Concentric activation during stance phase to push the body forward in horizontal direction

Photo credit: NIH health research images

Orchard et al. 2002, Ramos et al. 2017

Local Tissue Response

- Functional deficits due to chemical and physical changes in muscle tissue
  - Destruction: 3-7 days
  - Repair: 4-21 days
  - Remodeling: 14 days to 14 weeks
- Tissue loading as collagen formation takes place is vital to avoid build-up of scar tissue and to minimize stiffness

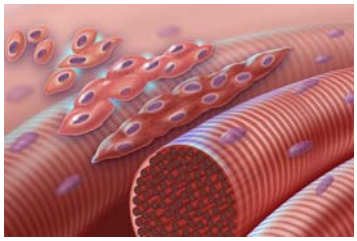
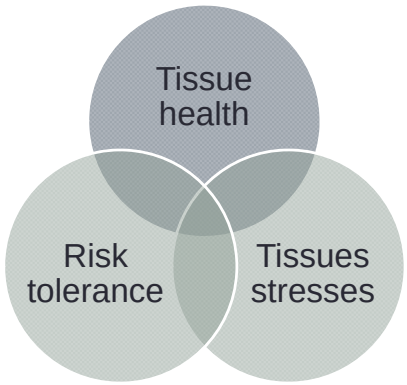


Photo credit: NIH health research images

Orchard et al. 2002, Ramos et al. 2017

Interventions for tissue health

- Local tissue health determines the amount of load that tissue can accept without injury or re-injury
- Physical therapy should be modalities are based on the stage of tissue recovery



TASTM

- Soft tissue mobilization through the use of instruments to provide mechanical advantage to therapist and more specific treatment over massage
- Thought to stimulate remodeling of connective tissue through resorption and chemical processes at a tissue level
- Generally well tolerated even in acute injury

Baker et al. 2016

Dry Needling

- Stimulation of myofascial trigger points using thin filiform needle to treat dysfunction in muscle, fascia, and connective tissue
- Decreases hypertonicity and metabolic byproducts in tissues, leading to reduction in pain
- The area of injury is not directly targeted with treatment, instead neighboring muscle groups may be addressed

APTA 2013

Manual Therapy

- Pelvic hypomobility is often present with the injured hamstring
- Addressing altered mechanics in adjacent joints can improve function of affected tissue
- Hip mobilization to improve hip extension and internal rotation
- Lumbar spine mobilizations to improve ROM and muscle activation
- Ankle dorsiflexion mobilizations for lower extremity alignment

Ramos et al. 2017

Hamstring Strain – Interventions for Tissue Health

Destruction
- Necrosis of myofibrils and hematoma formation, inflammatory response for 3-7 days
- Goal: minimize damage and promote good physiological healing
- Gentle TASTM to affected tissue, dry needling to adjacent and opposing muscle groups, joint mobilization as needed, cryotherapy vs heat, consider e-stim for pain modulation

Repair
- Regeneration of muscle fibers, nerve growth, vascular repair during the following 4-21 days
- Goal: load tissue optimally to avoid rigid scar formation but avoid excessive break-down of new tissue
- Continue TASTM to affected tissue, dry needling in adjacent muscle groups, address neural mobility in the case of positive slump test, consider low level laser

Remodeling
- Final phase of maturation as tissue reorganizes and begins to show improved functional capacity over 14 days to 14 weeks
- Goal: increase strength, flexibility, and function
- Continue interventions as needed to address soft tissue and joint impairments during loading process

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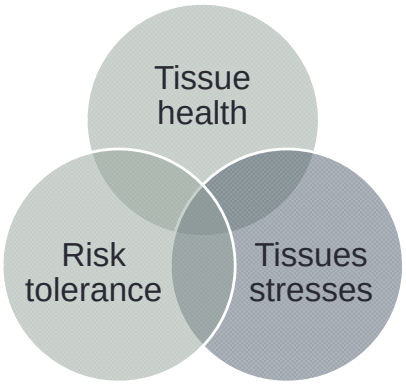
Tissue Stresses

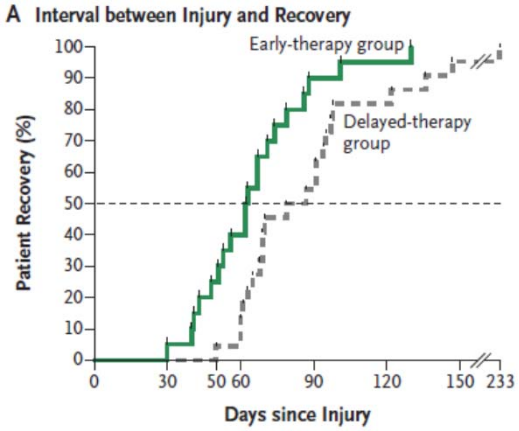
- Accelerated loading of healing tissues to avoid excessive scar formation
- Appropriate loading promotes improved collagen alignment and improved function in muscle tissue
- Return to play does not coincide with tissue healing

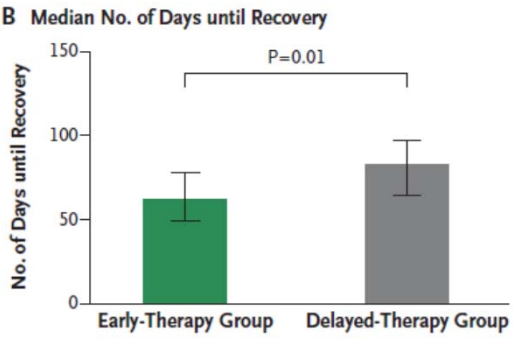


Orchard et al. 2002

Early Loading of Muscle Injury

- Decreased interval for return to sport without a significant increase in the risk of re-injury for amateur athletes

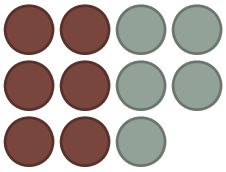




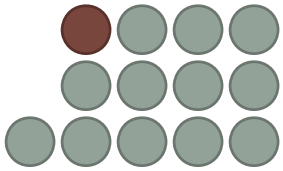
Baker. 2017

Functional Training for Hamstring Strain

- Acute hamstring strain (grade 1-2) treated with traditional vs functional rehab program
- Functional training (agility, lumbopelvic stabilization, plyometric) shows faster return to sport and fewer re-injuries as compared to traditional stretch and PRE exercise

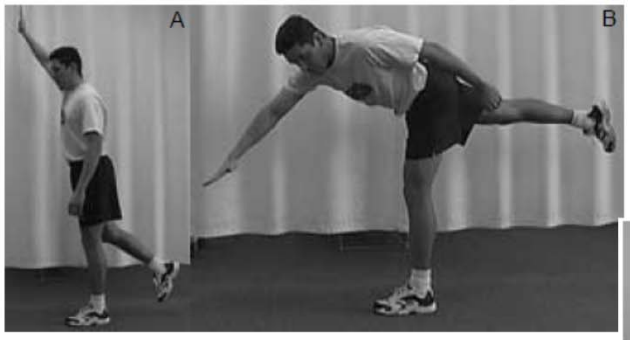


6 of 11 re-injury within one year
37.4 days +- 27.6 days return to sport



1 of 13 re-injury within one year
22.2 +- 8.3 days return to sport

Sherry et al. 2004



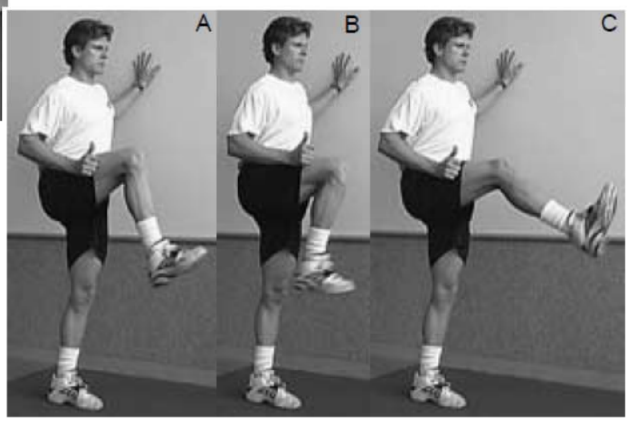


Photo credit: Sherry et al. 2004

Hamstring Strain – Interventions for Tissue Stress

Destruction
- Acute period of decreased ROM, painful resisted contraction 3-7 days
- Goal: restore neuromuscular control and prevent excessive fibrosis
- TE: isometric strengthening, pain-free low intensity movements

Repair
- Intermediate phase characterized by muscle regeneration, 4-21 days
- Goal: restore flexibility to promote better orientation of healing tissues, improve function of muscle
- TE: eccentric strengthening of the hamstrings, flexibility within tolerance, and increasing amplitude of neuromuscular re-education

Remodeling
- Final phase of maturation as tissue reorganizes and begins to show improved functional capacity over 14 days to 14 weeks
- Goal: increase strength, flexibility, and function
- Increase speed and intensity of eccentric loading, sport specific, and plyometric training

POST-OP ACLR

Avoiding deconditioning while protecting healing graft

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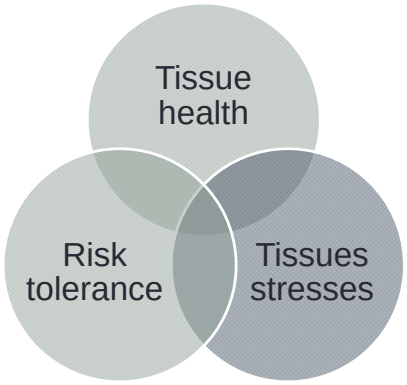
Limiting Functional Losses

- Rapid atrophy of quadriceps following ACL reconstruction is expected
- Athletes will also quickly lose cardiovascular and general fitness during early rehabilitation period
- Care must be taken to avoid injury to healing graft while avoiding excessive secondary loss in fitness
- Elite athletes progress more quickly through post-op protocols with careful monitoring

ACLR

- Specific training protocols might accelerate post-operative rehabilitation following surgical interventions
  - Blood flow restriction training
  - Sport specific protocols



Blood Flow Restriction or Occlusion Training

- Mechanical compression of affected limb to cause partial vascular occlusion
- Performance of low load exercise with occlusion shown to have similar muscular hypertrophy effects as high load exercise without occlusion
- Physiological cascade leading to muscle hypertrophy in affected limb
- Growing research in athletics as well as in general population

Schifers et al. 2016

BFR in Practice

- MNUFC players with limited weightbearing status or compromised joint integrity may use in-house BFR for strength training
- Owens Recovery Systems recommends 30/15/15/15 for reps and sets (30 second recovery)

Photo credit: Stacey Hardin, PT, DPT, ATC

Accelerating Post-op Protocols

- Therapy begins immediately post-operatively
- Sessions with PT or team PT/trainer generally last 60+ minutes
- Target weight bearing and ROM limits based on surgeon's report
- Manage edema with vasopneumatic compression every 2 hours
- Address general fitness and strength while maintaining post-op restrictions
  - Core training using BOSU/medicine ball
  - Maintain upper body strength with weight training
  - Higher reps and resistance than typical post-op protocols (i.e. 5 minutes of quad sets 5" on/10" off)

DETERMINING READINESS

Balancing risk and readiness

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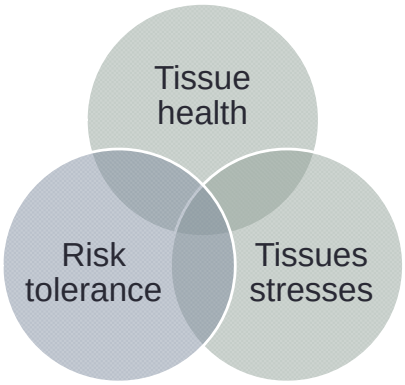
Quantifying Return to Sport

- Metrics to qualify performance (time, distance, velocity, points scored)
- Aspects of loading can be quantified using GPS, gyroscopes, and accelerometers
- Challenge is in relevance of measures and determining appropriate benchmarks
- Need to align objective measures with subjective reports related to acute and chronic training load



Ardern et al. 2016

GPS and Accelerometer Data

- Integrated hardware and software to quantify athletic performance during practice and games
- Utilizes positional tracking and inertial sensors to compile data
- Data collected:
  - Volume: total amount of movement
  - Intensity: work-rate of movement
  - Explosiveness: accelerations, decelerations, changes of directions, and jumps
  - Sport specific measures
- Catapult, STATsport and polar

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Practical Applications

- Use of Catapult with MNUFC players to measure speed, direction changes, and workload during rehab drills
- Able to quantify sport specific movements to determine readiness to return to practice
- Provides players objective feedback towards their progress in rehabilitation

Photo credit: catapultsports.com

Injury Specific Functional Testing

- Specific tools are being developed to measure performance outside of a laboratory setting
- Able to track data on individual athletes during the rehab process and identify areas of continued impairment
- NordBoard, KT1000/KT2000, GroinBar, handheld force dynamometers


Photo credit: valdperformance.com

The Human Component

- Objective measures, GPS data, functional testing, and protocols help to identify impairments during rehabilitation from injury
- No technology has yet been able to replace the art of adapting rehabilitation protocols for the individual athlete

Summary

- Return to sport requires adequate tissue health, tissue stresses, and awareness of risk tolerance
- Early mobilization and functional training lead to improved outcomes in muscle injury
- Post-op protocols can be adapted for the elite athlete to avoid deconditioning and accelerate return to sport
- Technology is becoming an important component in return to play decision making

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  - Tanya Snyder, PT, OCS, CKSPT

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