Exercise Modification Following Injury Human Performance and Optimization

Dr. Kaleb Redden DO ABFM CAQSM CRP
St. Lukes Sports Medicine & Orthopedics
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Learning Objectives

Following this presentation participants will be able to

- Identify patients at the highest risk for functional decline following injury
- Recognize the physiological & metabolic consequences of post injury inactivity
- Discuss the clinical significance of early deconditioning
- Implement evidence-based strategies to mitigate risk
- Apply clinical reasoning to prescribe safe and effective exercise modifications

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The problem with patients – aversion to seeking care

I don't want to talk to the doctors they'll just tell me to stop.
(patient with chronic tendonitis)

I don't want to have surgery; I'm not worried about the pain I don't think I can tolerate the down time.
(Rotator Cuff Tear that's now inoperable)

I kept going because I knew if I got it checked I'd be told to rest, my mental health can't handle that.
(metatarsal stress fracture)

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The problem with doctors-providing adaptive modification

- Excellent at diagnosis
- Excellent at providing treatment options to repair structures
  - Physical therapy is sufficient for rehabilitation of the injury but often neglects overall fitness
- Excellent at determining surgical vs nonsurgical
- Excellent at discussing timeline after injury to return to play for the specific injured structure
- Excellent at telling patients what they can't do
- **We need to improve at telling patients what they can do!**

- **We need to improve in our ability to prescribe exercise substitution following injury and surgery**

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Injury is detrimental to human performance

Impact of injury

- Physical impact leading to reduced strength and mobility
- Phycological effect – resulting in anxiety, stress, depression, loss of identity & hinders mental resilience
- Career consequence – threaten athletic career leading to missed competitions
- Long term effects – leading to pain and instability impacting health and performance

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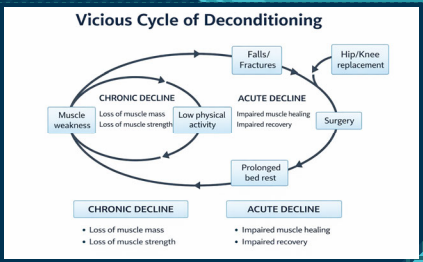
Deconditioning

- Cardiovascular decline
- Metabolic
- decline
- Musculoskeletal decline
- Mental health decline



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Muscle atrophy occurs rapidly following injury and is worsened with forced rest.

- Healing phase
- Rehabilitation phase
- Return to full function

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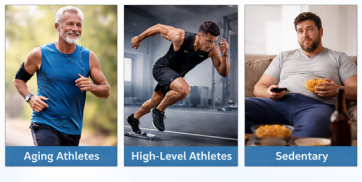
High risk patient profiles

Senior athletes
- Longer recovery times
- Reduced capacity for full restoration

High level athletes
- Significant performance drop carries consequences

Sedentary at baseline and chronic pain history
- Higher risk of rapid decline



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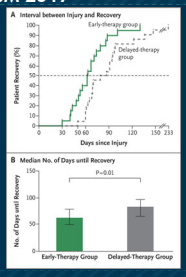
Clinical evidence for early mobilization NEJM 2017



The Time Course of Disuse Muscle Atrophy of the Lower Limb in Health and Disease. Hardy EJO, Inns TB, Hatt J, et al. Journal of Cachexia, Sarcopenia and Muscle. 2022;13(6):2616-2629. doi:10.1002/jcsm.13067.

Low-Volume Resistance Exercise Attenuates the Decline in Strength and Muscle Mass Associated With Immobilization. Oates BR, Glover EI, West DW, et al. Muscle & Nerve. 2010;42(4):539-46. doi:10.1002/mus.21721.

The Muscle Proteome Reflects Changes in Mitochondrial Function, Cellular Stress and Proteolysis After 14 Days of Unilateral Lower Limb Immobilization in Active Young Men. Doering TM, Thompson JM, Budiono BP, et al. PloS One. 2022;17(9):e0273925. doi:10.1371/journal.pone.0273925.

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Strategies to mitigate deconditioning exercise adaptation following injury

Visualization	Early movement	Isometric	Load management	Unique adaptions
Mental reps	Above and below the injury	concentric	Blood flow restriction	Cardiovascular training
	Contralateral training	eccentric	Tempo	Resistance training
			Time under tension	

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Prescribe safe and effective exercise modifications

- Tailored to specific injuries, incorporating biomechanical adjustments and kinetic chain consideration
- Consider the athletic goal, sport or activity they engage in
- Reiterate that appropriate modification is safe, effective, and essential for optimal recovery

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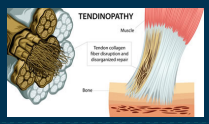
Adaptation and modification is injury specific

Tendonitis	Joint Damage & Fracture	Surgery	Sprain/strain
Eccentric activation	Decreased load, increased TUT	Contralateral training	Modified ROM and load
Progressive load	Blood flow restriction	Isometric activation	Dynamic vs Static
Exercise selection	Low impact	Low intensity	Bracing & assistive devises
Assistive devices			

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Clinical discussion for patient expectations

- Determine diagnosis and assess safety for activity
- Discuss goals about physical activity or sport
- Consider aerobic vs anaerobic exercise selection
- Create a simple modified program based on goal

- 3-5 day program
- Resistance training
  - 6 exercises, 3-5 sets, variable rep range
- Aerobic training
  - Time, intensity, upper vs lower body injury
    - Bike, rower, ski ergo, echo bike, kettle bells, battle ropes, plyometrics
- Balance training
  - Reduce risk of injury, engage CNS in an adaptive manor

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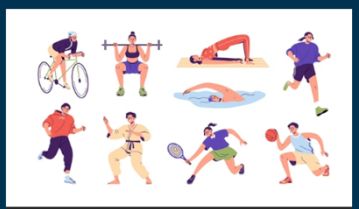
Exercise prescription essentials

Affordable
Enjoyable
Sustainable



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Resources

Utilize AI
UpToDate
Dot phrases
Clinical extenders
Athletic trainers
Build relationships with personal trainers

MCL Injury
Day 1 – Upper Body + Cardio
- Shoulder press 3×10
- Chest press 3×10
- Seated row 3×12
- Biceps curl 3×12
- Triceps pushdown 3×12
- Bike/Swim 15–20 min

Day 2 – Core + Rehab
- Quad sets 3×15
- Straight leg raises 3×12
- Heel slides 3×12
- Glute bridges 3×12
- Side leg lifts 3×12
- Plank 3×203×10/side
- Elliptical 15 min

Day 3 – Circuit + Cardio
- Battle ropes 20 sec
- Med ball slams –30 sec
- Dead bug 10
- Seated row 12
- Incline push-ups 10–12 (3–4 rounds)
- Arm bike 10–15 min

Day 4 – Active Recovery
- Walk 15–25 min
- Light stretching
- Foam roll (avoid knee)

Day 5 – Full Body
- Romanian deadlift 3×10
- Glute bridge 3×12
- Low step-ups 2–3×8
- Lat pulldown 3×10
- DB chest press 3×10
- Bike/Swim 15–20 min

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Exercise pre and post surgery improves outcomes

- Prehab programs for ACLR
  - 6-8 weeks including progressive strengthening, neuromuscular training, balance exercises reduces recovery time following surgery and better structural healing with MRI findings.
- Rehab programs that include full body training
  - Early phase – rehab, reduce swelling, restore ROM, improve neurologic function
  - Intermediate phase – cardiovascular, strengthening and restoring function
  - Late phase – ballistic movement, landing mechanics, progressive strengthening

If you are the first point of contact on the field or in the clinic presenting the diagnosis – start the conversation about maintaining exercise and physical fitness!

Fu Y, Tian Y, Zhao Z, Li Z. Prehabilitation enhances functional and structural recovery following anterior cruciate ligament reconstruction: A randomized controlled trial. Knee Surg Sports Traumatol Arthrosc. 2025 Nov 4. doi: 10.1002/ksa.70170. Epub ahead of print. PMID: 41188016.

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Summary

- Any patient who has sustained an injury is at risk of functional decline, but high-level athletes, elderly athletes and sedentary patients are at the highest risk.
- There are significant physiological & metabolic consequences of deconditioning that can be avoided with early activity modification and can be implemented in the clinical setting to improve outcomes
- Sports medicine physicians should prescribe safe and effective exercise modifications to limit deleterious effects of deconditioning

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Case report

41 yr old male
Status post L knee hemiarthroplasty
Post Op Day 1

Bicep curls 4x12
Triceps extension 4x12
Single leg sit to stand 3x5
Lateral deltoid raises 4x12
Front deltoid raises 4x12
Single leg hip flexion 3x5
Battle ropes 3x20 seconds

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Thank You

Dr. Kaleb Redden DO
redden@slhs.org
www.drkalebredden.com
Social media @dr.kalebredden

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References

Clinical Practice Guidelines for Enhanced Recovery After Colon and Rectal Surgery From the American Society of Colon and Rectal Surgeons and the Society of American Gastrointestinal and Endoscopic Surgeons. Irani JL, Hedrick TL, Miller TE, et al. Surgical Endoscopy. 2023;37(1):5-30. doi:10.1007/s00464-022-09758-x.

Clinical Practice Guidelines for Enhanced Recovery After Colon and Rectal Surgery From the American Society of Colon and Rectal Surgeons and the Society of American Gastrointestinal and Endoscopic Surgeons. Irani JL, Hedrick TL, Miller TE, et al. Diseases of the Colon and Rectum. 2023;66(1):15-40. doi:10.1097/DCR.0000000000002650.

Mitigating Disuse-Induced Skeletal Muscle Atrophy in Ageing: Resistance Exercise as a Critical Countermeasure. McKendry J, Coletta G, Nunes EA, Lim C, Phillips SM. Experimental Physiology. 2024;109(10):1650-1662. doi:10.1113/EP091937.

How Acute and Chronic Exercise Regulate Muscle Atrophic Genes to Mitigate Sarcopenia: A Narrative Review. de Sousa MV, da Silva Soares DB, Zouhal H, et al. Sports Medicine (Auckland, N.Z.). 2026;:10.1007/s40279-025-02383-3. doi:10.1007/s40279-025-02383-3.

The Effect of Early Mobilization as Part of Enhanced Recovery After Surgery on Postoperative Outcomes After Emergency Abdominal Surgery: A Systematic Review and Meta-Analysis. Torfadóttir MS, Degett TH, Olsen IH, et al. World Journal of Surgery. 2026;. doi:10.1002/wjs.70334.

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