Rehabilitation of Hamstring Strain Injuries: An Evidence-Based Approach

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Disclosures

- I have no financial disclosure or conflicts of interest

Rehabilitation Roadmap

- Evidence-Based Exercise Recommendations
- Running and Sport-Specific Progressions

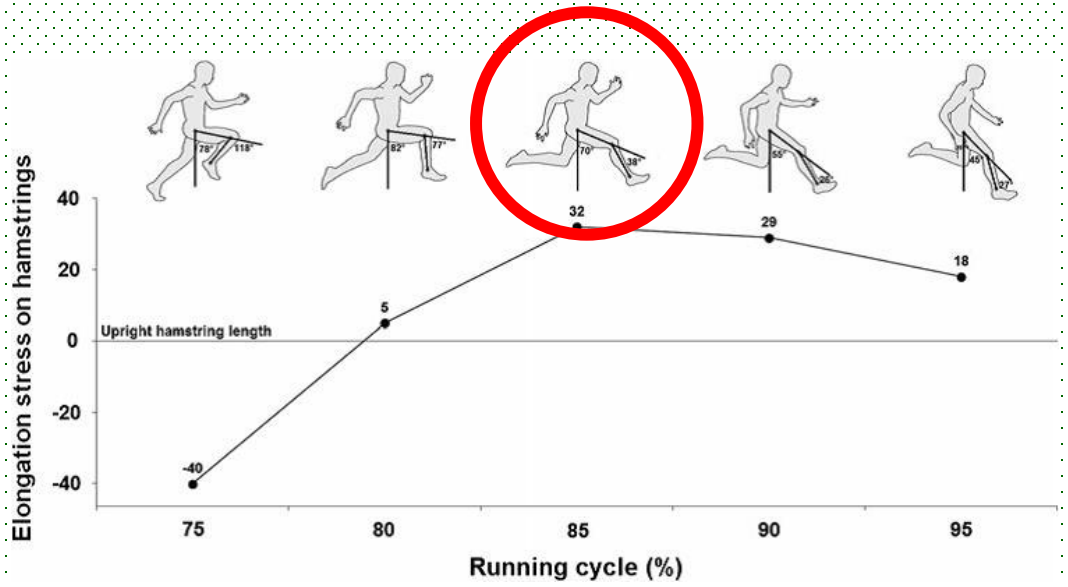
Hamstring Injury Mechanism

Muscle-tendon unit lengthening beyond moderate length

High force through muscle-tendon unit

High velocity movement

Hamstring Strain Injury



Evidence-Based Exercise Interventions

- Early and Optimal loading
- Hamstring Lengthening Exercises
- Eccentric Hamstring Strengthening
- Hip Extensor Strengthening
- Progressive Agility and Trunk Stability

Early and Optimal Loading

Protection
Rest
Ice
Compression
Elevation

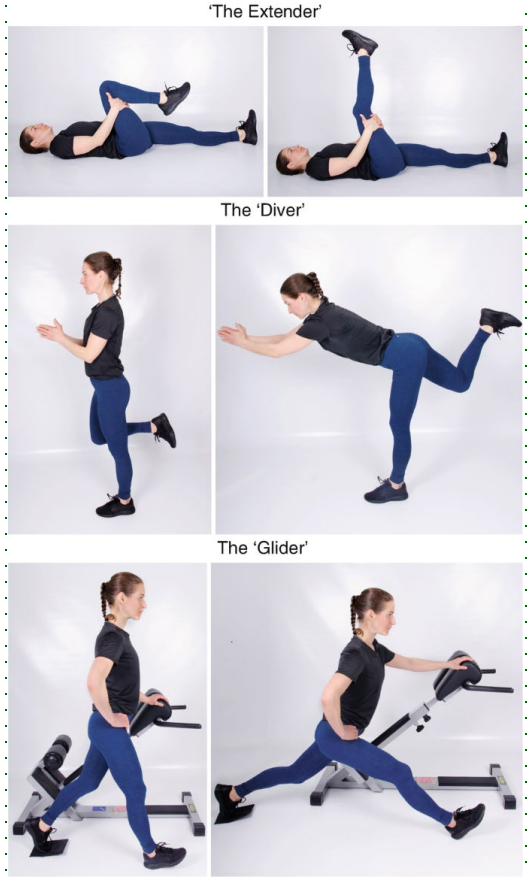
Protection
Optimal
Loading
Ice
Compression
Elevation

Optimal Loading - "the load applied to structures that maximizes physiological adaptation and restores function via various cellular and neural mechanisms"

Bayer et. al (2017)
- Early therapy (2 days post-injury) vs. delayed therapy (9 days post-injury)
- Early therapy shortened return to sport by 3 weeks with no significant increased risk of reinjury

Hamstring Lengthening Exercises

Askling L Protocol



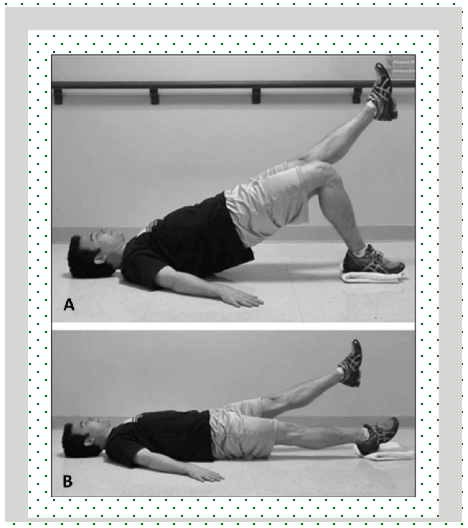
Askling C Protocol

- Two RCTs assessed L-Protocol vs. C-Protocol in addition to general rehabilitation protocol
- **Both trials showed shortened return to sport in L-Protocol groups**

Eccentric Hamstring Strengthening

- **Strong recommendation for inclusion of eccentric strengthening exercises in HSI rehabilitation protocol**
  - Higher intensity loading compared to Askling L-protocol
  - Decreases deficits in strength during a lengthened state
  - Decreases risk of re-injury

- Can be utilized safely during early rehabilitation stage
  - Ex: bilateral eccentric slide outs



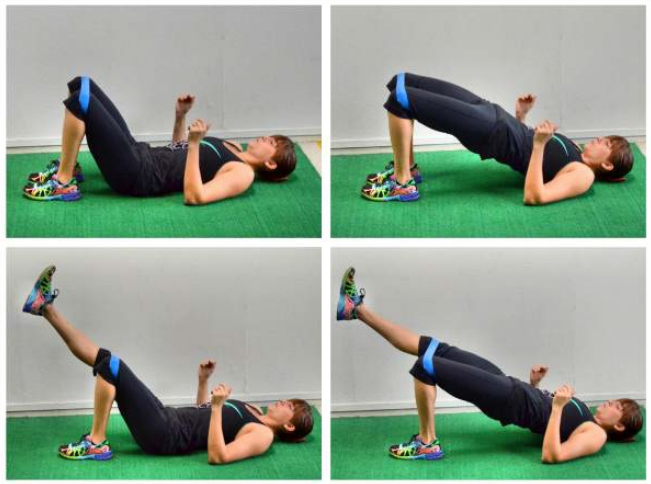
Hip Extensor Strengthening

Hamstring as Hip Extensor

- **Strong recommendation for hip extension exercises at longer muscle lengths**
- Multi-joint muscle requires strengthening at both the knee and hip
  - Ex: Askling Diver or Bilateral 45-degree hip Extension

Single-Joint Hip Extensor

- Recommendation to strengthen gluteus maximus, adductor magnus, gluteus medius
- Important during force production while running
  - Target using greater knee flexion angles in hip extension
    - Ex: Bilateral glute bridge or hip thrust



Progressive Agility and Trunk Stability (PATS)

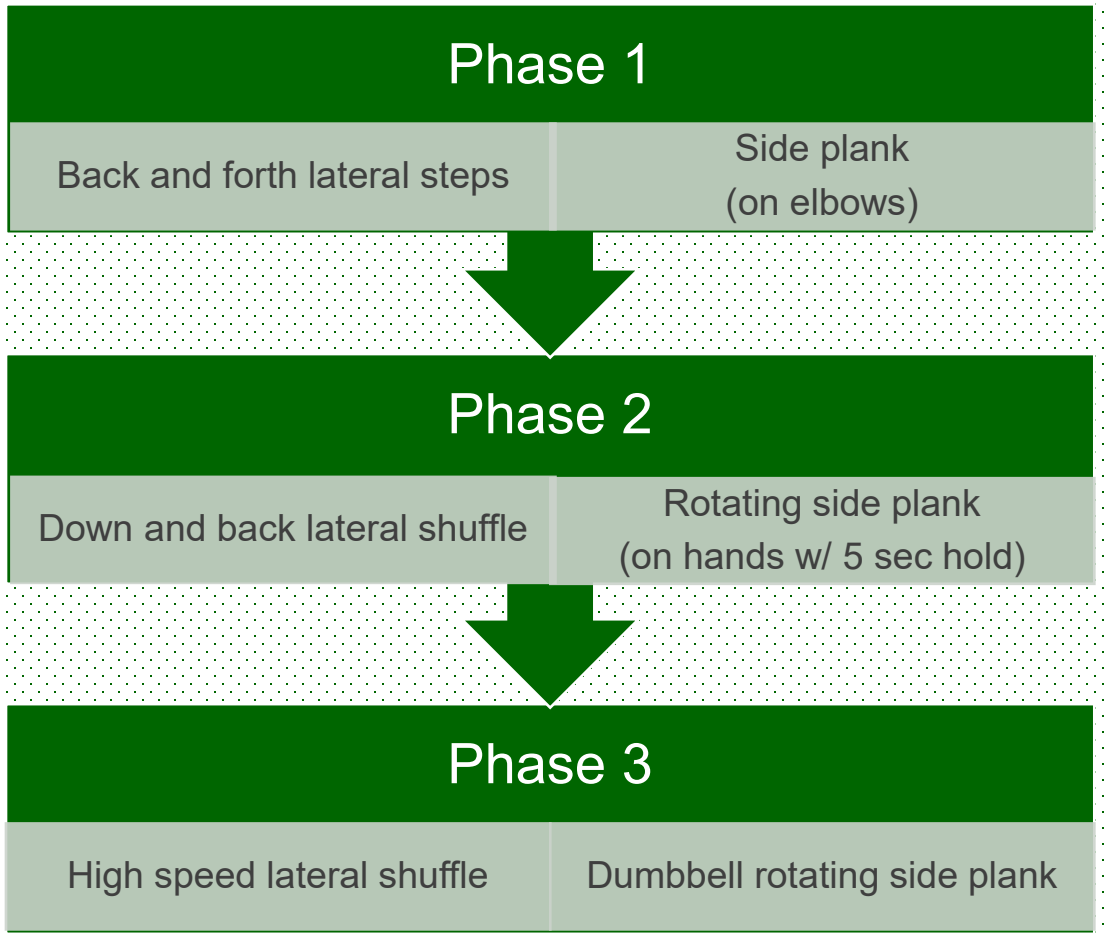
Inclusion of agility and trunk stability exercises to improve neuromuscular control of lumbopelvic region to create optimal function of hamstrings in sprinting and high-speed movements

RCT 1 - compared static stretching with strengthening vs. PATS

- No difference in time require to RTS, but decreased risk of re-injury in PATS group

RCT 2 - compared progressive running with eccentric strengthening vs. PATS

- No difference in time required to RTS or re-injury risk



Running and Sport-Specific Progression

- Aquatic Rehabilitation
- Body Weight Support Treadmill
- Running Progressions
- Sport-Specific Drills

Aquatic Rehabilitation

- Can be utilized to initiate closed and open-chain exercises, plyometrics, running and position specific drills at reduced body weight
  - EMG activation study showed lower peak muscle activity in water walking
  - Progress exercises, running speed, jet resistance to determine readiness to progress to land-based drills

- May be useful in maintaining cardiovascular fitness
  - Water resistance and arm movement contributed to higher cardiorespiratory response compared to land walking at same speed

Body Weight Support Treadmill

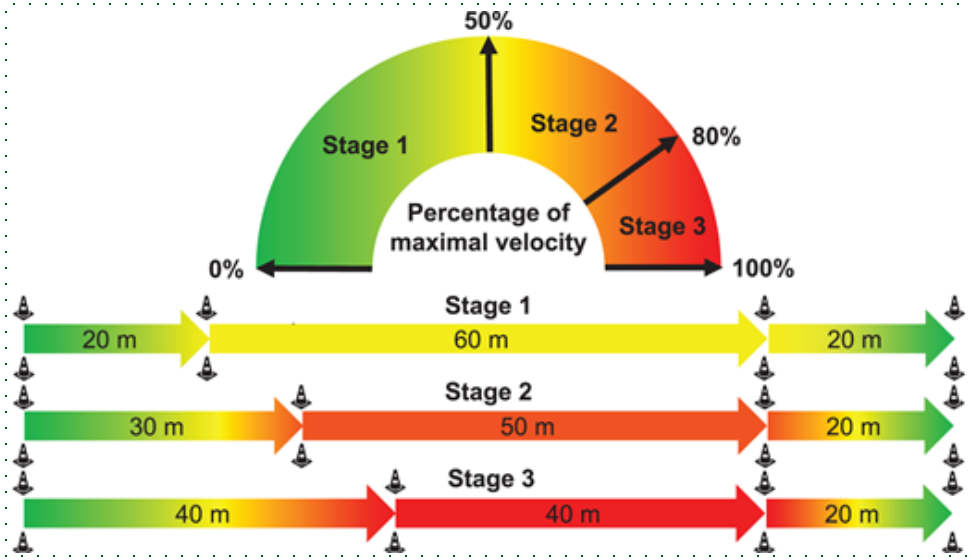
- Decreases load on joints and soft tissue while preserving aerobic fitness and muscle activation
  - Allows manipulation of bodyweight and incline

  Increase in stride length and flight time should be noted

- Higher than normal speeds required to induce similar physiological effects before returning to land

Running Progressions

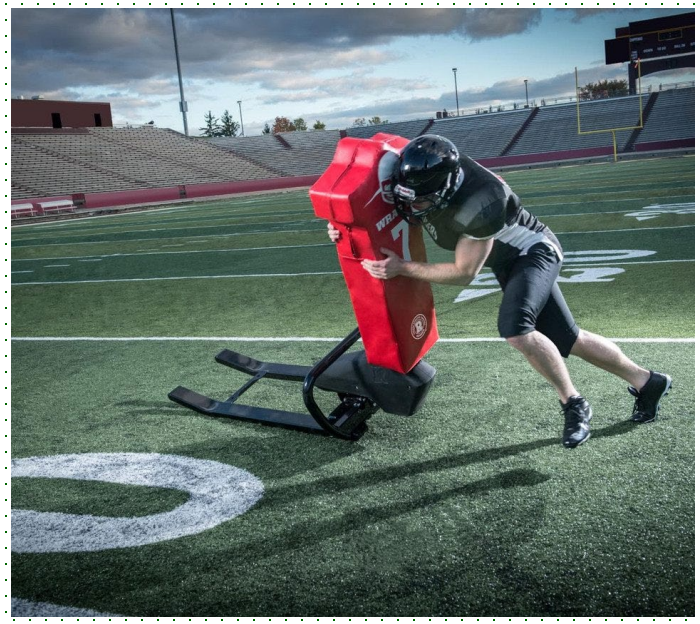
- Goals of running program:
  - Accelerate
  - Maintain constant speed
  - Decelerate
  - Avoid large spikes in high-speed running
- Intensity measured from patient reported RPE at percentage of max speed or GPS data



	Acceleration Distance (meters)	Constant Speed Distance (75% max speed)	Deceleration Distance (meters)
Level 1	40	20	40
Level 2	35	20	35
Level 3	25	20	25
Level 4	20	20	20
Level 5	15	20	15
Level 6	10	20	10
	Acceleration Distance (meters)	**Constant Speed Distance (90% max speed)**	**Deceleration Distance (meters)**
Level 7	40	20	40
Level 8	35	20	35
Level 9	25	20	25
Level 10	20	20	20
Level 11	15	20	15
Level 12	10	20	10

Sport-Specific Drills

- Lack of specific rehabilitation protocol consensus in research
- Total volume and distance high-speed running exposure should be similar to the demands of the sport
  - Avoids a high spike with RTS
  - Ensure readiness
- Incorporate change of direction and position-specific drills
  - Contact drills if necessary



THANK YOU!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