



Muscle Injury & Rehabilitation

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Overall Timeline

| Healing Phases of Soft Tissue (Kannus, 2000) | |
|---|-------------------|
| Phase | Days after Injury |
| Inflammation | 0 to 7 |
| Proliferation | 7 to 21 |
| Maturation | >21 |

Muscle Healing Process (Jarvinen et al. 2005)

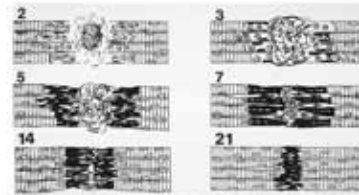


Figure 2 is schematic illustration of the healing muscle tissue. Day 2: The immediate early phase of the inflammatory reaction is being recruited. Macrophages (dark) progressively fill the void of the avascular blood clot up to 100% of the injured area. Day 3: The inflammatory reaction is still ongoing. The inflammatory reaction is still ongoing. Day 5: The inflammatory reaction is still ongoing. Day 7: The inflammatory reaction is still ongoing. Day 14: The inflammatory reaction is still ongoing. Day 21: The inflammatory reaction is still ongoing.

EBM Standpoint

EBM Evidence based prevention of hamstring injuries in sprint

Phase I (Inflammation), 0-7 days: The goal of the treatment is to control inflammation and control pain. Inflammation is a natural response to tissue injury. Inflammation is a natural response to tissue injury. Inflammation is a natural response to tissue injury.

Phase II (Proliferation), 7-21 days: The main focus is on the repair of the damaged tissue. The main focus is on the repair of the damaged tissue. The main focus is on the repair of the damaged tissue.

Phase III (Maturation), >21 days: The main focus is on the remodeling of the tissue. The main focus is on the remodeling of the tissue. The main focus is on the remodeling of the tissue.

An Early Return vs. The Risk of Recurrence (Orchard, 2002)

| Weeks after return from initial injury | Weekly percentage risk of injury recurrence (%) | | | |
|--|---|-----------------------------|----------------------|--------------------------|
| | Hamstring strain (n = 436) | Quadriceps strain (n = 211) | CAF strain (n = 217) | High hamstring (n = 220) |
| 1 | 12.0* | 6.0* | 3.2* | 5.6* |
| 2 | 8.3* | 4.3* | 3.7* | 1.2 |
| 3 | 4.9* | 3.0* | 3.3* | 1.3 |
| 4-6 | 4.3* | 3.0* | 3.0* | 3.0* |
| 8-9 | 3.3* | 3.3* | 3.3 | 3.3 |
| 9-14 | 2.7* | 3.3 | 3.1 | 3.6 |
| 15-22 | 1.4 | 2.1 | 2.1 | 3.0* |
| Incidence rate of recurrence for remainder of season (%) | 36.6 | 22.9 | 21.8 | 22.3 |

* Significantly greater than weekly risk of injury during following season (p < 0.05).
 † For recurrence reported during this time period.



Immobilization (Jarvinen, 2005)

- Early mobilization (Dr. Woodward, 1954)
- Histologic & Biomechanical changes
- A short period of immobilization

Immediate Treatment

- Rest
- Ice
- Compression
- Elevation

Sub-acute Phase Treatment

- Isometric
- Isotonic
- Isokinetic

Return to Sport-Specific Training

- The ability to stretch the injured muscle
- The pain-free use of the injured muscle in basic movements

What Does the Literature Say? (Askling et al. 2006)

ORIGINAL ARTICLE

Type of acute hamstring strain affects flexibility, strength, and time to return to pre-injury level

Askling, T. Lewné, & Reinselmann

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Objective: To investigate possible relationships between severity of acute, low-back hamstring strain in patients and degree and recovery of flexibility, strength, and function as well as time to return to pre-injury level. Methods: Eighteen elite sprinters and 17 professional distance runners with clinically diagnosed hamstring strain were included. They were divided according to injury level into 2 groups: 12 sprinters and 6 distance runners. Degree of strain in the Sprinter and recovery strength in both groups were measured. Self-reported and actual time to return to pre-injury level were recorded. Hamstring activities were recorded during a 10-week follow-up period.

Results: All the sprinters sustained their injuries during high-speed sprinting, whereas all the distance runners sustained theirs during easy-to-moderate running. The initial loss of flexibility and strength was greater in sprinters than in distance runners. At 10 weeks after injury, both groups could perform more than 90% of the test range of the original leg. However, the actual times to return to pre-injury level of performance were significantly longer (median 14 weeks longer in 100% for the sprinters and 33 weeks longer in 200% for the distance runners). These variables were related to the severity of the injury.

Conclusions: There is support in the literature for the possibility of a dose-response of acute hamstring strain in sprinters and distance runners and the time to return to pre-injury level. Initially, sprinters have more severe functional deficits but recover more quickly.

Results (Askling et al., 2006)

Figure 1: Hamstring strength (N) over 10 weeks. Sprinters (solid line) show a faster recovery of strength compared to distance runners (dashed line).

Figure 2: Degree of strain (mm) over 10 weeks. Sprinters (solid line) show a faster recovery of strain compared to distance runners (dashed line).



A Comparison of 2 Rehabilitation Programs in the Treatment of Acute Hamstring Strains

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Results

(Sherry & Best, 2004)

Results: The average (\pm SD) time required to return to sports for athletes in the STST group was 37.4 ± 27.6 days, while the average time for athletes in the PMS group was 22.2 ± 8.3 days. This difference was not statistically significant ($P = .2413$). In the first 2 weeks after return to sports, injury rate was significantly greater ($P = .00343$, Fisher's exact test) in the STST group, where 6 of 11 athletes (54.5%) suffered a recurrent hamstring strain after completing the stretching and strengthening program, as compared to none of the 13 athletes (0%) in the PMS group. After 1 year of return to sports, injury rate was significantly greater ($P = .0059$, Fisher's exact test) in the STST group. Seven of 10 athletes (70%) who completed the hamstring stretching and strengthening program, as compared to only 1 of the 13 athletes (7.7%) who completed the progressive agility and trunk stabilization program, suffered a recurrent hamstring strain during that 1-year period.

Muscle Training vs. Movement Training

Deep Longitudinal Sub-System



Posterior Oblique Sub-System



Anterior Oblique Sub-System



Lateral Sub-System



Summary

- Only a few clinical studies
- RICE principle
- A short immobilization
- Early Mobilization
- Clinical evaluation after 5 to 7 days
- Eccentric Exercises
- Progressive agility and trunk stabilization exercises