Athlete Recovery: Foundational Knowledge for the Athletic Trainer
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The Athlete Recovery Landscape Can be Challenging

Historical Look @ Athlete Recovery
• As ATCs we’ve known the concept has existed but perhaps never really paid much attention to it?
  – The effects of training on injury, illness, and performance has overshadowed the effects of recovery on these same areas
  – An increase into the effects of recovery in these areas of sports medicine has increased dramatically the last 10-15 years!
• Our colleagues in the strength and conditioning world are a bit more advanced of their understanding of recovery than most sports health care professionals!

Factors Affecting Athletic Performance
• Traditionally athletes have spent a much greater proportion of their time recovering than in training, but more attention has been focused on training and less on recovery!

Load-Overload-Recovery
• Load – a stimulus experienced and responded to by an individual before, during, or after participation.
  • Load creates a demand or stress both physiologically and psychologically.
  • Safely managed will result in improved athletic capacity and performance, as well as injury/illness risk reduction!
**External vs Internal Loads**

<table>
<thead>
<tr>
<th>Table 1. External loads relate physical, physiological, and psychosocial demands.</th>
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<tbody>
<tr>
<td>Load</td>
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<tr>
<td>External</td>
</tr>
<tr>
<td>Internal</td>
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**Adaptation to Loading**

**Model of Adaptation to Load**

**Medical Issues Associated with Overtraining**

- Overtraining is often characterized by performance plateau not improved with the usual rest & recovery cycle
- Systems that can be affected:
  - Cardiovascular
  - Respiratory
  - Hormonal - Immunity
  - Musculoskeletal
  - Bone Stress Injury (BSI)
  - Physical Injury
  - Muscular Injury
  - Tendinopathies
  - Joint Injury
  - Psychosocial & Mental Health

**Role of the Athletic Trainer**

- Understand medical issues including sleep disturbances, immune dysfunction, and overtraining
- Be involved in the management of medical illnesses/musculoskeletal injuries resulting from overtraining
- Understand sport- and age-specific implications of overload injuries
- Understand the psychological components of overload and recovery
- Collaborate with “athletic care network” (coaches, SA’s, S&C coaches, team physician, nutritionists, etc...) to manage medical manifestations of overload/overtraining
- Work with “athletic care network” to facilitate adjustments to training and competition loads, especially when internal loads are unfavorable

**Load-Overload-Recovery**

- Overload – a load that is excessive or not well managed
  - External load
  - Internal load
  - Results in anatomical, physiological, and/or psychosocial conditions that can alter performance and lead to injury/illness

- Recovery – is the period and process during which the body responds to load
  - Goal = optimize physical, physiological, and psychosocial adaptation to internal and external loads
  - From an athlete’s perspective — aid in reducing fatigue and enhancing performance!
  - Recovery of muscle function is chiefly a matter of reversing the major cause of fatigue/damage

- Effect of Training Overload

- Load-Overload-Recovery

- TABLE 3. Recovery optimizes adaptations to internal and external loads.
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<tr>
<th>Physical</th>
<th>Physiological</th>
<th>Psychosocial</th>
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<td>Joint stability</td>
<td>Heart rate</td>
<td>HR variability</td>
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<tr>
<td>Strength</td>
<td>Heart rate</td>
<td>Mood status</td>
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<tr>
<td>Endurance</td>
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<td>Scores</td>
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Categories of Recovery

- **Immediate Recovery** – is the recovery which occurs between rapid, time-proximal finite efforts
  - Ex. Race walker has 1 leg in immediate recovery between strides

- **Short-Term Recovery** – recovery between interval sprints or weight training sets
  - The duration of this recovery period has been evaluated and various work to rest ratios suggested

- **Training Recovery** – the recovery between successive work outs or competitions
  - Holds most promise for enhancing athletic performance and likely the category ATC’s would want to be involved with!

Measurement and Monitoring

- Due to the multifactorial nature of recovery, the assessment of the recovery-fatigue continuum should be relative to the demands of the sport
- Laboratory Measurements
- Questionnaires
- Measurement Systems
- Wearables Technologies

Laboratory Measurements

- Blood Tests
- Urinalysis

Training Recovery Hypotheticals

Limitations in Measurement Techniques

- Limited large-scale, independent, longitudinal data
- The need to place devices at specific anatomical locations
- Movement artifact
- Frequency of data sampling
- Monitoring of a few selected variables (instead of a suite)
- Lack of simultaneous measurement of environmental factors
- Inconsistencies and accuracy of algorithms that collect/analyze/distribute data
- Variability of data interpretation by coaches, scientists, medical personnel, athletes
- Inability to transmit data indoors, underwater, built-up areas, and interference from other physiological responses

Questionnaires

- Nuti
  - 7-day dietary recall log
Measurement Instrumentation

- Force Plates
- VO2 Max
- Imaging (US – MRI)
- Isokinetic Testing
- Assessment of Velocity & Power
- Video Analysis
- Internal Measurement Systems

Wearable Technologies

- Global Positioning Systems (GPS)
- Heart Rate Monitors
- Heart Rate Variability Devices
- Velocity/Acceleration Measurements
- Motion Capture Systems
- Sleep Monitors

Role of the Athletic Trainer

- There are components of load, overload, and recovery that are measurable
- Further research is needed to determine the utility of tools and technology in improving performance and risk for injury/illness in sport
- Become familiar with categories of measurement techniques
- Understand the limitations of the data obtained from these measurement processes and the interpretation of these data
- Collaborate with “athletic care network” to effectively monitor athletes using technology
- Collaborate with “athletic care network” to enable acute adjustments to the training and competitive loads for athletes if internal overload factors are unfavorable.

Intervention Strategies for Enhancing Recovery

- Training Tactics:
  - Customized periodization program with monitoring
  - Limiting weekly hours of training & mileage
  - Limiting the # of games and tournaments allowing adequate time for recovery between
  - Implementing NM training programs such as the FIFA 11

- Active vs. Passive Recovery Techniques:
  - Role of active recovery in reducing lactate concentrations has traditionally been the rationale, however research is incomplete!
  - Passive techniques range from application of external methods (massage) to implementing a period of inactivity or rest

- Nutritional Considerations:
  - Free radical physiology & reactive oxygen species has lead to an interest in antioxidant nutrient therapy during recovery from exercise and competition
  - Poor diets may contribute to early onset of fatigue
  - Iron deficiencies present in endurance athletes
  - Importance of hydration consumption during recovery period
    - Replenish electrolytes
    - Water and other sport beverages are recommended
Intervention Strategies for Enhancing Recovery

• Mental Health Considerations:
  -- The post-performance phase involves responses to external consequences and internal processes associated with performance
  -- 3 pathways:
    • Sustaining involvement
    • Re-engaging after a brief dysfunctional period
    • Disengaging from the activity

• Sleep Considerations:
  -- Athletes generally sleep less than non-athletes and often have difficulty sleeping
  -- Athletes need to understand how sleep affects performance/recovery, factors affecting sleep quality, and develop optimal sleep habits

• Whole Body Cryotherapy:
  -- Traditionally involved cold or contrast water immersion techniques
  -- Contemporary methods involve WBC
  -- Some evidence with recovery from sprint exercise
  -- Improvements in subjective recovery & muscle soreness, but little benefit towards functional recovery!
The Evolution of RICE

What if RICE is wrong? Newer evidence is suggesting that both ICE and REST may actually delay recovery! Does this turn an ATC’s life into peril?

P.O.L.I.C.E.

• Protection
• Optimal Loading
• Ice
• Compression
• Elevation

PEACE and LOVE

PEACE & LOVE

Intervention Strategies for Enhancing Recovery

• Massage Therapy:
  - Gained popularity because:
    • Feels good
    • Not banned by sport governing bodies
    • Has no known side effects
  - Effects of massage still questionable (systematic and mechanical benefits remain unsubstantiated)

Intervention Strategies for Enhancing Recovery

• Analgesics:
  - NSAIDS used to relieve signs associated with training inflammation
  - Effects on prostaglandin production
  - Useful in speeding training recovery of muscle function (prophylactic use better than therapeutic use)
  - Reduced muscle aches
  - Reduced CK activity

The Mechanisms of Massage and Effects on Performance, Muscle Recovery and Injury Prevention

Use of Nonsteroidal Anti-Inflammatory Drugs Following Exercise-Induced Muscle Injury
Intervention Strategies for Enhancing Recovery

- **Stretching/Flexibility Exercises:**
  - One of the most commonly used recovery strategies, yet least substantiated!
  - Reports of benefits and claims have been mixed
  - No detrimental effects on performance and recovery noted with stretching

- **Compression Garments:**
  - Compression clothing has been used medically in the treatment of lymphatic and circulatory conditions
  - Graduated compression to the limbs from proximal to distal
  - External pressure may reduce intramuscular space available for swelling and promote a stable alignment of muscle fibers
  - Reduction in DOMS in distance runners

- **Compression Modalities:**
  - Mechanical intermittent pneumatic compression
  - Aids in lymphatic flow and drainage and venous return

- **Micro-mobile Compression Device:**

- **Hyperbaric Oxygen Therapy:**
  - “Hyperbaric oxygen therapy (HBOT) saturates the organs with 100% pure oxygen to help improve recovery”. In theory “This helps alleviate pain and minimize training stresses by delivering restorative adenosine triphosphate (ATP) to muscles. This flushes lactic acid from muscles in order to accelerate recovery. Ultimately, more oxygen-rich blood boosts healing”
Intervention Strategies for Enhancing Recovery

• Infrared Saunas:
  – Aids the neuromuscular system in recovery from maximal endurance performance.

Concluding Thoughts

• Athletic trainers need to take an active role in the athlete recovery process — the "waters are murky" but trust your instincts!
• Understanding the benefits of a comprehensive, multifaceted approach to addressing the musculoskeletal, medical, and psychological issues in recovery is paramount!
• Collaboration with a comprehensive “athlete care network” is vital
• Plethora of recovery strategies can be cumbersome and “mind-boggling” so clinicians need to seek out the best available evidence to support their use

Helpful Resources

Recovery and Performance in Sport: Consensus Statement

Michael Rhind, Massimo Bertillo, Laurent Despeyrot, Michel Brice, Aaron J. Coutts, Rob Duffield, Daniel Eichhorn, Bruno L. Husson, Anne Hargreaves, Johan Hendriksen, K. Wolfgang Kalsbeek, Romain Meunier, Vigne Rujula, Cristina Rodasova, Sabine Schramm, Hans Verrier, and Jürgen Dreselmann

Compare Sports Tech

https://www.comparestech.com/