Introduction

- Greater the load, greater the recovery
- Identify common stressors
- Strategies to enhance recovery

NEED TO HAVE A PLAN
RECOVERY
TO GET BACK WHAT WAS LOST

ADAPTATION:
The process of adjustment to a specific “stimulus”

Positive Adaptation = Improved performance

Restoration is creating an ideal environment for the cell to regenerate.

Stressors are Additive

![Diagram showing Overtraining Syndrome and its effects on Performance Problems, Psychological Problems, and Physiological Problems.]

Fig 1. The major problems resulting from overtraining

Factors affecting performance

Diagram showing factors affecting performance:
- Diet: Carbohydrate, Water intake
- CNS Function: Arousal, Motivation
- Strength/Skill: Practice, Natural endowment, Body type, Muscle fiber type
- Environment: Attitude, Heat, Humidity
- Energy Production: Anaerobic sources, [PCr], Glycolysis, Aerobic sources, VO2 max, Cardiac output, O2 delivery, PO2, O2 extraction, Mitochondria
Prevention

Carefully Planned Training and Restoration

Considerations

- Training Regimen
  - Overtraining/Over-reaching
- Chronological/Training Age

Individual Variability

- Individuals tolerate different levels of stress
  - Stress hormones activated
  - Emotional stress and chronic elevation of cortisol
  - Physical stress and transient increase
Key to Recovery is Avoiding Overtraining

- Signs of Overtraining
  - Decreased performance with increased training
  - Frequent Upper Respiratory Infections
  - Frequent injuries

General Adaptation Syndrome

- Alarm Reaction: Similar to fight or flight
- Resistance: Struggle to overcome, hard work, limited rest/sleep
- Exhaustion: Body systems crash, fatigue, errors, irritability, vulnerable to illness (colds, URI)
Key to Recovery is Avoiding Overtraining

- Causes of Overtraining
  - Training too intense
  - Training too prolonged
  - Insufficient recovery
  - Stress unrelated to training
    - academic
    - significant others
    - financial

Suggested Minimum and Maximum Recovery Times Following Exhaustive Exercise

<table>
<thead>
<tr>
<th>Recovery Process</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATP + PC</td>
<td>2 Minutes</td>
<td>5 Minutes</td>
</tr>
<tr>
<td>Muscle Glycogen</td>
<td>10 hours (continuous exercise)</td>
<td>46 Hours (continuous exercise)</td>
</tr>
<tr>
<td></td>
<td>5 Hours (intermittent exercise)</td>
<td>24 Hours (intermittent exercise)</td>
</tr>
<tr>
<td>Liver Glycogen</td>
<td>Unknown</td>
<td>12 - 24 Hours</td>
</tr>
<tr>
<td>Reduction of Lactate</td>
<td>30 Minutes</td>
<td>1 hour</td>
</tr>
<tr>
<td>Restoration of O2 Stores</td>
<td>10 - 15 Seconds</td>
<td>1 minute</td>
</tr>
</tbody>
</table>

AEROBIC MUSCLE FATIGUE

Due to Aerobic Exercise
- results from
  - glycogen depletion
  - dehydration
  - buildup of heat
- recovery time
  - until glycogen repletion is complete
  - varies with intensity and duration of activity
ANAEROBIC MUSCLE FATIGUE

Due to Anaerobic Exercise
• results from
  – accumulation of hydrogen ions
  – depletion of substrate
• recovery time
  – within six hours lactate absorbed
    by non working muscles
  – time to allow microtrauma to heal
  – time normally 48-72 hours

ALACTIC MUSCLE FATIGUE

Due to Alactic Exercise
• results from
  – depletion of substrate (ATP)
  – unavailability of CP
• recovery time
  – approximately 3 minutes required
    for 98% return
  – no measurable waste
    products

Methods of Restoration

Have a Plan!!!!

Pedagogical (Coaching) Restoration
• employs periodized programs to optimize the balance between
  training stresses and natural recuperative processes

Medico-Biological Restoration
• covers a broad spectrum of therapeutic measures offered by
  medical and allied practitioners.

Psychological Restoration
• involves management of
  the mental state

Mel Siff “Super Training”
Planned Training Regimen
• The same workout may have different effects on:
  – Fitness
  – Fatigue
  – Illness
• Type of restoration may have different effects

TRAINING METHODOLOGY
• Considerations
  • training density
  • training emphasis
  • competitive demands
  • health
  • stress levels
• Recovery
  • resting pulse rate
  • weight
  • blood values

TRAINING METHODOLOGY
• Active recovery
  • increases lactate metabolism within muscle
  • reduces release of lactate into blood stream
  • decreases muscle lactate
• Passive recovery
  • increased glycogen resynthesis
  • not due to glycogen neogenesis
Russian Restoration System

Recognizes the specificity of each technique or sequence of techniques for a particular event, phase of training, individual athlete, time of the day, type of stress and type of fitness.

Applies a different techniques before, during, shortly after and a long time after training and competitions.

Records on athlete's daily variation in physical and psychological state, a process which implies close cooperation between athletes, coaches and athletic trainer.

Passive Physical Means

Classical massage  Nutrition) Myofascial
Release massage  Hydration
Acupressure/ shiatsu  Hydrotherapy
Stretching techniques  Flotation
Aromatherapy  Therapeutic Touch
Electronic technology  Laser therapy
Passive machines  Reflexology
Barotherapy (pressure)  Balneo-therapy (baths)
Aromatherapy  Active Release
Therapy

Active Physical Means

PNF (Neuromus means)  Stretching
Physical activity  Recreational sport
Manual labor  Dance
Play
Postural Alignment
Breathing regimens
Tai Chi
Progressive relaxation  Yoga
Self-massage (active/passive)
# Essential Recovery Methods

- Nutrition/Ergogenic Aids
  - Hydration Status
- Acclimatization
- Rest
- Therapeutic Modalities/Exercise

## EFFECTS OF DEHYDRATION

- Dehydration of 1-2% of body weight can impair performance and physiological processes
  - A 3 lbs weight loss in a 155 lb athlete
- Dehydration of >3% of body weight during exercise
- No one adapts to dehydration


## Ideal Fluid Replacement Beverage

- Palatability - "tastes good"
- Multiple sugars such as glucose (polymer), sucrose and fructose enhance fluid uptake
- Sodium can enhances fluid retention in short term
- Cooled to 50-59°F (10-15°C)
- Amino acids don’t seem to help fluid absorption or performance
- Plan to drop ship our sports drink and foods


During Exercise

- Drink 200 to 300 mL (7 to 10 fl oz) every 10 to 20 minutes
- Goal is to drink amount equal to sweat and urine losses


Acclimatization Example for Track and Field

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Week 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor hydration</td>
<td>Monitor hydration</td>
</tr>
<tr>
<td>Exercise intensity</td>
<td>Gradually ↑ intensity</td>
</tr>
<tr>
<td>Short duration</td>
<td>Gradually ↑ duration</td>
</tr>
<tr>
<td>Shorts, t-shirts</td>
<td>Gradually ↑ equipment</td>
</tr>
<tr>
<td>Consider ↑ salt</td>
<td>Blood sodium normalizes</td>
</tr>
<tr>
<td></td>
<td>Sweat rate ↑</td>
</tr>
</tbody>
</table>

Table 3.2
"Plateau days" of Physiological Adaptations (Point at Which Approximately 95% of the Adaptation Occurs) During Heat Acclimatization

<table>
<thead>
<tr>
<th>Adaptation</th>
<th>Days of heat acclimatization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Heart rate decrease</td>
<td></td>
</tr>
<tr>
<td>Plasma volume expansion</td>
<td></td>
</tr>
<tr>
<td>Rectal temperature decrease</td>
<td></td>
</tr>
<tr>
<td>Perceived exertion decrease</td>
<td></td>
</tr>
<tr>
<td>Sweat Na⁺ and Cl⁻ concentration decrease</td>
<td></td>
</tr>
<tr>
<td>Sweat rate increase</td>
<td></td>
</tr>
<tr>
<td>Renal Na⁺ and Cl⁻ concentration decrease</td>
<td></td>
</tr>
</tbody>
</table>

*While consuming a diet low in NaCl.
Reprinted from Armstrong and迪亚卡斯 1996.
**Acclimatization Factors**
- Clothing/equipment
- Duration of exercise in the heat
- Time of day
- Exercise intensity
- Hydration status
- Sleep loss
- Infection or illness
- Age
- Degree of maximal aerobic power (VO2max)

*Gender does NOT make a difference*

**Restorative Aids**
Identify medical facilities and support for training and competition

**Therapeutic Modalities**
- Electrical Stimulation
- Laser Therapy
- Cryotherapy
- Cooling Systems
Therapeutic Modalities

• Electrical Stimulation
• Laser Therapy

There is some indication of cryotherapy effectiveness over recovery periods relevant to between training session intervals following exercise that may be more representative of training than that used to induce DOMS.

• Cryotherapy

Cooling Systems

These data suggest an improved physiological response to exercise heat stress with all three commercial systems.

Endurance times for running at 95% of VO2max were increased by up to 49 s. Perceptions of the thermal state and skin wetness showed changes to greater levels of effectiveness.
Therapeutic Modalities

• Cooling Systems

Therapeutic Exercise

• Massage
• Manual Therapy
• Aquatics Therapy
• Core/Functional Exercises
Therapeutic Exercise

• **Massage**
  – No evidence of improved pre-exercise performance, post-exercise recovery or prevent muscular injury.
  – Benefits are primarily psychological thru relaxation.

• **Manual Therapy**
  – Only benefit occur from joint dysfunction

Therapeutic Exercise

• **Aquatic Therapy**

• **Core Exercise**

Conclusion

• Recovery individualized
• Life stresses slow recovery
• DEVELOP A PLAN
• Restoration aids