Injury Management and Return to Competition for the Cycling Coach and Athlete

Derek M. Hansen, CSCS
www.StrengthPowerSpeed.com
derek@strengthpowerspeed.com
@DerekMHansen
About Me

• Former Track and Field Athlete and Coach
• Strength and Conditioning Coach - SFU
• Sport Performance Consultant – NFL, NBA, MLS, MLB, Olympic Sports, NCAA Div 1
• Experience in cycling – BMX and Track Cycling
• Writer, educator (NCCP, post-secondary lecturer)
• Expertise in Performance Planning and Return to Competition
Prevalence of Injury in Sport

“Great sport begins where good health ends.”
Overview

• Types of injuries in cycling
• Implications for training and return to competition
• Working around the injury
• General approaches to prevention
Causes of Injury

Injuries can occur for a number of reasons:

• Accidental Injury – Falls, crashes, collisions, training
• Inadequate Warm-Up / Preparation
• Poor Biomechanical Execution
• Inappropriate or Faulty Equipment
• Inadequate Strength / Fatigue / Overuse
• Intentionally Inflicted Injury
Classifications of Injury

Practical classification of injuries:

- Visceral - Damage to internal organs
- Skeletal - Bone fractures
- Joint - Stretched or torn ligaments or cartilage
- Muscle and Tendon - Strains, bruises, partial tears and ruptures
- Dermal - Cuts and abrasions
- Neurological – peripheral nerves, spinal cord, brain injuries (concussion)
Common Injuries in Cycling

- Overuse, chronic injuries
- Joint, muscle, tendon and ligaments
- Related to biomechanics, volume and intensity – but also acute trauma
- Typically resolved by adjustments to:
  - Technique
  - Equipment
  - Training volume and intensity
Common Injuries in Cycling

- **Knee Joint**
  - Overuse repetitive (knee = 40-60% of all reported overuse injuries)
  - Anterior orientation (patellofemoral joint) – 30-40% (seat too low)
  - Iliotibial band irritation – 7-14% (seat too high)
  - Ligament and meniscal injuries rare
  - Direct trauma (falls/crash) – contusion or fracture
Common Injuries in Cycling

• Lower Leg
  • Medial tibial stress syndrome (shin-splints)
  • Sharp increases in training intensity and/or misalignment of the lower extremity (excessive foot pronation)
  • Stress fractures due to heavy increases in training volume – less common
  • Achilles tendonitis – poor bike fit (seat too low, poor foot alignment)
  • Plantar fasciitis – raising seat height and increasing cadence
  • Metatarsalgia – repeated load across metatarsal heads during pedal cycle – low cadence, stiff shoes, poor foot position
Low Back and Neck Pain

- Low-back: Forward lean and spinal flexion in cycling results in the accumulation of micro-damage to the posterior annulus (McGill 2001) and disc compression
- Neck: Constant hyperextension of neck during cycling can create spasms in levator scapulae and trapezius muscles
- Fatigue may also result in altered muscle patterns that contribute to risk of injury and persistence of symptoms
- Adjustments – bike fit, volume management, active recovery measures (massage, stretching)
- Training – sprinters squatting too much weight, poor technique
Common Injuries in Cycling

- Pelvic Issues (Groin, Buttocks)
  - Prolonged seated position on saddle
  - Numbness, irritation, sores, neurological issues
  - Seat design, seat position, volume adjustments
Common Injuries in Cycling

- **Wrist and Hand Pain**
  - Chronic numbness, tingling and weakness of hands
  - Constant pressure and vibration while wrist is in hyper-extension and abduction
  - Impacted by incorrect bike fit (too much pressure on hands) and chronic neck tightness (impingement of nerves – cervical radiculopathy)
Common Injuries in Cycling

- **Acute Traumatic Injuries Due to Falls and Collisions**
  - Bone fractures
    - Hand, wrist, forearm, clavicle, facial, ribs
  - Sprains and Joint dislocations
    - AC (acromioclavicular) Joint sprain or separation
  - Head injuries
    - Concussion, skull fracture
  - Internal organ damage
    - Ruptured spleen, collapsed lung
Injury Management Techniques

- Programming adjustments
  - Volume and intensity management
  - Appropriate progressions of work
  - Strength training interventions
  - Frequency and duration of recovery
- Biomechanical upgrades
  - Technical execution – posture, alignment, leverage
  - Appropriate cadence and gearing
- Equipment modifications
  - Bike fit – seat height, crank length, shoe cleat position, saddle setback, reach, handlebar height, handlebar width
  - Shoe selection
Injury Management - Programming

- Identify thresholds or “tipping points” for injury
  - Volumes of work – tracking and monitoring
  - Intensities (force through pedals) – cadence/gearing dependent
  - Consideration given to other stressors (i.e. weight room) and the accumulation of fatigue
  - Previous history and established “red zones”
Injury happens… Now what?

Determine the extent of the injury, then develop an individualized plan for re-entry into the training and competition arena.
Injury happens… Now what?

Who are the major players?

- Physicians (Sports Medicine, Specialist (i.e. orthopaedic surgeon)
- Physiotherapist / Athletic Trainer / Other therapists?
- Coach(es)
- Athlete
- Parents
Recovery and Rehabilitation Process

Volume

INJURY

CLINICAL REHAB

PRACTICAL REHAB

CONVENTIONAL STRENGTH & CONDITIONING

Time
Recovery and Rehabilitation Process

Primary Objective:

To get the athlete back into full competition / training shape as quickly and smoothly as possible.

How do we achieve this objective?

Progressive overload - The same concept we apply in training our athletes
Recovery and Rehabilitation Process
Recovery and Rehabilitation
Working Around the Injury

• Psychological impact of progress
• Cross-over effect – right-to-left, lower-to-upper (neurological, hormonal, metabolic adaptations)
• Electrical muscle stimulation
Working Around the Injury

Case study – track cyclist with broken wrist and clavicle (same side)

• Determine abilities and contra-indications
• No upper body resistance training options
• Can’t squat or hold a barbell, dumbbell
• Can’t wear weighted vest
• Can’t jump onto a box
• Limited training on cycle trainer
Working Around the Injury

Case study – track cyclist with broken wrist and clavicle (same side)

• Strategies:
  - Lifting with opposite arm (moderate weight)
  - Lower body work with machines (leg extension and hamstring curls)
  - Step-ups and lunges with weighted belt (20-25lbs)
  - Electrical muscle stimulation – lower body, back and upper extremities
Working Around the Injury

Case study – BMX athlete with fractured ankle

• Determine abilities and contra-indications
• Limited lower body weightlifting options
• Can’t ride a bike
• No jumps or force application through injured ankle
• Don’t want to irritate SI-joint with excessive single leg training
Working Around the Injury

Case study – BMX athlete with fractured ankle

• Strategies:
  - Lifting with opposite leg – leg press, leg extensions, hamstring curls
  - Heavy upper body lifting emphasis – pressing and pulling movements
  - Medicine ball throws from seated position – linear and rotational
  - Electrical muscle stimulation – lower body and back
Electrical Muscle Stimulation

- 20+ years experience
- Supported by research – strength development
- Portable and easy to use
- Can provide a profound peripheral stimulus to contract muscle (independent of the CNS)
- Afferent signals conveying restored function and a safe environment
Electrical Muscle Stimulation

Contracting Muscles
Electrical Muscle Stimulation

Bypassing the Central Nervous System
# Electrical Muscle Stimulation - Frequency

<table>
<thead>
<tr>
<th>Stimulation Frequency</th>
<th>Muscle Fiber Type</th>
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| 1 - 40Hz              | **Type 1**  
|                       | Slow Twitch  
|                       | Slow Fatiguing |
| 40 - 70Hz             | **Type 2a**   
|                       | Fast Twitch   
|                       | Intermediate Fatiguing |
| 70 - 120Hz            | **Type 2b/2x** 
|                       | Fast Twitch   
|                       | Fast Fatiguing |
EMS Applications – Pulsing

• Circulatory effect and muscle loosening
• 1 – 10 Hertz
• Constant or varied
• Warm-Up
• “Active Recovery” or “Massage”
• Low to moderate intensities
• Longer durations – 20 to 40 minutes
EMS Applications – Facilitating Exercise

Superimposed EMS

• Using electrical stimulation during exercise
• Squatting – contracting quads eccentrically and/or concentrically
• Facilitates muscle contraction during a movement – particularly where inhibition is present
EMS Applications – Superimposed Squatting
Diagnostic Value of Electrical Stimulation
Diagnostic Value of Electrical Stimulation

Max of 120 mA

<table>
<thead>
<tr>
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<th>Injured Knee</th>
<th>Healthy Knee</th>
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<tbody>
<tr>
<td>Left Quadriceps</td>
<td>56 mA</td>
<td>24 mA</td>
</tr>
<tr>
<td>Right Quadriceps</td>
<td>50 mA</td>
<td>26 mA</td>
</tr>
<tr>
<td>Left Quadriceps</td>
<td>38 mA</td>
<td>27 mA</td>
</tr>
</tbody>
</table>

WEEK 1 | WEEK 4 | WEEK 7
Concussions

- Ongoing research in this area for many sports
- Prohibit any physical training before physician/neurologist gives green light – then proceed with caution and close monitoring
- Increases in blood pressure from even low intensity exercise can exacerbate problem
- Prevention
  - Neck strengthening protocols – research inconclusive
  - Good equipment
  - Teach athletes how to fall
Recovery and Rehabilitation Process

Psychological Implications

• Injuries can have drastic implications for an athlete

• The sooner you can implement the rehab and recovery process, the better off the athlete will be psychologically

• A successful and expedient recovery process can build an athlete's confidence in his or her coach and support system

• Hence, the next time an injury occurs, the less devastating the consequences
Injury Prevention Considerations

- Appropriate allocation of work
- Proper execution of technique and biomechanics
- Excellent recovery and regeneration strategies in place for athletes
- Flexibility on the part of the coach when implementing workouts in different situations
- Constant monitoring of your athletes’ condition at workouts and at competition - verbal, visual and physical
Injury Prevention Considerations

- Strength training interventions - strengthening your weaknesses
- Flexibility and mobility
- Nutritional requirements
- Equipment considerations
- Environmental / situational considerations
  - Weather and temperature
  - Facilities (i.e. running/playing surfaces)
  - Athlete emotional state