Getting the Injured Back on Track
Treatment and Prevention of Injuries

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Orlando, FL

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Objectives/Overview
- General Overview
- Injury Recognition and Prevention
- Injury Treatment
- Bridging the Gap from Rehab to Performance
- LE Progressions
- UE Progressions
- Kinetic Linking Progressions

Absolute and Relative
- Absolute
  - We often speak in absolutes to get point across
  - Used as a foundation of teaching/information sharing
- Relative
  - There are always different perspectives/point of references
    - Rehab/Performance
    - Individual Needs/Differences
  - There are always exceptions
  - Nothing is absolute
- Absolute and Relative
  - Both need to be considered when teaching/learning

Athletes’ Performance Goals

Relationships & Results

TRAINING & PERFORMANCE
OPEN
SKILL
PSYCHOLOGY
PHYSIOLOGY
TACTICS
EMOTION
CHARACTER
ENVIRONMENT
ALTITUDE
HEAT
COLD
HEALTH
NUTRITION
FOCUS
CONFIDENCE
COMMITTMENT
CLOSED
COMPLEX
OFFENSIVE
DEFENSIVE
SPECIAL
PASSION
SELF
CONTROL
ENERGIZED
INTEGRITY
RESPECT
CARING
FITNESS
OXYGEN
TRANSPORT
PHYSIOLOGY
POWER
STRENGTH
REST/FATIGUE
NUTRITION
FATIGUE
ABSOLUTE
RELATIVE
SPECIFIC
AEROBIC
ANAEROBIC
LACTIC
ANAEROBIC
ALACTIC
CENTRAL
PERIPHERAL
PULMONARY
SPEED
EXPLOSIVE
INJURY
DISEASE
OVER
TRAINING
RECOVERY
SLEEP
REPAIR
FUELS
HYDRATION
NUTRIENTS
Performance Training Continuum

**Performance Training Continuum**

<table>
<thead>
<tr>
<th>REHAB</th>
<th>REHAB (PREHAB) INTEGRATION</th>
<th>PERFORMANCE</th>
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<tbody>
<tr>
<td>EVALUATE</td>
<td>ISOLATE</td>
<td>INNERVATE</td>
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</table>

**MD:**
- Diagnosis
- Gameplan
- Psychology

**PT, ATC, CHIRO:**
- Decrease Pain
- Joint Function
- Compensation Patterns
- Psychology

**Performance Specialist:**
- Strength
- Movement Skills
- Metabolic
- Recovery/Regeneration
- Nutrition
- Psychology

**SKILL COACH:**
- Technical
- Tactical
- Psychology

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**Optimum Performance Pyramid**

- Buffer Zone
- Skill / Tactics
  - Performance Training
  - Efficient Movement Patterns
- Mobility / Stability
  - Fundamental Movements

Gray Cook, 2004

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**Over Powered Athlete**

- **SKILL**

  **High Injury Potential!!!**

- **FOUNDATION**

Gray Cook, 2001

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**Under Powered Athlete**

- **SKILL**

  **PERFORMANCE**

- **FOUNDATION**

Gray Cook, 2001

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**Under Skilled Athlete**

- **SKILL**

  **PERFORMANCE**

  **FOUNDATION**

Gray Cook, 2001

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**Understanding Injury:**

**Prediction & Prevention**

Gray Cook, 2001
Injuries and Illnesses Among United States Track and Field Athletes During International Competition from 2000 to 2009

Information taken from:
Jack Ransone, PhD, ATC
Texas State University
USATF National Convention
Indianapolis IN

Data compiled from these competitions (2000-2009)
- Olympic Games
- Pan American Games
- Outdoor/Indoor World Track and Field Championships
- World Cross Country Championships
- World University Games
- World Cup
- Outdoor World Junior Track Field Championships
- Ekiden Road Relays
- World Cup of Race Walking
- Junior Pan American Championships
- NACAC

Type of USATF Injury
- 33.8% Strain (n = 361)
- 16% Sprain (n = 173)
- 16% Illness (n = 172)
- 10.9% Tendonitis (n = 117)
- 4% Heat Illness (n = 45)
- 1% Fractures (n = 9)
- 0.01% Concussion (n = 2)
- 3% Soft Tissue — (burns, open wounds, contusions)

Body Part Injured-USATF
- 27.3% Hip / Thigh (n = 292)
- 19.7% General Body (n = 210)
- 17.5% Spine / Head (n = 187)
- 17.1% Lower Leg / Ankle / Foot (n = 182)
- 8.6% Knee (n = 92)
- 4.8% Shoulder (n = 52)
- 2.4% Wrist / Hand (n = 26)
- 1.5% Elbow (n = 17)

Action Taken with Injury
- 73.6% First Aid/ATC (n = 785)
- 47.9% Seen by Physician (n = 511)
- 1% Hospitalized (n = 11)

Why do highly trained athletes sustain non-contact injuries?
Why do these injuries become chronic?

Injuries

There are two main categories of injury

1. Acute
   - Contact & non-contact
   - Mechanism of injury

2. Chronic (overuse)
   - Insidious onset
   - No mechanism of injury
   - Repetitive microtrauma

Injury Prediction

<table>
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<tr>
<th>Acute Contact Injuries</th>
<th>Acute Non-Contact &amp; Chronic Injuries</th>
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<tr>
<td>Unpredictable!</td>
<td>Predictable?</td>
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<tr>
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<td>Possible causes…</td>
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<tr>
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<td>Mobility?</td>
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<td>Stability?</td>
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<td>Asymmetries?</td>
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<td>Poor functional movement?</td>
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</table>

What are the Risk Factors for Injury?

Prospective Cohort Studies

Prospective cohort studies

- Previous Injury
  - 24 Prospective Studies
  - Increased Injury Risk
    - 2-19x greater risk of injury

Modifiable Risk Factors
### Asymmetries
- Strength
- Flexibility
- Alignment
- ROM
- Joint Laxity


- Knapik, took seven lower body flexibility measurements and showed that athletes were 2.6 times more likely to suffer injuries if they had a hip extension flexibility imbalance of 15% or more. *Sports Med* (1992)
- Knapik indicated that no clear evidence was identified to implicate tightness or weakness of a particular muscle group with injury, but a significant amount of injuries were noted in athletes with right to left sided strength and flexibility imbalances (asymmetries).

### Dynamic Neuromuscular Control
- Hewett 2005
  - Increased knee ABDuction angle was 8 degrees greater and 2.5x greater ABD moment with landing in ACL injured
  - ACL injured had increased ground reaction force and decreased stance time

Zazulak 2007
- 277 collegiate athletes (140 female and 137 male)
- Trunk displacements (in response to sudden unloading)
- Proprioception (active repositioning error) and a History of low back pain, predicted knee ligament injury with 91% sensitivity and 68% specificity.

### Injury Risk Factors
- Previous Injury (24)
- Asymmetries (8)
- Dynamic Neuromuscular Control (7)
- BMI (5)

(All Prospective Studies)

### Other Injury Risk Factors
- Repetition
- Surface/Environment
- Postural Alignment
- Improper Biomechanics
- Poor Footwear/equipment
- Over-training/improper training
Either we are not fully rehabilitating these athletes/patients

OR

Something fundamentally changes after injury

OR

BOTH?!

What is the “something” that fundamentally changes after injury?

MOVEMENT PATTERNS CHANGE

• Athletes with a history of LBP (asymptomatic at time of testing) were slower on the 20 M shuttle run than matched controls with no history of LBP

Why Movement?

“The motor system functions as an entity, it is in principle a wrong approach to try to understand impairments of different parts of the motor system separately, without understanding the function of the motor system as a whole”

Why Movement?

Nadler ’02 Arch Phys Med Rehabil

Janda ’64
"The observation of whole movements may redirect and broaden the clinical focus by revealing limitations unrelated to the medical diagnosis but pertinent to restoration of normal function."

Cook 2001

Why Movement?

So if movement is so important, what do we do about it?

How do we get our athletes from the table, back to the track?

- Movement-based evaluation and treatment system
  - Evaluate and treat the cause not only the source of the athlete’s pain
  - Progressive tissue loading
    - Stress → Recover → Adapt
  - Blending rehabilitation/performance training/technical work is an art
  - Athletes start at different places in the continuum
  - Develop a plan and work the plan backwards

Performance PT Philosophy

- Look at the body as a whole, not individual parts
- One part of the kinetic chain will effect the others
- Normalize function within their movement pattern

Performance PT Philosophy

- Can’t truly get normal function lying on the table
  - Table work is necessary but we need to keep an eye on the ultimate goal:

  **IMPROVE MOVEMENT!!!!**

Performance PT Philosophy

Functional Rehabilitation and Training

"Preparing like you play!"

A sport and athlete specific prescription of progressive, integrated multi-joint, multi-planar, proprioceptively enriched, movements at various loads and speeds.
Performance PT Philosophy

- Pillar Strength
- Posture and Movement
- Soft Tissue Dysfunction
- Sites of Common Movement Dysfunction
- Kinetic Linking/Elasticity

Bridging the Gap

- Bridging the Gap Between Rehab and Performance
- We must be able to speak to both ends
- Returning an athlete to sport vs. rehabilitating and injury
- Two different mindsets

Rehab Philosophy

**The Pillar**

- Evolving the concept of core stability
- More inclusive concept
- Core stability should NOT equal abdominal strength!
- Involves scapula, trunk, and hips

Rehab Philosophy

**Pillar Strength:**
The foundation for kinetic linking

The dynamic relationship of the 3 parts of the pillar create a stable base to move from

- Scapulae
- Trunk
- Hips

Lack of Pillar Strength

Lack of Pillar Strength

- Instability and Loss of Energy

Pillar Strength Training in Action
Pillar Strength = Power Output

- Pillar Strength & Joint Mobility
- Muscular Strength & Flexibility
- Neural Programming

Stability as a limiting factor to Power Output

Posture and Movement

A working relationship

- Posture affects movement, movement affects posture
- Poor sensory input (proprioception) and myofascial trigger points will alter the ability and quality of movement
- Inefficient posture can result in inefficient movement, which produces an energy leak

“A CHANGE OF FUNCTION OF THE MOTOR SYSTEM EVOKES CHANGES IN THE MUSCULAR SYSTEM”

(Janda, 1982)

Ideal Alignment/Posture

- Upright posture
  - Co-activation of flexors and extensors
  - Co-activation of adductors/abductors
  - Co-activation of internal/external rotators

Poor Alignment/Posture

- Balance is disturbed in the body
- “Old system” takes over
- Occurs with injury, central nervous dysfunction, and even fatigue

Trigger Points

“Myofascial trigger points represent the most typical source of pain in disturbed motor function.”


Trigger Points Role in Stability

- “Their role in pathophysiology, however, is to restrict movement where the stabilizing role of the deep stabilization system is impaired, in order to compensate lost stability by reducing mobility.”

Kinetic Linking

- Based on production or transfer of distal movement from a proximal stable base
- Effects force production
- Effects injury potential
- Occurs between the extremities via the pillar

Kinetic Linking

A Biomechanical Analysis of a Golf Swing

Implementation

Training Program Components

- Evaluation
- Planning
- Prescription/Implementation
  - Prehabilitation/Pillar Strength
  - Movement Preparation
  - Movement Skills
  - Strength
  - Energy System Development
  - Regeneration/Recovery

Evaluation

- Athlete/Support Team Interview
- Functional Movement Screen
- Upper and Lower Quarter Screens
- Joint Function Evaluation
- Requirements of the Sport and Position
- Performance Tests (Field Tests)
- Strength (Traditional)
  - Olympic, Squat, Bench, Dips, Push-Ups, etc.
- Metabolic
  - Peak VO2
  - AT Threshold

"As to methods there may be a million and then some, but principles are few. The man who grasps principles can successfully select his own methods. The man who tries methods, ignoring principles, is sure to have trouble."

-Ralph Waldo Emerson
### Implementation

**Training Program Components**
- Evaluation
- Planning
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- Strength
- Energy System Development
- Regeneration/Recovery

### Planning Questions
- What Are Your Most Critical Beliefs?
- How Have You Scripted These Into Day 1, Wk1, Cycle 1?
- Key Dates
  - What are the athletes goals and time frames?
  - Sport Goals, Athlete Goals, Program Goals
  - Where Do We Unload The Athletes?
    - Critical Camps, Competitions, etc.
    - Facility & Equipment Availability

### Monthly Planning
- Create Long Term Goal
- Create Short Term Goals Based off of Long Term Goal
- Create Weekly Goal Based off of Short Term Goal
- Create Daily Treatment Plan to Attain Weekly Goal

*Daily Treatment Plan Should Be Created With a Purpose!*

### Rehabbing Athlete Daily Plan

**Coaching Session**
- Warm Up
  - Pre-Hab/Activation
- Plyometrics/Neural Activ.
- Movement Skill/Application
- Total Body Speed/Power
- Prim/Sec. Strength Superset
- Supplemental Circuit
- Conditioning
- Regeneration/Recovery

**Rehab Session**
- Manual work
  - Joint mobs, soft tissue
- Manual exercises
- Corrective exercises/activation techniques
- Strength work
  - Within injury confines
- Additional Manual Work
  - Lymph drainage
- Modalities

### Integrated PT Athlete Daily Plan

**Movement Session**
- Manual Work
- Jt Mobs, ROM, STM
- Pre-hab/Pillar Strength
- Movement Prep
- Neural Activation
  - Low amplitude
  - High velocity
- Pyo
- Skill
- Skill Application
- Conditioning
- Regeneration/Recovery
- Nutrition

**Strength Session**
- Manual Work
- Jt Mobs, ROM, STM
- Warm-Up' Pillar Strength
- Neural Activation
- Power
- Primary/Secondary Strength/Flexibility
- Supplemental Strength/Prehab
- Conditioning
- Regeneration/Recovery
- Nutrition
Implementation

- Understand the demands of your athletes
- Learn from the strength coaches, nutritionist, exercise physiologists
- Be part of a TEAM!
- Bridge the gap between rehab and performance
- Returning an athlete to sport vs. rehabilitating and injury
- Two different mindsets

Guidelines for Implementation

Clear Joint Function

- Mobility → Stability → Contractile Continuum
- Movement Demands – Athlete Ability – Exercise

QUALITY OVER QUANTITY!!!

- Work Progressions and Regressions
- Exercise Selection Critical
- Place Athlete in Position to Execute Excellence (Achieve Then Challenge)

Movements to be Addressed

- Pre-hab/Pillar strength
- Movement Prep
- Neural activation / plyos
- Movement Skills
- Strength

Common Prehab/Pillar Strength Needs

- Glute Function
- Hip Mobility
- T-Spine Mobility/Stiffness in Chest
- Lumbar Spine/Pelvic Instability
- Shoulder Mechanics

Glute Function

- Hip Extension- Prone

Glute Function

- Glute Bridge- Adduction
Glute Function
Standing External Hip Rotation - Miniband

Glute Function
Miniband Walk - Lateral Bent Knee

Hip Mobility
Quadruped Rocking

Hip Mobility
Standing Squat Mobilization

Lumbar Spine/Pelvic Stability
Rotational Fall Out - Supine

Lumbar Spine/Pelvic Stability
Diagonal Arm Lift
Lumbar Spine/Pelvic Stability
Supine Running

Shoulder Mechanics
Core Board Twist

Shoulder Mechanics
Wall Walk

Achieve Clean Movement Patterns
- NOT only prehab exercises
  - We MUST integrate into performance and skill training
- Concepts apply across all types of movement
  - Coach EVERY rep of EVERY exercise
  - Daily living - posture
- EVERY exercise prescribed is a possible correction OR a possible negative reinforcement
- Means to an end
  - POWER!

Movement Preparation
- Elevation of Core Body Temperature
- Elongation of Musculature Actively
- Facilitation of Nervous System Activation
- Enhance Proprioception & Stabilization
- Execution of “Active” Motor Programs Required in Competition
- Use it to transition the athlete from the table to the field!

Movement Prep Session
Neural Innervations/Plyometrics

- **Movements:** Linear, Lateral, Vertical and Rotational
- **Execution:** Rapid, Short, Long, Very Long
  - Rapid Response great for rehabbing athlete (low F); Very Long Response produces most force and requires most stability; Short Response produces most power!
- **Keys:** Reduce Coupling Time \(\rightarrow\) Increase Power \(\rightarrow\) Decrease E expenditure for athlete \(\rightarrow\) Decrease injury potential

WHY PLYOMETRIC TRAINING?

- Decreases Potential for Injury
  - Improves Tolerance to Stretch Loads
  - Improves Efficiency/Energy Return
  - Improves Dynamic Stabilization
- Improves Performance
  - Improves Explosive Power
  - Improves Reaction/Responsiveness
- Movement is Plyometric!

Movements Progressions

- **Lower Body (Plyometrics)**
- **Movement Initiation (Jump-Hop-Bound)**
  - Eliminate Gravity/Stability Focus
    - NCM-CM to Box
  - Introduce Gravity/Stability Focus
    - NCM-CM
    - Double Contact (Stability vs. Continuous)
    - Continuous
    - Additional Load

Reduce Coupling Time = Power

Movement Skills

- Linear
  - Acceleration
  - Transition
  - Absolute
  - Deceleration
- Jumping
- Landing
  - Multidirectional
    - Basic
    - Shuffle
    - Change of Direction
    - Crossover
    - Dropstep
    - Backpedal

An Interplay of Mobility/Stability/Strength

What prep work has your injured athlete done to return to running?

Running Continuum

- **Start:** 0-10 Yards
  - Explore
  - Posture
  - Hips Tall
  - Hip Up
  - Step Over Shin
  - Toe Up, Heel Up
- **10-20 Yards:**
  - Push, Push, Push
  - Claw Down (Push Back)
  - Step Over Opposite Knee
  - Cycle (Claw) Down To Ground
- **20-400 Yards:**
  - Focus
  - Push, Push, Push
  - Claw Down (Push Back)
  - Step Over Opposite Knee
  - Cycle (Claw) Down To Ground

Until you learn these movements, your rehab will be a fraction of what it could be. YOU ALL ARE THE EXPERTS!
**Return to Linear Movement**

- Clear and restore ROM and joint function
- Progress speed, choose low amplitude force
- Rapid response
- Introduce Movement Preparation
- Active Elongation
- Preparation for specific skill
  - Concentric work
  - Elastic work

**Return to Acceleration**

**Establish baseline stability in acceleration position**

- Pillar bridge
- Pillar bridge on bench
- Mountain Climber
  - Unilateral vs. reciprocal
- Standing Cook March
- Wall drill- acceleration posture
- Wall drill- march
- Wall drill- load and lift
  - Double leg vs. single leg
- Wall drill- up/ down
- Wall drill- single exchange
- Wall drill- triple exchange
- TRX- posture hold
- TRX- march
- TRX- single exchange
- TRX- triple exchange

**Return to Absolute Speed**

- First consider:
  - *Do they need it?*
- Heavy load on hamstrings
- Establish baseline stability in absolute speed
  - Same as acceleration
  - Wall drills- absolute speed posture
  - Wall drills- single exchange
  - Wall drill- double exchange

**Strength Training Movements**

- Upper Body Push
  - Horizontal and Vertical
- Upper Body Pull
  - Horizontal and Vertical
- Lower Body Push
  - Double Leg and Single Leg
- Lower Body Pull
  - Double Leg and Single Leg
  - Hip vs. Knee Dominant
- Rotary

How does the rehabbing athlete fit in with the rest of your athletes?
**Contractile Continuum**

- Assisted Movements
- Free Movements
- Reactive Movements
- Rotational Movements
- Explosive Strength
- Max Strength
- Eccentric
- Limit Strength

Optimal Strength

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**Lower Body Push**

All of these strategies are LB Pushes but all accomplish different things with different emphasizes.

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**Rotary Strength Progressions**

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**Recovery and Regeneration**

Training + Recovery = "Work + Rest = Success"

- Many available means to aid / enhance recovery / regeneration from training / competition.

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**Soft Tissue and Joint Mobility Options**

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**Nutrition**

"Nutrition can make a good athlete great, or a great athlete good."

- Post-Workout Nutrition
- Hydration
- Alcohol Consumption
- Natural anti inflammatories/Supplementation
- Proper caloric intake
Flow

- Never absolute!
  - Pre-hab/Pillar strength
  - Movement Prep
  - Neural activation / plyos
  - Movement Skills
  - Strength

Progressions

- FMS, Corrective Exercise, to Performance
  - Progressive loading/rate of loading of tissue
    - Many of the more basic progressions can be done early on
  - Simple to Complex
  - Slow to Fast
  - Stable to Unstable
  - Gravity Limited to Hyper-Gravity
  - Mastery then Progress to the Next Limiting Factor
  - Rate of Force Development
  - Pre-Programmed to Random
  - Rapid & Long to Short Response

Designing Performance Progressions

<table>
<thead>
<tr>
<th>Lin-Vert</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
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<tbody>
<tr>
<td>Movement 1</td>
<td>Initial</td>
<td>Advanced</td>
<td>Pre</td>
<td>Advanced</td>
<td>Pre</td>
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<tr>
<td>Movement 2</td>
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Manage Limiting Factors

- Skill
- Performance
- Mobility
- Pillar Strength

Adapted, Cook, 2001

Remember, we Rehab and Train to Enhance Movement

Risk vs. Reward!
### Injury Treatment and Prevention References

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- Anything
- Stuart McGill
  - Low Back Disorders
  - Ultimate Back Fitness and Performance
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  - Diagnosis and Treatment of Movement Impairment Syndromes
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  - Thera-Band Academy "The Janda Approach to Musculoskeletal Pain"
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  - www.kineticcontrol.com
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  - Anatomy Trains
- Florence Kendall
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  - Prague School

### Athletes' Performance

Mentorship Program Information
www.athletesperformance.com