Childhood and Adolescent Sports Specialization and Overuse Injuries

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No Disclosures Exist with this Presentation
Objectives

• Review the pediatric anatomy, growth and development related to overuse injuries
• Describe the most common pediatric overuse injuries
• Recognize risk factors and identify recommendations for injury prevention
• Discuss the psychology of sports burnout and burnout prevention
Between 30-60 million children/adolescents participate in team or individual sports

Each year 3.5 million children < 14yo are treated for sports related injuries (~45% are overuse injuries)

A shift in youth sports culture from recreational play to single sport specialization

Increasing incidence of overuse injuries, psychological stress and withdrawal from competitive sport

Background
Mechanism of Injury

Repetitive submaximal loading causes microtrauma...

Microtrauma coupled with inadequate recovery...

PREVENTS Remodeling and adaptation of tissues
Mechanism of Injury

- Imbalance between loading and recovery causes injury if mechanical loading > the body's remodeling capacity → injury

Intrinsic Contributing Factors

- Previous injury is most predictive
- Adolescent growth spurt
  - Peak at 12 years in females, 14 years in male
  - Tissues are less able to accommodate the stress forces
- Previous level of conditioning – poor condition → bone stress
- Anatomic factors (alignment, ligamentous laxity)
- Irregular periods/Female Athlete Triad
Extrinsic Contributing Factors

• Training volume and overscheduling
  – Failure to incorporate scheduled rest
  – Increased frequency, duration or volume, multiple teams
  – Sport specialization

• Lack of sleep

• Equipment

• Sport technique

• Psychological
Office Evaluation - **History**

- Onset
- Location
- Relation to activity
- When pain occurs
- Training errors

- Days of rest
- Previous injury
- Menstrual status
- Growth Spurt
Office Evaluation

Exam
• Localize injured tissue
• Recreate loading pattern
• Alignment, laxity and tone
• Neurovascular status

Diagnostic Studies
• Not always needed
• XRay, CT, MRI, Bone Scan
General Treatment Principles

Protect the body by reducing load with modification of activity

Ice & Analgesics

“Rehab” to strength, add flexibility/increase proprioception

Avoid re-injury with education, keeping schedules, limiting training errors

Goal is to promote healing while developing strong tissues allows for quicker return to play.
Anatomic Sites For Overuse Injuries

- Growth plate
  - Apophysitis

- Muscle-tendon unit

- Bone/articular cartilage

- Generalized burnout
Growth Plate Injuries

Closed Growth Plate

Open Growth Plate
Label the parts of a growing bone from bottom to top
A. Epiphysis, Physis, Metaphysis, Diaphysis
B. Physis, Metaphysis, Epiphysis, Diaphysis
C. Epiphysis, Metaphysis, Physis, Diaphysis
D. Diaphysis, Epiphysis, Physis, Metaphysis
Answer: A

**Diaphysis:** Shaft of the long bone

**Metaphysis:** Part that fans out that leads toward the end of the bone

**Physis:** Cartilaginous area of rapid bone growth

**Epiphysis:** Distal to the physis

**Apophysis:** Epiphysis that arises from an outgrowth of bone that does not attach to another bone (i.e. tibial tuberosity or calcaneus)
Growth Plate Injuries: **Epiphysis/Apophysis**

- Injury if bone grows faster than the tendon lengthens
- Weak cartilage relative to tendon
- Risks of avulsion fracture
Sever's Disease
(Calcaneal Apophysitis)

Mechanism
- Repetitive Achilles pull on calcaneal apophysis
  - Running, jumping, heel striking

Presentation
- Heel pain
  - Start of season or during growth spurt

Examination
- Point tender at insertion of Achilles on calcaneus
- Calcaneal compression test

Diagnosis
- Clinical
- Imaging rarely indicated

Treatment
- PRICE
- Heel cups
- Calf muscle stretching/strengthening
Osgood Schlater (Tibial Tuberosity Avulsion)

**Mechanism**
- Repetitive patellar strain on tibial tuberosity
  - Jumping, kneeling

**Presentation**
- Knee pain +/- swelling/tenderness
- In season

**Examination**
- Point tender
- Bony prominence

**Diagnosis**
- Clinical
- XRay/US

**Treatment**
- PRICE
- Strengthen quadriceps
Pelvic Apophyseal Avulsion Fracture

**Mechanism**
- Forceful muscle contraction
  - **Rectus Femoris**
  - **Sartorius**
  - Hamstring
  - Tensor Fasciae Latae
  - Iliopsoas
  - Rectus Abdominis

**Presentation**
- Sudden onset of pain
- Pop/Cracking

**Examination**
- Local tenderness +/- swelling
- Restricted ROM

**Diagnosis**
- Xray

**Treatment**
- RICE
- Non operative vs operative repair (degree of deplanement)
Little League Elbow (Medial Apophysitis)

Mechanism
- Repetitive valgus load from ulnar collateral ligament on medial epicondyle when throwing

Presentation
- Elbow pain in throwing
- Decreased velocity, accuracy, distance

Examination
- Point tenderness over medial epicondyle
- Pain with valgus stress

Diagnosis
- XRay
- MRI

Treatment
- RICE
- Activity modification
- Physical Therapy
- Wrist and elbow strengthening
Growth Plate Injuries - **Physis**

- Occur with repetitive loading which widens the physis
- Results in complete or partial growth arrest
Little League Shoulder
(Proximal Humeral Epiphysiolysis)

Mechanism
- Repetitive loading of the humerus as a result of muscle weakness

Presentation
- Shoulder pain that worsens by throwing/overhead activity

Examination
- Tenderness at the lateral proximal humerus

Diagnosis
- US
- XRay
- MRI

Treatment
- Cessation of throwing 2-3 months then throwing program when pain free
Bone and Articular Cartilage Injuries

**Stress Fractures**

- Bone breaks after being subjected to repeated stresses, none of which would be large enough individually to cause the bone to fail.

- Stress fractures may be the result of a small number of repetitions with a relatively large load, many repetitions with a usual load, or a combination of the two.
Bone and Articular Cartilage Injuries Cont.

Stress Fractures

Mechanism
- Prolonged walking, running, or jumping

Presentation
- Gradual progression of activity-related pain over several weeks
- Increase in training intensity

Examination
- Point tenderness at one specific area
- Local swelling
- (+) "Hop test" or "Tuning Fork test"

Diagnosis
- XRay/US
- MRI/Bone scan

Treatment
- RICE
- Stabilization +/- weight bearing
- Surgical fixation
"Do-not-miss" Stress Fractures

Can result in significant time away from sport and even risk of future participation!

- Pars Interarticularis
- Femoral Neck
- Patella
- Anterior Tibia
- Medial Malleolus
- Talus
- Tarsal Navicular
- 5th Metatarsal
- Sesamoids
Bone and Articular Cartilage Injuries Cont.
Lumbar Spondylolysis and Spondylolisthesis

Mechanism
• Usually overuse injury involving repetitive increased spinal loads/motion (L5 vertebrae most commonly)

Presentation
• Activity-related pain increases gradually progressing to pain at rest
• Low back pain with lumbar extension

Examination
– Pain with lumbar extension or sport-specific movement
– Antalgic gait
– "Stork test"

Diagnosis
– XRay
– MRI

Treatment
– RICE
– Surgical fixation
Which segment demonstrates the classic “Scottie Dog Deformity?”

A. L3
B. L4
C. L5
D. S1
Answer: C

Which segment demonstrates the classic “Scottie Dog Deformity?”

A. L3
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D. S1
Sport specialization increases injury risk for high school athletes, study finds

Youth Sports Have Gotten Too Crazy. They Should Relax.
Kids are walking away from the action early—the solution may be turning down the volume

How to Avoid Burnout in Youth Sports

Keeping the Fun in Children's Sports
“The evidence shows that what makes sports really fun for kids is trying hard, making progress, being a good sport, experiencing positive coaching,” a doctor of sports medicine said.

Guidelines for Young Athletes to Reduce Injuries
How Parents Can Set Age-Specific Time Limits

Are Some Youth Sports Too Intense?
Should there be limits on how much time students devote to sports each week?

Red Flag on Kids, Sports and Injuries
Burnout and Psychological Impact

- Overreaching and overtraining
- Chronic stress that causes the athlete to no longer enjoy the sport and stop participating
- Early sports specialization higher likelihood for withdrawal from the sport due to injury or burnout
- Psychological component
ONE SPORT BY AGE 12

Across all three divisions by sport, the percentage of female college athletes who specialized in their sport by age 12,
(Top 10 sports listed.)

- Gymnastics: 88%
- Soccer: 61%
- Ice Hockey: 57%
- Swimming: 53%
- Tennis: 49%
- Basketball: 44%
- Softball: 44%
- Volleyball: 23%
- Golf: 18%
- Lacrosse: 18%

Across all three divisions by sport, the percentage of male college athletes who specialized in their sport by age 12,
(Top 10 sports listed.)

- Soccer: 63%
- Ice Hockey: 59%
- Tennis: 45%
- Basketball: 40%
- Baseball: 37%
- Football: 35%
- Golf: 28%
- Wrestling: 24%
- Lacrosse: 20%

At least 90 percent of female college athletes in these sports say they started competing by age 9:
- Gymnastics 99%
- Soccer 94%
- Softball 90%
- Ice Hockey 90%

At least 90 percent of male college athletes say they started competing in these sports by age 9:
- Ice Hockey 97%
- Baseball 96%
- Soccer 92%

http://www.ncaa.org/champion/after-school-specialized
29 of 32 first round draft picks were multi-sport athletes in high school.
Prevention

• Preparticipation Exams
• Proper parental and coaching supervision
• Sport readiness

• Ensure rest and recovery/avoid overscheduling
  – 1-2 d of rest each week; 1 extended time off yearly
  – Max hours/week = age in years
  – Limits on repetitive movements (e.g. pitch counts)
  – Sleep - >7h per night reduces risk of overuse injury
• Diversified sports training in early and mid-adolescence more effective to develop elite skills
Prevention

• Delaying single-sport specialization
  – AAP recommends waiting until adolescence
    • No data to support risk
    • Only data to support improved elite-level skills
  – AMSSM Statement:
    • Early sport specialization may not lead to long-term success in sports and may increase risk for overuse injury and burnout.
Sports Volume Recommendations for Youth Athletes

3 Things Youth Athletes Should NOT Do

1. Youth athletes should NOT participate in multiple leagues of the same or different sports at the same time.

2. Youth athletes should NOT participate in more hours of organized sport per week than their age.

3. Youth athletes should NOT play one sport >8 months per year.

Have Fun!
5 Strategies to Prevent Burnout In Youth Athletes

1. Create a training environment that fosters perceived competence and having fun

2. Encourage multiple sport participation, as opposed to single sport specialization

3. In striving for perfection, the athlete must have realistic expectations and be able to accept less than perfect performance

4. Avoid pressuring the athlete; perceived coaching and parental pressures lead to burnout

5. Allow the athlete to have autonomy and ownership over the sport experience
Summary

Overuse injuries are common in children and adolescents and require prompt evaluation.

Be especially aware during the adolescent growth spurt and those with prior injury.

Delaying early sport specialization should be carefully considered.

With proper prevention techniques and monitoring, overuse injuries can be decreased.
Questions
References