Arm Injuries in Young Throwers

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Special Thanks

Disclosures (none)

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EMMANUEL ATHLETICS

- Define causes of youth arm injuries
- Differences between adolescents and adults
- Emphasize importance of preparation
- Discuss common injuries specific to adolescents
  - Recognition and prevention

Objectives

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- Overuse injuries are responsible for ½ of all sports injuries to middle and high school students
- 62% of organized sports-related injuries occur during practice, 1/3 of parents do not have their children take the same safety precautions at practice that they would during a game
- 20% of children ages 8-12 and 45% of ages 13-14 will have arm pain during a single youth baseball season

The problem

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- By age 13, 70% of kids drop out of youth sports. Top 3 reasons: adults, coaches and parents
- According to the CDC, more than half of all sports injuries in children are preventable
- Since 2000, 5x increase in S/E injuries

The problem

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Acute

- Sudden trauma such as sprains, strains, bruises and fractures

Overuse

- Series of repeated small injuries
- *micro*traumatic injury that results when an anatomic structure is exposed to a repetitive, cumulative force where the body's reparative efforts are exceeded and local tissue breakdown occurs
- Key concept: overuse injuries occur over time

Acute vs Overuse Injuries

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Causes of overuse injuries

Intrinsic

- Mal-alignment of body parts
- Instability of joints
- Imbalance of muscle strength
- Weakness of muscles
- Inflexibility
- Rapid growth

Extrinsic

- Training errors
- Equipment mismatch
- Technique error
- Environmental factors

Adapted from deWeber, K. Managing overuse injuries

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Adolescents vs adults

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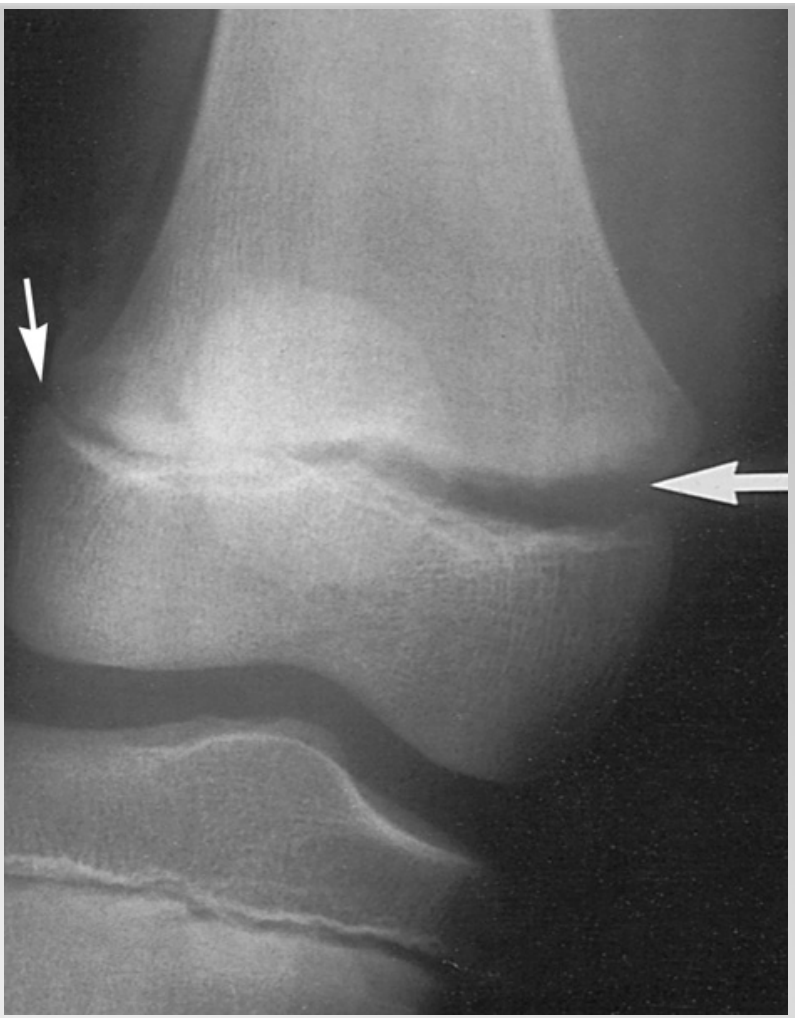
- Growth plate (physis) cartilage less resistant to stress than adult articular cartilage
- Less resistant to shear and tension than adjacent bone
  - Failure occurs through physis
- Physis 2-5 times weaker than fibrous tissue
- Normal Growth plate arrest
  - Girls 13-15
  - Boys 15-17



Growth plate injury

- Unique to the growing athlete
- Muscle-tendon imbalance during periods of rapid growth
- Increased susceptibility to repetitive microtrauma

Growth is a risk factor

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- Tissue overload, leads to...
- Tissue injury, leads to...
- Functional biomechanical deficit, leads to...
- Adaptive change in technique
  - leads to more tissue overload, and the cycle continues

Injury Cycle of overuse

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Vicious Injury Cycle of overload

Musculotendinous overload

Clinical symptoms
Decreased performance

Substitute biomechanical movements

Muscle damage

1. Microtears
2. Macrotears

Subclinical adaptations

1. Muscular weakness
2. Inflexibility
3. Scar tissue
4. Muscle strength imbalance

Adapted from deWeber, K. Managing overuse injuries

- Stage 1: Pain after activity, no functional impairment
- Stage 2: Pain during and after activity with minimal functional impairment
- Stage 3: Pain during and after activity that persists throughout the day, significant functional impairment
- Stage 4: Significant functional impairment with all daily activities

Classification of overuse injury

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- Athletes normally recognize early stages of tendinosis
- Key is education about early signs
- Coaches and trainers must know what types/amounts of activity put athletes at risk

Early Signs

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- Critical to an athlete's success
  - Helps prevent short and long term injury
- Coaches at all levels must educate
- Must maintain work-rest balance

Preseason Training

- Varies from different sports and levels
- 10 percent rule
- Should take min 6-8 weeks training prior to season
- Interval throwing program

Preseason Training

- Initially focus on improving core strengthening and balance
- Also vital to improve overall CV fitness
  - Helps even in anaerobic/explosive activities

Preseason Training

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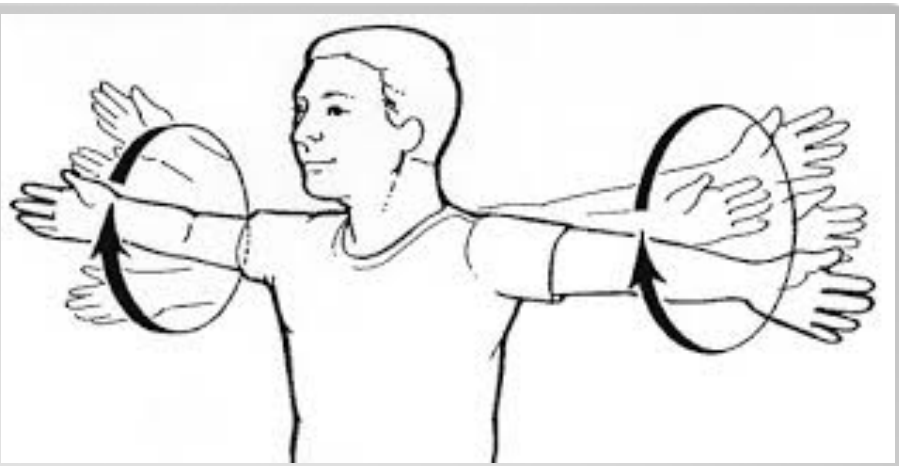
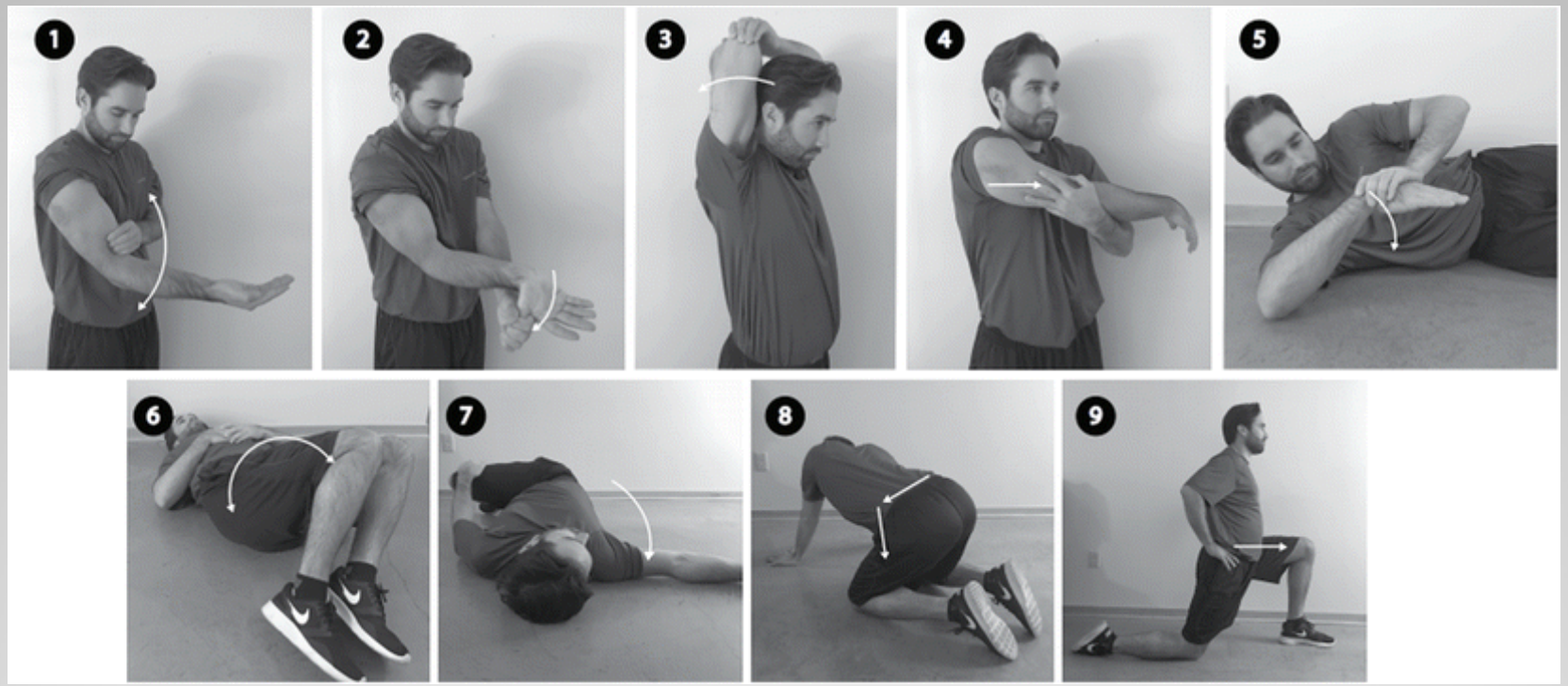
- Consider dynamic warm-ups
- Some evidence that static stretching decreases explosive performance
  - Also may not reduce the risk of injury
- Evidence that static stretching can be helpful post workout



Warming Up

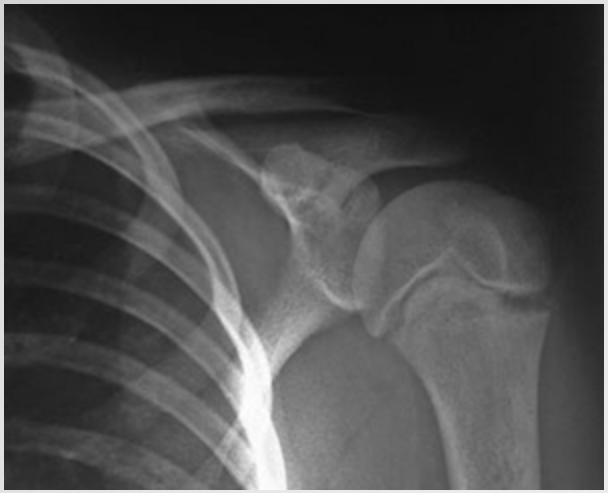


Yokohama Baseball 9 protocol

Sakata AJSM 2017

- Little League Shoulder and Elbow
- Acute injuries

Specific injuries



- Overuse injury to proximal humeral physis
- Repetitive forces result in growth plate damage
- Overhead sports
- Comb of growth plate weakness and muscle imbalance

Little League Shoulder

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- Gradual onset of upper arm/shoulder pain
- Signs include arm pain, fatigue, and decreased function
- Typically tender at top of arm, RC weakness

Little league shoulder

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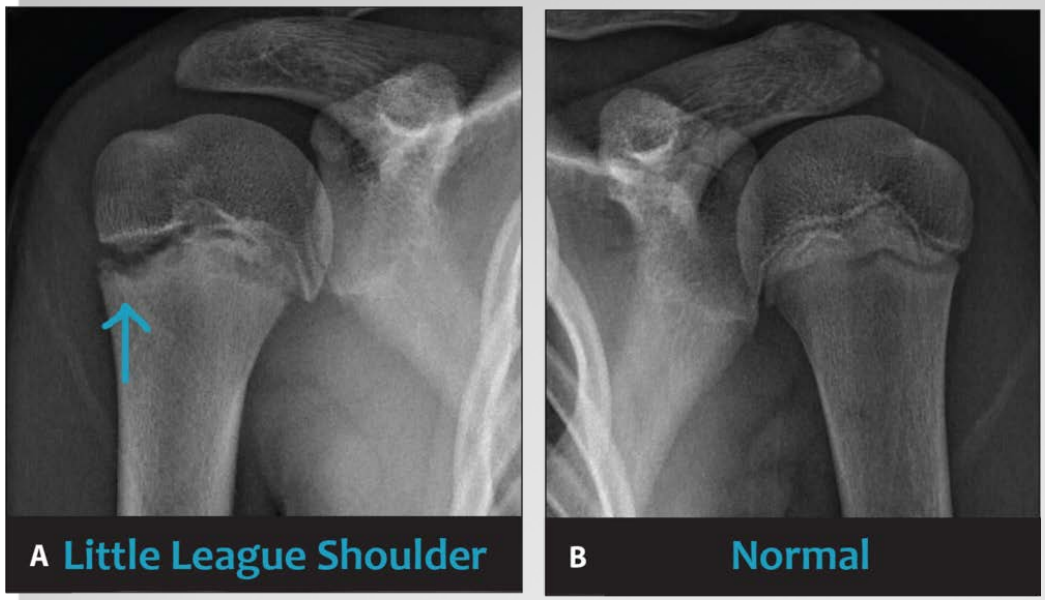
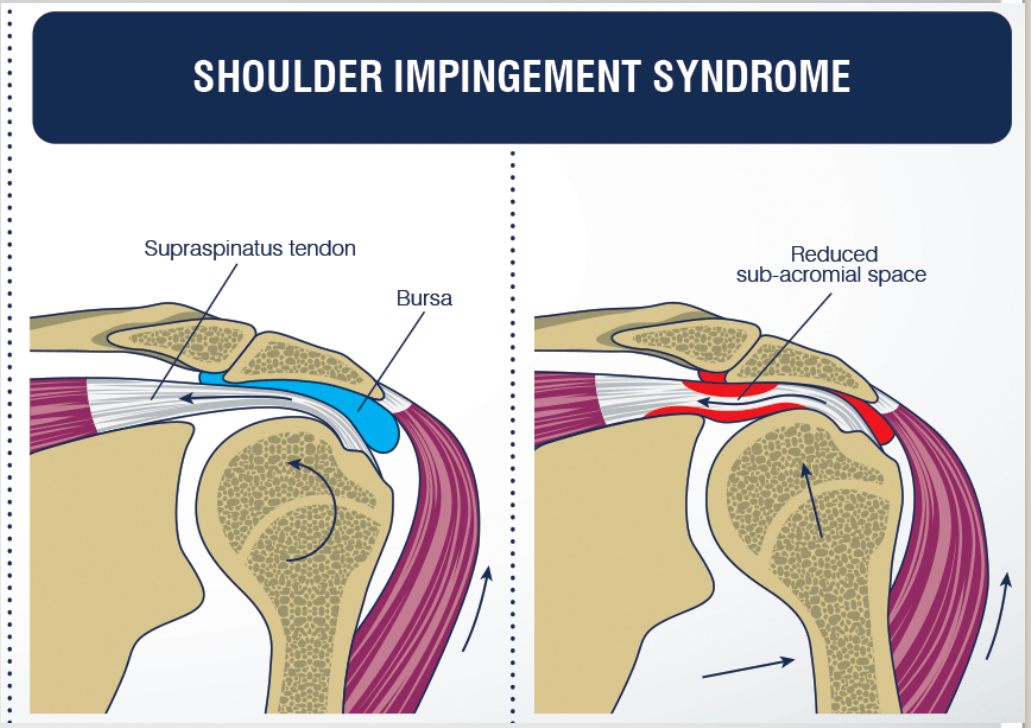


- REST
- No throwing for at least 3 months
- RC strength/motion
- Gradual interval throwing program

Treatment

- Common in overhead athletes
- Can be do to bony anatomy (intrinsic) or overuse (extrinsic) factors
- Treatment: Rest, NSAIDs, PT
- Gradual return to play



Rotator cuff tendinitis

- Common in baseball and tennis players
- Injury to medial elbow physis
  - Can be acute or chronic
- Medial elbow tensile stress
- Ligament damage in adults

Little league elbow

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- Gradual onset of pain, decreased motion, performance
  - Also acute
- TTP medial elbow
  - Also can be lateral
- Xrays can be normal
  - Typically widening of medial physis

Little league elbow

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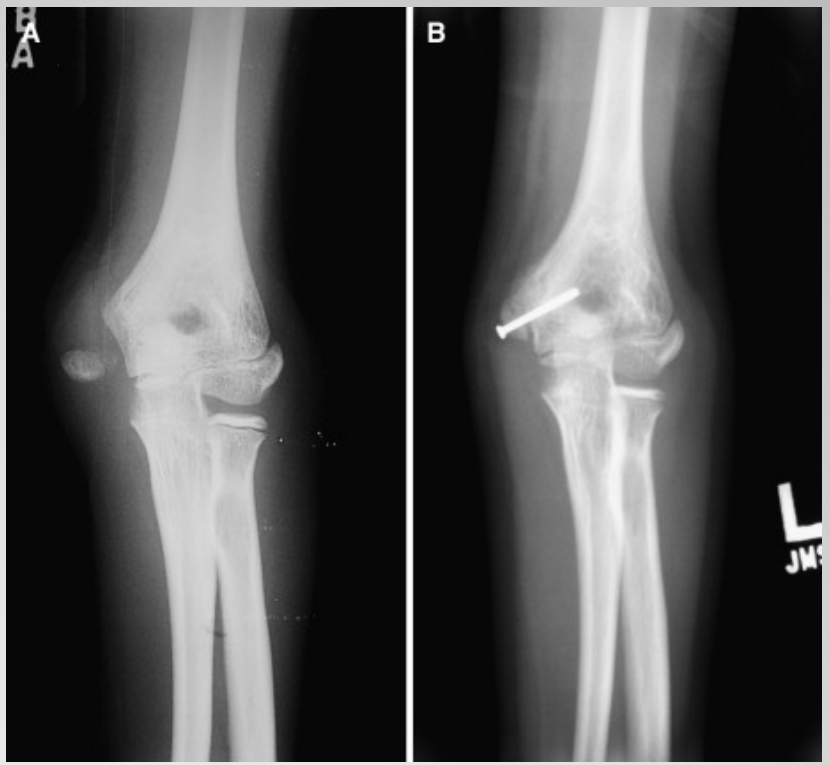
- Stress lesions
  - 8-12 weeks rest, followed by rehab, throwing
- Avulsion fracture
  - Occasional surgery



Treatment

- Fragmentation of capitellum
- Common in youth baseball players
  - M>F
- Can be treated cons. in early stages
  - Later stages require surgery
- Prevention of utmost importance

Capitellum Osteochondritis Dissecans (OCD)

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Risk Factors for Shoulder and Elbow Injuries in Adolescent Baseball Pitchers

Samuel J. Olsen II, MD, Glenn S. Fleisig,* PhD, Shouchen Dun, MS, Jeremy Loftice, and James R. Andrews, MD
From the American Sports Medicine Institute, Birmingham, Alabama

- Likelihood of sustaining a shoulder or elbow injury
  - 5x more likely if pitch > 8 months/year
  - 4x more likely if average > 85 pitches/app
  - 36x more likely if player pitches through arm fatigue
    - AJSM 2006

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Authors' Safety Recommendations for Adolescent Baseball Pitchers

1. Avoid pitching with arm fatigue.
2. Avoid pitching with arm pain.
3. Avoid pitching too much. Further research is needed on this topic, but reasonable limits are as follows:
   a. Avoid pitching more than 80 pitches per game.
   b. Avoid pitching competitively more than 8 months per year.
   c. Avoid pitching more than 2500 pitches in competition per year.
4. Monitor pitchers with the following characteristics closely for injury:
   a. Pitchers who regularly use anti-inflammatory drugs or ice to "prevent" an injury
   b. Regularly starting pitchers
   c. Pitchers who throw with velocity >85 mph
   d. Taller and heavier pitchers
   e. Pitchers who warm up excessively
   f. Pitchers who participate in showcases

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Risk of Serious Injury for Young Baseball Pitchers

A 10-Year Prospective Study

Glenn S. Fleisig,[*†] PhD, James R. Andrews,[*] MD, Gary R. Cutter,[‡] PhD,
Adam Weber,[*‡] BS, Jeremy Loftice,[*] BS, Chris McMichael,[*‡] MPH,
Nina Hassell,[*] MPH, and Stephen Lyman,[§] PhD
Investigation performed at the American Sports Medicine Institute, Birmingham, Alabama

- 3.5x more likely to be injured if pitches more than 100 innings/year
- 5% risk of injury during 10 year study period
- Slight increased risk (not sig.) in athletes to pitch and catch
  - AJSM 2011

Risk-Prone Pitching Activities and Injuries in Youth Baseball: Findings From a National Sample

Jingzhen Yang, Barton J. Mann, Joseph H. Guettler, Jeffrey R. Dugas, James J. Irrgang, Glenn S. Fleisig and John P. Albright

- Likelihood of sustaining an arm injury
  - 8x more likely if arm feels "tired"
  - 7.5x's more likely if arm is "painful"
- Likelihood of developing arm pain…
  - 2.5x's more likely if pitched on consecutive days
  - 1.85x's more likely if pitched on multiple teams with overlapping seasons
  - 1.9x's more likely if pitched multiple games per day during the previous 12 months
    - AJSM 2014

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- Prospective evaluation of little league players age 10-12
- Pre- and postseason shoulder MRI/PE
- 61% had positive dominant shoulder MRI findings not present on ND arm
- 81% selected to all-star team had abnormal findings compared to 14% non all-star
- 35% had new or worsening changes

The Curse of the All-Star Team: A Single-Season Prospective Shoulder MRI Study of Little League Baseball Players

Holt, Pennock et al

AJSM 2020

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- Year round play, single sport athletes and playing for multiple teams increased risk
  - Not related to position or pitch counts
- All star team selection was the most predictive of abnormal findings

The Curse of the All-Star Team: A Single-Season Prospective Shoulder MRI Study of Little League Baseball Players

Holt, Pennock et al

AJSM 2020

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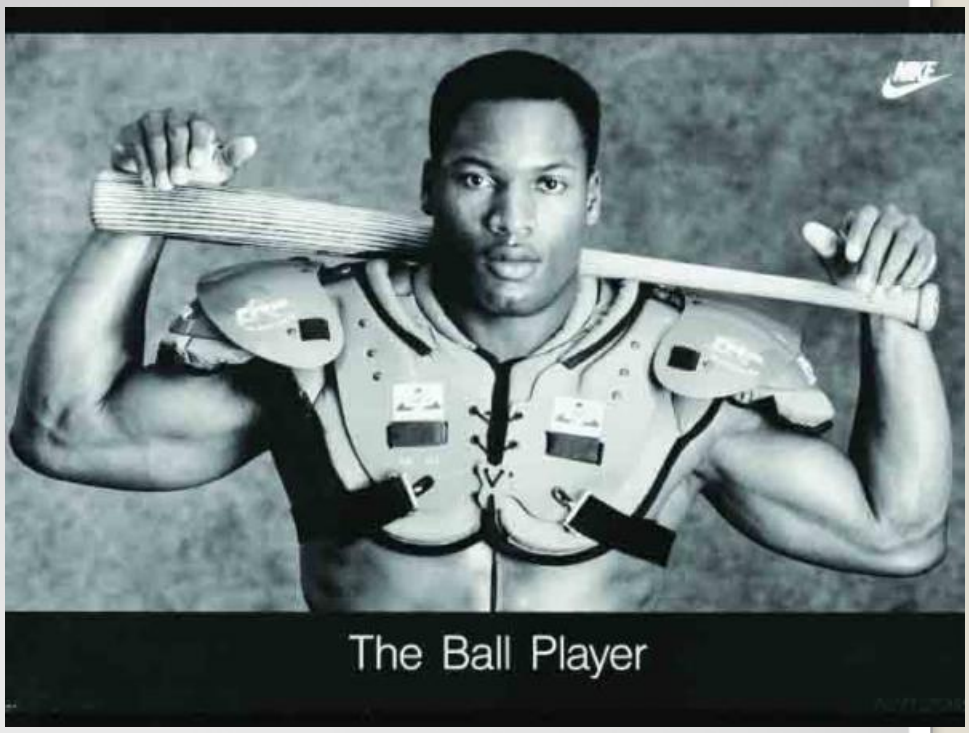
- Research shows clear advantage to diversification
  - *Gould, D. Research in youth sports*
- Youth athletic performance not good predictor
- Specialization should be delayed until H.S.
  - If sooner, 4 months rest per year



Sport Diversification

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- American Academy of pediatrics
  - 1 sport 5 days/week
  - Min. 1 day off
  - At least 3 months off per year
  - Play multiple sports
    - Esp before puberty
    - Fewer injuries

Recommendations

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- Pitch counts
- Rest days
- Pitch types
- For more information, visit www.stopsportsinjuries.org or www.littleleague.org

Prevention

Maximum Pitch Counts

Age	Pitches/Game
7–8	50
9–10	75
11–12	85
13–16	95
17–18	105

Source: Little League Baseball

Rest Periods Required

Ages 14 and under	Ages 15–18	Required # of Rest Pitches
66+	76+	4 calendar days
51–65	61–75	3 calendar days
36–50	46–60	2 calendar days
21–35	31–45	1 calendar day
1–20	1–30	None

Source: Little League Baseball

Age Recommended for Learning Various Pitches

Pitch	Age
Fastball	8 ± 2
Slider	16 ± 2

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- Despite guidelines, effectiveness questionable
- Coaches only able to answer 43% of pitching rules questions correctly, despite 73% reporting that they follow them
  - Fazarale et al, Sports Health 2012
- In Japan 40% of coaches understood guidelines and 28% followed them
  - Yulutake et al, Sports Health 2013
- Cause of increased injuries multifactorial

Prevention

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- Overuse injuries among the most common and difficult to treat
- Children and adolescents at increased risk
- Prevention is the best treatment

Conclusions

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- Overuse injuries recognizable early
- Athlete's must report any pain early
- Better to miss one practice or game than entire season
- For more information, visit www.stopsportsinjuries.org

Conclusions

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Thank you

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