overuse injuries in pediatric sports

pediatric orthopaedic symposium
October 13, 2023
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early sports specialization

- Increasing frequency in children and adolescents
- Attempt to achieve elite performance status
- Attracting negative attention in medical and lay news
- Possibility of an increased risk of acute and overuse injuries
- **Definition:**
  - **participation in one sport only**
  - **train >8 months/year**

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studies show increased risk of overuse injuries

- Earlier specialization = increased risk
- More specialized = higher risk
- play primary sport more than 8 months of the year
- primary sport for more hours per week than their age
- single-sport specialized athletes in individual sports (gymnastics, tennis, dance)

- **Youth sports specialization and musculoskeletal injury: a systematic review of the literature** Fabricant PD et al. Phys Sportsmed. 2016 Sep;44(3):257-62.
- **Sport Specialization and Risk of Overuse Injuries: A Systematic Review With Meta-analysis.** Bell DR et al. Pediatrics. 2018 Sep;142(3)
- **The Association of Sport Specialization and Training Volume With Injury History in Youth Athletes.** Post EG et al. Am J Sports Med. 2017 May;45(6):1405-1412
- **Specialization patterns across various youth sports and relationship to injury risk.** Pasulka J et al. Phys Sportsmed. 2017 Sep;45(3):344-352.

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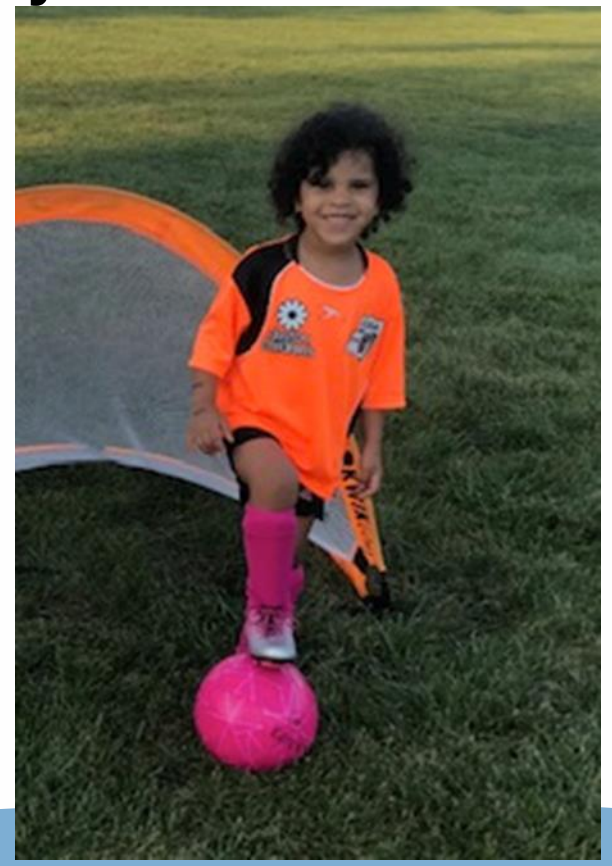
sports specialization

- **Socioeconomic Factors for Sports Specialization and Injury in Youth Athletes.**
  - Jayanthi NA et al. Sports Health. 2018 Jul/Aug;10(4):303-310
- Cohort study of 1139 patients, 7-18 yrs old
- High-SES athletes compared to low-SES athletes:
  - higher rates of sports specialization
  - more hours per week playing organized sports
  - higher ratio of weekly hours in organized sports to free play
  - greater participation in individual sports
  - = *more serious overuse injuries*



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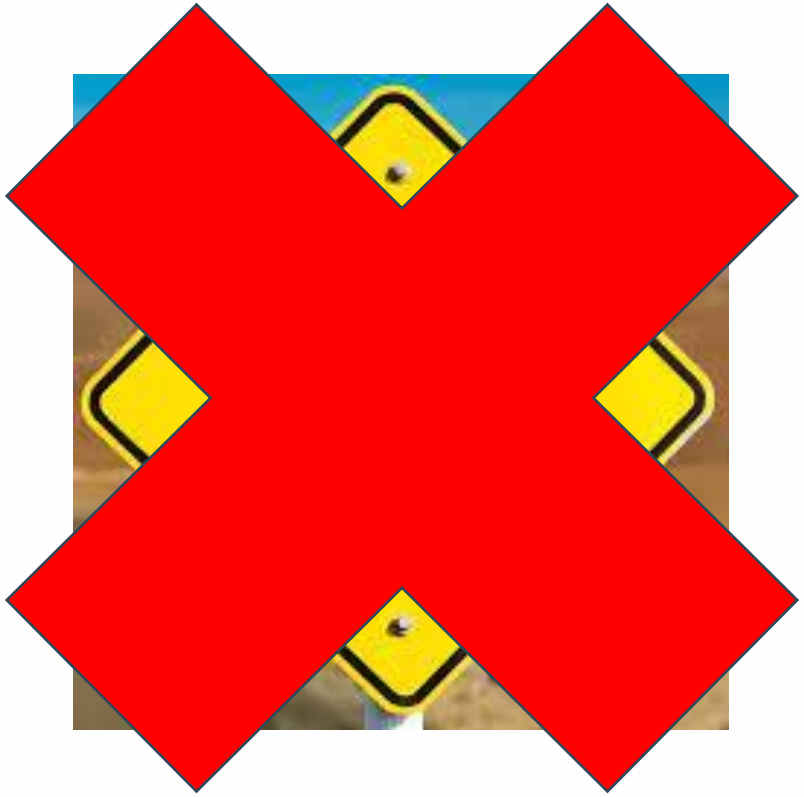
why?

- Growing bones cannot manage as much stress
  - peak growth velocity
- Repetitive motions
- Poor mechanics
- Pain is mild or vague
- Athlete/family often ignores it



symptoms

- Pain that increases with activity
- Swelling
- Changes in form or technique
- Decreased interest in practice
- Limping

AAP recommendations for prevention

- Limit each sporting activity to five days per week (including competitive play, sport-specific training, and scrimmage)
- At least one day per week of rest from all organized physical activity.
- At least 2-3 months off from sports per year.
- The weekly training time, number of repetitions, and total distance should not increase by more than 10% each week

overtraining

- Psychological, physiological, and hormonal changes that result in decreased sports performance
- Common manifestations: chronic muscle or joint pain, personality changes, elevated resting heart rate, fatigue, and lack of enthusiasm about practice or competition.
- Prevention similar to overuse injuries PLUS:
  - cross-training/play multiple sports throughout the year (emphasize different body parts)
  - learn to recognize cues from their bodies of overuse, fatigue
  - get sufficient rest between daily activities
  - one team per season
  - nutrition

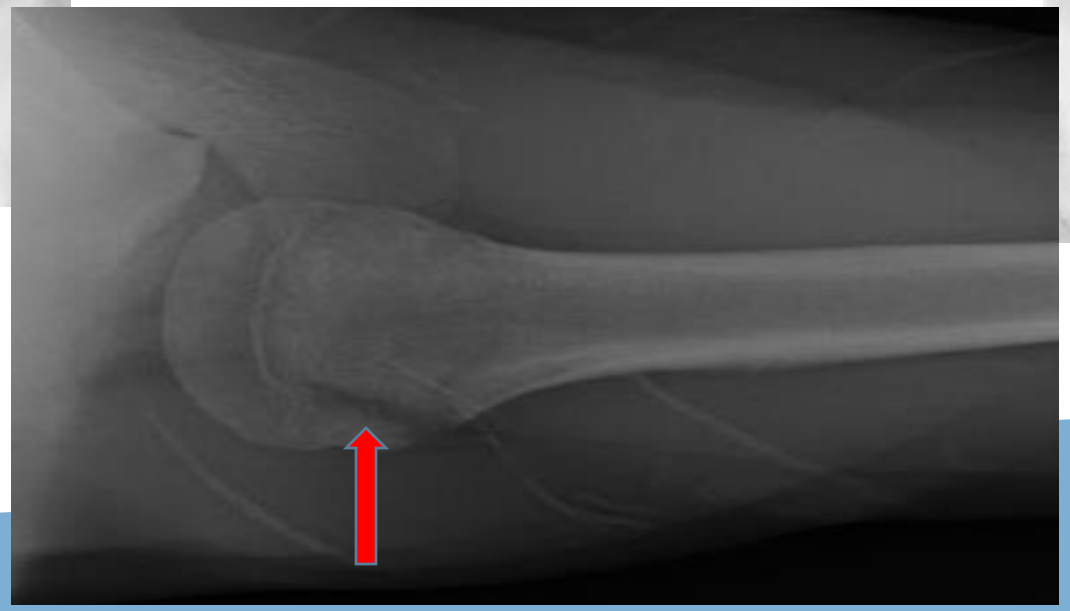
throwing injuries

baseball injuries

- **Risk Factors for Baseball-Related Arm Injuries: A Systematic Review.**
  - Agresta CE et al. Orthop J Sports Med. 2019 Feb 25;7(2):2325967119825557.
- Deficits in preseason shoulder range of motion and strength
- Pitching >100 innings in 1 year
- Age 9 to 11 years
- Pitcher or catcher
- Training >16 hours per week
- History of elbow pain

little league shoulder

- Repetitive microtrauma/traction to proximal humerus growth plate
- Repeated high load torque in a rapidly growing child athlete
- Typically 10-16 yo
- Overhead athletes: Baseball, Tennis



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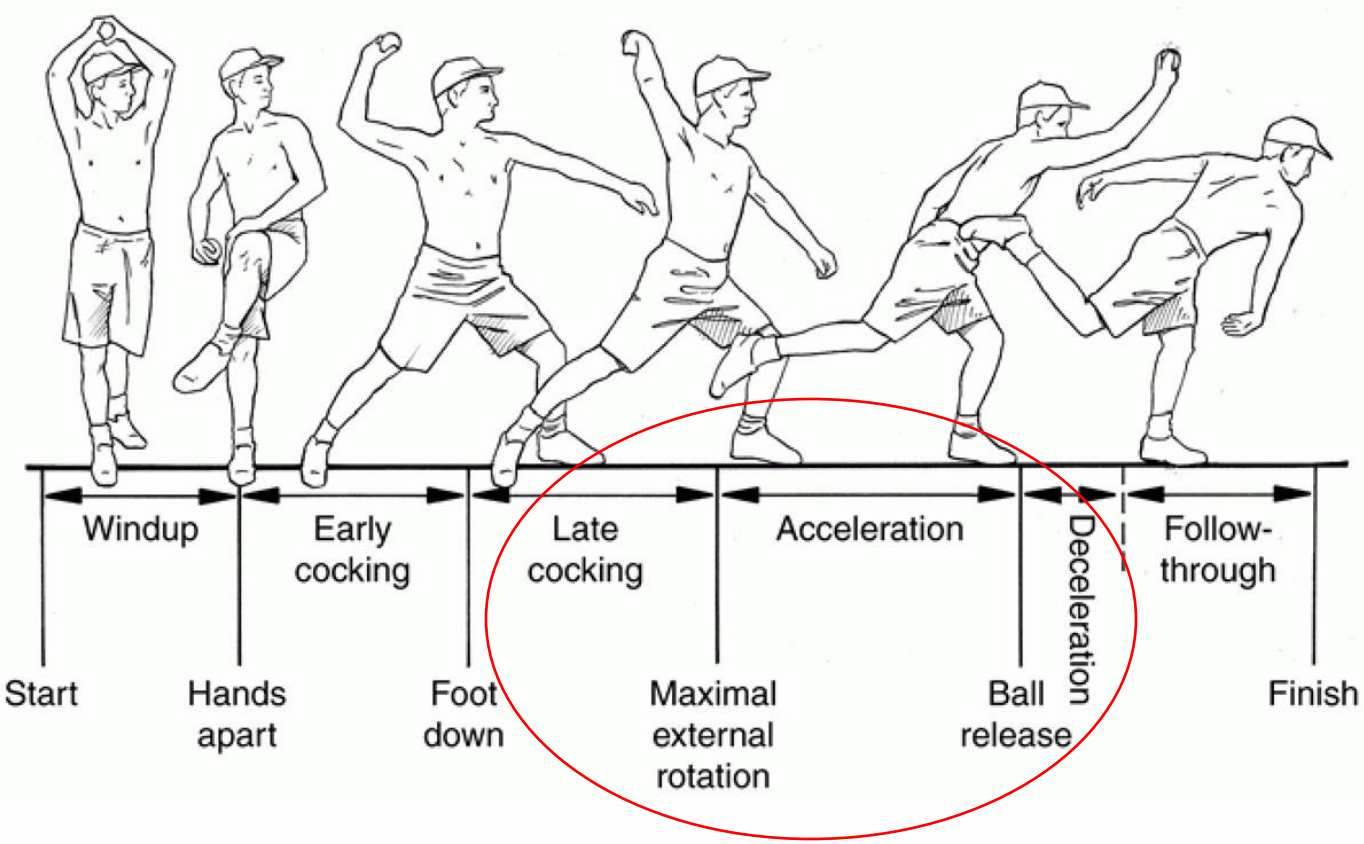
little league shoulder- history

- Generalized shoulder pain with throwing/overhead activities
  - Late cocking or deceleration phase
- Change in level of activity
  - Increased throwing
- Loss of velocity and/or control
- Rest pain later on
- Throwing curve ball or slider before growth plates have closed
- Too much throwing!!!!



dayton children's

little league shoulder - exam

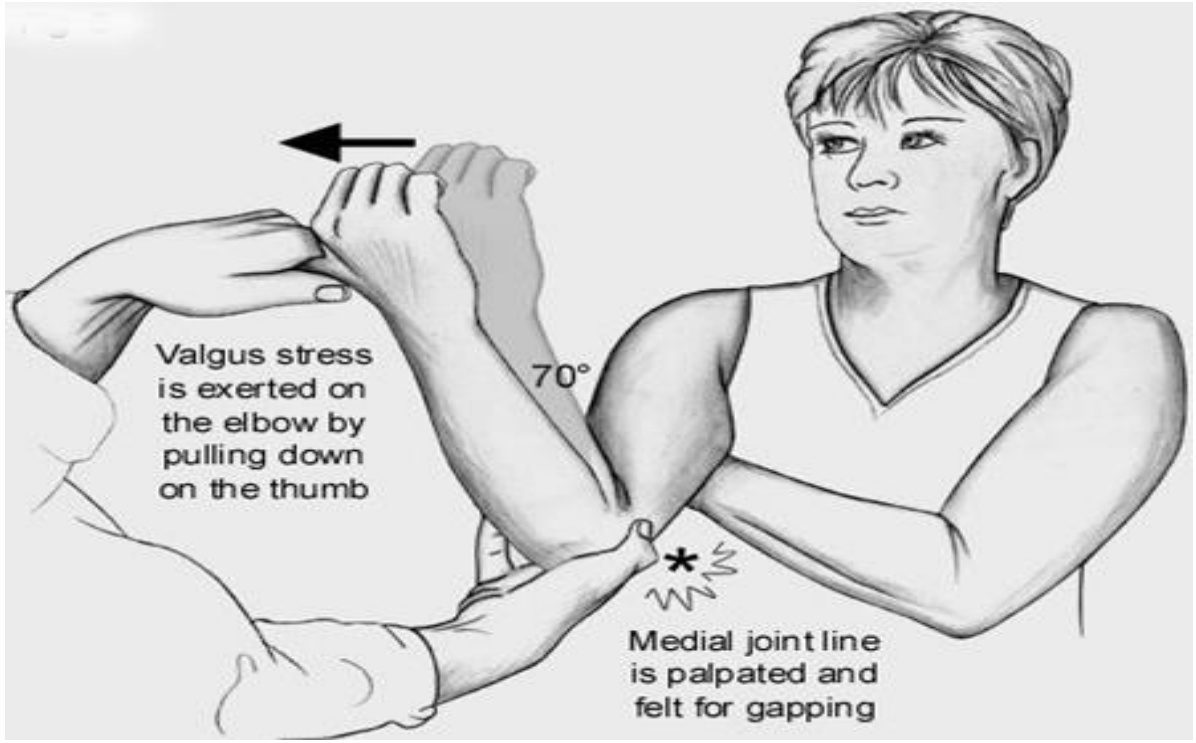
- Painful and/or limited range of motion
  - External rotation
- Pain with resisted elevation of the shoulder
- Pain with extreme of motion in any direction
- Tenderness over proximal humerus physis

little league elbow

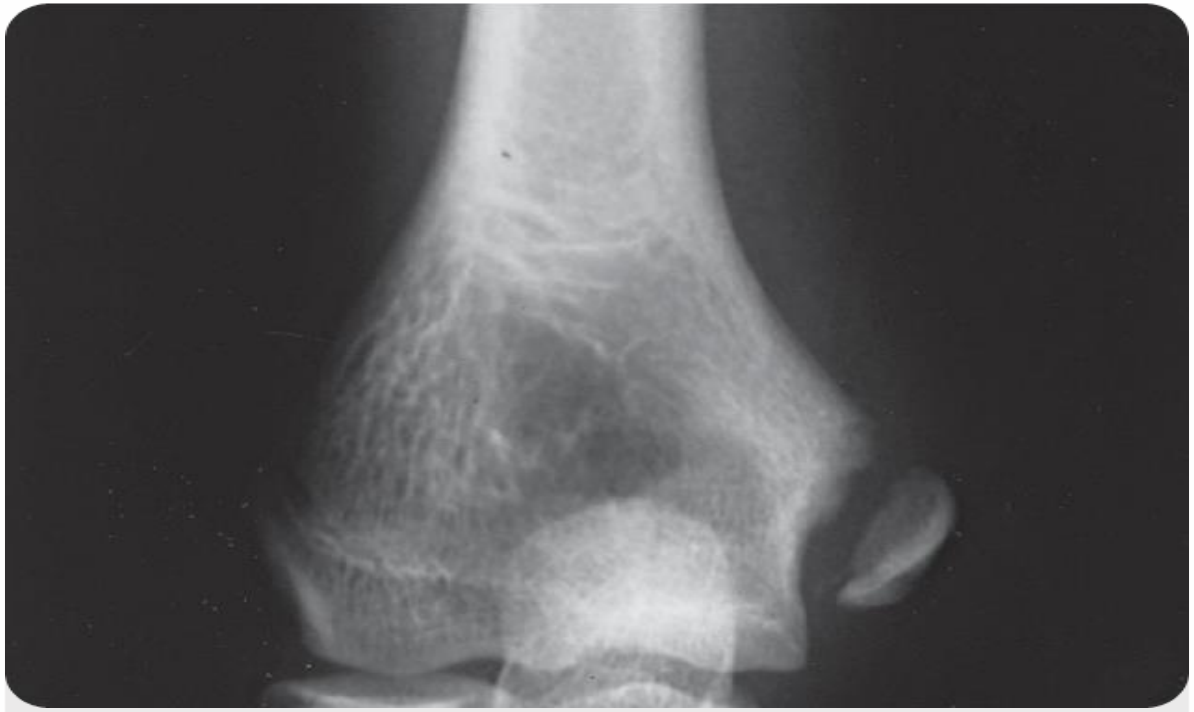
- Generic term for pain along the medial aspect of the proximal forearm or elbow
- Pain on the compressed radial side of the joint and/or the distracted ulnar side (Trochlea or medial epicondyle)
- Late-cocking/early acceleration
- Throwing curveballs, junk pitches, infielder side arm throws
- Younger patients – most likely apophysitis or an avulsion
- Older adolescent - UCL sprain

little league elbow exam

- Seated patient
- Point tenderness over the medial epicondyle and/or flexor mass
- Valgus stress with the arm in varying degrees of flexion and extension – pain or instability
  - Milking maneuver
- Increased carrying angle or flexion contracture if chronic



radiographic evaluation



Tachdjian's Pediatric Orthopaedics

- AP/Lat Elbow Xrays
- Comparison view of unaffected side
- Irregular appearance of the medial epicondyle physis
- Presence and degree of displacement
- Fragmentation of the medial epicondyle, trochlea, olecranon, or capitellum.
- Medial epicondyle hypertrophy or radial head hypertrophy may be present

little league shoulder and elbow - treatment

- CESSATION OF THROWING ACTIVITIES!
- Usually 2-3 months
- Rest 4-6 weeks (Long arm cast?)
- Physical therapy program
  - Rotator cuff strengthening
  - Progressive throwing program
  - Improve mechanics

Prevention is the best medicine

- Throwing mechanics
- Pitch counts
- Balanced shoulder strength

prevention

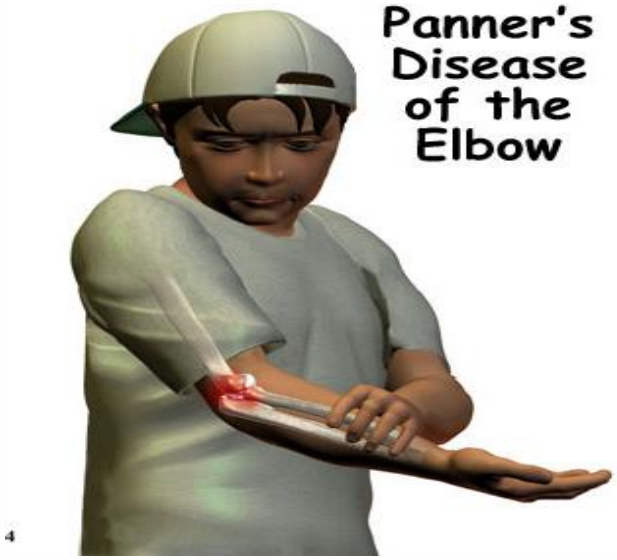
AGE	DAILY MAX (PITCHES IN GAME)	REQUIRED REST (PITCHES)					
		0 Days	1 Days	2 Days	3 Days	4 Days	5 Days
7-8	50	1-20	21-35	36-50	N/A	N/A	N/A
9-10	75	1-20	21-35	36-50	51-65	66+	N/A
11-12	85	1-20	21-35	36-50	51-65	66+	N/A
13-14	95	1-20	21-35	36-50	51-65	66+	N/A
15-16	95	1-30	31-45	46-60	61-75	76+	N/A
17-18	105	1-30	31-45	46-60	61-80	81+	N/A
19-22	120	1-30	31-45	46-60	61-80	81-105	106+

- https://www.littleleague.org/playing-rules/pitch-count/

dayton children's

panner’s disease

- Idiopathic, self-limiting osteonecrosis (loss of blood supply) to capitellum
- Children under 10
- Non-specific pain and stiffness about elbow
- Worse with activity
- Typically no history of injury
- Overuse/overload from repetitive compression injuries
- +/- Locking or Catching



panner’s disease

- Irregular, sclerotic capitellum
- Treat with rest, NSAIDS, therapy for contractures, +/- immobilization for 3-6 weeks
- Slow progression of activities over next 6-12 weeks
- >90% success rate
- May consider arthroscopic treatment if no improvement

dayton children’s

ocd of the elbow

- Older children
  - >10 years
- Similar mechanism to Panner's
- Capitellum ossified by this age
- Higher risk of permament disability
  - Inability to participate in sports
  - Long-term: Arthritis

ocd of the elbow

- Longer treatment than Panner's
  - 6-12 months before return to throwing or UE weight bearing sports
- Based on classification:
  - I: Intact cartilage – Non-op, treat same as Panner's, but maybe longer
  - II: Cartilage fracture – drilling +/- fixation
  - III: Loose bodies in joint – Loose body removal, drilling + fixation vs. Cartilage restoration

gymnast wrist

- Distal Radius Physeal Injury
- Young gymnasts with open physeal plates
- High-impact forces and repetitive injury to the growth plate
- Unlike adults, the immature wrist typically exhibits negative ulnar variance
  - higher distribution of load to the immature distal radius
- Chronic compression can lead to growth arrest of the physis
  - Premature closure of the ulnar aspect.
  - Deformity with distal radius shifted ulnar and volar

gymnast wrist

- Risk factors: female sex, repetitive loaded activities with extreme wrist dorsiflexion
- History: Dull radial wrist pain during the offending activity, usually relieved with rest.
  - Pain at rest is a sign of more severe injury.
- Exam: TTP at the distal radial physis
- 3 stages based on xray changes:
  - Stage 1- symptoms, but no radiographic changes
  - Stage 2- characteristic xray changes
    - widening of the radial physis, cystic changes of the metaphysis
    - breaking of the distal aspect of the epiphysis, haziness within the physis
  - Stage 3- addition of changes in ulnar variance

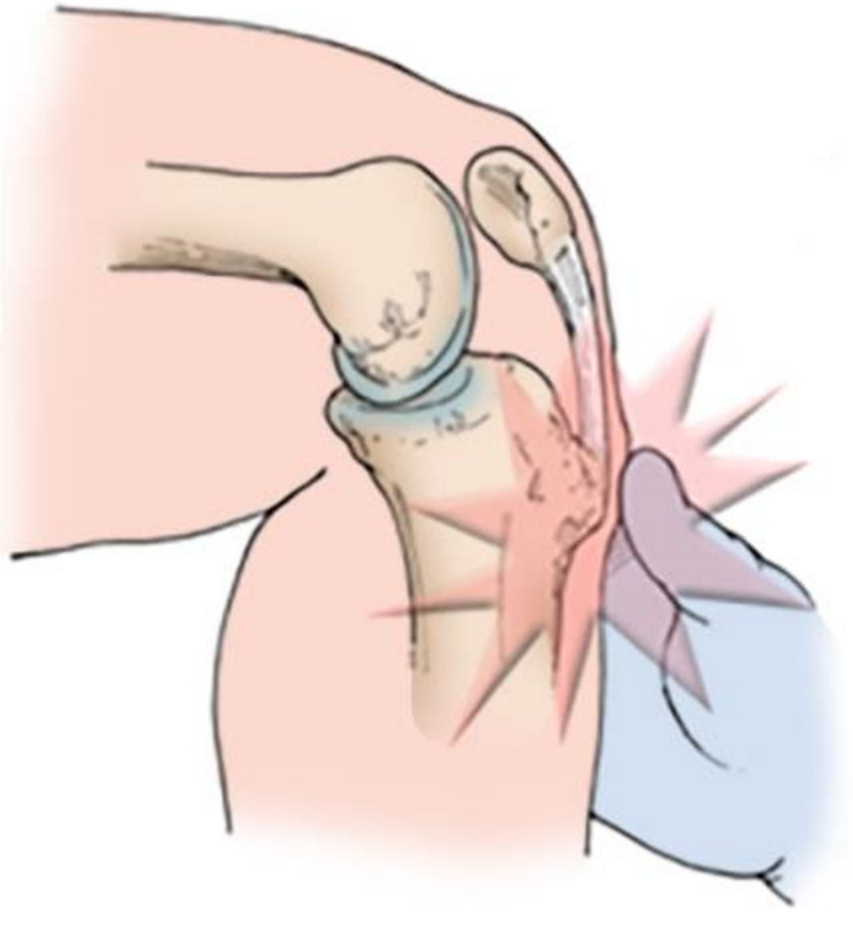
gymnast wrist

- Treatment: rest from weight-bearing for at least 6 weeks
- Rehabilitation: strengthening and proprioception training.
- Gibson brace and a palm pad is recommended.
- Surgery reserved for stage 3 injuries with positive ulnar variance and those at risk for physeal arrest

lower extremity overuse injuries

osgood-schlatter's

- Inflammation of tibial tubercle (apophysis)
- Swelling, "bump"
- Pain with/after running and jumping
- Direct trauma/fall
- Most symptoms will completely disappear when a child completes the adolescent growth spurt
  - Age 14 for girls,16 for boys.
- May be risk factor for tibial tubercle fracture
- May see X-ray changes



sever's disease

- Inflammation of calcaneal apophysis
- Impact from heel strike and traction from Achilles tendon
- Presents around age 10 (earlier than Osgood)
- Xrays not diagnostic, but rule out other pathology

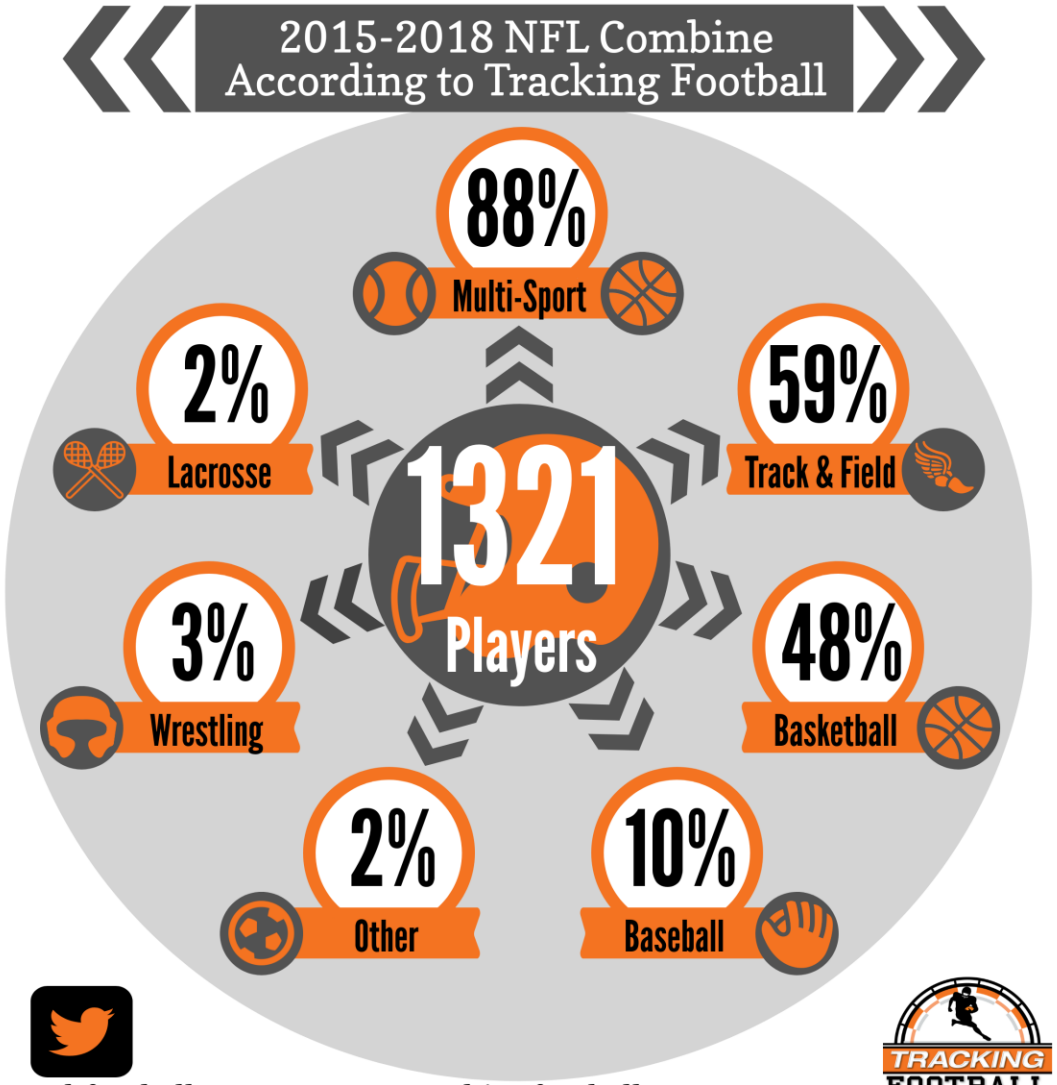
Treatment for LE apophysitis

- OK to continue sports if pain resolves by next morning after sports
  - No symptoms with ADLs
- Rest
- Ice
- NSAIDs
- Stretching
- Bracing:
  - patella tendon strap, knee sleeve, knee pad for OSD
  - Heel cups for Sever's
- If more severe, immobilize with restricted motion and strict rest for 3 weeks, then PT for ROM/Strength and gradual progression

shin splints (tibial stress syndrome)

- Overuse/repetitive-load injury leads to persistent dull anterior leg pain.
- posteromedial is most common
  - traction periostitis of tibialis posterior and soleus
- anterolateral
  - traction periostitis of tibialis anterior on tibia and interosseous membrane
- Clinical diagnosis (tenderness and pain with plantarflexion/dorsiflexion).
- Radiographs or bone scans to rule out stress fractures.
- Nonoperative treatment with NSAIDs, rest and shoe/surface/activity modifications, PT.

- Playing multiple sports makes kids more versatile, prevents burnout and prevents injuries



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