

Assessment of Common Orthopedic Injuries in School



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Objectives

- Review common orthopedic concerns in the school setting
 - Wrist/Forearm/Elbow
 - Finger
 - Shoulder
 - Knee
 - Ankle
- Use of the Ottawa Ankle Rules in practice to assist decision-making
 - Doesn't require special tissue testing, can assist with flow of assessment
- Patient management considerations

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Orthopedic Assessment Overview

- 4 main tissue types in the orthopedic realm
 - Bone, ligament, muscle/tendon, vascular/nerve
- Goal is to rule in or rule out involvement of different tissues
- I speak about involvement of tissues in terms of "suspicion"
 - low vs moderate vs high
- Mechanism of Injury
 - If accurate, can be used to narrow down involved tissues

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Basic Steps in Orthopedic Assessment

- Observation
 - Deformity, Swelling, Discoloration
- Palpation
 - Quality of Tissue, Diffuse vs Point Tender
- Range of Motion
 - Active vs Passive
- Muscle Activation
 - Active vs Resisted
- Neurovascular
 - Numbness/Tingling/Shocks
 - Burning/Cold
 - Capillary Refill, Pulse Assessments
- *Special Tissue Tests
 - Orthopedic-based
 - Joint Mobilizations
 - Nervous, Cranial

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Wrist / Forearm / Elbow Anatomy

- Bones
 - Humerus
 - Ulna, Radius
 - Carpals, Metacarpals
- Ligaments
 - Elbow: UCL
 - Wrist: Carpal Ligaments
 - Retinaculum
- Muscles
 - Biceps, Triceps
 - Forearm flexor / extensor bundles
 - Supinator, brachioradialis
- Nerves
 - Median, ulnar
- Blood Supply
 - Radial, ulnar

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Wrist / Forearm / Elbow Injuries

- Joint Dislocations
 - Elbow vs Wrist
- Fractures
 - Distal vs Proximal Forearm
 - Distal: Colles vs Smith
 - Carpal
 - Scaphoid
- Ligamentous Sprains
 - Elbow: UCL
 - Wrist: Radial/Ulnar
- Muscle Strains
 - Flexors, Extensors, Thumb
- Contusions
- Nerve Irritation
 - Ulnar Nerve, Carpal Tunnel

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Finger Anatomy

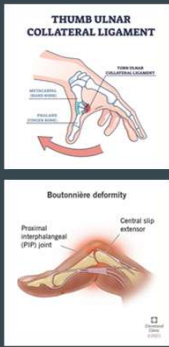
- Bones
 - Phalanges
 - Metacarpals
 - Carpals
- Ligaments
 - Capsular in nature
 - DIP, PIP, and MP/MCP
- Muscles
 - Flexors, extensors
 - Abductors, adductors
 - Tendon sheaths
- Nerves
 - Radial, median, ulnar
- Blood Supply
 - Radial, ulnar



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Finger Injuries

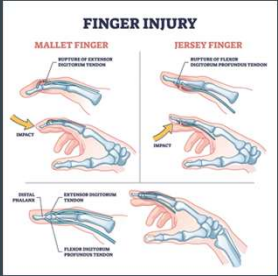
- Joint Dislocations
 - IPs vs MP/MCPs
- Fractures
 - Finger vs Metacarpals
- Ligamentous Sprains
 - Loss of capsule integrity
 - Skiers/Gamekeepers' thumb
- Muscle Strains
 - Flexors, extensors, thumb-MCP
 - Mallet finger, Jersey finger
- Contusions
- Nerve Irritation
 - Acute vs chronic
- Other
 - Tendon sheath: Boutonniere deformity



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Points of Focus

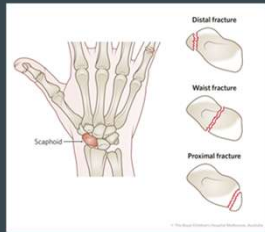
- Alignment
 - Is elbow in place?
 - Is wrist in alignment and stable?
 - Are IP and MP/MCP joints in place?
- Pain
 - Level of pain
 - Point tenderness vs diffused
- Is ROM significantly decreased
 - Secondary to...
 - Pain
 - Mechanical block
 - Change in muscle integrity
- Function
 - Patient's ability to move
 - Patient's willingness to move
- Neurovascular
 - Numbness/tingling, capillary refill



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Scaphoid Fractures

- MOI: FOOSH, "thumb jam"
- Pain: base of thumb, anatomical snuffbox
- Symptoms >2-3 weeks
 - Often missed on initial x-ray
- Scaphoid "wrist/neck" fracture can disrupt blood supply to proximal portion of scaphoid, resulting in bone death
- Delayed diagnosis can significantly affect prognosis



DON'T MISS THIS ONE!

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Case Study: Scaphoid Fracture

14 YO male presents with R wrist pain x 2 weeks after slipping on ice on the way to school. Student describes a FOOSH-type mechanism. Student has not sought medical attention until now. Student reports resting and icing, intermittent use of ibuprofen.

Nurse notes no deformity, no swelling, no discoloration. Student is point tender in anatomical snuffbox and endorses pain with thumb and wrist motions. Nurse notes guarding and compensatory movements in some positions.

Nurse calls home and based on location and length of symptoms recommends prompt contact/visit to PCP or UC within 24 hours.

Result: Non-displaced fracture of scaphoid requiring surgery

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Shoulder Anatomy


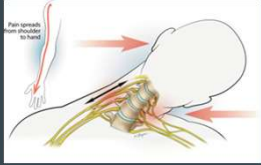
- Bones
 - Anterior: clavicle, sternum, humerus
 - Posterior: scapula (acromion, coracoid)
- Ligaments
 - GH joint: glenohumeral (3)
 - AC joint: acromioclavicular
- Muscles
 - Superficial
 - Trapezius, deltoids, biceps, triceps, pectoralis
 - Deep:
 - Rotator cuff
- Nerves
 - Branches of the brachial plexus
- Blood Supply
 - Brachial, subclavian



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Shoulder Injuries



- Joint Dislocations
 - GH joint vs AC joint
- Fractures
 - Clavicle vs humerus vs scapula
- Ligamentous Sprains
 - GH joint vs AC joint
- Muscle Strains
 - Acute vs chronic
 - Rotator cuff tears
 - Frozen shoulder
- Contusions
 - Ribs
- Nerve Irritation
 - Acute vs chronic
 - "Stinger"

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Points of Focus

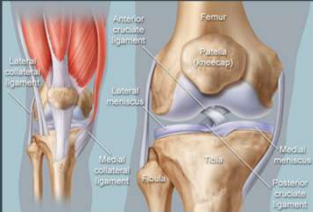
- Alignment
 - Is the shoulder in place?
 - Is there a tent sign over the clavicle?
 - Is there a piano key sign on the AC joint?
- Pain
 - Level of pain: muscle guarding
 - Point tenderness vs diffused
- Is ROM significantly decreased?
 - Secondary to...
 - Pain
 - Mechanical Block
- Function
 - Decreased motion vs sling
 - Patient's willingness to move
- Neurovascular
 - Numbness/tingling, capillary refill

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Knee Anatomy

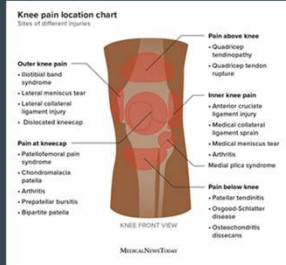
- Bones
 - Femur, tibia, fibula, patella
- Ligaments
 - ACL/PCL, MCL/LCL, patellar
- Muscles
 - Anterior: Quadriceps, Quad/Patellar Tendon
 - Posterior: Hamstring, Gastrocnemius
 - Medial: Adductors
 - Lateral: Iliotibial Band
- Nerves
 - femoral, sciatic, tibial, peroneal
- Blood Supply
 - femoral, popliteal
- Other:
 - Meniscus, Cartilage



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Knee Injuries

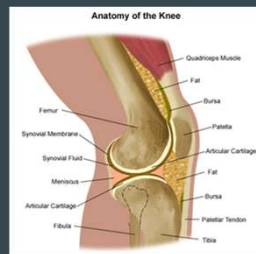
- Joint Dislocations
 - patellofemoral, tibiofemoral
- Fractures
 - femur, head of fibula, patella
- Ligamentous Sprains
 - collateral vs cruciate
- Muscle Strains
 - ant vs post, lat vs medial, patellar tendon
- Contusions
- Nerve Irritation
 - acute vs chronic
- Other
 - bursitis, meniscus tears



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Points of Focus

- Alignment
 - Is the patella in place?
- Pain
 - Level of pain
 - Point tenderness vs diffused
- Is ROM significantly decreased?
 - Secondary to...
 - Pain
 - Mechanical block
- Ambulation
 - Walk vs assistance
 - Patient's willingness to move



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Ankle / Lower Leg Anatomy

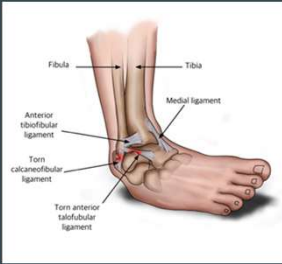
- Bones
 - Lower Leg: tibia, fibula
 - Foot: calcaneus, talus, tarsals, metatarsals
- Ligaments
 - Lateral: ATF, CF, PTF, tib-fib
 - Medial: Deltoid
- Muscles
 - Lower leg: gastrocnemius, soleus
 - Ankle / Foot: Tibial/Peroneal Bundles, Digitorum/Hallucis Bundles
- Nerves
 - Tibial, Super/Deep Peroneal
- Blood Supply
 - Ant/Post Tibial, Peroneal



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Ankle / Lower Leg Injuries

- Joint Dislocation
 - talocrural joint
- Fractures
 - tib-fib, base of 5th, navicular
- Ligamentous Sprains
 - lateral vs medial
- Muscle Strains
 - lateral vs medial
 - achilles tendon
- Contusions
- Nerve Irritation
 - acute vs chronic
 - drop-foot



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Clinical Prediction Rules (CPRs)

- Definition: A research-based combination of medical signs, symptoms, and other clinical findings used to predict the probability of a specific pathology
- The Goal: Aid the clinician in diagnosing and/or selecting the most appropriate intervention for a given pathology
- Can be a great addition to your existing assessment strategy

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Ottawa Ankle Rules

- Estimated that approximately 25,000 ankle sprains occur per day
 - Females > Males, Pediatric > Adult
 - Healthcare \$\$
- OAR determines the need for radiographs following acute ankle injuries
 - Developed in the hospital setting to address the need for a rapid and accurate way to avoid unnecessary imaging
 - 0 symptoms = <1% chance of fx



Lateral view

A Posterior edge or tip of lateral malleolus - 6 cm

B Posterior edge of tip of lateral malleolus - 6 cm

C Base of fifth metatarsal

D Navicular

Mid-foot zone

Malleolar zone



Medial view

A Posterior edge or tip of lateral malleolus - 6 cm

B Posterior edge of tip of lateral malleolus - 6 cm

C Base of fifth metatarsal

D Navicular

Mid-foot zone

Malleolar zone

A series of ankle x-ray films is required only if there is any pain in malleolar zone and any of these findings:

- Bone tenderness at **A**
- Bone tenderness at **B**
- Inability to bear weight both immediately and in emergency department

A series of ankle x-ray films is required only if there is any pain in mid-foot zone and any of these findings:

- Bone tenderness at **C**
- Bone tenderness at **D**
- Inability to bear weight both immediately and in emergency department

USE THIS!

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Case Study: Base of 5th Metatarsal Fracture

Initial: Nurse called to classroom at 10:15am to assess teacher who missed a step going down the stairs and twisted her left ankle. Teacher had to be assisted to classroom by security. No history of previous foot or ankle injury. Teacher reports moderate pain at lateral midfoot, does not recall "pop" or "crack". At initial assessment nurse notes tenderness with palpation in diffuse nature over lateral midfoot, minimal swelling, no discoloration, pain with side-to-side ankle movement, able to wiggle toes. Teacher wanted to remain at school so nurse provided ice, instructions to call if symptoms worsen.

Follow-Up: Teacher is referred to AT upon arrival at 12:30pm. Teacher reports no change in pain but endorses increased swelling and stiffness compared to earlier assessment. AT notes no obvious deformity, point tenderness localized to base of 5th metatarsal, unwillingness to walk without assistance, worsening swelling and no change in pain despite rest, elevation, and use of ice. Teacher wants to finish school day so AT recommends urgent visit to PCP or UC after school.

Result: Avulsion fracture of base of 5th metatarsal with minimal displacement

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Actionable Next Steps

- 1. Consider an orthopedic assessment outline that makes sense to you
 - Fits your knowledge, your setting / practice, the flow of your office / visits
 - If possible, consider adding a template or outline to your health system
- 2. Research and **print** CPRs that are the most applicable to your practice
 - #1 Pick: Ottawa Ankle Rules
- 3. Repetition and practice! Palpate and assess patients whenever you can.

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Questions?

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References

- Doherty, C., Delahunt, E., Caulfield, B., Hertel, J., Ryan, J. and Bleakley, C., 2014. The incidence and prevalence of ankle sprain injury: a systematic review and meta-analysis of prospective epidemiological studies. *Sports medicine*, 44(1), pp.123-140.
- Dalla Ali S, Alhiraki O A, Naeem T (July 22, 2024) Evaluating Compliance With the Ottawa Rules: A Retrospective Clinical Audit at a District General Hospital in the UK. *Cureus* 16(7): e65115. doi:10.7759/cureus.65115
- Kharel, P., Zadro, J.R., Chen, Z, *et al.* Awareness and use of five imaging decision rules for musculoskeletal injuries: a systematic review. *Int J Emerg Med* 16, 85 (2023). <https://doi.org/10.1186/s12245-023-00555-4>
