Management of Upper Extremity Injuries in the Pediatric Athlete

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Overview

• Hand Injuries

• Wrist Injuries

• Elbow Injuries
HAND INJURIES
Mallet Finger

• Occur during contact sports:
  • Softball
  • Baseball
  • Football
  • Basketball
  • Soccer
Mallet Finger

• Force against finger from:
  • Ball
  • Fall
  • Another player

• Mechanism of injury:
  • Jamming force against fingertips while DIPj is in extension
  • Force causes DIPj into flexion resulting in avulsion of extensor tendon
Mallet Finger Symptoms

• Pain

• Swelling on dorsal aspect of DIPj

• DIPj in flexed position

• Unable to actively extend DIPj
Mallet Finger Immobilization

- Immobilize for 6-8 weeks
- Splint with DIPj in slight hyperextension, PIP free
- Stack splint, cast, custom splint

**DIPj must stay in hyperextension at all times**
• Focus on DIPj extension ROM

• Careful of aggressive DIPj flexion: No passive flexion if extensor lag greater than 10 degrees

• Ensure composite fist ROM

• Address grip strength

• Continue night splint for 2-4 weeks
DIP ROM Exercises

- DIP blocking extension
- Composite finger flexion
- Composite fist flexion
DIP Extension Play Exercises
DIP Extension Strengthening

Finger Spread  Finger Extension  Finger Spread
DIP Extension Strengthening
Mallet Finger

- **Return to sports:**
  - After 10-12 weeks of rehabilitation
  - Strength regained
  - Splint or cast if returning early and cleared by MD
Mallet Fingers

• **Sports specific exercises to ensure ready to return to sport:**
  
  • Basketball: Dribbling and passing
  • Baseball/Softball/Soccer goalie: repetitive catching
  • Football: tackling, catching

** If using splint/cast, make sure fits properly in glove
Jersey Finger

• Occur during contact sports:
  • Football
  • Soccer
  • Rugby
  • Basketball
Jersey Finger

- Grasping jersey of opponent
- Avulsion of flexor digitorum profundus (FDP) off volar aspect of distal phalanx
- Due to forced hyperextension of DIPj while finger is actively
Jersey Finger

- **Testing FDP function:**
  - hold PIP in extension and have patient actively flex DIP joint
Jersey Finger Treatment

• Most treated operatively with Zone 1 flexor tendon repair

• Delayed mobilization best for young athletes
Jersey Finger Rehabilitation

• **4 weeks post-op:**
  
  • Dorsal blocking splint:
    • Wrist in 20 degrees flexion
    • MPs in 70 degrees flexion
    • IPs in full extension
  
  • Composite AROM/PROM in flexion/extension within splint
Jersey Finger Rehabilitation

• 6 weeks post-op:
  • AROM exercises completed out of splint

• 7 weeks post-op:
  • PROM exercises completed out of splint
Jersey Finger- 8 weeks post op

• Initiate light strengthening
  • Rubber bands
  • Light gripping
  • Theraputty
Jersey Finger - 10 weeks post op

- Progress strengthening
  - Grip strength
  - Hand weights
Jersey Finger

• Return to sports:
  • After 10-12 weeks of rehabilitation
  • Functional AROM regained
  • Minimal to no pain
  • Grip and pinch strength greater than 80% of uninjured side

**Heavy weight lifting not recommended till 14 to 16 weeks post-op**
Jersey Finger

• Sports specific exercises to return to sports

  • Basketball: dribbling, catching

  • Racquet sports: power gripping with torque

  • Football: tackling, throwing, catching
Scaphoid Injury

• One of most common wrist injuries that occur while playing sports

• Mechanism of injury: Falling on an outstretched hand
Scaphoid Injury Symptoms

• Radial sided wrist pain
• Tenderness at anatomic snuffbox
• Soft tissue swelling
Scaphoid Injury Treatment

• Immobilization with casting (nondisplaced or minimally displaced) for 8-12 weeks

• Surgery (nonunion, displaced fracture, carpal instability) cast for 6 weeks
Wrist/Thumb Orthosis

- Transition to orthosis after casting
- Provides stability of thumb and wrist during rehabilitation phase
- Low profile and “athletic look”
- Bars are removable
Scaphoid Injury Rehabilitation

• 3 phases:
  1. ROM
  2. Strengthening
  3. Sport-specific exercises

** Wrist important for sports and ADLs
Scaphoid Injury

• **Phase 1: ROM**
  - AROM and PROM
  - Wrist flexion/extension
  - Wrist radial/ulnar deviation
  - Forearm supination/pronation
  - Thumb flexion/extension/abduction/adduction
Scaphoid Injury

• Phase 2: Strengthening

• Begin once ROM pain free and fracture healed

• Hand, wrist, forearm strengthening
Scaphoid Injuries

• Phase 3: Sports Specific Exercises

• Throwing sports: begin with unweighted balls and progress to weighted medicine balls

• Gymnastics: begin with plyometric pushups and progress to high impact tumbling
Scaphoid Injury

• Return to play depends on:
  • Sport (contact vs non-contact)
  • Location and stability of fracture
  • Ability to participate in a cast or splint
### Scaphoid Injury

**Other considerations:**

- High rate of reoccurrence and complications due to impact of sports
- Pay close attention to pain and inflammation when introducing new exercises
- Pediatric athletes more likely to reinjure scaphoid
Gymnast Wrist

- Repetitive stress injury from tumbling
- Inflammation of growth plate at distal end of radius
Gymnast Wrist Symptoms

• Wrist pain with impact activities
• Reduced wrist motion
• Swelling at wrist
Gymnast Wrist

• **To excel in gymnastics:**
  • Full, painless arc of wrist motion
  • Ability to exert and sustain strong grip
  • Place wrist in extremes of extension
  • Bear significant loads through wrist
Gymnast Wrist

- **Sport-Specific Demands:**
  - Bear weight in high-impact maneuvers
  - Forceful pronation and sustained power grip
  - Transmission of loads more than twice
  - Axial stress on distal radial physis
Gymnast Wrist

• Wrist pain reported in 46%-80% of all gymnasts

• 37% of gymnasts trained through wrist pain

• 50% reinjury rate of wrist overuse injuries
Gymnast Wrist Treatment

**Treatment is Rest:**

- Time off from gymnastics
- No UE weight bearing activities
- 4-12 weeks of splinting or casting
- No weight bearing till pain free
Gymnast Wrist Rehabilitation

• After rest period:

  • Regain wrist mobility
    • AROM/PROM of wrist and forearm

  • Progress to strengthening of grip, wrist, and forearm

  • Must remain pain free to progress to weight bearing
Gymnast Wrist

• Gradual return to weight bearing
  • Wall push-ups
  • Modified push-ups
  • Bridges
  • Handstands
  • Cartwheels
  • Round-offs
  • Back Hand Springs
Tiger Paw

• Wrist support assists with hyperextension
• More stability added with inserts
• Do not use inserts without foam
• Make sure to break wrist support in
ELBOW INJURIES
Supracondylar Fracture

• Mechanism of injury:
  • Fall onto an outstretched arm
  • Fall directly onto the elbow
  • Direct blow to the elbow
Supracondylar Fracture

• Child is casted in 90 degrees of elbow flexion for 4-6 weeks

• Child often stops using the involved arm even when out of cast
Supracondylar Fracture

• Goals for treating supracondylar fractures:

  • Pain free elbow
  • Functional elbow
  • Stable elbow

**Unique goals for pediatric athletes**
Supracondylar Fracture

• Pediatric Athlete Goals:

  • *Gymnastics*- obtain end range of elbow extension for rings and tumbling

  • *Basketball*- obtain end range of elbow extension for success in free throw shooting

  • *Cheerleading*- obtain end range of elbow extension for stunts, formations, and tumbling
Supracondylar Fracture Rehabilitation

• Most treated with home program including:
  • Early active assistive ROM
  • Early active ROM
  • Early gentle passive ROM

• If full elbow ROM not obtained, serial orthoses for end range of elbow extension
Supracondylar Fracture - Serial Orthoses

- One time a week
  - PROM and heat to involved elbow
  - Remold orthosis for increased extension

- 4-6 weeks of orthosis adjustments depending on improvements and compliance

- Once reach end range of motion, maintain with night time splint for 3 months
Medial Epicondyle Fracture

• Significant in overhead athletes

• **Mechanisms of injury:**
  
  • Direct force to medial epicondyle
  
  • Avulsion force from valgus or extension loading
  
  • Elbow dislocation
Medial Epicondyle Fracture Rehabilitation

• 7-10 days post-op:
  • Posterior splint or hinged brace
  • Early gentle passive ROM
• Active ROM initiated once palpation of medial epicondyle is pain-free

• Outpatient occupational therapy initiated at 6-8 weeks if full ROM not achieved

• Return to sports and throwing at 3 months
Olecranon Stress Fracture

• Occur during sports:
  • Baseball pitchers
  • Javelin throwers
  • Gymnasts
  • Divers
  • Weight lifters
Olecranon Stress Fracture

- Result of repetitive microtrauma caused by olecranon impingement

- Pitchers present with posterolateral olecranon pain in throwing
Olecranon Stress Fracture Rehabilitation

• **Immediately post-op:**
  • Elbow splinted at 90 degrees
  • Begin wrist, hand, and shoulder ROM

• **7-10 days post-op:**
  • Unlimited passive ROM of elbow
  • No active elbow flexion beyond 90 degrees
  • Full active ROM of forearm
• **6 weeks post-op:**
  • Full active ROM of elbow

• **8 weeks post-op:**
  • Initiate light strengthening and throwing program
  • Thower’s Ten Program

• **12 weeks post-op:**
  • Advanced throwing program and full strengthening
INTERVAL THROWING PROGRAM FOR PITCHERS
AGES 13-14

A comprehensive program including injury-specific treatments as well as overall conditioning and training to address poor form.

WARM-UP & STRETCHING

Light exercises to increase blood flow. After beginning to sweat, perform total body dynamic stretching exercises, no more than 10-15 minutes total.
- Light jogging 5-10 minutes, or arm and leg exercises
- Upper body: ROM and stretching, core strengthening exercises (squeeze)
- Lower body: leg lifts, glute and ham stretch, hip adduction, hip rotation, hip abduction, hip flexion/extension, deep knee bend stretch

EARLY THROWING - PHASE 1: FLAT GROUND

- Do not exceed 50% effort, hip flexion is optimal.
- All warming up and stretching should begin with a "grip-up."
- Throw every other day, rest throwing arm or "off days."
- Do your upper body strength and conditioning exercises on same day as throwing workout, but do them after your throwing session. Progress to own step after 8-10 weeks if there is no pain during or after current step.
- Schedule: 2
  a. If sore, during warm-ups, repeat previous workout if soreness is gone after warm-ups.
  b. If sore on evening continues through first 15 throws: Step, take 2 days off, and return to step down one step.
  c. If sore only after throwing: Take one day off as you would anyway, and then return to the next step on the next session you resume throwing.

Warm-up throws: 10-15 throws at 30-45°. All warm-up should begin with a "grip-up" and be thrown with 50% effort.

Rest periods: 5-10 minutes

ScottishRiteSpa.org/Pitching
Interval Throwing Program

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<th>Step</th>
<th>Distance</th>
<th>Early Throwing Progress, %/m</th>
<th>Pitching on Flat Ground, %/m</th>
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<td>A) Warm-up throws</td>
<td>1) Warm-up throws</td>
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<td></td>
<td></td>
<td>B) 10 minutes</td>
<td>2) 10 minutes</td>
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<td>C) Rest</td>
<td>3) 10 minutes</td>
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<td></td>
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<td>D) Warm-up throws</td>
<td>4) 10 minutes</td>
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<td>E) 15 minutes</td>
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<td>A) Warm-up throws</td>
<td>1) Warm-up throws</td>
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**Phase III: Return to Pitching From the Mound**

- Take 2-3 days rest between sessions.
- No breaking pitching younger than age 14.
- All long throws should begin with a "Cow Hop" and be thrown with a minimum pitch velocity.
- Long toss begins throwing 21 feet 9 1/2 inches to 30 feet.
- Increase 10-15 feet every 9-10 throws until distance is reached to no more than 26 throws total.
- Pitching from the mound without throwing.

**Step 6**
Warm-up throwing
- 3 sets of 20 feet, 75% speed
- 3 sets of 30 feet, 60% speed
- Rest 4 minutes

Then, next 10 min before long toss
- Long toss 120 ft to 25 throws

**Step 7**
Warm-up throwing
- 4 sets of 30 feet, 75% speed
- Rest 4 minutes

Then, next 10 min before long toss
- Long toss 120 ft to 25 throws

**Step 8**
Warm-up throwing
- 4 sets of 20 feet, 60% speed
- Rest 4 minutes

Then, next 10 min before long toss
- Long toss 120 ft to 25 throws

**Step 9**
Warm-up throwing
- 3 sets of 20 feet, 75% speed
- Rest 4 minutes

Then, next 10 min before long toss
- Long toss 120 ft to 25 throws
Interval Throwing Program

Step 12
Wake-up throwing
20 throws at 50% (75% intensity)
25 throws at 60% (75%)
20 footballs at 100%
20 footballs at 75%
6 off-speed pitches (50%)
20 footballs (100%)
Rest 90 sec between each of the above sets.

Step 13
Wake-up throwing
20 footballs (75%)
6 off-speed pitches (75%)
Wake-up throws 120 ft
20 footballs (75%)
4 throws to 1st (75%)
15 footballs (100%)
10 off-speed pitches (100%)
20 footballs (100%)
5 off-speed pitches (75%)
20 footballs (75%)
4 throws to 2nd (75%)
29 throws to sets to 120 ft.

Step 4-6
Wake-up throws
20 footballs (100%)
Throws to 1st (100%)
15 footballs (100%)
10 off-speed pitches
20 footballs (100%)
5 off-speed pitches (100%)
20 footballs (75%)
5 throws to 1st (75%)
29 throws to sets to 130 ft.

Step 5: Conditioning Practice
00-90 pitch
10 throws to Left
Bunts and overload

Step 5L: Simulated game

GENERAL RULES

Throwing Progression: To establish a safe and gradual throwing progression, begin with step 1 and advance step by step, following the recommended rules for each step.

Throwing Axis Injury: After medical clearance, begin with step 1, advance step every other day for Phase 1.

- For a strain, ligament, or post-up injury, rest 2 days between each throwing practice once you get to Phase 2.
- Same rules apply for entire program.

We strongly encourage you to follow these recommendations. Failure to adhere to this program can result in re-injury or delayed return to full throwing.

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THANK YOU!