The Management of Hand Injuries in Athletes
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Course Objectives
× Understand basic anatomy of the wrist and hand
× Be familiar with some common orthotics
× Understand common injuries that occur and the mechanisms of injury
× Learn various assessment measures used for identification
× Learn some rehabilitation exercises used to treat
Injuries in athletes present a challenging orthopedic scenario:

- Financial implications
- Stress from coaches
- Self esteem issues

The treating therapist/ATC should consider the athlete's age, level of competition, position played, and desires of the athlete.

When is it safe to return to a sport?

**CONSIDERATION**

- Growth plates – carpal bones are ossified at 18 years of age
- Athletes are taught and expected to endure pain
- Pain cannot necessarily be the guide, respect pain

**COLLABERATION**

The decision for surgery, rehabilitation or return to play should never compromise care.

It is essential to educate the athlete on the risks and complications inherent to these injuries and rehabilitation.

The medical team should work together to reach the goals of the athlete.
SURFACE ANATOMY
- Observation is the starting point when evaluating a hand injury.
- Be familiar with the skin creases of the hand
- Look for focal swelling
- Digital malrotation
- Normal cascade of the fingers and hand
- Look for open wounds

BONY ANATOMY
- 5 METACARPALS
- 14 PHALANGEAL BONES
- 8 CARPAL BONES
- DIP = distal interphalangeal joint
- PIP = proximal interphalangeal joint
- MCP = metacarpophalangeal joint

CARPAL BONES
- SCAPHOID
- LUNATE
- TRIQUETRUM
- PISIFORM
- TRAPEZIUM
- TRAPEZOID
- CAPitate
- HAMATE
FLEXION/EXTENSION
- Occurs at radiocarpal and midcarpal rows, approximately 50/50
- Extension: proximal row glides volar, capitate glides volar on lunate, scaphoid supinates and lunate pronates (move away from each other)
- Flexion: proximal row glides dorsal, capitate glides dorsal, scaphoid pronates and lunate supinates

Radial / Ulnar Deviation
- Arc of motion is about 50 degrees
- Normal RD: 15–30 degrees
- Normal UD: 30–45 degrees

FLEXOR TENDONS
- Zone I = insertion of FDS at middle phalanx to insertion of FDP at distal phalanx
- Zone II = A1 pulley to the insertion of FDS; "No Mans Land"
- Zone II = from distal end of carpal tunnel to first pulley
- Zone IV = the carpal tunnel
- Zone V = proximal to carpal tunnel

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FLEXOR TENDONS

- Flexor digitorum superficialis (attaches to middle phalanx and flexes the PIP joint)
- Flexor digitorum profundus (attaches to distal phalanx and flexes the DIP joint)
- Flexor pollicis longus (flexes IP joint of thumb)
- The sheath is composed of pulleys which prevent bowstringing of tendons

EXTENSOR TENDONS

- Zone I= DIP joint/terminal tendon
- Zone II= triangular tendon and middle phalanx
- Zone III= central slip
- Zone IV= distal to sagittal bands and proximal to central slip
- Zone V= sagittal bands
- Zone VI= distal to extensor retinaculum proximal to MP joint
- Zone VII= extensor retinaculum
- Zone VIII= proximal to extensor retinaculum

ZONES

EXTENSOR TENDONS

- Arranged in 6 dorsal compartments which serve as landmarks
  1= APL/EPB
  2=ECRL/ECRB
  3=EPL
  4=EIP/EDC
  5=EDM
  6=ECU

- Extensor hood mechanism located over each PIP joint which aidsPIP and WR motion with assistance of intrinsic muscles
Considerations:
Focus on mechanism of injury
Consider prior medical history
What are the sport requirements?
Is injury to dominant or nondominant side?
Consider compliance, and is a cast or custom orthosis better?
Will the person be able to complete ADLS?

INJURY MECHANISMS
in Wrist
- Traumatic:
  - Throwing
  - Weightbearing
  - Twisting
  - Impact (FOOSH)
- Cumulative:
  - Loading wrist in dorsiflexion, up to 16X body weight

TFCC INJURIES
TFCC Lead Test: UD the wrist and axially loading the wrist and moving it volar and dorsal or rotating the forearm
A positive test elicits pain, clicking, or crepitus and reproduces the athletes' symptoms
**Wrist Weight Bearing Test**

- Use a non-digital analog scale and keep elbow straight.
- Press hand flat into scale.
- If athlete has pain with extension, test unaffected side.
- 60-120# is typical.
- No difference between right and left or dominant vs. non-dominant.
- Typically, 15% less than grip strength except in cases where there is heavy use of forearm-elite athletes.

**TREATMENT**

- Place in a Muenster orthosis or cast for 4-6 weeks full time. Remove only for hygiene.
- Goal is to limit forearm rotation and rest the ulnar side of wrist.
- May return to play if able in cast.
- Perform isometric activation of pronator quadratus in supination with neutral wrist will help stabilize DRUJ.

**Functional Casting**

Video Courtesy of Walters, Inc.
ECU TENDONITIS

- Often due to sudden flexion and UD
- These positions increase the angulation of the ECU tendon relative to the ulna and result in maximum force on ECU
- Rowing, golf, and racket sports
- Often traumatic event

EVALUATE and TREATMENT

- Test with palpation and manual resistance to ECU
- Immobilize in Muenster style cast or orthosis
- Often responds well to cortisol injection and rest
**SCAPHOID FRACTURE**
- Most common carpal fracture
- Can fracture the proximal, middle or distal 3rd
- Occurs most often from fall on outstretched hand with maximum extension
- Commonly the injury is left unreported and can result in nonunion or delayed union
- Distal fractures heal more readily than proximal fractures

**Identification**
- Tenderness in the anatomic snuffbox
- Swelling in the snuffbox
- Axial compression of thumb elicits pain
- Complain of dull ache in wrist, may increase with grip
- Tenderness over scaphoid tubercle (with wrist extended apply pressure to proximal wrist crease)

**TREATMENT**
- Thumb spica orthosis or cast
- Screw or pin fixation
SCAPHOLUNATE LIGAMENT INJURY
May have difficulty with self-care and difficulty with gripping
Watson’s Scaphoid Shift Test
Cast for 6 weeks with thumb IP free
ROM to fingers, edema control
After cast removal, transition to orthosis and begin gentle ROM
Some MDs will allow RTP immediately in cast

HOOK OF HAMATE FRACTURE
Occurs often with racquet and bat handling sports
Most frequently results in excision of the hamate
Out of 36 surgeons treating professional athletes surveyed, 52.8% allowed RTP in 2 weeks from surgery
*Sports Health, July 2013.
METACARPAL FRACTURE

Commonly occurs with a clenched fist and axial load applied to hand

Also seen after hitting an object and fracturing 5th metacarpal = Boxer’s Fracture

Typically they will angulate dorsally due to the insertion of the intrinsics

Immobilize early with MP’s in 60-70 degrees flexion and IP’s extended

Identification

- When making a fist, the fingers should point towards radial scaphoid. If scissoring is observed this may indicate a malrotation of the metacarpal.
- You can also examine the nail with the finger straight. If nail is not facing up, malrotation has occurred.
- Point tender over the metacarpal and area of swelling.

Stable fracture

- Less than 10 degrees of angulation is acceptable
- Orthosis 4-6 weeks, wrist in 30 degrees of extension, MPs 60-70 degrees of flexion. Leave the IP’s free to allow finger motion with tendon gliding
- Transition to hand based orthosis for return to play

Treatment
Metacarpal fracture with fixation

- Place in either ulnar gutter style orthosis or a cast for 4-6 weeks
- When throwing hand is required for sport, out of play 6-8 weeks
- For field positions, can return in 3 weeks with protection

Bennetts Fracture

- Fracture at base of 1st metacarpal often with subluxation of trapezial 1st metacarpal joint
- Frequently seen in quarterbacks after striking hand on helmet after throwing a pass
- Immobilize in forearm-based thumb spica orthosis

Phalanx Fractures

**Identification**

- Look for swelling and/or open wounds
- Watch for malrotation when making a fist
- May be intra-articular or extra-articular

- If stable, buddy tape and begin gentle AROM (Buddy Loops by 3PP)
- With surgical fixation, fabricate orthosis and do not return to play for minimum 3 weeks (callus formation)
PROXIMAL INTERPHALANGEAL DISLOCATIONS

DORSAL
- More common
- Volar plate frequently disrupted

VOLAR
- May disrupt extensor mechanism and head of phalanx may protrude into central slip and injure lateral bands

DORSAL
- Splint in about 20 degrees of PIP flexion for 2 weeks
- Begin gentle finger flexion and extension to block of splint, allow full active extension in 2 weeks
- Return to play with protection

VOLAR
- Splint in full extension for 6 weeks
- Depending on sport and position, may return to play with protection right away
- I use QuickCast
• Terminal tendon (light blue)
• Lateral bands (dark blue) formed from the intrinsic and extrinsic extensors
• Central slip located over the PIP joint
• With normal finger extension the lateral bands pull and extend the PIP joint.
• Triangular ligament spans top of middle phalanx preventing migration of lateral bands

Boutonniere Deformity
• The central tendon is ruptured at the PIP joint causing a palmar subluxation of the lateral bands. The extensor force is now concentrated at the DIP joint resulting in hyperextension and loss of flexion at the DIP joint. The finger can no longer actively extend at the PIP joint.
• Treat by splinting in full PIP extension for 6-8 weeks. Leave the DIP joint free to perform hourly DIP flexion exercises to centralize the lateral bands.

Mallet Injury
• Evolves from striking tip of finger and rupturing the terminal extensor tendon and/or fracturing the distal phalanx.
TREATMENT

- Splint 6-8 weeks continuously and return to play immediately.
- Use serial casting techniques or fabricated orthosis. Stack splints usually result in poor positioning and not recommended.

JERSEY FINGER (FLEXOR DIGITORUM PROFUNDUS AVULSION)

- Most often caused from grabbing a player and getting the tip of finger caught in jersey
- Ring finger most common due to sharing muscle belly with small and middle finger
- Distal interphalangeal joint represents 15% of finger function

2 Things Can Happen:

- The FDP can avulse and retract down to the PIP joint (the vinculae help hold it in place), can wait 4-8 weeks if necessary before fixing it
- The FDP retracts into the palm and must be repaired within the week
Depending on the sport and the position played, an athlete may return to play 1-2 weeks after surgery with protective club style cast.

**Collateral Ligament Injuries to The Thumb**

- **Ulnar Collateral**
  - Most common
  - Occurs with abduction stress to MP joint, often from fall onto thumb or jamming thumb on ground or helmet
  - Often referred to as “Skier's Thumb”

- **Radial Collateral**
  - Results from sudden varus stress to MP joint
  - Often underdiagnosed

**Assessment**

- Tenderness at MP joint
- Swelling at MP joint
- Assess instability by passively abducting the thumb MP joint at 0 degrees of flexion and 30 degrees of flexion
- Painful, weak grip
- Always compare both sides!
TREATMENT FOR UCL INJURY

- Acute, Grade 1 (most common) – treat with forearm based thumb spica cast/orthosis with MP joint in 30 degrees flexion, IP free for 1-2 weeks

- Grade 11 – same immobilization device for 4-6 weeks.

- Grade 111 – complete ligament rupture, requires surgery – cast for 4-6 weeks

- With good healing may return to play 10-12 weeks post op

REHABILITATION

- Engage the athlete in the treatment process

- Develop a program for range of motion and strength to enhance the functional return of the hand

- Maintain functional stability during the healing process

- Compare side to side

- Threshold training – push it as hard as you can without overdoing it

- Remember: mobility vs. stability

EXERCISE LIMITS

- Dependent on gender, age, body size and stage of healing

- Consider sport and position specific needs

- Perform to fatigue not failure

- Integrate the entire kinetic chain

- Emphasize eccentric control/strength

- Emphasize proper form
**REHAB PROGRESSION**

- Begin active range of motion as soon as possible – stiffness is a fingers worst enemy!
- Progress to active-assistive and passive range of motion
- Strengthening – begin with isometrics, then endurance with high reps, move to mid range strengthening, then full range strengthening
- Sport specific activity

**ISOKINETICS**

- Great for proprioception training in athletes
- Muscle contraction performed at constant angular speed. Allows for controlled training and endures and proprioceptive joint functions and may allow earlier return to play
- Disadvantages: demands special equipment, time consuming and does not reflect the actual daily activities of a muscle across a joint

**ISOMETRICS**

- Active muscle contraction performed at a fixed joint angle and with constant muscle length
- Easy to use and can be used early in an injury to build strength
- Unilateral isometric exercises in wrist have been shown to increase voluntary muscle activation bilatorily. The motor cortex and neuromuscular control is stimulated; "helps keep the brain connected"
**ECCENTRICS**
- Designed to strengthen the muscle in its lengthened state
- Shown to decrease pain and build tendon strength in chronic tendinopathies
- Works on co-activation (simultaneous contraction of agonist and antagonist muscles) which will enhance the stability of a joint

**CO-ACTIVATION**
- Demand the use of eccentric, concentric, and isometric exercise
- May likely produce a re-education of "balance" in the joint
Video

TENDON GLIDE
EXERCISES

FACILITATES THE GLIDE OF FLEXOR AND EXTENSOR TENDONS TO MINIMIZE SCAR ADHESIONS

- ASSISTS WITH EDEMA REDUCTION
- PREVENTS JOINT STIFFNESS

Video
STRENGTHENING

- Use various styles of resistance to strengthen wrist flexors, extensors, deviators and forearm rotators
- Need recovery time between sessions
- Don’t focus so much on how many reps – go to point of maximum fatigue, then rest, and repeat

UPPER BODY ERGOMETER

DIGIFLEX SYSTEM

- Coordination and co-contractions
- Great way to warm up upper body

Video
Lee and Carroll, 2007

**CONTRALATERAL TRAINING**

"Cross education occurs in the absence of substantial muscle activity in the untrained muscles during unilateral exercise, and when there is also no muscle hypertrophy in the untrained limb."

By training the uninjured side, the injured limb can get strength benefits.

Give a gripper or putty to your hand athlete the day after surgery in the UNINVOLVED hand!

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**STRETCHING**

Use cylindrical foam to squeeze under fingers while slowly rolling fingers into a fist.

**STRENGTHENING**

Keep fingers fully extended while pushing down into the putty.

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**INTRINSICS**

Necessary for fine motor control and hand strength.

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**PUTTY - CISE TOOLS**

Useful for simulating various grips and pinch patterns.

Can change level of difficulty by changing resistance of putty.

Finger and thumb flexors (intrinsics and extrinsics) working.

Shoulder stabilizing muscles.
"Smilies" and "Frownies" – focuses on upper body co-contractions and strength. Great bilateral activity

Dart Throwers Motion – flexion of wrist with ulnar deviation and extension with radial deviation. More normal kinematics of wrist joint lending to a more normal functional movement pattern

A Variety of colors to progress resistance
Simulate push-pull tasks
Focus on advanced motions like grasp and twist
Frisbee with weight

Co-contractions – involves the distal and proximal muscles from the fingertips to the core

Vary the weight of the object from a marble to lacrosse ball to challenge the stability

Change the elbow and forearm position to incorporate different muscles

Stabilizing Exercises

Video

WALL PUSH UPS

STRENGTHENS MUSCLES IN WRIST AND SHOULDERS

ENGAGES MUSCLES IN CORE

PUSHES WRIST INTO EXTENSION FOR STRETCH

WEIGHT BEARING IN PUTTY

STRENGTHENS MUSCLES IN WRIST AND SHOULDERS

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PLYOMETRICS WITH BALL

Toss ball up

Catch on the return and control the lowering

Grading: start with light tennis ball to work coordination and wrist control then progress to heavier or larger ball
RICE BUCKET

- Wrist rotations: clockwise, counter clockwise
- Digs: go to bottom of bucket, grip, dig up and out
- “Flick” fingers and wrist as many reps as possible for 1 minute

CONCLUSION

- Keep the athletes goals and safety in mind
- Collaborate with other professionals involved in treatment process
- Remember stability over mobility – protect the injury with splinting, casting or taping
- Develop a rehab program that progresses appropriately, is sport specific and fun!

THANK YOU

Questions?

THANK YOU

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