Chapter 18:
Sprains of the Hand

Barbra Koczan, PT, CHT, DPT

Ligament Injuries of the Hand
I. Symptoms
   A. Localized pain, tenderness, edema at ligament
   B. Painful with lateral stress applied to ligament

II. Ligament Injury Classification
   A. Grade I–damage to individual fibers, no loss of stability or disruption of the ligament
   B. Grade II–complete disruption of ligament, passively unstable, actively stable through full ROM
   C. Grade III–complete disruption of ligament, actively and passively unstable
      1. Avulsion fracture
      2. Dislocation

III. Factors Affecting Healing
   A. Type of sprain
   B. Co-morbidities–systemic diseases (i.e. RA, Diabetes)
   C. Promptness of medical attention

IV. Sprain Management
   A. Conservative/Stable–minor ligament sprains with damage to individual fibers and incomplete ligament tears with minimal joint instability; treatment is typically immobilization
   B. Operative/Unstable–ligament tears with gross joint instability; treatment is typically surgical

V. Diagnostic Testing for Sprains
   A. X-Ray
   B. Radiograph
   C. Arthrogram
   D. Ultrasound
   E. MRI
   F. CT scan

VI. Principles of Ligament Management
   A. Prevent lateral stress to joint
   B. Early mobilization
   C. Ensure joint stability
   D. Decrease pain
   E. Control edema with RICE (rest, ice, compression, elevation)
   F. Never sacrifice stability for mobility
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VII. Complications--Pain, swelling and stiffness of the joint may persist for months

Ligament Injuries of the PIP Joint
I. Supporting Structures of PIP Joint
   A. Collateral ligaments
      1. Proper collateral ligament (PCL)
         a. Spans from lateral proximal phalanx to lateral tubercles of middle phalanx
         b. Taut in flexion and provides principal resistance to lateral deviation
      2. Accessory collateral ligament
         a. Spans from PCL to volar plate (VP)
         b. Taut in extension
      3. Most common ligament injury of the hand; radial collateral ligament (RCL) more frequently injured than ulnar collateral ligament (UCL)
      4. Injury occurs typically with lateral stress when PIP joint is extended
      5. Swollen, painful joint with AROM
      6. Tenderness over origin and insertion of ligament
      7. Conservative/stable ligament injury management1,2,3,5,6
         a. Buddy straps applied to the involved and adjacent digit (involved ligament is in between fingers) during day and begin immediate AROM (Fig. 1)
         b. Extension gutter orthosis at night. If very painful, then gutter orthosis with joint in slight flexion acutely for comfort at all times except AROM.
         c. RCL injuries of index finger (IF) and UCL injuries of small finger (SF) should be immobilized in extension gutter orthosis at all times except AROM because these ligaments are on the outside borders of the hand and are unable to be protected with buddy straps
         d. Focus on DIP joint motion early to prevent oblique retinacular ligament (ORL) tightness and encourage tendon gliding
      8. Surgical/unstable ligament injury management–ligament tears with gross joint instability1,2,3,5,6
         a. Immobilize 3-4 weeks in hand based orthosis in safe position with injured and adjacent finger included
         b. Initiate AROM at 3-4 weeks with buddy straps
      9. Complications
         a. Flexion contractures often develop
         b. Prolonged swelling and stiffness at PIP joint
   B. Volar Plate–thick, fibrocartilaginous structure at volar PIP joint, prevents hyperextension of PIP joint
      1. Cause--hyperextension of the PIP joint
      2. Symptoms--swelling and tenderness palmar PIP joint
      3. Management--see dorsal dislocation of PIP joint section below
   C. Extensor Mechanism/Central slip–provides dorsal support
      1. Cause—forceful flexion injury to PIP joint
      2. Symptoms—weakness or inability to extend PIP joint; swelling and tenderness
dorsal PIP joint
3. Management--see volar dislocations of PIP joint section below and extensor tendon chapter

**Dorsal Dislocations of the Pip Joint** (Fig. 2)
(i.e. Middle phalanx dislocates dorsally in relation to the proximal phalanx)
I. Mechanism of Injury
   A. Hyperextension of an extended finger
   B. Typically a consequence of axial loading
   C. Volar plate and collateral ligaments may be attenuated

II. Management \(^1,2,3,5,6\)
   A. If joint can be reduced and maintained—Closed reduction is usually possible and joint is typically stable once reduced
      1. Therapy management of joint that is stable after closed reduction
         a. Dorsal blocking orthosis (DBO) or figure of eight orthosis and begin protected early PIP joint AROM into flexion (Fig. 3)
         b. At 3 weeks—extension block discharged and extension exercises begun
         c. At 6 weeks—gradual progressive strengthening, PROM, dynamic Orthosis usage
   2. Therapy management of joint that is unstable after closed reduction
      a. Immobilize 2-3 weeks in DBO; AROM, general conditioning and strengthening to uninvolved joints
      b. At 3 weeks, if joint is stable—orthosis removed for protected AROM
      c. At 6 weeks—PROM if early PIP joint flexion deformity; extension orthosis prn
   3. Complications
      a. Recurrent dislocation or subluxation; persistent instability (swan-neck deformity)
      b. Flexion contracture (pseudoboutonniere deformity)
      c. DIP joint stiffness due to extensor mechanism or ORL adhesions
      d. PIP joint stiffness
   B. Surgical Intervention—If joint reduction cannot be maintained
      1. Volar plate arthroplasty—Collateral ligaments are excised. Pullout wire inserted through volar plate to hold joint in reduction. Kwire placement to stabilize joint.
         a. At 10-14 days—Kwire removed, PIP placed in DBO at 30 degrees, AROM and PROM into flexion
         b. At 4 weeks—AROM out of orthosis
         c. At 5 weeks—passive extension, dynamic extension orthosis
         d. At 6 weeks—strengthening
         e. Emphasis on joint blocking to prevent tendon adhesions
         f. Complications—tendon adhesions, flexion contractures
      2. Fixation—Fixation of middle phalanx fracture with screw or wire
         a. At 3-5 days—initiate AROM; DBO for up to 6 weeks
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Chapter 18 Figures

Fig. 1. Buddy Straps used for PIP collateral ligament injury.

Fig. 2. Dorsal dislocation of the PIP joint with volar lip fracture of middle phalanx. Printed with permission: McAuliffe JA. Hemi-hamate autograft for the treatment of unstable dorsal fracture dislocation of the proximal interphalangeal joint. J Hand Surg. 2009; 34A.

Fig. 3. Dorsal blocking orthosis used with PIP dorsal dislocation.
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b. At 6 weeks—unrestricted AROM and PROM
c. At 8 weeks—strengthening
3. Hemi-hamate arthroplasty—Osteochondral graft from hamate used to reconstruct fractured volar lip of middle phalanx (Fig. 4)\textsuperscript{2,7,8,9}
   a. At 5-10 days—initiate AROM exercises into flexion; DBO at 15-20 degrees for 3-6 weeks
   b. At 3-6 weeks—unrestricted AROM into extension
   c. At 6 weeks—initiate PROM into extension
d. At 8 weeks—strengthening
4. Complications\textsuperscript{2}
a. PIP joint flexion contracture
b. Recurrent subluxations
c. PIP joint swelling and stiffness

Volar Dislocations of Pip Joint
(i.e. middle phalanx dislocates volarly in relation to proximal phalanx)
I. Mechanism of Injury
   A. Rare disruption of central slip, at least one collateral ligament, transverse retinacular ligament
   B. Commonly unstable after reduction or irreducible and requires surgical intervention due to interposition of soft tissues (collateral ligament, extensor mechanism)

II. Management\textsuperscript{2,3,6}
   A. If central slip not completely disrupted
      1. Immobilization in PIP extension orthosis with DIP free for 2-3 weeks; orthosis removed for controlled AROM
      2. At 6 weeks—PROM and dynamic orthosis prn
   B. If central slip avulsed--6 weeks full time PIP extension orthosis usage with DIP free or tendon repair

III. Complications
   A. ORL/lateral band tightness if DIP ROM not encouraged
   B. Boutonniere deformity if central slip avulsion goes unrecognized
   C. Extensor lag

IV. Surgical Intervention
   A. Open reduction and central slip repair
      1. K-wire in place for 2-3 weeks
      2. PIP extension orthosis for an additional 3-4 weeks
      3. Initiate AROM PIP joint to 30 degrees via a short arc protocol; progress 10 degrees each week

MP Joint Sprain
I. MP joint less frequently injured than PIP joint because MP joint has more mobility therefore, the MP joint is able to dissipate forces due to its ability to move in not
only flexion and extension but also into abduction and adduction.

II. Supporting Structures of MP Joint
A. Collateral ligaments--taut in flexion and lax in extension
1. Proper collateral ligament
2. Accessory collateral ligament
3. Management
   a. Conservative–Incomplete collateral ligament injury: partial tear of collateral with minimal instability and non-displaced bony avulsions
      i. Hand based orthosis with injured and adjacent fingers included with MP at 30-50 degrees (Fig. 5)
      ii. At 3-4 weeks transition to protected AROM using buddy straps for 3-6 more weeks
   b. Operative–complete tear of collateral ligament
      * With ligament interposition between extensor hood of intrinsics and sagittal band (SB)
      * Without interposition
      * Displaced avulsion fracture
      * Complete tear with SB involvement
         i. Immobilization in hand based orthosis with injured and adjacent fingers included with MP at 30-50 degrees
         ii. At 3-4 weeks–AROM with buddy tape
         iii. At 6 weeks–PROM and dynamic orthosis usage
         iv. At 8 weeks–strengthening
4. Complications
   a. Watch for extensor lag or difficulty restoring full flexion of MP joint
   b. To prevent ligament shortening and loss of flexion, MP joint should be immobilized in 30-50 degrees per MD
   c. Healing can be jeopardized if MP joint is placed in orthosis in full flexion due to ligament being maximally stretched
   d. Often, injury to collateral ligaments is accompanied by injury to the lumbrical or interosseous muscles, therefore, gentle intrinsic stretching is recommended
B. Sagittal Band
1. Part of the extensor retinacular system that extends from the volar plate to the Extensor digitorum communis (EDC)
2. Primary lateral stabilizer of the EDC tendon at the MP joint and limits its excursion
3. Prevents tendon bowstringing during hyperextension
4. Prevents ulnar or radial subluxation of EDC
5. Injury usually occurs following forceful deviation of the digit against resistance with the MP joint extended
6. Management
   a. Conservative--Minor SB injuries without extensor tendon instability or with extensor tendon subluxation
      i. Buddy strap or hand based orthosis with involved and adjacent MP joint
Fig. 4. Hemi-hamate arthroplasty for PIP dorsal dislocation/fracture

Fig. 5. Orthosis for MP joint collateral ligament injury.
(injured SB is in between immobilized fingers) extended for 3 weeks; AROM as tolerated

b. Operative--Complete SB tears with extensor tendon dislocation
   i. Hand based orthosis with involved and adjacent MP joint in full extension
   ii. At 3-4 weeks--Initiate AROM

7. Complications
   a. Monitor MP joint throughout the course of treatment to be sure that active extension can be achieved so that an extensor lag doesn’t develop
   b. Watch Radial SB injuries of the SF as an abduction deformity can develop due to ulnar subluxation of the abductor digiti minimi

8. Surgical management
   a. Centralization of EDC with repair or reconstruction of the SB

Dislocations of MP Joint

I. Simple–Closed reduction possible; joint is stable\(^1,2,3,6\)
   A. Dorsal extension block orthosis, blocked at 30-40 degrees, is used for 3-4 weeks
   B. Within 1\(^\text{st}\) week begin MP joint AROM within confines of orthosis
   C. At week 3–begin gentle MP joint flexion PROM
   D. At week 6–begin progressive strengthening

II. Complex/closed Reduction not Possible\(^1,2\)
   A. Requires surgical intervention
   B. Post-op management
      1. Dorsal block orthosis MP joint at 30-40 degrees flexion for 4-6 weeks
      2. At week 1–begin protected MP joint AROM within confines of orthosis
      3. At week 3–begin gentle MP joint flexion PROM
      4. At week 6–begin progressive strengthening

III. Surgical Intervention—necessary if volar plate becomes interposed in the joint preventing closed reduction
   A. Open reduction—volar plate is removed from joint space allowing relocation
   B. Internal fixation–usually not necessary because MP joint is typically very stable after open reduction

IV. Complications
   A. Extensor lag may develop if extension exercises are not emphasized
   B. Persistent pain at volar MP joint

Thumb Ligamentous Injuries

I. Sprain
   A. Ulnar collateral ligament (UCL) injuries—occur due to forced radial deviation of the thumb\(^1,2,11,12\)
      1. Occur much more frequently than radial collateral ligament (RCL)
      2. Skiers or gamekeeper’s thumb
      3. Steners lesion—rupture of the adductor aponeurosis, which becomes interposed between the proximal stump of the UCL and its insertion on the proximal phalanx
4. Management\textsuperscript{1,2,3,5,6}
   a. Conservative--Incomplete ligament tear or non-displaced bony avulsions
      i. Immobilize in hand or forearm based thumb spica orthosis (with thumb positioned in slight flexion and ulnar deviation to take tension off of UCL) with IP free 3-6 weeks
      ii. At week 3-4--Initiate AROM MP joint
      iii. At week 5-6--PROM MP joint
      iv. At week 6--Dynamic flexion orthosis
      v. No tip pinch for 8 weeks; Goal--stable, painfree joint
   b. Surgical--Complete ligament rupture or displaced bony avulsions
      i. Immobilize in cast then thumb spica orthosis with IP joint free full time for 4-6 weeks
      ii. At 4-6 weeks—Initiate AROM MP joint
      iii. At 6-8 weeks—Initiate PROM and dynamic orthosis of the MP joint
      iv. Avoid strengthening tip pinch for 8-10 weeks
   c. Complications
      i. Immediate IP mobilization necessary to prevent extensor mechanism adhesions
      ii. Goal of rehabilitation is a stable, pain-free joint--must avoid being too aggressive
   d. Surgical intervention
      i. ORIF of fracture fragment--with K-wire or mini screw
      ii. Direct ligament repair--with interosseous sutures
      iii. Ligament reconstruction with tendon graft or MP joint fusion performed in chronic cases

B. Radial collateral ligament (RCL) injury--usually occurs due to forced ulnar deviation of thumb. Conservative and surgical management is the same as that for ulnar collateral ligament injury except that the thumb is placed in slight flexion and radial deviation to take tension off of the RCL when immobilized in the orthosis and tip pinch strengthening can begin earlier.\textsuperscript{1}

II. Dislocation
   A. Simple--Closed reduction possible\textsuperscript{3,5}
      1. Thumb Spica Orthosis--MP joint blocked at 20-30 degrees of flexion for 3 weeks
      2. At 3 weeks--AROM of entire thumb
      3. Focus on regaining strength and function as opposed to trying to achieve maximal flexion
   B. Complex--Closed reduction not possible due to soft tissue interposition (typically volar plate becomes interposed between intrinsic muscles\textsuperscript{3,5})
      1. Open reduction with partial excision of flexor pollicis longus (FPL) tendon sheath and repair of collaterals (if injured)
         a. Dorsal block Thumb Spica Orthosis with MP at 30 degrees for 2-3 weeks
         b. At 2 weeks-- Initiate blocked AROM
         c. At 6-8 weeks--Initiate gentle PROM
References

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Multiple Choice Questions

1. The role of the sagittal band is:
   A. Prevent EDC bowstringing during flexion
   B. Prevent radial subluxation of the EDC
   C. Limit FDP excursion
   D. Allow for coordinated movement between the PIP and DIP joint

2. Patient is 5 weeks status post operative repair of MP dislocation. Which of the following is appropriate treatment?
   A. AROM, PROM, scar management
   B. AROM, PROM, strengthening
   C. Hand based DBO MP joint at 70 degrees, AROM, PROM
   D. Forearm based DBO MP joint at 20 degrees, AROM

3. Following conservative management of UCL injury which is an appropriate treatment
   A. Tip Pinch exercises to strengthen thumb musculature
   B. Immobilize in hand based orthosis with thumb in slight flexion and radial deviation to support ligament
   C. Immediate IP joint ROM to prevent extensor mechanism adhesions
   D. Aggressive stretching to recapture ROM

4. You suspect an acute UCL injury of the MP joint of the thumb. The following can be done to confirm the diagnosis except
   A. Tenderness to palpation over the ligament
   B. Pinch should be equal to the uninvolved hand
   C. Gapping of the joint with application of lateral stress
   D. Pain and swelling radial MP joint

5. Principles of ligament management include all of the following except
   A. Prevent lateral stress to the joint
   B. Decrease pain
   C. Control edema with rest, ice, compression
   D. Push to regain ROM as early as possible

6. A goal of conservative treatment of UCL injury to the MP joint of the thumb is
   A. A tip pinch that is equal to that of the contralateral hand by 4 weeks
   B. Discharge of orthosis within a week of injury
   C. A stable, painfree joint
   D. AROM that is WFLs by 2 weeks after injury

7. The following is a possible surgical option for dorsal dislocation of PIP joint
   A. Tenodesis
   B. Flexor tenotomy
   C. Volar Plate Arthroplasty
   D. Central slip repair
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Multiple Choice Questions

8. Patient is 8 weeks status post PIP joint collateral ligament injury treated conservatively. She has ROM WFL but continues with pain and stiffness. What do you tell her?
   A. This is normal, as it often takes months for swelling, stiffness and pain to subside post injury
   B. Refer her to her doctor for further work-up
   C. Instruct her to wear her buddy straps again until pain subsides completely
   D. Fabricate a orthosis to immobilize the PIP joint

9. Following a PIP joint collateral ligament injury what would be orthosis usage that may be necessary at 6 weeks post injury to address a typical complication?
   A. Composite flexion orthosis to address decreased composite ROM
   B. DIP extension orthosis to address swan neck
   C. Extension orthosis to address PIP flexion contracture
   D. Protective hand based orthosis to address prolonged stiffness and swelling of PIP joint

10. Which of the following statements are true regarding hand therapy after surgical intervention of a dorsal dislocation PIP joint?
    A. Strict immobilization is essential
    B. Early PROM is recommended
    C. Early protected AROM is recommended
    D. Focus should be on regaining extension as soon as possible

11. Post-operatively, which of the following patients would not be placed in a dorsal blocking orthosis?
    A. Dorsal dislocation of the PIP joint
    B. Volar dislocation of the PIP joint
    C. Dislocation of the MP joint
    D. Complex thumb MP joint dislocation

12. Orthosis used after surgical repair of a torn MP joint collateral ligament should be:
    A. Hand based with injured and adjacent MP joints in 45 degrees with IP joints free
    B. Hand based with injured MP only at 45 degrees with IP joint free
    C. Forearm based with injured and adjacent MP at 45 degrees with IP joint free
    D. Hand based with injured and adjacent MP at 70 degrees with IP free

13. Which structure is responsible for preventing hyperextension of the PIP joint?
    A. Oblique retinacular ligament
    B. Sagittal bands
    C. Volar plate
    D. Lumbricales

Multiple Choice Question Answer Key
Chapter 18

1-B, 2-A, 3-C, 4-B, 5-D, 6-C, 7-C, 8-A, 9-C, 10-C, 11-B, 12-A, 13-C