15

Common Finger Sprains and Deformities

CYNTHIA COOPER

Only with the invisible knowledge of the fingers will one ever be able to paint the infinite fabric of dreams.

From *The Cave* by Jose Saramago, Harcourt Books, 2002

KEY TERMS

Accessory collateral ligament (ACL)
Bicondylar
Boutonniere deformity
Central extensor tendon (CET)
Collateral ligaments
DIP extensor lag
DIP flexion contracture
Functional stability
Fusiform swelling
Gamekeeper's thumb
Ginglymus joint
Lateral bands (LB)
Mallet finger
Oblique retinacular ligament (ORL)
ORL tightness
Proper collateral ligament (PCL)
Pseudoboutonniere deformity
Skier's thumb
Stener's lesion
Swan neck deformity
Transverse retinacular ligament (TRL)
Volar plate (VP)

Mallet fingers, boutonniere deformities, and swan neck deformities are common finger injuries that can be recognized by a hand therapist with a keen eye. They also can be treated successfully by precise management. The trauma and disease processes that cause these deformities vary, but regardless of the cause, the therapist's detailed knowledge of pathomechanics and therapy guidelines helps to manage and direct the course of treatment.

Some clients may be referred by primary care physicians, who may not have identified serious injuries such as gamekeeper's thumb or a **volar plate (VP)** injury. This may be especially likely in the setting of an occupational medicine clinic. In this situation, the therapist has an opportunity to identify the clinical findings and help

arrange for the client to see a physician who specializes in hand problems.

Jamming injuries to the digits occur often in sports. Football players have a high incidence of proximal interphalangeal (PIP) joint injuries. In these sports-related injuries, dorsal dislocations are more common than volar dislocations. Boutonniere deformities frequently occur in basketball players. Mallet injuries occur when the player's fingertip strikes a helmet or ball.[1] Therapists whose clients participate in sports can expect to see these common sprains and finger injuries as part of their caseload.

Many nonathletes enjoy sports activities after work, and these "weekend warriors" often sustain finger injuries that initially go untreated. Clients who later seek medical attention may have chronic pain, edema, and stiffness. More long-term problems, such as persistent residual pain and swelling, can be very challenging to treat.

MALLET FINGER

A finger with drooping of the distal interphalangeal (DIP) joint is called a **mallet finger** (Fig. 15-1).[2] Typically the DIP can be passively corrected to neutral, but the client is unable to actively extend it; this condition is called a **DIP extensor lag.** If the DIP joint cannot be passively extended to neutral, the condition is called a **DIP flexion contracture.** A DIP flexion contracture seldom is present early after injury; however, if the injury goes untreated, this problem may develop.

ANATOMY

The DIP joint of the finger is a **ginglymus joint,** or hinge joint. It is **bicondylar** (it has two condyles) and is similar to the PIP joint in its capsular ligaments. The terminal extensor tendon and terminal flexor tendon attach to the most proximal edge of the distal phalanx. This insertion contributes to the joint's dynamic stability.[3]

DIAGNOSIS AND PATHOLOGY

A mallet injury frequently is caused by a blow to the fingertip with flexion force or by axial loading while the DIP is extended.[4] The terminal tendon is avulsed. An avulsion fracture also may occur and should be ruled out. Laceration injuries are another cause of this deformity. Anteroposterior (AP) and true lateral x-rays typically are obtained. In addition, the PIP joint should be examined for possible injury.[5]

TIMELINES AND HEALING

The DIP joint is splinted in full extension for approximately 6 weeks to allow the delicate terminal tendon to heal. The joint should not be allowed to flex even briefly during this period of immobilization. After 6 weeks, the client is weaned off the splint while the therapist observes for DIP extensor lag.

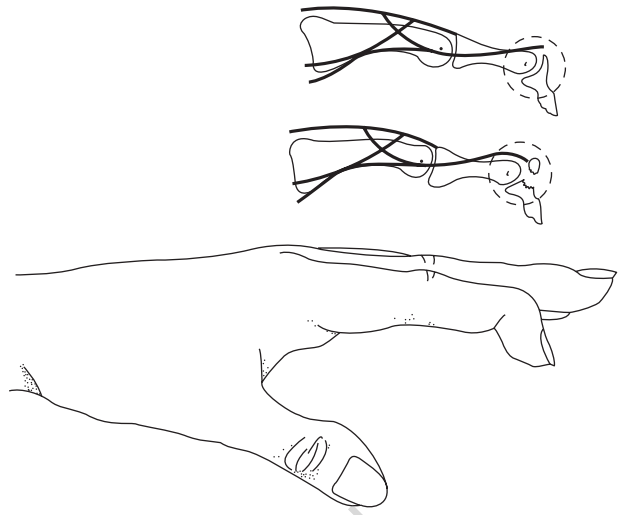


FIGURE 15-1 Mallet finger deformity. A fracture may also occur with this injury. (From *The hand: examination and diagnosis,* ed 2, Edinburgh, 1983, Churchill Livingstone.)

NONOPERATIVE TREATMENT

The DIP joint is splinted in extension or hyperextension, depending on the physician's preference. If hyperextension is recommended, the therapist should make sure the position of hyperextension is less than that which causes skin blanching. Exceeding tissue tolerance in DIP hyperextension can compromise circulation and nutrition to the healing tissues.[6]

Many types of DIP splints are available, and clients sometimes need more than one type (Fig. 15-2). They may also need a splint designated for showering; the client can carefully remove this type of splint after showering, according to the therapist's instructions, and replace it with a dry splint. In this way, the skin is protected against maceration, which occurs if a wet splint is left on a digit. Casting also can be used when client compliance is a concern. Quick Cast, a waterproof casting material, can be applied and changed weekly.

If the DIP joint cannot be passively extended to neutral, serial adjustments of splinting may be done. If necessary, a small static progressive DIP extension splint can be used.[7] In addition to splinting of the DIP, edema is treated as appropriate, and normal PIP active range of motion (AROM) with the DIP splinted is promoted. Dorsal edema and tenderness over the DIP are common and can interfere with full DIP extension.

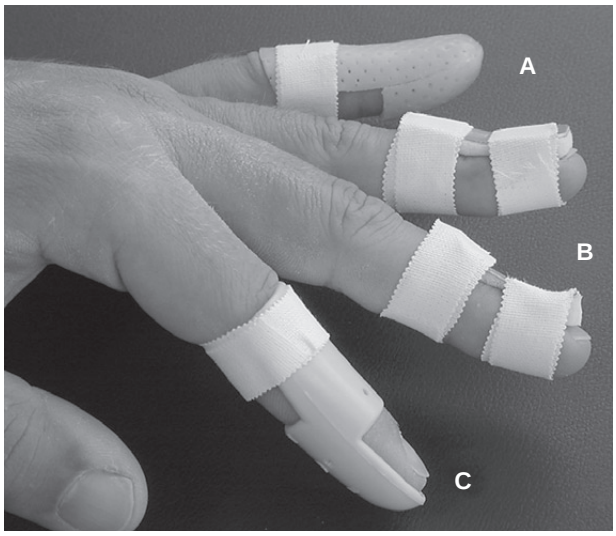


FIGURE 15-2 Mallet splints. **A,** Custom thermoplastic. **B,** Alumafoam. **C,** Stack. (From Burke SL: *Hand and upper extremity rehabilitation: a practical guide,* ed 3, St Louis, 2005, Churchill Livingstone.)

After 6 weeks of continuous splinting, if no DIP extensor lag is present and the physician approves, gentle composite AROM can be started. The therapist should instruct the client to avoid forceful or quick grasping or forceful DIP flexion in the early phase of AROM therapy. At this point, it is very important to watch for DIP extensor lag. If DIP extensor lag occurs, the splinting regimen is adjusted to promote recovery of DIP active flexion while maintaining active DIP extension. Some prefer to splint between gentle AROM sessions initially. Night splinting typically continues for another 2 to 3 weeks. If DIP extensor lag recurs, daytime splinting should be reinstituted. If splinting does not correct the DIP extensor lag, the client is referred to a hand surgeon, because surgery may be needed to correct the problem.

Although splinting is best initiated as soon as possible after injury, even a delayed splinting regimen can be effective.[8] Operative intervention can produce complications; therefore, nonoperative solutions often are well worth the effort.

OPERATIVE TREATMENT

Surgical complications include the possibility of infection and nail deformities. Nonetheless, if the mallet injury has associated large fracture fragments (greater than 30% of the joint surface), surgery may be necessary. A variety of procedures can be performed to treat this injury.[4,9,10]

The client may be sent to therapy with the DIP pinned for instruction in pin site care, edema control as needed, and protective splinting. Protective splinting may also help the client avoid bumping the pins. When the pins are removed, AROM guidelines, as provided by the physician, are followed. Some physicians may order a DIP extension splint when the pins are removed to assist with the gradual weaning program. As with nonoperative treatment, the therapist should observe for DIP extensor lag.

Questions to Ask the Physician

- *Is a bony injury present?*
- *How long will the DIP need continuous extension support?*
- *Does the physician prefer the DIP in neutral position or in hyperextension?*
- *If a wound is present, what are the dressing guidelines?*
- *If the DIP is pinned, how long will the pin remain in place?*
- *Will a splint be needed after pin removal?*

What to Say to Clients

About the Injury

Information about the injury might be provided as follows:

"Here is a diagram of the anatomy of the distal digit and the terminal tendon. The terminal tendon is very delicate, and in order to heal, it needs continuous, uninterrupted DIP support for about 6 weeks." Reiterate this concept as necessary until the client appears to understand the importance of continuous DIP extension.

About Splinting

Information about splinting might be provided as follows:

"It is important for us to practice techniques for putting the splint on and taking it off while maintaining DIP extension. One technique is to keep the hand palm down on the table and carefully slide the splint forward. A second technique is to use your thumb to provide support under the fingertip while using your other hand to remove the splint, sliding it forward. To reapply the splint, maintain DIP extension with your other hand as you put the splint back on."

Work with the client to devise a schedule for removing the splint four to six times daily to provide airflow. Make sure the client knows the proper techniques for keeping the DIP always supported in extension.

Emphasize the importance of skin care: "Moisture that is trapped inside the splint may lead to skin problems such as maceration, which must be avoided." Teach the client what skin maceration looks like.

About Exercises

Information about exercise might be provided as follows:

"It is important to avoid resistive or powerful gripping or forceful bending or flexion of the injured fingers and

of the entire hand, if need be, to prevent any strain on the healing terminal tendon."

Instruct the client in AROM for the unsplinted digits and especially PIP flexion of the injured digit: "It is very important to achieve full PIP active flexion. The injured finger could stiffen at the PIP if it is not exercised gently. It is very important to prevent the uninjured digits from stiffening." Demonstrate and practice gentle PIP blocking exercises and flexor digitorum superficialis (FDS) fisting motions with the DIP splint in place.

EVALUATION TIPS

- The client's finger is likely to be tender and swollen over the dorsal DIP area. Use a gentle touch around this area.
- Circumferential measurements may best be deferred to avoid causing pain by applying or cinching a tape measure or similar measurement device. Also, measuring the DIP joint is difficult while maintaining and supporting the digit in full DIP extension.

Precaution. *Avoid volumetric measurement, because this would leave the DIP unsupported, which is contraindicated.*

- Assess the client for digital hypermobility. Observe for DIP extensor lag or PIP hyperextension of other digits and treat accordingly (see description of swan neck deformity).
- Check isolated DIP flexion of other digits gently while the injured DIP is splinted, if the client can isolate this without stressing the terminal tendon of the injured digit. This helps prevent the development of a quadriga effect.

DIAGNOSIS-SPECIFIC INFORMATION THAT AFFECTS CLINICAL REASONING

- Individualize the treatment based on your observation and evaluation. If DIP hyperextension has been ordered but the client cannot tolerate it, support the DIP in a tolerable position and see the client every few days for splint modification until the desired position is achieved. Notify the physician if full DIP extension or hyperextension cannot be achieved in the splint.
- If edema is significant, assume that you will need to readjust the splint as this resolves and schedule recheck visits accordingly. Upgrade the interventions as appropriate for edema management.
- A client who is hypermobile and has laxity of the uninjured digits is at greater risk of developing a secondary swan neck deformity. This client needs a splint that prevents PIP hyperextension and supports the DIP in extension. Teach clients the FDS fist exercise with the DIP splint in place. The FDS fist technique is a compatible exercise because it does not stress the mallet injury and it promotes metacarpophalangeal (MP) and PIP flexion AROM.
- Make sure your client is well trained in monitoring skin tolerances to the splint. Consider giving clients a color picture showing maceration. Using more than one style of splint can help prevent skin problems.

Precaution. *Clients should call for a recheck if any skin problems occur.*

TIPS FROM THE FIELD

Splinting

- Show the client pictures or samples of DIP splints or casts. Explain your recommendation in terms of comfort, effectiveness, and adjustability. Ask clients about their preferences. Advise the client to tape the splint in place at night, because it may slide off during sleep.
- Small splints are not always the quickest to make. Allow time to fine-tune the splint and readjust it as needed.
- Clients often appreciate having a separate splint to use in the shower. Also, they can change into the dry splint after the shower, which helps prevent maceration.

Client Compliance

- In the clinic, does the client demonstrate proper technique for maintaining DIP extension at all times? Is the splint clean? Does it look unused? Are the straps showing wear? Do you see lack of improvement in gaining DIP extension?
- Some clients need more supervision and follow-up than others. Reasons to recheck the client more often include (1) resolving or fluctuating edema, (2) wound care, (3) PIP stiffness, (4) risk of swan neck deformity developing, and (5) questionable technique for putting on and taking off the splint. The therapy note should document whether the client demonstrates good technique in therapy and at follow-up.

Precautions and Concerns

- *Check for skin maceration.*
- *Emphasize the importance of avoiding forceful or resistive gripping or quick flexion motions.*
- *Monitor for the development of PIP hyperextension, especially if the client demonstrates laxity of the digits.*

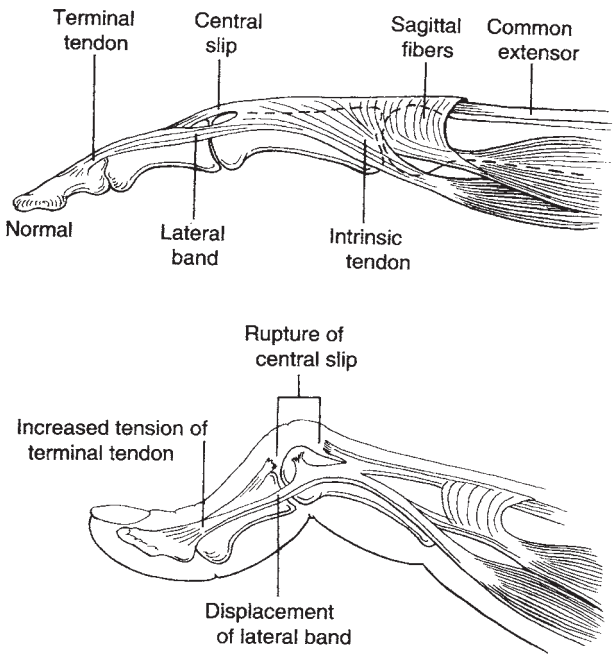


FIGURE 15-3 Boutonniere deformity. (From Burke SL: *Hand and upper extremity rehabilitation: a practical guide,* ed 3, St Louis, 2005, Churchill Livingstone.)

- *If the splint is taped on at night, caution the client to avoid circumferential taping, because this could produce a tourniquet effect.*

BOUTONNIERE DEFORMITY

ANATOMY

With a **boutonniere deformity,** the finger postures in PIP flexion and DIP hyperextension (Fig. 15-3). The injury may be open or closed. With a closed injury, the boutonniere deformity may not develop immediately but may become noticeable within 2 or 3 weeks after the injury.[8] The client may have a PIP extensor lag or, with an older injury, a PIP flexion contracture. This distinction affects the therapy choices.

DIAGNOSIS AND PATHOLOGY

A boutonniere deformity involves disruption of the central slip of the extensor tendon, which normally inserts into the dorsal base of the middle phalanx. The disruption of the central slip causes the **lateral bands (LB)** to slip volar to the PIP joint axis of motion, creating flexor forces on the PIP joint.[11] The imbalance results in hyperextension of the DIP joint.[12] With this DIP posture, the **oblique retinacular ligament (ORL)** of Landsmeer, which is located at the dorsal DIP joint, is at risk of becoming tight. A **pseudoboutonniere deformity** is actually an injury to the PIP volar plate and is usually the result of a PIP hyperextension injury.

CLINICAL *Pearl*

With a pseudoboutonniere deformity, the damage occurs at the volar surface. With a boutonniere deformity, the damage occurs at the dorsal surface[1]

TIMELINES AND HEALING

PIP extension splinting or casting may be used day and night for up to 6 weeks. This is followed by 3 weeks of night splinting. Splinting is used during the time needed for the central slip to re-establish tissue continuity and for correction of the deformity.[8]

NONOPERATIVE TREATMENT

The ability to passively extend the PIP may be a good indicator for nonoperative treatment with PIP splinting in extension. The MP and DIP are not splinted. Serial splinting adjustments may have to be made to achieve full passive PIP extension. Different types of splints can be used for this purpose (Fig. 15-4).

While the PIP is being splinted, it is very important that the therapist instruct the client in isolated DIP flexion exercises to recover normal length of the ORL. These exercises are done actively and passively in a gentle fashion (Fig. 15-5). The therapist should watch for normal MP AROM and should exercise this as needed.

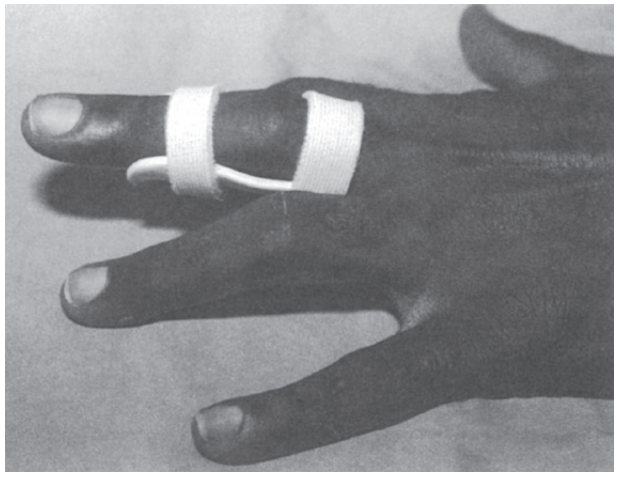
Precaution. *After the client has been medically cleared to begin PIP active flexion, initiate restricted amounts of flexion at first and watch for PIP extensor lag.*

It also is important to exercise PIP active extension, which is facilitated by positioning the digit in MP flexion. Splinting is reinstituted as needed if a PIP extensor lag develops.

If exercise fails to recover DIP flexion with the PIP extended, **ORL tightness** (limited passive DIP flexion with the PIP extended) may need to be addressed with splinting. Various small, custom-made splints can be used for dynamic or static progressive DIP flexion with the PIP in full extension.[13]

OPERATIVE TREATMENT

Boutonniere deformity is caused by injury to zone III of the extensor tendons. Various surgical techniques are used to treat these injuries.[8] The therapy protocol is determined by the hand surgeon. The short arc of motion



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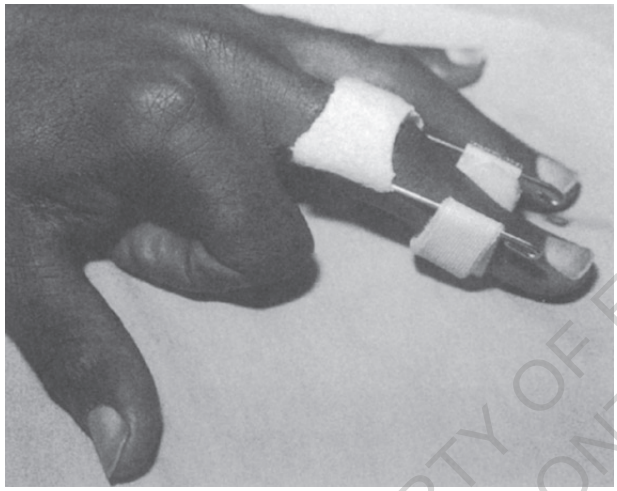

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FIGURE 15-4 A, Volar splint for boutonniere deformity. **B,** Wire-foam splint for boutonniere deformity. (From Clark GL: *Hand rehabilitation: a practical guide*, ed 2, New York, 1998, Churchill Livingstone.)

protocol for zone III extensor tendon repairs is appropriate if the client is considered a good candidate for this treatment (see Chapter 16).

Questions to Ask the Physician

- *Nonoperative clients*
  - *How long should the PIP be splinted in extension?*
  - *When can active PIP flexion be started?*
- *Operative clients*
  - *What structures were repaired? (Ask to see the operative report.)*
  - *Does the surgeon prefer an early active motion protocol or more conservative therapy, such as immobilization?*

FIGURE 15-5 Oblique retinacular ligament stretch entails isolated DIP flexion with PIP supported in extension. This is done actively and passively. (From Clark GL: *Hand rehabilitation: a practical guide*, ed 2, New York, 1998, Churchill Livingstone.)

  - *When can active PIP extension be started?*
  - *What are the precautions?*

What to Say to Clients

About the Injury

Information about the injury might be provided as follows:

"Here is a diagram of the area of your finger that is injured. Notice how, as a result of injury to the central slip, the lateral bands have slipped forward (volar) and how they now contribute to the bent posture of the PIP joint. The PIP joint needs to be supported in extension for the injured tendon to heal in proper alignment. Also note how the end of the finger is tipped upward (hyperextended). As the injury at the PIP is corrected, the position at tip of the finger will also improve. In addition, specific exercises can help correct this."

About Exercises

Information about exercise might be provided as follows:

"With this diagnosis, improving DIP flexion while the PIP is extended actually helps improve PIP extension. Therefore, flexing just the DIP helps correct the lack of extension at the PIP. It is very important to exercise by bending the tip gently while the PIP is splinted, because this is corrective for your injury."

EVALUATION TIPS

- Check for hypermobility of the other digits. Do the uninjured digits have a boutonniere-like posture? If so, document this condition.
- Determine whether the PIP joint can be passively corrected to neutral and whether the DIP joint can

be passively corrected to normal flexion with the PIP in extension (i.e., check for ORL tightness).
- Check and practice isolated DIP flexion of the other digits. Think ahead about preventing a quadriga effect.
- Check composite flexion of the other digits as you are able.

DIAGNOSIS-SPECIFIC INFORMATION THAT AFFECTS CLINICAL REASONING

- In nonoperative clients, determine whether the injury involves a PIP extensor lag (the PIP can be passively extended to neutral position, but the client cannot actively extend it) or a PIP flexion contracture (the PIP cannot be passively extended to neutral position). This distinction affects splint decisions (see below).
- Determine whether the client has ORL tightness. With this condition, both active and passive DIP flexion with PIP extension are limited.

TIPS FROM THE FIELD

Clinical Picture

- Edema over the area of injury (dorsal PIP) worsens the deforming forces of a boutonniere position. Treat the edema as a high priority, because this helps recover PIP joint passive extension and promotes normalization throughout. Light compression wrapping can help reduce the edema.

Precaution. *If ORL tightness is present, the client may be at risk of losing flexor digitorum profundus (FDP) excursion, and a quadriga effect could develop.*

- Isolating and exercising DIP active flexion of the uninjured digits while protecting the injured finger is a good measure for preventing a quadriga effect. PIP cylindric splints may be helpful for performing isolated blocking exercises for DIP flexion. These splints can be used on all digits to isolate DIP active flexion with varying MP positions.

CLINICAL *Pearl*

- *After the client has been medically cleared for active PIP extension exercises, use positioning of the MP in flexion for the exercises. This can help isolate and achieve active PIP extension.*
- *Check for intrinsic versus extrinsic tightness if composite flexion is limited and prioritize the MP position accordingly for PIP exercise.*

Precaution. *As PIP flexion improves, watch closely for PIP extensor lag.*

Splinting

- If the client has a PIP flexion contracture, corrective splinting or casting is needed. Splint and casting choices for recovering PIP extension include serial static splints, serial casts, static progressive splints, and dynamic splints. These may be prefabricated or custom-made and digit based or hand based. Therapists have different preferences, and the client should participate in the selection process. Comfort, fit, and skin tolerance all influence these choices.
- If full passive PIP extension is possible, a small PIP extension gutter splint or cast may be used. Adjust it as needed to accommodate resolution of edema and the client's comfort. The splint may need to be taped in place at night. It is very important to keep the DIP free and to perform frequent exercises for DIP active and passive flexion while the PIP is splinted in extension.
- If ORL tightness is present, a dorsal dropout splint for DIP flexion may be helpful, or a gentle DIP flexion static progressive or dynamic splint may be appropriate. Ease of application and adjustability are criteria that help determine which type should be used.
- If the client has been cleared for active PIP extension and flexion exercises and if ORL tightness is present, try using a dorsal distal splint that maintains DIP flexion while actively exercising PIP extension.

Precautions and Concerns

- *Avoid PIP flexion during the protective splinting phase.*
- *If the client has had surgery, follow the guidelines presented in Chapter 16. Instruct the client in techniques for supporting the digit while putting on and taking off the splint for skin care needs. If surgery was not required, instruct the client in ways to manage splint and skin care while avoiding PIP flexion. If a cast has been applied, change it at least weekly.*
- *ORL tightness contributes to the boutonniere deforming forces. Monitor this condition throughout the program and continue exercising active and passive DIP flexion with the PIP extended.*
- *Monitor for loss of FDP excursion and difficulty isolating the FDS, particularly in the involved digit.*
- *If the client has had surgery, adhesions may occur at the incision sites.*

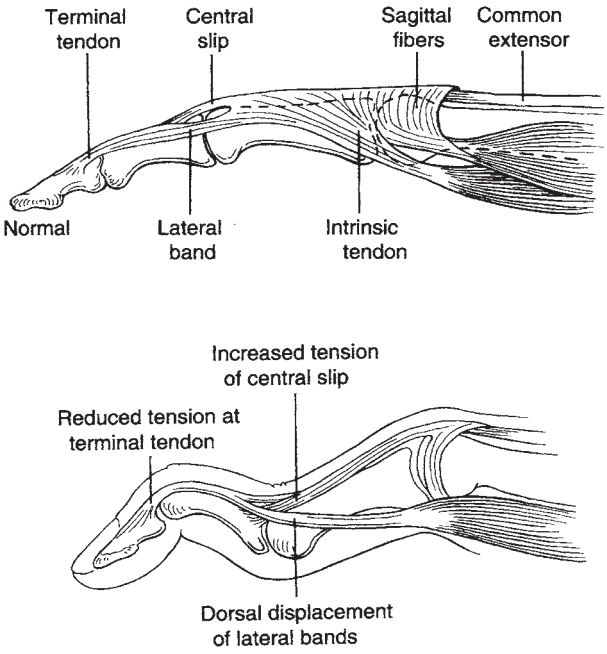


FIGURE 15-6 Swan neck deformity. (From Burke SL: *Hand and upper extremity rehabilitation: a practical guide,* ed 3, St Louis, 2005, Churchill Livingstone.)

SWAN NECK DEFORMITY

ANATOMY

In a **swan neck deformity,** the finger postures with PIP hyperextension and DIP flexion (Fig. 15-6).[5] The MP tends to be flexed, and the finger appears to zigzag when observed from the side. The IP joints may be passively correctable, or they may be fixed in their deformity positions. The IP positions in the swan neck deformity are the opposite of their positions in the boutonniere deformity.

DIAGNOSIS AND PATHOLOGY

The swan neck deformity can be caused by injuries at the level of the DIP, the PIP, or the MP joint. At the DIP level, a mallet injury can lead to swan neck deformity. In this case, the terminal extensor tendon is disrupted (i.e., stretched or ruptured). This allows the extensor force to be more powerful proximally at the PIP joint, leading to PIP hyperextension.[12]

If the cause is primarily at the PIP level, the volar capsule is involved, with hyperextension at the PIP joint. The LB are dorsally displaced, contributing to PIP hyperextension; this minimizes the pull on the terminal extensor tendon; therefore, the DIP joint assumes a flexed position. Normally the FDS helps deter PIP hyperextension. However, if the FDS has been ruptured or lengthened, PIP hyperextension forces are less restricted or controlled. Intrinsic muscle tightness compounds the problem.[12] Painful snapping may be noticed with active flexion. This snapping is caused by the LB at the proximal phalanx condyles.[14]

If the cause of the swan neck deformity is primarily at the MP level, MP volar subluxation and ulnar drift may be the initiating factors, as is seen in rheumatoid arthritis. The MP joint disturbance leads to intrinsic muscle imbalance and tightness, with resulting PIP hyperextension forces.[12]

TIMELINES AND HEALING

Swan neck deformity is a challenging diagnosis. In conservative management of this condition, splinting may be used indefinitely if it promotes improved function and eliminates painful snapping with active flexion.

NONOPERATIVE TREATMENT

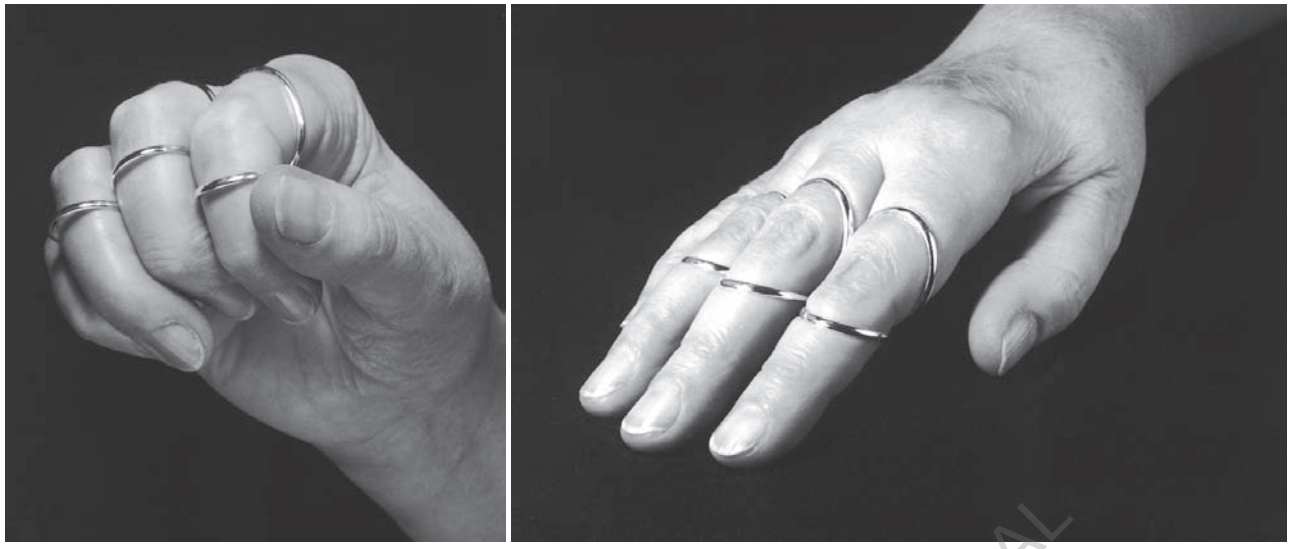
Splinting of the PIP in slight flexion may be very helpful functionally. Many different kinds of splints can be used for this type of deformity, including dorsal blocking splints, figure **8** splints, and commercially available splints, such as the SIRIS (i.e., silver ring) splint (Fig. 15-7). The purpose of the splint is to prevent hyperextension at the PIP joint and to promote active PIP flexion.

OPERATIVE TREATMENT

Surgery to correct swan neck deformity may be done in conjunction with other reconstructive procedures for clients with rheumatoid arthritis. Surgical techniques include flexor FDS tenodesis or VP advancement procedures.[14] Some researchers have found that capsulodesis and tenodesis techniques for restoring balance lose effectiveness as a result of attenuation if these issues are stressed over time.[15]

After the surgery, clients may be referred to therapy for protective dorsal PIP splinting in flexion or for pin site care, wound care, or edema control. After they have been medically cleared for them, active DIP extension exercises may be advised. Positioning the digit in PIP flexion helps promote DIP active extension excursion.

Pins often are used postoperatively to maintain PIP flexion. When the pins are removed, digit-based, dorsal PIP splints are used, typically fabricated in approximately 20 to 30 degrees of flexion. This is done to prevent recurrence of PIP hyperextension and imbalance. Active PIP



A B

FIGURE 15-7 A SIRIS (silver ring) splint prevents PIP hyperextension and allows PIP flexion. (Courtesy Silver Ring Splint Co., Charlottesville, VA.)

flexion exercises are started when ordered by the surgeon. The PIP dorsal splint can remain in place during PIP AROM. The Velcro strap is removed distally to allow PIP flexion while full extension is blocked.

The therapist should focus on balancing digit and hand function while avoiding stress or PIP hyperextension. DIP caps may be helpful exercise tools to promote ease of flexion at the PIP. As a result of the imbalance associated with swan neck deformities, these clients habitually have made fisting motions with the PIP in hyperextension, visibly initiating motion with DIP flexion while the PIP is hyperextended. Their fisting motions look awkward and difficult to achieve. The therapist should try practicing gentle fisting arcs of motion, with PIP flexion preceding DIP flexion if possible. Gently holding the MPs in flexion may help restore a more natural and balanced fisting motion. Practicing on the contralateral side may also be helpful.

Questions to Ask the Physician

- *Nonoperative clients*
  - *Are particular precautions required?*
  - *Is surgery a possibility?*
- *Operative clients*
  - *What structures were repaired? (Ask to see the operative report.)*
  - *When will the pins be removed?*
  - *When can active PIP flexion be started?*
  - *What specific precautions are in order?*

What to Say to Clients

About the Injury

Information about the injury might be provided as follows:

"Here is a diagram of the deforming forces associated with swan neck deformity. Notice how the lateral bands have slipped upward (dorsally) and how they now contribute to the overextended posture of the PIP joint. The PIP joint needs to be supported in flexion for balance and proper alignment to be restored."

About Exercises

Information about exercise might be provided as follows:

"With this diagnosis, it is most important to avoid extending the PIP joint beyond its newly pinned or corrected position until the doctor upgrades the program. For this reason, we will use protective dorsal splints. When the doctor gives the okay for exercise, it is important to practice gentle bending movements at the PIP joint in a comfortable range."

EVALUATION TIPS

- Check for hypermobility or swan neck posture of uninjured digits. Document this condition if present.
- Determine whether PIP hyperextension is passively correctable or fixed. Does it affect function?
- In a nonoperative client, distinguish between primary injury to the DIP or the PIP:

  - Stabilize the PIP in neutral position. If the client cannot actively extend the DIP, the injury is primarily a DIP extensor injury. If the client can actively extend the DIP, the injury is primarily a volar PIP injury.
- When exercise therapy has been medically cleared, observe the quality of active flexion and promote practice of motions that do not elicit snapping.

DIAGNOSIS-SPECIFIC INFORMATION THAT AFFECTS CLINICAL REASONING

- Focus treatment on the primary cause of the deformity. If the client has rheumatoid arthritis (RA), are other digits involved or at risk? Have any tendons ruptured? Is the client receiving medical care for the RA? Consider antideformity splinting for other digits as appropriate. Is MP involvement present? Is intrinsic tightness of other digits a factor? Night splinting or intrinsic stretching (or both) to counteract deforming forces may be valuable. Even if this option was not ordered originally, discuss it with the client and the physician.
- Is PIP flexion splinting likely to be long term? If so, consider a low-profile, long-lasting style of splint, such as a silver ring splint.

TIPS FROM THE FIELD

- Observe the balance of the digit and the hand, and address uninvolved digits unless this is contraindicated. Promote normal range of motion (ROM) throughout the extremity as appropriate.
- If postoperative wound healing is a factor, try to see the client often for splint modifications to accommodate dressing changes and edema reduction.
- If the client's joints are hypermobile, instruct the person in hand use patterns for activities of daily living (ADL) that do not encourage PIP hyperextension. For example, teach the client not to put stress on the digits in PIP hyperextension.

Precautions and Concerns

- *If you are treating a mallet injury, watch closely for signs of PIP hyperextension that occur secondary to DIP splinting (see the section on mallet finger).*
- *Clients do not need to be hypermobile to develop a swan neck deformity after distal digital injury.*
- *Mallet injury is not the only diagnosis that can lead to PIP hyperextension. A distal crush or fracture requiring DIP splinting may also result in PIP hyperextension. Be alert for this and treat it accordingly with PIP splinting in slight flexion to normalize the balance of the digit.*

PIP JOINT INJURIES

Digital PIP injuries occur frequently, yet they can be extremely challenging to treat. Proper management of therapy helps prevent the situation from becoming frustrating.

PIP joint dislocation is a common injury.[15] A client initially may ignore a sprain of the small joints of the hand, not realizing the significance of the injury, and may not seek medical attention for days or weeks after the injury. *By this time, significant edema, fibrosis, and stiffness may be established.* Joint enlargement and flexion contractures are common residual problems.[3,16]

CLINICAL *Pearl*

Therapists are likely to see clients with digital sprains or dislocations quite often. Because clients may not understand the serious clinical implications of this seemingly simple diagnosis, they can become frustrated with the progression of treatment. Early communication with the client about the nature of the PIP joint injury and the likelihood of a prolonged recovery are important.

ANATOMY

PIP Joint Architecture

The PIP joint is a hinge joint with 100 to 110 degrees of motion. At the proximal phalanx are two condyles, and between the condyles is the intercondylar notch. Because of the slight asymmetry of the condyles, about 9 degrees of supination occurs with PIP flexion.[3] At the base of the middle phalanx are two concave fossae and a ridge that separates the phalanx's flat, broad base. Stability is enhanced by the amount of congruence of this joint and by its tongue-and-groove contour. The IP joint of the thumb is architecturally similar to the PIP joint of the other digits.[15]

PIP Joint Stability

The architecture of the PIP joint, along with its ligamentous support, provides joint stability. The **collateral ligaments** are the main restraints on deviation forces at the PIP joint. These ligaments are 2 to 3 mm thick and are extremely important to the joint's stability. The collateral ligaments have two components: the **proper collateral ligament (PCL),** and the **accessory collateral ligament (ACL),** which are differentiated by their areas of insertion.

The PCL originates on the lateral aspect of the proximal phalanx. The fibers of this ligament insert volarly

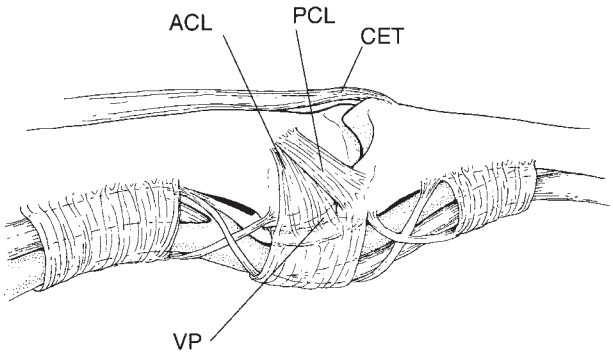


FIGURE 15-8 Structures that provide PIP joint stability include the accessory collateral ligament (ACL), the proper collateral ligament (PCL), the dorsal capsule with the central extensor tendon (CET), and the volar plate (VP). (From Mackin EJ: *Hunter, Mackin & Callahan's rehabilitation of the hand and upper extremity,* ed 5, St Louis, 2002, Mosby.)

and distally, on the lateral tubercles of the middle phalanx. The fibers of the ACL insert in a more volar direction on the VP. The VP is fibrocartilaginous and is situated between the collateral ligaments on the volar aspect of the PIP joint. The convergence of the PCL, ACL, and VP at the middle phalanx is known as the *critical corner,* a term that reflects its importance to PIP joint stability.[3]

The anatomic arrangement of the VP functions to prevent PIP hyperextension. The VP also acts as a secondary PIP joint stabilizer laterally when the collateral ligaments have been injured.[3,15]

The dynamic stability of the PIP joint is enhanced by the tendons that cross the joint. These are the **central extensor tendon (CET),** the LB, the **transverse retinacular ligament (TRL),** and the ORL. The CET is part of the dorsal capsule of the PIP joint and attaches to the middle phalanx at the dorsal tubercle. The LB have intrinsic muscle contributions and lie volar to the MP joint axis; they join dorsal to the PIP joint axis to form the terminal extensor tendon. The TRL originates from the volar surface of the LB and envelops the collateral ligaments and PIP joint, thereby preventing dorsal displacement of the LB. The ORL originates from the flexor sheath, progresses volar to the PIP joint axis, and inserts at the terminal extensor tendon dorsally. The ORL tightens when the PIP joint extends. It provides concomitant PIP and DIP extension and helps prevent hyperextension of the PIP joint (Fig. 15-8).[3]

DIAGNOSIS AND PATHOLOGY

Physical examination of ligament injuries at the PIP joint requires assessment of joint stability. Posteroanterior (PA) and true lateral x-rays can identify articular involvement, but x-rays alone may not reveal subtle injuries. The critical issue is whether joint stability exists with active motion.[15]

The **functional stability** of the PIP joint is tested actively and passively. If the client demonstrates normal active ROM with no PIP joint displacement, joint stability is adequate despite the injury. A brief period of immobilization can be followed by protected ROM exercises. If the joint is displaced with active ROM, major disruption of the ligaments probably has occurred. In these cases the position of immobilization is determined by the physician, partly by identifying the range at which the displacement occurs (Box 15-1). In grade I and mild grade II injuries, the joints are swollen; they also are painful on palpation and with lateral stress.

BOX 15-1

Grades of Ligament Sprain Injuries

MILD GRADE I SPRAIN

- ***Definition:*** No instability with active or passive ROM; macroscopic continuity with microscopic tears. The ligament is intact, but individual fibers are damaged.
- ***Treatment:*** Immobilize the joint in full extension if comfortable and available; otherwise, immobilize in a small amount of flexion. When pain has subsided, begin AROM and protect with buddy taping.

GRADE II SPRAIN

- ***Definition:*** Abnormal laxity with stress; the collateral ligament is disrupted. AROM is stable, but passive testing reveals instability.
- ***Treatment:*** Splint for 2 to 4 weeks. The physician may recommend early ROM, but avoid any lateral stress.

GRADE III SPRAIN

- ***Definition:*** Complete tearing of the collateral ligament, along with injury to the dorsal capsule or volar plate. The finger usually is dislocated by the injury.
- ***Treatment:*** Early surgical intervention often is recommended.

Modified from Campbell PJ, Wilson RL: Management of joint injuries and intraarticular fractures. In Mackin EJ, Callahan AD, Skirven TM et al, editors: *Rehabilitation of the hand and upper extremity,* ed 5, St Louis, 2002, Mosby; and Glickel SZ, Barron A, Eaton RG: Dislocations and ligament injuries in the digits. In Green DP, Hotchkiss RN, Pederson WC, editors: *Green's operative hand surgery,* ed 4, Philadelphia, 1999, Churchill Livingstone.

BOX 15-2

Directional Types of PIP Joint Dislocation

DORSAL PIP DISLOCATIONS

Dorsal PIP dislocations are classified according to three subcategories:

- ***Type I (hyperextension):*** Volar plate avulsion and minor split in collateral ligaments longitudinally; if left untreated, this type of dislocation can lead to a swan neck deformity.
- ***Type II (dorsal dislocation):*** Dorsal dislocation of PIP joint and volar plate avulsion with major split in collateral ligaments bilaterally.
- ***Type III (fracture-dislocation):*** This type of dislocation may be stable or unstable.

LATERAL PIP DISLOCATIONS

Lateral stability is tested with the PIP joint in extension so that the collateral ligaments and secondary stabilizers, including the volar plate, can be assessed. Complete collateral ligament disruption is suggested by deformity that exceeds 20 degrees of deformity with gentle stress.

VOLAR PIP DISLOCATIONS

Volar PIP dislocations are rare. The injury may have a rotational component, and the central slip may be ruptured.

Modified from Glickel SZ, Barron A, Eaton RG: Dislocations and ligament injuries in the digits. In Green DP, Hotchkiss RN, Pederson WC, editors: *Green's operative hand surgery,* ed 4, Philadelphia, 1999, Churchill Livingstone.

Direction of PIP Joint Dislocation

The direction of dislocation is determined by the position of the middle phalanx at the time of joint injury (Box 15-2).

TIMELINES AND HEALING

CLINICAL *Pearl*

PIP joint sprains usually require a prolonged recovery period, and clients are at risk for long-standing edema. Permanent limitations in ROM and function are not uncommon.

PIP joint sprains initially have **fusiform swelling** (swelling that is fuller at the PIP joint and tapers at both ends), and ligament fibrosis can progress for over a year after injury, resulting in limitations in ROM and function. *Uninjured digits may become stiff, and a quadriga effect can occur.*

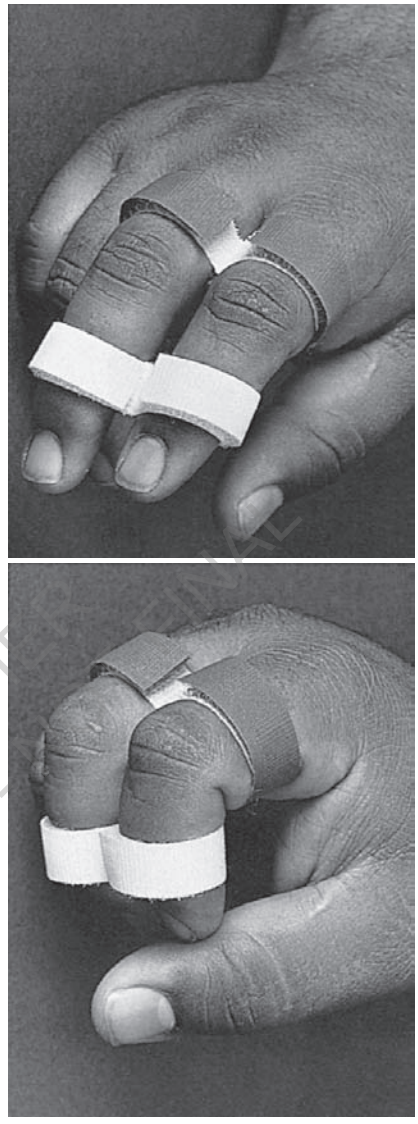


FIGURE 15-9 Buddy straps support the injured digit and facilitate motion. (From Mackin EJ: *Hunter, Mackin & Callahan's rehabilitation of the hand and upper extremity,* ed 5, St Louis, 2002, Mosby.)

NONOPERATIVE TREATMENT

Grade I injuries are treated with edema control and PIP immobilization in extension or possibly slight flexion while acute pain is present, which may be for a week or so. Buddy taping (Fig. 15-9) is very important, because it protects the injured digit by enhancing support from the adjacent digit and allows initiation of early AROM in pain-free ranges. Many different styles of buddy taping can be used.[3]

Grade II injuries are treated with splinting for up to 4 weeks. If early AROM is prescribed, the therapist should take care not to put stress on the joint (i.e., the joint should not be pushed laterally, and loading the tip

should be avoided). The client also should be taught to avoid stressing the joint. Edema is treated as possible. Compressive sleeves or wraps may not be tolerated early on, but an attempt can be made to try to use them with light pressure.

Grade III injuries frequently require surgical correction. If joint congruence is present with AROM, conservative treatment may be tried. If the VP has been injured (as in a hyperextension injury), a dorsal blocking splint can be provided to prevent full PIP extension in the first few weeks. The amount of PIP flexion in this splint usually is 20 to 30 degrees, and the physician may specify the degree of flexion.

OPERATIVE TREATMENT

Surgical techniques vary, depending on the injury. VP arthroplasty may be performed on dorsal dislocations. Complications of this procedure can include angulation deformity of the middle phalanx, recurrence of subluxation, or IP joint stiffness. FDS tenodesis techniques may be performed for chronic PIP hyperextension (swan neck) deformities. Complications with the tension of the tenodesis may affect the PIP position after surgery. Collateral ligament repair may be performed for lateral PIP dislocation injuries. Stiffness can be an undesirable sequela of this surgery.[15]

Questions to Ask the Physician

- *Nonoperative clients*
  - *Is surgery a possibility?*
  - *Are precautions required regarding AROM and stability (i.e., a safe range for AROM exercises or VP implications)?*
- *Operative clients*
  - *What structures were repaired? (Ask to see operative report.)*
  - *Is PIP extension to be restricted? If so, to what degree (i.e., is VP involvement a factor)?*
  - *What ROM does the physician expect the client ultimately to achieve?*

What to Say to Clients

About the Injury

Information about the injury might be provided as follows:

"This diagnosis is associated with a long timeline for slow healing, and swelling typically persists for a much longer time than you might expect. It helps to be aware of this so that you won't be discouraged by the persistent swelling or stiffness. Sometimes clients have had to have their rings resized, but time will tell whether this will be necessary. It may be helpful to use sleeves or wraps for the swelling for a considerable time."

"While the tissue is healing over weeks and months, it is very important not to stress the finger with force or high-demand gripping activity. If you do something with your hand and the finger swells or becomes painful, this is a sign that your tissues are not tolerating that much stress. It is best to avoid this response so that the swelling and flexibility can continue to improve."

About Splinting

Information about splinting might be provided as follows:

"Buddy straps are very helpful in providing support to the injured finger. You may find they also help promote more flexibility of the finger. Various splinting options can help with recovering motion, and different types may be tried over time."

Instruct the client in a schedule for wearing the buddy straps and splints between exercises and at night as appropriate.

About Exercise

Information about exercise might be provided as follows:

"Each time your tissue is stimulated by pain-free movement, favorable clinical responses occur, including lubrication and circulation to promote healing. The more this happens, the better the finger will be. However, exercises that result in swelling or pain are not helpful and are actually detrimental."

EVALUATION TIPS

- Ask about previous injuries to this or other digits, because pre-existing stiffness may affect the client's prognosis.
- Be very gentle when evaluating the digit; the client's finger may be quite sore.
- Distinguish between fusiform swelling (swelling localized around the PIP joint) and edema throughout the digit.
- When the client is cleared for AROM exercises, check isolated FDS and FDP function. Also check for ORL tightness (i.e., check for DIP flexion with PIP extension).
- Distinguish between intrinsic, extrinsic, and joint tightness.
- Inquire about daily activities to determine whether some of them may be detrimental to the healing process.

DIAGNOSIS-SPECIFIC INFORMATION THAT AFFECTS CLINICAL REASONING

- The mechanics of the injury and whether the VP was involved are important pieces of information. If the VP was involved, the PIP should be protected in 20 to 30 degrees of flexion to promote VP healing. Also,

keep in mind that collateral ligaments are at risk of tightening if full extension is not achieved in a timely fashion.
- Edema management is paramount with PIP joint injuries, which are notorious for persistent swelling. Swelling contributes to pain, shortening or tightening of the collateral ligaments, and loss of joint motion and tendon excursion. Therefore the treatment of swelling should be a clinical priority. Compounding the problem, AROM and all exercises should be limited to the amount of stimulation that does not cause increased swelling.

CLINICAL *Pearl*

- It does no good to gain 10 degrees of motion with exercises if swelling and stiffness also occur in response to those exercises.

- Devise exercises that are tissue specific. Distinguish between intrinsic and extrinsic tightness and position the finger for exercises accordingly. Check FDS and FDP excursion in the uninjured digits and perform isolated FDS exercises, because these promote PIP flexion and prevent the insidious development of limitations.

TIPS FROM THE FIELD

Tissue Tolerances and Client Education

- Monitor tissue tolerances, which dictate the hand therapy intervention. This can be frustrating to clients and therapists. Explain to clients that with this type of injury, they cannot force motion to improve, and strenuous hand movements will only worsen the clinical condition. Despite this instruction, clients may be inclined to perform forceful place and hold exercises to recover flexion, and this may actually be injurious to the tissues. Keep discussing tissue tolerances with clients and teach them how to perform pain-free exercises. Friends may have recommended forceful gripping exercises, such as squeezing a tennis ball or a resistive gripper; explain that the tissues need to be ready for this much stimulation, that negative tissue responses are manifested by swelling and pain after exercise, and that these responses can set back the progression toward recovery.

Buddy Taping

- Include clients in the decision on which adjacent finger to buddy tape to the injured finger. Normally, the finger that supports the injured side is selected. If the right long finger sustained an injury to the PIP radial collateral ligament, it needs protection to avoid ulnar stress. In this instance, buddy tape the long finger to the index finger to promote neutral alignment.
- Buddy tapes may be most helpful when used at two levels (e.g., proximal phalanx and middle phalanx). The important features are support, comfort, and ease of use. Monitor the tightness of the buddy tapes, because tapes that are too tight can worsen the edema by creating a tourniquet effect.

Exercise Guidelines

- Brief, frequent, pain-free exercises are more effective than infrequent sessions. Explain to the client that tissue tolerance dictates the exercise regimen.
- Gentle upward petting or stroking of the skin on the sides of the PIP joint, along with gentle circular motions over the dorsal PIP joint, may promote comfort with exercises. The pressure should be just enough to move the skin (this technique should not be used if tenderness is present).

Precautions and Concerns

- *Avoid exercises that cause increased pain or stiffness.*
- *With PIP joint injuries, the importance of tissue tolerance cannot be overstated.*
- *Persistent edema that is avoidable can lead to serious clinical and functional consequences.*
- *The long healing timeline for this type of injury makes therapy a challenge. Therapists must be very creative in providing factual information about steady progress while preventing the client from becoming disappointed or discouraged.*

THUMB MP JOINT INJURY

Clients with injuries of the thumb MP joint, particularly ulnar collateral ligament (UCL) injuries, frequently are referred for hand therapy. Proper hand therapy can favorably affect the recovery of stable, pain-free function in such cases.

Injury to the thumb MP joint may involve either the ulnar collateral ligament (UCL) or the radial collateral ligament (RCL). The UCL is injured 10 times as often as the RCL. The treatment guidelines described for UCL injury also apply to the RCL.

ANATOMY

The MP joint of the thumb is primarily a hinge joint. Flexion and extension comprise the primary arc of

motion. Pronation-supination and abduction-adduction are considered secondary arcs of motion at this joint. Pronation occurs as the thumb MP joint flexes because the radial condyle of the metacarpal head is wider than the ulnar condyle.[3,15]

The thumb MP joint's ROM is unique; it has the most variation in the amount of movement of all the body's joints. ROM at the thumb MP joint ranges from 6 to 86 degrees of flexion. People with flatter metacarpal heads tend to have less motion, and individuals with more spherical metacarpal heads have more motion. Lateral motion at the thumb MP joint ranges from 0 to 20 degrees when the MP is in extension. The stability of this joint comes primarily from ligamentous, capsular, and musculotendinous support.[15]

Laterally, the thumb MP joint displays strong proper collateral ligaments that arise from the metacarpal lateral condyles and progress volarly and obliquely to their insertion on the proximal phalanx. The ACL originates volar to the PCL and inserts on the VP and the sesamoid bones.[17] The sesamoid bones have been described as the convergence point of the thumb MP joint's periarticular structures.[18] The proper collateral ligaments are tightest with MP flexion.

The thumb MP joint receives stability from thenar intrinsic muscles, specifically the adductor pollicis (AP), the flexor pollicis brevis (FPB), and the abductor pollicis brevis (APB). The FPB and the APB insert on the radial sesamoid, and the AP inserts on the ulnar sesamoid.[15]

DIAGNOSIS AND PATHOLOGY

A UCL injury is called **skier's thumb,** because a fall on an outstretched hand with the thumb in abduction is a common skiing injury. The ski pole handle may cause the thumb to abduct. Historically, this injury has also been called **gamekeeper's thumb,** because the term describes an injury that occurred as a result of killing rabbits with a technique that stressed the thumb MP joint radially. Nowadays the term *gamekeeper's thumb* refers to chronic UCL instability at the thumb MP joint.[3]

Acute UCL injuries of the thumb MP joint usually involve detachment of the ligament from its proximal phalanx insertion. Concomitant injury of the ACL, the VP, or the dorsal capsule also may occur. If complete disruption occurs along with forceful radial deviation at the thumb MP joint, displacement of the ligament superficially with interposition of the adductor aponeurosis may result; this condition is called **Stener's lesion** (Fig. 15-10).

Precaution. *Stener's lesion requires surgical correction because the interposition prevents healing of the ligament.*[3]

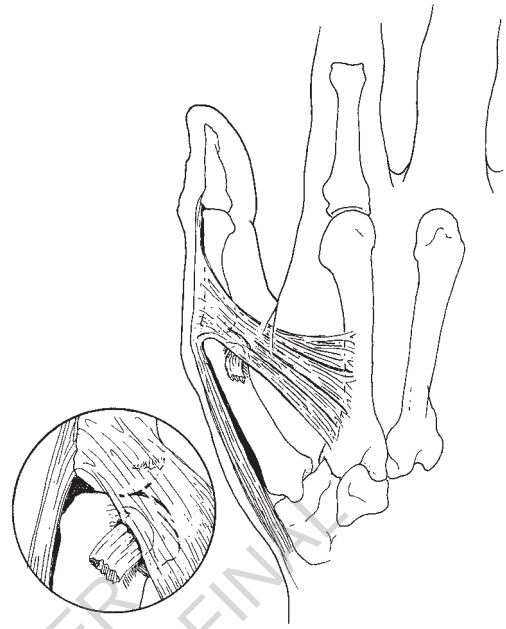


FIGURE 15-10 Stener's lesion. The ulnar collateral ligament is displaced with interposition of the adductor aponeurosis. Surgery is required for this type of injury, because interposition of the adductor aponeurosis prevents healing. (From Mackin EJ: *Hunter, Mackin & Callahan's rehabilitation of the hand and upper extremity,* ed 5, St Louis, 2002, Mosby.)

The thumb MP joint is clinically assessed for UCL injury by providing gentle stress in radial deviation to the thumb with the MP joint in both extension and flexion at 30 degrees. This result is compared with that on the contralateral side. Physicians may use an injection of anesthetic if pain prohibits testing. Varying criteria are used to describe a complete ligament tear: (1) instability greater than 35 degrees or (2) instability 15 degrees greater than on the uninjured side.

CLINICAL *Pearl*

Stress testing may be more painful on a partial tear than on a complete tear.

X-rays in the PA, lateral, and oblique views are taken to rule out the possibility of an avulsion fracture. Stress x-rays may also be helpful. Additional imaging techniques, such as ultrasound studies, magnetic resonance imaging (MRI), and arthrograms, may be ordered as necessary. An overlooked and untreated injury can lead to pain and instability.

TIMELINES AND HEALING

The thumb is immobilized for approximately 4 to 6 weeks to allow healing. Thumb IP joint ROM should be encouraged throughout the immobilization stage. It can take a few months after injury for resistive pinch or axial loading of the thumb to be comfortable and safe to perform.

NONOPERATIVE TREATMENT

If the ligament injury is a partial tear, the thumb is immobilized in a hand-based thumb spica cast (with the IP joint left free) for 2 to 4 weeks. After this, treatment is upgraded to a splint, and AROM exercises are begun with medical clearance. A variety of splints may be used.[19,20] Progression to active assistive range of motion (AAROM) occurs gradually over a few weeks. Light key pinch exercises are started early, but tip pinch and thumb tip loading exercises are not performed until medically approved, which may be 8 weeks or longer after injury. This restriction is necessary in prevent stress on the ligament.[3]

OPERATIVE TREATMENT

Surgical procedures may include open reduction with internal fixation (ORIF) to reduce fracture fragments. The UCL may be reattached to its insertion. The MP joint may be pinned, and this often may be done with a slight overcorrection ulnarly to prevent stress on the repaired ligament. A thumb spica cast is used for 4 weeks, at which time the pin usually is removed.[3]

After the cast is removed, AROM of the thumb carpometacarpal (CMC) and MP joints is started. Scar management and edema control are helpful for minimizing the possibility of adherence of the extensor pollicis longus (EPL) at the incision scar. As in the nonoperative program, lateral pinch may be initiated sooner than tip pinch, which should be avoided for about 8 weeks after surgery to prevent stress on the repair. Protective splinting with a hand-based thumb spica splint may be used for up to 6 to 8 weeks after the repair. The therapist should inform the client that some tenderness at the ulnar MP joint is normal for a few months after this surgery.[3]

Questions to Ask the Physician

- *Nonoperative clients*
  - *Are any precautions indicated for AROM?*
  - *How long should axial loading or resistive tip pinch be avoided?*
- *Operative clients*
  - *What structures were repaired? (Ask to see the operative report.)*
  - *How much ROM does the physician expect the client to achieve at the MP joint?*
  - *How long should axial loading or resistive tip pinch be avoided?*
  - *Should any other precautions be taken?*
  - *How long should protective splinting be used?*

What to Say to Clients

About the Injury

Information about the injury might be provided as follows:

"With this diagnosis, it is more important to achieve a pain-free, stable thumb MP joint than it is to achieve full MP motion. You may not recover full MP motion, but achieving functional, pain-free motion for pinching and resistive hand use usually is considered a successful result."

About Splinting

Information about splinting might be provided as follows:

"You may need to wear your protective splint to prevent forceful use of or stress on the injured thumb. It may also help signal others to be careful when shaking your hand or interacting with you in public."

About Exercises

Information about exercise might be provided as follows:

"It is important to focus on the motion at the last joint [the IP joint] and to prevent stiffness at this site. However, be careful not to put pressure on the end of the thumb tip or to use a powerful pinching motion against the tip of the thumb until the doctor permits this."

EVALUATION TIPS

- Observe the client's contralateral thumb for laxity (including laterally).
- Assess the contralateral thumb for MP and IP AROM.
- Is tightness of the injured thumb's web space present?
- In clients who have had surgery, observe for scar adherence and test for full excursion of the EPL, which also may be adherent.
  - Is full IP active extension present with MP extension? If not, is IP active extension present with the MP in some flexion?
  - Is IP extensor lag present?
- Explore the client's ADL needs and discuss any adaptations needed to protect the injured tissue.

DIAGNOSIS-SPECIFIC INFORMATION THAT AFFECTS CLINICAL REASONING

- Be careful to avoid radial stress on the thumb when splinting and exercising. Some therapists overcorrect the splint position with slight thumb MP ulnar deviation for this reason.

- Fabricate the splint with a good web space opening and with the thumb positioned to prevent loading of the tip. Placing the thumb CMC in abduction/extension may be more protective for preventing loading than placing it in opposition.

TIPS FROM THE FIELD

- The location of the incision scar can put the EPL at risk for developing adherence at that point. If EPL adherence is present, splinting the IP joint in extension at night or when not exercising may help. Work on scar management and, at that site, position the MP or other proximal joints in some flexion to promote active IP extension.
- The flexor pollicis longus (FPL) is easier to isolate than the FPB. Because of this, and because immobilization contributes to MP stiffness, clients often have difficulty isolating active flexion at the thumb MP. If they override with IP flexion, try using a volar IP extension gutter splint to isolate for MP flexion active exercises. Simultaneous proximal support of the metacarpal also may help.

Precautions and Concerns

- *Be alert for and takes steps to prevent the development of a thumb web space contracture. Although a typical approach is to splint in overcorrection (slight ulnar deviation), don't allow thumb abduction or tightness of the thumb web space to occur.*
- *Avoid tip loading and resistive pinching.*
- *Assess and problem-solve ADL to protect injured structures. Try building up the girth of implements (e.g., construct padded pens) to reduce the load on the thumb MP joint.*
- *Instruct clients to avoid painful use of the thumb.*

Roles of Therapy Assistants

Therapy assistants may be assigned the following tasks:

- Managing edema
- Modifying and refurbishing splints
- Instructing clients in a home program, splint application, and splint and skin care
- Assisting in skin inspection and wound care
- Supervising clients' home exercise program as identified by the therapist
- Providing modifications and adaptations that assist the client in activities of daily living (ADL)
- Reinforcing precautions as identified by therapists

CASE *Studies*

CASE STUDY 15-1

RP, a 48-year-old, left-dominant warehouse worker, had a work-related accident that resulted in a soft tissue mallet injury (i.e., no bony involvement). He was seen for medical care 2 weeks after injury. He had not been splinted after the injury.

Treatment

RP was referred to hand therapy for DIP splinting in neutral position. He had moderate localized edema and tenderness over the dorsal DIP. He had a 30-degree DIP extensor lag but could be passively positioned to neutral. He did not demonstrate signs of hypermobility of the other digits.

RP was shown the typical splint options. He also was taught the importance of maintaining PIP flexion while avoiding any DIP flexion for approximately 6 weeks. He stated that he preferred a splint that supported both the PIP and the DIP for use at work. He said he would not be well enough protected in just a DIP splint. He agreed to use a DIP splint with the PIP free when not at work. He stated that he understood the importance of PIP flexion AROM and that he understood the blocking exercises he had been shown. All this information was documented.

RP was seen again 7 days later. His long splint was dirty, indicating good use of it, but his shorter DIP splint was not dirty. He had limited PIP flexion AROM. He was adamant about continuing to use the full digit-based splint for protection at work. He agreed to exercise more to recover PIP flexion. The physician was consulted and agreed to this plan only if RP demonstrated normal PIP flexion at the next therapy visit in 7 days. All this information was documented.

Result

When seen at the third therapy appointment 7 days later, RP had achieved full PIP flexion. He demonstrated a good understanding of his home splint regimen. The rest of his therapy program was uneventful. He made a good recovery, with full AROM at the DIP in flexion and extension over time.

CASE STUDY 15-2

AR, a 73-year-old, retired, right-dominant man was a winter visitor to the southwest. He attended therapy with his wife and his daughter, who was a physician. AR fell while playing tennis and sustained an ulnar dislocation of the right small finger PIP joint. He initially was seen in the emergency department (ED) of a local hospital. He reported no medical problems that would affect his recovery.

The ED physician splinted the finger in a full-digit alumifoam splint, but the client removed it immediately because it was uncomfortable and he did not want to be restricted in function. He was referred to hand therapy 10 days later with significant edema of the involved digit. Circumferential measurements were deferred because of tenderness. He reported his pain to be localized to the radial PIP joint area; he rated the pain as 4/10 with motion (i.e., 4 on a scale of 1 to 10, 10 being the worst pain) and 1/10 at rest. No sensory problems were reported. AROM of the digit was MP 0/90, PIP 0/45, and DIP 0/17. No dislocation was noted with AROM.

Treatment

AR and his family were instructed in the concepts of tissue tolerance and in balancing rest and gentle stimulation with AROM. AR initially was seen for edema control and fabrication of a hand-based protective splint with the right ring and small fingers in intrinsic-plus position with slight PIP flexion of the small finger. The splint was hand based to provide radial support to the small finger with the ring finger. AR and his family were instructed in splint and skin care. He was instructed to wear the splint when not exercising and at night. He was also instructed in pain-free AROM with gentle blocking for IP flexion. Offset buddy straps were provided for the ring to small finger.

AR was highly motivated and tended to perform strenuous exercises. Further discussion revealed that he was eager to return to playing tennis, and he believed that more aggressive exercising would be helpful. The hand therapist emphasized the importance of tissue tolerances and the significance of edema control in his functional recovery. Manual edema mobilization pump points, digital compressive sleeves, gentle frequent PIP blocking exercises, and FDS and FDP fists were very helpful. After five visits over 3 weeks, AR's pain was 0/10, edema at the PIP had been reduced from 6.7 to 5.9 cm (the uninvolved digit measured 5.4 cm), and he demonstrated good PIP alignment with AROM at MP 0/88, PIP 0/76, and DIP 0/48. He had begun to hold a tennis racquet without pain, and doing this had been his favorite exercise. He used buddy straps occasionally for support. A small, soft, ring-style Velcro strap was fabricated for use around the proximal phalanx of the small finger, and this facilitated active IP flexion without pain. AR also liked using a very small volar PIP gutter in flexion as an exercise tool with composite flexion AROM to promote supported DIP flexion with composite fisting.

Result

AR was a highly motivated client. He did not "comply" with the initial splinting provided by the ED, although he may not have understood the medical rationale for resting the injured digit, or he might have tolerated a better-fitting or more comfortable splint. This client was determined to return to playing tennis quickly, and he did, despite having sustained a complicated injury.

CASE STUDY 15-3

RG was a 20-year-old, right-dominant female who worked as a nanny. She enjoyed playing softball and exercising. She fell and sustained an injury to the UCL of the left thumb MP joint; the injury was surgically repaired. RG was referred to hand therapy when the pin was removed 4 weeks later. She had been taking pain medications that day and had difficulty staying awake during the therapy session for splint fabrication.

Treatment

A protective forearm-based thumb spica splint was fabricated with the IP free. All instructions were provided in writing and reviewed with the client. She was instructed to wear the splint at all times except for skin care and for gentle AROM to the wrist and thumb CMC and IP. She had not been medically cleared to begin thumb MP AROM at that time.

RG did not attend her next three therapy appointments. Attempts were made to call her, messages were left, and the physician was notified. When seen 2 months later, she reported that she had stopped wearing her splint after about a week. Her incision scar had healed, but she demonstrated EPL adherence at the incision site.

AROM was thumb MP 0/14 and IP 11/35. Passive IP extension was full. Passive MP flexion was 0/14 and was equal to active MP flexion. RG had thumb IP extensor lag and also MP joint tightness. She was not tender over the ulnar MP joint area, nor was she tender with radial stress. CMC motion was normal. Wrist AROM and index through small finger AROM were normal. RG expressed concern primarily about the droop of her thumb at the IP and secondarily about MP joint stiffness.

Therapy focused on scar softening with silicone gel, gentle scar mobilization, and AROM. The client was instructed in thumb IP extension AROM with available (limited) MP flexion to promote EPL function. Place and hold exercises also were performed. For MP flexion, she was fitted with a removable volar gutter in IP extension, and this was used for MP flexion AROM with self-stabilization at the metacarpal joint. Medical clearance was provided to begin gentle passive MP flexion, and she was instructed in this. Use of a dynamic thumb MP flexion splint was planned if passive MP flexion did not improve quickly.

Active flexion exercises progressed from isolated MP to composite motions. Active IP extension exercises

were upgraded with the wrist and thumb MP in varying positions of flexion and in extension. Emphasis was placed on promoting flexibility of the EPL and on gaining thumb MP flexion if able. The client was reminded that the goals of surgery were to have a pain-free, stable MP joint and that some stiffness might linger.

Result

RG did not attend any therapy or medical appointments thereafter. The EPL adherence probably could have been prevented completely if timely therapy visits had been made earlier on.

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