

Mallet Finger

Operative and Non-operative Indications and Considerations

Anatomical Considerations: The digit extensor muscles are weak and the glide length is less than the flexors to the digits. The extensors travel over a greater distance and require more motion than the antagonist. The extensor tendons are thin and cover a broad surface which makes them vulnerable to injury and susceptible to the re-injury. The finger is strongest when extending the distal interphalangeal (DIP) joint. The DIP has more tension when passively flexing the DIP causing it to rupture easily. Consequently a direct blow that forcibly flexes an extended finger can cause a disruption to the terminal tendon inserted on the DIP.

Pathogenesis: The distal phalanx extends via the extensor tendon. The extensor tendon mechanism can be disrupted via a sudden forced flexion of the extended finger. A Zone I and II injury of the extensor tendon mechanism can tear or rupture at or near the distal phalanx. It can also cause an avulsion fracture at the insertion of the extensor tendon on the distal phalanx as well as hyperextension of the PIP joint. The deformity is an extension lag which is a DIP droop and is known as a “mallet finger injury”. The extensor lag may not be noted for several days. The underlying forces of a Zone I extensor tendon injury which have been reported are: 1) a fingertip is struck by a ball, 2) stubbing a finger during bed making and 3) elderly people pulling on their socks.

Epidemiology: Most commonly seen are closed mallet finger injuries which are known as a Type I injury. Mallet finger is more common in males with significant trauma in younger males and minor traumas in older females. Sixty-six percent of the injuries occur in the dominant hand with the most common involvement being of the last three digits and is typically limited to only one finger.

Diagnosis:

Acute Stage: less than 10 days of injury

- Patient report and inability to extend their finger actively.
- Extensor lag of DIP, extent depends on severity.
 - Ecchymosis over the dorsum of the DIP joint.
 - Painful, swollen fingertip.
 - Possibility of hyperextension of the PIP joint.
- Radiographs, AP, lateral, oblique, to rule out avulsion.
- Mallet Finger Classification:
 - Type I: Closed trauma, tendon is damaged with no fractures or a small avulsion fracture. Injury of extensor tendon mechanism.
 - Type II: Rupture of the tendon near or at the DIP joint.
 - Type III: Deep abrasion of the tissues, open injury.
 - Type IV: Injury to trans-epiphyseal (growth plate) in children and fractures involving a large (greater than 20%) part of the joint surface in adults.

Operative versus Non-operative Management: Surgical repair is typically reserved for patients with an open injury or more severe injuries. It may involve sutures to the tendon, fracture reduction and fixation or correction of a deformity. Operative methods may consist of an internal percutaneous fixation such as a Kirschner wire, mini screws or tension band wiring with a stainless steel wire and arthrodesis. Surgical complications include: pain, infection, skin irritation, nail deformity, joint incongruity, impaired sensation, skin necrosis scar tenodesis, pulp fibrosis and decreased flexion of the DIP joint. Indications for non-operative management includes type I mallet finger injury with the skin intact. Conservative treatment involves splinting the DIP joint in excess extension 24 hours a day for 6-8 weeks followed by overnight splinting for 4 weeks. Positioning the DIP in extension relaxes the extensor tendon and aligns the torn tendon or fractured fragments to promote healing. Considerations for management include: skeletal maturity with serious consideration needs to be given to epiphyseal fracture in children and rheumatoid arthritis, occupation, digit injured, type of injury, time since injury, loss of extension, functional disability, pain, inconvenience and previous treatment. Splinting options are: 1) Stack splint which is difficult to remove and reapply for hygiene. 2) Perforated custom-made splint which has a lower incidence of treatment failure, 3) Padded Aluminum-allow malleable finger splint known to have fewer complications and 4) Abouana splint which requires frequent replacing of rubber cover and lacerations from its exposed wire. Considerations for choice of design are: convenience of application and use, comfort and tolerability and complication avoidance.

Surgical Procedure: Surgical procedures are more often performed when the patient has an open injury with a bony avulsion that is irreducible or involve one third or more of the articular surface, or volar subluxation of the distal phalanx, or is past the acute stage of 10 days, or a failed conservative treatment. Ruptured tendons may be repaired with fine braided non absorbable sutures. Caution must be considered due to an avascular critical zone where the tendon is compressed over the head of the middle phalanx during flexion which will influence the healing phase. The Kirschner wire is surgically placed through the DIP and PIP to reunite the tendon and align the fragmented bone by stabilizing the distal joint in neutral or slight extension. The distal wire compresses the fracture site and prevents dislocation of the tendon and fragment. Arthrodesis is a surgical fusion placing the DIP joint in full extension and is sometime done as a last measure.

Preoperative Rehabilitation:

- Acute wound protocol
 - Wound cleansing and dressing
- Remove restrictive jewelry
- Control inflammatory response
 - Elevation, ice, compressive dressing, manual lymphatic drainage
- Option to splint prior to surgery
 - Follow non-operative treatment intervention.

Postoperative Rehabilitation

Note: The following rehabilitation program is a summary of the guidelines provided by Hunter, Mackin, Callahan located in *Rehabilitation of the Hand: Surgery and Therapy*, Mosby 1995 and Handoll, Vaghela, located in *Interventions for treating mallet finger injuries*. Refer to their publications to obtain further information regarding treatment rationales.

Phase I: for Traditional Surgical Immobilization and Rehabilitation: Weeks 1-6

Goals: Reduce infection risk
Control inflammatory response.
Joint support and repair protection

Intervention:

- Patient education in skin integrity.
- Elevation, ice, compression, manual lymph drainage.
- Splinting in extension in slight extension.

Phase II: for Traditional Surgical Immobilization and Rehabilitation: Weeks 6-8

Goals: Continue to reduce residual symptoms for infection risk, edema and pain.
Joint support for ongoing healing.
Increase DIP joint flexion.

Intervention:

- Patient education in skin integrity, elevation and ice.
- Splinting DIP joint in slight extension.
- DIP active range of motion with splint removed.

Phase III: for Traditional Surgical Immobilization and Rehabilitation: Weeks 8 -12

Goals: Improve functional movements.
Reduce re-injury of tendon.
Reduce scar tissue adhesions.
Restore full range of motion.
Ongoing splint if extension lag is present.

Intervention:

- Function mobility-finger flexion to distal palmar crease for holding an item such as a toothbrush, and finger grip for coins.
- Manage tendon flexibility during DIP flexion.

- Scar tissue mobilization at surgical site to reduce fascial adhesion and improve skin integrity.
- Active range of motion for DIP flexion.
- Splinting if indicated.

Non-Surgical Rehabilitation

Note: The following rehabilitation program is a summary of the guidelines provided by Hunter, Mackin, Callahan located in *Rehabilitation of the Hand: Surgery and Therapy*, Mosby 1995 and Handoll, Vaghela, located in *Interventions for treating mallet finger injuries*. Refer to their publications to obtain further information regarding treatment rationales.

Phase I: for Traditional Non-surgical immobilization and Rehabilitation: Weeks 1-6

Goals: Splint finger

- Control inflammatory response.
- Reduce infection risks and skin breakdown
- Independently don and doff splint.
- Joint support.
- Increase knowledge in splint complications
- Compliance in splinting regimen.
- Consequences of non-compliance.

Intervention:

- Choose appropriate splint.
- Elevation, ice, compression, manual lymphatic drainage.
- Instruction and demonstration donning and doffing splint for the DIP joint with 0 degrees to slight hyperextension of the DIP joint. The PIP joint is not immobilized.
- Hygiene during splint removal. Maintaining excess extension while donning and doffing splint.
- Adjustments to joint splint due to a decrease in swelling and increased extension.
- Patient education in splint wear and tear complications: rubber padding, lacerations from exposed wires or edges, dorsal skin blanching with cutaneous and terminal tendon ischemia.
- Splint to be worn 24 hours per day for 6 weeks.
- Non-compliance requires returning to beginning of 6 week regime.

Phase II: for Traditional Non-surgical immobilization and Rehabilitation: Weeks 6-10

Goals: Restored tendon continuity

Ongoing maintenance of skin integrity.
Restore active range of motion without re-rupture of tendon.
Night splinting for 4 weeks.
Restore Function.

Intervention:

- Radiograph
- Patient education for skin integrity.
- Finger flexion exercises
- Education in night splinting for 4 weeks.
- Functional finger flexion activities: patient driven goals, grasp toothbrush and pinch coin.

Phase III: for Traditional Non-surgical immobilization and Rehabilitation: Weeks 10-12

Goal: Restored tendon continuity
Ongoing maintenance of skin integrity.
Continued mobility and functional restoration.

Intervention:

- Non-restoration requires orthopedic physician referral.
- Patient follow through in skin integrity.
- Home exercise program to restore finger flexion without re-rupture of tendon.

No Treatment:

- Persistent extension lag-loss of full extension
- Swan neck deformity-flexion deformity of DIP joint and hyperextension deformity of the PIP joint due to an imbalance of the extensor mechanism.

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