

UNIT NO. I

MINOR FRACTURE, SPRAIN AND STRAIN

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ABSTRACT

Sprains, strains and minor fractures involving the upper and lower limbs are relatively common injuries presenting to primary care physicians and emergency departments. A significant number of these injuries are managed conservatively with appropriate splinting and gradual staged mobilisation therapy. Proficiency in the acute management of these injuries ensures pain relief, optimal siting of care, optimal healing and best patient outcomes.

Keywords:

Primary Care, Minor Fracture, Sprain, Strain

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INTRODUCTION

Sprains, strains and minor fractures involving the upper and lower limbs are relatively common injuries presenting to primary care physicians and emergency departments.

Strain: A tearing injury to muscle fibres resulting from excessive tension or overuse. Sprain: A tearing injury to one or more ligaments of a joint, which occurs when the joint is forced beyond the limits of its normal plane of motion. Aide memoire: **STeM: STrain = Muscle; SPeL: SPrain = Ligament.**

Fracture: A disruption of bone tissue. Fractures may be caused by application of a force exceeding the strength of the bone, repetitive stress, an invasive process that undermines the bone's integrity.

Splinting and institution of PRICE (protection, rest, ice, compression, elevation) plays a major part in the management of these injuries. Compared with casts, splints permit swelling and help prevent neurovascular compromise. Splints may provide definitive treatment for some of these injuries.

Consider obtaining radiographs before physical examination to evaluate for potentially unstable fractures/dislocations. Document the integrity of the neurovascular status of the affected limb prior to and following application of splints.

FINGER SPRAINS & STRAINS

Volar plate sprain: Usually follows hyperextension injuries.

Patients present with tenderness over the proximal interphalangeal (PIP) or distal interphalangeal joint (DIPJ) joints. Treatment of a mild finger hyperextension injury usually requires only 1-2 weeks of protective buddy taping to an adjacent finger in addition to the institution of early ROM exercises.

Avulsion fractures, suspected volar plate disruptions should be splinted with an extension block splint (figure 1) and referred for orthopaedic review in 5-7 days.



Figure 1: Extension block splint

Collateral ligament injury: Partial collateral ligament tears may be treated with buddy taping and early ROM exercises. Initiate ROM exercises after 2 weeks. Continue protective buddy taping of the digit for sports activities until pain-free function returns.

Collateral ligament injuries of 1st MCP joint (Gamekeeper's/ Skier's thumb): The injured joint should be splinted with a thumb spica and referred for orthopaedic review in 5-7 days.

Central slip rupture: Loss of active extension over the PIPJ indicates a central slip injury. If unrecognised, can lead to a

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boutonniere deformity caused by unopposed action of the flexor tendons. Treatment of an acute central slip injury consists of splinting the PIPJ in full extension for 6 weeks using an aluminium foam splint (dorsal, or volar)(figure 2).



Figure 2: Extension splint

Orthopaedic review should be done in 5-7 days.

Flexor tendon injury of distal interphalangeal joint (jersey finger)

Inability to actively flex the DIPJ following rupture of the flexor digitorum profundus insertion indicates this injury. Acutely, the injured finger should be placed in an aluminum splint with the PIPJ and the DIPJ slightly flexed. (figure 1) The splint provides support and prevents extension of the DIPJ.

ALL jersey finger injuries should be referred urgently to a hand surgeon. Definitive treatment is surgical in all cases, and some injuries require surgical repair within 7 to 10 days.

FINGER FRACTURES

Distal phalanx fractures

Distal phalanx fractures, including tuft fractures and extensor digitorum insertion tears, with or without associated avulsion fractures (Mallet finger) heal well with conservative treatment and should be splinted with the DIPJ in extension (figure 3) for a minimum of 3 to 4 weeks. Commercial devices for immobilisation include Stack splints. Extension splints for mallet finger injuries must be worn at all times till healing is confirmed at orthopaedic review.

Multiple fibrous septa attach the tuft of the distal phalanx to the volar skin. The clinician should not attempt to reduce comminuted fractures of the distal portion of the distal phalanx. The fibrous septa of the distal phalanx or tuft usually support the fragments when splinted.¹

Indications for referral:

Immediate referrals are imperative if there are open fractures with extensive soft tissue/ bony maceration (e.g., severe crush injury), severe nail-bed or nail-plate injuries and fractures associated with neurovascular compromise.



Figure 3: Extension splint for Mallet finger

Middle phalanx fractures

Middle phalanx fractures are commonly associated with tendon or other soft tissue injuries leading to joint immobility, and fracture instability. All middle phalanx fractures should be evaluated carefully for evidence of rotation, shortening, or angulation.

Non-displaced stable fractures of the middle phalanx without angulation are treated by buddy taping them to an adjacent finger. If the ring finger is involved, it should be buddy taped to the little finger.²

Short-term immobilisation with a dorsal or volar finger splint can be used for added protection or pain control.¹



Buddy splint

Non-displaced fractures should be reevaluated by physical examination and radiographs within one week of the injury



Figure 4: Dorsal finger splint



Figure 5: Volar finger splint

to check for displacement, angulation, or rotational deformity.

Displaced or angulated fractures: Closed reduction should be attempted under digital block, using three-point pressure to bring the distal fragment into alignment with the proximal fragment. Following reduction, the injured finger should be immobilised in an ulnar or radial gutter splint with buddy taping to an adjacent finger.⁴

Post-reduction radiographs should show no more than 1 or 2 mm of displacement or shortening. Up to 10 degrees of angulation is acceptable but no amount of rotation is permitted.

Comminuted, rotational, intra-articular fractures, and displaced or angulated fractures that cannot maintain their reduction should all be referred to a hand or orthopaedic surgeon.³

Proximal phalanx fractures

Proximal phalanx fractures are often unstable due to the forces exerted on the fracture fragments by both the intrinsic (interossei, lumbricals) and extrinsic (extensor digitorum, FDS, FDP) hand muscles via their respective tendons.

A transverse, oblique, or avulsion fracture that is nondisplaced, not angulated, and appears stable can be treated initially by splinting and buddy taping. If the ring finger is involved, it should be buddy taped to the little finger. An ulnar or radial gutter splint can be used for increased comfort and stability if needed.

Closed reduction should be performed for angulated fractures, with a digital block providing adequate anaesthesia for the procedure. The reduction is held in position by a radial or ulnar gutter splint.

Displaced or angulated fractures that are successfully reduced should be re-evaluated one week following reduction, looking for evidence of displacement, shortening, angulation, or rotation.

Indications for referral:

A hand or orthopaedic surgeon should be consulted immediately for any open fracture and any fracture associated with a tendon, nerve, or vascular injury.

All intra-articular, unstable, rotated, shortened, or significantly angulated fractures should be referred to an orthopaedic or hand surgeon. Referral is necessary whenever a fracture cannot be reduced or the reduction cannot be maintained. NO degree of rotation is acceptable following a reduction.² Less than 10 degrees of angulation and < 2 mm of shortening may be tolerated.

METACARPAL FRACTURES

First metacarpal

The thumb is integral to normal functioning of the hand. Due to the unique anatomy and biomechanics of the thumb, first metacarpal fractures are described and managed differently than other metacarpal fractures. Thumb metacarpal fractures are divided into two large groups: intra-articular and extra-articular.

Intra-articular fractures (Bennett's & Rolando's fractures) should be managed initially using a thumb-spica splint prior to being referred to orthopaedics within two to three days for surgical fixation.

Extra-articular fractures are typically managed in a closed fashion with thumb-spica immobilisation and rarely require surgery. Extra-articular fractures do not require perfect anatomic reduction and can tolerate up to 30 degrees of angulation.

Second to fifth metacarpal(s)

Fractures involving the 2nd to 5th metacarpals must be



Figure 7: Thumb spica

specifically assessed for intact extensor mechanism ("pseudo-clawing"), angulation and rotational alignment. Acceptable angulation for metacarpal shaft fractures:

- $\leq 10^\circ$: 2nd and 3rd metacarpals
- 20° : 4th metacarpal
- 30° : 5th metacarpal

Fractures with an unacceptable degree of angulation require reduction. Anaesthesia can be adequately and expediently

achieved using a haematoma block.

Non-displaced metacarpal shaft fractures should initially be splinted using a gutter splint. Ulnar gutter splints for 4th and 5th metacarpal fractures, and radial gutters for 2nd and 3rd metacarpal fractures.

Indications for referral:

- Immediate: all open fractures and all fractures with associated vascular compromise or nerve injury.
- Early (1-2 days): fracture associated with a suspected complete tendon laceration.
- Patients with metacarpal shaft fractures should be seen in follow-up within 5 days.



Figure 8: Radial gutter splint



Figure 9: Ulnar gutter splint

CARPAL FRACTURES

Scaphoid

Scaphoid fractures are among the most common upper extremity injuries. Plain radiographs taken soon after the injury may not reveal a fracture. The prevalence of occult scaphoid fractures in patients with trauma-related wrist pain but negative plain radiographs is approximately 25 percent.⁶ The clinician should assume one is present until definitive proof otherwise is obtained.

Therefore, the management of symptomatic patients with negative radiographs consists of immobilisation in a thumb

spica cast for 7 to 10 days followed by reimaging with plain radiographs.

Lunate

The patient should be immobilised in a long arm cast or a double sugar tong splint with a well-moulded wrist giving symmetric dorsal and volar support.²

Because of the frequent incidence of concurrent bony and ligamentous carpal injuries, and the potential for lunate non-union and osteonecrosis, all patients with lunate fractures should be referred to an orthopaedic review in 5 days.

Triquetral

If the patient has a chip, avulsion, or non-displaced body fracture, a short arm cast with the wrist in slight extension is indicated.

The clinician should be alert to the possibility of other undiagnosed pathology, such as a lunotriquetral ligament tear, pisiform fracture, or injury to the triangular fibrocartilage complex. Specialist review for consideration for CT/MRI imaging should be arranged within 1-2 weeks.

Pisiform

Immobilisation using a short arm cast is appropriate. Pisiform fractures heal well with 3-6 weeks of immobilisation in a short arm cast.² Malunions and non-unions are rare.

Trapezium

Non-displaced non-comminuted fractures, avulsion fractures, and ridge fractures can be treated nonoperatively with immobilisation. Splinting with a thumb spica and orthopaedic review in 3-5 days.

Trapezoid

Non-displaced fractures typically heal well with four to six weeks of short arm casting. Comminuted fractures, dislocations or fracture-dislocations should be referred for hand surgery evaluation within 5 days.

Capitate

A short arm cast should be placed. Patients with displaced capitate fractures (displacement >2 mm), delayed diagnosis of nondisplaced fractures, and concomitant carpal fractures or ligamentous instability should be seen by a hand surgeon for definitive care within three to seven days.

Hamate

Non-displaced hamate body fractures, avulsion fractures, and fractures of the hook being treated nonoperatively can typically be placed immediately in a definitive short arm cast.

WRIST SPRAIN: TRIANGULAR FIBROCARILAGE COMPLEX (TFCC) INJURY

The TFCC stabilises the wrist at the distal radioulnar joint and ulnocarpal articulations while allowing for adequate wrist

motion, and is a focal point for force transmission across the ulnar aspect of the wrist. Injury to the triangular fibrocartilage complex involves tears of the fibrocartilage articular disc and the tissue that connects the disc to the triquetrum and other carpal. FOOSH is the most common mechanism. Wrist pain along the ulnar aspect of the wrist is the primary symptom of TFCC injury.

In minor TFSS tears with no evidence of wrist instability, treatment consists primarily of a temporary above elbow splint worn for four to six weeks, followed by progressive strengthening and range of motion exercises. If pain persists after 4 weeks of splinting, referral to a hand surgeon is indicated.

DISTAL RADIUS FRACTURES

Colles' fractures involve extra-articular fractures with dorsal displacement of the distal radius fragment; Smith's fractures involve palmar displacement of the distal radius fragment.

Non-displaced extra-articular fractures (no dorsal tilt of the distal radial articular surface, < 5 mm of radial shortening, < 2 mm of displacement of fracture fragments) are relatively stable and can be treated with a sugar tong splint. Splints should allow full flexion and extension of the metacarpal phalangeal (MCP) joints. Orthopaedic review should be arranged within 5-7 days.

Open fractures, fractures associated with an acute neuropathy or compartment syndrome, and fractures associated with circulatory compromise in the hand need emergency orthopaedic referral.

TOE FRACTURES

Great toe

Decreased function of the great toe can have a significant impact on a patient's life, given the toe's crucial role in balance and the toe-off phase of locomotion. Consequently, referral is more common for great toe fractures than for lesser toe fractures.

Indications for referral:

- Fracture with dislocation;
- Displaced intra-articular fractures; or
- Fractures initially reduced that immediately displace once traction is released (i.e., unstable displaced fractures).

Second to fifth toes

Referral is rarely required for fractures of lesser toes. However, referral is indicated in the following situations:

- Displaced intra-articular fractures;
- Irreducible fractures;
- Open fractures of non-distal phalanges; or
- Fractures that do not maintain acceptable position with buddy taping.

With the exceptions mentioned above, most undisplaced and

displaced fractures can be managed by non-specialists. Following reduction of displacement under digital block, a short-leg walking cast is usually used for immobilisation. Review should be arranged after 1 week.

Non-displaced fractures are immobilised by buddy splinting for 4 to 6 weeks.

METATARSAL FRACTURES

Most fractures of a single metatarsal shaft are minimally displaced due to the splinting action of adjacent metatarsals and their abundant ligamentous and muscle attachments. If the fracture is minimally or non-displaced, initial treatment includes immobilisation in a posterior splint with no weight-bearing and a follow-up visit in 3 to 5 days.

Isolated shaft fractures with > 3 to 4 mm displacement in the dorsal/plantar plain or >10° angulation should be reduced under regional/ haematoma block.^{6,7}

Fifth metatarsal

Three different fracture types occur in the proximal fifth metatarsal: tuberosity avulsion (pseudo Jones fractures), acute diaphyseal (Jones fractures), and stress diaphyseal. The prognosis and treatment differ substantially among them. Avulsion fractures generally heal without difficulty and are readily managed by primary care clinicians. Undisplaced fractures can be successfully managed with nonsurgical management. Diaphyseal fractures benefit from non-urgent orthopaedic referral in view of higher rates of delayed union and malunion.

Indications for referral

Immediate: All open fractures and all fractures with associated vascular compromise or nerve injury.

Urgent referral:^{2,8,9}

- Fractures of multiple metatarsals;
- Displaced fractures near the metatarsal head;
- Intra-articular fractures;
- Displaced fractures of the first metatarsal, even if displacement is minimal, because anatomic position is necessary for optimal weight-bearing function; or
- Concurrent injuries of other structures, including injury of the tarso-metatarsal (i.e., Lisfranc injury) ligament complex and fractures of other foot or ankle bones.

TARSAL FRACTURES

Talus & calcaneal fractures

Most of these fractures occur as a result of falling from a significant height or from high-energy trauma, which may have caused severe internal injuries. Most of these fractures require more urgent evaluation and management (within a few hours) due to the increased risk of avascular necrosis from disruption of the vascular supply to the talus, it is best that the patient be

splinted in a short leg splint and referred to the emergency department.

Stress fractures of the calcaneum: Repetitive overload can lead to a stress fracture of the calcaneus. For patients with mild symptoms, activity restriction coupled with heel inserts may suffice. For patients with severe symptoms (e.g., pain with any walking), crutches and no weight bearing are recommended until symptoms subside.²

ANKLE SPRAIN

Ankle injuries are among the most common injuries presenting to primary care offices and emergency departments. Grades of ankle sprains are based on clinical signs and functional loss:

- **Grade I sprain** results from mild stretching of a ligament with microscopic tears. Patients have mild swelling and tenderness. There is no joint instability on examination, and the patient is able to bear weight and ambulate with minimal pain.
- **Grade II sprain** is a more severe injury involving an incomplete tear of a ligament. There is mild to moderate joint instability on exam with some restriction of the range of motion and loss of function. Weight bearing and ambulation are painful.
- **Grade III sprain** involves a complete tear of a ligament. Patients have severe pain, swelling, tenderness, and ecchymosis. There is significant mechanical instability on exam and significant loss of function and motion. Patients are unable to bear weight or ambulate.

Decisions to proceed with imaging of the ankle and foot are guided by the Ottawa ankle rules. Palpate the entire fibula (for associated Maisonneuve fracture), the distal tibia, the foot, and the Achilles tendon.

Initial management goals for all ankle sprains are to limit inflammation and swelling and to maintain range of motion. Early treatment includes RICE (rest, ice, compression, elevation — above the level of the heart) for the first 2 to 3 days.

Patients with Grade 1 ankle sprains do not require immobilisation.¹⁰ Treatment with an elastic wrap for a few days following the injury is sufficient. Patients with Grade 2 sprains are managed with a combination of elastic wrap and an Aircast followed by referral for early mobilisation therapy. Grade 3 sprains benefit from immobilisation with short leg back slab and

non-weight-bearing crutches. Early referral for orthopaedic review should be arranged.

ANKLE FRACTURES

For stable, non-displaced, isolated malleolar fractures, below-knee slab with non-weight-bearing crutches, and PRICE therapy are prescribed. The cast should hold the ankle at 90 degrees to prevent a flexion contracture. The importance of elevating the leg should be emphasised to patients, as complications with splint treatment often stem from allowing the foot to remain in a dependent position for too long.

Ankle fractures are considered unstable if two or more sites of significant injury are present, such as a lateral malleolar fracture with deltoid ligament disruption or a bimalleolar fracture. Patients should be splinted with the ankle joint at 90 degrees, remain non-weight-bearing, be advised about strict limb elevation, and be referred to an orthopaedic review within 5 days.

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LEARNING POINTS

- **Primary care physicians can satisfactorily manage undisplaced and minimally displaced fractures acutely. Management involves splinting and referral for orthopaedic review within 5-7 days.**
- **Consider obtaining radiographs before physical examination to evaluate for potentially unstable fractures/dislocations.**
- **A hand or orthopaedic surgeon should be consulted on an emergency basis for any open fracture and any fracture associated with a tendon, nerve, or vascular injury (including suspected compartment syndrome).**
- **Document the integrity of the neurovascular status of the affected limb prior to and following application of splints.**
- **Printed splint care advice should be explained and handed over to the patient.**