Rehabilitation of the hand

Theresa Goggins

Stacey Williams

Abstract

This article outlines the general principles that are considered to provide successful rehabilitation of hand injuries and following hand surgery. It includes a broad summary of assessment and treatment techniques and the clinical reasoning behind therapeutic interventions. It contains information regarding exercise, mobilization, splinting and rehabilitation regimes.

Keywords early mobilization; exercise; hand therapy; joint replacement; rehabilitation; splinting; tendon repair

All members of the team and the patient are responsible for recovery and the rehabilitation process begins when the patient first presents following injury or surgery. Clinical reasoning underpins the whole rehabilitation process.

From simple to complex injuries, the aim is to restore pain-free functional use taking the following into consideration.

Communication

Firstly, get to know your team.

Many, but not all units have designated personnel responsible for dressings, splints and rehabilitation. When planning management following injury or surgery, it is important to consider the level and availability of expertise within the team to provide this treatment. There should be regular and easy communication between all members of the team.

Oedema management

From contusions to complex fractures and surgery, the hand will swell.[1] Early intervention to control and reduce swelling is key to the long-term outcome.

Everyone, including the patient should take responsibility for managing the swelling by using elevation, compression and safe mobilization.[2] In cases of significant swelling, it is worth considering short-term immobilization of the hand in a position of comfort to aid resolution of swelling.

The therapist may also consider use of electrotherapy, ice and soft tissue massage as appropriate.

Mobilization

After acute injury or surgery to the hand the patient will be assessed by the team. The hand will become stiff very quickly. Active movement is key to maximizing tendon glide, oedema management, joint movement and ultimately function, therefore an early protected mobilization regime should be employed wherever possible.[3] There are likely to be restrictions of specified positions and activities of the hand and fingers to protect healing of repaired structures. Establishing these restrictions will depend on many factors including the structures involved, bony stability, likely deforming forces, expected outcome, patient's expectations and activity level.

Fractures

Management of hand fractures is determined by many factors including the stability and type of fracture and the deforming forces acting upon it. If not surgically managed, there will usually be a period of immobilization to allow bony healing. Knowledge of healing times of the bones affected will help to govern the period of immobilization. It is crucial during this period that all uninjured structures are actively moved to maximize tendon glide and minimize swelling. If surgery is required, as soon as stability of the fracture is achieved, active movement should commence.[3]

Tendon repairs

There are many different rehabilitation regimes to manage tendon repairs but if a strong repair has been achieved in theatre early protected motion is advocated. Recent research supports that early active mobilization will allow optimal tendon gliding, preserve joint movement, reduce tendon adhesion and reduce postoperative complications. A regime based on these principles should be devised for the individual patient also taking into account the type and level of injury, tendon and repair quality, delayed surgery, concurrent fractures and wounds.

For flexor tendon repairs, the patient will be fitted with a dorsal blocking splint within 5 days of surgery to prevent hyperextension of the fingers and wrist in differing degrees usually for 4–6 weeks. Examples of regimes include controlled active mobilization (CAM),[4] Belfast/modified Belfast,[5] Manchester short splint.[6]

Conversely, for extensor tendon repairs there will be a splint which limits flexion, for example Short Arc Motion Regime (SAM),[7] Norwich/modified,[8] Merritt[9]

Joint replacements

Active movement should be initiated as soon as possible to maximize movement of the new joints. Patients usually require protective splinting for function to protect or position the joints within the first 4–6 weeks. If there has also been tendon realignment or reconstruction, the splint may need to assist movement in order to aid recovery of the soft tissues.

Splinting

Casts, splints and custom made thermoplastics can be used to immobilize or mobilize the injured hand, protect repaired structures, maintain soft tissue length and prevent development of contractures. The healing process[10] will govern the type and duration of splintage. They are used in conjunction with other therapeutic treatments and can be used for the following purposes.

Immobilization

When immobilizing an injured structure, the splint used must provide support to the damaged structure while allowing uninjured tissues to move.

When managing a bony injury, the effects of the soft tissues should also be considered.

Theresa Goggins *BSc MCSP Specialist Physiotherapist, Wrightington Hospital, Wigan, UK. Conflicts of interest: none declared.*

Stacey Williams *BSc MCSP Specialist Physiotherapist, Royal Albert Edward Infirmary, Wigan, UK. Conflicts of interest: none declared.*

A clinical example of this is a base of proximal phalanx fracture (Figure 1a). Left untreated, the forces of the intrinsics on the proximal fragment and central slip on the distal fragment would cause further displacement of the fracture. A splint (Figure 1b) applied with the metacarpophalangeal joint (MCPJ) in flexion prevents these deforming forces and aligns the fragments (Figure 1c).

Another effective use of immobilization splinting is to treat a mallet injury (Figure 2). This splint immobilizes the distal interphalangeal joint (DIPJ) while allowing the proximal joints to move freely.

Mobilization

A splint can be used effectively to reduce swelling thereby reducing pain, facilitate soft tissue movement and restoring mobility to an injured joint. An injured proximal interphalangeal joint (PIPJ) could be splinted (Figure 3) to aid reduction of swelling, while allowing flexor digitorum profundus (FDP) activation to maintain differential tendon glide and further aid swelling drainage.

Protected mobilization

A splint may be required to protect healing tissues against specified movements during particular tasks or function whilst allowing regular exercise.

A dorsal hood following flexor tendon rehabilitation is a good example of a splint which will protect the repair while allowing mobilization (Figure 4).

Assisted mobilization

Where injured or healing structures need assistance to work, splints can be used to aid the healing tissue, optimize tendon glide and maximize joint movement.

Figure 1 A fracture of the base of the proximal phalanx **(a)** is splinted[11] with the metacarpophalangeal joint in flexion **(b** and **c)** to counteract the forces of the intrinsics on the proximal fracture fragment.

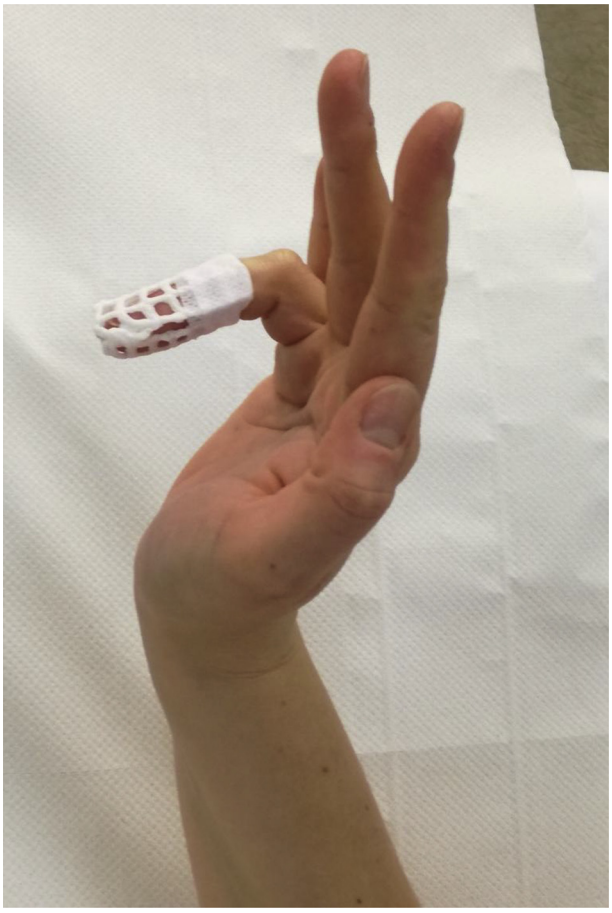

Figure 2 A mallet deformity is immobilized in a neutral position for at least 6 weeks to allow tendon healing.

An example of this in clinical practise could be an outrigger splint (Figure 5) following extensor tendon realignment. This splint allows active flexion and MCPJ movement but will assist the extensor action in good alignment. A capener splint (Figure 6) works on the same principle of allowing PIPJ flexion but assisting extension to a maximal passive range.

Positioning

Splints can be used to improve the posture of the hand and fingers after injury or aid function and maximise gains in movement achieved in theatre or during therapy treatment. They can also be used to facilitate the management of muscle imbalance.

An anti-claw splint (Figure 7) does exactly this. Following an ulnar nerve injury, this can be used to prevent hyperextension at the MCPJs of the ring and little fingers thereby improving hand posture and function.

Static progressive

These are moulded in a static position with the joint or tissue at maximum length and are worn for long periods to accommodate the lengthening of soft tissue. The splint is then remoulded at intervals by the therapist to maximize the joint range, and promote positioning of soft tissue in an increasingly lengthened position.

Sometimes plaster of Paris finger casting is used (Figure 8). In this example the cast would be changed regularly, serially increasing the PIPJ extension.

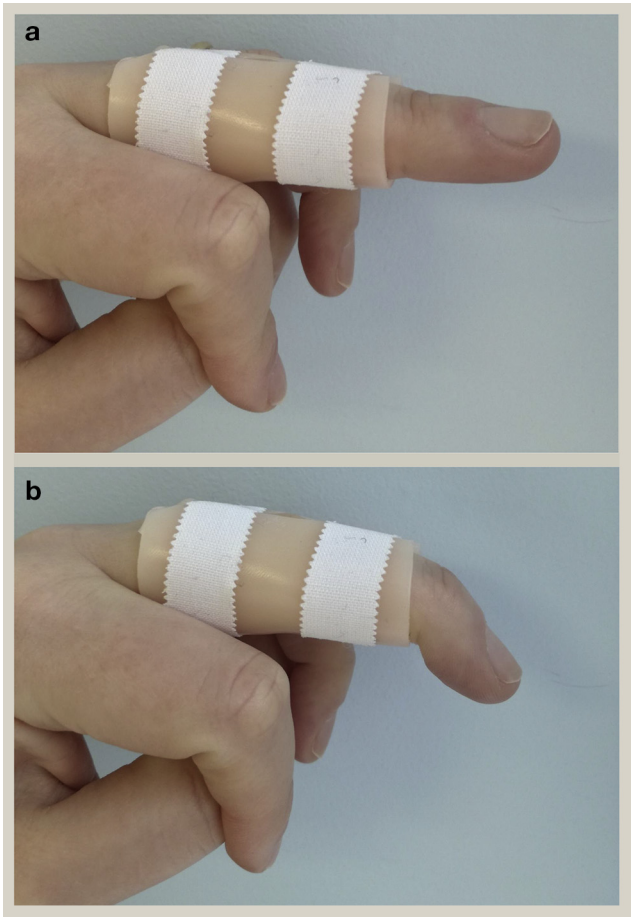

Figure 3 Immobilisation of the proximal interphalangeal joint **(a)**, allowing active flexor digitorum profundus movement **(b)**. This ensures maintenance of differential flexor tendon glide and allows mobilization of the unaffected joints.

Figure 4 Dorsal hood to protect flexor tendon repair.

Figure 5 Examples of an outrigger splint used following extensor tendon realignment to assist the extensor lift in good alignment but allow active flexion and good joint movement.

Exercise

Active

Active movement should be employed when there is good skeletal fixation and in the case of repaired soft tissue the repair is strong enough to withstand the forces of unresisted active movement.

It is essential to prevent adherence of tendons following any hand injury as this will seriously compromise hand dexterity. Active movement is the best way to maintain differential tendon glide and

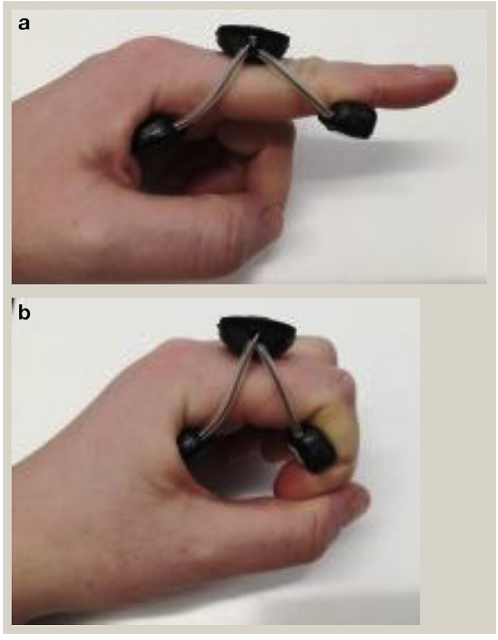

Figure 6 Capener splint to assist active extension of the central slip **(a)** while allowing full flexion **(b)** of the proximal interphalangeal joint.

Figure 7 Example of a splint designed for use during hand function to prevent hyperextension of the ring and little finger metacarpophalangeal joints following an ulnar nerve injury.

Figure 8 Serial casting to gradually increase proximal interphalangeal joint extension.

should be introduced as soon as the injured structures allow. Any dressings required should be minimal to allow movement.

Active movement of unaffected joints including the elbow and shoulder should always be encouraged aiding resolution of swelling and preventing shoulder hand syndrome.[12]

Passive

Passive motion is used to maintain joint mobility and soft tissue length when active movement cannot be achieved. Passive movement is gentle and not a forced process. It would typically be used as a precursor to active movement when swelling or soft tissue opposition would generate too much resistance for a repaired structure during active motion.

Accessory joint mobilizations can be used to move stiff joints prior to active or passive movement.

Assisted

Weak or repaired structures can be guided to move using the muscle activity available aided by the practitioner or the patient using their other hand. This is particularly beneficial with a painful hand to aid increase range of motion.

As rehabilitation progresses, resisted movement can be introduced to restore functional muscle power.

Conclusion

The management of the acutely injured hand relies upon good communication, patient education and a collaborative team effort. Early mobilization is advocated wherever possible and a return to full function without pain is the ultimate aim. ◆

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