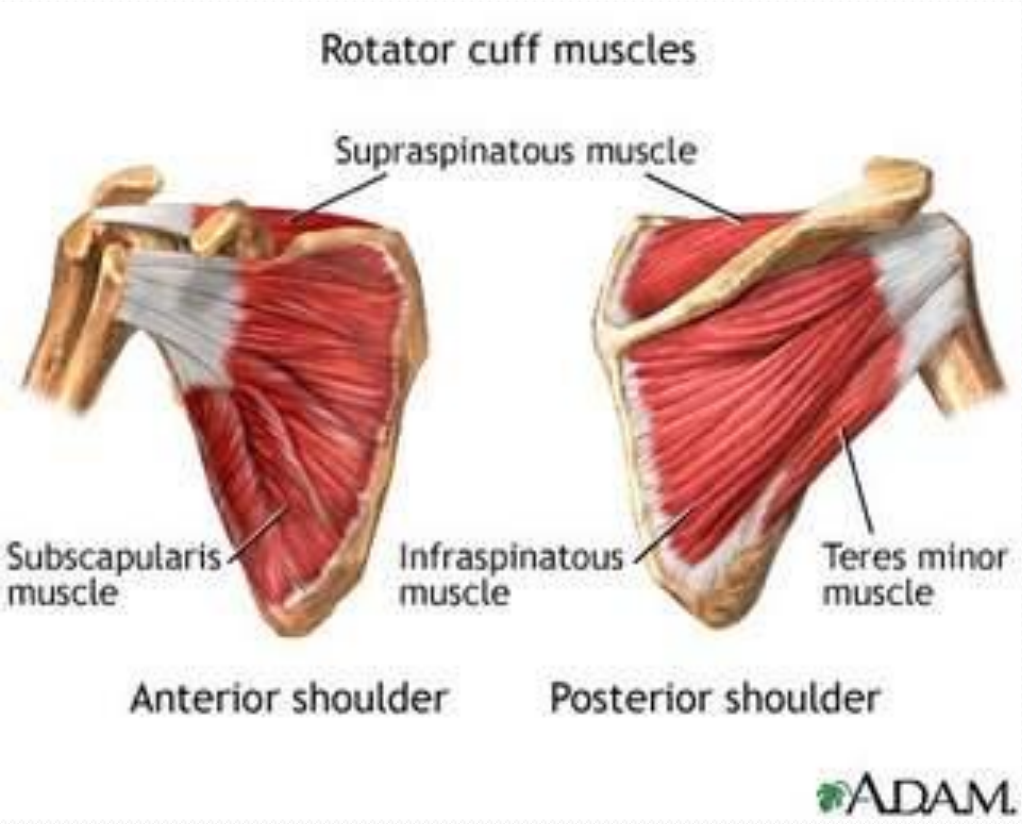
Pathologies of Upper Limb

Date: 25 January 2019

Rotator cuff muscles

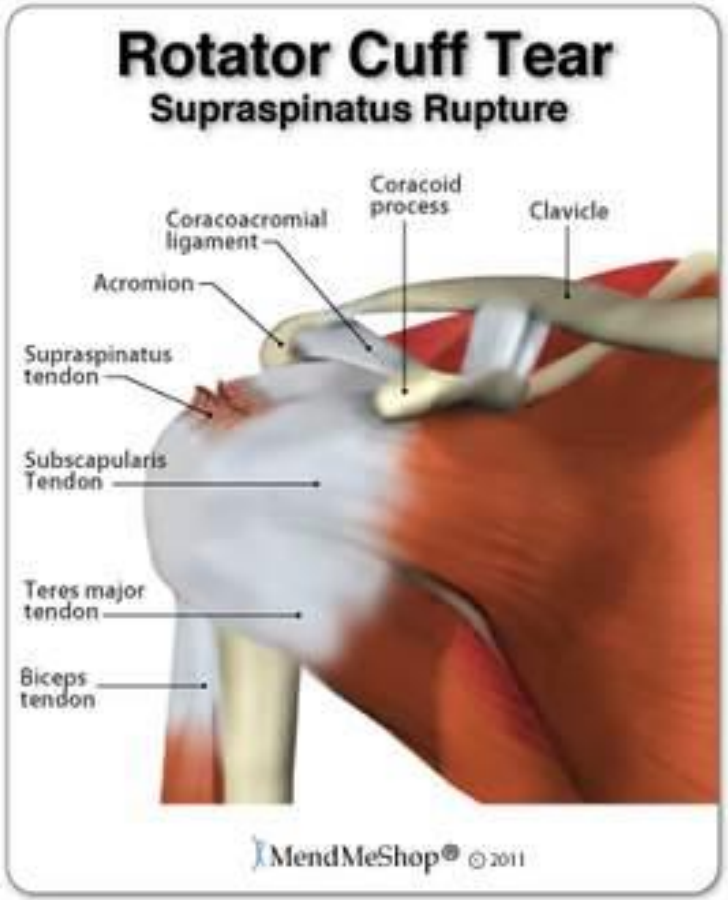
There are four muscles make up the rotator cuff:

- Supraspinatus muscle
- Infraspinatus muscle
- Teres minor muscle,
- Subscapularis muscle.



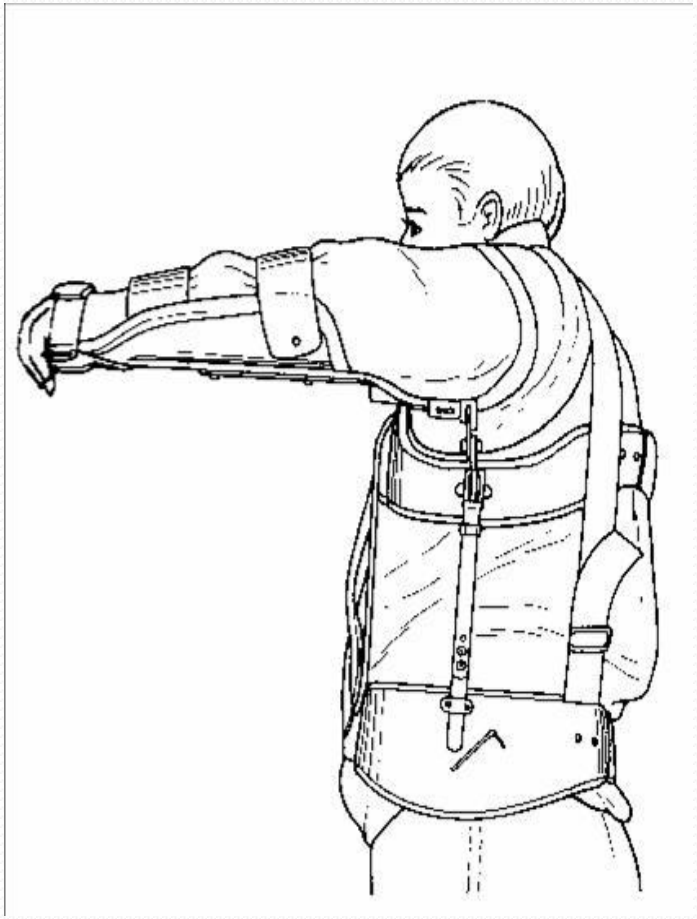
Rotator cuff injury

- Cause: Direct trauma or **repetitive overuse**, throwing
- Lead to: tendonitis, muscle tear or dislocation/subluxation
- Pain, weakness and limitation of active motion around shoulder.
- Pain can be located in the anterior superior and lateral aspects of the shoulder
- Overhead activities = pain



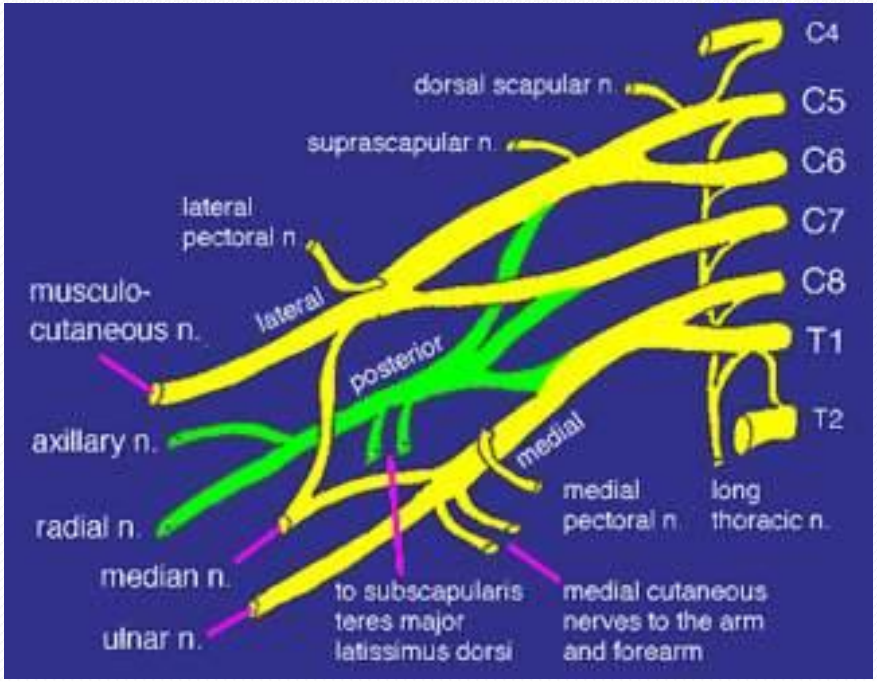
Orthotic intervention

- Often not treated with an orthosis
- Post-operatively immobilization
- Use SEWHO to immobilize upper limb



Brachial Plexus

- Network of nerves in the neck
- Passing under the clavicle and into the axilla
- Originating in the C5,6,7,8 and T1 nerves
- It innervates the muscles and skin of the chest, shoulder and arm



Brachial Plexus injury (BPI)

- The primary cause of Brachial Plexus Injury (BPI) in adults is trauma from a Motor Vehicle Accidence (MVA) gunshot or stab wound.
- 90% of BPI in children occurs as a result of trauma during birth (Erbs Palsy).
- The symptom of BPI will present differently, depending on the type and location of BPI.
- Muscles weakness or be completely paralysed. Cutaneous sensation may be lost. Shoulder subluxation can occur, and poor functional positions occur.

Brachial Plexus injury (BPI)

There are three types of brachial plexus injuries:

- **Avulsion** – nerves are pulled from the spinal cord resulting in a flaccid extremity
- **Rupture** – nerves are torn at one of more places in the plexus
- **Stretch** – nerve has been damaged but not torn. Nerves can often be compressed due to swelling or bruising, and spontaneously recover with 90-100% return of function

Orthotic intervention

- Depend on the type and level of BPI (a simple sling, a shoulder immobilisation orthosis, Elbow orthosis, Wrist-Hand Orthosis (WHO) and prehension WHO

Humeral Fracture

- Cause: by falls or direct trauma to the arm region.
- Location of #: the surgical neck, the anatomical neck, mid-shaft or distally.
- Distal humeral #'s (supracondylar) are common in children who FOOSH (Fall On OutStretched Hand)
- Symptom: pain, loss of grip strength, swelling, and often a visible bump or malalignment at the fracture sight.
- Treatment: surgically or conservatively.

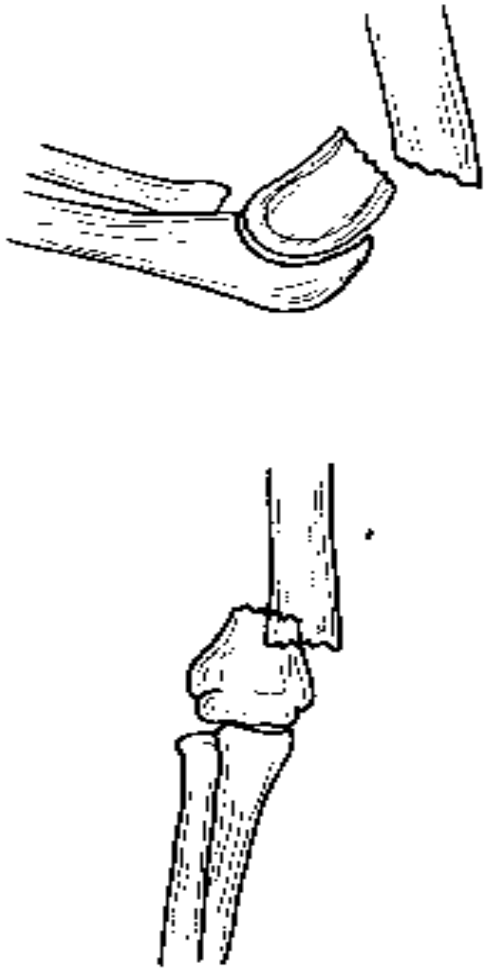


Fig 5 – Supracondylar humeral fracture

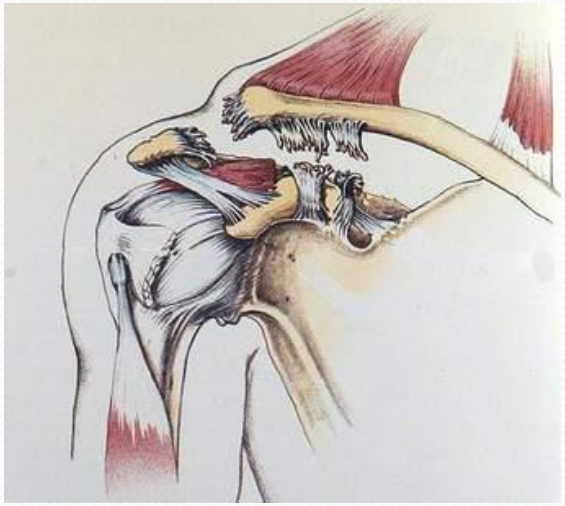
Taken from CSPO manual

Orthotic intervention

- Often a humeral facture orthosis is used to immobilise the arm section and hold the bone segments in alignment.
- Depending on the location of the fracture, immobilisation of the joint above (shoulder) or below (elbow) may be required.

A-C Joint separation

- Caused by a fall onto the shoulder. The ligaments around the Acromioclavicular Joint (AC joint) tear, separating and dislocating the joint.
- Sign and Symptom: pain, tenderness over the joint, swelling, bruising and sometimes a visible 'bump' over the area.



Treatment

- In severe cases, surgery is required to treat AC joint separation.
- Otherwise, an AC joint sling (Fig 9) is used to apply an inferior directed force to clavicle and superior directed force to proximal forearm with elbow at 90 degrees.

Fig 8 – Visible ‘bump’ or ‘step’ caused by AC joint separation

Taken from CSPO manual

Clavicle Fracture

- 'broken collar-bone'.
- A clavicle # is usually a result of direct trauma.
- There is a high rate of non-union in the bones, but this is generally asymptomatic and therefore left alone.

Orthotic intervention

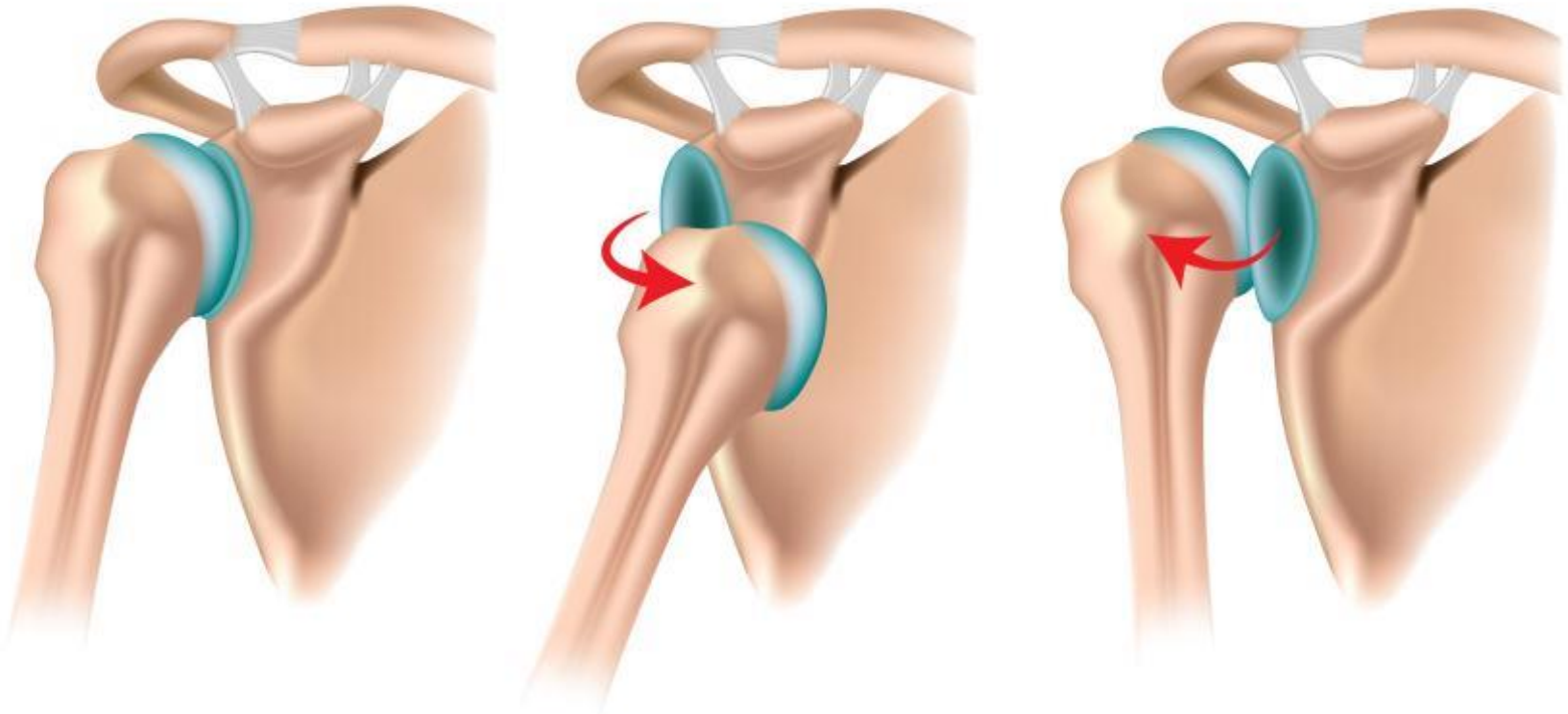
- A figure 8 clavicle orthosis is sometimes used to retract the shoulders and reduce–
  Clavicle fracture showing visible ‘bump’ after non-union

Shoulder dislocation

Cause:

- Fall on an externally rotated and abducted arm – this causes an anterior inferior dislocation, accounting for 95% of shoulder dislocations.
- A seizure or electric shock can lead to axial loading of an adducted and internally rotated arm, causing a posterior inferior dislocation.

Shoulder Dislocation



Normal anatomy

Anterior dislocation

Posterior dislocation

Orthotic intervention

- In either case, a sling or abduction pillow may be used for immobilisation after the event.

Arthritis in shoulder

- on occasions, the Acromioclavicular or Glenohumeral joints will suffer from arthritis (osteo, rheumatoid or post-traumatic). If orthotic intervention is requested, it will aim to immobilise or support the shoulder area.

Tennis Elbow

- Caused by sudden or repetitive movements. Its cause is tendonitis of the extensor carpi radialis brevis muscle

- Sign and Symptom: Pain occurs around the lateral elbow which can radiate down to the wrist. Pain intensifies with strong gripping when the elbow is extended.

Extensor carpi radialis brevis

Origin: Lateral epicondyle of humerus

Insertion: Base of 3rd metacarpal

Action: Extend and abduct hand at wrist joint

Innervation: Deep branch of radial nerve (C7 and C8)

Arterial Supply: Radial artery

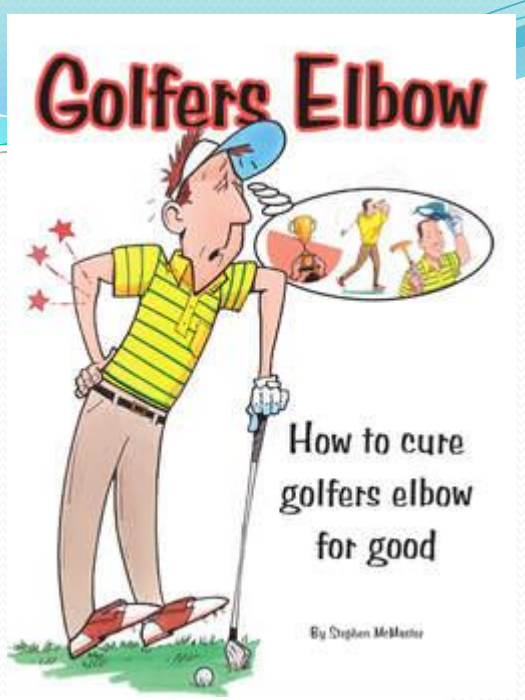
Orthotic intervention

- To reduce the inflammation and pain, and reduce the tension on the muscle origin.
- Achieved by applying pressure to the extensor muscles/tendon immediately distal to the insertion.
- A reduction in the activity that causes the discomfort, or a change in technique, may assist the healing process.
- A referral to a GP may be required for the use of anti-inflammatory drugs
- Should not be too tight to cause vascular occlusion (stop the blood flow).

Golfers elbow

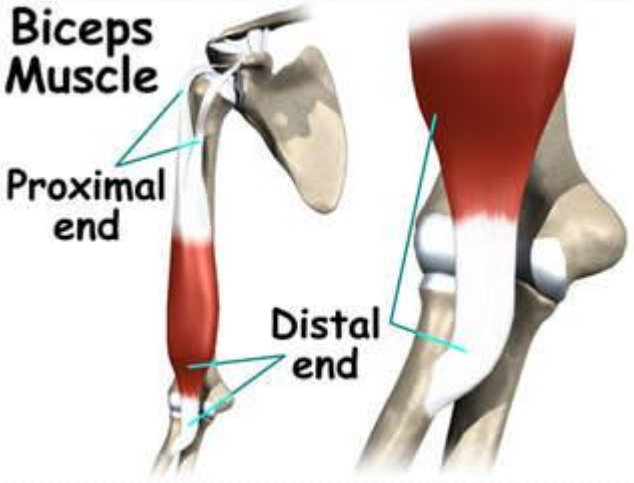
- Cause: tendonitis of the flexor tendons, which originates at the medial humeral epicondyle.

- Treatment of golfers elbow is the same for tennis elbow, but with the pressure pad over the medial muscle belly at the elbow.



Ruptured biceps tendon

- The long head of biceps tendon that ruptures – ruptures of the distal tendon are rare (approximately 5%). Rupture is usually from chronic tendonitis or overuse.
- Caused by an eccentric contraction or resisted flexion of the elbow. It may also occur when an unexpected force is applied to a flexed forearm.
- When a biceps tendon ruptures, and audible 'pop' or 'snap' is often heard. Clinically a patient might present with weakness in elbow flexion, supination and some decrease in shoulder flexion strength.



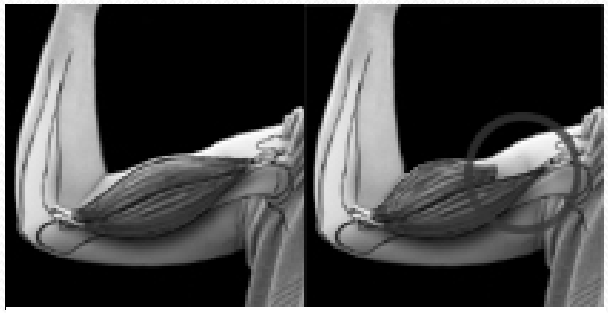
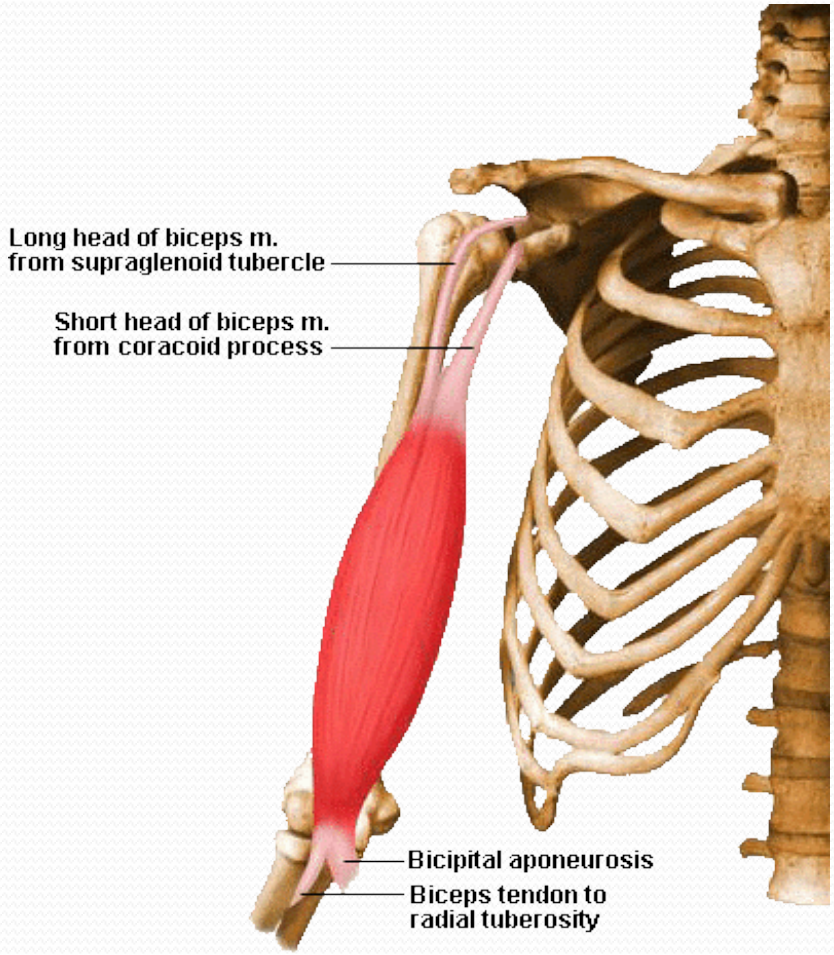


Fig 14 – Biceps brachii muscle. Normal muscle (left) and ruptured tendon (right)

Taken from: www.dynomed.com

Biceps brachii : Long head and Short head

- Origin: Short head: coracoid process of the scapula, Long head: supraglenoid tubercle
- Insertion: Radial tuberosity and bicipital aponeurosis into deep fascia on medial part of forearm
- Action: Flexes elbow, flexes and abducts shoulder, supinates radioulnar joint in the forearm.
- Innervation: Musculocutaneous nerve (C5–C7)
- Blood supply: Brachial artery



Orthotic intervention

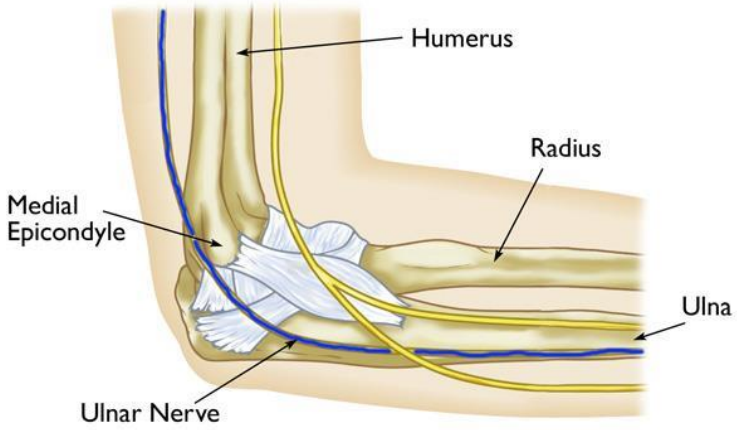
- Partial tear – treated conservatively or surgically. Orthotic intervention to restrict elbow extension for 4-6 weeks, then progressively increase extension ROM until full extension is reached.
- Complete tear – requires surgery to reinsert the muscle. Usually post-op the patient will be in a back-slab cast or elbow orthosis to immobilise the elbow in 90° flexion.

Fig 15 – ROM elbow orthosis

Taken from:
www.bledsoebrace.com

Ulnar nerve entrapment

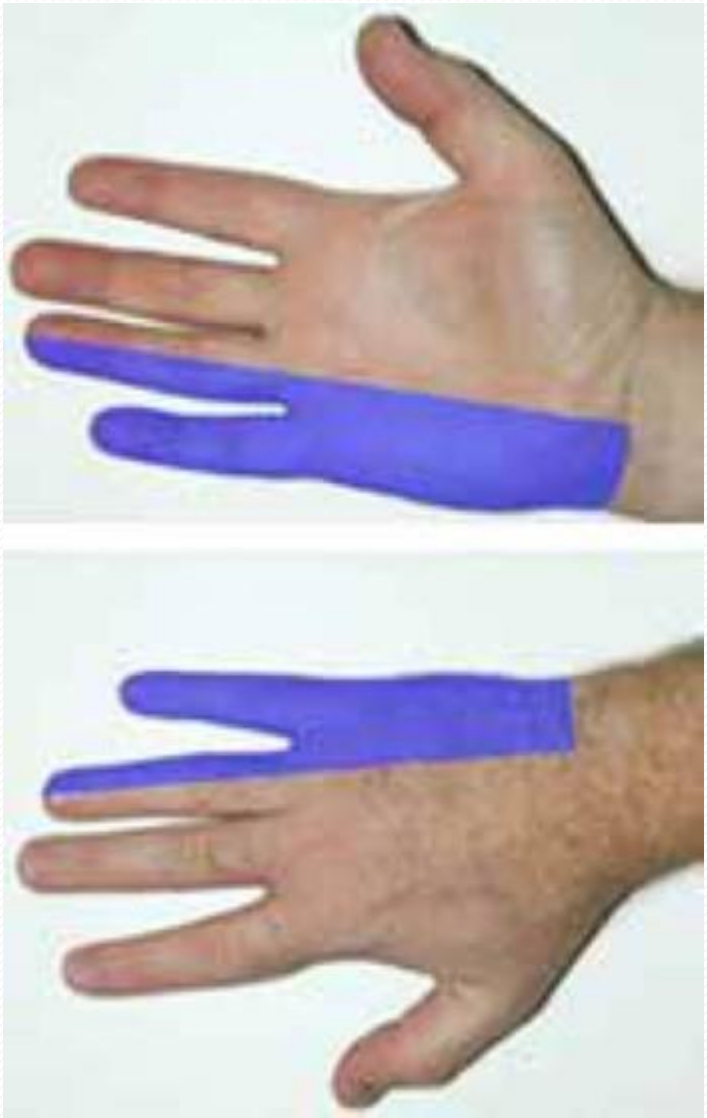
- Knows as Cubital Tunnel Syndrome, this occurs when the ulnar nerve is compromised as it passes through the cubital tunnel at the elbow.
- Cause: The ulnar nerve can become squashed or irritated in the cubital tunnel from direct or indirect trauma to the elbow joint, repetitive bending of the elbow causing stretch of the ulnar nerve, or from prolonged pressure on the cubital tunnel.



Ulnar nerve entrapment

Symptoms:

- the hand and fingers, and present with tingling and numbness in the 5th and 4th fingers (little and ring fingers) and corresponding palm and dorsal surfaces of the hand.
- Tenderness is often seen along the inside of the elbow.
- Numbness is sometimes felt in the hand, particularly with the elbow flexed, whilst decreased grip and pinch strength is often found due to muscle weakness.



Orthotic intervention

- The aim of orthotic intervention can be to limit elbow flexion as an extended elbow puts less pressure on the ulnar nerve.
- This can be done as a night-time device, or used as well during the day if the problem is severe.

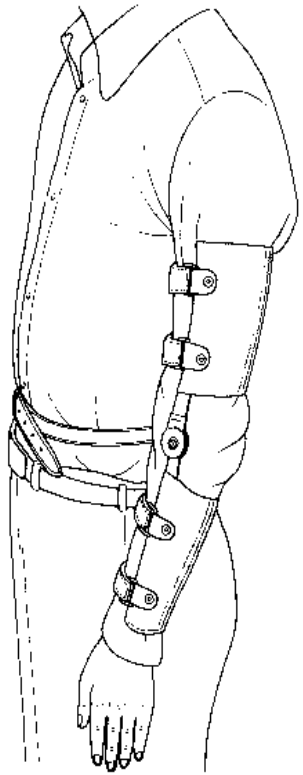


Fig 17 – elbow orthosis limiting elbow flexion

From CSPO manual

Elbow contracture

- The connective tissue (ligaments, tendons, joint capsule) becomes scarred or when muscle tissue becomes shortened.

The most common causes :

- Trauma or surgery – including post-surgical joint stiffness, ligament or tendon repairs, joint replacements, post fractures and burns
- Neurological disorder – including CVA, spinal cord injury, cerebral palsy and head injury.

Orthotic intervention

To correct or prevent further contraction, and create a gradual stretch of soft tissue over an extended period of time.

- In patients with moderate or severe spasticity, dynamic orthoses are contra-indicated
- It is best to use orthoses in conjunction with a stretching program
- Orthoses are most effective if worn almost 24 hours per day (where practical)
- As there can be a large force involved, spread the load over the maximum surface area possible
- Careful monitoring of pain and pressure is required.

Fig 18 – Gradual stretch of the elbow soft tissue

Taken from: www.acplus.com/images/photos

Dislocated elbow

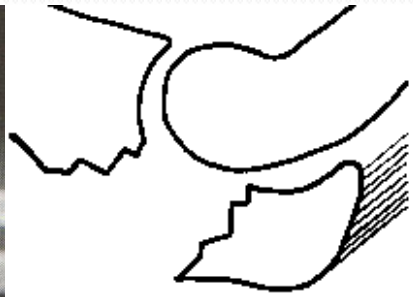
- The alignment of the radius and ulna compared to the humerus is interrupted .
- Cause: fall with the elbow extended, or a result of trauma.
- Associated injuries with a dislocated elbow are fractures and nerve & artery damage.
- Sign and Symtom: pain, swelling and an inability to flex the elbow.
- Nerves such as the radial, ulnar and median nerve may be damaged
- Orthotic management is generally immobilisation of the elbow

Olecranon fracture

- Cause: direct trauma.
- Sign and symptoms: pain, bruising, swelling, and be unable to extend their elbow.
- Treatment: Severe fractures may require surgery, otherwise, a plaster of paris cast or an orthosis will be used to immobilise the elbow at 90°.

Fig 20 – x-ray (left) and drawing (right) of olecranon fracture

Taken from CSPO manual

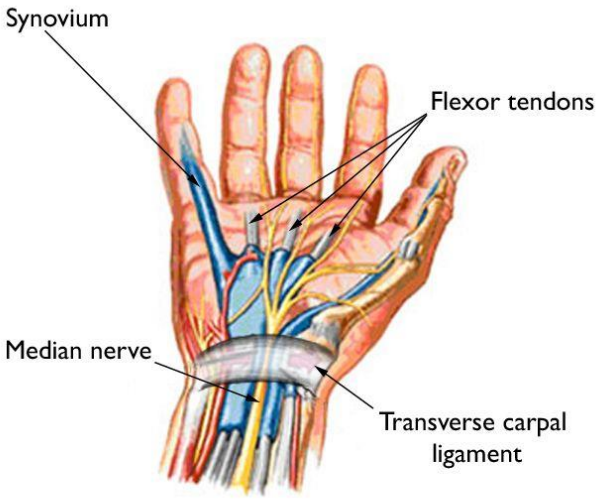


Radial head/neck fracture

- Cause: direct trauma, usually a fall onto the elbow.
- Sign and Symptoms: Pain at the lateral elbow, and during supination and pronation movements.
- Treatment: Severe fractures may require surgery, otherwise, a plaster of paris cast or an orthosis will be used to immobilise the elbow at 90°.

Carpal tunnel syndrome

- Cause: trauma, fractures, repetitive motions and rheumatoid arthritis. It can cause inflammation, swelling or thickening of the tenosynovium (the tendon sheath) of the flexor tendons.
- Sign and Symptoms: numbness, “pins and needles”, weakness and pain in the palm on the radial side of the hand. Weak of thenar muscles and thumb opposition.



Scaphoid fracture

- Cause: trauma such as falling on an outstretched wrist, and often occurs in a motorcycle accident.
- Notice the 'shadow' on the scaphoid bone (above the radius)
  A scaphoid # is often difficult to diagnose from an x-ray, but will cause pain at the base of the thumb and pain during gripping.

Scaphoid fracture

- Treatment: via a plaster cast to immobilise the wrist for 6-8 weeks, and if required, a WHO to maintain wrist position for another 6-8 weeks.
- The position required is a neutral wrist position (flexion/extension), with slight radial deviation. The thumb should be in a functional position, with the thumb IP joint free to move. The MCP joints of fingers 2-5 should have full movement.

Colles fracture

- Fracture of the distal radius and may involve the distal ulnar. The fracture is typically dorsally displaced and angulated
- Cause: fall on an outstretched wrist .
- A colles # will be treated similarly to a scaphoid # - a plaster cast, followed by an orthosis if required.
- The main difference is the position
  - the wrist slight flexion
  - Radial/ulnar deviation
  - Full MCP and thumb range.

Fig 26 – position for casting a patient with a Colles fracture

Taken from CSPO manual

Radial nerve injury

- Cause: midshaft humeral #, shoulder dislocation, proximal radius #, or compression in the axilla 'Saturday night palsy'.
- Location determines deficitSign and symptom: "Wrist drop"
- Sensory loss can include the posterior surface forearm and lateral three-and-a-half digits (to the nail bed of the thumb, and to the PIP joints of the other digits).

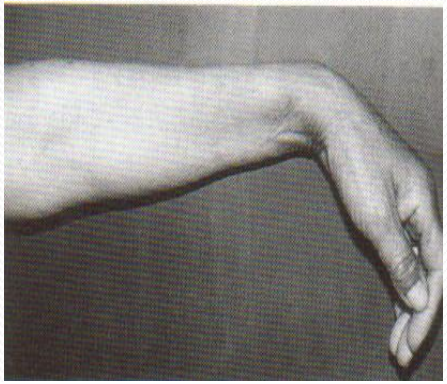
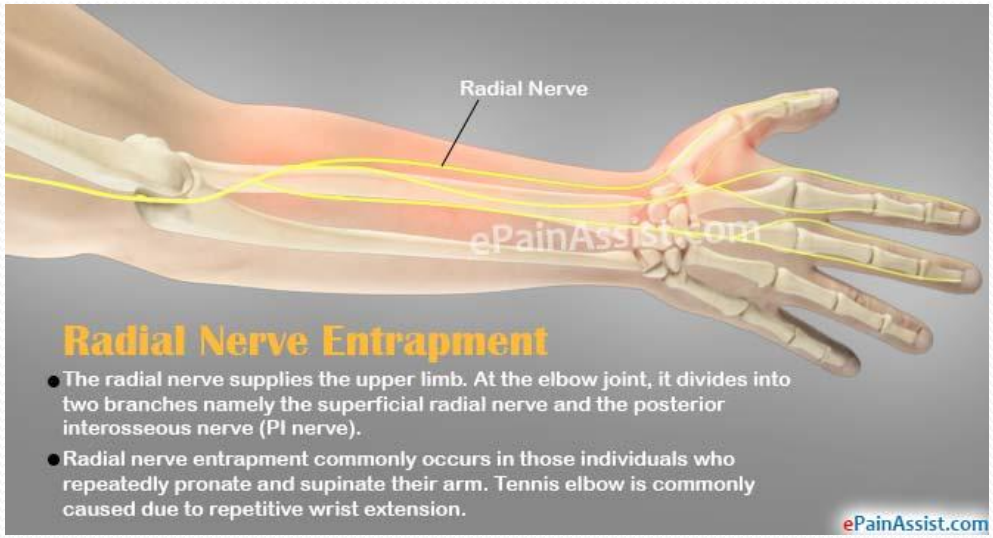


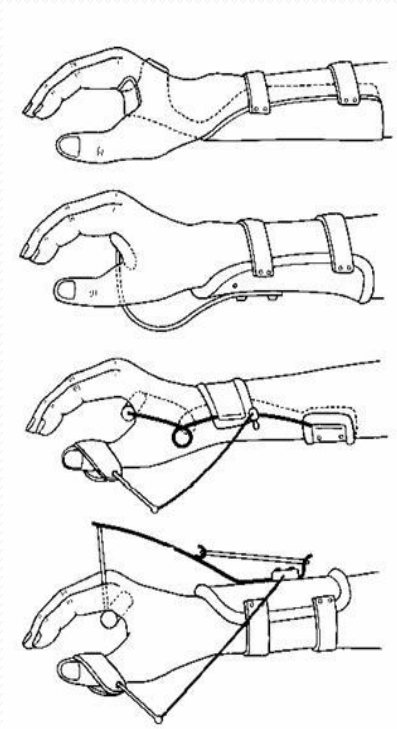
Fig 27 – radial nerve palsy effecting the wrist extensors

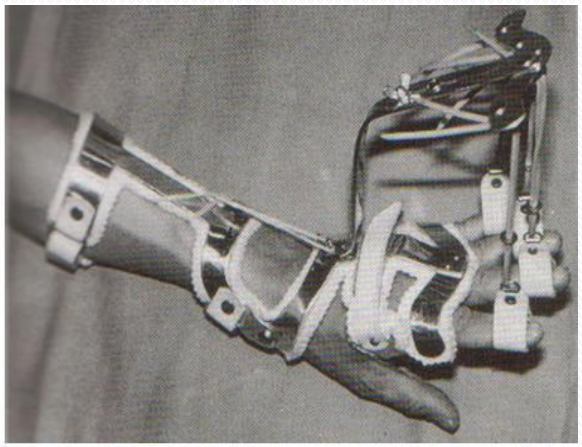


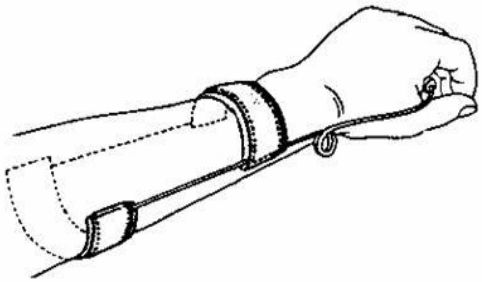
Taken from CSPO manual

Orthotic intervention

- Achieve a functional position, prevent wrist-drop .
- WHO in a functional position, which may provide immobilisation or assist movement dynamically





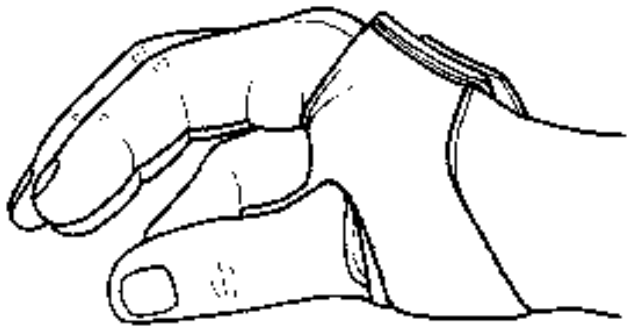


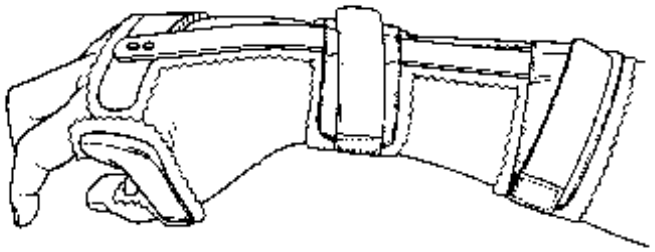
Median nerve injury

- Cause: trauma injuries, fractures or dislocations.
- Occurs in cubital fossa, anterior wrist
- Location determines deficit
  - Proximal: loss of wrist flexion strength, ulnar deviation , thumb opposition,
  - Distal: the fingers are still able to flex, but thumb opposition is often lost. The deformity of the hand is commonly referred to as “ape hand”.

Orthotic intervention

Hold the wrist/hand in a functional position and assist with thumb opposition





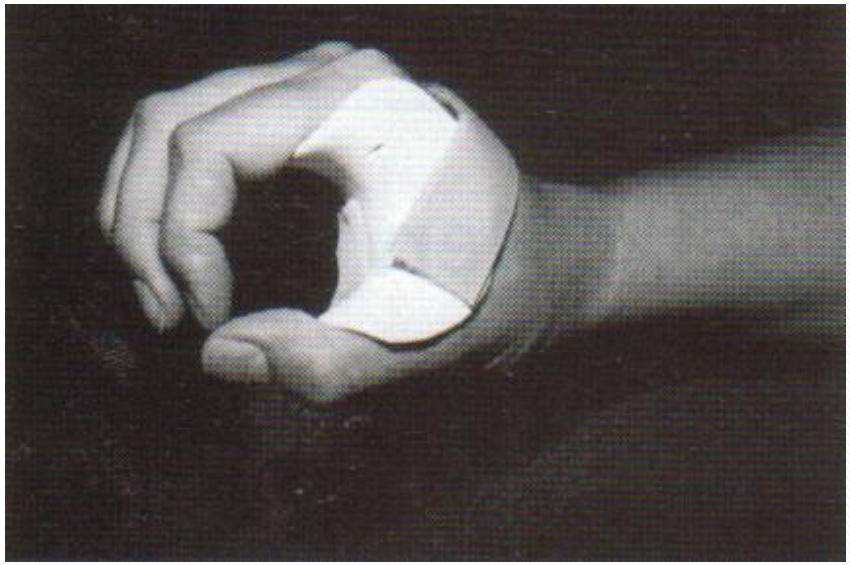


Fig 30 – Median nerve injury orthoses

Taken from CSPO manual

Ulnar nerve injury

- Cause: dislocation, fracture, or swelling to the cubital region. Pressure in the axilla can also lead to ulnar nerve injury, as can a trauma injury to the wrist.
- Location determines deficit
- Effect 4th and 5th fingers
- “Claw Hand”
- sensory deficit will be seen on the palmer and dorsal regions of the medial hand around fingers 4 and 5.

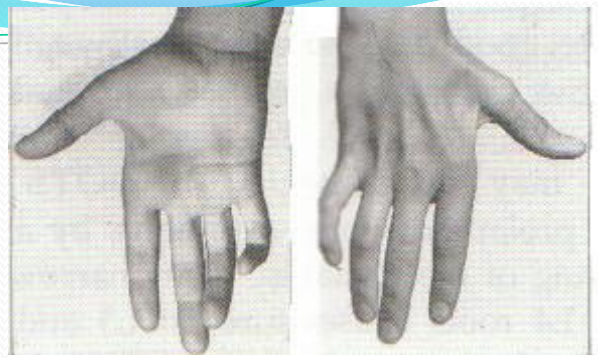


Fig 31 – Ulnar nerve injury

Taken from CSPO manual

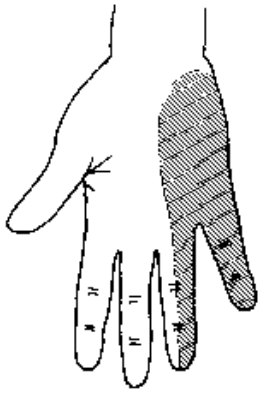


Fig 32 – Sensory loss with ulnar nerve in jury

Taken from CSPO manual

Orthotic intervention

- To prevent contracture to the 4th and 5th fingers

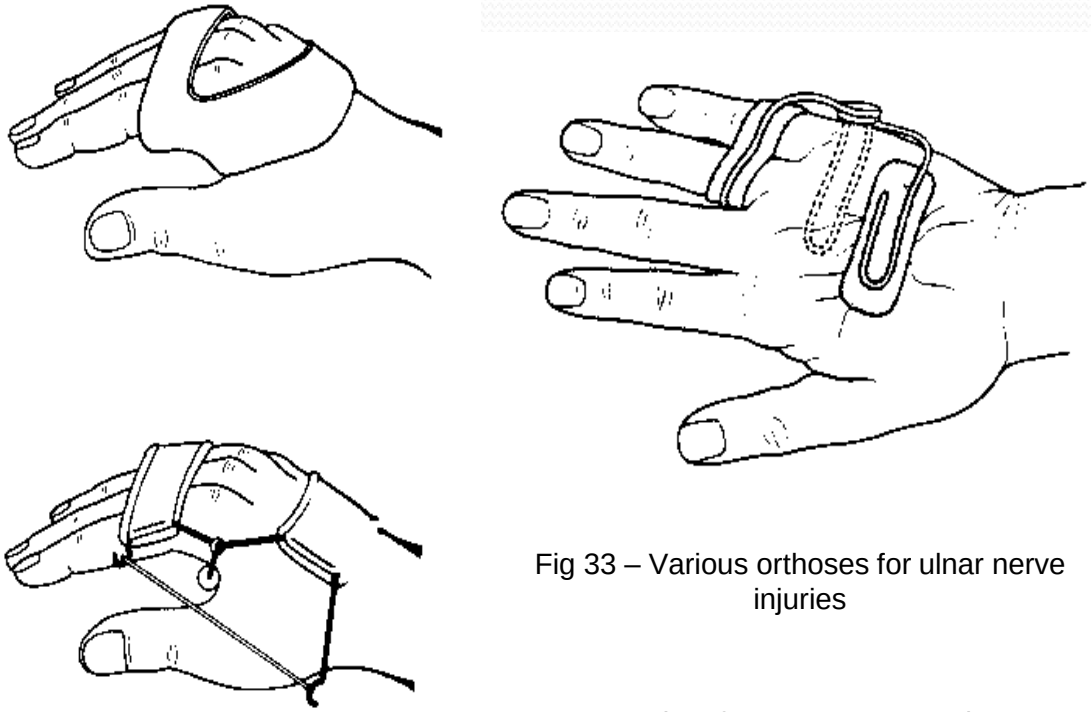


Fig 33 – Various orthoses for ulnar nerve injuries

Taken from CSPO manual

Rheumatoid arthritis

- Systemic autoimmune disease that involves inflammation of the lining of the joints (synovium) and sometimes organs too.
- Sign and symptom: pain, stiffness, warmth, redness and swelling.
- Wrist, MCP and PIP joints

Orthotic intervention

- Reduce or prevent deformity of wrist and fingers (ie: typically, address ulnar deformity).
- Provide support for weakened muscles.
- Try to achieve the functional position of wrist: increasing function and decreasing pain.

The client may require a night time resting orthosis to prevent progression, if it is a severe case. Orthoses are typically worn at most times during the daytime.

Gamekeepers thumb

- Cause: excessive abduction force applied to the 1st MCP joint from repetitive stress or trauma.
- Sign and symptom: pain, swelling and tenderness along the ulnar side of the 1st MCP joint, leading to medio-lateral instability of the joint.
- In chronic patients: weakness in opposition and pinch, and possible degenerative arthritic changes.

Orthotic intervention

- To immobilise the 1st MCP joint in a functional position, whilst still allowing IP joint range.
- Worn short-term for 6-8 weeks while the ligament heals, although long-term wear may be required with chronic instability or during certain activities that cause the problem.
- Custom made or prefabricated orthoses are available

Osteoarthritis of the thumb

- Affects the CMC and MCP joints of the thumb.
- Sign and symptom: pain, decreased ability to oppose the thumb, decreased grip strength and significant functional deficit.

Orthotic intervention

- depend on the severity.
- Chronic painful - immobilised in a functional position.
- Sometimes worn for specific activities

Bennett's fracture

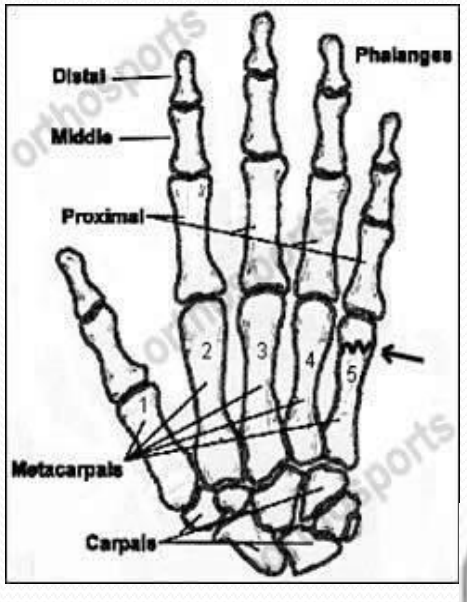
- 1st CMCJ # from axial abduction force
- Trapezium is subluxation.
- An orthosis will be used post-operatively to immobilise the thumb during bone healing

Fig 37 – x-ray showing a Bennett's fracture

Taken from CSPO manual

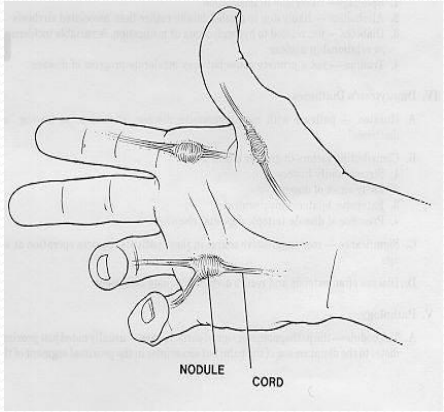
Boxer's

- Fractured neck 5th metacarpal
- Compressive force/ trauma to fist
- Boxers/ fighters
- Plaster or orthosis to immobilize medial hand until bone healed



Dupuytren's contracture

- Palmar fascia thickens and shrinks
- MCPJ and PIPJ flexion
- Usually in 4th and 5th
- Often occurs bilaterally
- Orthosis after surgery
- Orthosis prevent further contracture



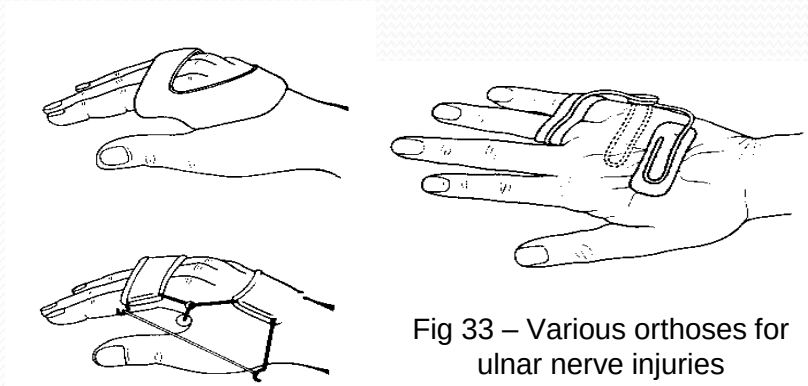
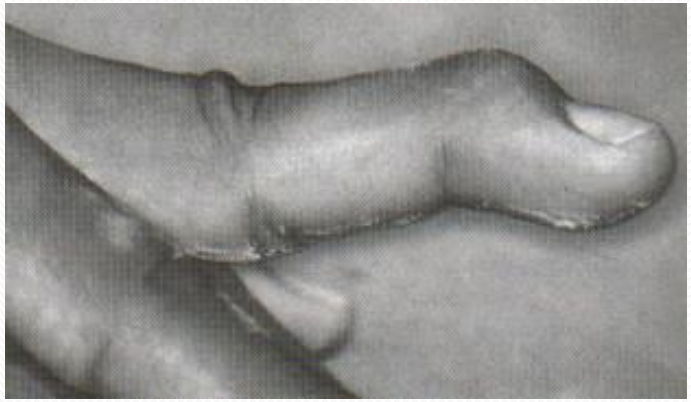


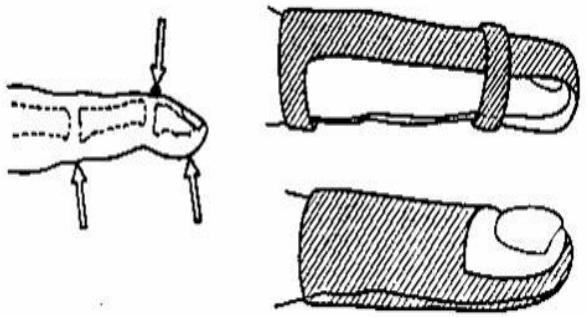
Fig 33 – Various orthoses for ulnar nerve injuries

Taken from CSPO manual

Mallet finger

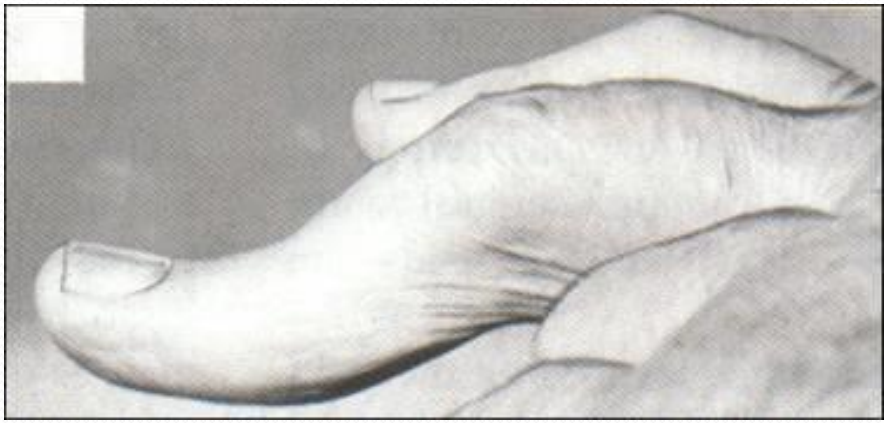
- Sudden flexion force to DIP
- Ball hits end of finger
- Avulsion of the extensor tendon, or an avulsion fracture of the base of the distal phalanx
- Orthosis to Immobilize DIP in extension

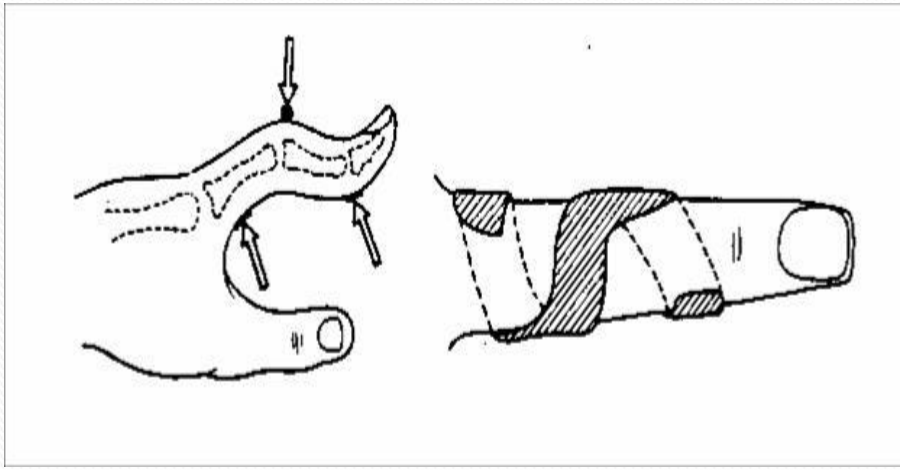




Boutonniere deformity

- From dorsal trauma over PIP, RA, or flex. against resistance
- PIP flexion, DIP hyperextension
- Orthosis to immobilize PIP in extension, allow flexion of DIP



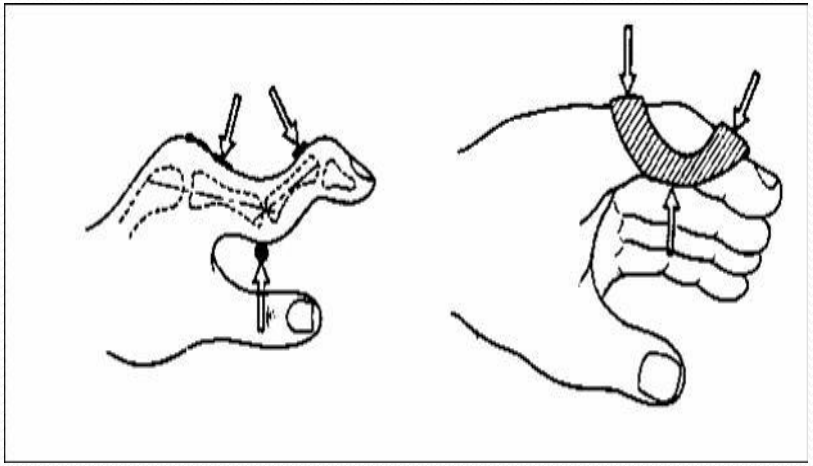


Swan neck deformity

- Imbalance b/w finger flexors and extensors
- RA patients
- PIP hyperextended, DIP flexed
- Correct by tendon surgery and stabilization by orthosis

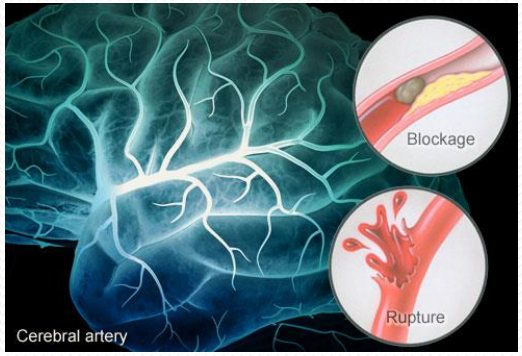
Fig 44 – Swan-neck deformity

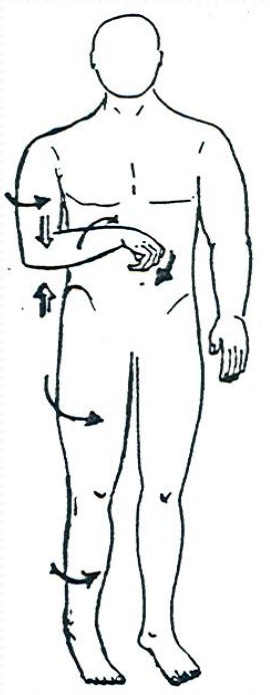
Taken from CSPO manual



Cerebro Vascular Accident (CVA)

- Cause: not enough blood supply to the brain.
- Symptoms: depend on severity/ location of CVA, spasticity, internal shoulder rotation, flexed elbow, flexed wrist, flexed thumb, flexed fingers.
- Associated problem: poor function, poor hygiene, skin damage from nails, oedema and shoulder subluxation.





Orthotic intervention

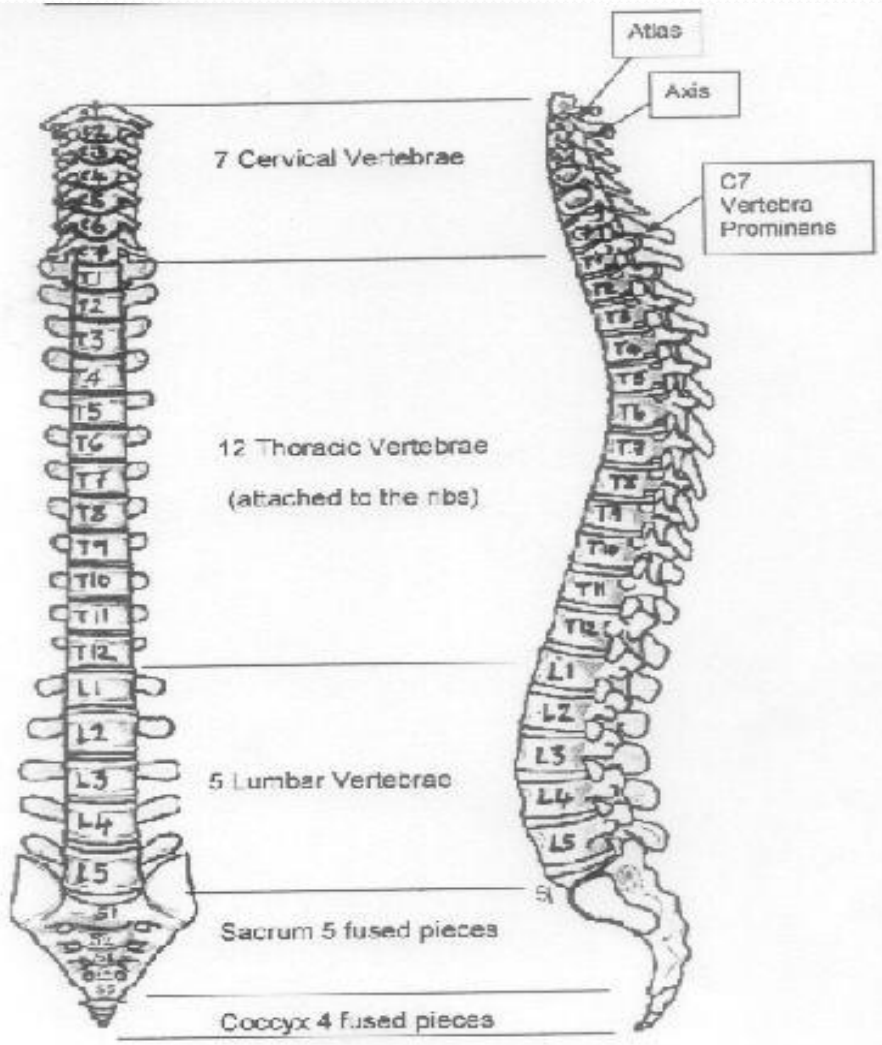
- Preventing or correcting flexion contractures, resting orthoses or a sling for protection , or management of shoulder subluxation.

Burns

- Can occur anywhere on body
- Orthosis for immobilisation or limit/ reduce contracture
- Typical problem areas: elbow, axilla, little finger, neck

Spinal Cord Injury (SCI)

- Can get spastic paralysis, lost sensation and contractures
- Treatment depends on severity and location of SCI
- Often used with other devices, such as wheelchair or other orthoses



Repetitive Strain Injury (RSI)

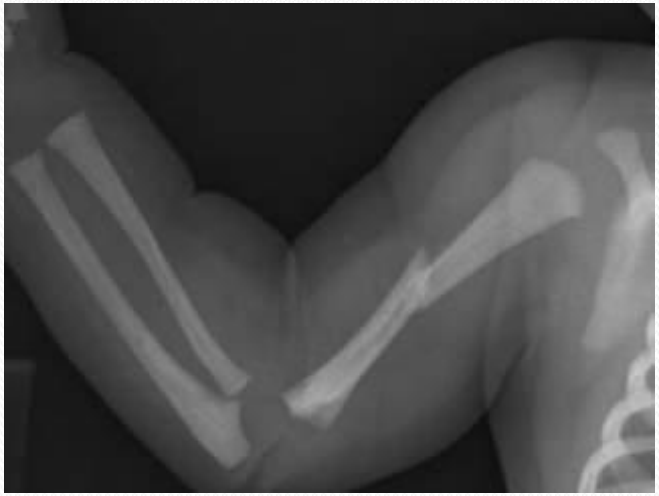
- Repetitive strain of a muscle group
- Can occur anywhere
- Typically seen at elbow (tennis/ golfers elbow) or at the wrist
- Orthosis for Immobilization and re-positioning
- Changing task can make a difference

Post-surgical tendon repair

- Surgery to a muscle will often require immobilization post- surgery
- Orthoses are often an effective way of treatment to limit or assist ROM.
- Can occur at any joint/ muscle
- Often immobilization followed by increase ROM

Fractures (#'s)

- Can occur anywhere in the body
- Upper Limb #'s common
- Usually immobilisation via plaster cast
- Orthoses sometimes used after or instead of plaster



Cerebral Palsy (CP)

- Permanent non-progressive disorder occurring before, at, or shortly after birth.
- Every patient has different symptoms.
- Thorough examination required
- Orthoses for contractures
- Improve function and position

Nerve injuries

- Always depends on location of nerve injury
- Spinal root lesion – brachial plexus, SCI
- Peripheral lesion – damage to single nerve
- Orthotic intervention depends on type and location of injury

Any Questions????

Thank you!!!!