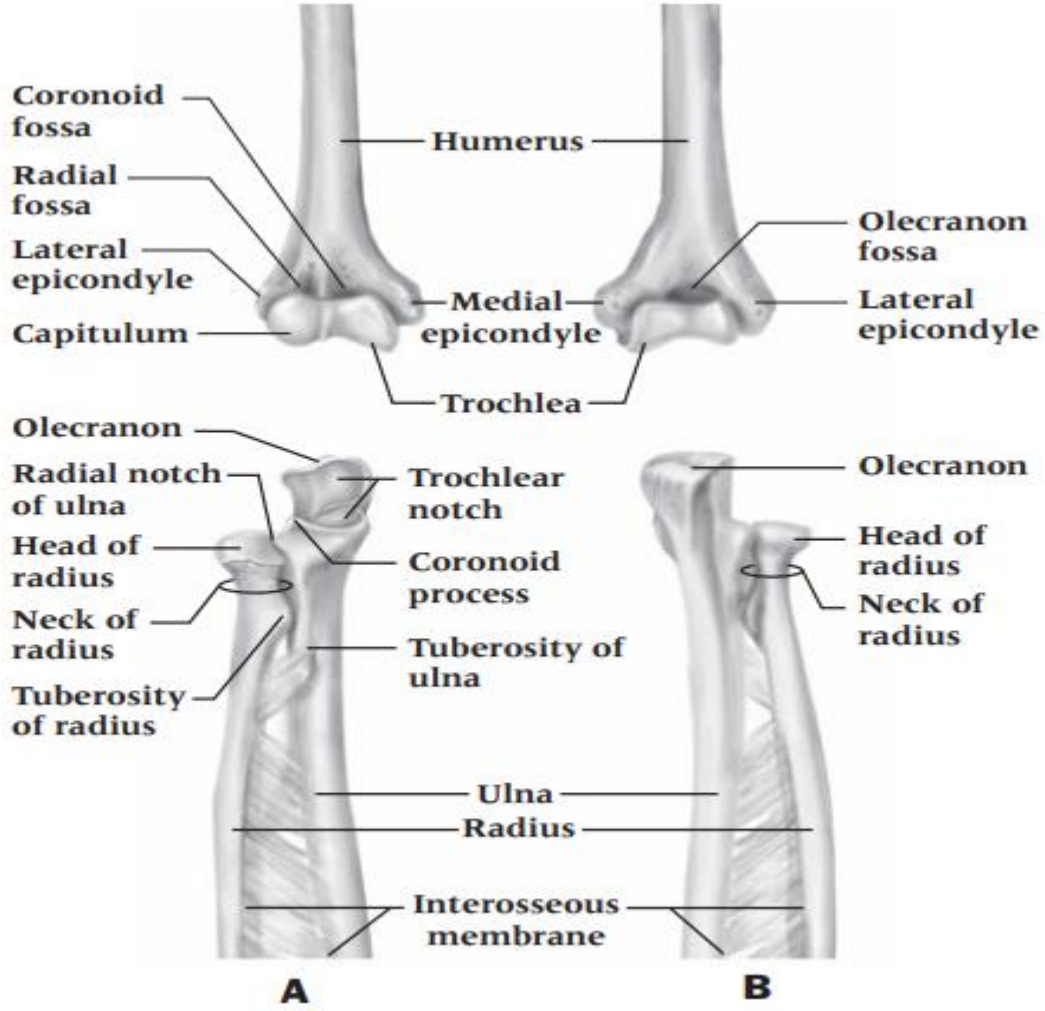
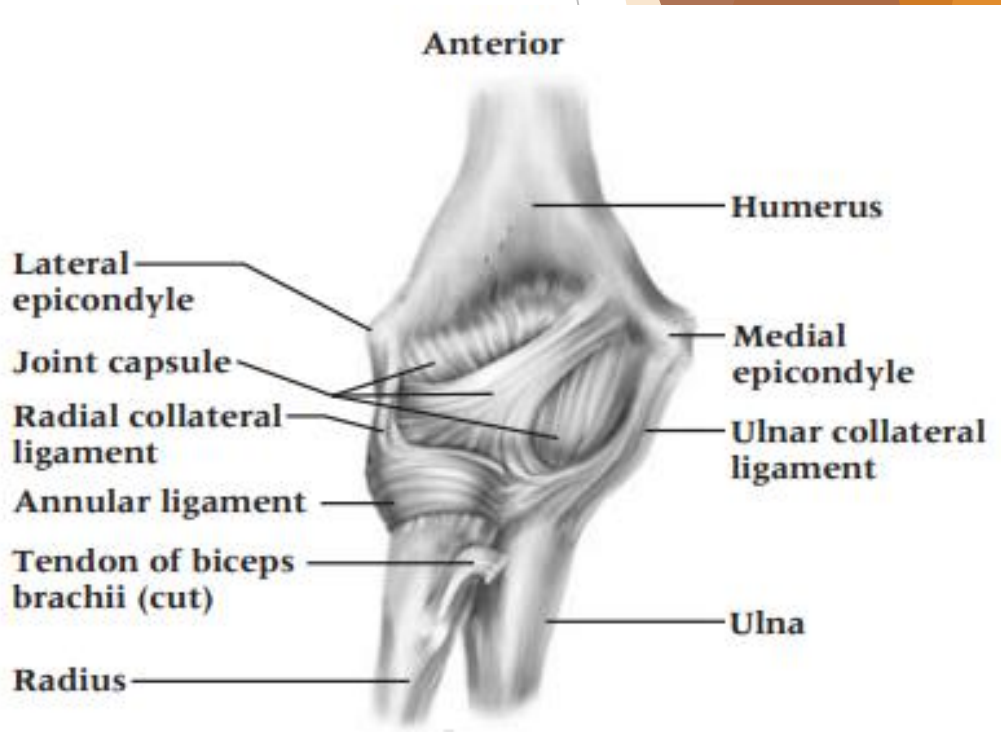
Elbow joint

FUNCTIONAL ANATOMY AND BIOMECHANICS





Pathophysiology

Epicondylitis is primarily considered a chronic tendinosis as opposed to an acute inflammatory process. Along with the degenerative changes associated with overuse, there are findings of angiofibroblastic hyperplasia or tendinosis.

Four stages of epicondylar tendinosis:

- Generalized inflammation
- Angiofibroblastic degeneration
- Structural failure
- Fibrosis and calcification

Lateral epicondylitis

Anatomy

- The elbow joint is made up of three bones: the humerus, the radius and ulna At the distal end of the humerus there are two epicondyles, one lateral (on the outside) and one medial (on the inside).
- The area of maximal tenderness is usually an area just distal to the origin of the extensor muscles of the forearm at the lateral epicondyle. Most commonly, the extensor carpi radialis brevis (ECRB) is involved, but others may include the extensor digitorum, extensor carpi radialis longus (ECRL), and extensor carpi ulnaris.
- The radial nerve is also in close proximity to this region, and divides into the superficial radial nerve and the posterior interosseous nerve.

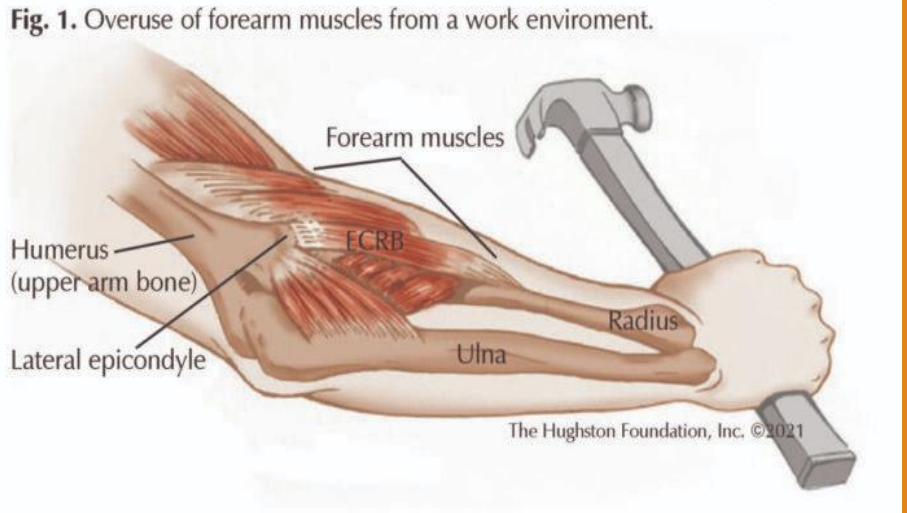
Tennis elbow

- Lateral elbow tendinopathy (LET) is the most common musculoskeletal elbow tissue injury and can result in significant limitations in function and decreased participation in activities. Lateral epicondylitis (tennis elbow) occurs with repetitive microtrauma that results in either concentric or eccentric overload of the wrist extensors and supinators, most commonly the extensor carpi radialis brevis

Mechanism of injury

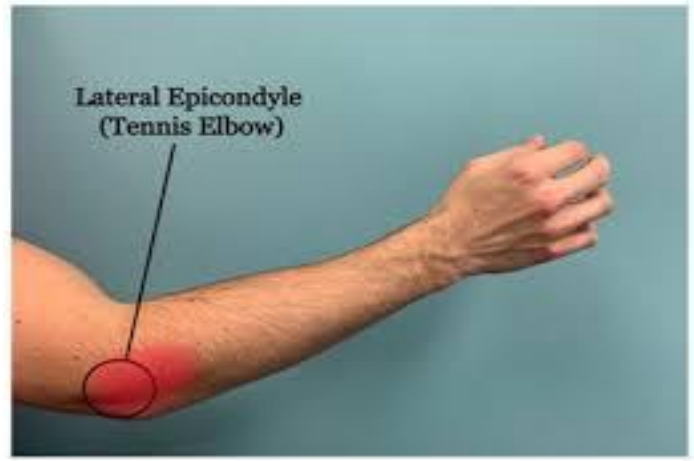
- Lateral epicondylitis usually results from repeated forceful wrist hyperextension, as often occurs in hitting a backhand stroke in tennis.

- This injury is often work-related, any activity involving wrist extension, pronation or supination during manual labour, housework and hobbies are considered as important causal factors.



Clinical presentation

- There is pain along the lateral aspect of the elbow, particularly at the origin of the extensor carpi radialis brevis.
- Pain increases with passive flexion of the wrist with the elbow extended, as it does with resisted wrist dorsiflexion.
- Pain with resisted wrist extension and full elbow extension indicates involvement of the extensor carpi radialis longus.



Risk factors

Risk factors for developing tendinopathy are both load related (biomechanical) and systemic.

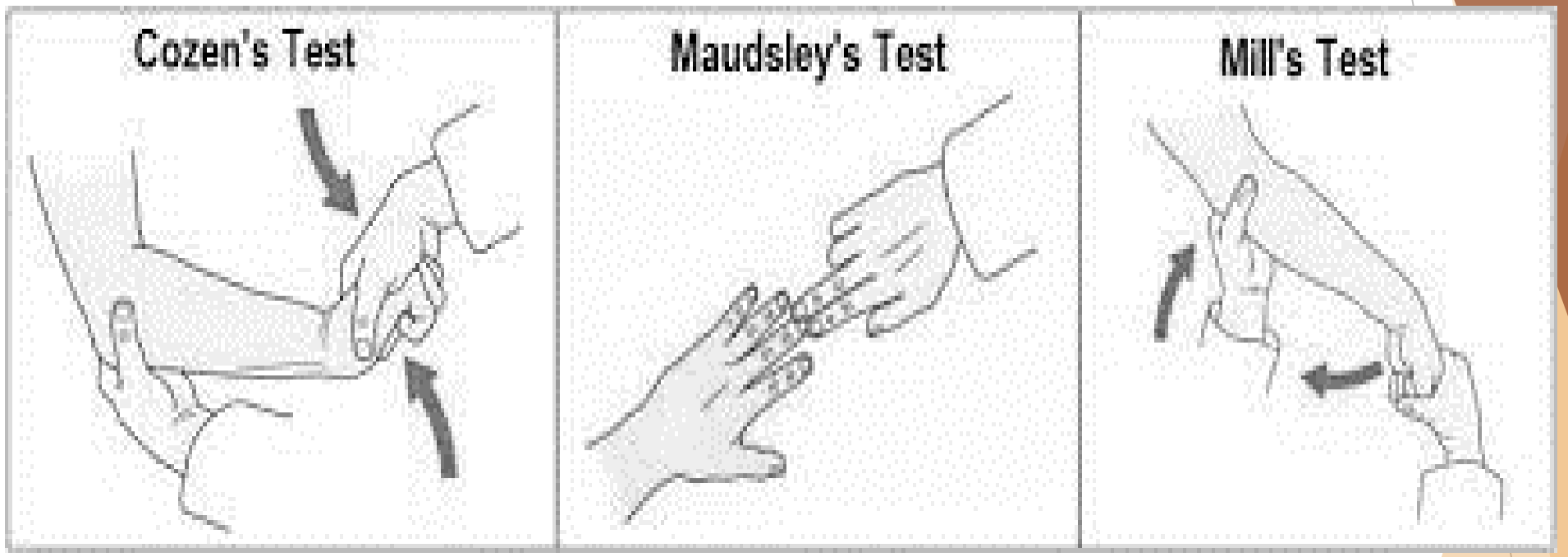
- Biomechanical risk factors (occupational physical factors) including repetitive movements of the hands and wrists, lifting heavy loads > 5 kg, activities demanding high hand grip forces, and the use of vibrating tools or computer use all pose a risk for lateral epicondylitis

- systemic risk factors include hypercholesterolemia, diabetes, hormonal imbalances, age and genetics.

Examination

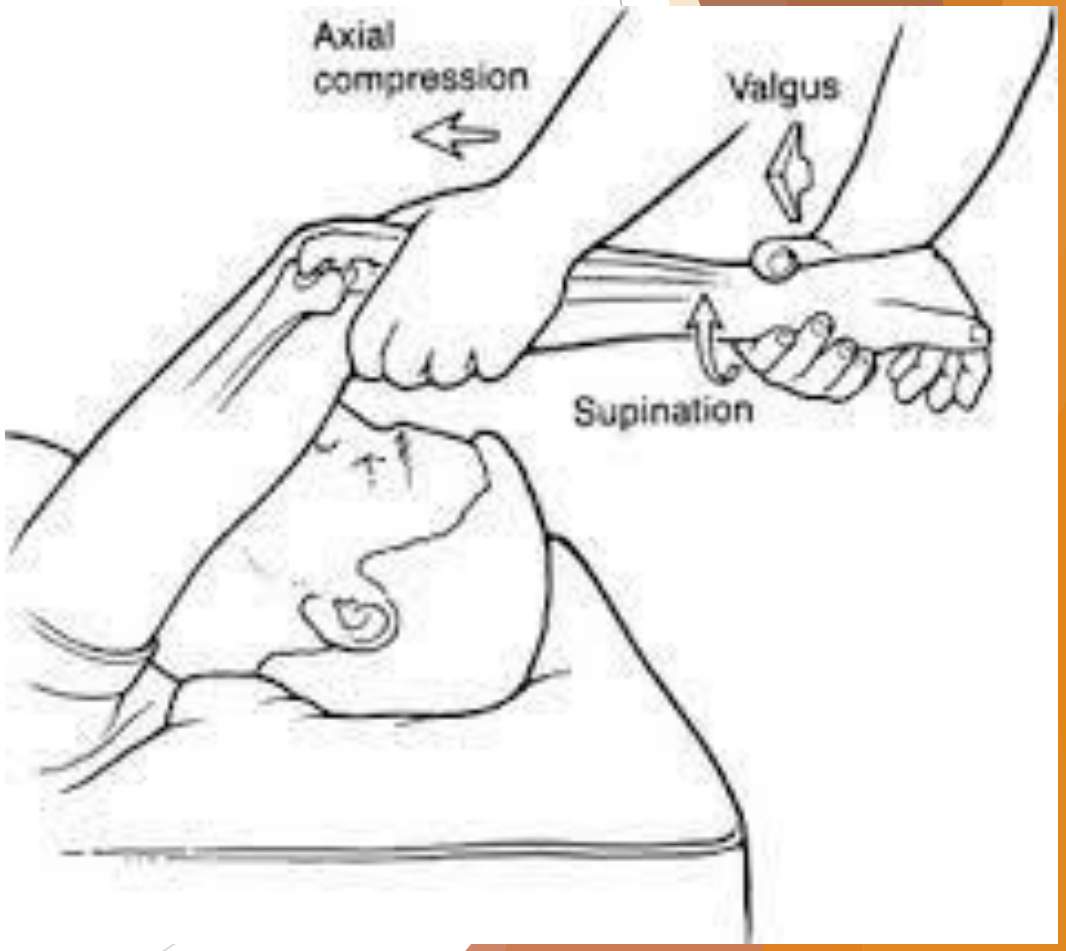
- Pain provoking tests are the most utilized method of diagnosing Tennis Elbow.

1. Maudsley's test
2. Mill's Test
3. Cozen's test.


Cozen's Test
Maudsley's Test
Mill's Test

During examination, signs of elbow instability should be noted, such as clicking, loss of control and difficulty with pushing up with the forearm supinated.

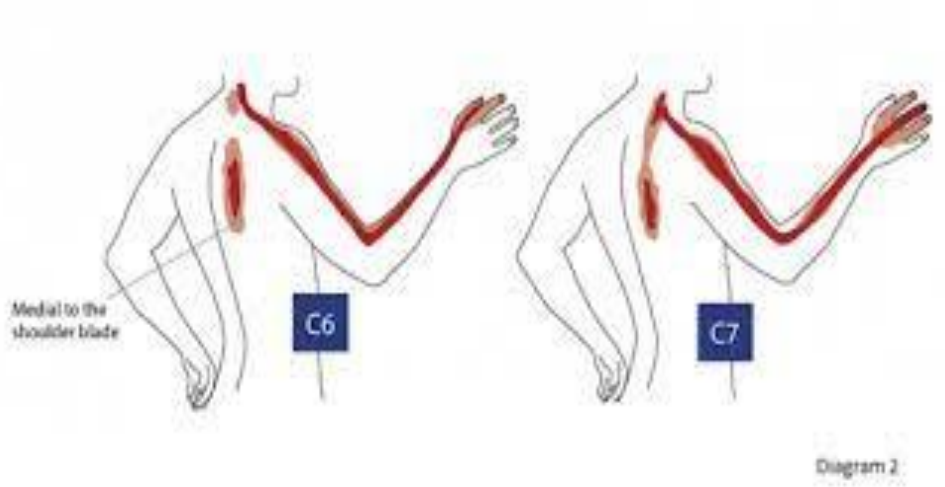
The posterolateral rotary drawer test



differential diagnosis

- Common differential diagnosis for LET include

1. cervical radiculopathy
2. radial tunnel syndrome
3. lateral collateral ligament pathology
4. Radiocapitular osteoarthritis
5. fracture
6. Triceps tendonitis
7. referred pain from wrist injuries



Conservative treatment

Cryotherapy

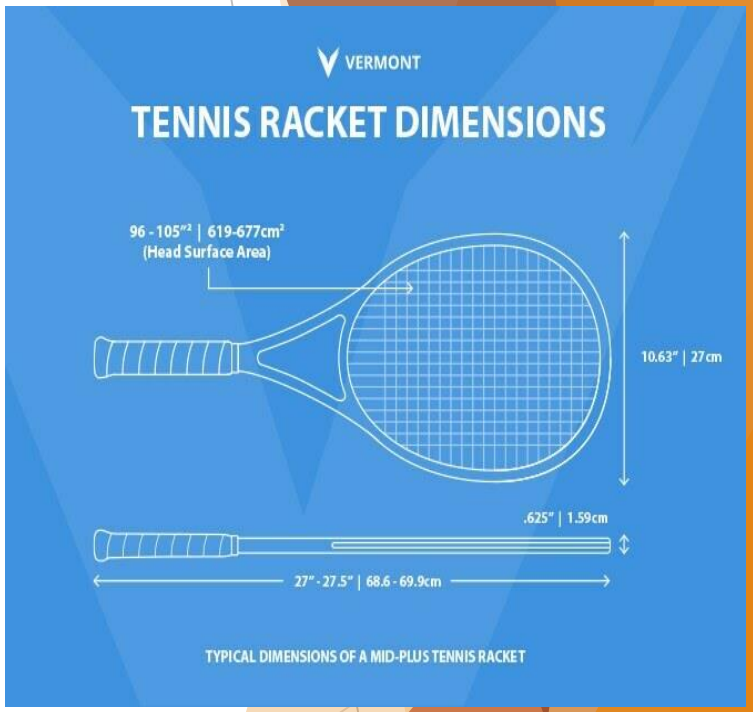
- Cryotherapy may be effective in reducing local pain through a mechanism known as the gait control theory. In addition, cryotherapy causes vasoconstriction of superficial blood vessels and thus can reduce chemical pain that might be present. More specifically, ice massage has been shown to be effective as part of a multimodal program to treat tendinopathies,

- **Extracorporeal shockwave therapy (ESWT)**: A device generates shock or pressure waves that are transferred to the tissue through the skin. This is supposed to improve the circulation of blood in the tissue and speed up the healing process.
- **Laser therapy**: The tissue is treated with concentrated beams of light. This is supposed to stimulate the circulation of blood and the body's cell metabolism.
- **Transcutaneous electrical nerve stimulation (TENS)**: TENS devices transfer electrical impulses to the nervous system through the skin. These are supposed to keep the pain signals from reaching the brain.
- **Acupuncture**: The acupuncture needles are inserted into certain points on the surface of the arm. Here, too, the aim is to minimize the perception of pain.

Elbow Orthosis

patient education should include the following thoughts:

1. Rest from activities that increase tendon loading and aggravate pain. The therapist will guide the patient in the proper loads and timing of those loads to ensure proper healing.
2. Avoid repeated wrist, forearm or elbow movements. Do not avoid all upper limb motions as this will further reduce the tendons ability to take load.
3. When exercising, make sure the exercises do not increase your pain as this might be a signal that the load is too much. Be particular mindfully of stretching.
4. Use larger handles on utensils, tools, or tennis rackets



TENNIS RACKET WEIGHT

Racket weight	Range	Power	Control	Level
Lightweight	8oz - 10.5 oz	High	Low	Beginner
Midweight	10.6oz - 11.5 oz	Medium	Medium - High	Beginner - Intermediate
Heavy	11.6oz - 12.6 oz	Low	High	Advanced - Professionals

5. Make modifications to your work area to promote good posture. Don’t maintain fixed postures for long periods of time. Consider setting a timer every 30 minutes to stand up.

6. Consult a trainer in your sport to help correct faulty mechanics or make appropriate adjustments in equipment

7. Avoid palm down lifting; instead always try to lift with your palm up

8. Avoid injections for pain management. Patients receiving multiple corticosteroid injections as a treatment modality typically fair worse in function and pain management in the long term.

Soft Tissue Mobilization

For the purposes of reducing local pain, promoting tissue healing by increasing blood flow, and increasing tissue extensibility the treating therapist is given the option of performing a variety of soft tissue techniques.

- Deep friction massage (DFM) is typically performed in small circular movements across the common wrist extensor tendon. DFM is thought to assist the remodeling phase of an already degenerating tendon and to reduce scar

- myofascial techniques addressing the common wrist extensors are applied to relieve pain and improve soft tissue extensibility.

Mobilization with movement

A. Sustained lateral glide of elbow with pain free grip

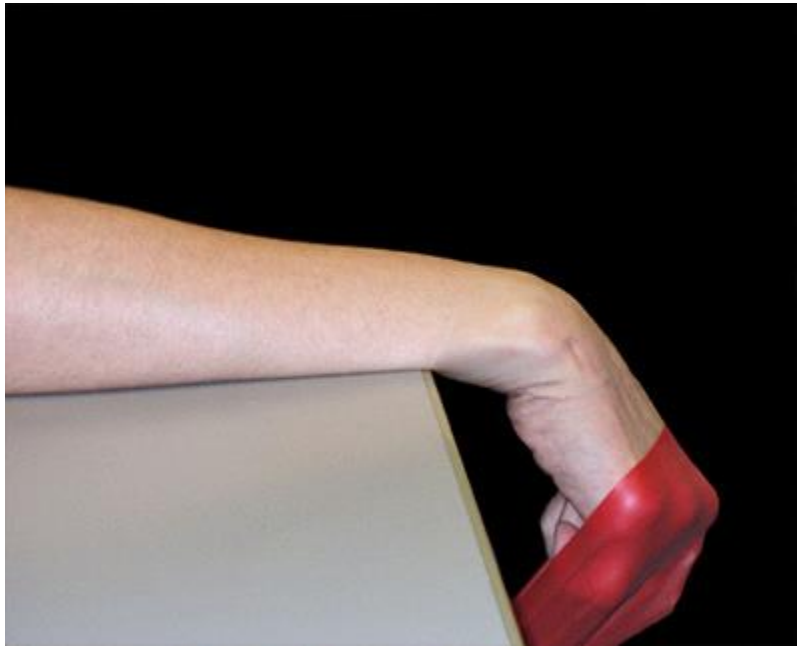
B. Sustained lateral glide of elbow with pain free grip (using mobilization belt)

C. Radiohumeral joint sustained postero-anterior glide with pain free grip

Stretching exercise

Wrist extensor stretch

Wrist Extensor Strengthening Progression

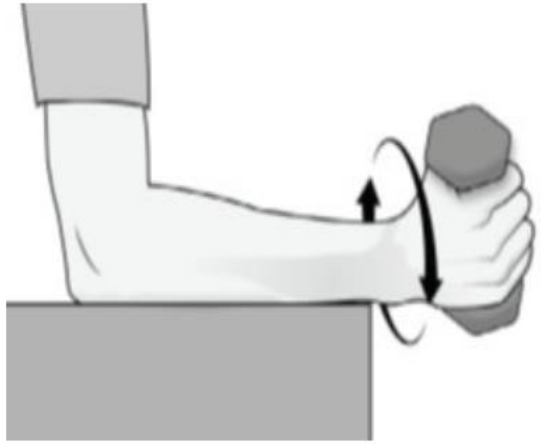


A. Phase 1: Short lever Isometric Wrist Extension

B. Phase 2: Short Lever Resisted Wrist Extension

C. Phase 3: Long Lever Resisted Wrist Extension

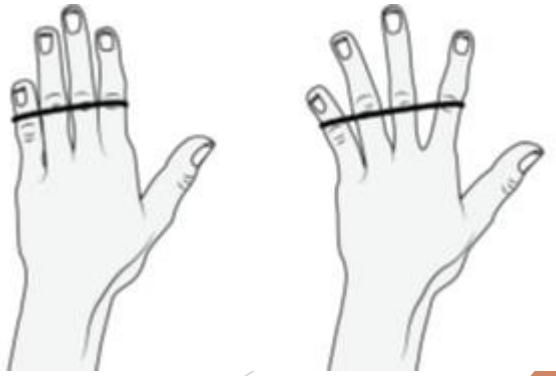
b. Forearm Supination & Pronation (Strengthening)



Stage 1 using 1 lb. weight

Stage 3 using 1 lb. weight

c. Finger Stretch



Scapular Muscle Strengthening Progression.

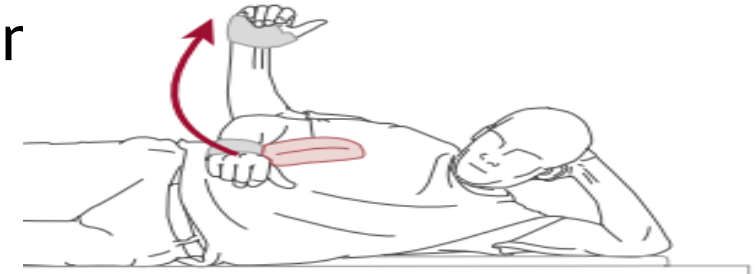
A. Phase 1: Isometric Scapular Retraction

B. Phase 2: Elastic Resistance Rows with Elbows at Side

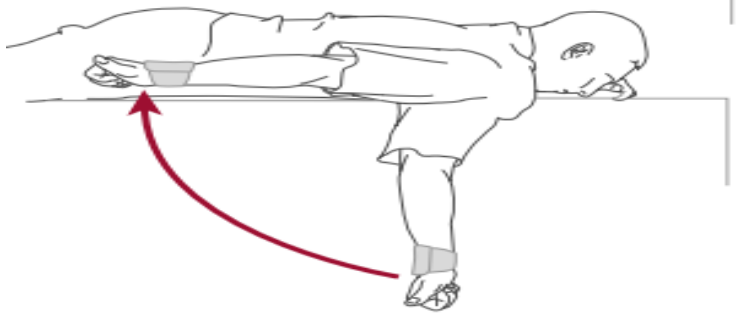
C. Phase 3: Prone Extension with/without Weight

Strengthening the posterior rotator cuff (3 set-25 repititior

SIDE-LYING EXTERNAL ROTATION:



SHOULDER EXTENSION



PRONE HORIZONTAL ABDUCTION

90/90 EXTERNAL ROTATION

Rotator cuff exercise movement patterns based on EMG research emphasizing posterior rotator cuff activation and positions with less than 90 degrees of glenohumeral joint elevation

Plyometric exercise

Prone 90/90 external rotation plyometric

Advanced Distal Upper Extremity Exercises For Rehabilitation Of Humeral Epicondylitis

Traditional curls for the flexors and extensors with either light isotonic dumbbells or elastic tubing or bands and forearm pronation- supination and radioulnar deviation with a counterbalanced weight.

Progression to isokinetic exercise for wrist flexion–extension and forearm pronation–supination is recommended once

Ball dribbling for distal upper extremity strengthening.

Criteria for Full Return

- Perhaps the biggest mistake made with epicondylitis is trying to progress too quickly in the exercise program and rushing full return to play. The athletic trainer should counsel the patient about doing too much too soon, cautioning that rapid increases in activity levels often exacerbate the condition.
- The involved muscles must regain appropriate strength, flexibility, and endurance with reduced inflammation and pain.
- Functional activity needs to progress slowly to prepare the patient for the return without restrictions.

Medial epicondylitis

Medial epicondylitis

- Medial epicondylitis, also known as “golfer’s elbow” or “thrower’s elbow”, refers to the chronic tendinosis of the flexor-pronator musculature insertion on the medial epicondyle of the humerus as a result of overuse or repetitive stress.
- The flexor-pronator muscle group is composed of the pronator teres and the common flexor tendon, which includes tendons of the flexor digitorum superficialis, flexor carpi ulnaris, flexor carpi radialis, and palmaris longus. The flexor carpi radialis and the pronator teres are the most commonly involved tendons in medial epicondylitis.

Etiology

- Medial epicondylitis is primarily caused by repetitive strain from activities that involve frequent loaded gripping, forearm pronation, and/or wrist flexion. In the sports world, it can be seen in throwing athletes (baseball pitchers, javelin throwers), golfers, tennis players, bowlers, rock climbers, archers, and weightlifters.
- The intense valgus forces during the late cocking and acceleration phases of throwing or the late phases of the golf swing just before and during contact with the ball or ground contribute to the prevalence among these athletes.
- Medial epicondylitis is often precipitated by poor body mechanics, improper techniques, and/or inadequate equipment or tools.

Clinical presentation

- The patient usually complains of pain on the medial aspect of the elbow, which is exacerbated when throwing a baseball, serving or hitting a forehand shot in racquetball, pulling during a swimming back stroke, or hitting a golf ball, in which case the trail arm is affected.
- There is tenderness at the medial epicondyle, and pain is exacerbated with resisted pronation, resisted volar flexion of the wrist, or passive extension of the wrist with the elbow extended.
- Associated ulnar neuropathy at the elbow has been reported in 25 to 60 percent of patients with medial epicondylitis

Risk factors

Prevalence seems to be higher in the following categories:

- age range of 45–65
- current and former smokers
- high body mass index, larger waist circumference, higher waist to hip ratio
- type 2 diabetes, and tasks requiring repetitive wrist flexion or forearm pronation for at least two hours daily.

Classification

Medial epicondylitis has been classified according to the presence and severity of concomitant ulnar neuropathy.

- Type I describes patients with classic symptoms of epicondylitis without associated ulnar nerve symptoms.
- Type II describes patients with combined epicondylitis and ulnar neuropathy symptoms and is further subdivided into two groups based on the severity of the ulnar nerve symptoms.
- Type IIA patients have subjective ulnar nerve symptoms without objective findings
- Type IIB patients demonstrate objective deficits present on examination or electromyographic studies.

Physical examination

- The patient’s range of motion is normal, although the end ranges of motion cause pain at the medial collateral ligament.
- Muscle testing shows strength to be normal.
- Tenderness is usually localized distal or anterior to the medial epicondyle over the pronator teres or flexor carpi radialis but may also be present directly over the epicondyle itself.
- Palpation shows pain at the medial collateral ligament and a positive Tinel’s sign at the ulnar nerve.
- There is pain and slight laxity to the medial collateral ligament with valgus testing.

- Examination of the ulnar nerve should include testing for Tinel’s sign, ulnar nerve compression test, elbow flexion test, and signs of ulnar nerve subluxation.

Golfer’s Elbow Test

Differential dignosis

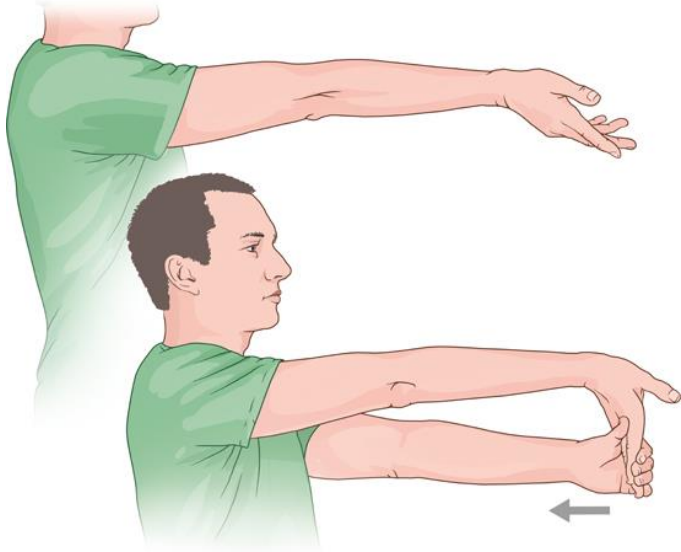
The differential diagnosis includes

- cervical radiculopathy
- snapping medial head of the triceps
- medial antebrachial cutaneous nerve neuroma
- elbow arthritis.

PHASE ONE ACUTE INFLAMMATORY STAGE (1-7 days)

- GOALS: Pain modulation and rehabilitate within healing constraints.
- The goal is to establish pain-free motion with a gradual and continual increase to full ROM with the use of modalities and passive, active-assistive, and active motion exercises.

- Stoppage of the activities that exacerbate symptoms is recommended in this time frame.
- Night splinting with a cock up wrist splint may be helpful. A counterforce brace can unload the tendon, decreasing pain.
- Stretching elbow flexors
- Strengthening exercises that benefit strength and endurance can be done within the constraint of no pain before, during, or after exercise.



PHASE TWO FIBROBLASTIC-REPAIR STAGE (1-3 weeks)

- GOALS: Increase the strength of the elbow flexors,, supinators, pronators, and ulnar and radial deviators of the wrist.

- Modalities such as electrical stimulation for muscle reeducation and pain modulation as well as ice are continued.

- A gradual progression of rehabilitation exercises (PRE) is begun. These exercises incorporate not only the elbow and wrist/hand.

- shoulder for rotator cuff and scapular stabilization.

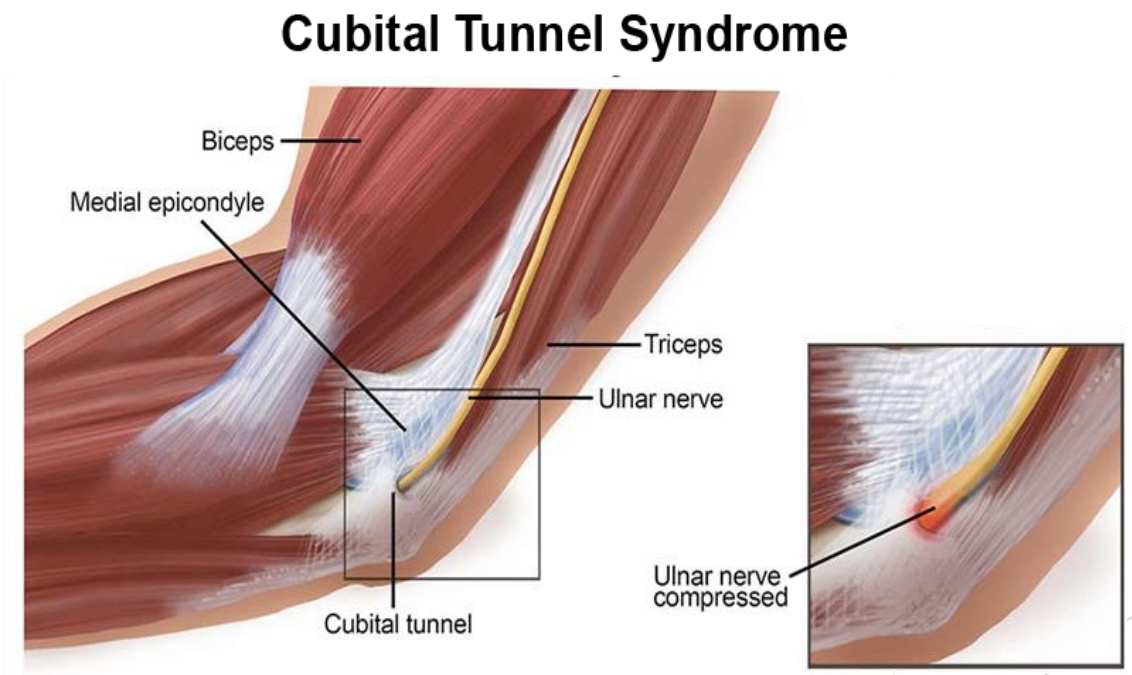
- Aquatic therapy can increase function with the benefits of buoyancy, and is also recommended for the elbow and upper extremity.

PHASE THREE MATURATION-REMODELING STAGE (Week 3 to Full Return)

- GOALS: Complete elimination of symptoms for return to sport.

- The patient can continue the PRE exercise regimen and increase activity in the aquatic setting, with stroke mechanics in the water with a racquet to mimic all forces that will be used when back on the court.

Cubital Tunnel Syndrome



Anatomical Point of View

Cubital tunnel consists of:

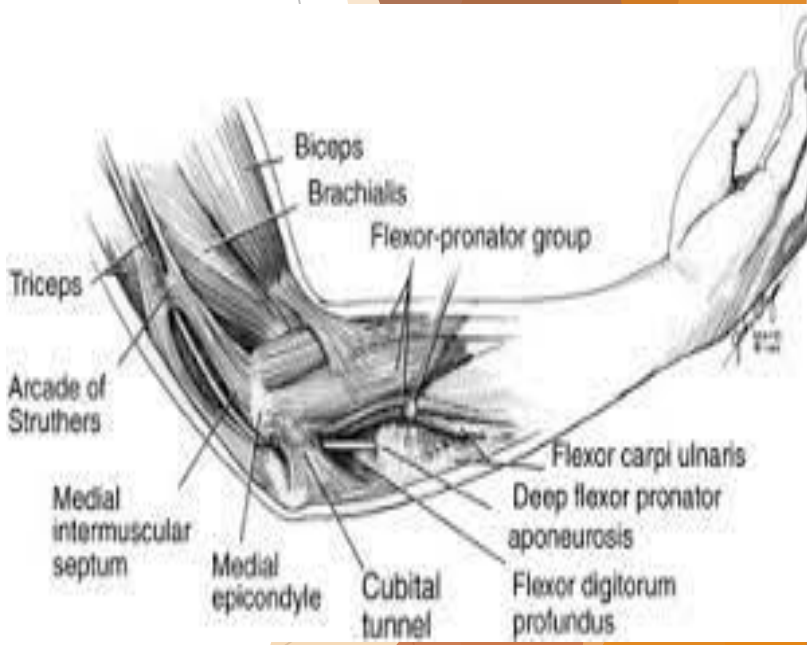
Floor: ulnar collateral ligament.

The roof: an aponeurosis(the arcuate ligament, or Osborne's band).

Posterior border: medial head of triceps.

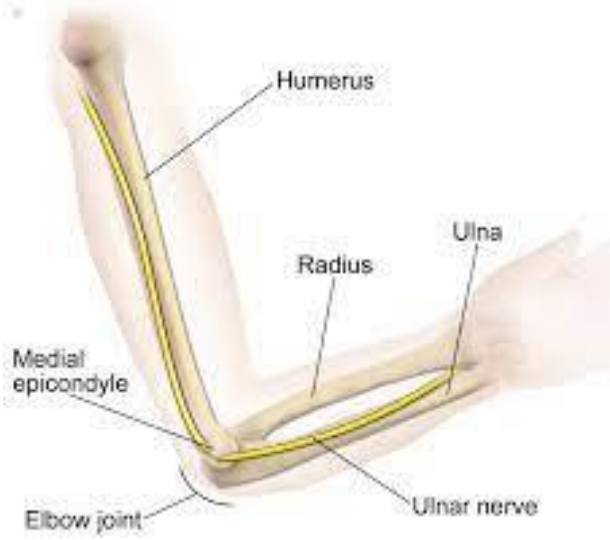
Anterior and lateral border: medial epicondyle and olecranon, respectively.

The volume of the cubital tunnel is greatest with the elbow held in extension. As the elbow is brought into full flexion, there is a 55% decrease in canal volume.



The ulnar nerve

- The ulnar nerve travels down the posterior aspect of the arm to eventually traverse posterior to the medial epicondyle through an area known as the cubital tunnel.
- The nerve runs superficial to the ulnar collateral ligament (UCL) and deep to the aponeurotic attachment of the flexor carpi ulnaris (FCU), which is also known as Osborne's ligament.
- Once the ulnar nerve reaches the proximal border of Osborne's ligament distal to medial epicondyle. it is located in the cubital tunnel.

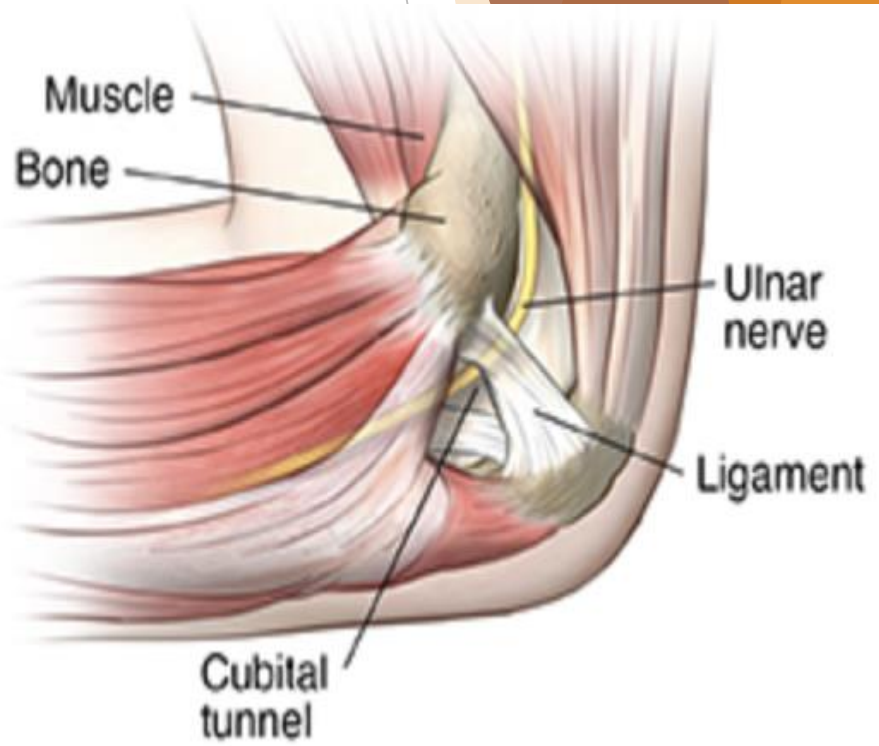


Elbow and Ulnar Nerve

Cubital Tunnel Syndrome

Cubital tunnel syndrome (CuTS) is a compressive neuropathy of the ulnar nerve. It is the second most prevalent peripheral neuropathy of the upper extremity after carpal tunnel syndrome

The incidence of CuTS is estimated at 24.7 cases per 100,000 people, and its prevalence is 2–6% in the general population



Causes of CBTS

- **Pressure** on the ulnar nerve is a common cause of symptoms. The ulnar nerve is quite superficial at the point of the medial epicondyle
- **Stretching** the ulnar nerve can also result in similar symptoms. The ulnar nerve lies behind the medial epicondyle. During flexion of the elbow joint, the ulnar nerve gets stretched because of this anatomical position. Repetitive elbow flexion and extension can cause further damage and irritation to the ulnar nerve. Some individuals sleep with elbows bent which can stretch the ulnar nerve for an extended period during sleep, which is an identified cause of irritation to the ulnar nerve.
- **Injuries** to the elbow joint (fractures, dislocations, swelling, effusions) can cause anatomical damage which will cause symptoms because of compression/irritation of the ulnar nerve.

Risk factors

1. Anatomical changes after trauma, degenerative changes, systemic diseases such as lipomas, ganglion cysts, inflammatory processes, etc.)
2. Other risk factors for CuTS are related to upper extremity motor activity, overhead activity, heavy physical work, obesity, and nicotinism

Clinical presentation

- In the early stages of CuTS, sensory symptoms such as paraesthesia and slight hypoesthesia are reported, occurring mostly paroxysmally and related to the position of the elbow.

- Over time, motor disturbances, mostly weakness and atrophy of the intrinsic muscles of the hand

- **Wartenberg sign** (abduction of the fifth digit due to weakness of the third palmar interosseous muscle) may be present.

Grades of cubital tunnel syndrome

Grade I: Mild symptoms including:

Intermittent paresthesia

Minor hypoesthesia of the dorsal and palmar surfaces of the fifth and medial aspect of fourth digits

No motor changes

Grade II: Moderate and persistent symptoms including:

Paresthesia

Hypoesthesia of the dorsal and palmar surfaces of the fifth and medial aspect of fourth digits

Mild weakness of ulnar innervated muscles

Early signs of muscular atrophy

Grade III: Severe symptoms including:

Paresthesia: Obvious loss of sensation of the dorsal and palmar surfaces of the fifth and medial aspect of fourth digits.

Significant functional and motor impairment

Muscle atrophy of the hand intrinsics

Possible digital clawing of fourth and fifth digits (Sign of Benediction)

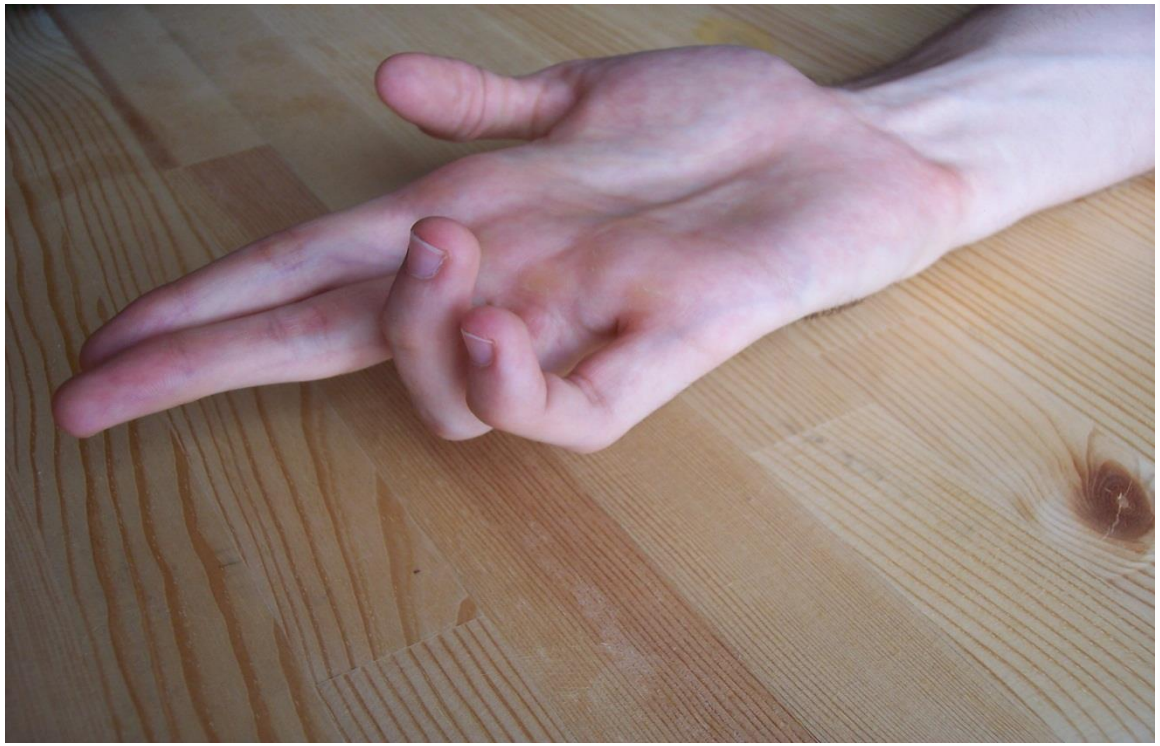
Examination

1. Sensory changes in the ulnar nerve distribution (½ of the 4th digit and entirety of the 5th) pain. A sensory examination that includes both light touch, a test of the ability to distinguish between sharp or dull stimulus, and the ability to distinguish 1 point from 2 points (2-point discrimination).

2. By observation:

There may be atrophy of the intrinsic muscles of the hand.

Abnormal claw posture of the 4th and 5th fingers



3. By Palpation

The ulnar nerve may be enlarged or palpable and tender in the groove.

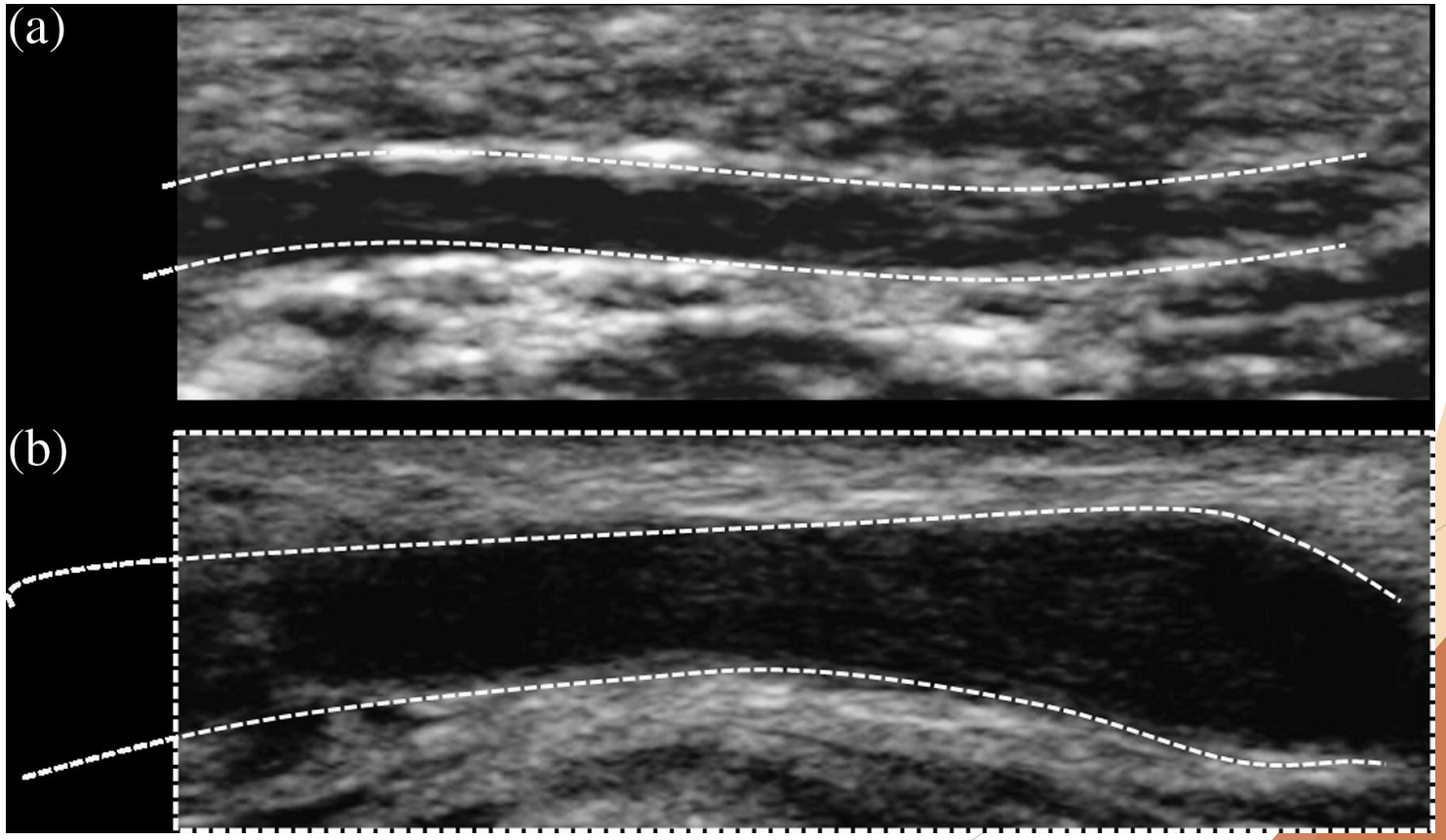
4. Special tests

Flexion test:

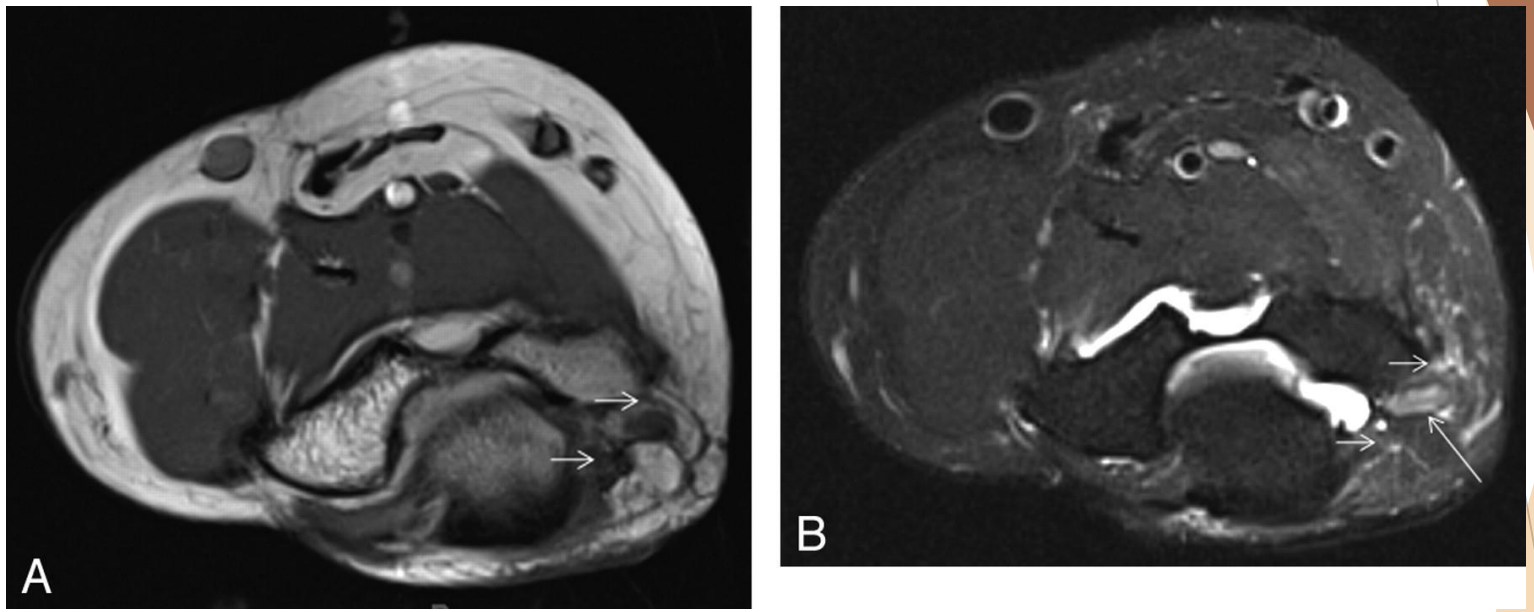
Tinel Sign:

Imaging

high-resolution neuro-ultrasonography shows changes in the size and position of the ulnar nerve at the elbow (b).



magnetic resonance neurography (MRN) shows structural changes of the ulnar nerve and its environment.



Axial T1 (*A*) and T2 SPAIR (*B*) images show a hyperintense ulnar nerve (*long arrows*) entrapped at the cubital tunnel due to focal fibrosis (*short arrows*) related to previous injury. No denervation atrophy was seen at the time of imaging, and clinical as well as electromyography findings were in keeping with neurapraxia.

Differential Diagnosis

- Lesions in the Guyon (ulnar) canal
- Cervical spondylosis
- Thoracic outlet syndrome
- Pancoast tumors
- Motor neuron disease
- Carpal tunnel syndrome
- Polyneuropathy

Operative Management:

It is indicated when:

1. Failure of three month conservative treatment.
2. An electrodiagnostic test of less than 39-50 meters per second across the elbow.
3. Progressive symptoms
4. Sensorimotor deficits
5. Lack of clinical and electro-neurographic improvement
6. Worsening of the objective findings on follow up several weeks after the initial visit.

A surgeon may recommend one of the following procedures:

•**Cubital tunnel release (simple decompression):** The surgeon opens the cubital tunnel to increase its size in order to relieve pressure to the affected nerve.

•**Ulnar nerve anterior transposition:** The surgeon moves the nerve from behind the bony bump, the medial epicondyle, in the elbow to in front of the bump. This procedure prevents the nerve from rubbing against the bump.

•**Medial epicondylectomy:** A surgeon removes part of the bony bump in the elbow preventing the nerve from rubbing against the bump.

Physical Therapy Management

1- Splint or rigid night splinting:

- At 45 degrees of flexion and the forearm in neutral rotation.

- The lowest value of these pressures is at an elbow position of 40-50 degrees of flexion. Pressures are significantly higher in full flexion or extension of the elbow.

- Splinting is designed to alleviate symptoms and prevent the progressive dysfunction of nerves

2- Patient education and activity modification:

- The patient is educated about pain provoking movements and how best to avoid them in ADLs.

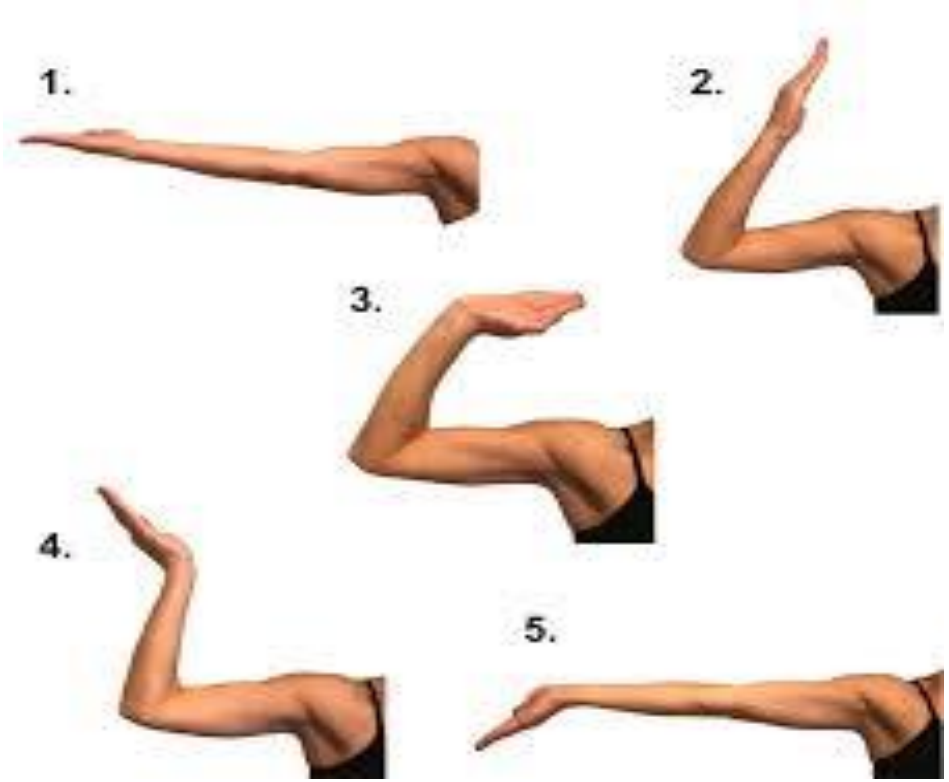
- Patient should avoid positions that develops symptoms such as stretching or compressing the nerve when collaterally tilting the head or abducting.

- Avoid prolonged elbow flexion (static or repetitive) puts strain on the ulnar nerve and increases extraneural and intraneural pressure in the cubital tunnel.

Pain Relieving Modalities

- dry needling
- percutaneous electrical stimulation
- pulsed radiofrequency
- Ultrasound was applied in water as a transmission vector on the compression site with the following param- eters: Frequency, 1 MHz; transducer area, 5 cm2 ; intensity, 1.5 W/cm2 ; duration, 5 min; and continuous mode.
- LLLT for 2 weeks used a 905-nm wavelength, mean output power of 25 mW, 30 sec per point and 4 points around the entrapment site.
- extracorporeal shock wave therapy

Neurodynamic techniques



Exercises

Exercises must not reproduce the distal nerve symptoms and may, there or, initially need to be performed in limited arcs of motion.

- **Straight finger flexion:** Make a right angle with your knuckles and keep your fingers straight. Hold this position for 10 seconds. Repeat 5 times.

8. STRAIGHT FINGER FLEXION: Make a right angle with your knuckles and keep your fingers straight. Hold this position for 10 seconds. Repeat 5 times.

STRAIGHT FINGER FLEXION

6. ACTIVE ELBOW FLEXION AND EXTENSION: Gently bring your palm up toward your shoulder and bend your elbow as far as you can. Then straighten your elbow as far as you can 10 times. Do 3 sets of 10.

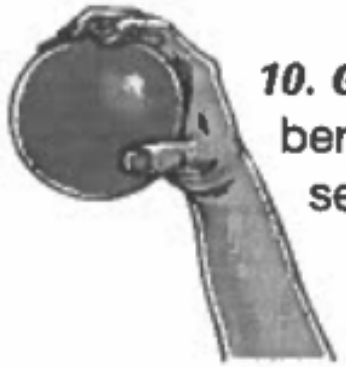
ACTIVE ELBOW FLEXION AND EXTENSION

WRIST STRETCH

7. WRIST STRETCH: With one hand, help to bend the opposite wrist down by pressing the back of your hand and holding it down for 15 to 30 seconds. Next, stretch the hand back by pressing the fingers in a backward direction and holding it for 15 to 30 seconds. Keep your elbow straight during this exercise. Do 3 sets on each hand.

9. FINGER SQUEEZE: Practice squeezing items between each of the fingers on one hand. You can use paper, pens, and sponges. Hold for 10 seconds. Repeat 5 times for each finger.

FINGER SQUEEZE



10. GRIP STRENGTHENING: Squeeze a rubber ball and hold for 5 seconds. Do 3 sets of 10.

GRIP STRENGTHENING

Prognosis

- About half the patients achieve an improvement in their symptoms with conservative management

Prevention

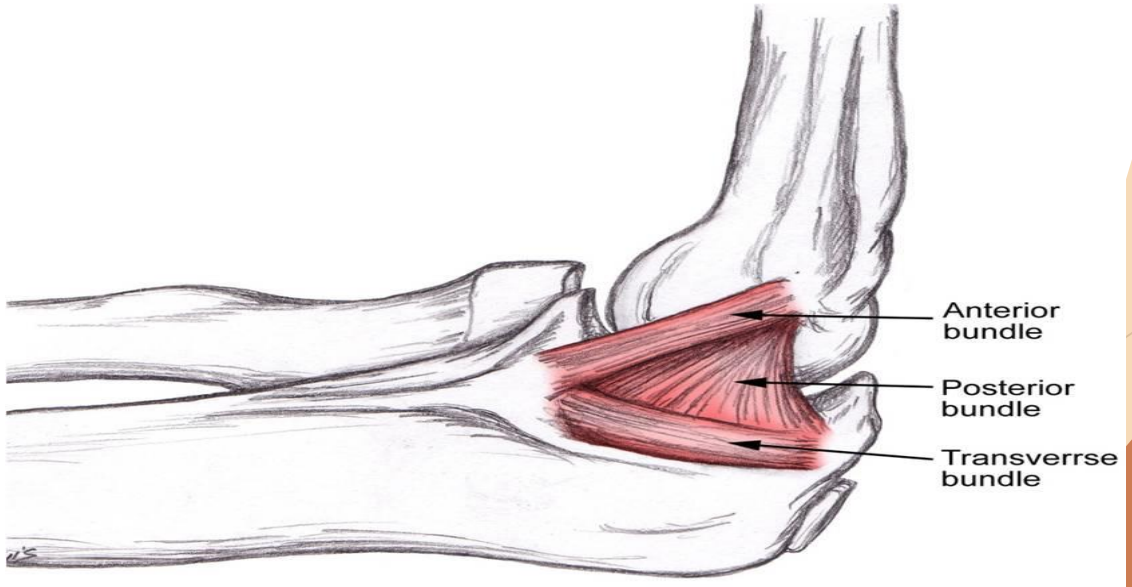
How can I reduce my risk of cubital tunnel syndrome?

- Avoid leaning on your elbow.
- Avoid putting pressure on the inside of your arm.
- Don't rest your elbow on your computer chair armrest if you use it frequently. Keep your chair high.
- Sleep with your elbow straight.
- Stay away from anything that makes you bend your arm for a long time.

Ulnar collateral ligament injury

Anatomy of ulnar collateral ligament:

The ulnar collateral ligament (UCL) or medial collateral ligament (MCL) extends from the central two-thirds of the anteroinferior surface of the medial epicondyle to the proximal medial ulna, from just posterior to the axis of the elbow medial epicondyle to just distal to the tip of the coronoid

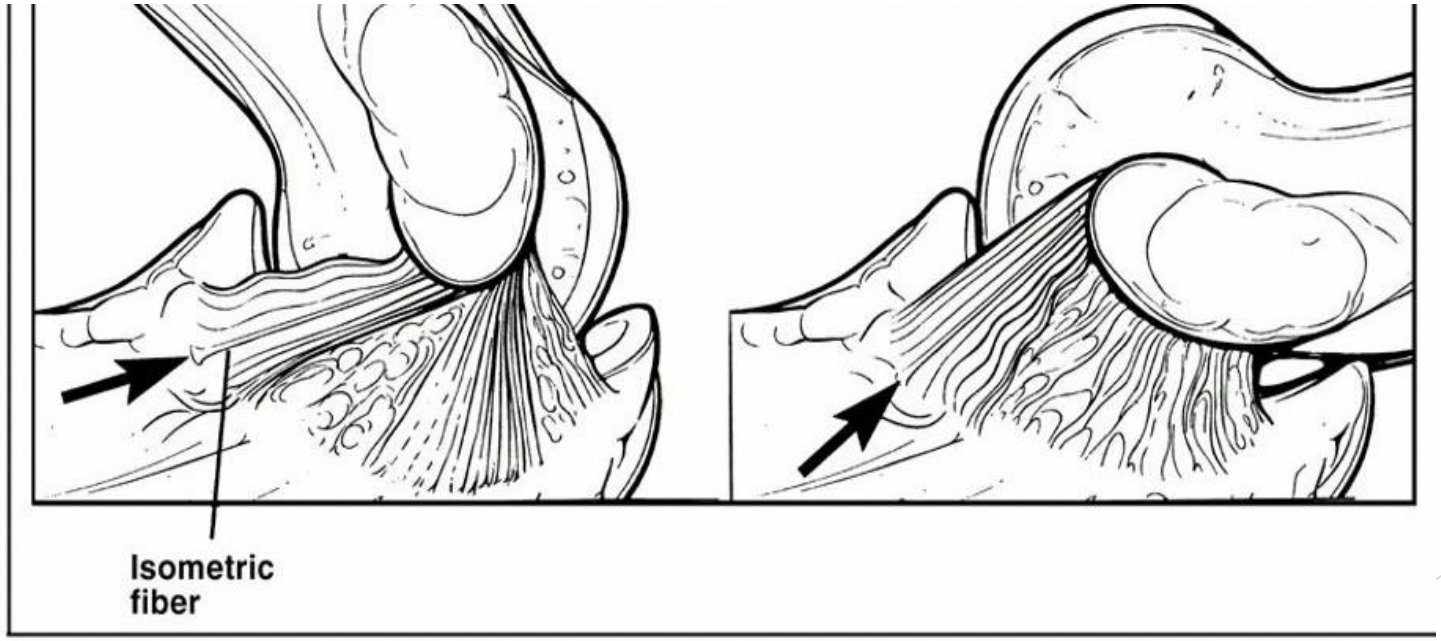


MCL is the most important ligament in the elbow for providing stability against **valgus stress**, particularly in the range of 20–130 degrees of flexion and extension with the humeroradial joint functioning as a secondary stabilizer to valgus loads.

The UCL or (medial collateral ligament) has three bundles (anterior, posterior and transverse bundles).

Two of them are primary importance, anterior and posterior bundles .

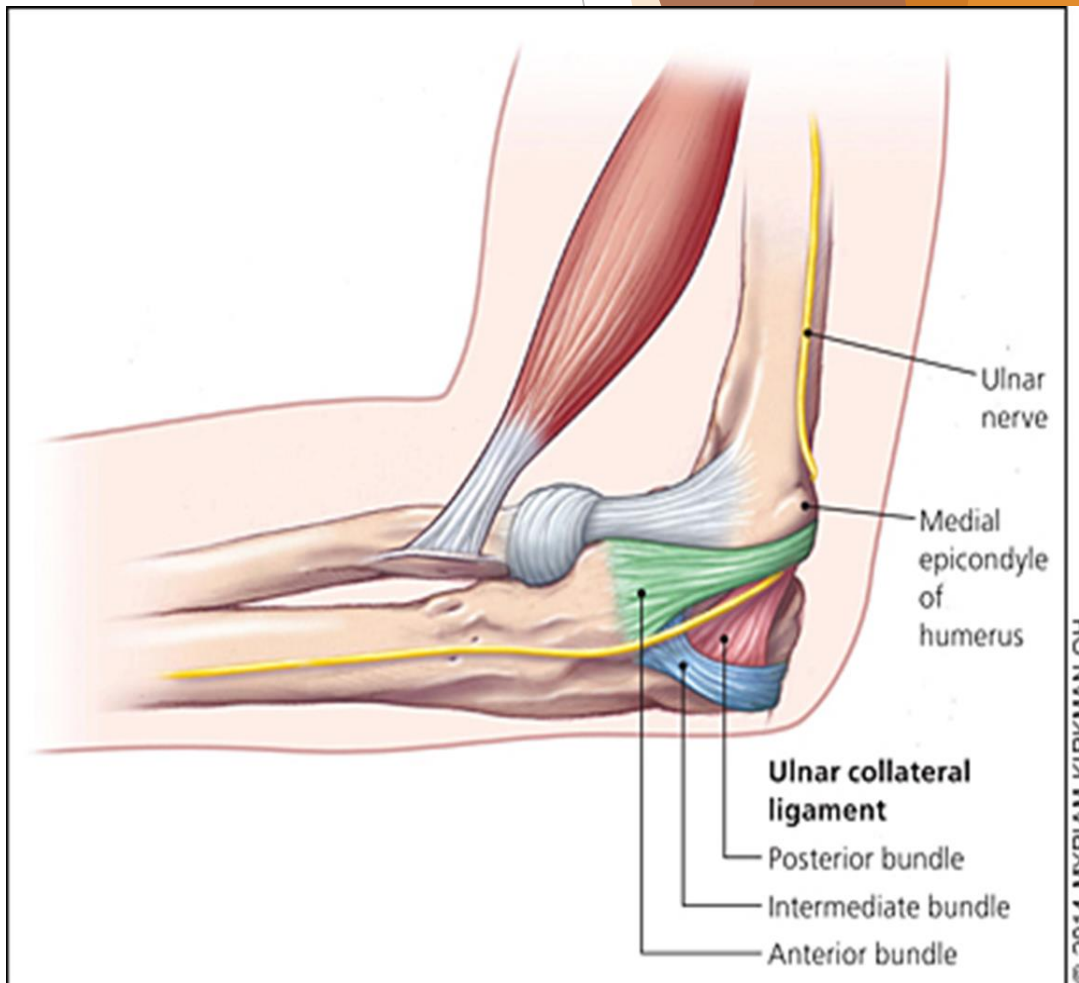
These two bundles tighten in reciprocal fashion as the elbow is flexed and extended. **The anterior bundle** tightens in **extension** and loosens in **flexion**. The **posterior bundle** tightens in **flexion** and loosens in **extension.**



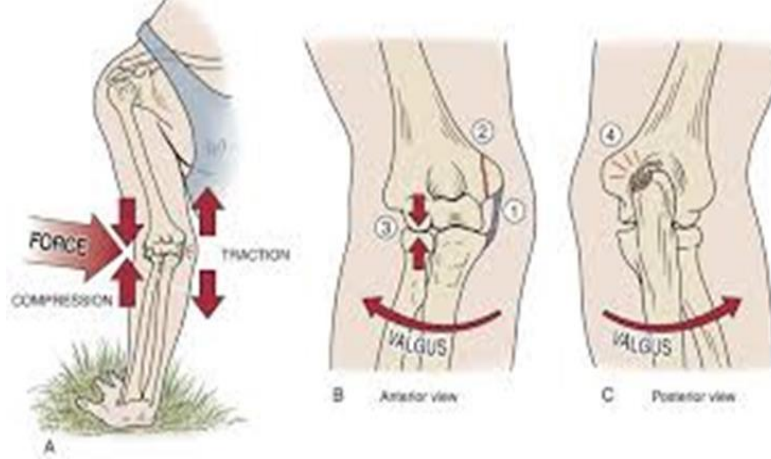
Oblique (Transverse) Bundle

- The oblique bundle, also known as Cooper`s ligament, It does not cross the elbow joint and comprises fibres running along the medial joint capsule from the tip of the **olecranon** to the medial ulna, just distal to the **coronoid**.

- The transverse fibres have **little role in elbow stability** due to the fact that they both originate and insert on the ulna.



Mechanism of Injury



- The ulnar collateral ligament is most often injured as a result of a valgus force from the repetitive trauma of overhead throwing. It can also be injured during a forehand stroke in tennis, or in the trail arm during an improper golf swing.
- During the late cocking phase through the early acceleration phase of throwing, tremendously high, repetitive stresses are applied to the medial elbow joint, frequently resulting in ligament failure, tendinitis, or osseous changes

Clinical presentation

Acute or sub-acute phase:

- Medial elbow pain
- Medial swelling
- Point tenderness along the ligament
- Throwers may often recall feeling or hearing a "pop".
- Ulna nerve compression signs and symptoms - usually sensory.

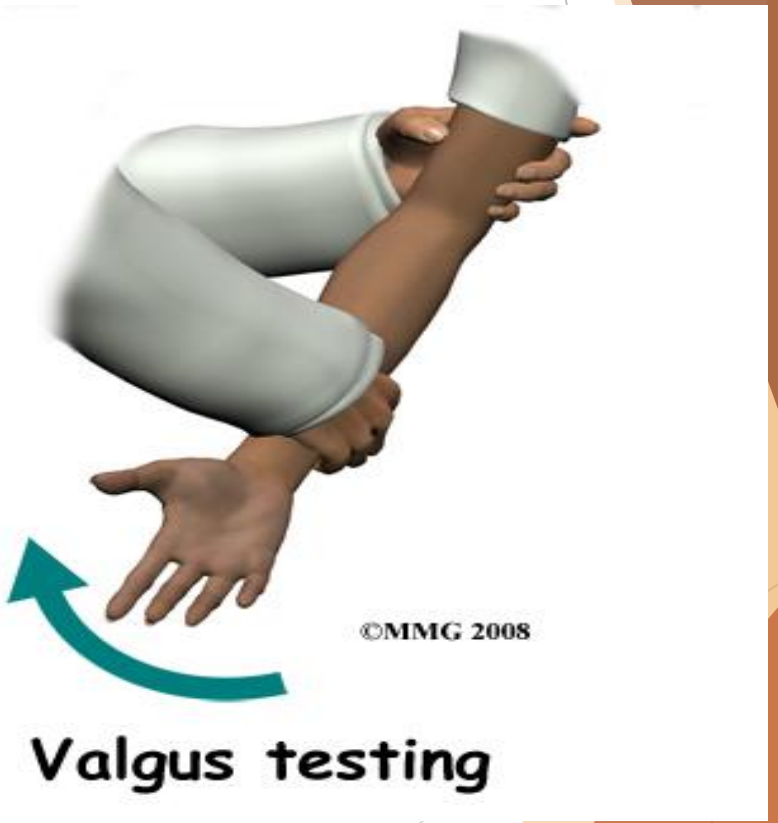
Chronic:

- Medial elbow pain
- Decreased velocity of accuracy with throwing

Physical examination

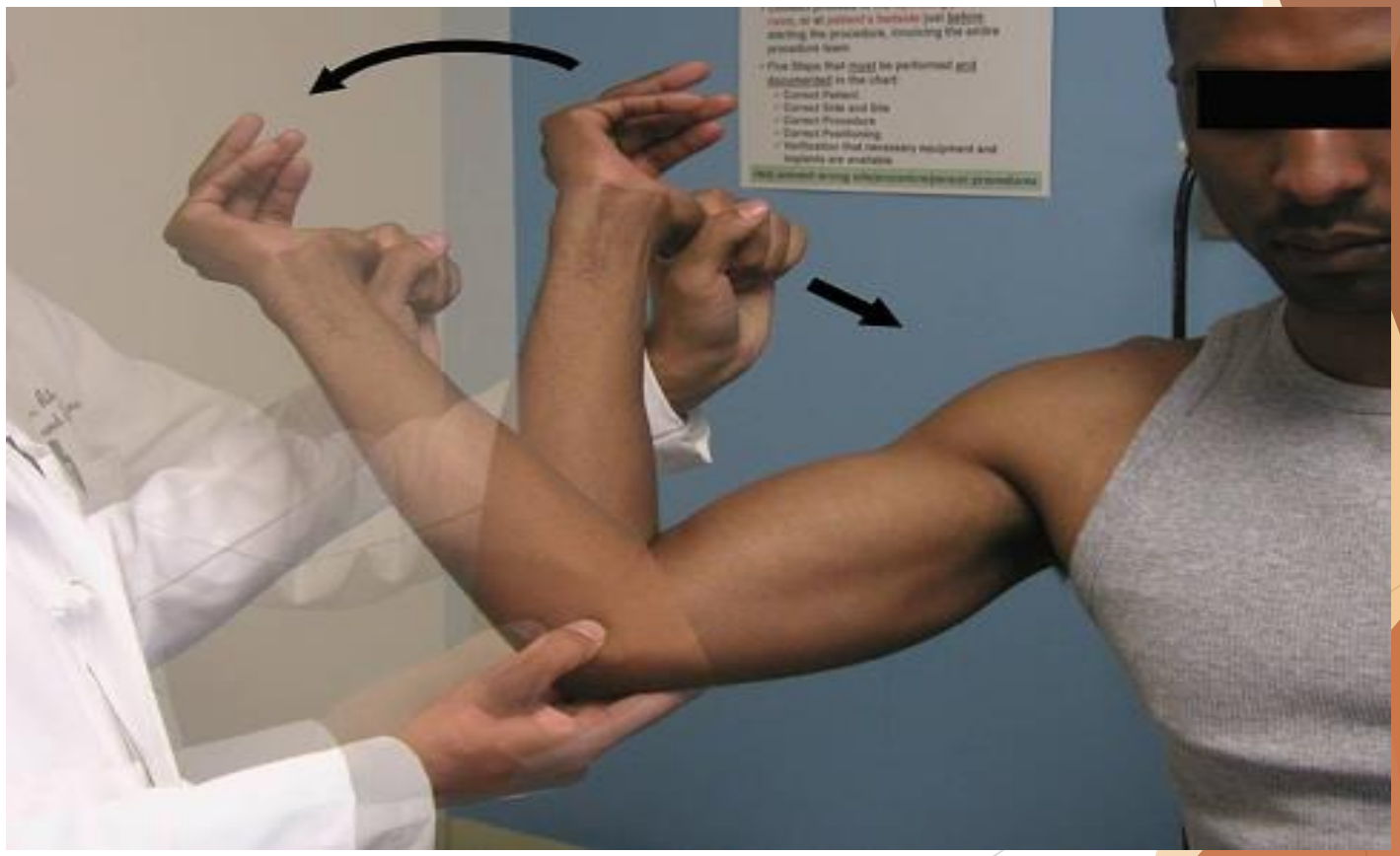
- Palpation, in order to manually exam the integrity of the ligaments.

Special test:
1. valgus stress test

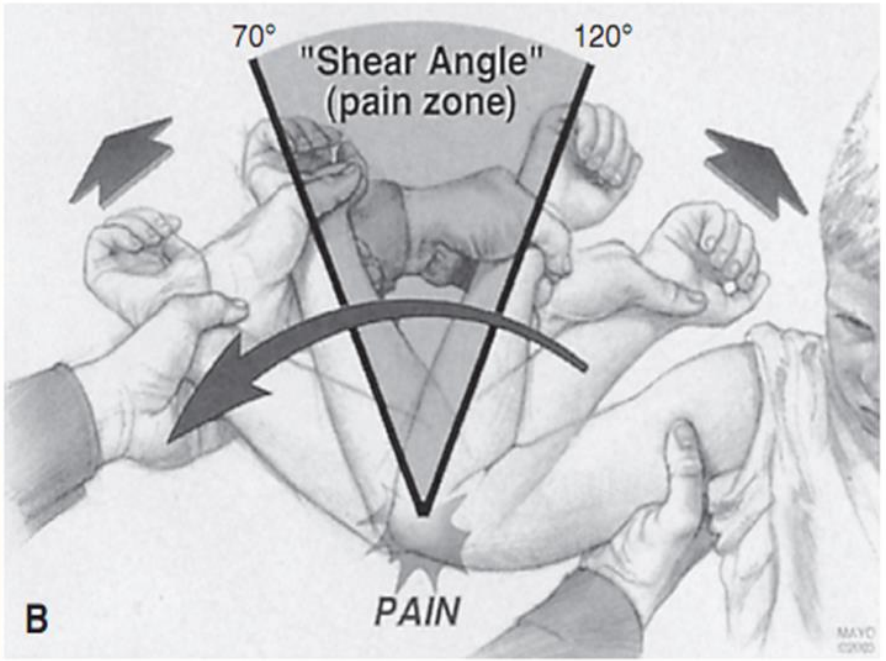


How to differentiate between the lesion of the anterior or the posterior bundle of the MCL?

3. a milking maneuver.



4. Moving Valgus Stress Test for chronic MCL tear



A, The moving valgus stress test. **B,** Schematic representation of the moving valgus stress test. The shear range refers to the range of motion that causes pain while the elbow is extended with valgus stress. The shear angle is the point that causes maximum pain.

Differential diagnosis

- Cubital Tunnel Syndrome
- Medial Epicondylalgia
- Dislocation: Exaggerated boney prominence, effusion, or appearance of elongation of forearm and could affect neurovascular status.
- Infection: Sudden swelling without trauma
- Vascular Compromise: numbness, tingling, pulse abnormalities
- Referred Cervical Pain

Rehabilitation Concerns

- Most ulnar collateral ligament injuries can be managed without surgery. Conservative treatment of patients with chronic ulnar collateral ligament injury should begin with rest and nonsteroidal anti-inflammatory medication
- If periods of rest and rehabilitation fail to result in a resolution of symptoms, surgical intervention might be necessary.

Operative management consists of repair or reconstruction.

- In the case of an acute rupture, surgical repair can be considered; however, the indications are extremely limited. The avulsed ligament should be without evidence of calcification, and if there is any question as to the quality of the tissue, reconstruction should be performed.

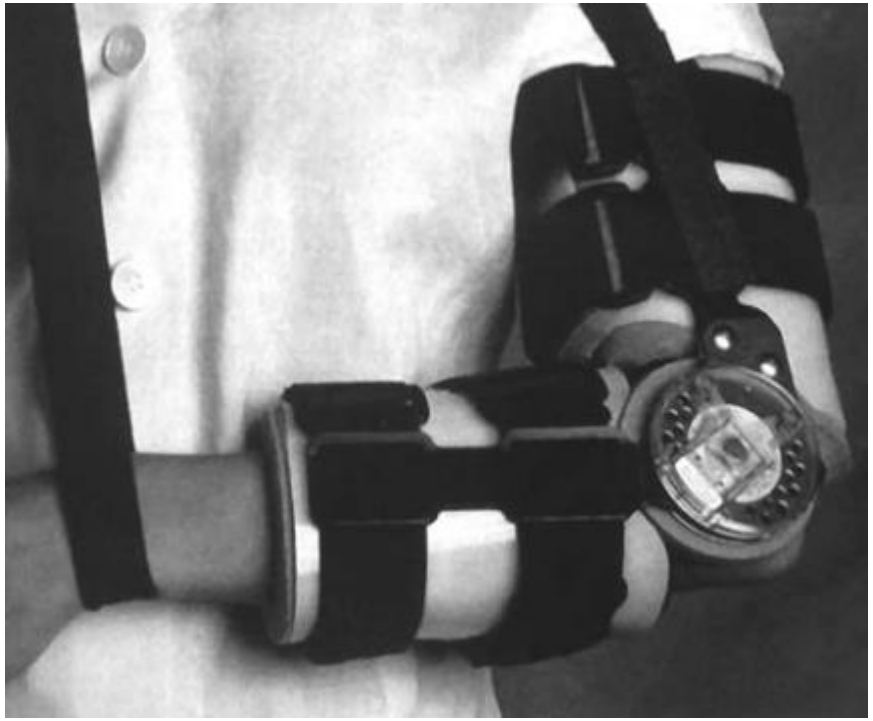
- The ulnar collateral ligament is the primary stabilizer to valgus stress at the elbow, so reconstruction is vital to competitive throwing athletes who wish to return to their previous levels of performance. An autograft, using either the palmaris longus or extensor hallucis, is used to reconstruct the ulnar collateral ligament

Conservative/Physiotherapy Management

Phase 1 (1-2 weeks)

- reduce pain and swelling
- protect valgus stress
- improving range of motion (avoid external rotation to minimise valgus stress on the elbow)
- strengthening of the elbow, wrist, hand, and shoulder

- Ice and bandaging and Ultrasonic to reduce inflammation
- Dynamic brace (non painful range (20-80).



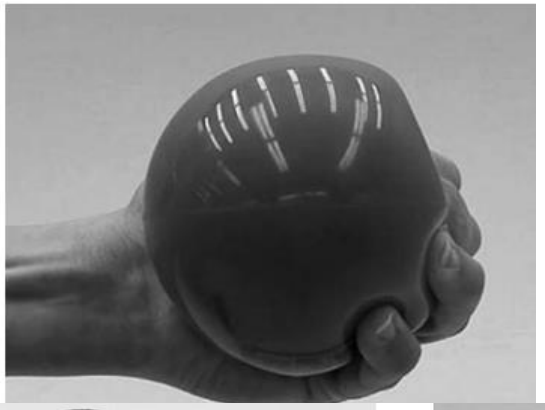
1. **AAROM**, **PROM** elbow, wrist and shoulder (non-painful ROM and no shoulder ER stretching)
2. Gentle muscle setting ex
3. no external rotation strengthening which may place valgus stress on the medial structures of the elbow).

Isotonic Open-Kinetic-Chain Strengthening Exercises

Initiate Isometrics - wrist and elbow musculature, gripping exercises

A

B



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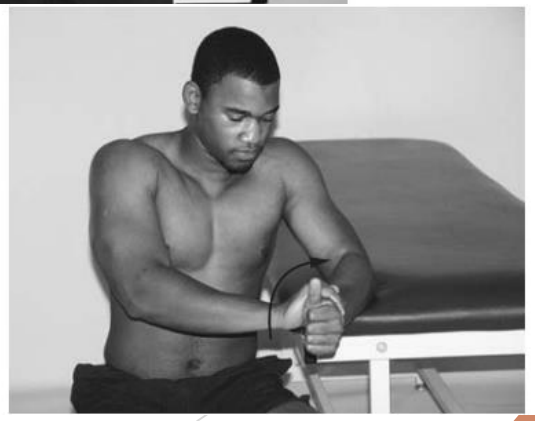


B

Low load, long duration stretching

A

B

Methods

Criteria to Progress to Phase II

1. No Swelling
2. Acute pain is diminished

Ice and bandaging

1- Range of Motion

Gradually increase motion 0-135 degrees (increase 10 ° per week). 5 degrees of extension, 10 degrees of flexion.

Phase 2 (2-4 weeks)

- normalize strength
- prepare for RTP
- proprioceptive neuromuscular facilitation
- forearm and wrist strengthening

Strength Exercises

2- Initiate isotonic exercises:

Wrist curls.

Pronation-supination

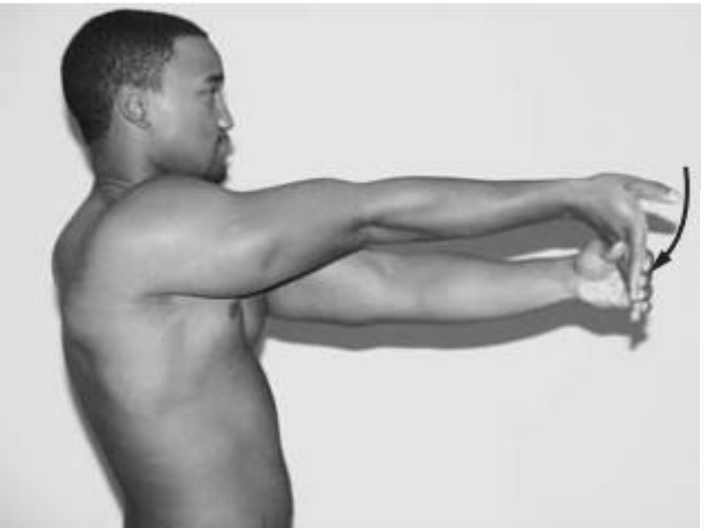
Biceps-triceps.

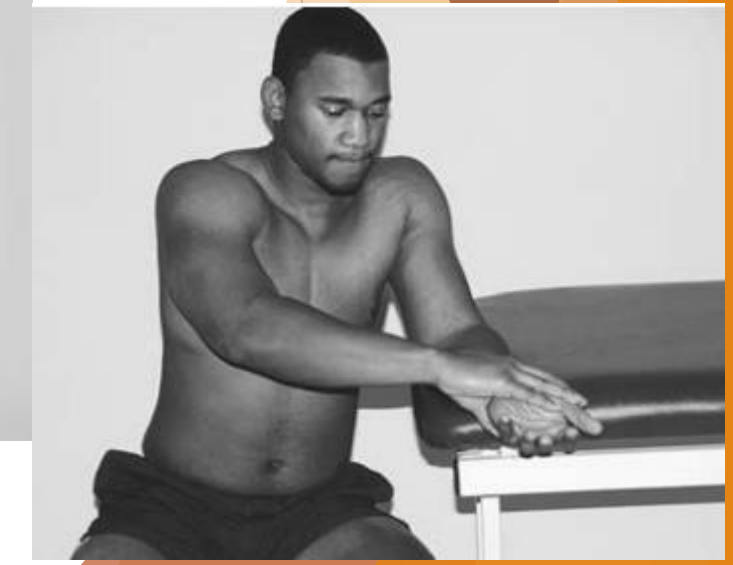
3- Advance shoulder strengthening

- external rotation
- internal rotation (Week 3)
- Supraspinatus

4- Ice, compression

stretching





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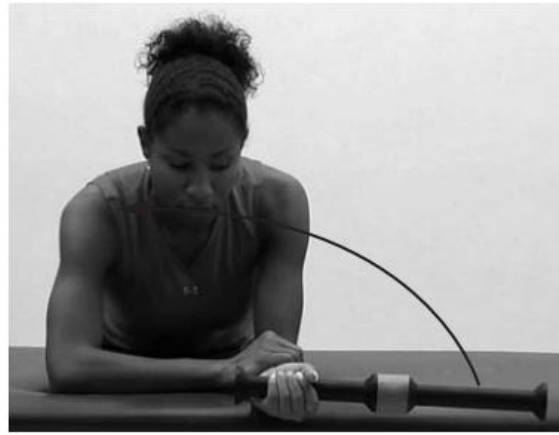

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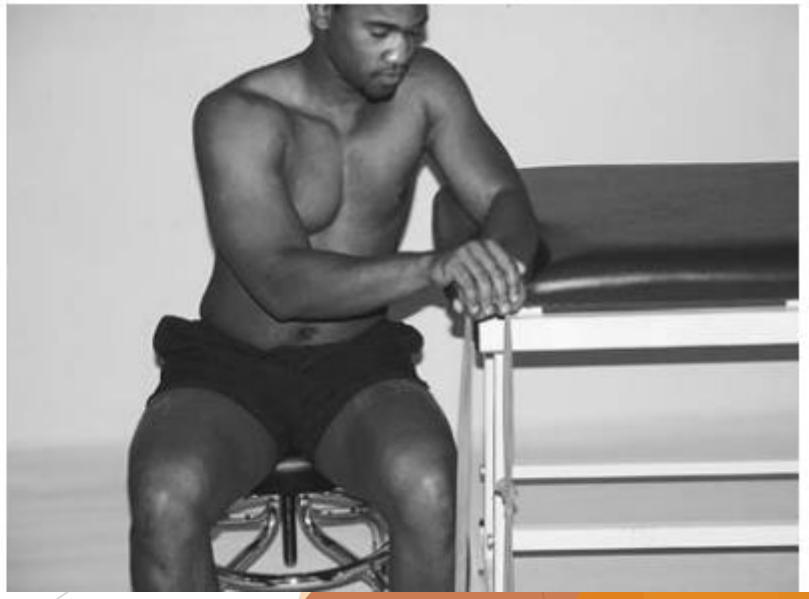


B

Phase 3

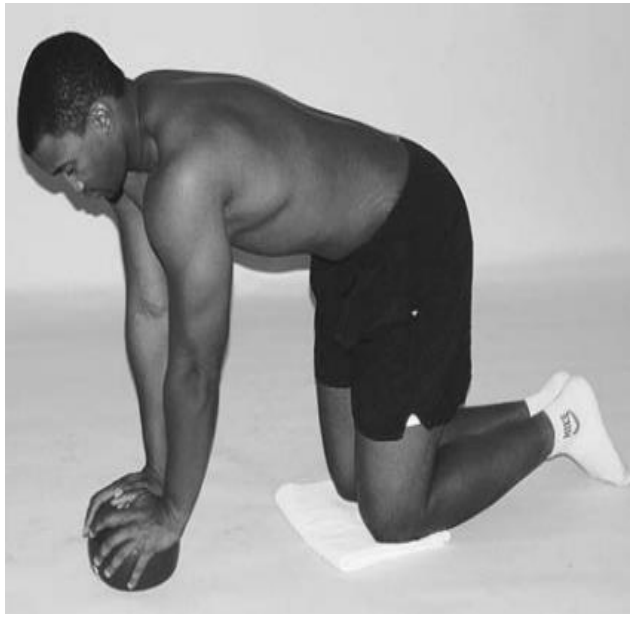
- return-to-throw program
- lasts about 6 weeks

Criteria for Progression to Phase 3:

1. Full AROM
2. No pain or tenderness
3. No increase in laxity
4. Strength 4/5 in the elbow flexors/extensors

Methods:

- Strength Exercises
- Continue the strength program in the eccentric contraction form for:
- Biceps-triceps program.
- Supination-pronation.
- Wrist extension-flexion.
- Initiate PNF
- Initiate isokinetics
- Initiate plyometrics
- to include trunk rotation, and Play ball with mini tramp



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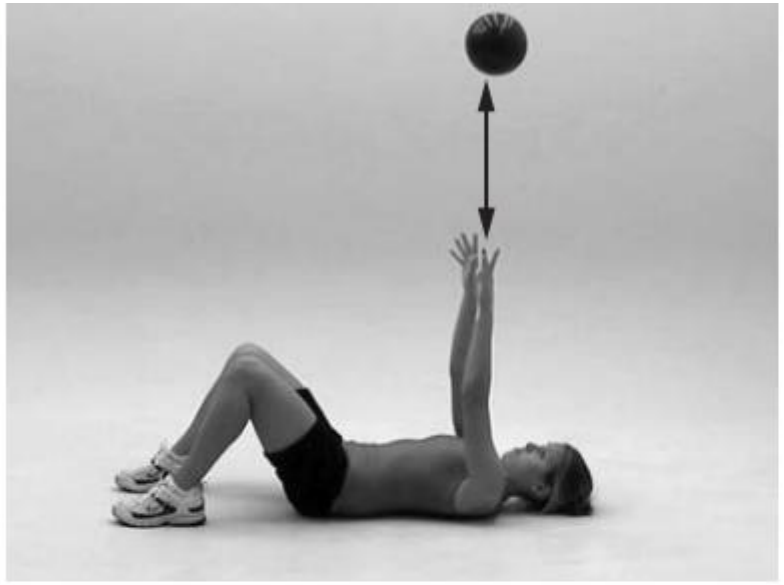
Isokinetic Exercises

Plyometric Exercises

A



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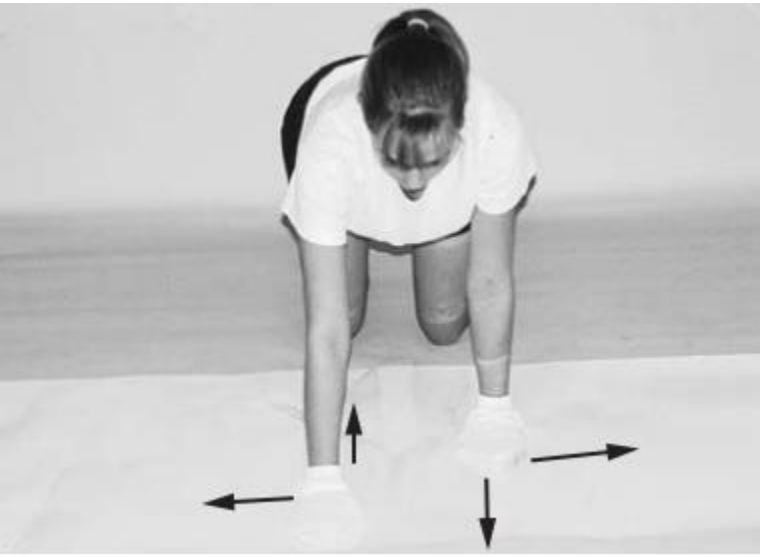
C

D

Exercises to Reestablish Neuromuscular Control



Phase IV Return to Activity Phase

7 - 10 Weeks post-injury:

Criteria to progress to return to throwing

1. Full, non-painful ROM
2. No increase in laxity
3. Isokinetic test fulfills following criteria

- pronation: 20% greater than non-dominant side
- flexion : 15% greater than non-dominant side
- extension: 5% greater than non-dominant side

4. Satisfactory clinic exam, Physician’s approval
5. 2 successful weeks of pain-free plyometric.

Phase IV Return to Activity Phase

Activities

1. Initiate Interval Throwing Program (ITP)

6-8 weeks post-injury (check date on which week to throw)

2. Continue Thrower's Ten program

3. Continue plyometric progression

4. Initiate hitting progression program after successfully completing 90 foot phase of (ITP)

45-Foot Phase

Step 1:
A. Warm-up throwing
B. 45 feet (25 throws)
C. Rest 15 minutes
D. Warm-up throwing
E. 45 feet (25 throws)

Step 2:
A. Warm-up throwing
B. 45 feet (25 throws)
C. Rest 10 minutes
D. Warm-up throwing
E. 45 feet (25 throws)
F. Rest 10 minutes
G. Warm-up throwing
H. 45 feet (25 throws)

60-Foot Phase

Step 3:
A. Warm-up throwing
B. 60 feet (25 throws)
C. Rest 15 minutes
D. Warm-up throwing
E. 60 feet (25 throws)

Step 4:
A. Warm-up throwing
B. 60 feet (25 throws)
C. Rest 10 minutes
D. Warm-up throwing
E. 60 feet (25 throws)
F. Rest 10 minutes
G. Warm-up throwing
H. 60 feet (25 throws)

90-Foot Phase

Step 5:
A. Warm-up throwing
B. 90 feet (25 throws)
C. Rest 15 minutes
D. Warm-up throwing
E. 90 feet (25 throws)

Step 6:
A. Warm-up throwing
B. 90 feet (25 throws)
C. Rest 10 minutes
D. Warm-up throwing
E. 90 feet (25 throws)
F. Rest 10 minutes
G. Warm-up throwing
H. 90 feet (25 throws)

120-Foot Phase

Step 7:
A. Warm-up throwing
B. 120 feet (25 throws)
C. Rest 15 minutes
D. Warm-up throwing
E. 120 feet (25 throws)

Step 8:
A. Warm-up throwing
B. 120 feet (25 throws)
C. Rest 10 minutes
D. Warm-up throwing
E. 120 feet (25 throws)
F. Rest 10 minutes
G. Warm-up throwing
H. 120 feet (25 throws)

150-Foot Phase

Step 9:
A. Warm-up throwing
B. 150 feet (25 throws)
C. Rest 15 minutes
D. Warm-up throwing
E. 150 feet (25 throws)

Step 10:
A. Warm-up throwing
B. 150 feet (25 throws)
C. Rest 10 minutes
D. Warm-up throwing
E. 150 feet (25 throws)
F. Rest 10 minutes
G. Warm-up throwing
H. 150 feet (25 throws)

180-Foot Phase

Step 11:
A. Warm-up throwing
B. 180 feet (25 throws)
C. Rest 15 minutes
D. Warm-up throwing
E. 180 feet (25 throws)

Step 12:
A. Warm-up throwing
B. 180 feet (25 throws)
C. Rest 10 minutes
D. Warm-up throwing
E. 180 feet (25 throws)
F. Rest 10 minutes
G. Warm-up throwing
H. 180 feet (25 throws)

Step 13:
A. Warm-up throwing
B. 180 feet (25 throws)
C. Rest 15 minutes
D. Warm-up throwing
E. 180 feet (25 throws)
F. Rest 15 minutes
G. Warm-up throwing
H. 180 feet (25 throws)

Step 14: Begin throwing off the mound or return to respective position

For throwing patients, the interval throwing program can be initiated at week 14

Criteria for Full Return

- Generally the throwing athlete can return to competitive levels at about 22 to 26 weeks postsurgery. The patient may return to full competitive activity when

(1) full range of motion in flexion, extension, supination, and pronation has been regained

(2) strength is at least equal to that of the uninvolved elbow

(3) there is no complaint of pain in the elbow while performing throwing or loading activities

(4) the interval throwing program has been completed.

Thank you