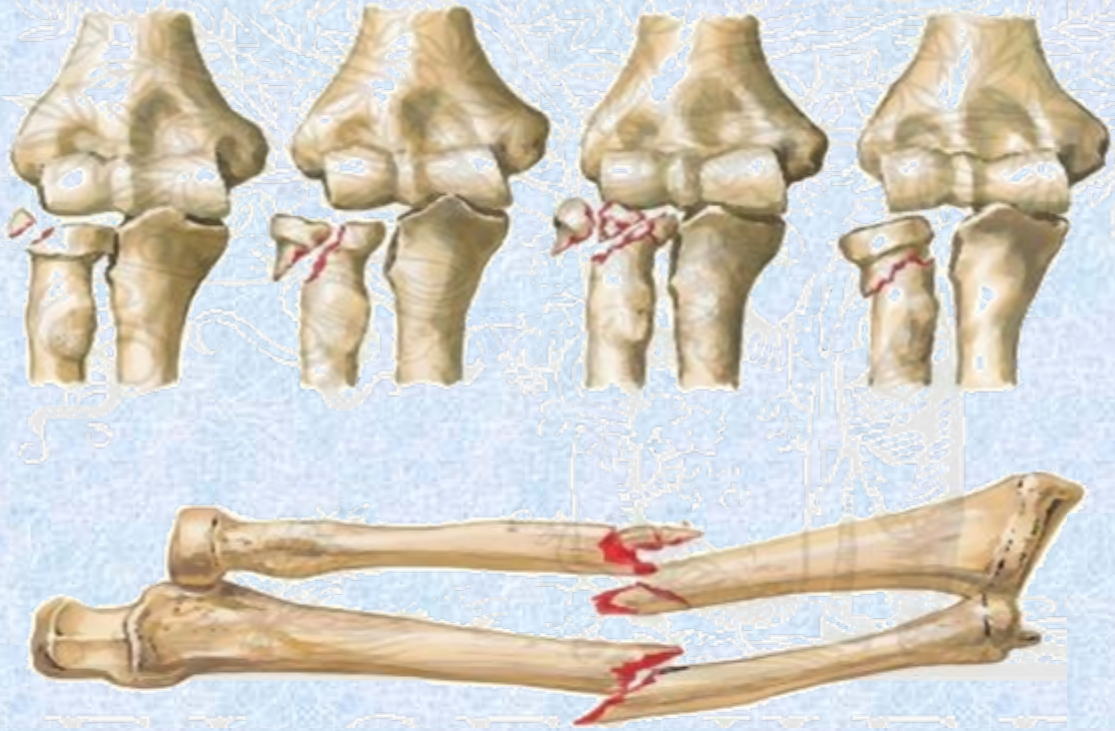
Occupational Therapy Perspective on Rehabilitation for Patient with Forearm Fracture



Ken Wong

Occupational Therapist (PWH)

14/3/10

OT treatment goals in forearm fracture

1. Maximize elbow / forearm / wrist range of motion and strength

2. Minimize complications related to forearm fractures

3. Resume premorbid functional status in ADL, Work and Leisure

Common problems encountered with forearm fracture

1. Post traumatic swelling
2. Need of immobilization and controlled mobilization
3. Diminished range of motion and strength
4. Joint stiffness
5. Uninvolved joints stiffness
6. Complications associated with forearm fracture
7. Hypertrophic scar
8. ADL deficits
9. Impaired work capacity

(1)
Post traumatic swelling

Edema control

- Elevation of hand above the level of heart
  - Use sling with caution as it promote elbow and shoulder stiffness
  - Use sling for short period only in crowded, public situation

- Active finger mobilization
  - In conjunction with elevation reduce edema by the pumping action

Edema control

Pressure garment

Finger stall

Glove

Arm tube

(2)
Immobilization and controlled mobilization

Indication for immobilization by splintage

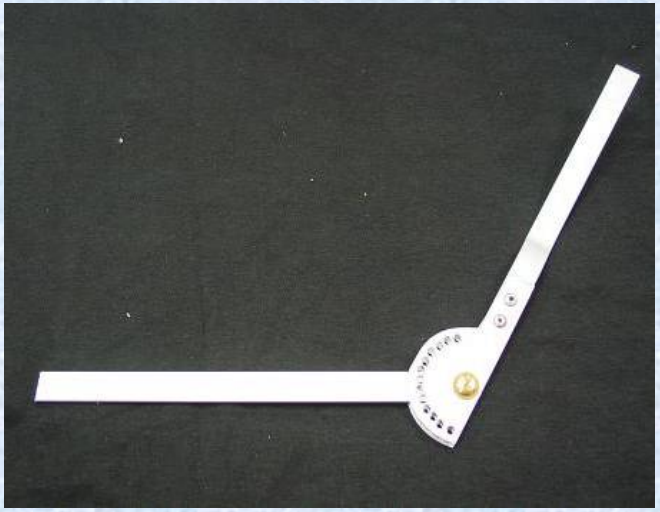
1. Conservative treatment
2. Post operative management

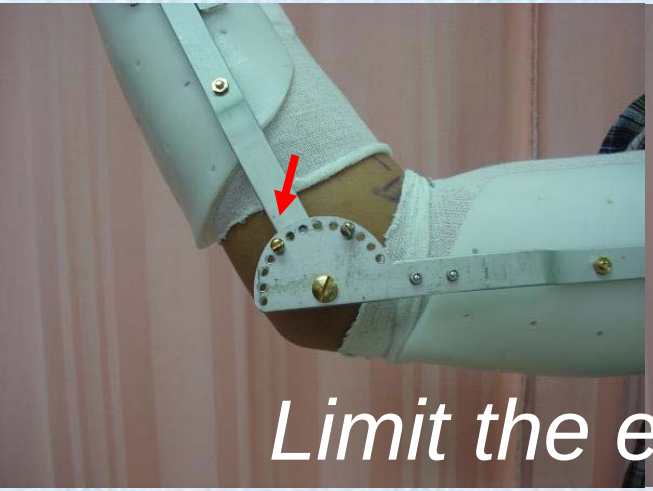
- Prevent displacement or angulations
- Maintain correct alignment
- Prevent excessive limb motion
- Control direction of movement
- Protect the healing fragments
- Pain relief

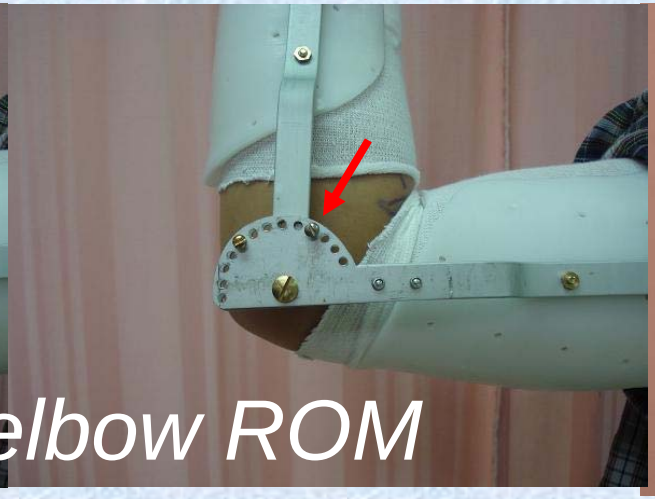
Tips on early controlled motion

- Approximately 80% of elbow contracture occurred within the first 3 weeks (Morrey, 2009)
- Elbow exhibits a marked tendency to develop articular adhesions, therefore early controlled motion is desirable (Talyor, 2003)
- Early motion can enhance bone healing and decrease recovery time after injury or surgery (Thompson ST, Wehbe MA. 1996)

Controlled motion with LAB







Limit the elbow ROM

Lock

Distal radius fracture

Forearm shaft fracture

Radial head fracture

Olecranon fracture

Monteggia fracture

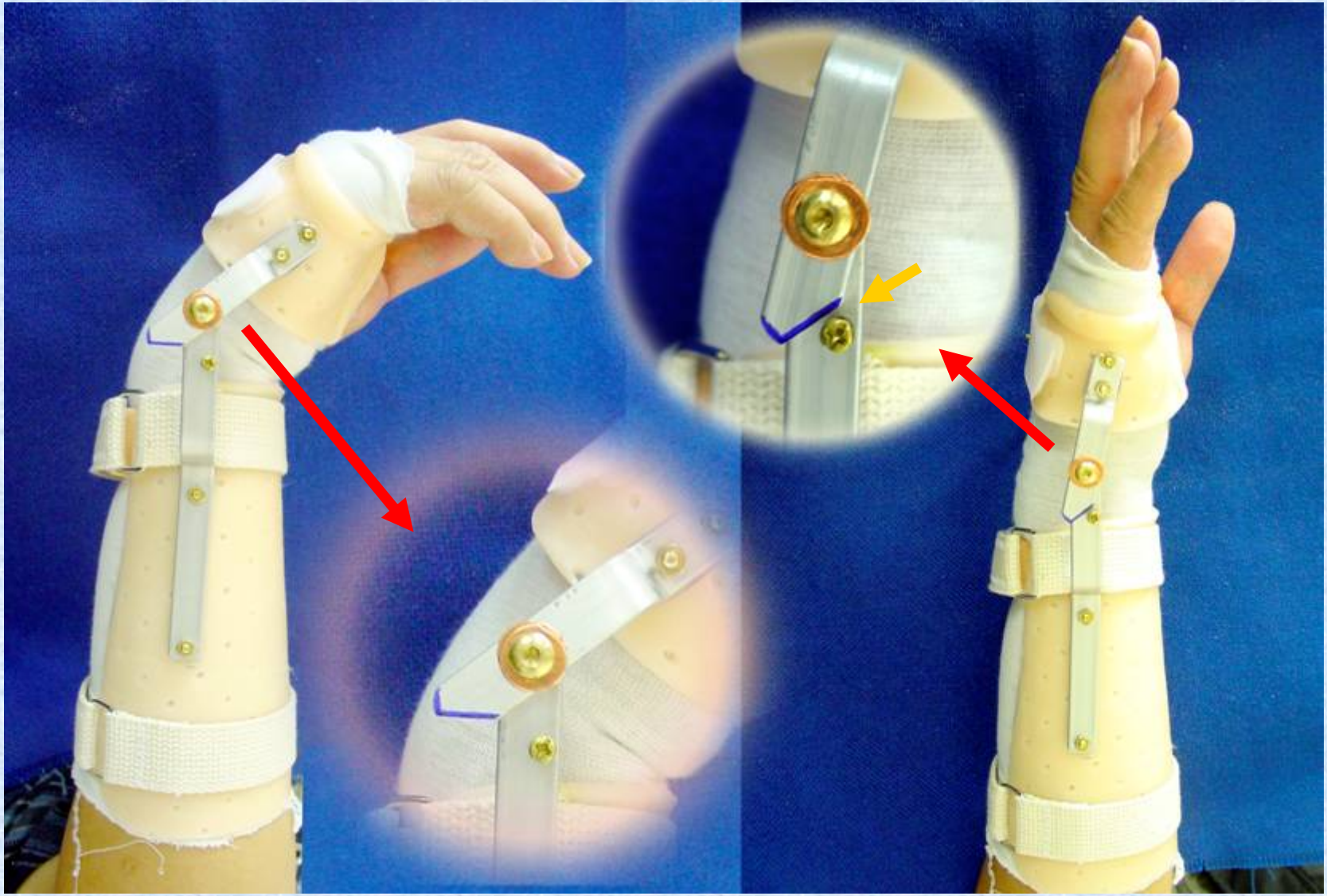
Galeazzi fracture

Distal radius fracture

- Distal radius fracture occur as a result of a fall on the outstretched hand
  (Laseter, 2002)

- Cast for ~ 5 weeks
- Start controlled active mobilization
  - Colles' fracture with dorsal displacement of fracture fragment
  - Allow free wrist flexion with zero extension

Short arm brace with dorsal block



Controlled active mobilization

- Stable non-displaced fracture or post-operation
- Wrist resting splint
  - As a bridge between total immobilization and no support (Georgiann F. Laseter, 2002)
- Encourage mobilization out of splint and put on splint for resting

Forearm fracture

- Conservative treatment of forearm shaft fractures usually results in:
  - poor functional outcome
  - exception of undisplaced & simple fracture
  - resort to operative management

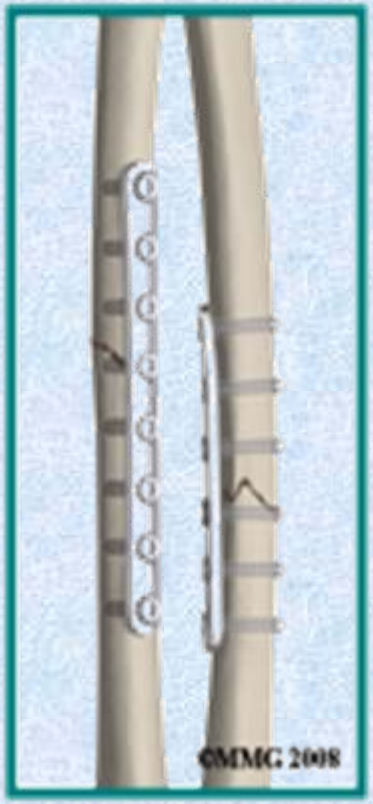
  (Charnley, 1961)
- Functional bracing apply to:
  - non-displaced fractures
  - protective bracing in post operation

  (Sarmiento, 1975)
- Interosseous membrane strain
  - immobilization provide opportunity for healing

  (Charnley, 1961)

Forearm fracture

- Diaphyseal radial & ulnar fracture
- Result of a fall with axial loading on hand



Forearm shaft fracture

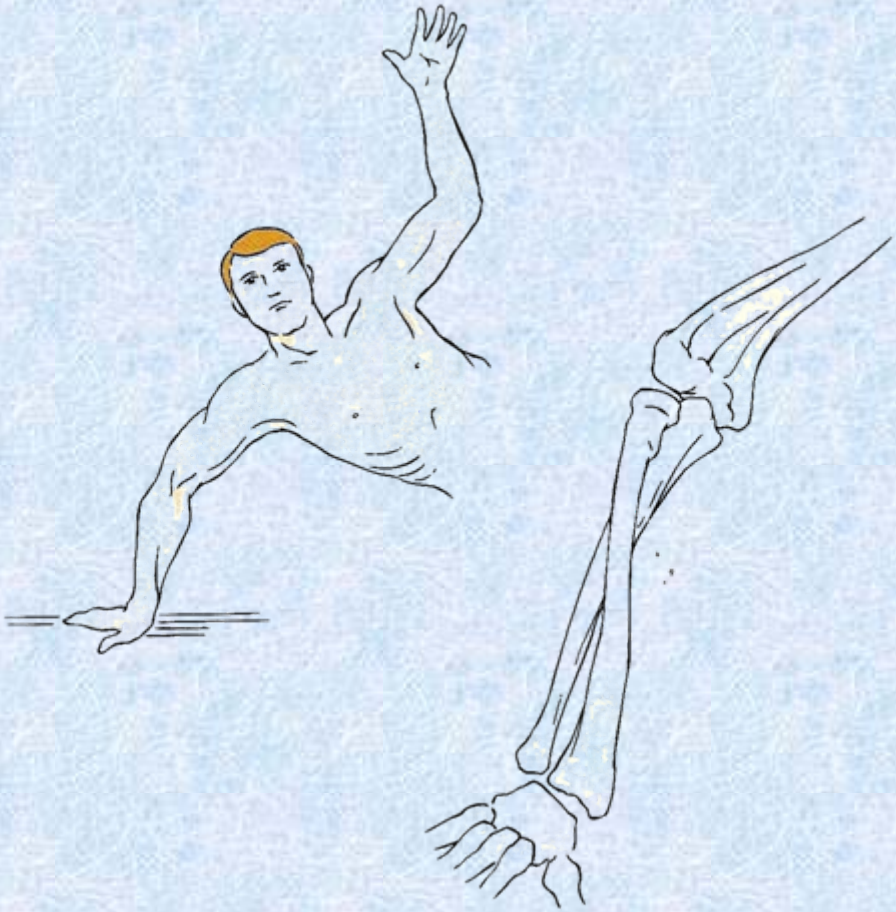
- Isolated ulna shaft fracture (nightstick #)
- Results of a direct blow on ulna in a self-defense position

Immobilization & controlled mobilization

- 3-4/52 – elbow cast in 90 with forearm in neutral position
- Then depending on # condition:
  - Hinge brace free elbow but keep forearm in neutral
  - Circumferential forearm brace
  - Forearm cast
  - Free mobilization

Radial head fracture

- Outstretched hand with elbow flexed and pronated
- Most radial head fracture is crack # without displacement

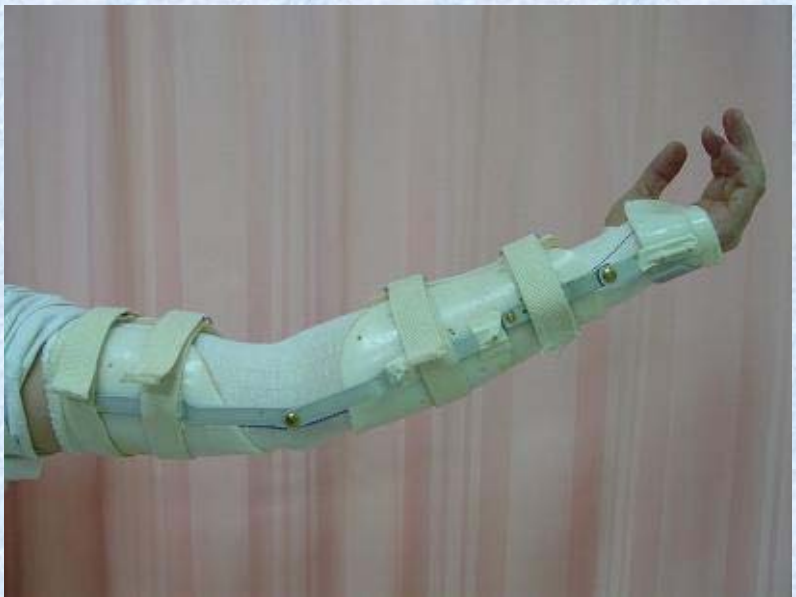


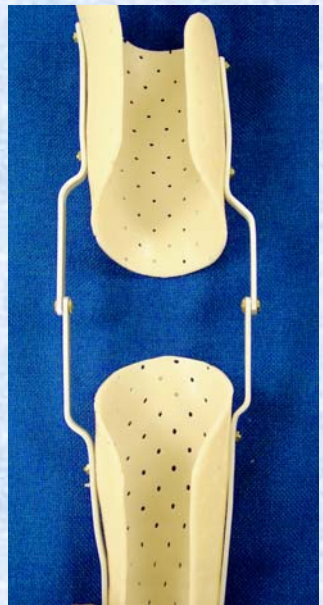
Immobilization & controlled mobilization

** Forearm rotation lead to radial head fragment instability
  - limit forearm rotation

** Radial head is one of the anatomical restraints to valgus stress at elbow (Robbin et al, 1986)
  - avoid valgus stress

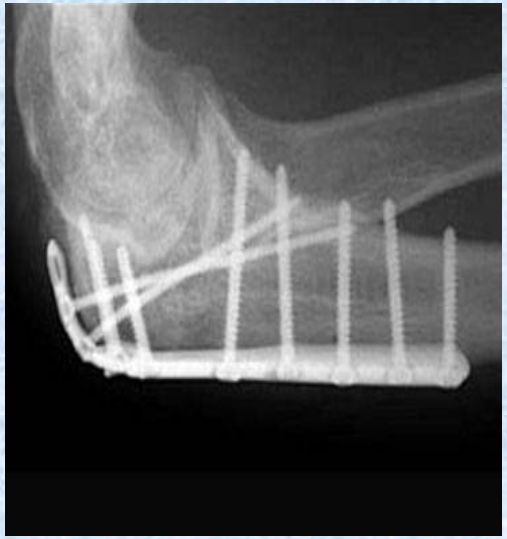
- Long arm hinged brace with 30 to 100 elbow ROM and forearm in supination ~5/52





Olecranon fracture

- Fall on the olecranon process
- Undisplaced stable fracture
  → conservative Rx
- Displaced fracture
  → operative Mx



Immobilization & controlled mobilization

** Elbow in 90, bone fragments are held together by surrounding aponeurosis

** Too much elbow flexion lead to increased tension over # site by tricep muscle

1-3/52

- LAB with elbow keep in 90 and forearm in full supination / neutral

3-7/52 onward

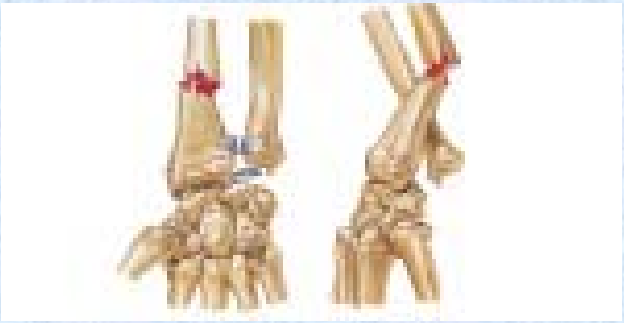
- LAB hinge brace with elbow 0-90

Monteggia / Galeazzi fracture

Monteggia fracture	**Galeazzi fracture**
Ulnar shaft fracture associated with dislocation of radial head /PRUJ	Radial shaft fracture associated with dislocation at DRUJ
• Fracture dislocation of the forearm results in an extremely unstable skeletal dissociation → poor result • Fell with outstretched hand with hyperpronated forearm / direct blow • Need operative management	

Monteggia

Galeazzi



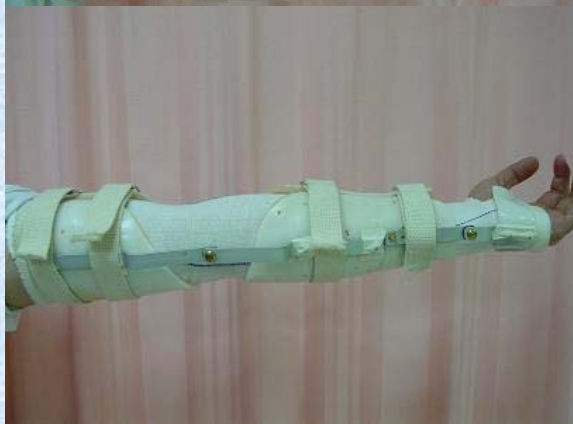
Immobilization & controlled mobilization

** Reduction of fracture dislocation
  - Difficult to maintain
  - Prone to malunion
    - Radioulnar joint incongruence
      - Severe loss of forearm rotation

(Reckling, 1982)

- 4-6/52
  - Long arm cast
    (elbow in 90, forearm in supination)
- 6/52 onward
  - Long arm hinge brace
    (free elbow, forearm in supination)

Rehab. is guided by the
stability of PRUJ / DRUJ reduction



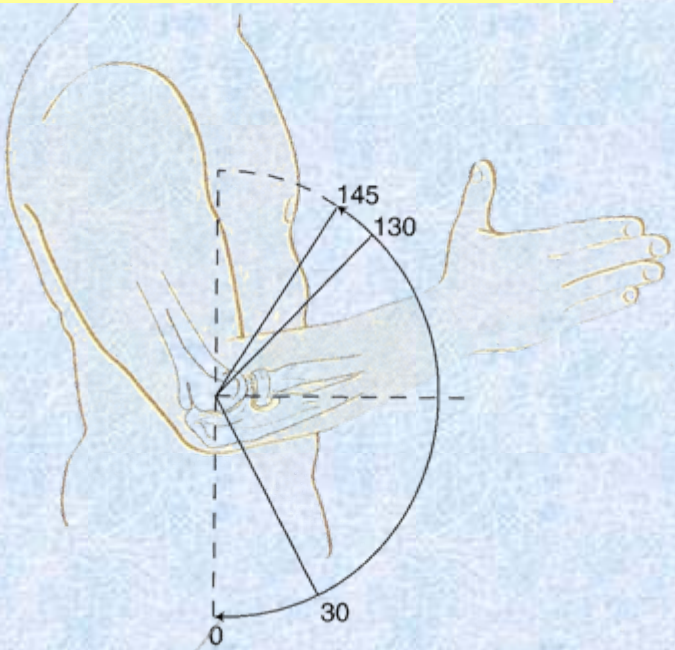
(3)
Diminished ROM and strength

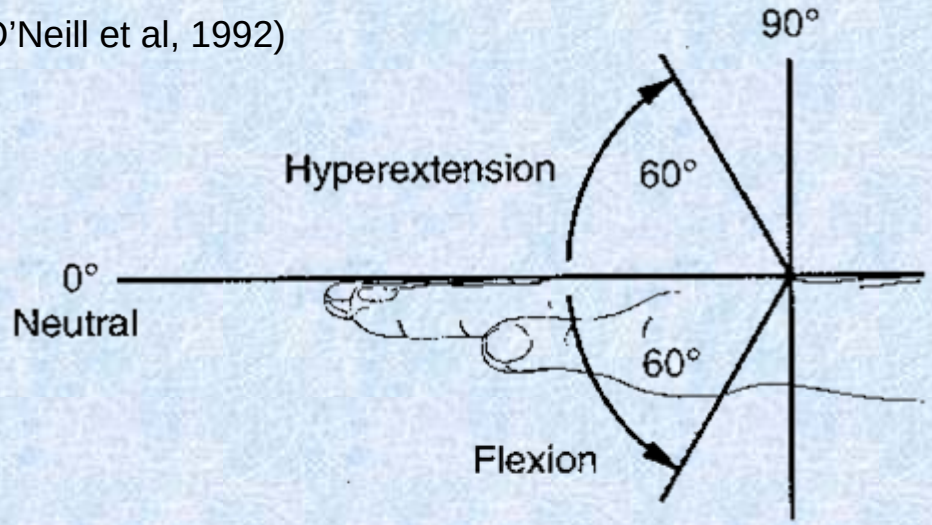
Functional ROM (Braddom R., 1996)

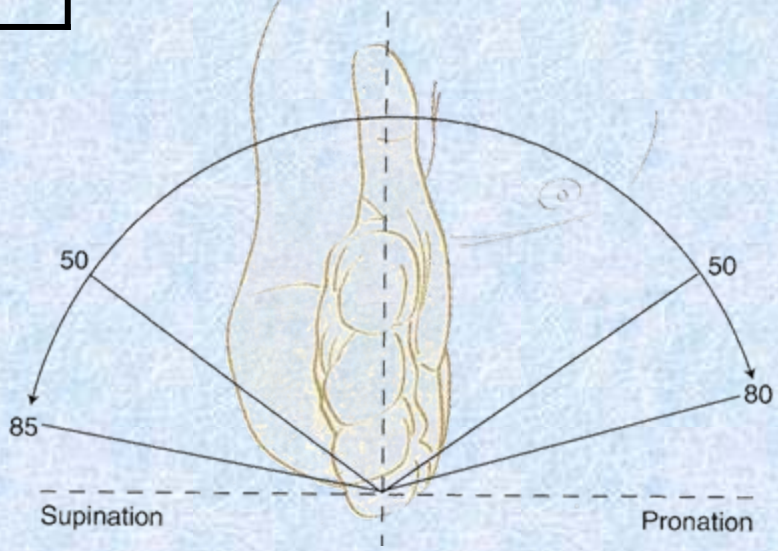
The joint movement required for functional use in daily living tasks

	Motion	Normal ROM	Functional ROM
Elbow	Extension	0	30
	Flexion	145	130
Forearm	Supination	85	50
	Pronation	80	50
Wrist	Extension	60	40
	Flexion	60	40

(O'Neill et al, 1992)







Loss of forearm rotation is extremely disabling

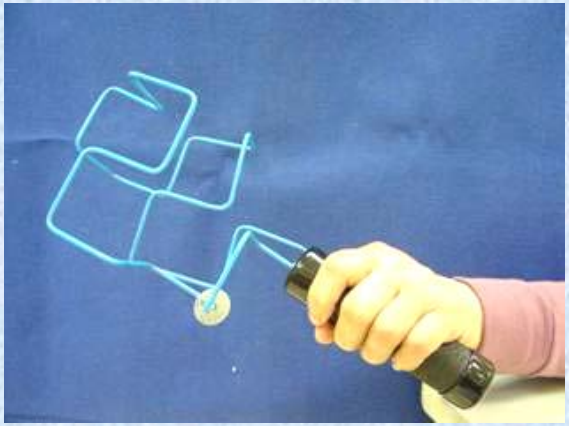
(Duncan, 1992)

- Forearm fracture usually results in loss of forearm rotation
  - complicated dual intra-articular structures of the PRUJ / DRUJ
- Forearm rotation is one of the important features that differentiate human as the most highly developed hominids / mammals (Almquist, 1992)
  - Forearm rotation
  - Increase in brain size
  - Prehensile thumb
- Regaining forearm rotation is one of our treatment focus




Forearm rotation training

Elbow & wrist mobilization
Hand function training



Wrist extensor weakness x fracture DR

- Wrist extensor weakness is due to a period of immobilization in a flexed position (Stanley. B & Tribuzi M, 1992)
- Wrist extension with a substitution pattern by long finger extensor (Terri M. Skirren, 2002)
- Reestablish independent wrist extension is critical to the development of power grip and hand function (Werremeyer MM et al. 1997)

Wrist extension / flexion training

- Re-establish normal muscular balance
- Synergistic relationship
  - Wrist ext. with finger in flexion
  - Wrist flexion with finger in either extension

Strengthening

Start only when

Fracture is clinically stable

Healing in progress

<u>Progressive resistive strengthening activities</u>

Strengthening with computer machinery

(4)
Joint stiffness

Corrective splintage

When to start corrective splintage?

- Joint ROM plateaus before reaching the acceptable functional ROM

- Corrective splintage applied for loss of motion related to:


soft tissue tightness


bony blockage or joint incongruence

(Richard, 1995)

Corrective splintage

Basic principles

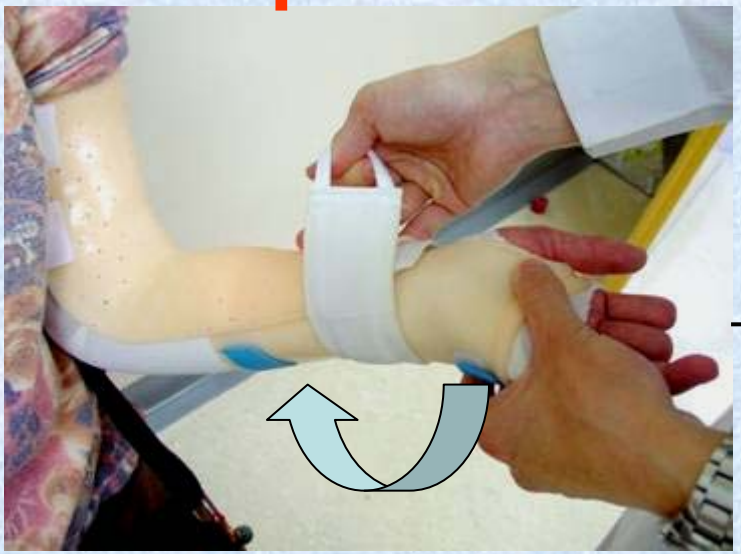
- Excessive / aggressive passive stretching lead to reactive inflammation (Richard, 1995)
- Low-load prolonged stress (LLPS) is more effective than high load brief stress (HLBS) (Flower KR & Michloritz SL, 1988)
  - 20-25 minutes alternative stretching, 5-6 times a day
- Stretch are followed by AROM to re-establish neuromuscular control within the newly obtained motion arcs (Smidt, 2002)

Forearm rotation brace

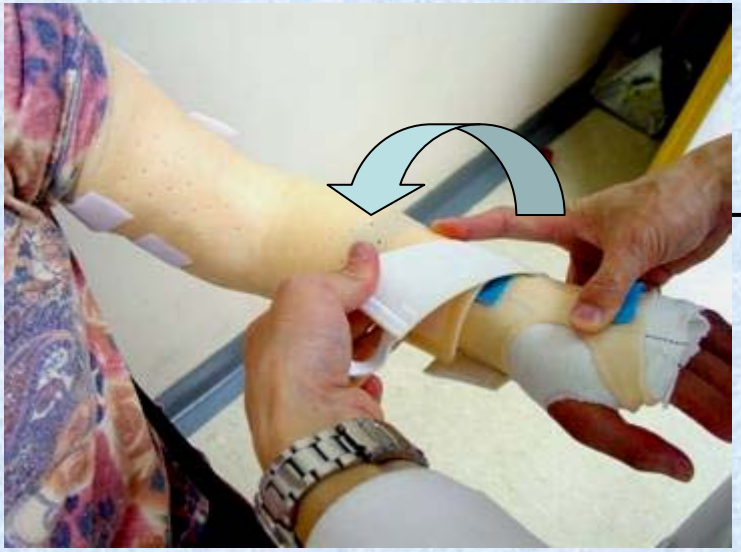
Provides progressive stretch to the joint capsule and soft tissues

Circumferential short arm splint can prevent torque at the wrist

Supination



Follow the axis of radioulnar joints
radial head proximally to the fovea of the ulnar head distally

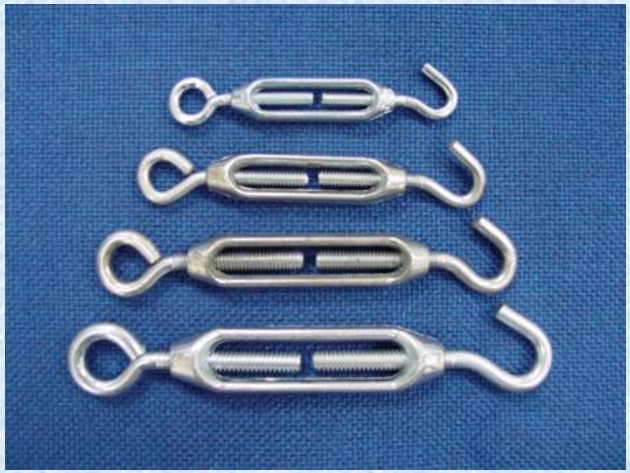


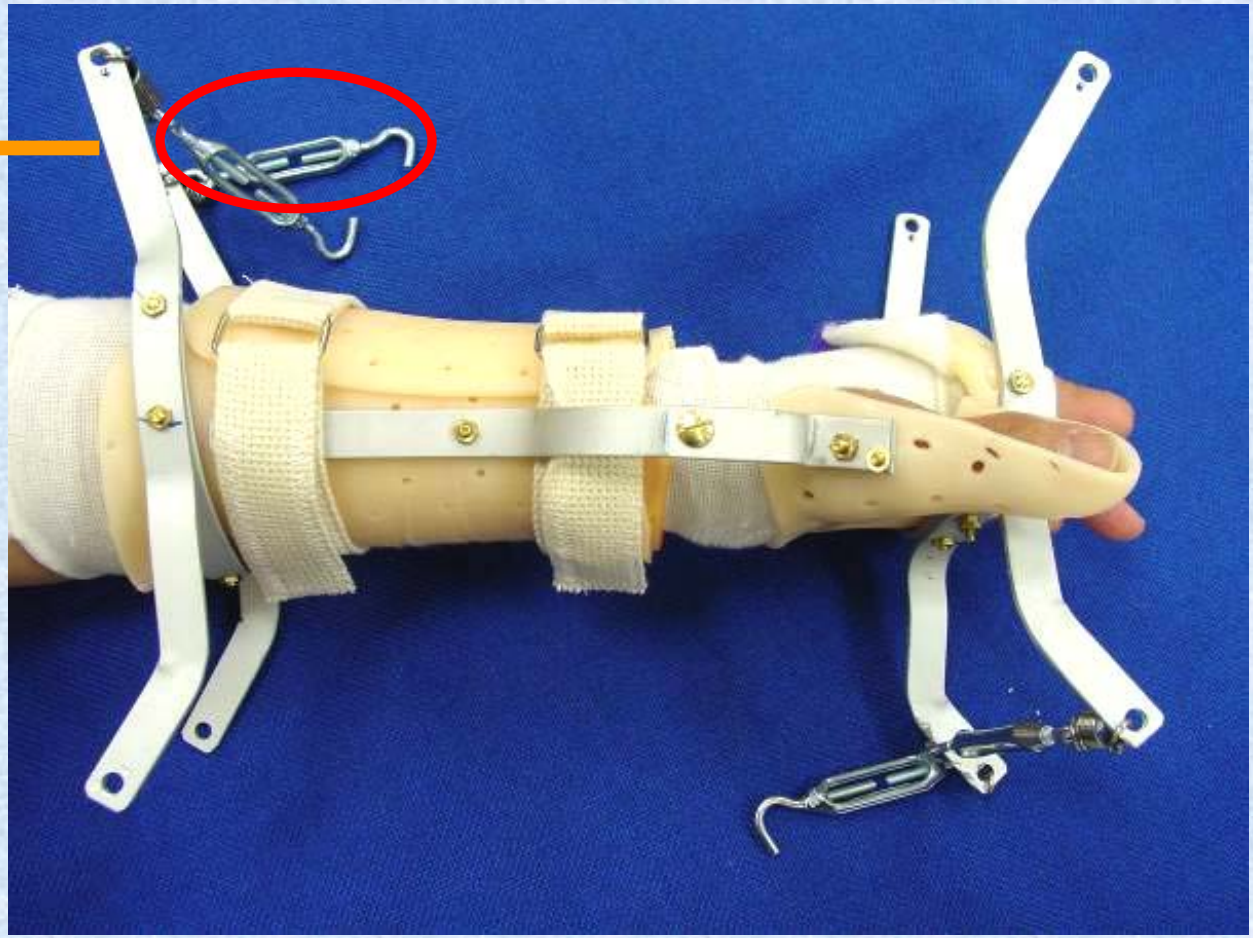
Pronation

Turn buckle brace for wrist E/F

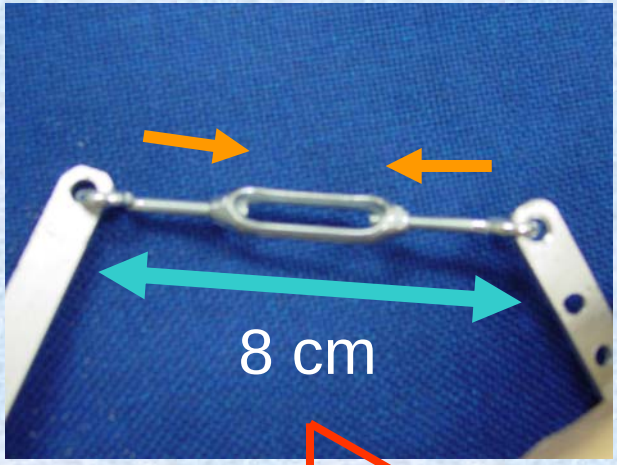
Turn buckle bracing provides progressive stretch to joint capsule and soft tissues by a serial adjustment of the buckle

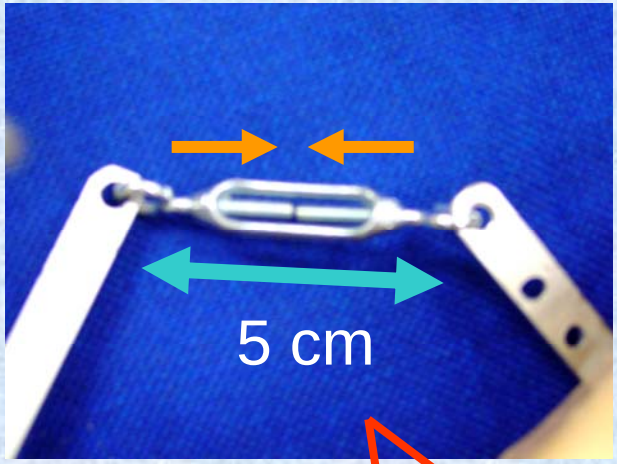
- Buckle -

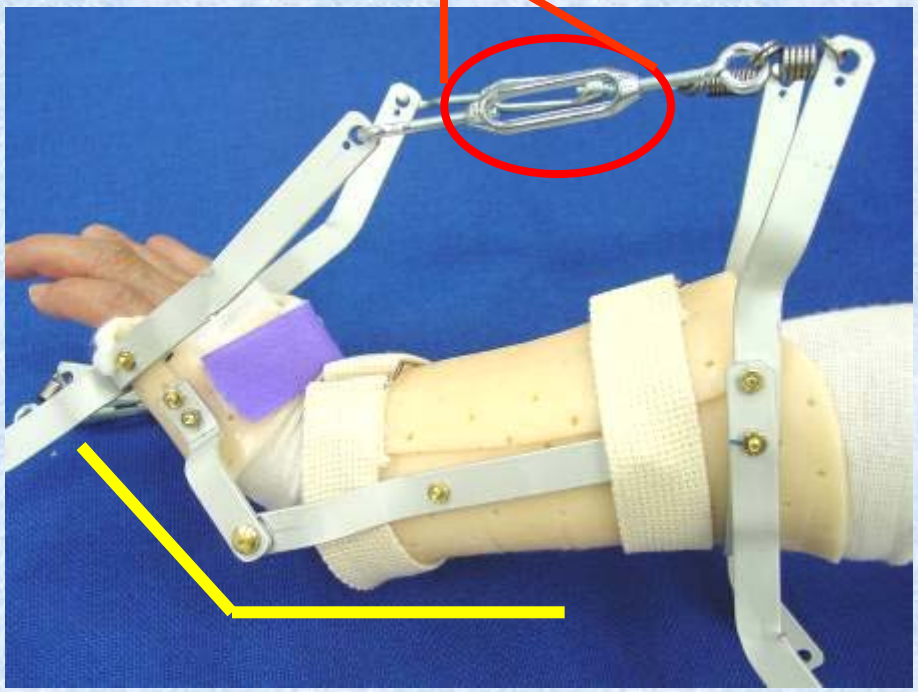


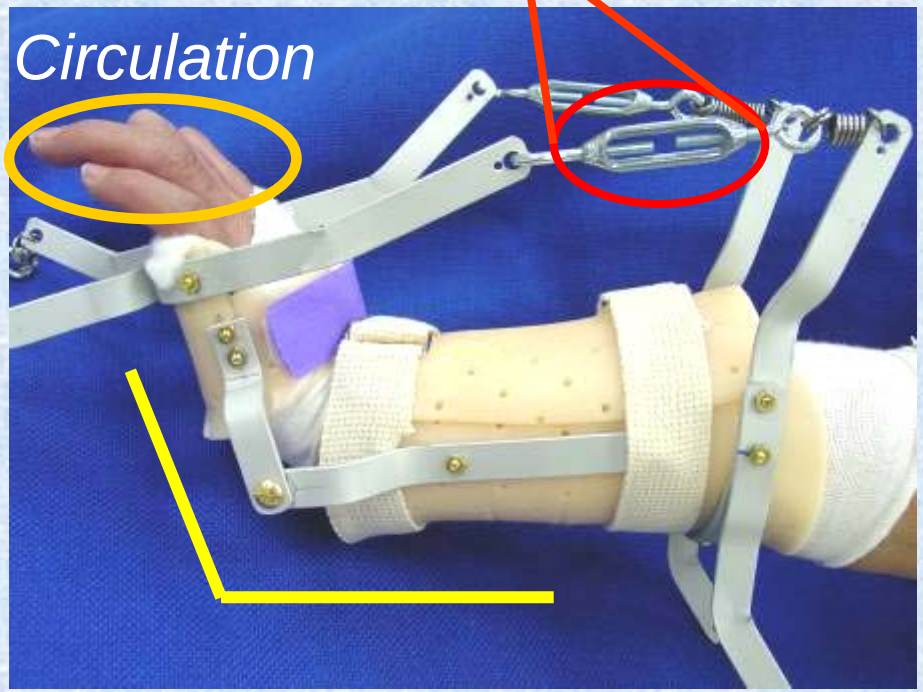


Wrist Extension

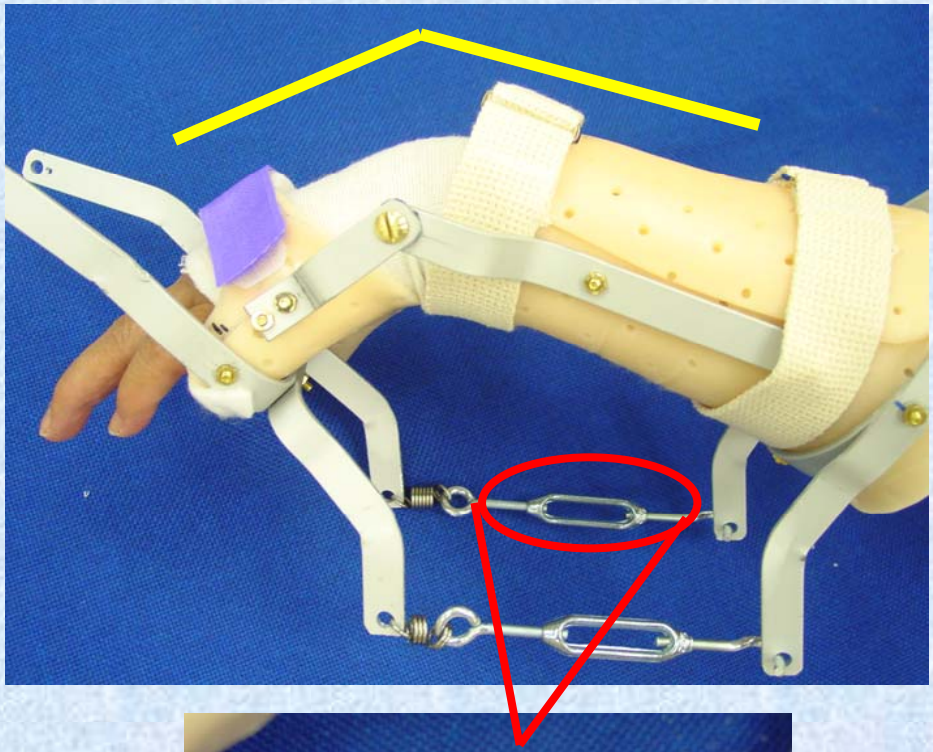


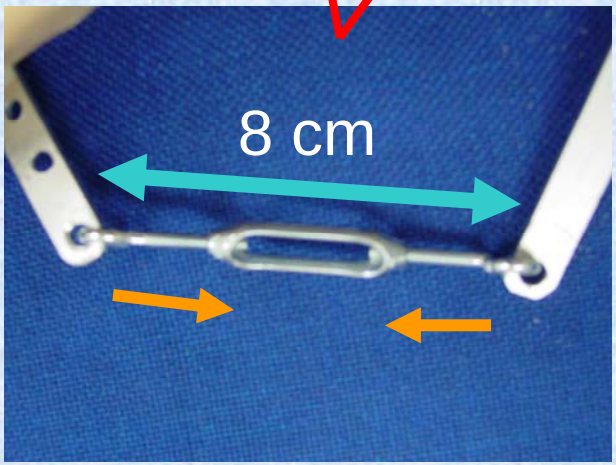


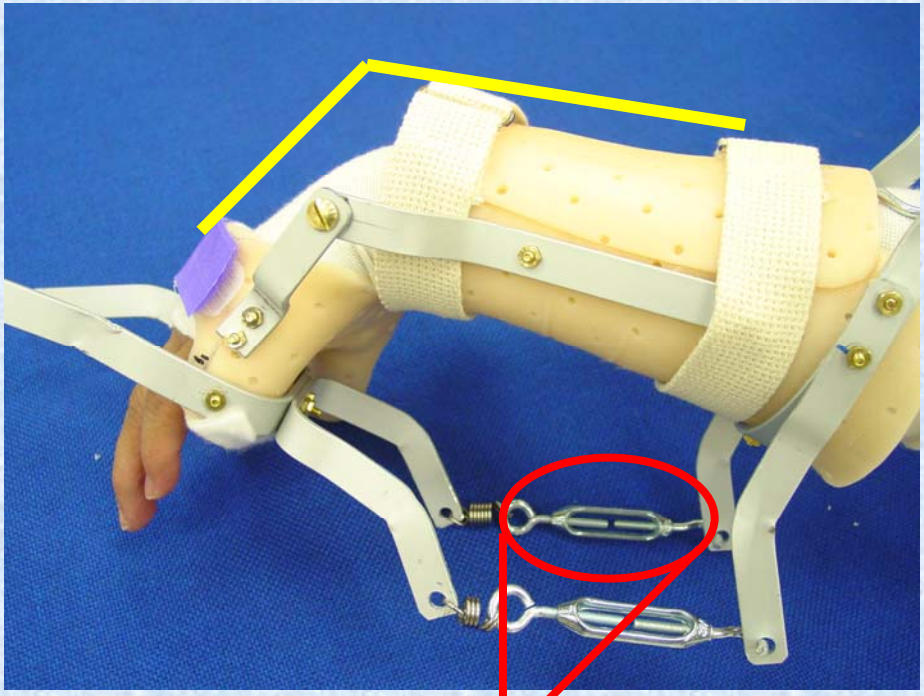


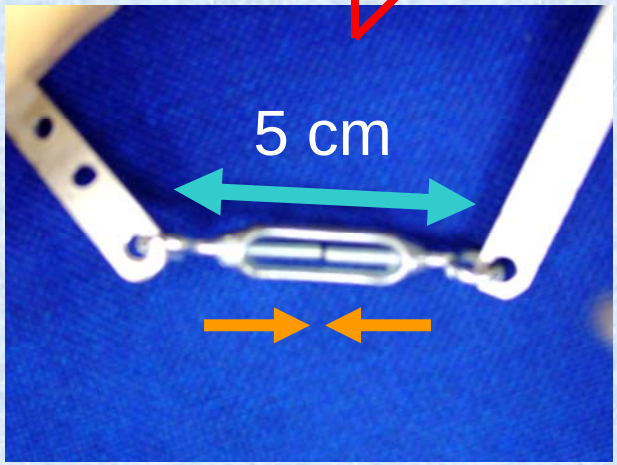


Wrist Flexion



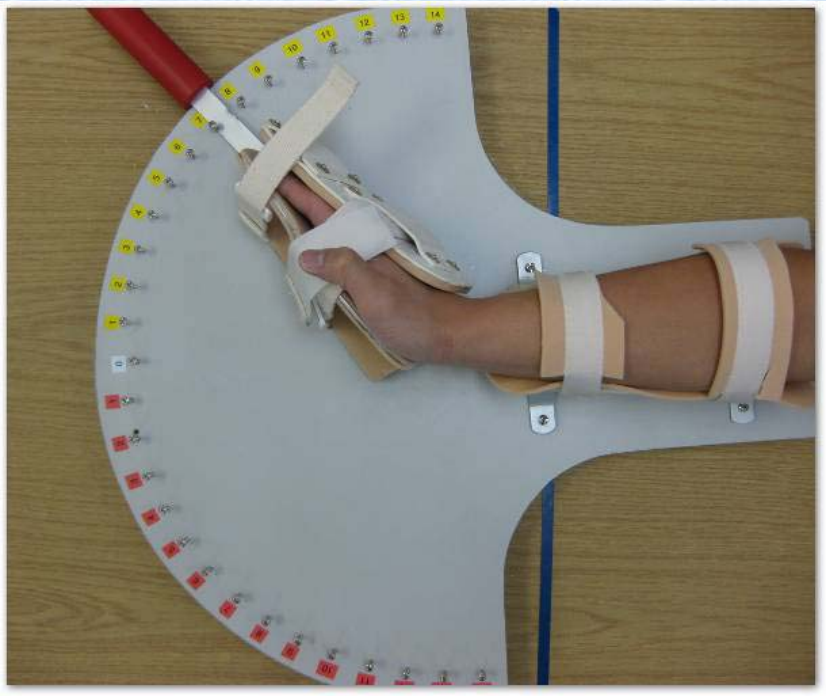


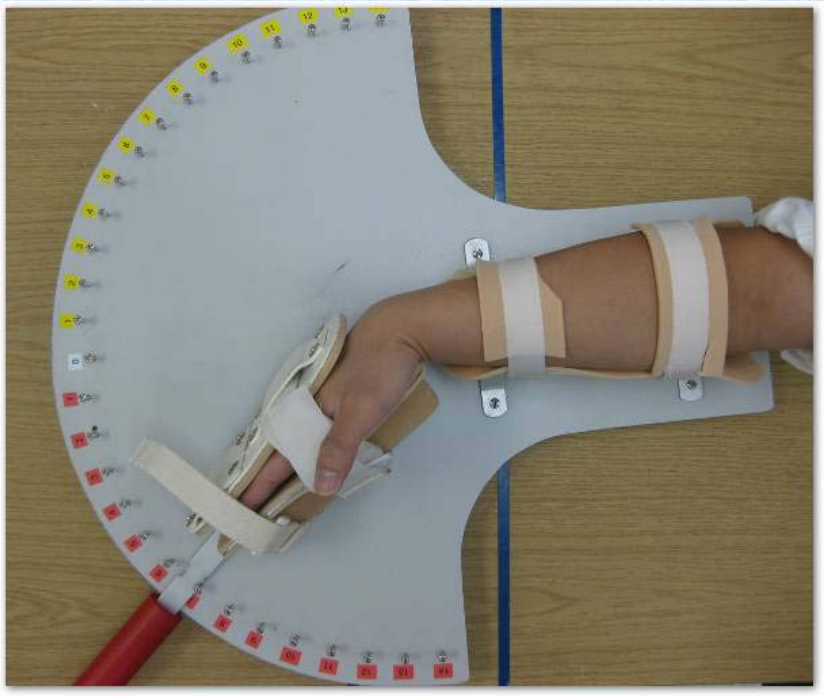




Passive stretching device for wrist E/F

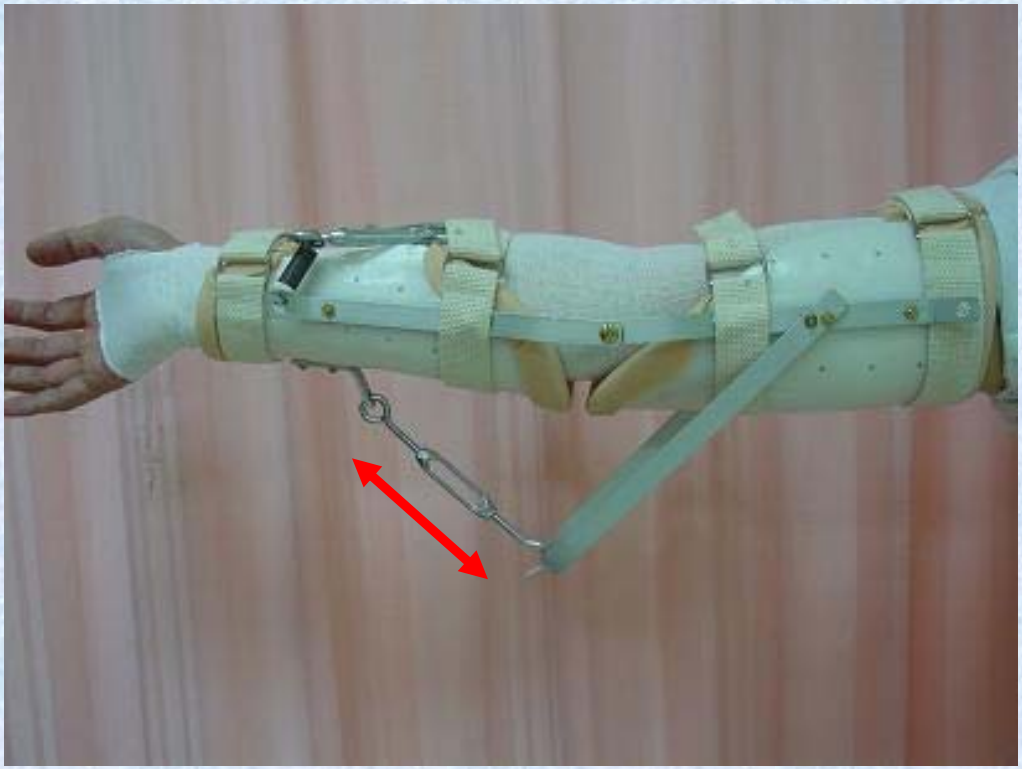
OPD training – alternative wrist E/F stretching



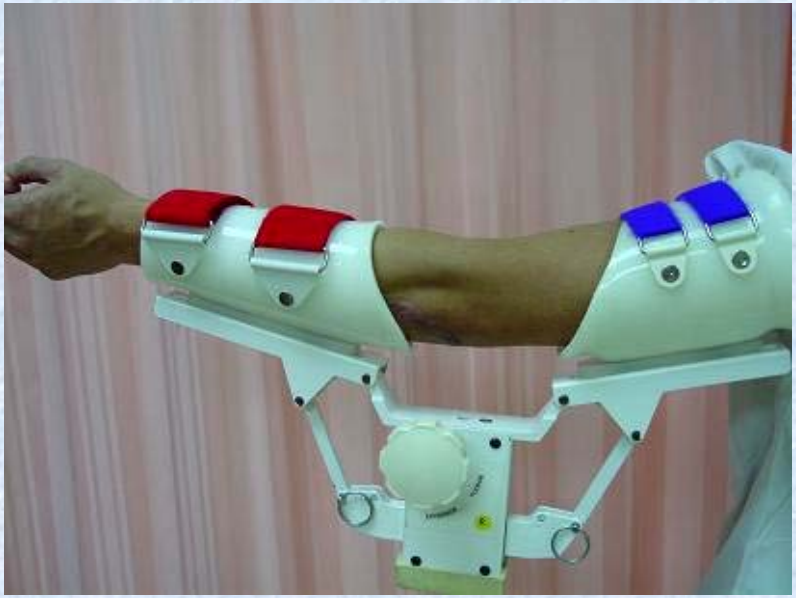


Turn buckle brace for elbow E/F

Turn buckle bracing provides progressive stretch to joint capsule and soft tissues by a serial adjustment of the buckle



JAS device for elbow E/F

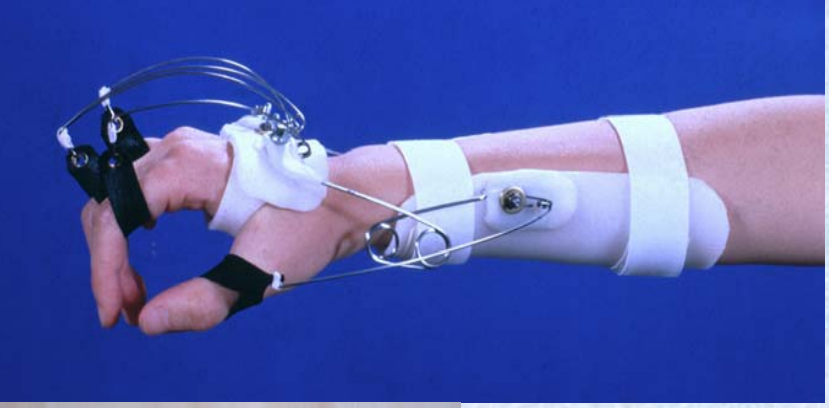


(5)
Uninvolved joints stiffness

Mobilization of uninvolved joints

Mobilization of shoulder, elbow, wrist, fingers & thumb
Prevent soft tissue adhesion
Maintain joint mobility

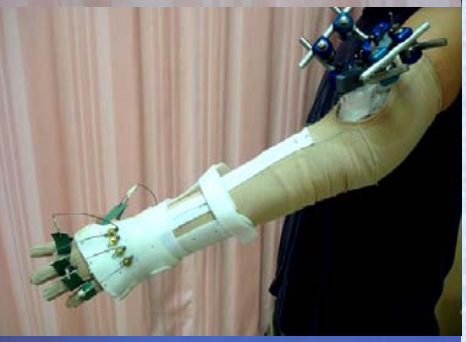
(6)
Complication associated with forearm fracture



Neuropathy

PIN (forearm shaft #)
Dynamic outrigger splint

Radial n. (monteggia #)
Dynamic wrist and finger outrigger splint



Sensory branch of radial n. (Galeazzi #)
sensory charting + sensory reeducation

Ulnar n. (olecranon #)
anti claw hand

Medial n. (DR #)
wrist neutral splint

Permanent

Transient Tardive

Delay- / non- / mal- union

– Common

1. Complicated forearm anatomical structure
2. Imperfect immobilization
   - rotatory shearing movement between fragments

** Improve compliance with immobilization and controlled mobilization program

** Operative management

Ulnar wrist pain

- Common in DR#
- DRUJ instability, ulnar variance
- Wrist arthroscopy
- Conservative Rx or post op rehab. program

Osteoarthritis

- Post traumatic
- Irregularity of a joint surface will accelerate the OA changes

** Avoid heavy weight bearing

Reflex Sympathetic Dystrophy (RSD)

- Persistent pain
- Persistent swelling
- Joint stiffness
- Trophic skin changes
- etc…

(Procacci P, 1987)

→ Close monitoring

→ Start with gentle mobilization as tolerated

→ Pressure garment

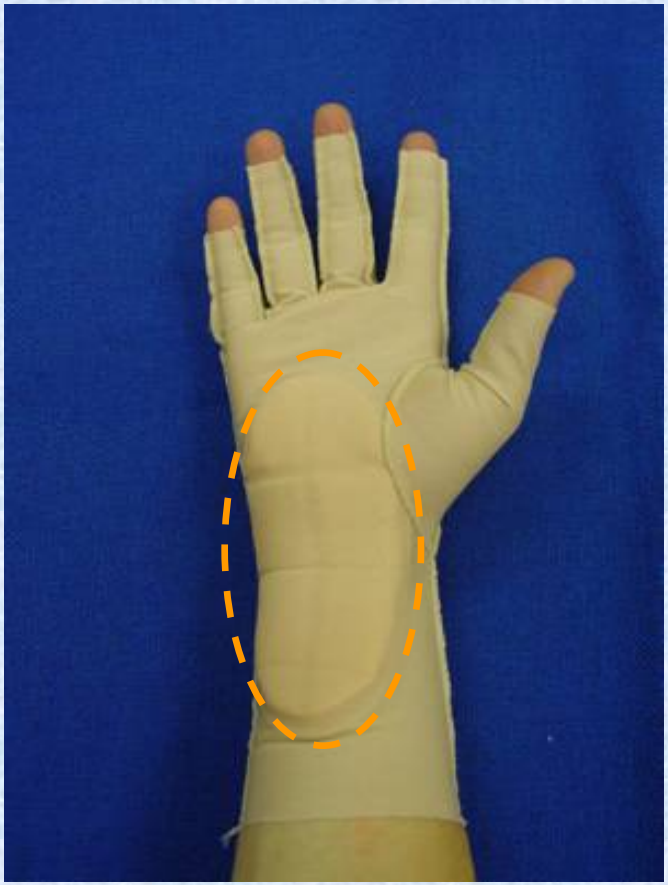
→ Resting splint for pain relief

→ Encourage active use of hand in ADL tasks

(7)
Hypertrophic scar

Scar management

PG +/- Padding



Silicon gel

(8)
ADL deficits

Encourage early involvement of affected limb in ADL tasks

ADL training and aid prescription

(9)
Diminished work capacity
Return to work?

Stage Model of Industrial Rehabilitation

Pathology • Impairment • Functional Limitation • Disability • Feasibility • Employability • Vocational Handicap • Earning Capacity

Patient

Worker

Goal of Work Rehabilitation
Transition of Patient to Worker

Work Complexity / Diversity

Job Analysis

- Identify a patient's Job Demand to match with the patient's Work Capacity to determine treatment goals.

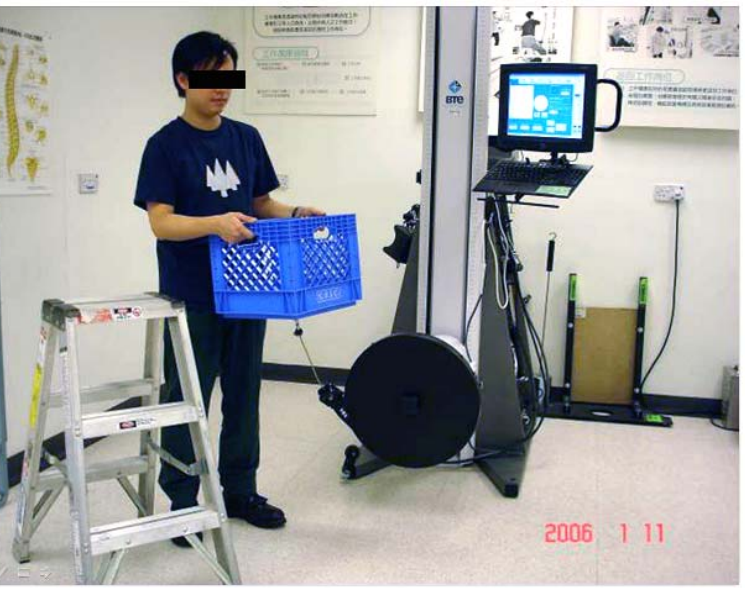
Job Demand

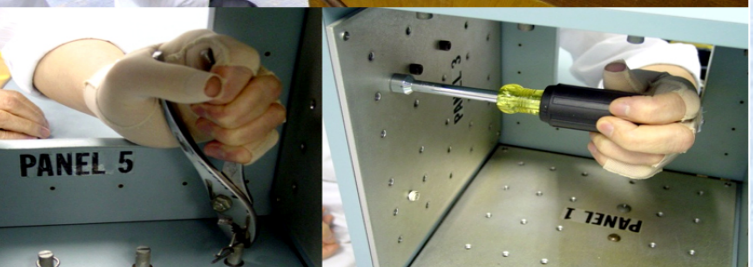
- Physical demand
- Breakdown of tasks
- Tools and machines handling
- Physical Work environment

Taste & Feel

Work Capacity Evaluation

To measure patient's work capacity





Job demand vs pt's work capacity

- Pt's work capacity > job demand
  - Return to work
- Job demand > pt's work capacity
  - Start work hardening program

Work hardening program

Intensive job-specific training to improve pts' work capacity

Work hardening

Structured work simulation

Work hardening

Work Simulators

Conclusion

- Forearm fracture is a common but difficult orthopaedic condition
- Ultimate goal is to restore premorbid functional status
- Require team work in the hospital settings
  - Orthopaedic specialists
  - Nurses
  - Occupational / Physical Therapists


~Thank you~

Reference

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