# Elbow Stiffness

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## INTRODUCTION

- Functional arc of motion (activity of daily living) from 30° to 130°(Morrey et al.)[4)26)27)]
- In spite of the marked stiffness that can be tolerated when adjacent joints have full motion, and request treatment when flexion contractures approach 30°.
- 50% loss of elbow motion resulting in nearly an 80% loss of upper extremity function.

## INCIDENCE

elbow stiffness due to ① high degree of congruency of joint
② close continuity of the muscule to the capsule
③ propensity for comminuted fracture
④ somewhat unique response of joint capsule to trauma

## ARTICULAR CONGRUITY

motion limitation may occur simply because of the presence of exuberant callus
juxtaposed with the articular surface

## PERICAPSULAR MUSCLE

95% muscle rather than tendinous tissue
rich vascular supply enhance contracture of the capsule and the muscle

## COMMINUTED FRACTURE

lack of soft tissue attachment to the comminuted fragment, which causes an incongruous joint and intra-articular adhesions

tight congruity of the joint

## ETIOLOGY

- Most frequently following elbow trauma.
  5% of elbows after traumatic injury[3,15-17,22,23]
- previous fracture-dislocation 38%
- isolated fractures 30%
- previous dislocation 20%
- Inflammatory, degenerative, or septic arthritis.
- Congenital : rare - arthrogryposis
- Paralytic contractures : cerebral vascular accident, cerebral palsy
- Upper limb burn etc.[7]

- Extrinsic contracture[18]
- do not involve the joint(extra-articular), they are the most common type & arise in the soft tissue, bone, or both.
- capsular contracture, flexor-extensor muscle damage,[12] collateral ligament scarring[1], skin contractures
- Heterotopic ossification following closed head injuries, burns, or elbow fracture-dislocations.[19-21,28-30]

- Intrinsic contracture
- intra-articular adhesions with articular cartilage destruction
- fractures, bone spurs, loose bodies, and synovitis
- Peripheral causes
- head injury, cerebral palsy, and neuromuscular dysfuction

- Almost all stiff elbows have a thickened anterior & posterior elbow capsule.
- Secondary contractures of the collateral ligaments & muscles around the elbow can occur.

## CLASSIFICATION

- Classification for Heterotopic ossification of the elbow (Hastings & Graham)
  Type I : involves no fuctional deficits
  Type II : some functional deficits
  Type III : results in elbow ankylosis

### EXTRINSIC CONTRACTURE

soft tissue contracture
osseous ankylosis - ectopic bone formation

### INTRINSIC CONTRACTURE

① intra-articular adhesion
② loss of articular cartilage due to avascular changes of the comminuted segment
③ gross joint distortion due to the initial trauma, or to inadequate or failed reduction

### MIXED CONTRACTURE

in most cases even with marked limitation of flexion and extension, pronation-supination motion is minimally distorted.

**Table 1.** Classification and Pathology Found in Different Types of Joint Contractures

| |
|---|
| Extrinsic |
| Posterior capsule |
| Anterior capsule |
| Osseous bridege |
| Intrinsic |
| Articular adhesions |
| Articular deformity |
| Mixed |

## PATHOGENESIS OF POSTTRAUMATIC ARTHROFIBROSIS

- results from soft-tissue trauma, hemarthrosis, and the patient s reaction to pain.
- tearing and contusion of periarticular soft tissue
  hemarthrosis stimulate fibrous tissue response
  fibrosis, capsular hypertrophy, ectopic bone formation or myositis ossificans
- intra-articular lesions : fractures, osteochondral lesions, or other articular incongruencies

## TREATMENT

### Acute Injury

transolecranon osteotomy - 5% nonunion, intraarticular adhesion
Mayo triceps-sparing approach for more medial fracture
modified Kocher approach for more lateral fracture

### Subacute Trauma

SPLINTS
① static splint : so-called resting splint. It has no hinge; the extremity is placed in it for protection or rest.
②hinged splint : allows motion generated by the patient. It protects against varus and valgus stress.
③dynamic splint : characterized by a mechanism that places continuous flexion or extension across the articulation. spring or a rubber band.
④adjustable static splint : placed in different positions but does not move once the position has been attained.

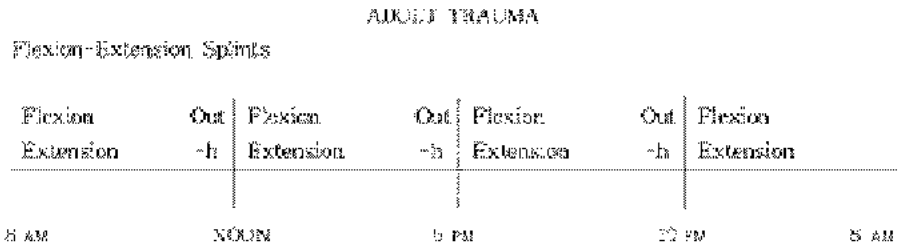


**Fig. 1.** Time schedule for patients with individual instructions instructions regarding splint usage. The time in and out of flexion and extension splints is adjusted every 2 to 4 weeks and written on this schedule.

### Chronic Stiffness

ASSESSMENT
① full understanding of the patient s specific expectation and what functional limitation is being experienced
② analysis of the patient s specific functional needs
③ whether the required intervention is within the competence of the surgeon

pain- 60세 이상 joint replacement
55세 이하 interposition arthroplasty
stability
surgical release of collateral ligament
① obtain adequate soft tissue release

② remove ectopic bone that may have developed in the ligament
③ provide adequate exposure if interposition arthroplasty is performed

weakness

improving elbow motion in this circumstance almost always results in an apparent or real loss of strength, particularly in extension.

range of motion

a 45-degree flexion contracture should rarely be addressed surgically, and only under unusual circumstances would flexion of less than 115 degrees require surgical intervention.

## NONOPERATIVE MANAGEMENT

- most improvement is achieved if treatment is initiated within the first 6 months.
- periarticular soft-tissue injury and in cases without significant intra-articular involvement.
- minimum of 3 months before considering surgery
- physical therapy with active-assisted range of motion
- manipulation under anesthesia
- serial casting
- static progressive splinting & dynamic splinting
- passive ROM exercises that are too aggressive can result in increased stiffness, swelling, and pain and possibly in the development of heterotopic ossification.
- risk of periarticular fractures

## OPERATIVE MANAGEMENT

- Arthroscopic Capsular Release

### 1. Indications

- flexion contracture more than 30 degrees or flexion less than 130 degrees
- lesser degrees of flexion contracture but symptoms of intra-articular pathology (pain, popping, locking)

### 2. Contraindications

- previous surgical procedures around the elbow
- significant extra-articular deformity

- The column procedure

**1. Indications**

- marked limitation of flexion and/or extension
- preservation or minimal changes of the articular cartilage
- anterior contracture and/or posterior contracture

**2. Contraindications**

- significant alteration of the articular contour
- loss of joint cartilage(50%)
- pathology that requires release of one or both collateral ligaments
- motor deficiency or spasticity

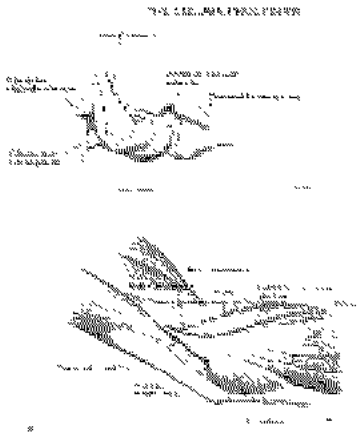

**Fig. 2.**

- postoperative" rebound" about 15 to 20 degrees from the amount of extension gained at surgery, full extension atthe time of surgery is considered.
- advantages
- simple operative technique
- rapid post-op. recovery
- early return of function
- no loss of stability
- ability to approach both front and back

**Extrinsic Motion Loss**

Extrinsic contractures almost always involve the anterior capsule but also can involve the posterior capsule and extensor mechanism.

POSTERIOR CONTRACTURE

A Kocher skin incision is made, and the triceps and posterior capsule are simply elevated from the posterolateral aspect of the joint.

ANTERIOR CAPSULAR CONTRACTURE

Using a modified Henry approach, direct access to the joint allows mobilization of the median nerve and the brachial artery, and a complete capsular incision is carried out.

Ant. release

Results : Patients with significant arthrosis of the joint itself (intrinsic process) did less well and were not considered ideal candidates for this procedure.

Anterior Capsulectomy : Lateral Approach

① it allows release of the triceps and posterior capsule if needed

② the anterior capsule can be simply and safely released, leaving the collateral ligament intact by elevating the brachialis muscle from the scarred capsule

③ release of the lateral collateral ligament may be accomplished if necessary for gaining access to the joint or to allow more thorough soft tissue release.

**Intrinsic Contracture**

interposition arthroplasty

① if more than half of the articular suface has been violated and not covered with hyaline cartilage

② if significant adhesions cause avulsion of half of the articular surface, or

③ if a malunion causes a refashioning of the articular surface

DISTRACTION DEVICE

Indications and Rationale

The rationale for the use of the distraction device is based on the fact that the center of rotation of the elbow constitutes a locus that is less than 4 mm, which is the diameter of the distraction pin.

The landmarks for placing the pin are the anteroinferior aspect of the medial epicondyle and the projected center of the capitellum, which is right in the center of the lateral epicondyle.

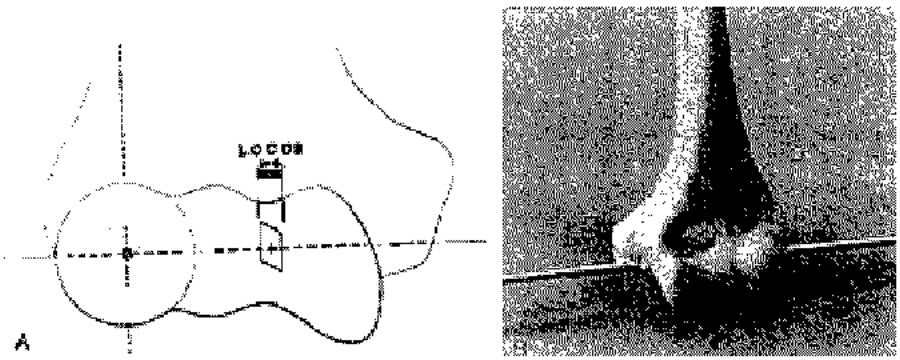


**Fig. 3.** The locus of the center of rotation of the elbow (**A**) is smaller than the 4-mm pin used to replicate this (**B**).

Technique

At surgery, depending on the problem being treated, motion of at least 50 to 110 degrees is possible with the distraction device.

SPLINTS

both an extension splint and a flexion splint are usually required because most patients have intrinsic or mixed elements requiring improvement in both flexion and extension.

The most important information is to have the patient adjust the splint to sleep through the night without undue discomfort, and to avoid inflammation with anti-inflamatory agents and ice.

Splint treatment is continued for a minimum of 6 weeks and often up to 3 moths.

## RESULTS

Motion

**Table 2.** Mean Flexion Arc Before and After 26 Distraction Arthroplasty Procedures

| Parameter | Extension (degrees) | Flexion |
|---|---|---|
| Preoperative motion (mean) | 62 | 95 |
| Postoperative motion (mean) | 27 | 122 |
| Improvement | +35 | +27 |

## PAIN

No patient had more pain after surgery than before.

## STABILITY

no patients had significant instability after reconstruction.

The contour of the joint is intended to remain congruous and provide some inherent stability, and the collateral ligaments are meticulously reconstructed and protected.

## STRENGTH

A loss off about 15 percent of extension strength was revealed, compared with a gain in flexion strength of about 10 percent. Pronation and supination strength decreased about 20 percent, and grip strength decreased about 50 percent.

## COMPLICATIONS

**Table 3.** Complications After 77 Releases for Elbow Stiffness

| Complication | NO. (Reoperation) |
|---|---|
| Infection total | 6 (3) |
| Deep | 2 (2) |
| Pin site | 4 (1) |
| Neural total | 8 (3) |
| Ulnar neuritis (temporary) | 5 (2) |
| Radial neuritis | 2 |
| Median nerve transection | 1 (1) |
| Motion lost | 1 |
| Wound slough (superficial) | 1 |
| Neurotrophic joint (?) | 1 |
| Triceps avulsion | 1 (1) |
| TOTAL | 18 [23%] (7 [9%]) |

### Total Joint Replacement

As an alternative to the preceding discussion of procedures for the stiff elbow, joint replacement arthroplasty might be considered.

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