Examination of the Elbow

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Clinical Orthopedic Rehabilitation Education
elbow articulations

Humeroulnar and Humeroradial Joints
- uniaxial diarthrodial joints with 1° of freedom
- sagittal plane flexion-extension about a coronal axis

Superior and Inferior Radioulnar Joints
- uniaxial diarthrodial pivot joints with 1° of freedom
- transverse plane supination-pronation about a longitudinal axis
Joint Morphology Reminder
Humeroulnar Joint

**Concave Surface:** ulna – trochlear notch

**Convex Surface:** humeral trochlea

**Closed Pack Position:** full extension

**Resting Position:**
- 70° flexion;
- 10° supination

**Capsular Pattern:** flexion > extension
Joint Morphology Reminder
Humeroradial Joint

Concave Surface: radial head
Convex Surface: humeral capitellum
Closed Pack Position: 90° flexion; 5° supination
Resting Position: Full extension-supination
Capsular Pattern: flexion = extension
Joint Morphology Reminder
Proximal Radioulnar Joint

Concave Surface: 
Convex Surface: 
Closed Pack Position: 5° supination
Resting Position: 70° flexion; 35° supination
Capsular Pattern: Equal limitation of pro-supination

radial notch of ulna
radial head
Ligamentous Support

**Ulnar (medial) Collateral Ligament**
- triangular ligament composed of three bands (anterior, posterior, and oblique) on the medial side of the elbow
- Anterior portion is the primary stabilizer to valgus stress from 20-120°

**Radial (lateral) Collateral Ligament**
- fan shaped ligament on lateral side of the elbow
- reinforces humeroradial articulation, protects against varus stress, and resists distraction to the joint surfaces
% contribution to resist varus, valgus, and distractive stresses at the elbow

<table>
<thead>
<tr>
<th>Force</th>
<th>Valgus Stress</th>
<th>Varus Stress</th>
<th>Distraction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0°</td>
<td>90°</td>
<td>0°</td>
</tr>
<tr>
<td>UCL</td>
<td>31%</td>
<td>54%</td>
<td>6%</td>
</tr>
<tr>
<td>RCL</td>
<td></td>
<td></td>
<td>14%</td>
</tr>
<tr>
<td>Joint Capsule</td>
<td>38%</td>
<td>10%</td>
<td>31%</td>
</tr>
<tr>
<td>Osseous</td>
<td>31%</td>
<td>33%</td>
<td>55%</td>
</tr>
</tbody>
</table>
elbow axis orientation

- the longitudinal axis of the forearm is abducted relative to the longitudinal axis of the humerus in full extension.
- as the elbow flexes the forearm moves medially to parallel the longitudinal axis of the humerus in full flexion.
Carrying Angle

- 5º in men
- 10-15º in women

with the elbow extended and supinated
Imaging Review

lateral view

humerus

radius

ulna

UT Southwestern Medical Center
What is this?
What is this?

Radial Head Fracture
What is this?  fat pad sign

never normal posteriorly
Rule Out Elbow Fractures
Presence of full active elbow extension

- **SN = 97**
- **SP = 69**


- **SN = Prospective multi-center validation study**
  (adults and children)
  - **SN = 97** (negative LR = 0.03)
  - **SP = 49**

Olecranon Enthesophytye

Olecranon Bursitis
subjective interview

- Chief complaint & rehab goals
- Mechanism of Injury
- Current Status and Previous Treatment
- Location, nature, severity of symptom(s)
- Meds, Injections, Braces, Slings?
- Aggravating-Relieving Factors
- Previous History
Key Questions

- Does your complaint change with posture or movement of your neck?
  - Cervical spine exam indicated
- Does your elbow ever slip out or feel unstable?
  - Elbow instability
- Does your pain change with gripping activities?
  - Tendinopathy
- Do you ever experience numbness or tingling in the hand?
  - Nerve entrapment/compression syndromes
- Was your elbow hyperextended during your injury?
  - Check for fracture and/or capsular/ligamentous damage
- Is your complaint aggravated by throwing?
  - Medial instability/overuse
Observation and General Appearance

- Posture
- Symmetrical Appearance
  - dominant arm differences
Observation and General Appearance

Anatomical Deformities

» Soft Tissue swelling, effusion, atrophy, etc
  – Swelling most visible in posterolateral elbow

» Carrying Angle
  – presence of cubitus varus (< 5°) or cubitus valgus (>15°)

» Isosceles triangular relationship of olecranon and medial and lateral epicondyles in 90° of flexion
  – Linear relationship in full extension
elbow triangle sign

medial and lateral epi-condyles relationship to the olecranon in full extension and 90° flexion
CERVICAL CLEARING

- AROM with overpressure to end range or cervical radiculopathy CPR to rule out proximal involvement
  - cervical rotation
  - lateral flexion
  - flexion-extension
  - protraction-retraction
elbow range of motion

Extension/Flexion
- AROM – 0-145°
- PROM – 0-160°

Pronation/Supination
- AROM – 85-0-90°
Elbow AROM Considerations

**Flexion – Extension ROM:**
- Highly Reliable ICC > .90
- Meaningful Change 5°
- Functional range 30° – 130°

**Pronation – Supination:**
- Highly Reliable ICC > .90
- Meaningful Change 10°
- Functional range 50° – 0° – 50°

- Quantity-Quality-Effect on Symptoms
Elbow PROM

Normal End Feels

• Flexion
  » soft tissue approximation or hard bony end feel of coranoid process abutting coranoid fossa in individuals with minimal biceps bulk

• Extension
  » bony or abrupt end feel as olecranon process enters the olecranon fossa for hyperextension or bicep muscular tension in well developed males

• Pronation-Supination
  » firm capsular for supination and hard firm end feel in pronation as the radius hits the ulna and capsular ligaments become tense
Clinical Interpretation of Mobility Exam

PROM

• What directions of motion reproduce complaint?
• What is the cause of the limited motion?
• What is the general tissue extensibility?
• What is the pain-resistance sequence?
Accessory Motion Testing of the ELBOW

Humeroulnar Medial/Lateral Glide
» medial force directed through the radial side of the proximal forearm and a lateral force directed through the ulnar side of the forearm

Radiohumeral Dorsal/Ventral Glide (in full extension)
» dorsal force on the ant surface of the proximal radius and a ventral force to the posterior surface of the proximal radius

Superior Radioulnar Ventral-Medial/Dorsal-Lateral Glide
» ventral medial force to the posterior surface of the proximal radius and a dorsal lateral force to the anterior surface of the proximal radius
Elbow manual muscle testing

- Biceps
- Triceps
- Pronators
- Supinators
- Wrist Flexors-Extensors
- Wrist Deviators
- Shoulder Rotator Cuff
elbow palpation

**Soft Tissue Structures**
- Ulnar nerve
- Common flexor insertion
- UCL
- Olecranon fossa
- Triceps insertion
- Brachioradialis
- RCL
- Annular ligament
- Bicep tendon
- Brachial Artery
- Median nerve

**Bony Structures**
- Med-Lat Condyles
- Olecranon
- Olecranon Fossa
- Radial Head
- Capitellum

Can review any bony or soft-tissue landmark during lab as requested
ELBOW SPECIAL TESTS
valgus stress
UCL integrity test

- impart a valgus force (ulnar abduction) in mid-range flexion to evaluate for instability or pain as compared to the opposite side
“milking” test

- provocative maneuver for evaluating UCL instability
- test stresses the posterior band of the **anterior** bundle
- With the patient’s forearm fully supinated, the thumb is grasped and a valgus stress is applied to the elbow as the joint is flexed > 90° or flexed and extended while maintaining valgus stress
- A positive test reproduces the symptoms of medial elbow pain
Milking Test or O’Brien Sign

- The milking test is also known as the O’Brien sign when valgus stress is produced by pulling on the thumb and reproducing medial elbow pain.
The Moving Valgus Test for UCL Tears

- Performed at 90° of shoulder
- Starting with elbow maximally flexed a modest valgus stress applied at the elbow until the shoulder reaches end range external rotation
- While the valgus load is maintained the elbow is quickly extended
The Moving Valgus Test for UCL Tears

- Test is + when medial elbow pain is reproduced in 120-70° range
  - consistent with the late cocking and early acceleration phases in the throwing motion
- Highly SN (100%) and SP (75%)

Valgus Extension Overload

Valgus stress is maintained while taking elbow from 30° of flexion into complete extension to accentuate the contact between the medial aspect of the olecranon and the olecranon fossa.

Osteophyte development on the posterior medial aspect of the olecranon process will produce a positive test with pain and palpable grating.
impart a varus force (ulnar adduction) in mid-range flexion to evaluate for instability or pain as compared to the opposite side
Tennis Elbow Test
Lateral Epicondyle Pain

Mill’s Test (passive stretch of common extensors)
- Elbow placed in extension, forearm in pronation, and wrist in ulnar deviation
- From this position the examiner passively flexes the wrist to end range

Cozen’s Test (active contraction from position of stretch)
- Reproduction of pain at the common extensor when wrist extension is resisted in position of elbow extension, forearm pronation, and wrist ulnar deviation
however, the clinical utility of these tests has not been studied

- Mills test and resisted wrist extension tests (Cozen’s) were positively correlated with perceived pain, *and*
- resisted wrist extension tests were associated with decreased grip strength.

Study not specifically designed to gauge diagnostic accuracy

Golfer’s Elbow Test
Medial Epicondyle Pain

- Elbow placed in extension and forearm in supination
- From this position the examiner passively extends the wrist to end range
- Test is positive when medial elbow symptoms are reproduced at end range wrist extension or with resistance to wrist flexion from this position
radial capitellar crepitus

- Elbow in 90° of flexion with one hand cupping the elbow with the finger tips directly over the radial head and lateral epicondyle
- Other hand is placed in the patient’s hand and exerts compressive force through the radius while moving the elbow through a small range of flex-extension and pro-supination
- Pain and palpable grating are reported as a positive test and compared to the opposite side
Coat Hook Test

• Evaluation of distal tendon bicep integrity
  - can not “hook” the tendon in a complete avulsion whereas a partial tear will cause pain when it is hooked with the finger

• Perfect SN/SP (100%)

Functional Grip Strength

Patient sits with elbow flexed 90°, forearm in neutral, and slight wrist extension and squeezes maximally on a hand dynamometer.

Findings are reported bilaterally in units of psi, kg or mm hg.
Push-off Test

- Quantify a patient’s ability to bear weight through the upper extremity using a HHD with handle reversed to the curved side
  - High reliability with low SEM and good relation to function
  - Should not be significant differences based on handedness

Micholivitz SA. CSM, 2004
Pinch Grip Test

Patient is asked to pinch the tip of the thumb to the tip of the index finger.

If the subject is unable to pinch tip to tip, but instead pinches by approximating the pads of the distal phalanges, the test is positive and indicates a lesion in the anterior interosseus nerve.

**Pronator Teres Syndrome** (branch of the median nerve)

Jeanne’s Sign

normal
Tinel’s Sign

- Examiner taps the ulnar nerve where it lies in the cubital tunnel

- A tingling sensation within the distribution of the ulnar nerve in the forearm or hand constitutes a positive test

- Tinel's sign can also be elicited for the median nerve by tapping over the median nerve in the carpal tunnel of the wrist
# Additional Provocative Tests for Cubital Tunnel Syndrome

<table>
<thead>
<tr>
<th>Test</th>
<th>SN</th>
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<tbody>
<tr>
<td>Tinel’s Sign</td>
<td>.70</td>
</tr>
<tr>
<td>Elbow Flexion Posture</td>
<td>.32</td>
</tr>
<tr>
<td>Pressure Provocation</td>
<td>.55</td>
</tr>
<tr>
<td>Pressure Provocation in Elbow Flexion</td>
<td>.91</td>
</tr>
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Scratch-Collapse Test
Level II Diagnostic Study – Cheng CJ, J Hand Surg (Am), 2008

If the patient has allodynia (scratch stimulus should not be painful) due to compression neuropathy, a brief loss of muscle resistance will be elicited.

<table>
<thead>
<tr>
<th>Quality</th>
<th>Finding</th>
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<tbody>
<tr>
<td>SN</td>
<td>.69</td>
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<tr>
<td>SP</td>
<td>.99</td>
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<tr>
<td>NPV</td>
<td>.86</td>
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<tr>
<td>PPV</td>
<td>.99</td>
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<tr>
<td>Accuracy</td>
<td>.89</td>
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<tr>
<td>+ LR</td>
<td>69</td>
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<tr>
<td>- LR</td>
<td>.31</td>
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**SIREFT – Shoulder Internal Rotation Elbow Flexion Test**

**Provocation Position**

- 90° abduction slightly in front of coronal plane with maximal IR
- Forearm supinated, wrist and fingers extended and slowly flex elbow to end range to hold for 5 seconds
- + test is reproduction of ulnar paraesthias

- SN = .87 (13/98 = - LR of 0.13)
- SP = .98 (87/2 = + LR of 44)

Comparison of Shoulder IR to Elbow Flexion

- Sensitivity of 80% at 10 seconds for shoulder IR
- Sensitivity of 36% at 30 seconds for elbow flexion

outcome assessment tools

- Functional self-reports
  - Patient-rated Elbow Evaluation
  - American Shoulder Elbow Surgeon’s
    - Pain, functional difficulty, and activity ability scales

- Region Specific Scale
  - DASH

- General Health or Quality of Life Measures
  - SF-36