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Upper Extremity Assessment: Elbow to Hand

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Learning Objectives

By the end of the course, the participant will be able to:

- Identify appropriate assessments for determining the cause of pain and/or dysfunction for several common upper extremity conditions.
- Differentiate between capsular tightness, intrinsic tightness, and extrinsic tightness in the hand.
- Recognize the correct techniques for measurement of range of motion for the elbow, wrist, hand, and grip/pinch strength.
Today's Outline

- History
- Range of Motion
- Grip and Pinch Strength
- Volume
- Sensibility
- Stiffness
- Pain (Provocative Testing)
- Outcome Measures

History

- Most important part of assessment
- Develop rapport
- Obtain informed consent, release of information if needed
- Obtain information about injury, past injury, other medical conditions, treatment to date
- Document observations and investigations – look for pain behaviors and general posture of upper extremity while talking
- Determine goals (informal) This tends to happen with future visits in a busy setting. This applies to some assessments too.
**History**

<table>
<thead>
<tr>
<th>Date</th>
<th>Referring Source</th>
<th>Next Appt</th>
<th>Date of Injury</th>
<th>Dominance</th>
<th>Third Party Source (please circle)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WSIB Insurance, Self Pay</td>
</tr>
</tbody>
</table>

Diagnosis:

Surgical Procedure/Date:

Occupation/Hobbies:

Consent received to release information contained in this database to:

Patient Signature:

Why Measure?

- Establish a baseline
- Document improvement (or lack thereof...)
- Determine effectiveness of specific treatments
- Some measures are surrogates for occupational performance
- Outcome measures can justify overall practice
AROM or PROM?

- Most of the ROM measurements we discuss will be AROM.
- There are some specific occasions when PROM is measured.

“Normal” AROM

- Elbow ext/flex: 0/145
- Wrist ext/flex: 70/75
- Wrist RD/UD: 20/35
- Pronation/Supination: 70 to 75 / 80 to 85
- Finger MCP ext/flex: 0 to +30/90
- Finger PIP ext/flex: 0/100
- Finger DIP ext/flex: 0/80
“Functional” AROM

- Different for all clients
- There are some numbers that we usually aim for:

- Elbow ext/flex – 30/130 \(^{(1)}\)
- Wrist ext/flex – 40/40 \(^{(2)}\)
- Pronation/supination – 50/50 – supination more important

\(^{(1)}\) Sardelli et al., JBJS 2011 93(5), 471-477

Goniometry

- Usually has good inter-rater and intra-rater reliability – within 5-10 degrees *
- Should select the appropriate size/type of goniometer
- Stationary arm is usually proximal, with the goniometer centred over the joint axis of rotation
- Notations are used for descriptive purposes
  1. 0 is neutral or full extension
  2. + means hyperextension
  3. - means extensor lag

Elbow Extension and Flexion

- Normal 0/140
- Goniometer centred over capitellum
- Proximal arm along humerus (not always the middle of arm)
- Distal arm between radius and ulna with forearm in neutral

Forearm AROM

- Sitting position
- Arm “eyeballed” perpendicular to floor
- Goniometer “eyeballed” to be perpendicular to floor then also over volar wrist with supination
- Sometimes inaccurate – currently developing a new method
Wrist Extension and Flexion

- 3 different techniques
- Radial, ulnar, dorsal/volar
- All acceptable reliability coefficients, but dorsal/volar is best – and easiest
- Carter et al. Accuracy and Reliability of three different techniques for manual goniometry for wrist motion J Hand Surg 2009 34

Wrist Radial and Ulnar Deviation

- Hand flat on table
- Proximal arm centred between radius and ulna
- Axis over lunate
- Distal end over centre of 3rd metacarpal head
Finger AROM

- Dorsal Approach, using a flat finger goniometer
- Wrist in neutral position
- Usually measure all joint in one finger rather than all MCP’s then PIP’s then DIP’s – to avoid cheating

Thumb AROM

- Similar to finger ROM
- Use dorsal placement for MCP and IP joint
Total Active Motion (TAM)

- TAM is a nice summary measure to describe the amount of active finger motion.
- When improvement is slow, this is a good way to encourage clients to keep at it.
- To record TAM, just add together the range at each joint for the MCP, PIP, and DIP.

TAM Examples

- MCP is 0/70, PIP is -10/80, DIP is -5/45
  - Total active motion is 70+80+45-10-5=180 degrees

- MCP is 0/80, PIP is +10/90, DIP is 0/50
  - Total active motion is 80+90+50+10=230 degrees
Other Measures

- Tip to Distal Palmar Crease (DPC) – measured in cm or mm
- Thumb Opposition – what finger?

Grip and Pinch Strength

- Reliable and valid measurement techniques
- Very well accepted methods of measurement using a dynamometer and pinch gauge
Grip & Pinch Strength

- When to measure grip and pinch strength?
- What does grip and pinch strength tell you?
- Is 20 kg good grip?

Grip Strength

- Seated
- Elbow at side, flexed to 90 degrees
- Forearm and wrist in neutral
- Average 3 trials, with adequate rest in between
- For screening, usually use handle position 2
Grip Strength

- Normative data is available
- Several studies looking at psychometric properties
- Best benchmark is almost always the contralateral side

Pinch Strength

- 3 types commonly measured
- Tip to tip
- Lateral (Key)
- Tripod
Pinch Strength

- Usually with forearm in neutral
- Wrist in slight extension
- Norms readily available
- Important to measure the same each time

Volume

- Volumeter is a standardized tool
- Dowel between long and ring fingers
- No touching the sides
- Water must completely stop
Volume

- Circumferential measures used around the elbow, wrist, PIP’s and DIPs

Volume

- When should you measure?
Assessment of Sensation

- Options:
  1. One point sensory threshold (Semmes-Weinstein Monofilaments)
  2. 2 Point discrimination – static and moving
  3. The Ten Test

Semmes-Weinstein Monofilaments

- Standardized measure with good reliability, sensitivity and validity with respect to sensory threshold
Semmes-Weinstein Monofilaments

- Each monofilament is a different thickness
- Hand usually supported with putty or a towel
- Applied perpendicular to the skin until it bends
- Held in place for 1-2 seconds then removed
- With vision occluded, client responds when they feel the stimulus

Semmes-Weinstein Monofilaments

- Smaller number means better one point sensory threshold
- 2.83 is the monofilament commonly used for screening and considered normal if you can feel this one
- Used to assess amount of nerve damage and for mapping nerve injury and recovery
Static 2-Point Discrimination

- Easier and faster to administer than Semmes-Weinstein
- A measure of the ability to detect 1 vs 2 points – not light touch sensory threshold
- Not as reliable as Semmes-Weinstein, due to differences in application pressure
- Moving even less reliable than static

2-Point Discrimination

- Hand supported in a comfortable position
- 7-10 responses should be correct for accuracy
- At the tip of finger, 3-4 mm is considered normal for static
- 7 mm normal for moving 2-point
- Remember to test along the digital nerve – not across 2 nerves
The Ten Test

- The patient develops a ratio between normal light moving touch and diminished moving touch.
- Subsequent determinations can detect serial changes.
- The ratios obtained can be compared with a standard scale of sensibility with a high degree of validity and reliability.


Stiffness

- Assessment of stiffness is usually performed by looking at PROM.
- We will discuss the assessment of hand stiffness since this is most difficult.
Stiffness

- In the hand, a limitation in passive joint motion can be due to 3 things:
  1. Joint capsule or peri-capsular structures
  2. Intrinsic muscle contracture or adhesion
  3. Extrinsic muscle contracture or adhesion

Assessment of Stiffness

- When you have stiffness, alter the position of adjacent joints
- If no change, think capsule
- If there is a change, consider what other structures you have tightened (or relaxed) to figure out the problem
- Once you have narrowed it down, you can select the appropriate treatment
Joint Capsule

- Think joint capsule if PROM does not change regardless of the position of surrounding joints

Intrinsic Muscle Contracture or Adhesion

- Intrinsic muscles pass volar to the axis of MCP, dorsal to PIP joint
- Thus, when tight or adhered, may limit MCP extension or PIP flexion
Extrinsic Contracture or Adhesion

- Long flexor tendons – Run volar to the axis of rotation for wrist, MCP, PIP, and DIP
- Long extensors – Run dorsal to the axis of rotation for wrist, MCP, PIP, and DIP

Example

- Figuring out what is causing a limitation in PROM requires critical thinking.
- If Jon has a 30 degree limitation in PIP flexion (can only flex his PIP passively to 70 degrees.
- This could be due to 3 possible problems – a joint contracture, intrinsic tightness, or extrinsic tightness
- How do we know?
Management of Stiffness

- Once you figure it out, how does it change your treatment?

Another example

- Jane has passive MCP ROM of -30/90.
- Capsule, Intrinsic, or Extrinsic problem?
- How do you test?
- If capsular, how do you treat?
- If intrinsic, how do you treat?
- If extrinsic, how do you treat?
Assessment of Stiffness Summary

- When you have stiffness, alter the position of adjacent joints
- If no change, think capsule
- If there is a change, consider what other structures you have tightened (or relaxed) to figure out the problem
- Once you have narrowed it down, you can select the appropriate treatment

Assessment of Pain

- Unfortunately, when a client has pain, the best way to figure out what is wrong is to reproduce their pain with clinical tests. This “provoking” of pain gives us the term:

  Provocative Testing
Provocative Testing

- Purpose of provocative testing is to help narrow down the source of pain
- For many of these tests we will talk about sensitivity and specificity. What does this mean?

Sensitivity

- The proportion of patients with the target disorder who have a positive test result
- \[ a/(a+c) = 84\% \]

<table>
<thead>
<tr>
<th></th>
<th>Surgical Result</th>
<th>RC torn (+)</th>
<th>RC intact (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>RC torn (+)</td>
<td>42</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>RC intact (-)</td>
<td>8</td>
<td>86</td>
</tr>
</tbody>
</table>

\[ a = 42, \quad b = 14, \quad c = 8, \quad d = 86 \]
Specificity

- The proportion of patients without the target disorder who have a negative test result
- \( \frac{d}{b+d} = 86\% \)

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Provocative Tests at the Elbow

- Pivot Shift Test, push up test – testing for lateral instability of the elbow
- Moving valgus stress test and milking manoeuvre – testing for medial instability
- Resisted third finger extension test (Mills test) or resisted wrist extension for lateral epicondylalgia

LATERAL ULNAR COLLATERAL LIGAMENT

- Important varus and rotational elbow stabilizer
- Usually torn in elbow dislocations: late posterolateral rotatory instability occasionally seen

Morrey et al 1985, O’Driscoll et al 1992
Josefsson et al 1987
Signs and Symptoms of Possible Lateral Instability

- Clicking with motion
- “My elbow feels like it pops”
- Pain with varus loading and supination
- Inability to do a push up or push off a chair

REMEMBER THESE SYMPTOMS ARE SENSITIVE BUT NOT SPECIFIC

The Lateral Ulnar Collateral Ligament

[Images of surgically treated joint]
Causes of PLRI

- Doesn’t just “happen”
- Trauma
  - Multiple injections for tennis elbow
  - Iatrogenic from tennis elbow release
  - Growth abnormalities / Congenital

Suspect Someone has PLRI – How to test?

- Possible clinical tests – useful when sent an “elbow sprain”
  - Straight varus loading
  - Hypersupination
  - Chair push up
  - Lateral pivot shift test
When NOT to Test

Push Up Test
Chair Push Up

Lateral Pivot Shift Test
MCL Important?

MEDIAL COLLATERAL LIGAMENT

- Important valgus elbow stabilizer
- Can be completely torn in elbow dislocations
- Attritional ruptures frequently occur in baseball pitchers

VALGUS STRESS TEST

MILKING MANOUVER (O’Brien)

- Patient performed
- 70-90°
MOVING VALGUS STRESS TEST

- Full ER at 90° ABD
- Valgus torque
  1. 45° = OCD lesion
  2. 70° - 120° = AMCL
  3. Terminal extension = Trochlear chondral lesion
- O'Driscoll et.al. 2005

Final thoughts on elbow instability

- Remember when NOT to do these tests
- PLRI is more common than MCL insufficiency
- Diagnosis of instability is rarely made on these tests alone
- These tests give us an idea that there may be instability
Lateral Epicondylosis (Tennis Elbow)

- Very common condition
- Most common source of lateral elbow pain
- Usually starts as an inflammation of ECRB
- Most non-acute cases are not inflammatory, but degenerative

Clinical Tests for Lateral Epicondylosis (Tennis Elbow)

- Tenderness with palpation over lateral epicondyle
- Pain over this area with resisted extension of the long finger or wrist
- Usually a decrease in grip strength due to inability to co-contract
Provocative Tests for the Wrist

Radial Tests
- Finklestein’s Test
- CMC Grind Test
- Tinel’s over DRSN

Dorsal Tests
- Scaphoid Shift Test
- S-L and L-T Ballottements

Ulnar Tests
- Ulnar Fovea Sign
- GRIT
- TFCC Load Test

Volar Tests
- Phalen’s
- Median Tinel’s
- Allen’s

Questions

Please answer yes or know to this statement:

I know my basic wrist and hand anatomy, including the names/locations of the carpal bones and the location of the muscles and tendons in the hand.
Finklestein’s Test

- Thumb in fist
- Passively push wrist into ulnar deviation
- Positive if pain in 1st dorsal extensor compartment
- Indicative of DeQuervain’s Tenosynovitis

CMC Grind Test

- Hold client’s thumb
- Apply axial load, twist metacarpal back and forth
- Positive if pain in at the base of the 1st CMC
- Sensitivity 42%
- Specificity 91%
Dorsal Radial Sensory Nerve

- Tap along course of nerve
- Can elicit paraesthesia in distribution of the nerve
- Sometimes confused with DeQuervain’s

Scaphoid Shift Test – Testing the S-L

- Start in ulnar deviation and slight wrist extension
- Pressure on distal pole of scaphoid to prevent it from flexing
- Move to radial deviation and slight wrist flexion and let go of pressure
- Painful “clunk” if positive
- Must compare to other side
- Sensitivity and Specificity both about 67%
Ballottement Tests for S-L and L-T

- General test to screen for issues over these ligaments
- Sensitivity 66%
- Specificity 44% - low because this often hurts even with a normal wrist

Ulnar Fovea Sign – Ulnotriquetral ligament test

- Pressure distal to ulnar styloid just dorsal to FCU tendon
- Pain with pressure indicative of a positive test
- Sensitivity 95%
- Specificity 86%
Gripping Rotatory Impaction Test (GRIT)

- Place arm by side and elbow in 90 degrees of flexion
- Using a grip dynamometer, measure grip in 2 positions: full supination, full pronation
- GRIT Ratio = (supinated grip strength) / (pronated grip strength)
- GRIT ratio is greater than 1.0 indicates possible ulnar impaction syndrome

TFCC Load Test

- Supinate forearm
- Ulnar deviation and axial load on ulnar wrist
- Reproduction of pain a positive test and may indicate TFCC tear
Phalen’s Test

- Passive wrist flexion for up to 1 minute
- Positive test reproduces parasthesia in median nerve distribution
- Sensitivity 68%
- Specificity 71%

Median Nerve Tinel's

- Tapping over median nerve at wrist
- Positive test reproduces parasthesia in median nerve distribution
- Sensitivity 64%
- Specificity 83%
Allen’s Test

- Pressure over radial and ulnar arteries
- Client makes 10 fists to drain blood from hand
- Alternately remove pressure on each artery and ensure perfusion

Thumb UCL Tear Assessment

- Very common injury (Skier’s Thumb)
- Grasp thumb metacarpal with one hand, place radial stress on thumb proximal phalanx
- Positive test is either pain or gapping
- Test contralateral side to compare
Testing for FDP function

Testing for FDS Function
Self-Reported Outcome Measures

- A necessary component of every hand therapy practice
- Validates what you are doing is helping (or not…)
- We need to continually validate our practice for
  1. Our clients
  2. Ourselves
  3. Our employers
  4. Third party payers
  5. Policy Makers

Common Self Reported Outcome Measures

- DASH
- PRWE
- PREE
- PRUNE
- SF 36
- COPM
- Michigan hand
Disabilities of the Arm Shoulder and Hand

- DASH
- Probably the most common general outcome measure used in hand therapy practice and in upper limb research
- Easy to administer and score
- Minimally important difference – 11 points
- Established reliability, validity, and responsiveness to many upper limb disorders
- Detractors will suggest that it is not responsive for all conditions since it is not region specific

Region Specific Questionnaires

- Patient rated elbow, wrist, and ulnar nerve evaluations
- PREE, PRWE, PRUNE
- Region specific, with established validity and responsiveness
- Developed at HULC by Dr. Joy MacDermid
What We’ve Covered

- History
- Range of Motion
- Grip and Pinch Strength
- Volume
- Sensation
- Stiffness
- Pain (Provocative Testing)
- Outcome Measures

Questions? mike.szekeres@gmail.com