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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

Date: Referring Source: Next Appt:

Date of injury: Dominance:

□ Third Party Source (please circle): WSIB Insurance Self Pay

Diagnosis:

Surgical Procedure/Date:

Occupation/Hobbies:

□ Consent received to release information contained in this database to:

Patient Signature:

PMHistory:

□ Verbal consent obtained for Tx

□ ADL concerns reviewed with patient

□ PMHx reviewed with patient

Current Orthotic Devices:

Observation/Investigation/Sensitivity:

Pain:

	ROM (S/P)	WDF	RP	DIP			AROM	PROM
Index	Active Passive	/ /	/ /	/ /	Wrist	EXT/FLEX UD/RD		
Middle	Active Passive	/ /	/ /	/ /	Elbow	SUP/PRO EXT/FLEX		
Ring	Active Passive	/ /	/ /	/ /	Shoulder	FLEX ER		
Little	Active Passive	/ /	/ /	/ /		ABD IR		
Thumb	Active Passive	CMC	MCP	IP				

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
- 2 - Ryu et al. Journal of Hand Surgery. 1991 16(3), 405-419

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

- *Marx RG et al. What do we know about the reliability and validity of physical examination test for the upper extremity? J Hand Surg 1999, 24A 185-193.

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:

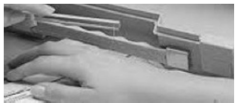
1. One point sensory threshold (Semmes-Weinstein Monofilaments)
2. 2 Point discrimination – static and moving
3. The Ten Test

Semmes-Weinstein Monofilaments

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

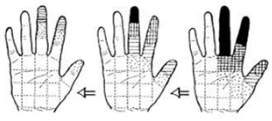
Semmes-Weinstein Monofilaments

- 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.

- Strauch B1, Lang A, Ferder M, Keyes-Ford M, Freeman K, Newstein D. **The ten test.** Plast Reconstr Surg. 1997 Apr;99(4):1074-8.

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

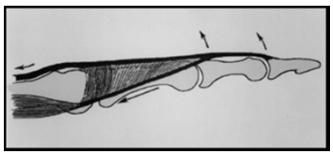
- When you have stiffness, alter the position of adjacent joints
- If no change, think capsule
- If there is a change, consider what other structures you have tightened (or relaxed) to figure out the problem
- Once you have narrowed it down, you can select the appropriate treatment

Joint Capsule

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

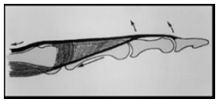
Intrinsic Muscle Contracture or Adhesion

- Intrinsics pass volar to 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%

		Surgical Result	
		RC torn (+)	RC intact (-)
US	RC torn (+)	42 (a)	14 (b)
	RC intact (-)	8 (c)	86 (d)

Specificity

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

		Surgical Result	
		RC torn (+)	RC Intact (-)
US	RC torn (+)	42 (a)	14 (b)
	RC intact (-)	8 (c)	86 (d)

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Scientific/Clinical Article

The value of provocative tests for the wrist and elbow: A literature review

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ABSTRACT

To describe and determine the usefulness of provocative tests for the wrist and elbow a literature search was performed. A total of 31 diagnostic studies were identified, assessed, and ranked. The highest ranking tests had a mean positive likelihood ratio of ≥2.0, or a mean negative likelihood ratio of ≤0.5, from more than one

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 epincondylalgia

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

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?

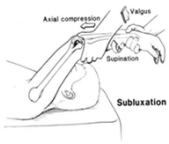
- Possible clinical tests – useful when sent an "elbow sprain"
- Straight varus loading
- Hypersupination
- Chair push up
- Lateral pivot shift test

When NOT to Test

Push Up Test

Chair Push Up

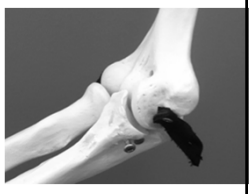
Lateral Pivot Shift Test



MCL Important?

MEDIAL COLLATERAL LIGAMENT

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



Morrey et al 1985, Joseffsson et al 1984, Conway et al 1992

VALGUS STRESS TEST

MILKING MANOUVER (O'Brien)

- Patient performed
  - 70-90°

MOVING VALGUS STRESS TEST

- Full ER at 90º ABD
- Valgus torque
  1. 45° = OCD lesion
  2. 70° - 120° = AMCL
  3. Terminal extension = Trochlear chondral lesion

- ODriscoll 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 test 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 an 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	Dorsal Tests	Ulnar Tests	Volar Tests
Finklestein's Test	Scaphoid Shift Test	Ulnar Fovea Sign	Phalen's
CMC Grind Test	S-L and L-T Ballottements	GRIT	Median Tinel's
Tinel's over DRSN		TFCC Load Test	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

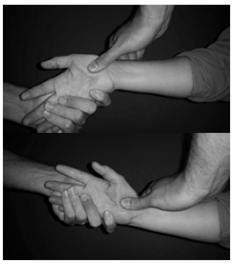
- Hold client's thumb
- Apply axial load, twist metacarpal back and forth
- Positive if pain in at the base of the 1st CMC
- Sensitivity 42%
- Specificity 91%

Dorsal Radial Sensory Nerve

- Tap along course of nerve
- Can elicit parasthesia 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 Tinels

- 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