Examination of the Wrist/Hand

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Clinical Orthopedic Rehabilitation Education
Bony Anatomy of the Hand and Wrist
Joint Morphology Reminder
Distal RadioUlnar Joint (DRUJ)

Concave Surface: radius (sigmoid notch)
Convex Surface: ulna
Resting Position: 10° supination
Closed Pack Position: 5° of supination
Capsular Pattern: pain at extreme of motion
Joint Morphology Reminder
Radiocarpal (Wrist) Joint

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concave Surface:</td>
<td>distal radius</td>
</tr>
<tr>
<td>Convex Surface:</td>
<td>proximal carpal row (scaphoid/lunate;</td>
</tr>
<tr>
<td></td>
<td>triquetrum articulates TFCC)</td>
</tr>
<tr>
<td>Closed Pack Position:</td>
<td>full extension and radial deviation</td>
</tr>
<tr>
<td>Resting Position:</td>
<td>neutral with slight ulnar deviation</td>
</tr>
<tr>
<td>Capsular Pattern:</td>
<td>flexion = extension</td>
</tr>
</tbody>
</table>
Joint Morphology Reminder
MCP and IP Joints

Concave Surface: distal
Convex Surface: proximal
Closed Pack Position: Full extension
Resting Position: Slight flexion
Capsular Pattern: Flexion > extension
Dorsal Compartments

I  APL - EPB
II ECRL - ECRB
III EPL
IV ED - EI
V  EDM
VI ECU
Flexor Tendon Zones

- DIP Flexors
- PIP Flexors
- MCP Flexors
- Surgical No Man’s Land
Extensor Tendon Zones

- Finger zones:
  - I: DIP joint
  - II: Middle phalanx
  - III: PIP joint
  - IV: Proximal phalanx
  - V: MP joint
  - VI: Metacarpal
  - VII: Dorsal retinaculum
  - VIII: Distal forearm

- Thumb zones:
  - I: IP joint
  - II: Proximal phalanx
  - III: MP joint
  - IV: Metacarpal
  - V: CMC joint/ radial styloid
Accessory Motions

- Radiocarpal mobility particularly important for wrist extension ROM
- Intercarpal mobility important for wrist flexion and radial deviation ROM
- Radiocarpal and intercarpal mobility equally important for ulnar deviation ROM

Flexion: 30° from radiocarpal - 40° from intercarpal
Extension: 40° from radiocarpal - 20° from intercarpal
Subjective History

- Age, Sex, Occupation, Handedness
- MOI – traumatic vs. gradual
- Injury History
  - Date, Immobilization, Surgery, etc
- ADL Considerations
- Present Status
- Medical History
- Listen to patient’s adjectives
Key Questions

- Does your complaint change with posture or movement of your neck?
  - Cervical spine exam indicated

- Did you fall on an outstretched hand?
  - Scaphoid or Colles Fracture/Carpal Instability

- Does your pain change with gripping activities?
  - DeQuervain’s Tenosynovitis

- Does shaking hands alleviate your symptom?
  - Carpal Tunnel Syndrome

- Do you have abnormal sensations in your hand?
  - Entrapment neuropathy
Review Imaging Findings
General Observation/Inspection

- Resting Position
  - Fingers more flexed as you move from medial to lateral
- Cosmetic Appearance and Symmetry
- Creases
- Swelling/Atrophy
- Skin and Nails
- Wounds or Scars
Vaso-Sudo-Pilomotor and Trophic Changes

- Loss of hair (trophic changes)
- Brittle nails
- Skin color/temp (vasomotor)
- ↑ palm sweating
- ↓ palm sweating
- Shiny or dry skin (sudomotor)

Possible indications of peripheral nerve injury, peripheral vascular disease, diabetes, Raynaud's, RSD-CRPS, etc
Finger Nail Abnormalities

- **Clubbed Nails**
  - COPD or heart defects

- **Spoon Nails**
  - Anemia, iron deficiency, diabetes, local fungal infection
Upper Extremity Screening

- Cervical AROM with overpressure at end range
- Quadrant Testing
- Functional Reach Tests
  - Behind Back
  - Behind Neck
  - Cross Body
- Neural tension tests
- Peripheral innervation muscle weakness patterns
Hand Deformities

“You’re not losing your grip on reality. It’s just a little arthritis in your hands.”
Osteoarthritic Enlargements

Bouchard’s nodes at PIP; Heberden’s nodes at DIP
Common Deformities

Swan Neck

- MCP and DIP flexed; PIP extended
- Intrinsic contracture, rheumatoid arthritis, or volar plate injury

Boutonniere

- PIP flexed and DIP hyperextended
  - Central extensor tendon rupture over PIP causing lateral bands to migrate volarly and the PIP herniates through the central slip tear
Common Deformities

Ulnar Drift

- Bowstring effect of extensor tendons overcome by weakened MCP capsuoligamentous structures in rheumatoid hands
- Most common, but not limited to rheumatoid arthritics
Tendon Deformities

Duputryen’s

– Palmar fascia contracture
– More pronounced on ulnar side of hand
– Prominent in 50-70 year old men of Scandinavian descent
Tendon Deformities

Trigger Finger

- Digital tenovaginitis tenosans
- Thick flexor tendon sheath causing stenosis
- Tendon “sticks” and then suddenly “lets go” with an audible snap
- Most common in middle-aged women with rheumatoid arthritis
Neurological Deformities

Claw Hand
- Intrinsic minus deformity 2ary to loss of intrinsics and dominance of long extensors
- Cupping and arches lost
- Often due to median & ulnar nerve injury

Ape Hand
- Median nerve palsy
- Thenar atrophy
- Unable to oppose
Neurological Deformities

**Bishop’s Hand**
Flexed 4/5th fingers with hypothenar wasting secondary to ulnar nerve palsy

**Wrist Drop**
Radial nerve palsy
wrist extensor paralysis
Range of Motion

- Wrist F/E – RD/UD
  - High intratester reliability (ICC > .90)
  - Good intertester reliability (ICC > .80)

- Digital Flexion-Extension
  - Dorsal goniometry with wrist in neutral is default

- Thumb Motions

- Functional Positions
Strength Testing

- Manual Muscle Testing
- Power Grip
- Chuck Pinch
- Lateral Key Pinch
- Tip Pinch
Grip and Pinch Strength Assessment

- Power Grip
- Chuck Pinch (three-finger or digital prehension)
- Lateral (Key) Pinch
- Thumb-Index Pulp Pinch
Grip Strength Normals

- Poor volitional effort (often interpreted as lack of sincere effort) is also typical of clinical depression

Non-bell shaped curve or > 20% test-retest change may indicate inconsistency.
Palpation

- Tenderness, temperature, crepitation, nodules, anomalies, etc
  - Bony Landmarks
  - Soft Tissues
  - Pulses
- Check scars for mobility and sensitivity
- Push-Pull
  - Axial loading aggravates fractures
  - Unloading/Stress aggravates ligaments
Special Tests - Ligamentous

- Valgus Stress to 1st MCP
  - UCL laxity

- Murphy’s Sign
  - indication of lunate dislocation
Special Tests - Range of Motion

- **Bunnel-Littler (Intrinsic +)**
  - Capsular vs. intrinsic muscular limitation in PIP flexion

- **Retinacular Test**
  - Capsular vs. retinacular limitation in DIP flexion
Special Tests - Musculotendinous

- Eichhoff (Finkelstein) (high SN, low SP)
- Sweater Finger
- Isolated FDS-FDP Tests

1) Passive UD; 2) UD with OP; 3) Passive Thumb flexion; 4) Thumb flexion with OP
Wrist Hyperflexion and Abduction of the Thumb deQuervain’s “WHAT” Test

- Wrist in hyperflexion with the 1\textsuperscript{st} MCP and IP in extension and examiner resists thumb abduction.
- Pain reproduction constitutes a positive test.
- Contraction of the APL and EPB tendons cause a painful shear stress on the inferior palmar border of the pulley in the first dorsal compartment.

- 94% SN; 29 SP; Neg LR 0.04
Special Tests - Bony

- Axial Loading
  - to test for presence of scaphoid fracture
  - Compressive load through an abducted and extended 1st metacarpal to reproduce pain
    - SN = 89
    - SN - .98
    - + LR = 0.02; - LR = 49

### Clinical Prediction Rule for Detecting Scaphoid (Navicular) Fractures

<table>
<thead>
<tr>
<th>S/S</th>
<th>Description</th>
<th>Point Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of snuffbox concavity</td>
<td>swelling is noted in anatomical snuffbox</td>
<td>1</td>
</tr>
<tr>
<td>Clamp sign</td>
<td>to indicate the most painful area the patient uses his thumb and index finger to encircle the scaphoid like a clamp</td>
<td>4</td>
</tr>
<tr>
<td>Snuffbox tenderness</td>
<td>there is increased tenderness to palpation in the snuffbox</td>
<td>1</td>
</tr>
<tr>
<td>Scaphoid palmar tenderness</td>
<td>pain is elicited with palpation of the scaphoid from the palmar side of the hand</td>
<td>2</td>
</tr>
<tr>
<td>Longitudinal axis compression of thumb</td>
<td>compressive stress parallel with the 1st metacarpal elicits pain</td>
<td>2</td>
</tr>
<tr>
<td>Pain with Resisted Supination</td>
<td>hand shake position resistance to supination elicits pain</td>
<td>3</td>
</tr>
<tr>
<td>Ulnar Deviation Pain</td>
<td>snuffbox pain is reproduced with maximal ulnar deviation from a forearm pronated position</td>
<td>4</td>
</tr>
</tbody>
</table>
Scaphoid Decision Tool as applied in Emergency Room

Clinical Suspicion of Scaphoid Fx in ER

One of the following are true:
- Patient < 16 years old
- Trauma ≥ 7 days
- Bone Disease
- Previous Hx of Scaphoid Fx

YES → Exclude from Rule

NO →

Scaphoid Decision Tool Applied: ≥ 5 points

NO →

Radiograph reveals Fracture

YES →

Plaster Immobilization or Surgery

NO →

Bandage & Re-eval in 2-3 wks

Detection of Scaphoid Fractures
(within first 24 hours of injury)

- Tenderness in snuffbox – SN = 100; SP = 9
- Tenderness over scaphoid tubercle – SN = 100; SP = 30
- Longitudinal compression of thumb pain – SN = 100; SP = 48
- Thumb ROM – SN = 69; SP = 66

- Combination of all 4 – SN = 100; SP = 74

Pavizi J, J Hand Surg Br, 1998
Scaphoid Fracture S/S

- Logistic regression model identified these findings as independent predictors of fracture:
  - male sex ($p = 0.002$); injured in sports ($p = 0.004$)
  - anatomical snuff box pain on ulnar deviation of the wrist $> 3$ days post-injury ($p < 0.001$)
  - scaphoid tubercle tenderness at two weeks ($p < 0.001$)
- All with no pain at anatomical snuff box with UD within 72 hours of injury did **not** have a fracture.
- With four independently significant factors positive, the risk of fracture was 91%.

Special Tests - Vascular

- Allen’s Test
- Volumetric Displacement

Intra/Intertester ICC = .99
Carpal Tunnel Special Tests

- Phalen’s
- Reverse Phalen’s
could also evaluate cubital tunnel syndrome
- Modified Phalen’s
- Tinel’s
- Carpal Compression
Carpal Tunnel Syndrome
Special Testing

- At least 15 different special tests described in the literature in addition to the common physical and subjective history findings associated with the syndrome
- Difficult to assess accuracy secondary to lack of a gold standard
- Majority of studies have significant design flaws and/or bias confounders

Boyer K, et al, J Hand Ther Am, 2009
McCabe SJ, J Hand Surg, 2010
## Carpal Tunnel Syndrome Testing

### “Classic” Diagnostic Summary Systematic Review

<table>
<thead>
<tr>
<th>Test/Sign</th>
<th>Pooled SN</th>
<th>Pooled SP</th>
<th>+ LR</th>
<th>- LR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phalen’s</td>
<td>68</td>
<td>73</td>
<td>2.52</td>
<td>0.30</td>
</tr>
<tr>
<td>Tinel’s</td>
<td>50</td>
<td>77</td>
<td>2.18</td>
<td>0.65</td>
</tr>
<tr>
<td>Carpal Compression</td>
<td>64</td>
<td>83</td>
<td>3.77</td>
<td>0.43</td>
</tr>
</tbody>
</table>


- One study showed increased diagnostic accuracy if Phalen and Carpal Compression test results are combined
- SN and SP = 92, + LR = 12; - LR =0.12

Tetro Provocation Test

- Elbow extended, forearm supinated, and wrist flexed to 60°
- Single thumb pressure over median nerve at carpal tunnel for 20 seconds

- SN = 82; SP = 99
- + LR = 5.5; - LR = 0.17

### Carpal Tunnel Syndrome Testing

**My Diagnostic Summary**

<table>
<thead>
<tr>
<th>Test/Sign</th>
<th>Pooled SN</th>
<th>Pooled SP</th>
<th>+ LR</th>
<th>- LR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phalen’s</td>
<td>45 (10-80)</td>
<td>77 (55-86)</td>
<td>1.96</td>
<td>0.71</td>
</tr>
<tr>
<td>Tinel’s</td>
<td>41 (9-63 )</td>
<td>73 (55-86)</td>
<td>1.52</td>
<td>0.82</td>
</tr>
<tr>
<td>Hyperparaesthesias</td>
<td>43 (15-70)</td>
<td>79 (59-93)</td>
<td>2.04</td>
<td>0.72</td>
</tr>
<tr>
<td>APB Weakness</td>
<td>52 (39-66)</td>
<td>73 (66-80)</td>
<td>1.92</td>
<td>0.66</td>
</tr>
<tr>
<td>Carpal Compression</td>
<td>40 (5-87 )</td>
<td>86 (74-94)</td>
<td>2.86</td>
<td>0.70</td>
</tr>
<tr>
<td>Reverse Phalen’s*</td>
<td>55</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modified Phalen’s**</td>
<td>85</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* low quality study
** based on single study with spectrum and selection bias

Semmes-Weinstein Monofilament Sensory Exam used in Modified Phalen’s Test

- Threshold test that measures stimulus intensity
- SWM sensory exam generally considered specific but not sensitive
- Modified Phalen’s – SN: 85/SP: 100 (using 2.83 monofilament)

- Normal Light Touch 1.65-2.83
- Diminished Light Touch 3.22-3.61
- Diminished Protective Sensation 3.84-4.31
- Loss of Protective Sensation 4.56-6.65
- Anesthetic > 6.65
Carpal Tunnel Syndrome
Clinical Prediction Rule

1. Hand shaking improves symptoms
2. Wrist Ratio index > .67 (AP width/ML width)
3. Symptom Severity Scale > 1.9
4. Diminished sensation in thumb area of median distribution
5. > 45 years old

- SP = .99; SN = .18
- Increased pre-test probability from 34% to 90%
- + LR of 18.4

Example of evaluating diminished discrimination sensation

2-point Discrimination testing

- 2-4 mm fingertips is normal
- 6-10 mm is fair
- 11-15 is poor

functional discriminative touch test that correlates well with hand use and ability

specific but not sensitive for CTS
ULTT 1 to identify Carpal Tunnel Syndrome

- Reproduction of symptoms, limited elbow extension, and/or symptoms impacted by contralateral neck flexion
  \[SN = 92; SP = 15\]

- Reproduction of symptoms in first 3 digits
  \[SN = 54; SP = 70\]

Is it really Flexor Tenosynovitis?

- One study suggest that the Phalen’s, Reverse Phalen’s, and Carpal Compression tests were more sensitive and specific in identifying flexor tenosynovitis of the forearm muscles than carpal tunnel syndrome.

Diagnostic Probability

- Instead of dichotomous diagnoses it may make more sense to classify into ordinal based probability categories
  - Classic
  - Probable
  - Possible
  - Unlikely

### Rating System for Hand Diagrams

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Classic**| • Tingling, numbness, or decreased sensation with or without pain in at least two of digits 1, 2, or 3  
• Palm and dorsum of the hand excluded  
• Wrist pain or radiation proximal to wrist allowed |
| **Probable**| Same as classic except palmar symptoms allowed unless only on ulnar aspect |
| **Possible**| Tingling, numbness, or decreased and/or pain in one of digits 1, 2, or 3     |
| **Unlikely**| No symptoms in digits 1, 2, or 3                                           |
Do we even need electrodiagnosis?

<table>
<thead>
<tr>
<th>Clinical Finding</th>
<th>Point Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbness symptoms in median nerve distribution</td>
<td>3.5</td>
</tr>
<tr>
<td>Nocturnal numbness</td>
<td>4</td>
</tr>
<tr>
<td>Thenar Atrophy</td>
<td>5</td>
</tr>
<tr>
<td>Positive Phalen’s</td>
<td>5</td>
</tr>
<tr>
<td>Loss of 2-pt discrimination</td>
<td>4.5</td>
</tr>
<tr>
<td>Positive Tinel Test</td>
<td>4</td>
</tr>
</tbody>
</table>

For the majority of patient who are considered to have CTS on the basis of history and clinical exam, ED testing does not change the probability of diagnosing this condition to an extent that is clinically relevant – Graham, *J Bone Joint Surg*, 2008
# Diagnostic Criteria for CPRS I – RSD

Baron, et al, Lancet, 2004

<table>
<thead>
<tr>
<th>Clinical: 1 or more symptoms in 3 or more categories and 1 or more signs in 2 or more categories</th>
<th>SN = 85; SP = 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research: 1 or more symptoms from each category and 1 or more signs from 2 or more categories</td>
<td>SN = 70; SP = 96</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneous pain</td>
<td>Vasodilation</td>
<td>Swelling</td>
<td>Motor weakness</td>
</tr>
<tr>
<td>Mechanical hyperalgesia</td>
<td>Vasoconstriction</td>
<td>Hyperhidrosis</td>
<td>Nail, hair changes</td>
</tr>
<tr>
<td>Thermal hyperalgesia</td>
<td>Skin temperature asymmetries</td>
<td>Hypohidrosis</td>
<td>Tremor</td>
</tr>
<tr>
<td>Deep somatic hyperalgesia</td>
<td>Skin colour changes</td>
<td></td>
<td>Dystonia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Joint stiffness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Coordination deficits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Soft tissue changes</td>
</tr>
</tbody>
</table>

[Image of the table with columns labeled 1. Positive sensory abnormalities, 2. Vascular abnormalities, 3. Oedema and sweating abnormalities, 4. Motor or trophic changes. Rows include Spontaneous pain, Vasodilation, Swelling, Motor weakness; Mechanical hyperalgesia, Vasoconstriction, Hyperhidrosis, Nail, hair changes; Thermal hyperalgesia, Skin temperature asymmetries, Hypohidrosis, Tremor; Deep somatic hyperalgesia, Skin colour changes, Dystonia, Skin atrophy; and Soft tissue changes. SN = 85; SP = 60 for Clinical criteria; SN = 70; SP = 96 for Research criteria.]
CPRS Severity Score

- Checklist of symptoms scored 0-17
- Reliability, validity, and responsiveness established

Peripheral Nerve Sensory Innervation

- Median nerve
- Pronator teres
- FPL, ½ of FDP, and FDS
- Pronator quadratus
- FCR
- Thenar Mms
- ½ lumbricales
Peripheral Nerve Sensory Innervation

Radial
preparatory nerve

ECRL/ECRB
ED- EI
ECU
EDM
EPB
APL
Peripheral Nerve Sensory Innervation

- Ulnar power nerve
- FCU
- Ulnar FDP
- Hypothenar Mms
- Lumbricales 3-4
- Interossei
- Adductor Pollicus
Functional Tests

Purdue Pegboard

- Fine motor coordination
- Assesses with the use of small pins, washers, and collars
- Assignment categories include one hand, both hands, alternating hands, or assembly
- Performance is timed and compared to normal values based on sex and occupation
Functional Tests

Minnesota Rate of Manipulation

- Gross coordination and dexterity
- Involve placing, turning, displacing, or one and two-hand turning and displacing
- Activity is timed and compared to standardized norms
Wrist/Hand Outcome Tools

- QuickDASH
  - MCID – 20% change in score

- Boston Carpal Tunnel Questionnaire
  - MCID for CTQ was 1.95 for diabetics and 1.25 for non-diabetics

Copy in your “Resources” folder