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Description

- This is the second part in a two course series that will provide clinical assessment tools and guidelines to aid in the treatment planning for the upper extremity involved patient.
Learning Outcomes

As a result of this course, participants will be able to:

- Define 2 guidelines when screening for UE motion
- List 2 tests of dexterity to use for the upper extremity population
- List 2 tests of sensibility for use on the hand patient.
- List one outcome tool specific to the upper extremity population.

Review of course 1: Purpose

- Establish baselines
- Determine components to be addressed in treatment/establish treatment plan
- Determine limitations
- Establish treatment goals
- Determine treatment results and outcomes
- Efficacy of treatment
Examination methods need to be:

- Accurate
- Standardized
- Reliable
- Reproducible
- Valid
- Meaningful to your outcome

Objective Measurements: ROM

- ASHT recommendations for ROM:
  - “0” is neutral.
  - “+” is hyperextension
  - “−” is an extension deficit
  - Measurements should be written as extension/flexion (e.g. -10/85).
  - Volar/dorsal for fingers and wrist
  - Hamilton and Lachenbruch ‘equal reliability between lateral and dorsal goniometer placement’
Active Range of Motion (AROM)

- Muscle’s ability to move a joint
- Variations from person to person in what is considered “normal”
  - Younger not accurate: don’t hold the maximal
- Pay attention to the “arc of motion”

AROM:

- Limitations can be due to:
  - Adhesions
  - Denervation
  - Weakness
  - Edema
  - Subluxation, dislocation, or bowstringing of tendons
  - Lack of tendon continuity or tendon attenuation
  - Joint restrictions (articular or capsule)
Thumb ROM

- The thumb has a highly mobile CMC joint with the saddle-shaped trapezium as its base
- Composite flexion: to base of small finger
- Occurs in the frontal plane, parallel to the plane of the palm.

Radial Abduction

Frontal plane: Parallel to the palm of the hand.
Palmar Abduction

- Sagittal plane: perpendicular to the palm
- Adduction returns the thumb to the palm.

Opposition: composite abduction, rotation and flexion
Opposition measurement

- To base of small finger
- Ability to oppose each finger tip
- Kapandji opposition test

Landmarks with Assessment

- Fingertip to palm
- Measure in cm.

- Fingertip to distal palmar crease (DPC)
Total Active Motion (TAM)

- TAM = AROM of the MP, PIP, and DIP minus any extension deficits.

**Example:**

<table>
<thead>
<tr>
<th>Joint</th>
<th>AROM (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP</td>
<td>0/90</td>
</tr>
<tr>
<td>PIP</td>
<td>-10/85</td>
</tr>
<tr>
<td>DIP</td>
<td>-5/55</td>
</tr>
</tbody>
</table>

TAM = (90 + 85 + 55) – (10 + 5) = 215

- *not accurate if the patient has hyper extensible joints.
- Total passive motion (TPM) – same formula

Tendon Integrity through ROM:

Following examination of ROM: should perform wrist flexion/extension to assess tenodesis.
Passive Range of Motion (PROM)

- Ability of a joint to be moved through its normal arc of motion by means outside the body.
- Assesses the capacity of a joint, may be affected by:
  - soft tissues
  - joint incongruence
  - capsular structures surrounding the joint.

Limited Motion due to Structures outside of the joint

- If PROM>AROM then the joint is being limited by adhesions, weaknesses or tendon integrity. Document measurement of A/PROM.
Stress Testing of Joints

- Test for ligament integrity
- Volar Plate

- Perform radial and ulnar stress test with:
- MP joint in flexion and PIP and DIP joints in extension (closed packed position)
- Use caution with an acute injury prior to x-ray

Muscle/tendon length tests

- **Intrinsic Tightness Test:**
  - Hold MP in extension and passively flex the PIP, note ROM.
  - Then place MP into flexion, and passively flex the PIP, note ROM.

Test is positive if PIP ROM is greater with the MP flexed.
Oblique Retinacular Ligament (ORL) Length Test

- **PROXIMAL ATTACHMENT**: volar proximal phalanx
- **DISTAL ATTACHMENT**: terminal extensor tendon
- **SLACK IN PIP FLEXION AND DIP EXTENSION**
- **TAUT IN PIP EXTENSION AND DIP FLEXION**
- Helps coordinate extension of IP joints

**ORL Length Test:**

- Test Position: max PIP extension then flex DIP. If motion is less than with PIP flexed, ORL is tight.
Extrinsic Extensor Tightness/Length Test

- Hold MP in extension and passively flex IPs (elbow extended and forearm pronated)
- Repeat IP flexion with the MP in flexion.
- Test is “+” if the IP ROM is greater with the MP in extension (vs. flexion).
- Varying wrist position will affect results.
- Must rule-out IP limitations prior to completing this test
Extrinsic Flexor Tightness/Length Test

- Place wrist in neutral and passively extend the digits; then slowly increase wrist extension (elbow extended and forearm supinated)
- Positive test if patient is unable to passively maintain IPs in extension as the wrist extension is increased
- Rule out PIP or DIP joint tightness by evaluating the individual joint status with wrist in neutral or slight flexion

Strength: Manual Muscle Test (MMT)

- MMT: can measure groups of muscles or can be specific to each muscle.
  - Scale is 0-5
  - Use consistent scale
    - (0=no movement, 5=full AROM and strength)
  - Note any pain with excursion of muscle-tendon unit
    - (i.e. 1st dorsal compartment with De Quervain’s tendonitis)
Grip and Pinch Strength:

- **Dynamometer**
  - **Standard Method**
    - Seated
    - Elbow 90 degrees
    - At side of body
    - Forearm neutral
    - Not resting on surface
    - Tester holding dynamometer
    - Wrist 0-30 ext; 0-15 UD

Pinch Strength:

- Pinch gauge:
  - Seated
  - Forearm neutral
  - Elbow 90 degrees at side
  - Wrist neutral to slight extension
  - Examiner holds gauge
  - Can pronate for tripod and tip
Types of Pinch:

Tripod (3 Jaw Chuck)
Thumb against IF and MF.
Median n. injuries or
CMC; DJD

Lateral (key)
Thumb against radial
side of IF
Ulnar N. (add pollicus or
First dorsal interossei)

Tip to tip
Thumb against IF
Anterior interosseus
Nerve

Functional Strength:

- BTE
- Cybex

- Performance of activities
Sensibility/Sensation:

- Hierarchy of Testing
  - Autonomic/sympathetic
  - Detection
  - Discrimination
  - Quantification
  - Identification
Progression of Sensory Recovery:

- Pain/temperature
- 30 cps vibration
- Moving touch
- Static touch
- 256 vibration
- 2-point discrimination
- Localization to touch
- Stereognosis

Sensibility: Detection

- Touch Threshold
  - Light touch
  - Deep pressure
  - Vibration

  Monofilaments
  Vibrometers
Spatial Discrimination:
- Localizing and discriminating orientation
  - 2 point discrimination
  - Touch Localization

Identification:
- Shape, texture and object identification
  - Moberg Pick up
  - Shape, texture identification
Two Point Discrimination

- This test is performed using a discriminator
- Innervation density test
- Ability to perceive number of stimuli
- The patient's hand should be supported with vision occluded

Two Point Discrimination: Static and Moving

- Points are applied to digital pulps
- Static testing: Performed in a randomized sequence on the digital pulps in a longitudinal fashion with points perpendicular to skin
- Static testing begins at 5 mm of distance between the 2 points
- Testing is proximal to distal
- Patient responds with “one” or “two”
- Dynamic testing: Begins at 8 mm between the 2 points and the points are across width of the pulps, and traced from proximal to distal
Two Point Discrimination

- Use enough pressure to just blanch the skin
- Make sure points are perpendicular to the skin surface
- Use random order to test
- 7/10 correct responses are needed to assess accurate sensation level
- If no response or inaccurate response is given, the distance between the ends is increased by 1 mm until 7 of 10 responses are accurate
- Compare to contralateral side
- Compression neuropathies can still have a “normal” result.
- Sensitivity 32%, Specificity 81%

Two Point Discrimination

- Indications for testing:
  - Nerve lacerations with repairs or grafts
  - Nerve compressions after surgical releases
  - Long-standing nerve compression with motor changes

- Problems with testing:
  - No force control
  - No inter-rater reliability
  - Skin topography can alter results
  - Vibration of examiner's hand can alter results
  - Difficult to control velocity of points
  - Limited repeatability
Semmes-Weinstein Monofilaments

Standardized test
- Correlates the ability to functionally discriminate light touch to deep-pressure
- The test evaluates the cutaneous innervation of the median, ulnar and radial nerves
- Patient is seated with the upper extremity in a comfortable position and vision occluded
- Sensitivity 82%, Specificity 86%

Application by standardized methods:
- Applied perpendicular to skin for 1.5 seconds and the monofilament bends in a C, and then removed for 1.5 seconds
- Repeat for 3 trials per monofilament for a positive response with monofilaments 1.65-4.08
- Repeat once for monofilaments 4.17-6.65
Sensibility: Threshold

- Temperature
- Stereognosis
- Vibration

Sensation: Functional Tests

- Assess the usefulness of the sensibility
  - Moberg Pick up
  - Touch localization
  - Tactile gnosis
Sensibility: Objective Tests

- Level I: Autonomic/sympathetic
- Passive cooperation
  - Ninhydrin sweat test
  - Sudomotor function
  - NCS
  - Wrinkle test

Sensation: Provocative Tests

- Provocative postures
- Activity simulation
Dexterity: Manual

- Nine hole peg test
- Minnesota Rate of Manipulation

Dexterity and Coordination

- Jason Taylor Hand Function Test
- MRMT
- Purdue Pegboard
- Crawford Small Parts Dexterity
- Box and Block Test
- Bennett Hand Tool Dexterity Test
- Functional Dexterity Test
Pediatric Normed Dexterity:

- **9-Hole Peg Test:**
  - Normed ages 4-19
  - Portable/easy
  - Time: 5 to 10 minutes total
  - Tests speed and dexterity with grasp/release

- **Functional Dexterity Test:**
  - Norms: ages 3-17 (per new article)
  - Portable
  - Time: 15 to 20 minutes
  - Dynamic in hand manipulation

- **Jebson-Taylor Test:**
  - Normed ages 6+
  - Not portable: needs to be done in OT dept. for space and supplies
  - Lengthy:
    - Dynamic Functional Dexterity

- **Purdue Pegboard:**
  - Normed(?) 2.5 – 19
  - Portable
  - Time: 15 minutes
  - Speed and dexterity

- **Box and Block Test**
  - Normed: 6-19 year old
  - Portable
  - Time: 10 to 15 minutes
  - Speed: grasp/release
Pediatric Normed:

- BOT II: Subtest for Manual Dexterity
  - Normed ages 4-19
  - Moderately Portable: done in OT with table
  - Time: 20 minutes
  - Functional Dexterity and Manipulation

Functional Abilities/ADLs:

- Self reports
- Performance of tests
- Functional capacity tests
Evaluation/Examination:

- Summarize data to get full picture
- Documentation is important
- Set goals for components to achieve long term functional goals
- Re-examine at intervals to determine progress and outcome from treatment

Issues with the Evaluation Process:

- How do we define limitations?
- We cannot just treat and address the components to the hand.
- This is a person, not a “hand patient”.
References


References:

References


THANK YOU!

- Valeri Calhoun MS, OTR/L, CHT
- Saint Louis Children’s Hospital
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