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Measuring Outcomes in Hand Therapy

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Financial Disclosure

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Outline

• WHO International Classification of Function and Disability
• Reliability, Validity and Responsiveness
• Measure of Physical Impairment
• Patient Reported Outcomes
• Measuring and Selecting Outcome Measures
• Questions & Discussion

Outcomes in Clinical Practice or Research

• To provide an accurate representation or interpretation of the patient’s status
• No consensus on a single test or measure to assess physical impairments or function following injury, surgery or therapy
• WHO – model of human functioning & disability
• Focus on “components of health” & includes health & health-related domains
• Reflects the relationship between health conditions & contextual factors

• Interrelationships: health condition, body functions/structures, activity, participation and influence of the contextual factors.
• Dynamic interaction between person & environment. Reflects positive (improvement) & negative (degradation)
Health Condition

Body Function & Structure
- Sensory, strength, ROM

Activities
- Limitations in tasks

Participation
- Restriction in work
- Social, recreation

Environmental Factors
- Work, climate, cultural, family responsibilities

Personal Factors
- Age, co-morbidities, catastrophizing, self-efficacy

ICF - Assessment

Clinical Assessment – sensory & motor function
- Body Functions & Structures: physiologic function and anatomical body parts.
- Impairment of structures or functions: loss deviation from normal function.

Functional Assessment & Self-report
- Activity: ability to perform an action or task; may be limited with difficulty performing required tasks or actions.
- Participation: involvement in life situations.
- Individual’s capacity to perform actions and their environment, including personal factors reflects performance.

Contextual factors
- environmental and personal factors - includes environment in which they live & factors such as age, gender, medical co-morbidities, coping styles, other psychosocial issues
Assessment of Patient outcome

- Physiological
  - NCS
  - EMGs
- Clinician Reported
  - SWMF
  - 2pd
  - Strength
  - ROM
- Patient Reported
  - Symptoms
  - Disability
  - Health Status
  - HRQoL
  - Psychosocial
- Caregiver Reported

Outcome

- Distal radius fracture
  - X-ray
  - ROM
  - Strength
  - Functional evaluation
  - Patient reported outcome: DASH, Patient Rated Wrist Evaluation, Michigan Hand Questionnaire
Assessing Outcomes

• Range of motion, joint restriction, strength
• Functional status
• Self-report questionnaires

Measurement

• **Valid** - measure is assessing what it intends to measure
• **Reliable** - measure is consistent and free from random error
• **Responsive** - able to detect change when it has occurred
Validity

• measure is assessing what it intends to measure
• Content validity – measure represents all facets of the construct (often used in development of measure)
• Construct validity - measures what it claims to be measuring

Reliability

• Consistency of a measure and is free from random error
• Reproducibility
• Precision
Reliability

- Intra-rater – measures repeated by the same person
- Inter-rater – measures repeated by different people
- Test-retest – measures on different occasions
  - Constant over time if no change in patient status

Responsiveness

- Able to detect change when it has occurred
- Positive or negative changes
Responsive & Sensitive to Change

Related to test situation & type of change

Factors to consider:
- compression vs. injury
- worsening vs. recovery
- time of assessment
- individual patient change vs. group comparisons

Challenge: Pick the correct measurement or battery of measures to obtain required outcome data

- Measure height and weight (measuring tape, scale)
- Valid, reliable, sensitive measures
- Function related to tendon, nerve, distal radius???
Which test is best to assess patient outcome?

- ROM
- Strength
- Function
- Self-report

Case Scenario

- 70 yo woman presents with loss of radial nerve function
- Unable to extend L wrist, fingers and thumb
Nerve Related Outcome Measures

Motor
Objective
• NCS, EMG
Quantitative
• ROM, degrees of motion
• manual muscle testing
• manometer
• strength
Qualitative/subjective

Sensory
Objective
• NCS
Quantitative
• vibration thresholds
• 2pd
• SWMF
Qualitative
• Hot/cold, pain

Which test is best to assess nerve recovery/patient outcome?

Sensory, motor, NCS, function
**Strength**

- Qualitative
  - Atrophy
- Quantitative
  - Manual muscle testing – Medical Research Council (0-5 scale)
  - Manometers & Dynamometers

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**Manual Muscle Testing**

**MRC Grading Scale**

Grade 5: Full ROM against full resistance.
Grade 4: Full ROM against some resistance.
Grade 3: Full ROM against gravity
Grade 2: Active movement with gravity eliminated
Grade 1: Trace or flicker contraction
Grade 0: No contraction

Medical Research Council
Standardized Muscle Grading Scale

- Allows comparisons
- Important to use scale as it was described
- Validity, reliability and responsiveness

Ulnar Nerve

- Froment’s sign
- Atrophy
- Crossing fingers
- Lateral key pinch
Motor

- Pinch strength – lateral key, tip
- Grip strength
  - static grip
  - rapid exchange grip
  - simultaneous grip

Grip Strength

- Standard positioning
- 5 handle positions
  - Varies by size & span of hand
- Reliability – static
  - Highest reliability
  - Mean of 3 trials
    • Mathiowetz et al (JHS 1984)
Age sex side reference values

Meta-analysis of multinational data

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<th>Age range (years)</th>
<th>Source references</th>
<th>Total subjects (n)</th>
<th>Left (lb) mean (95% CI)</th>
<th>Left (kg) mean (95% CI)</th>
<th>Right (lb) mean (95% CI)</th>
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<td>39.6 (31.3-48.9)</td>
<td>18.0 (16.0-19.9)</td>
</tr>
</tbody>
</table>

Grip Strength

- 5 handle positions to assess maximal effort
- Maximal grip at each handle position

Stokes HJ, J Occup Med 1983;25(9):683-4
Grip Strength

- Rapid Exchange Grip
- Simultaneous Grip
  - with a lack of full effort increase of strength in the affected hand
  or
  a decrease of strength in the unaffected hand

Sensory Assessment

Objective
- NCS

Quantitative
- Vibration thresholds
- Two-point discrimination
- Cutaneous pressure thresholds SWMF

Qualitative
- Hot/cold
Interrater Reliability for Sensory Measures

- Moving 2pd ICC = 0.991
- Static 2pd ICC = 0.989
- Vibration ICC = 0.982
- SWMF ICC = 0.965


Semmes Weinstein Monofilaments

- Significant increase in pressure thresholds as contact time increased (SW p < 0.0001, stress p < 0.05, force p < 0.22)
- Significant increase in pressure threshold as age increased (p < 0.003)

Two-point discrimination

- Establish normal values of moving 2pd in children
- 313 children/adolescents ranging from age 4-18 years
- Moving 2pd of 2-3 mm in majority of subjects
- Unreliable responses in children ≤ 5 yrs

Hermann, Novak, Mackinnon. Dev Med Child Neurol, 1996

Sensory Measure of Hand Function

- Relationship between hand function and 2pd
- 43 patients following median nerve repair or graft
- Hand function assessed with small and large object identification
- Strong correlation, $r = .7$

Novak, Mackinnon, Kelly. Ann Plast Surg, 1993
Nerve Compression
• early changes in threshold measures & later changes with severe nerve compression; atrophy, abnormal 2pd

Measures
• Nerve Compression - early changes in threshold measures
  - severe nerve compression; atrophy, abnormal 2pd
• Nerve Injury - threshold may not return to normal & 2pd correlates well with object identification
Functional assessment

<table>
<thead>
<tr>
<th>Activity</th>
<th>No.</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>1. Open a tight screw cap</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. Type</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. Run a tap</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. Perform a task</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. Plan an obstacle to disturb your head</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. Do heavy household chores e.g. wash, walk, wash/room</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. Garden or do yard work</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. Stalk a bed</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Functional Measures

- No one test evaluates all facets of motor and sensory function
- Functional Capacity Evaluation
- Use of composite scores combining sensory & motor function & pain (Rosen & Lundborg, JHS 2000)
**Functional Assessment**

- Object identification
- Jebsen
- Purdue pegboard
- Minnesota Rate of Manipulation
- Sollerman test
- Braille identification test – 9 dot pattern

**Tendon Outcomes - ROM**

Tendon Rating Systems
- Kleinert, Strickland, ASSH, IFSSH
- Total Active Motion: flex – ext lag
- Differ in use of goniometric measure and criteria for classification
Outcomes and Evaluation of Flexor Tendon Repair

- Classification of outcome
  - excellent, good, fair, poor
- % contralateral digit/hand

<table>
<thead>
<tr>
<th>Function Grade</th>
<th>% Return of Motion*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>85-100 (&gt;150°)</td>
</tr>
<tr>
<td>Good</td>
<td>70-84 (125°-149°)</td>
</tr>
<tr>
<td>Fair</td>
<td>50-69 (90°-124°)</td>
</tr>
<tr>
<td>Poor</td>
<td>0-49 (&lt;90°)</td>
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</table>

Jin Bo Tang, Outcomes & Evaluation of Flexor Tendon Repair
Hand Clin 2013; 29:251-259

Physical Impairment (ROM, strength)

- Timing – initial vs. final
- Total active motion
- Passive motion
- Methodology – instrumentation
Patient Reported Outcomes

- Previously considered subjective
- Established method of evaluation
- Provides an understanding patient perspective and impact of injury/disease

- General health status - SF-36, SF-12
- UE questionnaire – DASH MHQ
- Disease specific - CTS symptom severity & functional scale, PRWE, Shoulder Pain Disability Index
- Symptoms - Cold sensitivity, pain, AusCan (pain & stiffness)
- Specific disability - Pain disability
- Psychosocial – pain catastrophizing, depression, anxiety
PRO - Administration

- Paper based
- Electronic format
- Verbal – person or by telephone
- Surrogate – family, caregiver, translator
- Scales: Verbal rating, numeric, VAS, composite scoring

Visual Analog Scale

- 10 cm line
- To measure intensity of symptoms

No Pain                   Most Severe Pain
Not Affected             Severely Affected
Healthy                  Death
Good quality of life     Worst quality of life
McGill Pain Questionnaire

- Adjectives
- 10 cm VAS
- Present Pain Intensity
- New version to differentiate neuropathic & non-neuropathic pain

Symptom Diagram

- Body
- Extremity
- Hand

Rank 0-10
- Numeric Rating Scale
### Self-Reported Outcome

<table>
<thead>
<tr>
<th>Self-reported Outcome</th>
<th>Self report Questionnaires</th>
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<tbody>
<tr>
<td>Valid, reliable, responsive</td>
<td></td>
</tr>
<tr>
<td>Standardized items</td>
<td></td>
</tr>
<tr>
<td>Construct measured</td>
<td></td>
</tr>
<tr>
<td>Consideration of time:</td>
<td>Application, Scoring, Patient burden</td>
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</table>
Extremity vs. Condition Specific

- DASH & QuickDash
  - 30 items (symptom & activity)
  - Easily scored
  - Translated in multiple languages

- Patient Rated Wrist Evaluation
  - 15 items (pain & activity)
  - Easily
  - Translated in multiple languages

Established validity, reliability and responsiveness

DASH Scoping Review

- Literature review evaluated the DASH scores for hand/wrist conditions
- 85 articles – DASH scores for 24 conditions
- Scores varied between conditions & between studies assessing the same conditions
- Variability in questionnaire application & methods

Patient Specific Items

- COPM – Canadian Occupational Performance Measure – performance issues about self-care, productivity & leisure (performance & satisfaction) (Published by CAOT 1991)
- Patient Specific Functional Scale – 3 items ranked 0-10 scale (Stratford et al. Physiother Can 1995)

Canadian Occupational Performance Measure & Patient Specific Functional Scale

- Patient specific items
- Comparisons or change over time
- Standardized items are NOT used & difficult to compare between patients
Patient Specific Functional Scale

Assess functional status with items that are identified by the patient. Identify 3 items: unable to perform or have difficulty with

Degree of difficulty assessed 10 cm VAS


PSFS in Nerve Injury

• 157 patients after nerve injury
• PSFS scores
  – correlated with DASH and SF-36 physical role domain
  – Significantly lower in BP injuries
• Provides construct validity in nerve injury

Novak et al. HAND 2013
PSFS in Hand Fractures or Dislocations

• 63 patients with hand fractures or dislocations attended hand therapy
• Significant improvement in function (increased PSFS)

58 yo RHD male
Onset of weakness to right hand. Brachial plexus neuritis – radial nerve function & ulnar innervated intrinsics

10cm VAS
Measure 0 – 10

How to Score?
Each item
Best
Worst
Mean
Clinical or Research Outcomes

No one measurement tool possesses all the qualities necessary to evaluate all patients under all conditions.

Challenge

- To determine how to measure outcome and to select the best measure
- From the perspective of the patient, surgeon, therapist
- Identify the goals of measurement and criteria
Outcomes

• Identify the goals of measurement and criteria
• Understand the domain or measurement concept/content
• Measures of impairment, symptoms, function, impact on activities & participation

Outcome – Complex Construct
Biomedical Psychosocial model
Physical impairment
Patient Reported Outcomes
Impact of the injury – activity & participation