**Motor Assessment of the Upper Limb**

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**Evaluation**
- Range of Motion Measurements
- Strength testing – Pinch and Grip

**Introduction**
- The Biometrics’ E-LINK Clinical Testing and Rehabilitation Systems.
- Designed by Therapists for Therapists.
- Sets a new world standard with modules for Evaluation, Exercise, Documentation, Progress Reporting, and Impairment Calculations.

**Overview**
- Use of computerized testing can increase the objectivity, speed, and accuracy of testing and data collection.
- Additional clinical information may be obtained.
- Data can easily and quickly analysed for progress reporting, research studies, or outcomes measures.

**Computerized Interactive Rehabilitation**

**Evaluation**
- Baseline Measurements
- Pinch Strength
- Dynamometer (Grip Strength)
- Range of Motion
**Pinch**
- Accuracy 2% full scale 0-25 kg
- Unique thin profile measures functional end range pinch
- Measures in 0.1 kg increments

**Pinch Measurements**
- Key (Lateral Pinch)
- Three Jaw (Tripod Pinch)
- Tip to Tip Pinch
- Thumb to Digit Opposition

**Co-efficient of Variation (CV)**
- Statistical calculation of variability between the measurements
- \[ \text{Standard Deviation of the measurements} \times 100 \]
- Average
- May document if the patient is not giving consistent effort

**Grip Strength**
- Accuracy 2% full scale 0-90 kg
- Measures in 0.1 kg increments
- Industry standard design provides comparisons against normative data

**Grip Strength**
- 5 position Peak Force Test
- Sustained Grip Test
- Rapid Exchange Test

**Standard 5 Position Grip Test**
- Measures grip strength throughout the ROM
- Calculates the average and the CV
- Graph of the 5 positions
  - Max strength is usually position 2 or 3
  - Positions 1, 4, & 5 should be lower, if the patient is giving maximum effort
**Sustained Grip Test**

- Measure of force over time
  - 5, 10, 15 or 30 seconds
- Cannot do with manual dynamometer
- Gives us additional clinical information

  - Reference - "Assessing Sincerity of Effort in Maximal Grip Strength Tests" – Smith, G., MS; Nelson, R., PhD; Sadoff, S., MS; Sadoff, A., MD - American Journal of Physical Medicine and Rehabilitation, Apr 1989, Vol. 68, No 2

**Rapid Exchange Grip Test**

- Detection of Submaximal Effort

  - Reference - "Detection of Submaximal Effort by Use of the Rapid Exchange Grip" – Hildreth, D., MD; Breidenbach, W., MD; Lister, G., MD; Hodges, A., MS, PT - Journal of Hand Surgery, July 1989, Vol. 14A, No 4

**Results**

- Average
- Co-efficient of Variation (CV)
- Average Correlation – compares the average of the RET against the average of the standard test
- Graph

**Negative RET**

**Positive RET**

- Maximum force – simple lower level brain function
- Controlled force less than maximum – higher level brain function requiring more time
Grip Analysis & Progress Reports

- Normal values for grip strength are based on age, sex and dominant hand
  - reference: Grip and Pinch Strength: Normative Data for Adults, Archives of Physical Medicine and Rehabilitation, V. Mathiowetz, et al., Vol 64, Feb 1985
- Normal data is position 2 only
- Progress reports of multiple session include percentage change

Range of Motion

- Range of Motion (ROM) is described as the available arc of motion within a joint which is assessed by goniometer measurements.
- Active Range of Motion (AROM) is the movement when the patient utilizes his muscle power to effect movement at a joint
- Passive Range of Motion (PROM) is the movement achieved at a joint when the examiner applies an external force.

Range of Motion

- Joints are measured on the dorsal aspect
- The axis of the goniometer is lined up with the axis of the joint
- The arms of the goniometer parallel the bones
- In the presence of edema, a lateral placement may be used

Computerized Interactive Rehabilitation

Range of Motion

- Accurate to one degree
- Increase speed of data collection

Range of Motion

- ±15° Hyperextension
- 0° Full Extension
- +10° Extension Lag
- 0° Flexion

Range of Motion

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TAM/TPM

- Total Active Motion (TAM)
- Total Passive Motion (TPM)
- Total motion of a digit is described by a single number
- Composite statement of the integrated motion of a digit to facilitate comparison of data

For each digit:

- Sum of the flexion values minus the sum of the extension values
- Hyperextension values are counted as zero

Range of Motion

- Multiple sessions of ROM may be compared to show progress

Summary
Improve Testing and Measurement

The E-LINK precision engineered tools are manufactured to exacting standards.
- Provide greater accuracy and speed of data collection.
- Patients can be objectively tested earlier in the rehab process.
- Includes tests that are impossible to do with traditional instruments.

Improve Documentation and Reporting

- Computerized reports save valuable staff time.
- Database software easily and quickly documents meaningful progress over extended time.
- Data export for research studies and statistical analysis.

Technology to Meet the Changing Needs of Rehabilitation

Now and in the Future