NATIONAL MANUAL
for measuring motion and strength in the
elbow, forearm and hand

Manual for motion and strength measurement of elbow, forearm and hand

Version 1, 2019
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INTRODUCTION:

National measurement manual

This is a national measurement manual compiled in 2010 by the rehab units at hand surgery clinics in Göteborg, Linköping, Malmö, Stockholm, Umeå, Uppsala and Örebro.

Aim

The aim of the measurement manual is to ensure the highest possible reliability when measuring functions in HAKIR, and to try to create a Swedish standard for assessment of the hand and upper limb.

Status measurement

- All measurements are performed throughout with active movements
- Distances are measured in millimetres
- Strength is measured in kilograms, with one decimal point, using the mean of three measurements
- When specifying time and date for post-operative treatment, the date of the surgery is considered to be day 0.
- Minus and plus when measuring (1)

For extension/flexion of the elbow, fingers and thumb. Indicate hyperextension with a minus (-). Example:

Extension/flexion MCP 0/90°
For hyperextension MCP -10/90°
For extension deficit MCP 20/90°

For pronation, supination of forearm and extension, flexion, radial deviation and ulnar deviation of wrist. For lack of mobility, specify degree as a minus (-). Example:

Supination between 20° and 70° is indicated as:
Pronation -20
Supination 70
Instruments, reliability and validity

To ensure high reliability, it is important to define and use identical measuring positions and to repeat these in all measurements. A margin of error of around 5° when using a goniometer is considered acceptable. If measurements are taken in a way not prescribed by the manual, this should be described to increase reliability (2).

The goniometer is an instrument with high validity for measuring angles (2). The choice of goniometer should be based on each respective measuring situation, for example using a shorter-armed goniometer when measuring DIP flexion. The goniometer can be calibrated using known angles (3). Reference values for goniometer measurements are listed in a table (3).

The Jamar dynamometer has been shown to be reliable as long as normal calibration, standardised positions and instructions are used during testing (4). It is valid in the sense that it measures strength rather than pressure (5).

The measurement manual can be downloaded at www.hakir.se and is revised annually.
Joint: Elbow joint.

Starting position: Standing, shoulder adducted, forearm supinated.

Axis of motion: Lateral humerus epicondyle.

Fixed arm: Lateral, parallel with the humerus.

Moving arm: Lateral, parallel with the radius.

Measuring method: Goniometer 20 cm.

Reference: 2.
FOREARM

**Joint**
Proximal and distal radioulnar joint (PRU and DRU).

**Starting position**
Elbow next to waist, elbow joint approx. 90° flexion, forearm in neutral position.

**Axis of motion**
Parallel with the forearm’s longitudinal axis.

**Fixed arm**
Longitudinal in line with humerus.

**Moving arm**
Resting dorsally or volarly on radius and ulna, respectively proximal to caput ulnae parallel with radiocarpal joint.

**Measuring method**
Goniometer 20 cm.

**Reference**
1, 2.
**WRIST**

**Extension**

**Joint**  Wrist.

**Starting position**  Flexed elbow, forearm in neutral position, relaxed fingers.

**Axis of motion**  Radiocarpal and midcarpal joint.

**Fixed arm**  Radially parallel with the radius.

**Moving arm**  Radially parallel with second metacarpal.

**Measuring method**  Goniometer 20 cm.

**Reference**  1.
WRIST

**Radial deviation**

**Joint**

Wrist.

**Starting position**

Forearm resting pronated on surface, wrist 0° extension/flexion.

**Axis of motion**

Radiocarpal and midcarpal joint.

**Fixed arm**

Dorsally, midline of forearm.

**Moving arm**

Dorsally, midline of third metacarpal.

**Measuring method**

Goniometer 20 cm.

**Reference**

2.
**THUMB**

**Palmar abduction**

**Joint**  
CMC I joint.

**Starting position**  
Forearm resting with ulnar side against a surface, wrist 0-30° extension (neutral position).

**Motion**  
Thumb is abducted at a right angle to the palm.

**Axis of motion**  
Intersection of the lines created between metacarpals I and II.

**Fixed arm**  
MC II radially.

**Moving arm**  
MC I dorsally.

**Measuring method**  
Goniometer 20 cm.

**Reference**  
2.
# Radial abduction

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Extension of MCP and IP joint

Joint MCP and IP joint dig I.

Starting position Forearm, wrist and CMC I joint in neutral position.

Axis of motion MCP and IP joint.

Fixed arm Dorsally, metacarpal and proximal phalanx, respectively.

Moving arm Dorsally, proximal phalanx and distal phalanx, respectively.

Measuring method Finger goniometer ___°/
Hyperextension indicated with a minus.

Reference 1 pages 175-176, 180.
### THUMB

**Flexion of MCP and IP joint**

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Opposition

**Joint**
CMC I.

**Starting position**
Forearm and wrist in neutral position.

**Reference points**
The distance between thumb and each respective fingertip as well as to the base of dig V. Measured from the middle of the pulp under the nail. Note if the thumb only reaches the radial side of the pulp.

**Measuring method**
Ruler. Opposition distance in mm.

**Reference**
1 page 181.
### Fingers

**Joint**
Dig II-V MCP.

**Starting position**
Forearm resting pronated on surface. Wrist in neutral position. Extended MCP and IP joints.

**Axis of motion**
MCP joint.

**Reference points**
Distance between middle of fingertips.

**Measuring method**
Ruler. Distances are indicated in mm.

**Reference**
1 page 179.
FINGERS

Finger extension

Joint
MCP, PIP and DIP joint dig II-V.

Starting position
Forearm and wrist in neutral position.

Axis of motion
MCP, PIP and DIP joint.

Fixed arm
Dorsally, metacarpal, proximal phalanx and middle phalanx, respectively.

Moving arm
Dorsally, proximal phalanx, middle phalanx and distal phalanx, respectively.

Measuring method
Finger goniometer ___°/
Hyperextension indicated with a minus.

Reference
1 pages 175-176, 178.
**FINGERS**

*Finger flexion*

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**FINGERS**

Pulp to palm distance when attempting to fully fist the fingers.

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GRIP
STRENGTH

Grip strength

Measuring instrument
Jamar dynamometer.

Starting position
Sitting with elbow by waist, elbow joint approx. 90° flexion, forearms and wrist in neutral position. The examiner supports the dynamometer.

Procedure
Grip in second position. Start with the unaffected hand. Switch between right and left hand. Instruction: “Squeeze the handle as hard as you can, a little harder, a little harder, and relax”.

Measuring method
Mean of three measurements in kg. One decimal point.

Reference
5, 6.
PINCH STRENGTH

Two-point pinch

Measuring instrument  Pinch Gauge.

Starting position  Sitting with elbow by waist, elbow joint approx. 90° flexion, forearm and wrist in neutral position. The patient grabs the gauge between the index finger and thumb making an O, with the remaining fingers flexed in towards the distal palmar crease. The examiner holds the Pinch Gauge lightly at the other end.

Procedure  Start with the unaffected hand. Switch between the right and left hand. Instruction: “Pinch as hard as you can, a little harder, a little harder, and relax”.

Measuring method  Mean of three measurements in kg. One decimal point.

Reference  6.
PINCH STRENGTH

Tripod pinch

Measuring instrument  Pinch Gauge.

Starting position  Sitting with elbow by waist, elbow joint approx. 90° flexion, forearm and wrist in neutral position. The patient grabs the gauge between the thumb, index and middle finger. The examiner holds the Pinch Gauge lightly at the other end.

Procedure  Start with the unaffected hand. Switch between the right and left hand. Instruction: “Pinch as hard as you can, a little harder, a little harder, and relax”.

Measuring method  Mean of three measurements, in kg. One decimal point.

Reference  6.
Key pinch

Measuring instrument Pinch Gauge.

Starting position Sitting with elbow by waist, elbow joint approx. 90° flexion, forearm and wrist in neutral position. The gauge rests on the index finger’s middle phalanx, top of thumb on opposite side. The examiner holds the Pinch Gauge lightly at the other end.

Procedure Start with the unaffected hand. Switch between the right and left hand. Instruction: “Pinch as hard as you can, a little harder, a little harder, and relax”.

Measuring method Mean of three measurements in kg. One decimal point.

Reference 6.
REFERENCES


Paramedical reference group with representatives of the hand surgery clinics in Göteborg, Linköping, Malmö, Stockholm, Umeå, Uppsala and Örebro.