Finger Goniometry for DISC: Measurement of Passive and Active Range of Movement

1 Introduction

This manual describes the preferred method of measuring the contracture of the finger joints for the DISC study[1]. The standard practice describes the goniometer, the position of the limb, the method of measurements of active and passive movement of the metacarpo-phalangeal, proximal and distal interphalangeal joints, the instructions given to participants, repetitions and the alternative methods used. A simple checklist is presented.

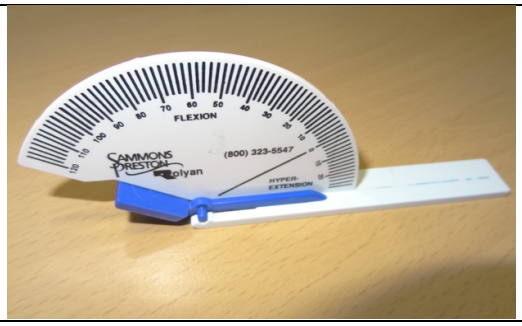
Although total active and passive movement for the joints of a finger have been described, for DISC we will record the active and passive movements for each joint of affected fingers[2] at baseline and the study "reference finger" at each follow-up time point.

2 Goniometers

There are several goniometers used to measure the range of movement of the finger joints.

2.1 Type of goniometers

The different types of goniometers have been investigated[3],[4]. We recommend that the DISC recruiting sites use a finger goniometer that permits assessment of hyperextension, and has a precision of at least 2 degree marks.
The research team at each site should designate a finger goniometer for the DISC study.

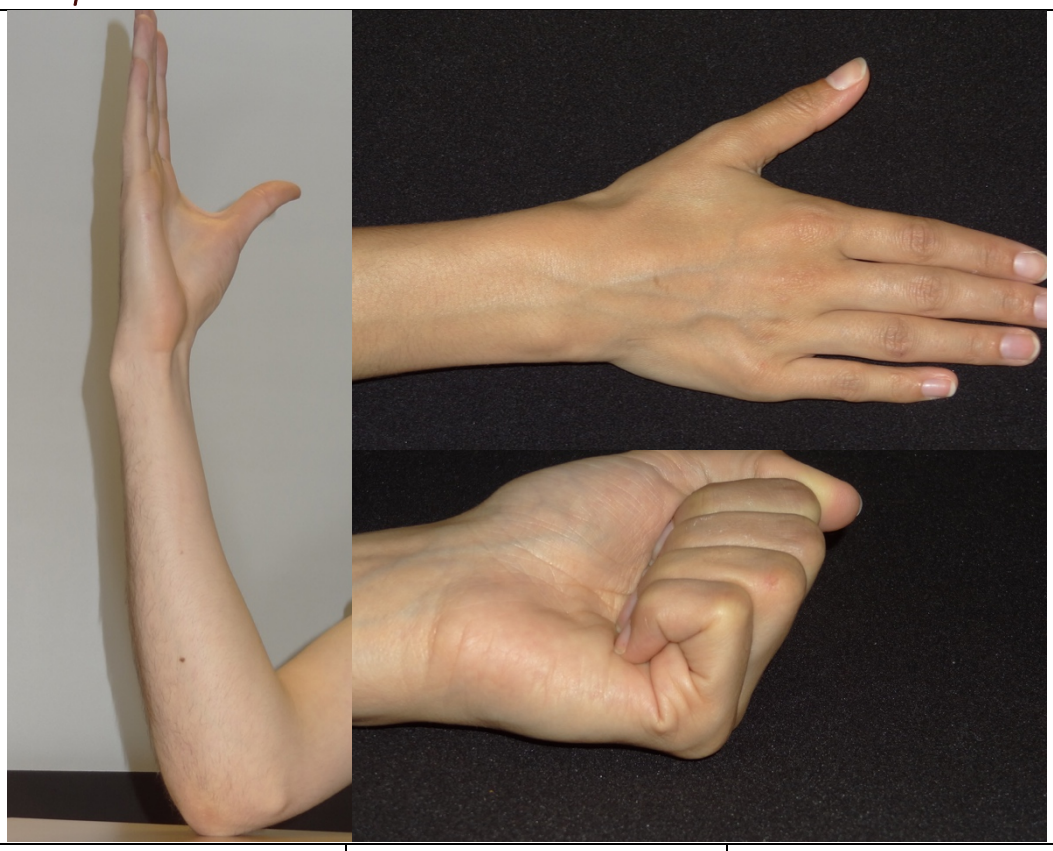


The preference for DISC is to use a **Rolyon Finger Goniometer**[5, 6] but we do not have a preference for the red (loose hinge) or blue (stiff hinge) variety of this goniometer.
This goniometer meets the DISC requirements. The Rolyon Goniometer permits the measurement of up to 30 degrees of hyperextension to investigate the range of metacarpophalangeal extension and any compensatory hyperextension of the distal interphalangeal joint. It can measure flexion to 120 degrees. The units of measurement are in degrees, in 2 degree increments. It has flat long and short limbs to allow easy and stable placement on the dorsum of the digit and hand. The

long limb of the goniometer is around 10 cms., and the short limb is around 2 cms. This is the commonest finger joint goniometer and has been extensively tested.

3 Position

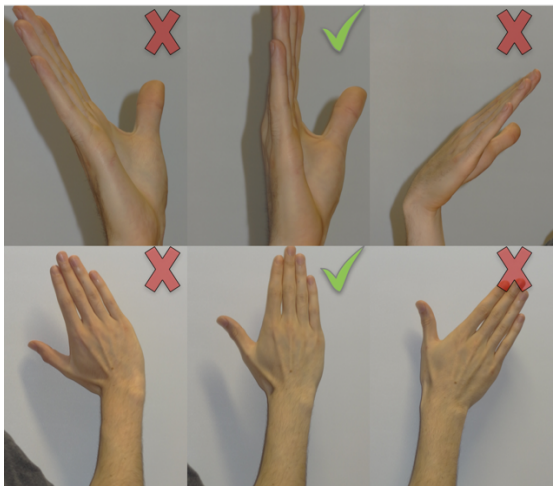
3.1 Arm position [6]



Upright	Prone	Supine
Use whichever position is comfortable for the participant or is your preference, as long as the wrist is placed in a neutral position		

3.2 Wrist position

Although the arm is positioned so the assessor can access the appropriate part of the hand, the wrist position is important as in some participants the Dupuytren cord is such that the measured angle of contracture can change substantially from full wrist extension when the contracture is greater, especially at the MCP joint, caused by a "fasciodesis" effect on the contracted cord. The assessor should check that the position of the wrist does not change the measurement, and if it does the position of the wrist should be neutral.



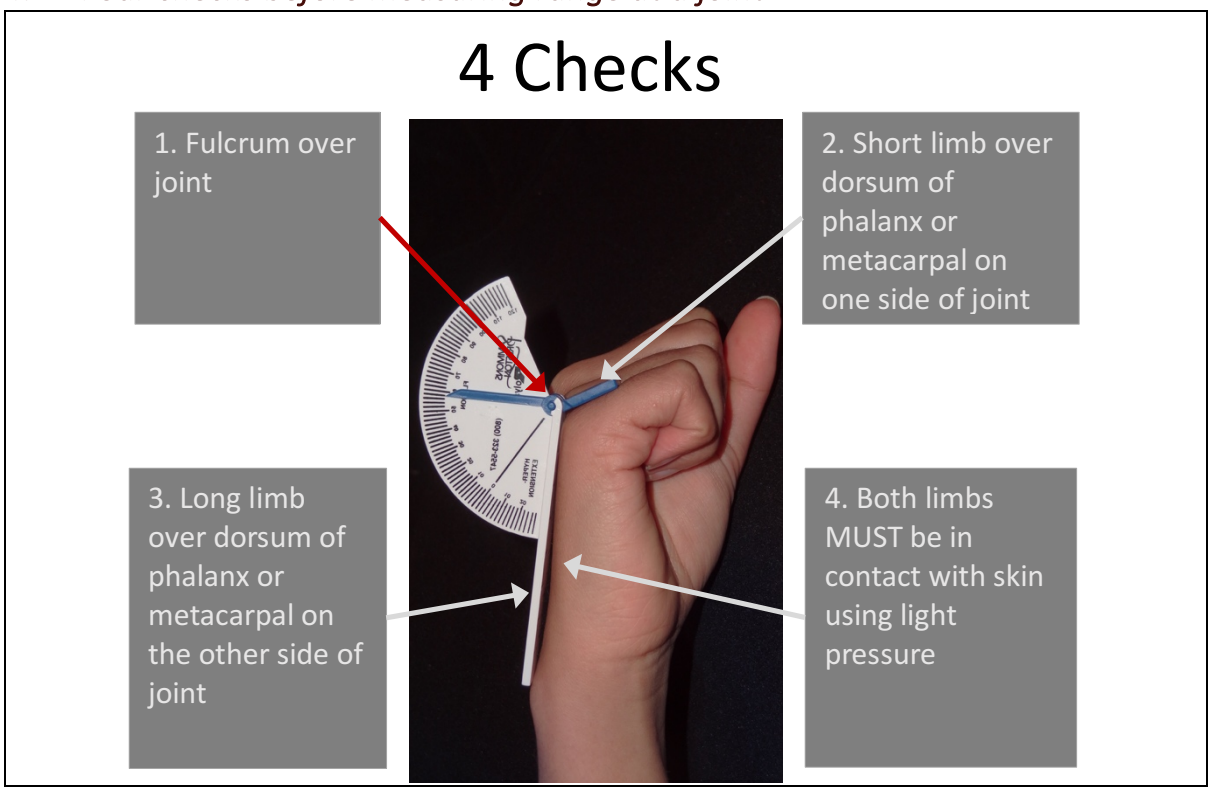
3.3 *Metacarpophalangeal position when measuring the proximal interphalangeal joint*

A similar "fasciodesis" effect can occur when measuring the PIP joint contracture in different positions of the metacarpophalangeal joint[1, 2, 7]. For consistency, we recommend that the PIP extension contracture is measured with the participant trying to straighten the finger at all joints.

4 Measurement of range

Dorsal position of the finger goniometer is preferred as recommended by American Society of Hand (ASHT) and other researchers[8, 9].

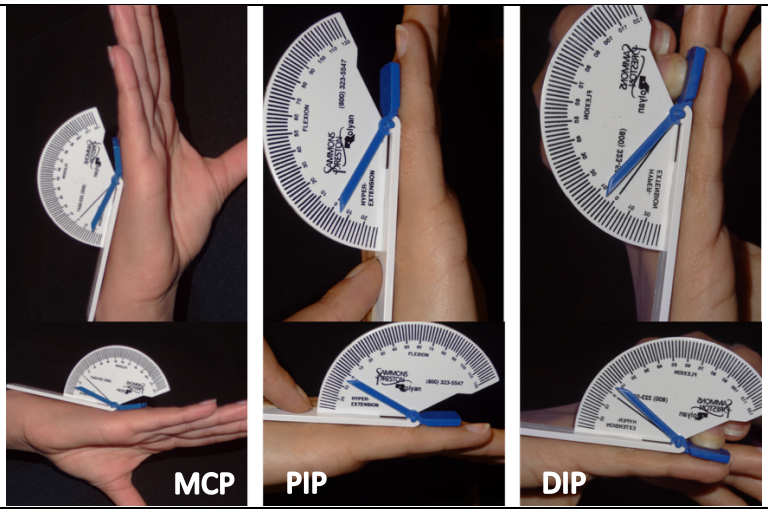
4.1 *Four checks before measuring range at a joint*



4.2 *Extension*

Ask the participant to *"straighten your fingers*[6] *as much as you can but keep your wrist still".*

4.2.1 Measure each joint



This demonstrates the placement of the goniometer to measure the joint range (note that the wrist is near neutral) in the upright position and in the prone position

4.2.2 Measuring passive range

Before measuring passive range ask the participant, *"Now relax your fingers and let me move your finger. I will measure them passively. Tell me if I am hurting you."*

Give gentle pressure to push the finger into further extension if possible and measure the angle again. This is the passive extension range for that joint .

4.2.2.1 Hyperextension:

It is usual to find hyperextension at the MCP joint in most people. Hyperextension can also be noted in the PIP and DIP joints in hyperlax individuals. In Dupuytren Contracture there can be compensatory hyperextension of the DIP and MCP joints if there is severe flexion contracture of the PIP joint.

4.2.3 Proximal Interphalangeal joint

The measurement extension of the proximal interphalangeal joint is usually done in full extension of the finger. The clinician should also routinely check and note if the angle of contracture recorded is improved with the metacarpophalangeal joint in flexion to counter the effect of "fasciodesis" [2, 7].

4.2.4 Distal Interphalangeal joint

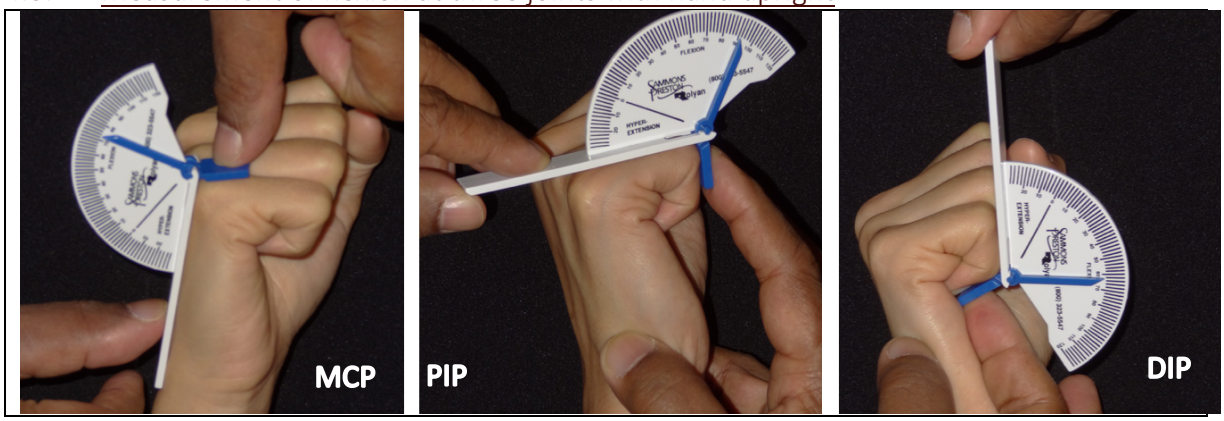
The distal interphalangeal joint can hyperextend, so the goniometer should allow measurement of hyperextension.

4.3 Flexion

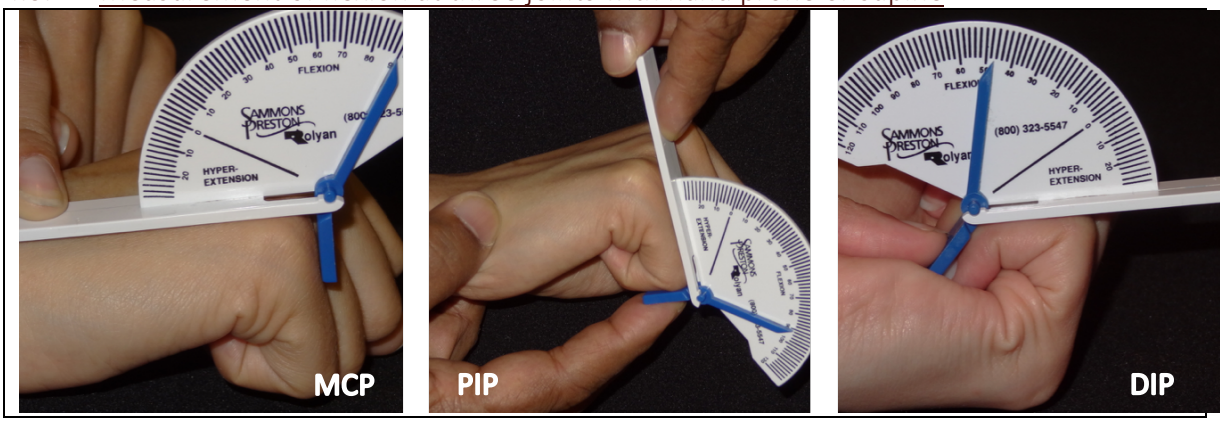
Ask the participant to "make a fist as best as you can[6] but keep your wrist still".

All three joints can then be measured.

4.3.1 Measurement of flexion at three joints with hand upright



4.3.2 Measurement of flexion at three joints with hand prone or supine

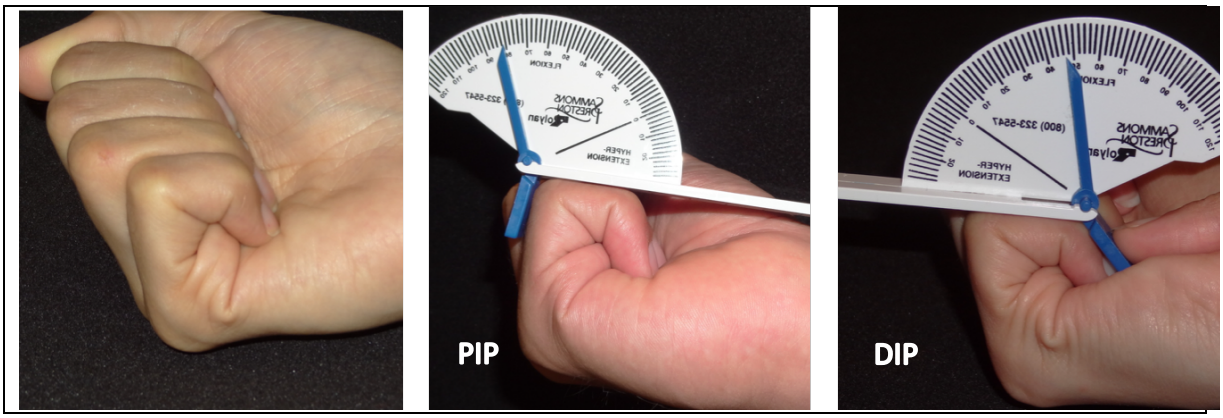


4.3.3 Distal Interphalangeal joint

If the short limb of the finger goniometer does not permit the assessment of the distal interphalangeal joint flexion angle because the length of the distal phalanx is less than 2 cm, straighten the proximal interphalangeal joint enough to allow measurement.

4.4 Measuring flexion of interphalangeal joints in full supination and making a fist

Sometimes it is easier to measure the flexion range of the proximal interphalangeal and distal interphalangeal joint in flexion in supination. This is left to the discretion of the clinician as long as attention is paid to keeping the wrist in a neutral position. It is difficult to measure the metacarpophalangeal joint in supination.



5 Checklist

1. Get arm comfortable.
2. Ensure wrist is in neutral position.
3. Get participant to extend fingers by asking "*straighten your fingers as much as you can but keep your wrist still*".

4. Ensure the proper placement of the goniometer by doing the following 4 checks (but we do not specify which part of the goniometer goes proximal or distal):
   4.1 position of one limb of the goniometer is over the dorsum midline of the finger on one side of the joint being measured without the length of the goniometer limb getting in the way.
   4.2 position of the other limb of the goniometer is on the dorsum midline of the finger on the other side of the joint being measured.
   4.3 check that the fulcrum of the goniometer is positioned correctly.
   4.4 check that the surface of each limb of the goniometer is in proper contact with the skin.

5. Measure **active** range.
6. Now say to the participant, *"Now relax your fingers and let me move your finger. I will measure them passively. Tell me if I am hurting you."* And measure the passive range at each joint.
7. Get participant to flex fingers by asking "*make a fist but keep your wrist still*".
8. Measure **active** range followed by **passive** range at each joint.

Table 1: Summary of goniometer placement

Goniometer	MCP	PIP	DIP
Fulcrum	Dorsally over the MCP joint	Dorsally over the PIP joint	Dorsally over the DIP joint
one limb	Over dorsal midline of metacarpal	Over dorsal midline of proximal phalanx	Over dorsal midline of middle phalanx
other limb	Over dorsal midline of proximal phalanx	Over dorsal midline of middle phalanx	Over dorsal midline of distal phalanx
Pressure	Light to maintain contact with skin surface. Ensure that the long and short limbs of the goniometer are in contact with the dorsal skin surface of the adjacent parts of the finger		
Passive range pressure	Gently push the phalange distal to the joint being measured in the appropriate direction		

6 Summary

Position the arm so it is comfortable, keep the wrist neutral, place the goniometer and do the "4 checks", measure extension at each joint followed by flexion at each joint assessing active range followed by passive range.

7 References

1. A. L. Pratt and C. Ball. Variation in Range of Movement Reporting in Dupuytren Disease. In: P. M. N. Werker, J. Dias, C. Eaton, B. Reichert and W. Wach, eds. Dupuytren Disease and Related Diseases- The Cutting Edge. Switzerland: Springer; 2016.
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