

GRIP STRENGTH
Hand-Held Dynamometry

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GRIP STRENGTH

Hand-Held Dynamometry

1. Background and rationale

Muscle strength is an indicator of muscle function and therefore an important outcome of this study. Fiatarone et al¹ have postulated that strength is a more important limiting factor than cardiovascular endurance in the ability of older individuals to maintain an independent lifestyle.

Muscle strength decreases with age but little is known about the influence of changes in muscle mass, fat mass, and physical activity on this decrease.

Grip strength is a commonly used measure of upper body skeletal muscle function and has been widely used as a general indicator of frailty. Grip strength in both hands will be measured using an adjustable, hydraulic grip strength dynamometer.

2. Equipment and supplies

- Jamar Hydraulic Hand Dynamometer which registers maximum kilograms of force during a trial, with adjustable handgrip
- Standard chair
- Table (moveable tray table preferred)
- Mouse pad

Use and Maintenance: For routine maintenance, follow the instructions in the Jamar dynamometer owner's manual.

To use the dynamometer:

1. Please remember that it is a precision instrument and its accuracy can be impaired by abuse. Never force the handles or subject the instrument to unnecessary impact.
2. Set the adjustable handle to the desired spacing. (Before moving the handle from one position to another, note that the handle clip is located at the lower (furthest) post from the gauge. If the handle is not replaced in the correct position, the readings will not be accurate.)
3. Rotate the red peak-hold needle counter-clockwise to 0. Always look straight ahead at the dial when reading.
4. After the participant has used the instrument, reset the peak-hold needle to zero before attempting a new reading.

Service Tips: To make sure the instrument is reading accurately, it's a good idea to make a few checks each month, as listed below. If you detect a problem, report this to the quality control (QC) officer.

Posts: Remove the adjustable handle and check that each post moves up and down freely (through a very small distance, about 1/8") within the plastic aperture (the guide) even when you exert pressure on the side of the post. About once a year, place a small amount of grease on the two guides. If excessive friction exists between the post and guide, return the dynamometer to the QC officer.

Hydraulics: To check the hydraulic mechanism, first remove the adjustable handle. While watching the top post, push down on the bottom post. Normally, both posts should move about 1/8", with top and bottom posts moving in opposite directions. Movement less than 1/16" indicates a probable leak in the hydraulic system, which requires service. Return the dynamometer to the QC officer.

Handle: Grasp the instrument normally and look carefully at the way the forks of the adjustable handle are supported on the posts. Each fork should touch the post at approximately its mid-point. If this is not the case, return the instrument to your supervisor.

Peak-Hold Needle: Check for excessive friction in the peak-hold assembly by turning the peak-hold knob counter-clockwise. If the peak-hold needle causes the gauge needle to move, return the gauge for service.

If the peak hold needle is knocked off its support pin, it can readily be repositioned. Unscrew the crystal and turn it upside down. Locate the brass pin in the center of the crystal (the pin is part of the chrome knob on the outside of the crystal). Locate the slot on the brass pin and place the peak-hold needle into this slot.

Calibration check:

Every week: Check the calibration of the grip strength dynamometer by hanging 5 kg and 20 kg (or 10 and 50 lb) weights across the handle using two velcro straps, one strap on each side of the dynamometer handle, or one wide strap that covers the whole handle. Lift the weights slowly from the floor while they are strapped to the dynamometer handle and record the maximum kilograms registered. The lifting motion should be very slow and smooth, and the weight should remain evenly distributed between the two sides of the handle. Repeat the procedure three times and record each result.

Average the three calibration trials. The dynamometer should be accurate within ± 2 kgs for the average of the three calibration trials. If the calibration check is not within these limits, notify the QC officer. It may be necessary to send the dynamometer to the manufacturer for repair and recalibration. DO NOT attempt to recalibrate the dynamometer yourself. Calibration problems can be caused by dropping the dynamometer or by leaks in the hydraulic system.

Recalibration Directions for QC Officer: To get the dynamometer recalibrated, call 1-800-323-5547 (Patterson Medical). They will send you a form to complete and put in a box with the

dynamometer. Do not send in the dynamometer without the form. Send the box to Patterson Medical; 14 North Peoria, B-101, Chicago, IL 60607. They will return the dynamometer within 5 to 7 days. The cost is \$139.95.

3. Safety issues and exclusions

This test should not be performed in the affected hand of the participant:

- has undergone fusion, arthroplasty, tendon repair, synovectomy, or other related surgery of the upper extremity in the past 3 months.

If only one side is affected, test the unaffected side.

The test can be performed if the participant has a current flare-up of pain in their wrist or hand; for example arthritis or tendonitis. Be sure to record this information on the data collection form.

4. Participant and exam room preparation

The participant should be seated at a standard height table or on a seat with a moveable tray table attached.

5. Detailed measurement procedures

5.1 General issues/description

Grip strength will be measured in two trials of each hand (unless there are extenuating circumstances - see above) using a hydraulic, isometric dynamometer.

5.2 Administration

- 1) Determine if the participant has had surgery on their hands or wrists in the past three months.

Script: “Have you had any surgery on your hands or wrists in the past three months?”

If the participant says “Yes,” ask them which hand or wrist was operated on, and do not test that hand. Record this information on the data collection form.

- 2) Determine if the participant has an acute or recent flare of arthritis in their hands.

Script: “Has any pain or arthritis in your right hand gotten worse recently?”

Record answer on form. Then, if they answer “Yes,” ask:

Script: “Will the pain keep you from squeezing as hard as you can?”

Record answer on form. Then ask:

Script: “Has any pain or arthritis in your left hand gotten worse recently?”

Record answer on form. Then, if they answer “Yes,” ask:

Script: “Will the pain keep you from squeezing as hard as you can?”

Record answer on form.

Pain or arthritis that has gotten worse recently is not an exclusion for this test. If the participant is willing to have the grip strength test, test the participant and record the results on the data collection form.

3) Demonstration and practice

The examination is done with the participant in the sitting position with the arm to be tested resting on the table and the elbow held at approximately a right angle. The dynamometer is held in the hand to be tested and is resting on a mousepad.

Script: “I’d like you to take your right/left, arm, rest it on the table, and bend your elbow. Grip the two bars in your hand, like this. Please slowly squeeze the bars as hard as you can.”

Demonstrate the correct grip and arm position. As you demonstrate, instruct the participant to squeeze the hand maximally.

Adjust the grip size so that the participant holds the dynamometer comfortably (this will almost always be the second setting). If the handle hits the participant’s hand distal to the second knuckle the grip size should be smaller. Allow one submaximal practice trial to determine if the procedure is understood by the participant and the grip size properly adjusted. If the participant’s finger nails are hitting their palm the dynamometer needs to be adjusted to a larger grip size.

Script: “Now try it once just to get the feel of it. For this practice, just squeeze gently. It won’t feel like the bars are moving, but your strength will be recorded. Are the bars the right distance apart for a comfortable grip?”

Show dial to participant. Adjust the handgrip again, if necessary.

4) Test grip.

Script: “We’ll do this two times. This time it counts, so when I say squeeze, squeeze as hard as you can. Ready. Squeeze! Squeeze! Squeeze! Now, stop.”

Have the participant perform the test, starting with the right hand. Set the dynamometer to zero prior to each attempt:

Record the kilograms pulled from the dial to the nearest 2 kilograms. If the reading is exactly between two readings on the scale, round up to the next higher even number. Reset the dial to “0” after each trial.

Perform two trials with at least 15 to 20 sec rest in between.

Script: “Now, one more time. Squeeze as hard as you can. Ready. Squeeze! Squeeze! Squeeze! Now, stop.”

5) Repeat the procedure on the left side, unless contra-indicated.

6. Procedures for performing the measurement at home

No modifications required.

7. Alert values/follow-up/reporting to participants

When the test is completed tell the participant how many kilograms were read on the dial and that they did just fine.

Record maximum kilograms for each side on participant’s results form.

8. Quality assurance

8.1 Training requirements

The technician requires no special qualifications for performing this assessment. The training should include:

- Read and study manual
- Attend Health ABC training session on techniques (or observe administration by experienced examiner)
- Practice on other staff or volunteers
- Discuss problems and questions with local expert or QC officer

8.2 Certification requirements

- Complete training requirements
- Demonstrate maintenance check of dynamometer
- Demonstrate the proper adjustment of dynamometer handles
- Demonstrate the calibration check procedures
- Recite exclusions
- Conduct exam on 2 volunteers:
 - According to protocol, as demonstrated by completed QC checklist
 - ± 2 kgs on repeat assessment of volunteer

8.3 Quality assurance checklist

- Participant is asked about recent surgery on hands
- Participant is asked about pain and arthritis in hands
- Correct instructions given while demonstrating procedure
- Recording dial reset to zero after sub maximal practice
- Sub maximal practice; grip adjusted if necessary
- Forearm resting on table, elbow bent to approximate right angle
- Standard encouragement (motivation and feedback) offered to participant
- Recording dial (peak hold needle) reset to zero after first trial
- Measurement taken twice on each side (unless contra-indicated)
- Key points from script delivered clearly
- Correctly completes form
- Reviews form for completeness
- Log indicates calibration check up to date

9. Reference

1. Fiatarone MA, Marks EC, Ryan ND, Meredith CN, Lipsitz LA, Evans WJ.: The etiology and reversibility of muscle dysfunction in the aged. JAMA 1990;263:3029-3034.

Acknowledgment. This chapter is adapted from the Fracture Intervention Trial (FIT) Operations Manual.

10. Data collection form



HABC Enrollment ID #	Acrostic	Visit Year	Staff ID#
H <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input checked="" type="radio"/> 16	<input type="text"/> <input type="text"/> <input type="text"/>

GRIP STRENGTH
(Hand-Held Dynamometry)

1. Have you had any surgery on your hands or wrists in the past 3 months?

- Yes No Don't know Refused

a. Which hand?

Right Left Both right and left

Do NOT test right.	Do NOT test left.	Do NOT test either hand. Go to Questions #4 and #5 on next page and mark "Unable to test/exclusion/didn't understand."
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2. Has any pain or arthritis in your right hand gotten worse recently?

- Yes No Don't know Refused

a. Will the pain keep you from squeezing as hard as you can?

Yes No Don't know

3. Has any pain or arthritis in your left hand gotten worse recently?

- Yes No Don't know Refused

a. Will the pain keep you from squeezing as hard as you can?

Yes No Don't know



HABC Enrollment ID #	Acrostic	Visit Year
H [] [] [] [] []	[] [] [] []	● 16

GRIP STRENGTH (Hand-Held Dynamometry)

Script: "I'd like you to take your right/left arm, rest it on the table, and bend your elbow. Grip the two bars in your hand, like this. Please slowly squeeze the bars as hard as you can."

Examiner Note: *Hand the dynamometer to the participant. Adjust if needed.*

Script: "Now try it once just to get the feel of it. For this practice, just squeeze gently. It won't feel like the bars are moving, but your strength will be recorded. Are the bars the right distance apart for a comfortable grip?"

Examiner Note: *Show dial to participant.*

Script: "We'll do this two times. This time it counts, so when I say squeeze, squeeze as hard as you can. Ready. Squeeze! Squeeze! Squeeze! Now, STOP."

4. Right Hand Unable to test/exclusion/didn't understand

Trial 1: [] [] kg Refused Unable to complete

Examiner Note: *Wait 15-20 seconds before second trial.*

"Now, one more time. Squeeze as hard as you can. Ready. Squeeze! Squeeze! Squeeze! Now, STOP."

Trial 2: [] [] kg Refused Unable to complete

Repeat the procedure on the left side.

5. Left Hand Unable to test/exclusion/didn't understand

Script: "Now we'll test your left side. When I say squeeze, squeeze as hard as you can. Ready. Squeeze! Squeeze! Squeeze! Now, STOP."

Trial 1: [] [] kg Refused Unable to complete

Examiner Note: *Wait 15-20 seconds before second trial.*

"Now, one more time. Squeeze as hard as you can. Ready. Squeeze! Squeeze! Squeeze! Now, STOP."

Trial 2: [] [] kg Refused Unable to complete