

The NIHR Southampton Biomedical Research Centre (BRC) has a tight quality assurance system for the writing, reviewing and updating of Standard Operating Procedures. As such, version-controlled and QA authorised Standard Operating Procedures are internal to the BRC.

The Standard Operating Procedure from which information in this document has been extracted, is a version controlled document, managed within a Quality Management System. However, extracts that document the technical aspects can be made more widely available. Standard Operating Procedures are more than a set of detailed instructions; they also provide a necessary record of their origination, amendment and usage within the setting in which they are used. They are an important component of any Quality Assurance Framework, but in themselves are insufficient and need to be used and interpreted with care.

Alongside the extracts from our Standard Operating Procedures, we have also made available here an example Standard Operating Procedure and a word version of a Standard Operating Procedure template. Using the example and the Standard Operating Procedure template, institutions can generate their own Standard Operating Procedures and customise them, in line with their own institutions.

Simply offering a list of instructions to follow does not assure that the user is able to generate a value that is either accurate or precise so here in the BRC we require that Standard Operating Procedures are accompanied by face-to-face training. This is provided by someone with a qualification in the area or by someone with extensive experience in making the measurements. Training is followed by a short competency assessment and performance is monitored and maintained using annual refresher sessions. If you require any extra information, clarification or are interested in attending a training session, please contact Dr Kesta Durkin (k.i.durkin@soton.ac.uk).

This document has been prepared from Version 1 of the BRC Standard Operating Procedure for measuring grip strength and endurance using the MIE pinch/grip analyser. It was last reviewed in February 2014 and the next review date is set for February 2016. The version number only changes if any amendments are made when the document is reviewed.

NIHR Southampton Biomedical Research Centre

Procedure for Measuring GRIP STRENGTH AND ENDURANCE USING THE MIE PINCH/GRIP ANALYSER

BACKGROUND

This procedure is for measuring hand strength and endurance using the MIE Pinch/Grip Digital Analyser and for the use of the accompanying CAS software. When used correctly, this device will allow the accurate monitoring and assessment of hand function through improvement or deterioration in health, in physiotherapy, drug treatment and surgical management. The device can be used alone, to obtain maximum grip or pinch values in Pounds, Newtons, or Kilograms or through a computer link for more involved tests and data analyses.

PURPOSE

To ensure correct and uniform use of the MIE Pinch/Grip Digital Analyser and the CAS software for measuring hand strength and endurance.

SCOPE

This procedure applies to any study requiring the use of the MIE Pinch/Grip Digital Analyser and CAS software for measuring hand strength and endurance within the BRC

RESPONSIBILITIES

It is the responsibility of the measurer to use this procedure when measuring hand strength and endurance using the MIE Pinch/Grip Digital Analyser and the CAS software. It is the responsibility of the principle investigator to ensure that staff members who are working on specific studies have adequate experience to do so.

PROCEDURE

MIE Pinch/Grip Digital Analyser, MIE Medical Research Ltd., 6 Wortley Moor Road, Leeds, West Yorkshire, LS12 4JF.

Important Points

- Wipe the handles with an ethanol or detergent wipe before use.
- When placing the handles onto a surface, place them with the scale bar facing the ceiling.
- Ensure that the participant is seated on a chair with arms.
- Ensure that participant's arms, up to the wrist, are resting on the chair arms, leaving their hand free to squeeze the handles.
- Ensure that their feet are flat on the floor and that they do not leave the ground during the test.
- Try not to register any readings when presenting the handles to the participant: Hold them by the silver coloured metal by the scale bar.
- Ensure that the participant is holding the handles 2 cm down from the red indicator line.
- Ensure that the crook of the thumb is placed on the side with the red indicator line.
- If the participant finds the device too heavy, the operator can support some of the weight.
- Remember to adjust the handles to suit the participant's hand size.
- Remember to make a note of the handle settings by writing down in cm/mm the setting from the scale bar and use this setting for follow-up visits on the same participant.
- Remember to press and hold the "zero" button for 5 seconds before each test.

General Set-Up and Instructions

1. Install the CAS software onto the computer or laptop that you will have with you when seeing patients, following the on-screen instructions. The licence code for the software is:

DMS6U-9VY4S-PT8CI-7UNWW-RRKAW-S1103-F1

2. Referring to the information and figure below (figure 1), set up the equipment in the following way, when both the instrument and the computer are **switched off**:
 - a. Connect the pinch/grip handle to the input marked "transducer" on the back of the digital analyser.
 - b. Connect the "BNC" connector of the computer lead, supplied with the instrument to the connector marked "computer" on the back of the digital analyser.
 - c. Connect the 9-pin plug to the "COM" port of your computer (if your laptop does not have a "COM" port, use the dongle that turns this into a "USB" connection).
 - d. Connect the instrument to the mains by plugging the mains cable into the socket on the rear of the device.

- e. You are now ready to use the machine and will need to go through this connection procedure each time before use, unless you keep the device permanently attached to a designated computer. The participant needs to see the computer screen when the tests are being performed.

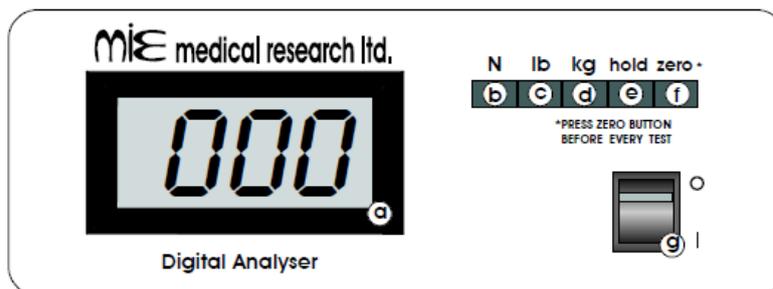


Figure 1: Digital Analyser (Front)

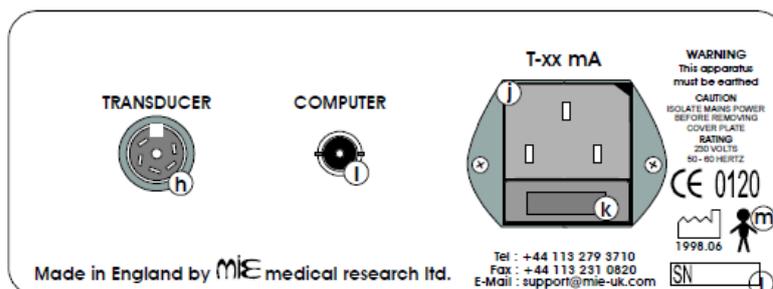


Figure 2: Digital Analyser (Rear)

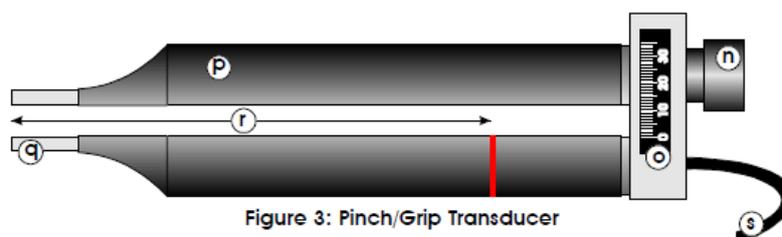


Figure 3: Pinch/Grip Transducer

- (a) digital display of force
- (b) press to display force in newtons
- (c) press to display force in pounds
- (d) press to display force in kilogrammes
- (e) press to store and display peak force value
- (f) press and hold for 1 second to set display to zero before each test
- (g) mains power switch
- (h) input socket for transducer (grip handle or myometer)
- (i) output socket to computers com port
- (j) IEC mains input socket
- (k) 230V: 2 x T-32mA mains fuses (5x20mm) or for 100/110V: 2 x T-63mA mains fuses (5x20mm)
- (l) serial number - should match those on the transducer
- (m) class B symbol
- (n) adjust handle to suit different hand sizes
- (o) width scale - use same handle width in repeated tests for maximum repeatability
- (p) comfortable ergonomic handles for grip measurement, even with most hand contractures
- (q) area for pinch strength measurement
- (r) forces measured over this part of the transducer will be independent of moment errors
- (s) connect to the transducer input socket (h) on the analyser/display unit

Figure 1. Identification of components

3. By depressing the orange buttons on either side of the machine, you can move the handle and use it as a stand so that it is at an angle, making it easier to press the buttons and view the digital display.
4. Switch on the computer and the machine (using the flick switch on the front).
5. Open the installed CAS software.
6. Depress the button on the machine to select whether you want the force to be displayed in Newtons, Kilograms or Pounds. Remember, the software analyses the data and displays the results in Newtons. If you want the machine to display the maximum force value, depress the "hold" button on the front of the machine.
7. Wash your hands and explain the procedure to the volunteer.
8. Demonstrate how to use the equipment fully by performing the test yourself in front of the participant as this will ultimately save time.
9. Wipe down the handles with an ethanol/detergent wipe before handing over to the participant.
10. Select "New Patient" from the start-up screen or alternatively click "File" on the drop-down toolbar menu and then select "New" (figure 2).

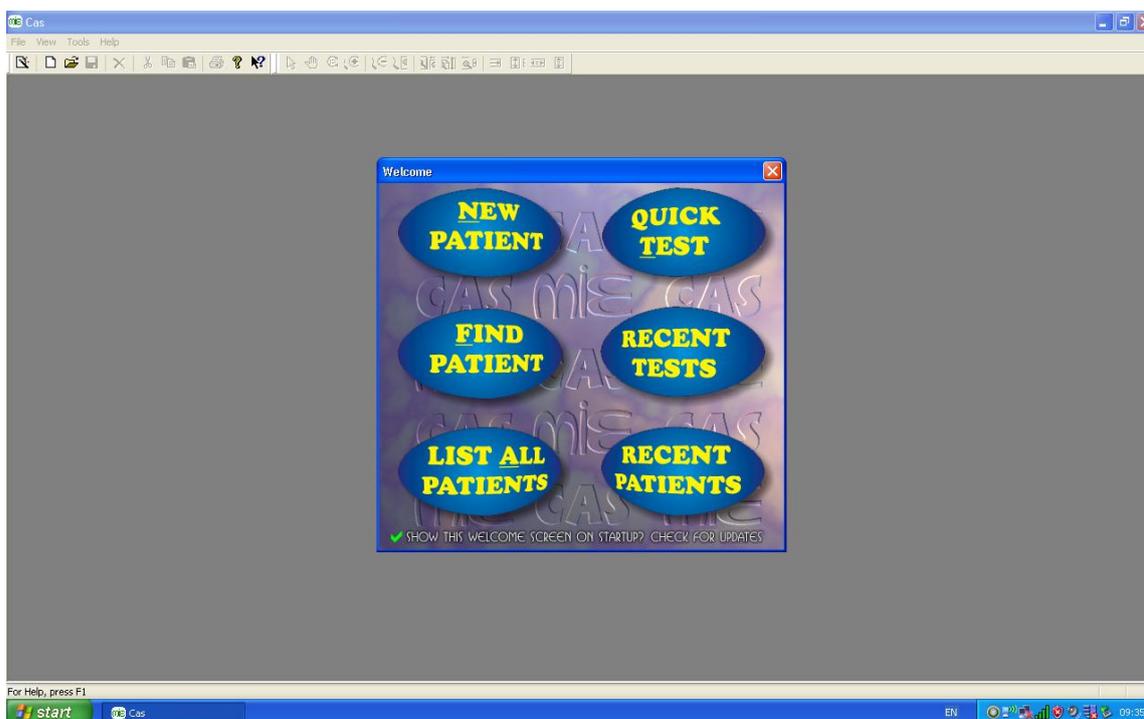


Figure 2.

11. A box then opens, giving options for the entering of patient details. In this section under the "Patient" tab, enter the patient details i.e. Surname, first name, patient number, etc. After entering this information you must click the "Save" icon on the toolbar in order to progress with the tests. Following this step you may now enter any further required/appropriate information into the boxes in any of the other tabs (clinical, tests, clinical info and treatment (figure 3).

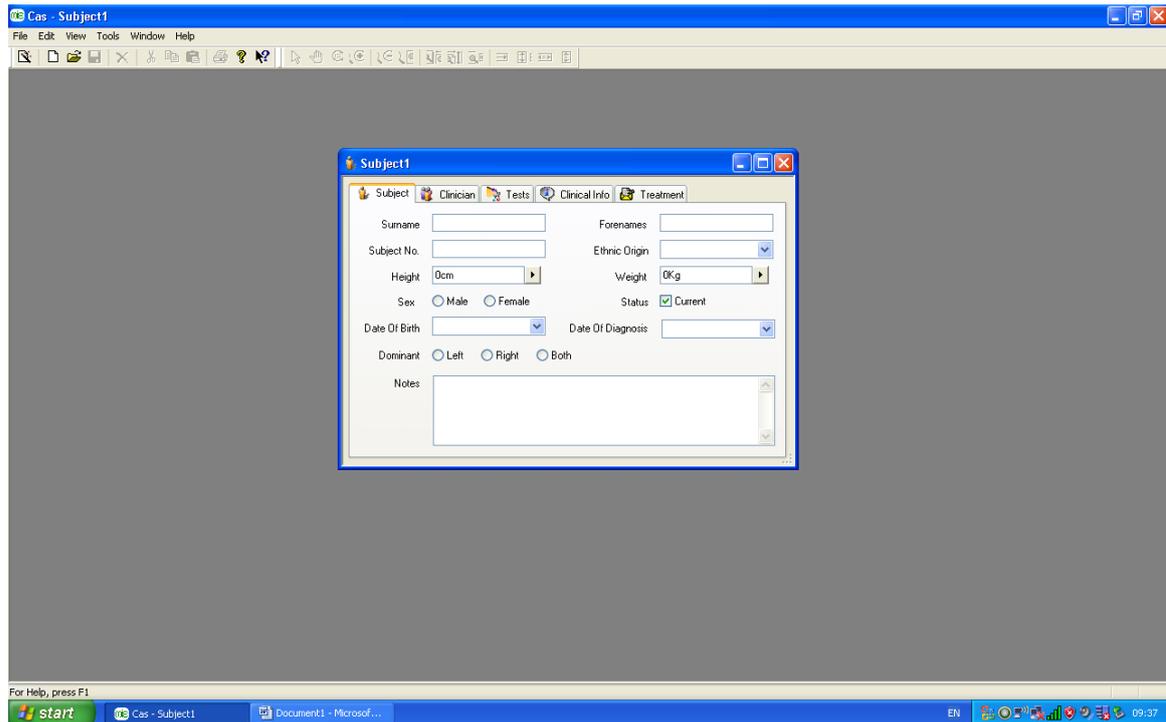


Figure 3.

12. After entering any extra information of your choosing, click the "Save" icon again.
13. To begin the test select the "tests" tab. The 2 tests applicable to this equipment are "Endurance Test (Pinch Grip)" and "Strength Test (Pinch Grip)" (figure 4).

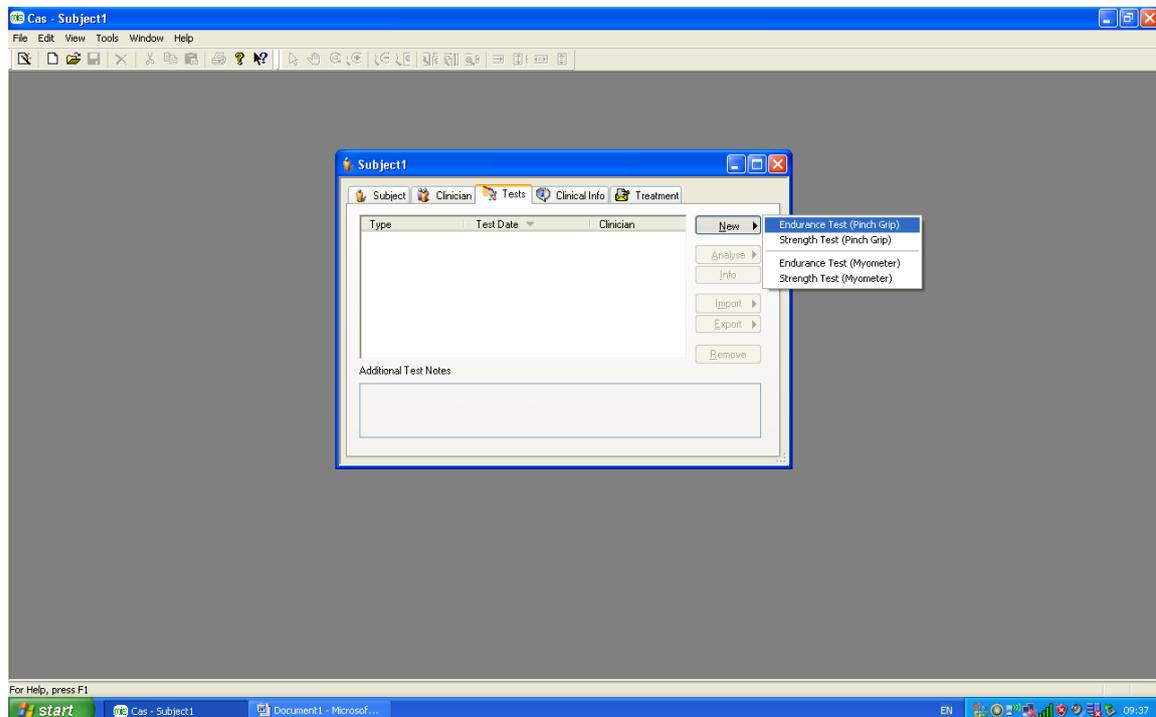


Figure 4.

14. Adjust the grip handle to suit the hand size of the participant using the silver coloured screw/knob at the end by the scale bar. Remember: it is very important to make a note of the handle position (in cm and/or mm) so that the same settings can be used on future visits for the same patient.
15. If you are working with a computer with sound you can follow the spoken instructions for the tests. If not you can follow the instructions displayed in the boxes on screen.

5.2.3 The Endurance/Fatigue Test

[For use by the EPI-HIP study, make the measurements on the non-dominant side and use the default settings as shown in figure 5 below: *Maximum Strength* – is set to auto; *Target Strength* – is set to 50%;and *Target Window* – is set to 5%].

1. To test for **overall muscle mass**, ensure the patient grips the handles with their **non-dominant** hand. For testing **maximal functional capacity** ensure the patient grips the handles using their **dominant** hand.
2. Under the “tests” tab, select “new test” and then “Endurance Test (Pinch Grip)”.
3. The “Endurance Test” wizard appears (figure 5).

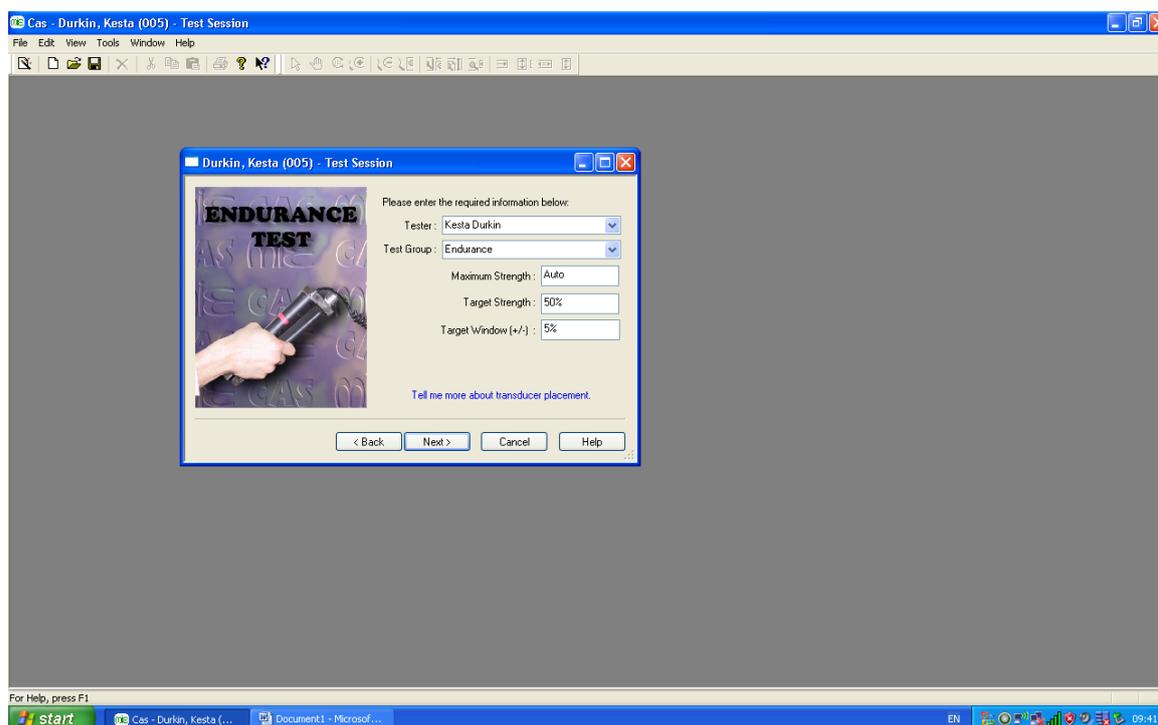


Figure 5.

4. Make sure that the information entered into the type boxes is correct and then click “next” (figure 5).

5. The wizard asks you to zero the machine. Press and hold in the “zero” button on the front of the machine for 5 seconds. After doing so, click “next” (figure 6).

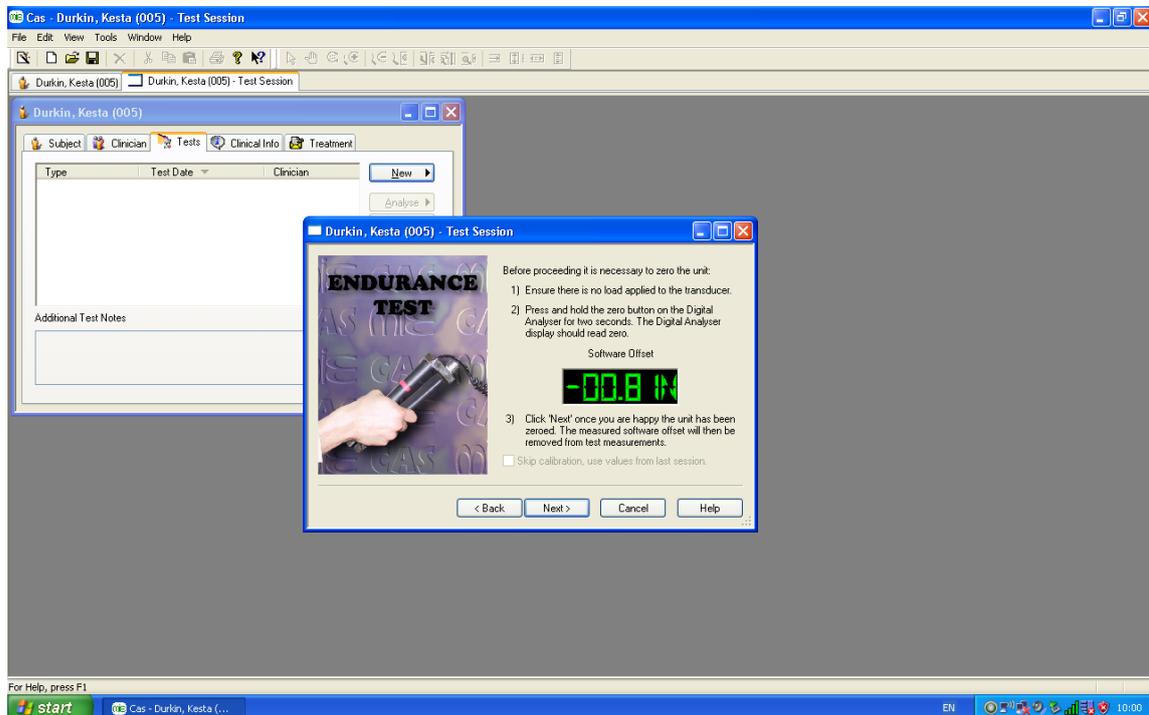


Figure 6.

6. The next box asks you to grip the handles as hard as possible.
7. The patient should be presented with the grip handles by holding them at the scale bar-end so as not to register any results detected by the operator’s hands.
8. Ensure that the patient places their hand around the handles with the crook of the thumb against the handle with the red marker. The hand position should be standardised and shouldn’t vary between patients. Always ensure that the crook of the thumb sits 2 cm below the red line, nearest the tip of the handles.
9. Ask them to grip as hard as possible then release their grip and the screen shown below (figure 7) will be displayed.

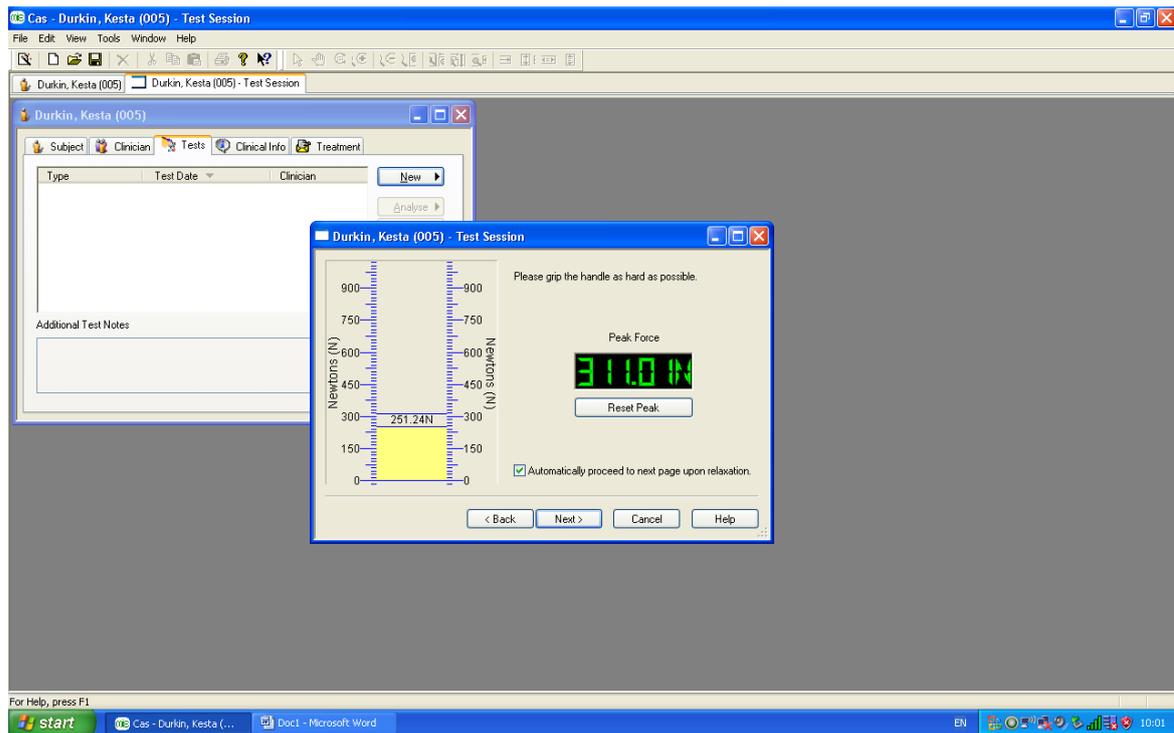


Figure 7.

10. The software will then ask for them to repeat this once more.
11. The next screen will display a scale on a section of which a green area can be seen (figure 8).
12. The participant must now grip the handles for as long as they possibly can whilst keeping the line displaying the force of their grip, within the green area (figure 8).

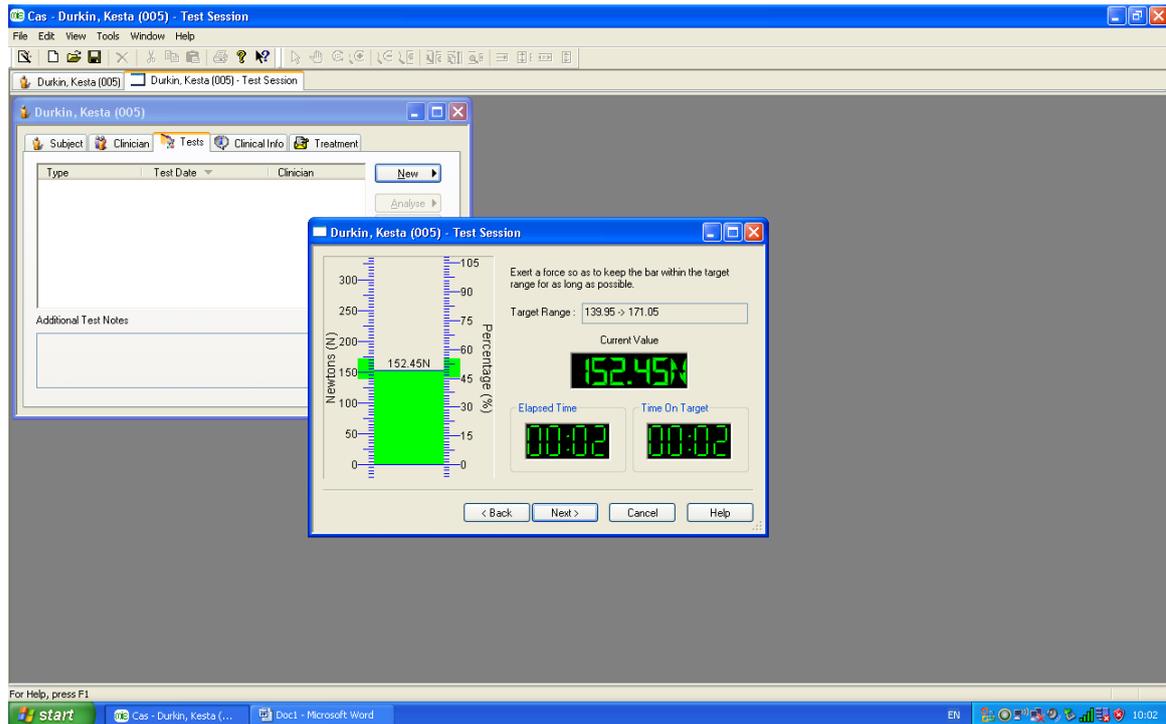


Figure 8.

13. When they are fatigued and they release their grip on the handles, the test is complete.
14. Click "next" and then select "analyse data" to view it now or "skip analysis" which allows you to view it later (figure 9).

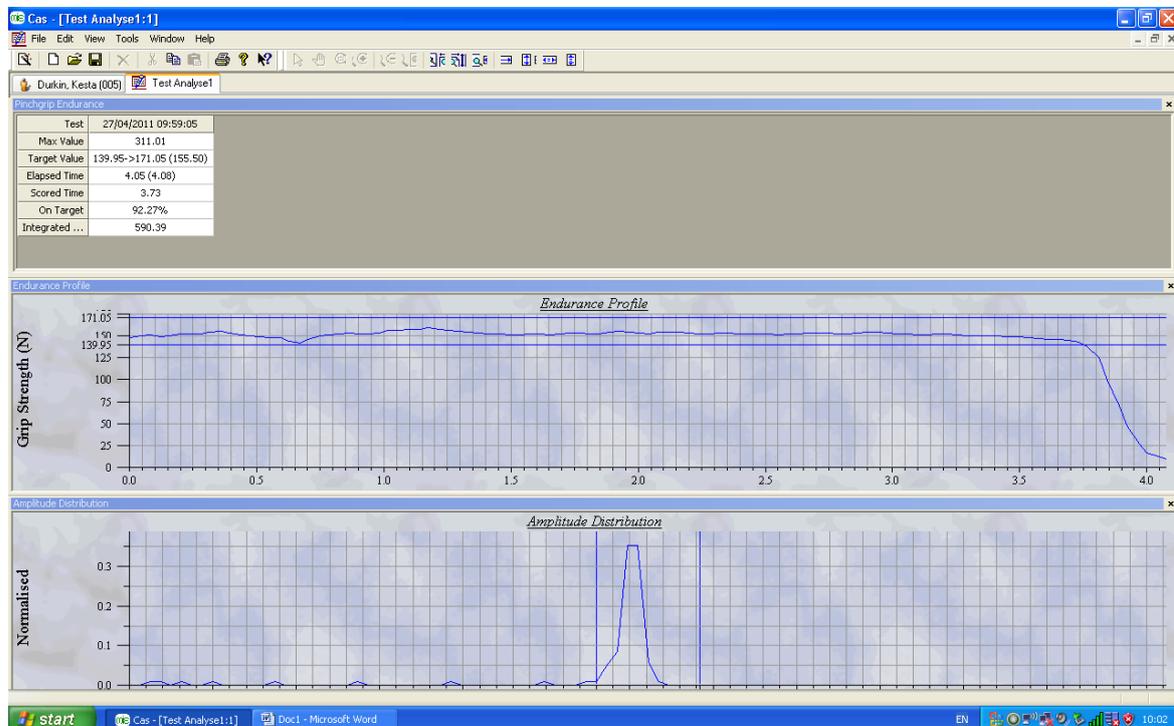


Figure 9.

Maximal Grip Strength

[For use by the EPI-HIP study, make the measurements on the non-dominant side. When viewing the screen shown in figure 11, ensure the *Cycle Test Duration* – is set to 5s; *No. of Cycles* – is set to 3; and *Resting Time* – is set to 15s. If after entering the No. of Cycles into the box, you are unable to alter the value in the “resting time” box, click on “test group” which will then permit you to amend the value in this box].

1. To test for **overall muscle mass**, ensure the patient grips the handles with their **non-dominant** hand. For testing **maximal functional capacity** ensure the patient grips the handles using their **dominant** hand.
2. Under the “tests” tab, select “new test” and then “Strength Test (Pinch Grip)” (figure 10).

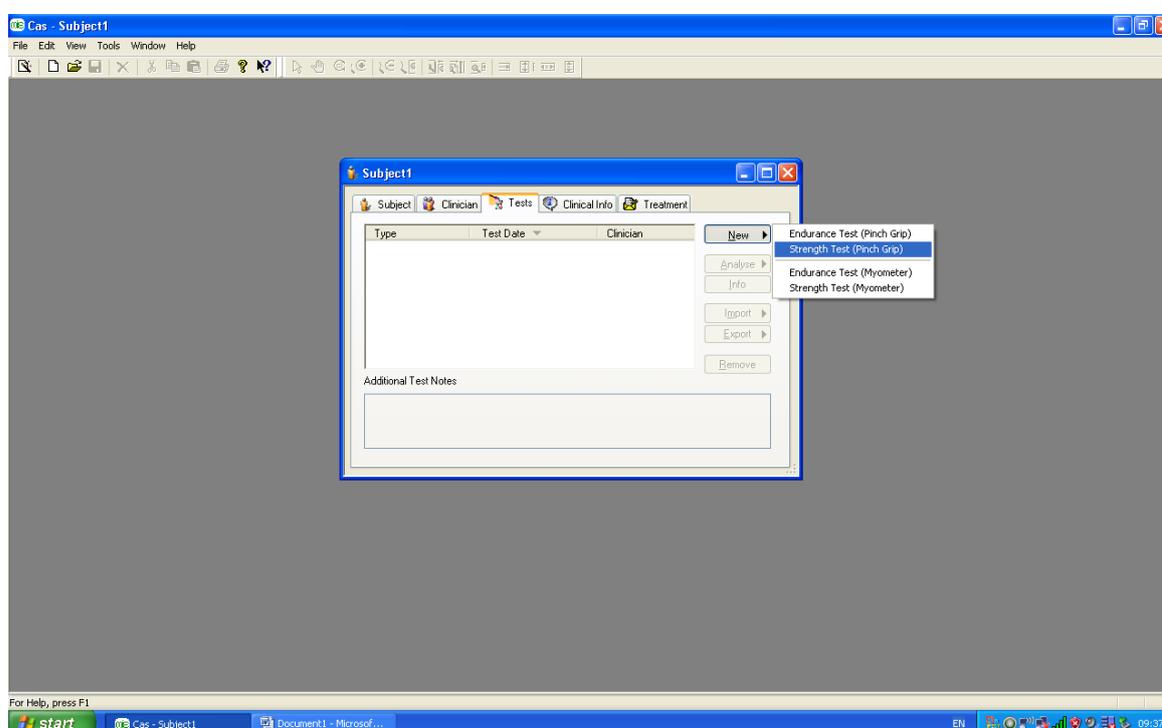


Figure 10.

3. Make sure that the information entered into the type boxes is correct and then click “next” (figure 11).

The details of this test are as follows:

The “test cycle duration” time allows you to specify how long the participant must maintain their maximal grip. For instance, if it is set at 2s and you have set “number of cycles” to 3 and “resting time” to 10s, this means that this one test will entail the participant gripping for 2 seconds, resting for 10 seconds, gripping for 2 seconds, resting for 10 seconds, and then gripping for 2 seconds and finishing.

4. Enter the details you require to perform this test and then click "next" (figure 11).

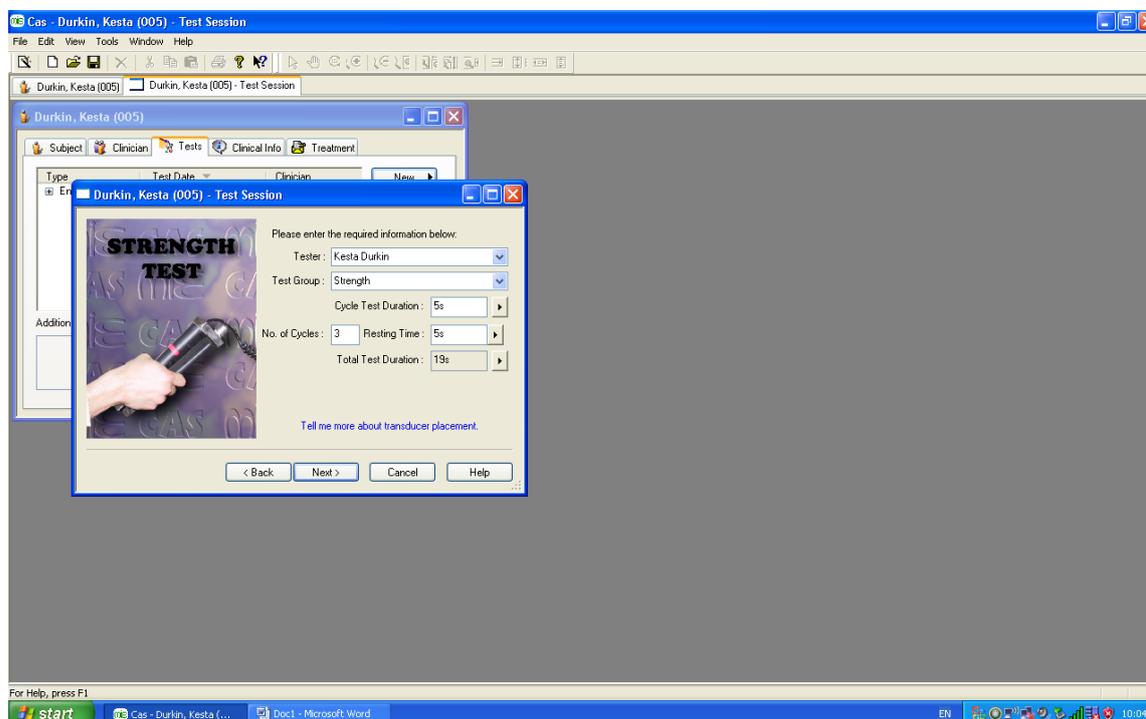


Figure 11.

5. Press and hold in the "zero" button on the front of the machine for 5 seconds. After doing so, click "next".
6. The participant must grip the handles and follow the spoken or on-screen instructions adhering to the specified times entered in the test details section. Traffic light signals are displayed to indicate "get ready", "grip" and "stop" (figure 12).

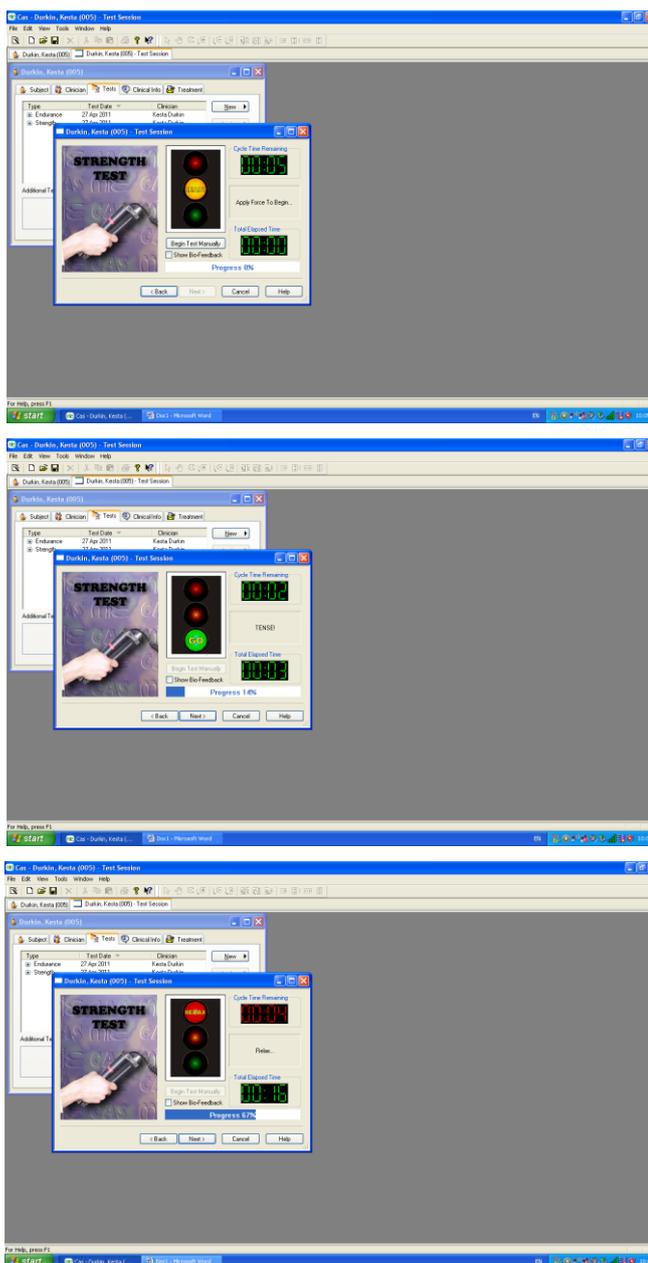


Figure 12.

7. Click "next" and then select "analyse data" to view it now or "skip analysis" which allows you to view it later.

Recalling Participant Data

1. Select "file" and then "open" (or click the folder to the left of the save icon on the toolbar).
2. Enter some information specific to the patient data you want to locate into one of the boxes and then click "search".
3. Double click on the participant of interest.

4. The patient information box that was used for entering information and selecting the grip test will be displayed.
5. Depending which tests you have performed it will give you the option of looking at the results for Endurance or Strength. Click the cross to expand and it will list the tests.
6. Select the one you want to view and then click the “analyse” button on the right hand side.