# ISOMETRIC STRENGTH (ISOMETRIC CHAIR)

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1. Background and rationale

Lower extremity strength is of critical importance to maintaining independence and mobility. Isometric strength assesses force against a fixed object and will be measured by the Good Strength Chair. The isometric chair will be utilized to measure maximal force produced during isometric contraction, and speed of force production and relaxation of the right and left knee extensors and flexors.

2. Equipment and supplies

- Good Strength Chair and Windows software
- Knee extension/flexion transducer
- Padding for transducer (for very thin or very heavy legs)
- Certified weight (e.g., 97.7 Newtons – will vary by field center) for calibration
- DC amplifier and A/D converter
- APC Performance SurgeArrest 11 Outlet with Tel2/Splitter, Coax and Ethernet Protection
- Long-arm goniometer
- Stool for participant to get up onto chair
- Stool with wheels for examiner
- Tape measure with centimeters
- Eyebrow pencil for marking joint line
- 12” x 8” carpenter’s framing square (ruler with right angle – one short and one long arm)
- Clear straight-edge ruler at least 45 cm long

2.1 Main components of the Good Strength system
2.2 Force transducers

The force transducers used in the Good Strength system are strain gauge transducers. The functioning of these transducers is based on the small reversible transformations in the shape of the iron or aluminum bodies of the transducers produced by the forces acting on them. The strain gauges are permanently fixed in these transformation areas. The resistance of the strain gauges changes as the result of the transformations and these small changes are then amplified by the amplifier and further transferred to the A/D converter and/or digital displays. The potentials and electric currents in the transducers are very low and strain gauges and electric wires are well isolated to prevent leakage or interference.

2.3 Power supply

There is an opto-isolatron connection between the computer and the Good Strength system. The Good Strength DC amplifier and A/D converter are powered by their own CE-approved Mascot Type 8713 AC/DC adapters which in turn are connected to the power supply via a protectively earthed safety adapter (Trafox KLMX/S 650-230/230 V) that has been approved for medical use. The PC, printer, and monitor must be connected to the power supply via this same safety adapter for safety reasons. The A/D converter converts the signal from the analogue into digital form and feeds the data into the computer via a standard serial (COM) port.

2.4 Digital displays

The amplifier is enclosed in a metal casing and it has separate analogue outputs for each channel and a common output for all channels to the A/D converter. The top panel of casing includes digital displays (LCD) for the continuous signal level and the peak signal level in the selected channel. The actual channel is selected by using a switch located on the panel. The top panel also includes potentiometers to set the level of each channel to zero separately. A more approximate adjustment of the zero levels as well as the adjustment of the gain of each channel is performed by the help of adjustable resistances located on the back panel of the unit. See figure below.

Back panel of the electronic unit:

- D6: input, signal from the trunk strength dynamometer
- D7: input, signals from the transducers of the strength chair
- D8: data output, to the computer (serial port)
- Analog out: A common output for the selected channel. Analogue measurement signal. Ratio: 98.1 Newtons (10 kg) = 250 mV.

**NOTICE!**

When analogue out is used for analysing the measurement signal, it’s highly recommended to switch off the A/D-converter by plugging the corresponding power supply cable off. This will decrease the noise level of the analogue output signal.
3. Service and maintenance

3.1 Warranty

Metitur Ltd. warrants all parts and labor for 30 days after delivery against faulty workmanship or defective materials. The warranty does not include damage resulting from improper handling and accidents. In addition, the warranty does not cover unauthorized repairs or alterations to any part of the system. The equipment is guaranteed for one year.

3.2 Service

3.2.1 Care of unit

The dynamometer can be cleaned with water and mild soap on a clean cloth. Check velcro straps and setting numbers on equipment for wear. Replace as needed. The need for maintenance and servicing with normal use is minimal. The system is regularly tested when calibration is performed (see Section 4). If the base level and gain cannot be adjusted to the correct level using the adjustable resistances on the back panel of the amplifier and the potentiometers on the top panel of the amplifier, then technical assistance should be sought.

3.2.2 Hardware issues

If the system should become defective within the warranty period due to faulty workmanship or defective materials, Metitur will repair or service the defective parts. After the warranty period Metitur will repair or service defective parts, but the client is responsible for shipping costs to get the nonfunctional components to Metitur and back to the United States. If there are hardware problems, immediately contact both Ari Korhonen and Pertti Era at the following e-mail addresses:

ari.korhonen@metitur.fi
pertti.era@metitur.fi

Also, contact Susan Averbach at the Coordinating Center: saverbach@psg.ucsf.edu
The Coordinating Center has a loaner replacement unit to be used when a site's unit is being repaired. If the replacement unit is already in use, Greg Pippin has one also. Below is his contact information:

Greg Pippin  
Data 2 Information Medical Corp.  
221 Mill Valley Drive  
Colleyville, Texas  76034-3667  
888-498-7874 (US toll free)  
817-498-7875 (phone)  
817-798-7624 (mobile)  
817-428-1243 (fax)  
EIN 752658450  
www.entknow.com

If you are instructed to send your unit back to Metitur for repair, please send it to the following address:

Metitur Oy  
Heinamaentie 7  
FIN-40250 Jyvaskyla  
Finland

3.2.3 Software issues

Software problems should be reported immediately to Mingdong Li and Pertti Era at Metitur. E-mail addresses are:

mingdong.li@metitur.fi  
pertti.era@metitur.fi

Also contact Susan Averbach at:  
saverbach@psg.ucsf.edu.

4. Calibration

Good Strength calibration should be performed once a week or more frequently if the system has been moved or the examiner for any reason is uncertain about the functioning of the system. Each clinic needs the Metitur calibration weight for calibration. The weight will be labeled with its weight in Newtons and will vary from field center to field center. See Appendix 1 for step-by-step calibration instructions.

5. Safety issues and exclusions

The quadriceps and hamstring strength tests using the Good Strength Chair are generally safe and well tolerated by study participants. However, injury may occur in participants with knee joint pathology or if the machine is operated incorrectly. A knee with a joint that has been replaced within the past 6 months cannot be tested.

Stopping rules:
• If the participant develops chest pain or dizziness during the test, do not complete the test.
• Participant says they cannot continue with test due to knee or back pain. Test other side if possible.

6. Participant and exam room preparation

Ideally, this test should be performed after a short period of warm-up exercise. The chair stand is well suited to this purpose and should be performed just before the isometric strength test. The Good Strength chair should be placed in a quiet office or exam room that can accommodate the participant and the examiner. The power should be turned on at least 15 to 20 minutes before use. The amplifier may be left on overnight if the system will be in use the next day. The system should be shut down for the weekend or when it will not be used for longer periods of time.

Below are detailed instructions for powering up and powering down the computer, amplifier, and Good Strength software. The main principle to follow is that when the power is either turned on or off in the computer, the power in the amplifier should not be on. This is to reduce the risk of possible electric peaks that can damage the amplifier.

6.1 Powering up

Make sure that the amplifier is off. Turn on the computer and wait until the computer is completed booted up. Turn on the amplifier. Begin the Good Strength program.

6.2 Powering down

To power down, reverse the procedure. Close the Good Strength program. Turn off the amplifier. Then close Windows and turn off the computer.
7. Record keeping

The Good Strength Chair has an automatic positioning feature that stores and recalls a participant’s exact positioning and testing protocol from one examination to the next. It is important for longitudinal evaluations that the methods of strength testing and the participant positioning be consistent throughout the study. In addition, participant identifiers and test data are entered into the computerized database via the keyboard. It is important to complete all of the required fields to allow the participant to be positively identified in the data set sent to the Coordinating Center for analysis.

Data are also recorded on a data collection form as a backup to the computer storage of participant positioning and for a tracking record of isometric dynamometry testing performed on each participant. Other data is also collected to help with later analysis. The following information is recorded:

- Which leg the participant uses to kick a ball
- Length from top of transducer to lateral joint line
- Back support (cm)
- Arm height (cm)
- Horizontal bar (knee angle fix) (cm)
- Vertical bar (height) (cm)
- Leg weight (N)
- Maximum force (Newtons)
- Time of maximal force (seconds)
- Maximum speed of force production (Newtons per second)
- Whether the participant had pain during test and whether that pain prevented them from pulling or pushing as hard as they can
- Whether test was performed and reason if not

*Important: Printouts of the participant’s test reports for all four exams should also be made immediately after each testing session and kept in the participant’s record in case of computer failure (see Appendix 5).*

8. Administration

8.1 Determining dominant leg

Although both legs are being tested, determine which is the participant’s dominant leg:

Script: “Which leg do you use to kick a ball?”

Record the participant’s answer on the Isometric Strength data collection form.
8.2 Introducing the test

Introduce the test:

Script: “This will be a test of your leg strength. We’ll be strapping your right, then your left leg onto this device and you will be pushing, then pulling against a lever arm. This lever arm will NOT move during the test. We’ll do two practice tests and three real tests, both pushing and pulling, both right and left.”

8.3 Testing right leg

8.31 Determine if right leg can be tested

Determine if the participant has had their right knee replaced, and, if so, if this knee replacement was done within the past 6 months. If “Yes,” go on to test the left leg, if it has not been replaced in the past 6 months. See Appendices 10 and 11 for specific questions regarding knee replacement.
8.32 Positioning the participant on the isometric chair

For detailed description of setting parameters, see Appendix 3a for baseline and Appendix 3b for follow-up.

Instruct participant:

Script: “Now I would like you to sit in the chair with your hands holding onto the arms of the chair.”

Once the transducer is in place, measure from the top of the transducer along the side of the participant’s leg up to the knee joint. Once the length measurement is recorded, zero out the unit with the participant’s leg off of the transducer support. Place the participant’s leg back into the transducer support. Fasten the transducer strap around the participant’s leg. Fasten the seat belts across the pelvis and thigh to prevent movement of the body during the force production. Ask the participant to relax their leg. Record the value once the participant’s leg is relaxed. If the leg weight number fluctuates between two numbers, record the higher of the two numbers. The settings (Back support, Arm support, Horizontal bar, Vertical bar) will be entered into the computer before the test is performed. See Appendix 2 for detailed instructions.
During the trial, check that the direction of thrust is forward / backward. Check that the participant keeps their buttocks on the chair and holds on to the arms of the chair. They should not try to lift the whole leg in the knee extension test or flex the hips in the knee flexion test.

BE CAREFUL TO NOT PULL ON THE TRANSDUCER WIRES UNDER OR BEHIND THE CHAIR. THESE WIRES ARE DELICATE.

8.33 Demonstration and practice extension

Give the participant two practice trials at 50% effort. This allows the participant to get the feel for how this test is going to go. Make sure that the participant relaxes and exhales slowly while pushing.

Script: “OK, this first test is going to be a practice test. When I say ‘push,’ all I want for you to do is to push forward against the pad. Please don’t hold your breath as you push. Just relax and exhale slowly. This lever arm attached to your leg will NOT move. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. Since it’s a practice test, I just want you to give me a 50% effort. 3, 2, 1, ready, push, push, push, push, push, push, OK relax.”

Then give the participant another practice trial at 50% effort.

Script: “Now let’s do this again. When I say ‘push,’ push forward against the pad. Again, I just want you to give me a 50% effort. 3, 2, 1, ready, push, push, push push, push push, push, push, OK relax.”

8.34 Test extension

Once the participant has practiced the testing procedure, tell them that you will do the real test. Again, make sure that the participantrelaxes and exhales slowly while pushing.

Script: “OK, now we will do the real test. As soon as I say ‘push’ I want you to push as hard and as fast as you can against the pad. You’re going to give a 100% effort. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. The test will take just a few seconds. We will do three trials. Please don’t hold your breath as you push. Just relax and exhale slowly. 3, 2, 1, ready . . . push, push, push, push, push, push, push, OK relax.”

NOTE: IT IS VERY IMPORTANT THAT YOU GIVE STANDARD MAXIMAL EFFORT ENCOURAGEMENT DURING THE TEST. Begin this encouragement after the “count-down” screen disappears. Encourage the participant for about 3 seconds. The computer counts out 30 seconds between tests.

To see the maximum force for each test on the electronic unit, you have to reset the peak value on the display for each test. Push the black reset button. Note, however, that whether or not you reset the peak value, the computer will capture the maximum force.

Once the three trials are done, ask the participant:
Script: “Did you have any knee pain during this test?”

If they answer “Yes,” ask them:

Script: “Was it mild, moderate, or severe?” and “Did this pain prevent you from pushing as hard as you can?”

Print results.

8.35 Practice flexion

MOVE TOGGLE SWITCH TO FLEXION. The participant’s leg will remain in the transducer support. Get ready to test. Instruct the participant to pull their leg back against the pad for the flexion test. Again, give the participant two practice trials at 50% effort. Make sure that the participant relaxes and exhales slowly while pulling.

Script: “OK, now we are going to test your leg strength as you pull your leg back. This first test is going to be a practice test. When I say ‘pull,’ all I want for you to do is to pull backward against the pad. Please don’t hold your breath as you pull. Just relax and exhale slowly. This lever arm attached to your leg will NOT move. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. Since it’s a practice test, I just want you to give me a 50% effort. 3, 2, 1, ready, pull, pull, pull, pull, pull, pull, OK relax.”

Then give the participant another practice trial at 50% effort.

Script: “Now let’s do this again. When I say ‘pull,’ pull backward against the pad. Again, I just want you to give me a 50% effort. 3, 2, 1, ready, pull, pull, pull pull, pull, pull, OK relax.”

8.36 Test flexion

Once the participant has practiced the testing procedure, tell them that you will do the real test. Again, make sure that the participant relaxes and exhales slowly while pulling their leg back.

Script: “OK, now we will do the real test. As soon as I say ‘pull’ I want you to pull as hard and as fast as you can against the pad. You’re going to give a 100% effort. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. The test will take just a few seconds. We will do three trials. Please don’t hold your breath as you pull. Just relax and exhale slowly. 3, 2, 1, ready, pull, pull, pull, pull, pull, pull, pull, pull, OK relax.”

AGAIN, IT IS VERY IMPORTANT THAT YOU GIVE STANDARD MAXIMAL EFFORT ENCOURAGEMENT DURING THE TEST. Begin this encouragement after the “count-down” screen disappears. Encourage the participant for about 3 seconds.

There are 30 seconds between trials. To see peak value results for each test, reset the peak value by pushing the reset button between trials. Once the three trials are done, ask the participant:
Script: “Did you have any knee pain during this test?”

If they answer “Yes,” ask them:

Script: “Was it mild, moderate, or severe?” and “Did this pain prevent you from pulling as hard as you can?”

Print results.

8.4 Testing left leg

8.41 Determine if left leg can be tested

Determine if the participant has had their left knee replaced, and, if so, if this knee replacement was done within the past 6 months. If “Yes,” do not test left leg. See Appendices 10 and 11 for specific questions regarding knee replacement.

8.42 Practice and test left leg

See Section 8.3 for practice and test instructions.

8.5 Cool down period

The examiner should encourage the participant to move, stretch, and shake their legs in order to reduce muscular pain and stiffness after the test.

Script: “We’re done testing. It’s a good idea for you to move and shake your legs, like this [demonstrate for participant].”

9. Data backup and data results transfer

Cumulative backup of data should be done everyday (see Appendix 6). Cumulative data should be sent to the Coordinating Center at the end of the first 4 weeks and then every 3 months. Also, data results (Appendix 7) should be transferred to the Coordinating Center monthly by uploading the data using the Secure Web Gateway.

10. Quality assurance

10.1 Training and certification

Onsite training is provided by Metitur Ltd. when the equipment is installed. Training will also be provided during the OAI centralized training session. The training will consist of machine
operations and the fundamentals of testing, as well as study-specific procedures. After the initial training session, operators should practice on other staff members, volunteers, and themselves until reliable measurements are achieved. Training should include:

- observe measurement by experienced examiner
- read manufacturer’s user’s guide and OAI OM with goal of understanding
  - the proper use of equipment
  - the proper calibration and adjustment of equipment
  - exclusions and safety considerations
  - detailed testing procedures
- practice on colleagues and volunteers who have no previous knowledge of the protocol
- Use 9999999 as participant ID# when you are training on volunteers so that you can easily find these records to delete

10.2 Certification requirements

- Complete training requirements
- Recite exclusion and stopping rules criteria
- Demonstrate calibration and adjustment of isometric chair
- Perform test on three volunteers under the observation of clinic QC officer or designated isometric chair expert.

10.3 Quality assurance checklist

BASELINE

Testing right leg

☐ Data from Prior Visit Report checked to see if participant had right knee replacement, and, if so, ascertains whether this was done in the past 6 months

☐ Participant offered a stool to step up and seat themselves on the chair

☐ Participant correctly positioned in chair:
  ☐ Participant’s back supported
  ☐ Chair arms at comfortable height for participant
  ☐ Knees hanging over edge of chair seat

☐ Joint line found and marked correctly

☐ Transducer support centered behind participant’s right leg

☐ Knee joint at a 60-degree angle (goniometer measurement done correctly)

☐ Bottom of transducer support 2 cm above participant’s right calcaneus

☐ Leg length from transducer to joint line is correctly obtained

☐ Leg length from transducer to joint line is correctly recorded

☐ Makes sure that toggle switch is “down” for weighing leg
- LCD numbers “zeroed out” with leg off the transducer
- Velcro strap of transducer support is tightened around leg
- Performs final check for participant positioning
- Participant tightly strapped into chair
- Records value after participant told to relax
- Makes sure that toggle switch is “up” for extension
- Computer information correctly entered, including muscle group to be tested, settings, staff ID#, participant enrollment ID# and acrostic
- Instructs participant to do two practice trials at 50% effort for extension test. Key points from script stated and clearly delivered
- Instructs participant to do three maximal trials. Key points from script stated and clearly delivered
- 30 seconds passed between trials
- Standard level of encouragement (motivation and feedback to elicit maximal effort) offered to participant
- Test is correctly performed by participant
- Asks participant if they had pain during test
- Records whether participant completed the test and if not, why not
- Prints report
- Toggles switch “down” for flexion
- Instructs participant to do two practice trials at 50% effort for flexion test. Key points from script stated and clearly delivered
- Instructs participant to do three maximal trials. Key points from script stated and clearly delivered
- 30 seconds passed between trials
- Standard level of encouragement (motivation and feedback to elicit maximal effort) offered to participant
- Test is correctly performed by participant
- Asks participant if they had pain during test
- Records whether participant completed the test and if not, why not
- Prints report
- Settings and results completely and correctly recorded on data collection form (including back support, arm support, horizontal bar, vertical bar, maximum force, time of maximum force, and maximum speed of force production)

**Testing left leg**
- Data from Prior Visit Report checked to see if participant had left knee replacement, and, if so, ascertains whether this was done in the past 6 months
Participant correctly positioned in chair:
  • Participant’s back supported
  • Chair arms at comfortable height for participant
  • Knees hanging over edge of chair seat
Joint line found and marked correctly (if applicable)
Transducer support centered behind participant’s left leg
Knee joint at a 60-degree angle (goniometer measurement done correctly)
Bottom of transducer support 2 cm above participant’s left calcaneus
Leg length from transducer support to joint line is correctly obtained (if applicable)
Leg length from transducer to joint line is correctly recorded (if applicable)
Makes sure that toggle switch is “down” for weighing leg
LCD numbers “zeroed out” with leg off the transducer
Velcro strap of transducer support is tightened around leg
Performs final check for participant positioning
Participant tightly strapped into chair
Records value after participant told to relax
Makes sure that toggle switch is “up” for extension
Computer information correctly entered, including muscle group to be tested, settings, staff ID#, participant enrollment ID# and acrostic
Instructs participant to do two practice trials at 50% effort for extension test. Key points from script stated and clearly delivered
Instructs participant to do three maximal trials. Key points from script stated and clearly delivered
30 seconds passed between trials
Standard level of encouragement (motivation and feedback to elicit maximal effort) offered to participant
Test is correctly performed by participant
Asks participant if they had pain during test
Records whether participant completed the test and if not, why not
Prints report
Toggles switch “down” for flexion
Instructs participant to do two practice trials at 50% effort for flexion test. Key points from script stated and clearly delivered
Instructs participant to do three maximal trials. Key points from script stated and clearly delivered
30 seconds passed between trials
☐ Standard level of encouragement (motivation and feedback to elicit maximal effort) offered to participant
☐ Test is correctly performed by participant
☐ Asks participant if they had pain during test
☐ Records whether participant completed the test and if not, why not
☐ Prints report
☐ (If applicable) Settings and results completely and correctly recorded on data collection form (including back support, arm support, horizontal bar, vertical bar, maximum force, time of maximum force, and maximum speed of force production)

After both right and left leg tested
☐ Offers stool to help participant get down off chair
☐ Encourages the participant to move, stretch, and shake their legs
☐ Form correctly filled out
☐ Reviewed form for completeness
FOLLOW-UP

Testing right leg

☐ Chair set up with baseline settings listed on Data from Prior Visits Report
  ☐ Chair back
  ☐ Chair arms
  ☐ Horizontal bar
  ☐ Vertical bar

☐ Ascertains whether participant had right knee replacement in the past 6 months
☐ Participant offered a stool to step up and seat themselves on the chair
☐ Joint line found and marked correctly
☐ Transducer support centered behind participant’s right leg
☐ Leg length from transducer to joint line is correctly obtained (usually same as baseline)
☐ Leg length from transducer to joint line is correctly recorded
☐ Makes sure that toggle switch is “down” for weighing leg
☐ LCD numbers “zeroed out” with leg off the transducer
☐ Velcro strap of transducer support is tightened around leg
☐ Performs final check for participant positioning
☐ Participant tightly strapped into chair
☐ Records value after participant told to relax
☐ Makes sure that toggle switch is “up” for extension
☐ Before testing, correct computer information viewed on screen, including muscle group to be tested, settings, staff ID#, participant enrollment ID# and acrostic
☐ Instructs participant to do two practice trials at 50% effort for extension test. Key points from script stated and clearly delivered
☐ Instructs participant to do three maximal trials. Key points from script stated and clearly delivered
☐ 30 seconds passed between trials
☐ Standard level of encouragement (motivation and feedback to elicit maximal effort) offered to participant
☐ Test is correctly performed by participant
☐ Asks participant if they had pain during test
☐ Records whether participant completed the test and if not, why not
☐ Prints report
☐ Toggles switch “down” for flexion
☐ Instructs participant to do two practice trials at 50% effort for flexion test. Key points from script stated and clearly delivered
Instructs participant to do three maximal trials. Key points from script stated and clearly delivered
☐ 30 seconds passed between trials
☐ Standard level of encouragement (motivation and feedback to elicit maximal effort) offered to participant
☐ Test is correctly performed by participant
☐ Asks participant if they had pain during test
☐ Records whether participant completed the test and if not, why not
☐ Prints report
☐ Settings and results completely and correctly recorded on data collection form (including back support, arm support, horizontal bar, vertical bar, maximum force, time of maximum force, and maximum speed of force production)

**Testing left leg**
☐ Chair set up with baseline settings listed on Data from Prior Visits Report
☐ Ascertain whether participant had left knee replacement in the past 6 months
☐ Joint line found and marked correctly (if applicable)
☐ Transducer support centered behind participant’s left leg
☐ Leg length from transducer to joint line is correctly obtained (if applicable)
☐ Leg length from transducer to joint line is correctly recorded (if applicable)
☐ Makes sure that toggle switch is “down” for weighing leg
☐ LCD numbers “zeroed out” with leg off the transducer
☐ Velcro strap of transducer support is tightened around leg
☐ Participant tightly strapped into chair
☐ Records value after participant told to relax
☐ Makes sure that toggle switch is “up” for extension
☐ Before testing, correct computer information viewed on screen, including muscle group to be tested, settings, staff ID#,s, participant enrollment ID# and acrostic
☐ Instructs participant to do two practice trials at 50% effort for extension test. Key points from script stated and clearly delivered
☐ Instructs participant to do three maximal trials. Key points from script stated and clearly delivered
☐ 30 seconds passed between trials
☐ Standard level of encouragement (motivation and feedback to elicit maximal effort) offered to participant
☐ Test is correctly performed by participant
☐ Asks participant if they had pain during test
☐ Records whether participant completed the test and if not, why not
Prints report
☐ Toggles switch “down” for flexion
☐ Instructs participant to do two practice trials at 50% effort for flexion test. Key points from script stated and clearly delivered
☐ Instructs participant to do three maximal trials. Key points from script stated and clearly delivered
☐ 30 seconds passed between trials
☐ Standard level of encouragement (motivation and feedback to elicit maximal effort) offered to participant
☐ Test is correctly performed by participant
☐ Asks participant if they had pain during test
☐ Records whether participant completed the test and if not, why not
☐ Prints report
☐ (If applicable) Settings and results completely and correctly recorded on data collection form (including back support, arm support, horizontal bar, vertical bar, maximum force, time of maximum force, and maximum speed of force production)

After both right and left leg tested
☐ Offers stool to help participant get down off chair
☐ Encourages the participant to move, stretch, and shake their legs
☐ Form correctly filled out
☐ Reviewed form for completeness
Appendix 1 Calibration of isometric chair

The room in which the chair is kept should be at a normal room temperature. Before starting the calibration procedure, the system should have been switched on for at least 15 minutes to allow the transducers and amplifier to warm up. If the device has been in cool or hot environments it should be kept at normal room temperature long enough to achieve that temperature (+18 to 25 °C). The system should not be stored or kept during transportation at less than 0 °C. The calibration weight mass and Newton value are marked on each calibration weight.

1. Place transducer on top of arm of Good Strength chair: The transducer must be set precisely horizontal.

2. Turn base level of amplifier to “000” after toggling switch to flexion (↓).
3. Place weight on transducer:

4. Check reading under “continuous” on amplifier. Calibration is OK if ± 1 Newton
If the calibration measurement is inaccurate, the weight's position should be checked, and if still not accurate should be removed and replaced completely prior to opening the amplifier. If it’s still inaccurate by more than 1 Newton, you can adjust the gain. To adjust the gain, you have to open the amplifier at the top and adjust the top screw. See arrow:

If the value in the left-most LCD is too small, turning the resistance clockwise with a small screwdriver increases the gain. If the value is too high, turning the resistance counter-clockwise decreases the gain. The calibration weight is next taken away from the transducer and the base level is checked. A change in the gain also usually brings about a change in the zero level, and must thus be adjusted back to zero. The calibration weight is then put back on the transducer, and it may be necessary to re-adjust the gain slightly as the base level has been changed. The gain is thus adjusted to achieve the desired value on the left-most LCD a second time, and after that the weight is removed again. It may still be necessary to change the base level as the gain has been changed. After some repetitions the correct level in both gain and base level will be found. The changes needed in subsequent repetitions should become smaller each time.
Appendix 2 Step by step initial set-up instructions

A. Changing the maximum speed of force production (N/sec) in the software to 30 to 90 (instead of 10 to 90).

1. Choose Options heading from pull-down menu
2. Choose Preferences
3. Click on the “Filtering” tab
4. Under “Force Production” use the arrow keys to raise “Low Level” from 10 (default) to 30.
5. Under “Relaxation” use the arrow keys to raise “Low Level” from 10 (default) to 30.

Note: the “High Level” for both the Force Production and Relaxation will remain at 90.

The screen will look like this:
B. Initial software set-up is done from the Stem Data drop-down menu. Project, muscle group, and settings must be entered prior to the very first participant. Examiner is entered only the first time an examiner administers testing. Participant is entered only the first time they are being tested.

1. Choose Stem Data from the main screen pull-down menu.
2. Choose **Project**
3. Choose New
4. Name the project OAI.

5. Click “Ok.”
6. Choose **Settings** from the Stem Data pull-down menu
7. Enter each of the chair settings, including the one default setting.

8. Click “Ok”
9. Choose **Muscle Group** from the Stem Data pull-down menu
10. Choose New
11. Name the new muscle group – for example, RIGHT KNEE FLEXION 60 DEG

12. Click “Add Setting”
13. Add each setting from the settings list. Click “Add Setting” and highlight all four settings (hold shift key and arrow down).

Click “Ok”
14. Follow these procedures for each of the muscle groups:
   RIGHT KNEE EXTENSION 60 DEG
   RIGHT KNEE FLEXION 60 DEG
   LEFT KNEE EXTENSION 60 DEG
   LEFT KNEE FLEXION 60 DEG

15. Choose **Examiner** from the Stem Data pull-down menu
16. Choose New
17. Type in your staff ID# in the space labeled “Last Name.”
18. Click “Ok.”

19. Choose **Participant** from the Stem Data pull-down menu
20. Choose New
21. Enter participant information (see Appendix 3 for more detail)
Appendix 3a Step by step instructions for testing participant - BASELINE

1. After you ask the participant to remove their shoes, offer them a stool to step up and seat themselves on the chair. Participant should sit with their knees hanging over the edge of the chair seat:

2. Move the back of the chair forward to support participant’s back: Tighten handles to prevent slippage. Be sure that the back is not skewed, i.e., that the back support setting is the same on both sides.
3. Place a mark along the lateral joint line of the right leg. To find the lateral joint line, locate the inferior pole of the patella. Move your fingers laterally (to the outside) to feel the “notch” opening that is the front of the lateral joint line. Draw a line along the lateral joint line, starting at the notch and extending approximately half-way around the lateral knee.

4. Have participant place their leg over transducer support. Transducer support should be centered behind the participant’s right leg.

5. Use long-arm goniometer with fixed arm pointed toward the greater trochanter, center of goniometer on the mark at the center of the lateral knee joint line, and moveable arm pointed to lateral malleolus. Move transducer support arm forward or backward to achieve a 60 degree angle. Tighten handle on horizontal bar to lock in angle.
6. Slide bottom of transducer support to 2 cm above the top of participant’s right calcaneus bone. Tighten handle.

7. Use the long clear ruler to measure line from top of transducer support along side of leg up to mark at lateral joint line. Record this measurement on the data collection form as the “leg length from transducer to joint line” measurement.

8. Find setting parameters, and record these on the data collection form. You will later need to enter these settings into the computer on the “Define Position” screen (item #22 below). Reading the parameters will be easier if you use a carpenter’s framing square:

a. Back support (will be 0 to 32 cm). The back setting is measured by using the framing square. Set it in at the blue part of the back of the chair, not pressing hard, but just resting on the chair back.
b. Arm support (will be 0 to 12 cm)
Arm support moves up and down on each side. Arms should be at a comfortable height for the participant to hold on during testing. The arms will be set at “8 cm” for most participants. Make sure that the chair arm safety locks are in place.

c. Horizontal bar under chair (knee angle fix): will be 10 to 40 cm

d. Vertical bar that transducer is attached to (height): will be 10 to 43 cm

Use the carpenter’s framing square to align the settings to the ruler; i.e., to enable you to get precise readings of the settings.

See detailed examples below:

9. Prepare to weigh leg.
• Have participant remove their leg from the transducer support
• Toggle switch down to flexion.
• LCD numbers should be “zeroed out” with the leg off the transducer
• Place the participant’s leg back into the transducer.

10. Tighten velcro strap around the participant’s leg to hold the leg firmly in the transducer support. Note that if a participant is very small, the leg strap may not be tight enough and padding should be added to the front of the leg to make the strap tighter. If a participant’s leg is too large for the transducer support, they may need padding behind their leg to make the support more comfortable.

11. Attach seat belt snugly across participant’s lower hips and snugly attach the strap around the thigh of the leg that is being measured.

12. Check that toggle switch is pointed downward for flexion and ask the participant to relax their leg. Record the value on the data collection form.

13. Check that toggle switch is pointed upward for extension.
14. Create examiner, if necessary (once this is done you can pull up your examiner ID# from the list on file). Enter your OAI Staff ID#.

15. Begin computer entry for the participant. Select Stem Data, Participant, New. Enter the participant’s acrostic into the space labeled “First Name.” Enter participant’s Enrollment ID# into the space labeled “Last Name.” Click the bubble next to “Female” or “Male,” then click “Ok.” Ignore “Date of Birth.”

This will only be done at the initial visit. Be sure to wait for the information to be saved before starting the exam. In subsequent years, participant data will already be stored.

16. Go through menus to set up test for the participant. See Appendix 2 for information about setting up new examiner, new project, new muscle group, and settings.

   a. Select Project
   b. Select Examiner
   c. Select participant (the participant has been entered into the system in previous step, but needs to be selected here)
   d. Select Muscle Group The first test will be RIGHT KNEE EXTENSION 60 DEG
Right knee extension
17. Select Measurement from menu.
18. Choose “New.”
19. Verify appropriate muscle group.

20. Measurement type should be max strength. Attempts should be “3.”
21. Choose “Ok.”
22. The Define Position screen will appear.
23. Enter the participant’s settings into the computer from the data collection form.

![Image of Define Position window]

At this point, you will be tempted to hit “Ok & Save Defaults.” DO NOT DO THIS YET. The test should not be started until after the two practice trials.

24. Test right knee extension.
   a. Instruct participant (see Section 8.34 for script.)

   ![Image of a participant and instructor]

   b. Give the participant two practice trials at 50% effort. See Section 8.33 for script. After first practice trial observe participant for proper technique and proper alignment in chair. Knee should not twist with effort. Make necessary positions changes and reinstruct as needed. Perform second trial using script.
   c. Now you can click “Ok & Save Defaults.”
d. The following screen appears to give you time to walk from the computer back to the participant to begin the test. Prepare for measurement:

![Prepare for Measurement!]

15

e. Begin the test. See Section 8.34 for script. Give standard maximal effort encouragement.

f. Have participant perform three trials. See computer screen for 30-second count down between trials. Wait for the count down screen to disappear before you begin test.
g. Press reset button between trials to see peak value.

25. Print right knee extension test results (Appendix 5) and record on data collection form. The results that are recorded on the data collection form include:
   a. Maximum force (N)
   b. Time of maximum force (seconds)
   c. Maximum speed of force production (N/sec)

Results should be rounded to the nearest whole number. Round up for 0.50 or greater, otherwise round down. For example, if the maximum force is 135.56 N, this would be rounded up and recorded as 136 N, and if the maximum speed of force production is 350.33 N/sec, this would be rounded down to 350 N/sec.
26. Ask participant if they had pain during the test, and if so, what the severity was, and if the pain kept them from pushing as hard as they can. See Section 8.34 for script.

27. Answer the question “Was the participant able to complete the right knee extension isometric strength measurements?” If not, mark why not. See Section 8.34.

**Right knee flexion:**

28. Prepare for knee flexion test. Make sure that the participant keeps their pelvis back in the seat and doesn’t scoot forward in the chair between tests.

   a. **MOVE TOGGLE SWITCH DOWNWARD FOR FLEXION.**
   b. Select new muscle group from main screen drop-down menu. This test is called **RIGHT KNEE FLEXION 60 DEG**

29. Do two practice right knee flexion tests after describing test for participant. See Section 8.35 for script.

30. Test flexion:

   a. Instruct participant (see Section 8.36 for script)
   b. Give standard maximal effort encouragement.
   c. Have participant perform three trials. See computer screen for 30-second count down between trials.
   d. Press reset button between trials to see peak value.

31. Print right knee flexion test results and record on data collection form. These results will also include:

   a. Maximum force (N)
   b. Time of maximum force (seconds)
   c. Maximum speed of force production (N/sec)

32. Ask participant if they had pain during the test, and if so, what the severity was, and if the pain kept them from pulling as hard as they can. See Section 8.36 for script.

33. Answer the question “Was the participant able to complete the right knee flexion isometric strength measurements?” If not, mark why not. See Section 8.36.

**Left knee**

34. Repeat the above procedures for the left knee with one exception. If you were able to obtain a leg length measurement of the right leg (right knee was not replaced in the past 6 months), do not measure the left leg. However, DO weigh the left leg. Follow the procedure described in item #9.

Determine if the back support, arm support height, horizontal bar, and vertical bar settings are the same for the left side. If so, go on to measure the left knee and do the practice left knee extension isometric measurements. If not, enter the new settings on the computer and on the data collection form.
collection form before you do the practice and trials for the left leg. BE SURE TO TOGGLE UP TO EXTENSION BEFORE PRACTICE AND TESTING.

35. Encourage the participant to move, stretch, and shake their legs in order to reduce muscular pain and stiffness after the tests. See Section 8.5 for script.
Appendix 3b Step by step instructions for testing participant – FOLLOW-UP

1. Have participant sit in another chair while you set up the isometric chair using the baseline settings. You'll find these on the Data from Prior Visits Report. Record these on the data collection form. You will need a carpenter’s framing square to align settings to the ruler:

   a. Refer to Data from Prior Visits Report for baseline settings for back support. The back setting is measured by using the framing square. Set it in at the blue part of the back of the chair, not pressing hard, but just resting on the chair back. Use and record this setting.

   b. Refer to Data from Prior Visits Report for arm support settings. Use and record these settings. Make sure that the chair arm safety locks are in place.

   c. Refer to Data from Prior Visits Report for horizontal bar settings. Use and record this setting.

   d. Refer to Data from Prior Visits Report for vertical bar setting. Use and record this setting.

Use the carpenter’s framing square to align the settings to the ruler; i.e., to enable you to get precise readings of the settings.

See detailed examples below:
2. After you ask the participant to remove their shoes, offer them a stool to step up and seat themselves on the chair. Participant will be sitting with their knees hanging over the edge of the chair seat:

3. Place a mark along the lateral joint line of the right leg. To find the lateral joint line, locate the inferior pole of the patella. Move your fingers laterally (to the outside) to feel the “notch” opening that is the front of the lateral joint line. Draw a line along the lateral joint line, starting at the notch and extending approximately halfway around the lateral knee.

4. Have participant place their leg over transducer support. Transducer support should be centered behind the participant’s right leg. Participant may need to shift their hips.
5. Use the long clear ruler to measure line from top of transducer support along side of leg up to mark at lateral joint line. Check the Data from Prior Visits Report to see if the leg length measurement is the same as baseline. If the measurement is different, assess the position of the bottom of the transducer. If it is about 2 cm above the calcaneus, record the new leg length measurement on the data collection form as the “leg length from transducer to joint line.” If the transducer is clearly not in the right place on the participant's leg, i.e., about 2 cm above the calcaneus, move the transducer up or down to match baseline leg length and record the new vertical bar setting.

Important! After the settings have been set and the participant is sitting in the chair, if you think that the leg angle is not 60 degrees, or the chair back should be set differently, or any other setting just doesn't seem right, see if you think that the participant can do the measurement without discomfort as it is, even though the setup doesn't look perfect to you. It is preferable that the baseline settings are used. However, if any setting has to be adjusted for participant safety or comfort, or is obviously so far wrong that it is most likely the setting was incorrectly recorded at the previous visit, make the adjustment and record the new setting on the data collection form.

6. Prepare to weigh leg.

- Have participant remove their leg from the transducer support
- Toggle switch down to flexion.
- LCD numbers should be “zeroed out” with the leg off the transducer
- Place the participant’s leg back into the transducer.

7. Tighten velcro strap around the participant’s leg to held the leg firmly in the transducer support. Note that if a participant is very small, the leg strap may not be tight enough and padding should be added to the front of the leg to make the strap tighter. If a participant’s leg is too large for the transducer support, they may need padding behind their leg to make the support more comfortable.
8. Attach seat belt snugly across participant’s lower hips and snugly attach the strap around the thigh of the leg that is being measured.

9. Check that toggle switch is pointed downward for flexion and ask the participant to relax their leg. Record the value on the data collection form.

10. Check that toggle switch is pointed upward for extension.

11. Create examiner, if necessary (once this is done you can pull up your examiner ID# from the list on file). Enter your OAI Staff ID#.

12. Pull up information about participant. See Appendix 9 for instructions to find a particular participant.

13. Make sure all of the following are brought up on the computer screen:

   a. **Project (OAI)**
   b. **Examiner** (Select your number from drop-down menu or create new)
   c. **Participant** (Find participant or enter new if not tested previously)
   d. **Muscle Group Choose from drop-down menu.** The first test will be RIGHT KNEE EXTENSION 60 DEG
Right knee extension
14. Select Measurement from menu.
15. Choose “New.”
16. Verify appropriate muscle group.

17. Measurement type should be max strength. Attempts should be “3.”
18. Choose “Ok.”
19. The participant's position screen that includes their chair settings will appear with the settings from their baseline measurement.

At this point, you will be tempted to hit “Ok & Save Defaults.” DO NOT DO THIS YET. The test should not be started until after the two practice trials.

20. Test right knee extension.
   a. Instruct participant (see Section 8.34 for script.)
b. Give the participant two practice trials at 50% effort. See Section 8.33 for script. After first practice trial observe participant for proper technique and proper alignment in chair. Knee should not twist with effort. Make necessary positions changes and reinstruct as needed. Perform second trial using script.

c. Now you can click “Ok & Save Defaults.”
d. The following screen appears to give you time to walk from the computer back to the participant to begin the test. Prepare for measurement:

```
Prepare for Measurement!

15
```

e. Begin the test. See Section 8.34 for script. Give standard maximal effort encouragement
f. Have participant perform three trials. See computer screen for 30-second count down between trials. Wait for the count down screen to disappear before you begin test.
21. Print right knee extension test results (Appendix 5) and record on data collection form. The results that are recorded on the data collection form include:
   a. Maximum force (N)
   b. Time of maximum force (seconds)
   c. Maximum speed of force production (N/sec)

   Results should be rounded to the nearest whole number. Round up for 0.50 or greater, otherwise round down. For example, if the maximum force is 135.56 N, this would be rounded up and recorded as 136 N, and if the maximum speed of force production is 350.33 N/sec, this would be rounded down to 350 N/sec.

22. Ask participant if they had pain during the test, and if so, what the severity was, and if the pain kept them from pushing as hard as they can. See Section 8.34 for script.

23. Answer the question “Was the participant able to complete the right knee extension isometric strength measurements?” If not, mark why not. See Section 8.34.

**Right knee flexion:**

24. Prepare for knee flexion test. Make sure that the participant keeps their pelvis back in the seat and doesn’t scoot forward in the chair between tests.

   a. MOVE TOGGLE SWITCH DOWNWARD FOR FLEXION.
   b. Select new muscle group from main screen drop-down menu. This test is called RIGHT KNEE FLEXION 60 DEG

25. Do two practice right knee flexion tests after describing test for participant. See Section 8.35 for script.

26. Test flexion:
a. Instruct participant (see Section 8.36 for script)
b. Give standard maximal effort encouragement.
c. Have participant perform three trials. See computer screen for 30-second countdown between trials.
d. Press reset button between trials to see peak value.

27. Print right knee flexion test results and record on data collection form. These results will also include:
   a. Maximum force (N)
   b. Time of maximum force (seconds)
   c. Maximum speed of force production (N/sec)

28. Ask participant if they had pain during the test, and if so, what the severity was, and if the pain kept them from pulling as hard as they can. See Section 8.36 for script.

29. Answer the question “Was the participant able to complete the right knee flexion isometric strength measurements?” If not, mark why not. See Section 8.36.

Left knee
30. Repeat the above procedures for the left knee with one exception. If you were able to obtain a leg length measurement of the right leg (right knee was not replaced in the past 6 months), do not measure the left leg. If, on the Data from Prior Visits Report there is a right and a left-leg measurement, you do not have to re-measure the left leg unless the left leg is the only leg that was measured at baseline, i.e., you do not have a right leg length measurement on the Data from Prior Visits Report. If you need to measure the left leg, follow the procedure described in item #5.

Remember, however, DO weigh the left leg. Follow the procedure described in item #9.

Check the Data from Prior Visits Report and use the same settings that were used at baseline for back support, arm support height, horizontal bar, and vertical bar settings, if these are listed. Do the practice left knee extension isometric measurements. BE SURE TO TOGGLE UP TO EXTENSION BEFORE PRACTICE AND TESTING.

31. Encourage the participant to move, stretch, and shake their legs in order to reduce muscular pain and stiffness after the tests. See Section 8.5 for script.
Appendix 4 Deleting a record

On rare occasions, you may need to delete a file. Be aware, however, that deleted records cannot be retrieved. Please confirm by looking at the ID#, date, etc., that this is the record you want to delete.

1. Open file:

2. Choose the file that you want to delete:

3. Click the (-).

4. A confirmation screen will come up:

5. Click “Ok.”

The dreaded "Schluesselverletzung!" indicates that you saved a file that is not a completed test. Click "OK" on the error message. Go to the measurement menu and delete the file. Proceed with testing as usual.
Appendix 5  Participant results report

In order to set up your Participant Results Report, you will have to configure the results. Go to the Options pull-down menu and choose the option called “Configure Results”:
Make sure that your Used Parameters are:
- Max Force
- Time of Max
- Speed Prod.
- Pos H Limit (P)
- Pos L Limit (P)
When the test is complete, a screen similar to the one below appears. To print the report, click “Use Mean Filter”, but do NOT click on "All".

To print, click the middle print icon in the left margin.
To print results later:

1. Select “Open” from the “Measurement” pull-down menu.

Choose the participant whose test you want to print and click OK.
Example report

Good Strength Report

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<tr>
<th>Project:</th>
<th>OAI</th>
</tr>
</thead>
<tbody>
<tr>
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<td>8</td>
</tr>
<tr>
<td>Examiner:</td>
<td>123</td>
</tr>
<tr>
<td>Nr. of Trials:</td>
<td>3</td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
</tr>
</tbody>
</table>

**Muscle Group:** RIGHT KNEE FLEXION 60 DEG

**Participant:** 7777777 save

**Measure Time:** 12/2/2003 / 5:08 PM

**Measure Type:** max strength

**Parameters:**

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<th>Speed Peak (N/s)</th>
<th>Pos. H. Limit (°)</th>
<th>Pos. L. Limit (°)</th>
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</thead>
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<td>3.09</td>
<td>517.32</td>
<td>2.06</td>
<td>1.33</td>
</tr>
</tbody>
</table>

Diagram of force vs. time.
Appendix 6 Data backup (daily and quarterly)

Save the 'strength.ldf' and 'strength.mdf' files on your Good Strength Chair computer onto a CD every day. Below are the instructions for backing up every day and for creating the quarterly backup CD that you will be sending to Susan Averbach at the UCSF Coordinating Center.

1. Before you start to make the backup of folder "C:\Program Files\Metitur\Good Strength," please stop the MSDE by right-clicking the icon on the right-lower corner on the task bar (the one with a small green triangle). Choose "MSSQLServer - Stop." Otherwise you cannot copy the files because the database files are still in use.

2. To find these files, double click on MY COMPUTER which should be on your local disk (usually C). Go to the PROGRAM FILES folder, METITUR folder, GOOD STRENGTH folder. Copy the following files: 'strength.ldf' and 'strength.mdf' onto a CD and store them in a safe place at your facility.

3. After this, if you want to continue using the Good Strength Chair, you can either reboot the computer or right click the icon on the right-lower corner (the one with a red dot, and choose "MSSQLServer - Start." Another window entitled "SQL Server Service Manager" pops up. Choose the button with the green triangle to "Start/Continue." Close the window.

Please send the cumulative quarterly backup CD to Susan Averbach on the first of November, February, May, and August. Send the CD via 2-day mail, UPS, or Federal Express to:

Susan Averbach
UCSF Coordinating Center
185 Berry Street
Lobby 4, Suite 5700
San Francisco, CA 94107-1762
415-514-8088
Appendix 7 Data transfer results (monthly)

USING VERSION 2.1 GOOD STRENGTH SOFTWARE TO EXPORT FILES

Before exporting, click on the "lightning" sign to make all of the fields blank.

Choose "OAI" next to "Project."
Go to the "Measurement" pull-down menu and choose "Open."
Click on the first date field under "Measurement Time" and a calendar will appear. Choose the first date. For example, if you are choosing all of the exams done between November 1, 2004 and January 28, 2005, you would choose November 1, 2004.

Note: Make sure that you are choosing the correct year. The default year is 2003, so you will have to scroll over to the correct year.

Make sure MType, Muscle Group and Participant fields are blank. Right click each field to make it blank.

Click on the second date field under "Measurement Time" (after hyphen) and a second calendar will appear. Choose the second date. In the example described above, you would choose January 28, 2005.

Be sure that the box next to "Use Measurement Time" is checked.

Click "Export Wizard" at the bottom of the screen.
The next screen you will see is:

Next screen will look like the screen below.

Click on “+OAI” to highlight.  
Click “Add to Export.”
Choose the Destination File where you want the file to go.

Name the file that you are saving. Each site will have a unique name. The first part of the name identifies your site, the rest of the name identifies the study and the date that you are backing up. For example, if you are sending records collected between 11/2/2004 and 1/28/2005, the files would be named:
- RL_OAI_11.02.04_01.28.05.txt
- UM_OAI_11.02.04_01.28.05.txt
- JH_OAI_11.02.04_01.28.05.txt
- OSU_OAI_11.02.04_01.28.05.txt
- PITT_OAI_11.02.04_01.28.05.txt

Be sure to add .txt at the end of the filename.

Click on "Start" and the exam results data acquired between the dates requested will be exported. Once the results export is done, the screen will look like this.

Your screen may go blank. Do not worry. This is normal.

Click "Close"
After you complete the export process, remove the check in box next to "Use Measurement." Be sure to reboot your computer. Otherwise, you may get the following error message: "DSMType: Dataset not in edit or insert mode."

Transfer the data monthly using the Secure Web Gateway. See instructions below.

**Data Transfer Using the Secure Web Gateway**

The following instructions explain the process for transferring data securely to the SF Coordinating Center.

In your initial connection, you may be requested to download an ActiveX control. This takes only a few seconds and is required for access to the secure site.

**To Start:**

In any browser go to site [https://ive.psg-ucsf.org/](https://ive.psg-ucsf.org/) and enter your username and password.

You will see a page similar to the page below. Most of you will only have a single role listed, although you may have more as does the user below. Select the appropriate project/task based on the data you wish to transfer.

**For OAI Clinics transfer of data:** Choose OAI Clinics

(note: all participant data transferred to/from the SFCC should use this folder: this includes GoodStrength data)
This will take you to a screen similar to the one below. Choose the appropriate folder.

For the OAI Clinics: Choose OAI Clinics and then your clinic folder

Some users may receive a request to type their username and password in again. Please do so, using the “psg\" prefix as shown below.
To upload data:

Select “Upload File”

Select “Browse” to locate the files for uploading. If you wish to rename the file, use “Save As” to enter the new name (otherwise this field can be left blank). Select “Upload”.

Once the file has been transferred, the upload status should reflect “Done”. Click “Close”. You should now see the file you uploaded in the Name column. To upload additional files, click “Upload File” and repeat the above process.

Once you are finished, click “Sign Out” and close your browser.
Appendix 8a  Task summary / "cheat sheet" - BASELINE

1. **Calibrate** once a week. Place transducer on top of arm of chair. The transducer must be set precisely horizontal. Turn base level of amplifier to “000” after toggling switch to flexion. Place weight on transducer. Check reading under “continuous” on amplifier. Calibration is OK if plus/minus 1 Newton. If the calibration measurement is inaccurate, please see manual - Appendix 1. Please record on Calibration Log.

2. **Script**: “Which leg do you use to kick a ball?” Record answer on data collection form.

3. **Script**: “This will be a test of your leg strength. We’ll be strapping your right, then your left leg onto this device and you will be pushing, then pulling against a lever arm. This lever arm will not move during the test. We’ll do two practice tests and three real tests, both pushing and pulling, both right and left.”

4. Determine if right leg can be tested by referring to Data From Prior Visits Report. If right knee has been replaced within 6 months go to question #11 and test the left leg.

5. **Script**: “Now I would like you to sit in the chair with your hands holding onto the arms of the chair.”

6. **Positioning the participant:**
   - Front edge of chair should be just below the back of knee joints
   - Arms at comfortable height
   - Backrest should support back at a straight angle
   - Mark lateral joint line
   - Transducer support centered behind participant’s right leg
   - Measure knee to 60 degree angle with goniometer
   - Transducer is adjusted so that lower edge is lifted to about 2 cm above upper edge of calcaneus bone.
   - Measure leg length from the lateral joint line to where the top of the transducer is attached to the participant’s leg
   - Record measurement on data collection form
   - Leg should be off transducer before zeroing out
   - Make sure toggle switch is down to zero out
   - Fasten seat belt across pelvis
   - Fasten seat belt across right leg/left leg
   - Fasten belt across ankle
   - Ask participant to relax and weigh leg
   - Flip toggle switch up
   - Double-check measurements of Back Support, Arm Support, Horizontal Bar and Vertical Bar and record on data collection form
7. Computer set up:

- Pull down Stem Data
- Choose Examiner and enter your number
- Choose Participant, Choose New and enter needed information
- Acrostic is entered in First Name and Participant ID # in Last Name, choose male/female
- Choose OK
- Pull down Measurement
- Open New
- Verify appropriate muscle group
- Measurement type should be Maximum Strength. Attempts should be “3”
- Choose OK
- The Define Position screen will appear.
- Enter participant’s measurements into computer from data collection form
- DO NOT HIT OK & SAVE TO DEFAULTS YET!

8. Practice test for extension:

- **Script:** “OK, this first test is going to be a practice test. When I say ‘push,’ all I want you to do is to push forward against the pad. Please don’t hold your breath as you push. Just relax and exhale slowly. This lever arm attached to your leg will NOT move. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. Since it’s a practice test, I just want you to give me a 50% effort. 3,2,1, ready, push, push, push, push, push, OK relax.”
- Observe participant for proper technique and proper alignment in chair. Knee should not twist with effort. Make necessary positions changes and reinstruct as needed.
- Hit Reset Button
- **Script:** “Now let’s do this again. When I say ‘push’ push forward against the pad. Again, I just want you to give me a 50% effort. 3,2,1, ready, push, push, push, push, push, push, push, push, OK relax.”

9. Test extension:

- **Script:** “OK, now we will do the real test. As soon as I say ‘push’ I want you to push as hard and as fast as you can against the pad. You’re going to give a 100% effort. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. The test will take just a few seconds. We will do three trials. Please don’t hold your breath as you push. Just relax and exhale slowly. 3, 2, 1, ready…. push, push, push, push, push, OK relax.”
- Computer will count down 30 seconds between tests.
- Complete 3 trials of this test.
- **Script:** “Did you have any knee pain during this test?” If they answer “Yes,” ask them: “Was it mild, moderate, or severe?” and “Did this pain prevent you from pushing as hard as you can?” Record on data collection form.
10. Printing test results:

- When test is complete click “Use Mean Filter.” To print, click the middle icon in the left margin.
- You will have only one printed sheet per test, staple together and put in chart
- Complete data form (Round up when necessary)
- Do this for each test

11. Right knee flexion:

- Move toggle switch downward for flexion
- Select new muscle group from main screen drop down menu
- Do 2 practice trials
- Script: “OK, now we are going to test your leg strength as you pull your leg back. This first test is going to be a practice test. When I say ‘pull,’ all I want for you to do is to pull backward against the pad. Please don’t hold your breath as you pull. Just relax and exhale slowly. This lever arm attached to your leg will not move. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. Since it’s a practice test, I just want you to give me a 50% effort. 3, 2, 1, ready pull, pull, pull, pull, pull, OK relax.”
- Script: Now let’s do this again. When I say ‘pull’ pull backward against the pad. Again, I just want you to give me a 50% effort. 3, 2, 1, ready, pull, pull, pull, pull, pull, OK relax.
- Script: “OK, now we will do the real test. As soon as I say ‘pull’ I want you to pull as hard and as fast as you can against the pad. You’re going to give a 100% effort. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. The test will take just a few seconds. We will do 3 trials. Please don’t hold your breath as you pull. Just relax and exhale slowly. 3, 2, 1, Ready, Pull, Pull, Pull, Pull, Pull, OK relax.
- Script: Did you have any knee pain during this test? If they answer ‘Yes’ – Ask them. “Was it mild, moderate, or severe?” and “Did this pain prevent you from pulling as hard as you can?”
- Print results

12. Testing left leg:

- Check Data from Prior Visit Report to determine if left leg can be tested
- Make sure participant is sitting all the way back in the chair
- Remove thigh and ankle straps, center transducer support behind left leg
- Recheck bar measurements
- Position same as right leg, recheck with goniometer
- Leg should be off transducer before zeroing out
- Toggle switch down and zero out
- Strap thigh and leg, ask participant to relax and weigh leg
- Give 2 Practice trials
- Follow scripts for right leg for flexion and extension
- Print results
13. Cool down period:

Script: “We’re done testing. It’s a good idea for you to move and shake your legs, like this (demonstrate for participant).”
Appendix 8b  Task summary / "cheat sheet" – FOLLOW-UP

1. **Calibrate** once a week. Place transducer on top of arm of chair. The transducer must be set precisely horizontal. Turn base level of amplifier to “000” after toggling switch to flexion. Place weight on transducer. Check reading under “continuous” on amplifier. Calibration is OK if plus/minus 1 Newton. If the calibration measurement is inaccurate, please see manual - Appendix 1. Please record on Calibration Log.

2. Refer to Data from Prior Visits Report and adjust chair settings: back support, arm support, horizontal bar, vertical bar.

3. **Script**: “Which leg do you use to kick a ball?” Record answer on data collection form.

4. **Script**: “This will be a test of your leg strength. We’ll be strapping your right, then your left leg onto this device and you will be pushing, then pulling against a lever arm. This lever arm will not move during the test. We’ll do two practice tests and three real tests, both pushing and pulling, both right and left.”

5. Determine if right leg can be tested by asking participant if they ever had a knee replacement surgery in their right knee, and, if "Yes," asking if right knee was replaced within last 6 months. If "Yes," go to question #11 and test the left leg.

6. **Script**: “Now I would like you to sit in the chair with your hands holding onto the arms of the chair.”

7. **Positioning the participant:**
   - Have participant remove shoes and offer them a stool to step up and seat themselves on chair.
   - Mark lateral joint line
   - Transducer support centered behind participant’s right leg
   - Measure leg length from the lateral joint line to where the top of the transducer is attached to the participant’s leg (check Data from Prior Visits Report for baseline leg length. If different than current measurement, see if bottom of transducer about 2 cm above calcaneus and record new leg length measurement; if transducer not about 2 cm above calcaneus, move transducer up or down to match baseline leg length, and record new vertical bar measurement)
   - Record measurement on data collection form
   - Leg should be off transducer before zeroing out
   - Make sure toggle switch is down to zero out
   - Fasten seat belt across pelvis
   - Fasten seat belt across right leg/left leg
   - Fasten belt across ankle
   - Ask participant to relax and weigh leg
   - Flip toggle switch up
   - Record Back Support, Arm Support, Horizontal Bar and Vertical Bar and record on data collection form. These should be the same as baseline. See Data from Prior Visits Report.
8. **Computer set up:**

- Go to Stem Data pull-down menu and choose Participant
- In Last Name field, choose Search
- Type in participant's ID# in the Last Name field
- Click OK
- Choose muscle group (RIGHT KNEE EXTENSION 60 DEG)
- DO NOT HIT OK & SAVE TO DEFAULTS YET!

9. **Practice test for extension:**

- **Script:** “OK, this first test is going to be a practice test. When I say ‘push,’ all I want you to do is to push forward against the pad. Please don’t hold your breath as you push. Just relax and exhale slowly. This lever arm attached to your leg will NOT move. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. Since it’s a practice test, I just want you to give me a 50% effort. 3, 2, 1, ready, push, push, push, push, push, OK relax.”
- Observe participant for proper technique and proper alignment in chair. Knee should not twist with effort. Make necessary positions changes and re-instruct as needed.
- Hit Reset Button
- **Script:** “Now let’s do this again. When I say ‘push’ push forward against the pad. Again, I just want you to give me a 50% effort. 3, 2, 1, ready, push, push, push, push, push, OK relax.”

10. **Test extension:**

- **Script:** “OK, now we will do the real test. As soon as I say ‘push’ I want you to push as hard and as fast as you can against the pad. You’re going to give a 100% effort. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. The test will take just a few seconds. We will do three trials. Please don’t hold your breath as you push. Just relax and exhale slowly. 3, 2, 1, ready…. push, push, push, push, push, push, OK relax.”
- Computer will count down 30 seconds between tests.
- Complete 3 trials of this test.
- **Script:** “Did you have any knee pain during this test?” If they answer “Yes,” ask them: “Was it mild, moderate, or severe?” and “Did this pain prevent you from pushing as hard as you can?” Record on data collection form.

11. **Printing test results:**

- When test is complete click “Use Mean Filter.” To print, click the middle icon in the left margin.
- You will have only one printed sheet per test, staple together and put in chart
- Complete data form (Round up when necessary)
- Do this for each test
12. Right knee flexion:

- Move toggle switch downward for flexion
- Select new muscle group from main screen drop down menu
- Do 2 practice trials
- **Script**: “OK, now we are going to test your leg strength as you pull your leg back. This first test is going to be a practice test. When I say ‘pull,’ all I want for you to do is to pull backward against the pad. Please don’t hold your breath as you pull. Just relax and exhale slowly. This lever arm attached to your leg will not move. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. Since it’s a practice test, I just want you to give me a 50% effort. 3,2,1, ready pull, pull, pull, pull, pull, OK relax.”
- **Script**: Now let’s do this again. When I say ‘pull’ pull backward against the pad. Again, I just want you to give me a 50% effort. 3,2,1, ready, pull, pull, pull, pull, pull, OK relax.
- **Script**: “OK, now we will do the real test. As soon as I say ‘pull’ I want you to pull as hard and as fast as you can against the pad. You’re going to give a 100% effort. Hold on to the arms of the chair. Try to keep your upper body still. Just use your leg. The test will take just a few seconds. We will do 3 trials. Please don’t hold your breath as you pull. Just relax and exhale slowly. 3,2,1, Ready, Pull, Pull, Pull, Pull, Pull, OK relax.
- **Script**: Did you have any knee pain during this test? If they answer ‘Yes’ – Ask them. “Was it mild, moderate, or severe?” and “Did this pain prevent you from pulling as hard as you can?”
- Print results

13. Testing left leg:

- Ask question about left knee replacement to see if left knee was replaced in past 6 months. If "Yes" do not test left leg.
- Make sure participant is sitting all the way back in the chair
- Remove thigh and ankle straps, center transducer support behind left leg
- Recheck bar measurements (see Data from Prior Visits or new settings, if right leg settings were changed)
- Leg should be off transducer before zeroing out
- Toggle switch down and zero out
- Strap thigh and leg, ask participant to relax and weigh leg
- Give 2 Practice trials
- Follow scripts for right leg for flexion and extension
- Print results

14. Cool down period:

**Script**: “We’re done testing. It’s a good idea for you to move and shake your legs, like this (demonstrate for participant).”
Appendix 9  Finding particular participant

Go to main Good Strength menu:

Go to the “Stem Data” pull-down menu and choose “Participant.”
Right click on the "Last Name" field and a small pull-down menu will appear that offers two choices: "Show List," and "Search."
Choose "Search."

Type in the Participant ID # in the "Last Name" field.
Click "OK"

You may proceed as usual to do a measurement or may print another report for the participant. See below.
To print a results report for a previously-done measurement follow the instructions below:

Right click on the Muscle Group box to get ALL Measurements, i.e., to make the MuscleGroup field blank.
Go to the Measurement pull-down menu and choose "Open".

Make sure that the MType and MuscleGroup are blank by right clicking at those fields.
All of the measurements for the participant will be listed. If more than one set of measurements appears for a participant, someone else’s test may have been saved with the wrong ID. This happens if the examiner forgets to choose “New” for a new participant. To identify which of the measurements are correct for that participant, you will need to compare the results on the screen to those that were printed and placed in the participant’s chart.

Appendix 10 Data collection form – BASELINE
ISOMETRIC STRENGTH

1. Which leg do you use to kick a ball?
   - Right
   - Left
   - Both right and left
   - Don't know
   - Refused

2. Was right knee replaced?
   (Examiner Note: Refer to Data from Prior Visits Report for the Enrollment Visit.)
   - Yes
   - No

   a. Was your right knee replaced in the past 6 months?
      - Yes
      - No
      - Don't know

      Go to Page 44, Question #12.

3. Leg length from transducer to joint line [ ] [ ] cm

4. Chair and transducer settings
   a. Back support [ ] [ ] cm
   b. Arm support [ ] [ ] cm
   c. Horizontal bar (knee angle fix) [ ] [ ] cm
   d. Vertical bar (height) [ ] [ ] cm

5. Right leg weight
   (Examiner Note: Toggle switch down for flexion to weigh right leg.) [ ] [N]

6. Right knee extension:
   (Examiner Note: Toggle switch up for extension.)

<table>
<thead>
<tr>
<th>Trial</th>
<th>Maximum Force (N)</th>
<th>Time of Max Force (seconds)</th>
<th>Maximum Speed of Force Production (N/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>[ ] [ ]</td>
<td>[ ] [ ]</td>
<td>[ ] [ ]</td>
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<tr>
<td>2.</td>
<td>[ ] [ ]</td>
<td>[ ] [ ]</td>
<td>[ ] [ ]</td>
</tr>
<tr>
<td>3.</td>
<td>[ ] [ ]</td>
<td>[ ] [ ]</td>
<td>[ ] [ ]</td>
</tr>
</tbody>
</table>
## ISOMETRIC STRENGTH

### 7 Did you have any knee pain during this test?
- Yes
- No
- Don't know
- Refused

#### a. Was it mild, moderate, or severe?
- Mild
- Moderate
- Severe
- Don't know

#### b. Did this pain prevent you from pushing as hard as you can?
- Yes
- No
- Don't know

### 8 Was the participant able to complete the right knee extension measurements?
- Yes
- No

#### a. Why not? 
(Examiner Note: Mark all that apply.)
- Knee pain
- Equipment problems
- Participant fatigue
- Participant refused
- Other

### 9 Right knee flexion:
(Examiner Note: Toggle switch down for flexion.)

<table>
<thead>
<tr>
<th>Trial</th>
<th>Maximum Force (N)</th>
<th>Time of Max Force (seconds)</th>
<th>Maximum Speed of Force Production (N/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>3.</td>
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</tr>
</tbody>
</table>

### 10 Did you have any knee pain during this test?
- Yes
- No
- Don't know
- Refused

#### a. Was it mild, moderate, or severe?
- Mild
- Moderate
- Severe
- Don't know

#### b. Did this pain prevent you from pulling as hard as you can?
- Yes
- No
- Don't know
ISOMETRIC STRENGTH

11. Was the participant able to complete the right knee flexion measurements?
   ○ Yes  ○ No

   a. Why not?
      (Examiner Note: Mark all that apply.)
      ○ Knee pain  ○ Equipment problems  ○ Participant fatigue  ○ Participant refused  ○ Other

12. Left leg
    Was left knee replaced?
    (Examiner Note: Refer to Data from Prior Visits Report for the Enrollment visit.)
    ○ Yes  ○ No

    a. Was your left knee replaced in the past 6 months?
       ○ Yes  ○ No  ○ Don't know

       STOP. Go to next exam.

13. Leg length from transducer to joint line
    (Examiner Note: Only measure if right leg was not measured.)

14. Are the chair and transducer settings for the left leg the same as the right leg settings?
    ○ Yes  ○ No

    Go to Question #16.

15. Chair and transducer settings
   a. Back support
   ○ cm
   b. Arm support
   ○ cm
   c. Horizontal bar (knee angle fix)
   ○ cm
   d. Vertical bar (height)
   ○ cm
ISOMETRIC STRENGTH

16. Left leg weight
   (Examiner Note: Toggle switch down for flexion to weigh left leg.) □ N

17. Left knee extension:
   (Examiner Note: Toggle switch up for extension.)

<table>
<thead>
<tr>
<th>Trial</th>
<th>Maximum Force (N)</th>
<th>Time of Max Force (seconds)</th>
<th>Maximum Speed of Force Production (N/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>3.</td>
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</tr>
</tbody>
</table>

18. Did you have any knee pain during this test?
   O Yes  O No  O Don't know  O Refused
   
   a. Was it mild, moderate, or severe?
      O Mild  O Moderate  O Severe  O Don't know
   
   b. Did this pain prevent you from pushing as hard as you can?
      O Yes  O No  O Don't know

19. Was the participant able to complete the left knee extension measurements?
   O Yes  O No
   
   a. Why not?
   (Examiner Note: Mark all that apply.)
      O Knee pain  O Equipment problems  O Participant fatigue  O Participant refused  O Other
# ISOMETRIC STRENGTH

## 20. Left knee flexion:
*(Examiner Note: Toggle switch down for flexion.)*

<table>
<thead>
<tr>
<th>Trial</th>
<th>Maximum Force (N)</th>
<th>Time of Max Force (seconds)</th>
<th>Maximum Speed of Force Production (N/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>3.</td>
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</tbody>
</table>

## 21. Did you have any knee pain during this test?
- Yes
- No
- Don't know
- Refused

  a. Was it mild, moderate, or severe?
  - Mild
  - Moderate
  - Severe
  - Don't know

  b. Did this pain prevent you from pulling as hard as you can?
  - Yes
  - No
  - Don't know

## 22. Was the participant able to complete the left knee flexion measurements?
- Yes
- No

  a. Why not?
  *(Examiner Note: Mark all that apply.)*
  - Knee pain
  - Equipment problems
  - Participant fatigue
  - Participant refused
  - Other
Appendix 11 Data collection form – FOLLOW-UP

<table>
<thead>
<tr>
<th>Type of Follow-up Visit</th>
<th>OAI Participant ID#</th>
<th>Acroset</th>
<th>Staff ID#</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-month</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>24-month</td>
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<tr>
<td>36-month</td>
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<td>48-month</td>
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<tr>
<td>Interim 8-month</td>
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</tbody>
</table>

**ISOMETRIC STRENGTH**

Does the participant require an isometric strength measurement?  
*(Examiner Note: Refer to Data from Prior Visits Report.)*

- [ ] Yes  
- [ ] No

1. Which leg do you use to kick a ball?  
- [ ] Right  
- [ ] Left  
- [ ] Both right and left  
- [ ] Don't know  
- [ ] Refused

**Right leg**

2. Have you ever had knee replacement surgery in your right knee?  
- [ ] Yes  
- [ ] No

  a. Was your right knee replaced in the past 6 months?  
  - [ ] Yes  
  - [ ] No

    - [ ] Go to Isometric Strength, Question #12.  
    - [ ] Administer Isometric Strength on right leg, Go to Isometric Strength, Question #3.  
    - [ ] Go to Isometric Strength, Question #12.

3. Leg length from transducer to joint line  
  [ ] . [ ] cm  
*(Examiner Note: Compare newly-measured leg length to leg length on Data from Prior Visits Report. See operations manual for instructions if leg length is different.)*

4. Chair and transducer settings  
*(Examiner Note: Refer to Data from Prior Visits Report for settings used during previous measurement. If possible, use previous settings. Record settings used during this measurement below.)*

  a. Back support  
  [ ] . [ ] cm

  b. Arm support  
  [ ] . [ ] cm

  c. Horizontal bar (knee angle fix)  
  [ ] . [ ] cm

  d. Vertical bar (height)  
  [ ] . [ ] cm

5. Right leg weight  
*(Examiner Note: Toggle switch down for flexion to weigh right leg.)*  
[ ] N
ISOMETRIC STRENGTH

Does the participant require an isometric strength measurement?
(Examiner Note: Refer to Data from Prior Visits Report.)

O Yes  O No

1. Which leg do you use to kick a ball?
   O Right  O Left  O Both right and left  O Don't know  O Refused

   Right leg

2. Have you ever had knee replacement surgery in your right knee?
   O Yes  O No

   a. Was your right knee replaced in the past 6 months?
      O Yes  O No  O Don't know

      Go to Isometric Strength, Question #12.
      Administer Isometric Strength on right leg; Go to Isometric Strength, Question #3.
      Go to Isometric Strength, Question #12.

3. Leg length from transducer to joint line [ ] cm
   (Examiner Note: Compare newly-measured leg length to leg length on Data from Prior Visits Report. See operations manual for instructions if leg length is different.)

4. Chair and transducer settings
   (Examiner Note: Refer to Data from Prior Visits Report for settings used during baseline measurement. If possible, use previous settings. Record settings used during this measurement below.)

   a. Back support [ ] cm
   b. Arm support [ ] cm
   c. Horizontal bar (knee angle fix) [ ] cm
   d. Vertical bar (height) [ ] cm

5. Right leg weight
   (Examiner Note: Toggle switch down for flexion to weigh right leg.) [ ] N
ISOMETRIC STRENGTH

6. Right knee extension:
(Examiner Note: Toggle switch up for extension.)

<table>
<thead>
<tr>
<th>Trial</th>
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</tbody>
</table>

7. Did you have any knee pain during this test?
   ☐ Yes ☐ No ☐ Don't know ☐ Refused
   
   a. Was it mild, moderate, or severe?
      ☐ Mild ☐ Moderate ☐ Severe ☐ Don't know
   b. Did this pain prevent you from pushing as hard as you can?
      ☐ Yes ☐ No ☐ Don't know

8. Was the participant able to complete the right knee extension measurements?
   ☐ Yes ☐ No
   
   a. Why not?
      (Examiner Note: Mark all that apply.)
      ☐ Knee pain ☐ Participant fatigue ☐ Participant refused ☐ Equipment problems ☐ Other
ISOMETRIC STRENGTH

9. Right knee flexion:
   (Examiner Note: Toggle switch down for flexion.)
   
<table>
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</tbody>
</table>

10. Did you have any knee pain during this test?
   ○ Yes  ○ No  ○ Don't know  ○ Refused
   
   a. Was it mild, moderate, or severe?
      ○ Mild  ○ Moderate  ○ Severe  ○ Don't know
   b. Did this pain prevent you from pulling as hard as you can?
      ○ Yes  ○ No  ○ Don't know

11. Was the participant able to complete the right knee flexion measurements?
    ○ Yes  ○ No
    
    a. Why not?
      (Examiner Note: Mark all that apply.)
      ○ Knee pain  ○ Participant fatigue  ○ Participant refused  ○ Equipment problems  ○ Other
ISOMETRIC STRENGTH

Left leg

12. Have you ever had knee replacement surgery in your left knee?
   O Yes  O No

   a. Was your left knee replaced in the past 6 months?
      O Yes  O No  O Don't know

      STOP. Go to next exam.
      Administer Isometric Strength on left leg.
      Go to Isometric Strength, Question #13.
      STOP. Go to next exam.

13. Leg length from transducer to joint line
   (Examiner Note: Only measure if right leg was not measured.)

14. Are the chair and transducer settings for the left leg the same as the right leg settings?
   O Yes  O No

   Go to Isometric Strength, Question #16.

15. Chair and transducer settings
   (Examiner Note: Refer to Data from Prior Visits Report for Follow-up Visit for settings used
during previous measurement. If possible, use previous settings. Record settings used during
this measurement below.)

   a. Back support  cm
   b. Arm support  cm
   c. Horizontal bar (knee angle fix)  cm
   d. Vertical bar (height)  cm
**ISOMETRIC STRENGTH**

*Left leg*

12. Have you ever had knee replacement surgery in your left knee?
   - O Yes
   - O No

   a. Was your left knee replaced in the past 6 months?
      - O Yes
      - O No
      - O Don't know

      STOP. Go to next exam.
      Administer Isometric Strength on left leg. Go to Isometric Strength, Question #13.
      STOP. Go to next exam.

13. Leg length from transducer to joint line
   (Examiner Note: Only measure if right leg was not measured.)
   
14. Are the chair and transducer settings for the left leg the same as the right leg settings?
   - O Yes
   - O No

   Go to Isometric Strength, Question #16.

15. Chair and transducer settings
   (Examiner Note: Refer to Data from Prior Visits Report for settings used during baseline measurement. If possible, use previous settings. Record settings used during this measurement below.)

   a. Back support
      
   b. Arm support
      
   c. Horizontal bar (knee angle fix)
      
   d. Vertical bar (height)
ISOMETRIC STRENGTH

16. Left leg weight
   (Examiner Note: Toggle switch down for flexion to weigh left leg.)  N

17. Left knee extension:
   (Examiner Note: Toggle switch up for extension.)

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<thead>
<tr>
<th>Trial</th>
<th>Maximum Force (N)</th>
<th>Time of Max Force (seconds)</th>
<th>Maximum Speed of Force Production (N/sec)</th>
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18. Did you have any knee pain during this test?
   ○ Yes  ○ No  ○ Don't know  ○ Refused
   a. Was it mild, moderate, or severe?
      ○ Mild  ○ Moderate  ○ Severe  ○ Don't know
   b. Did this pain prevent you from pushing as hard as you can?
      ○ Yes  ○ No  ○ Don't know

19. Was the participant able to complete the left knee extension measurements?
   ○ Yes  ○ No
   a. Why not?
      (Examiner Note: Mark all that apply.)
      ○ Knee pain  ○ Participant fatigue  ○ Participant refused  ○ Equipment problems  ○ Other
20. Left knee flexion:
   *(Examiner Note: Toggle switch down for flexion.)*

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21. Did you have any knee pain during this test?
   ○ Yes  ○ No  ○ Don't know  ○ Refused

   a. Was it mild, moderate, or severe?
      ○ Mild  ○ Moderate  ○ Severe  ○ Don't know

   b. Did this pain prevent you from pulling as hard as you can?
      ○ Yes  ○ No  ○ Don't know

22. Was the participant able to complete the left knee flexion measurements?
   ○ Yes  ○ No

   a. Why not?
      *(Examiner Note: Mark all that apply.)*
      ○ Knee pain  ○ Participant fatigue  ○ Participant refused  ○ Equipment problems  ○ Other