21. MUSCLE STRENGTH

How does sustained activity affect muscle grip strength?

Objectives

- Compare muscle performance between the right and left hand.
- Examine the effect of fatigue on muscle strength.

Materials and Equipment

- Data collection system
- Pressure sensor with tubing, connectors, and syringe

Safety

Follow regular lab safety procedures.

Procedure

Part 1 – Grip Strength of Left Hand versus Right Hand

1. Select Sensor Data in SPARKvue.
2. Connect the pressure sensor to your device.
3. Make sure the Pressure measurement is checked and choose the Graph template.
4. Attach the tubing to the pressure sensor (do not attach the syringe yet).
5. Push the plunger on the syringe to 30 mL, then connect the syringe to the other end of the tubing as shown in Figure 1.

Note: Read syringe volume from the first plunger line inside the syringe.

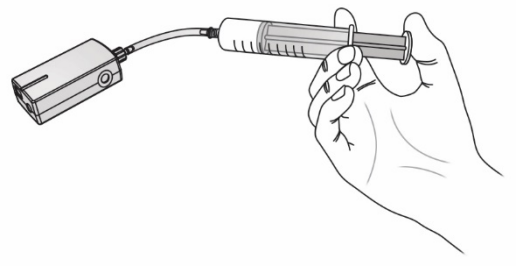

Figure 1: How to hold the syringe

6. Work in pairs. One partner will collect data and keep track of time while the other partner will be the *subject*, or the person whose data will be recorded. The subject will use their right hand to hold the syringe between the index and middle fingers with thumb on the plunger as shown in Figure 1. Partners will switch roles after the first subject has completed the procedure.
7. Select the live pressure reading located at the bottom-left corner below the graph. Choose Zero Sensor Now from the menu. The live pressure reading should now report 0.0 kPa.
8. Remind the subject to close their eyes or look away from the data while it is being collected. Select Start to begin collecting data. Have the subject compress the syringe as much as possible and sustain the compression for 10 seconds.
9. Stop collecting data. Identify the maximum pressure at the most stable part of the curve. Record the maximum sustained pressure in Table 1. Use the subject's data table and leave your table blank until it is your turn to be the subject.

10. Repeat Steps 7-9 with the subject's left hand, then allow the subject to rest their arms for at least one minute.

11. Repeat steps 7-10 for a total of three trials.

12. Calculate the subject's average maximum sustained pressure for each hand. Record the result in Table 1.

13. Disconnect the syringe from the tubing. Switch roles with your partner and repeat Steps 4-12.

Part 2 – Muscle Fatigue in the Strong Hand

1. Return to original roles. The subject will use their stronger hand as determined by results from Part 1. Disconnect the syringe from the tubing and repeat Steps 4-7.

2. Remind the subject to close their eyes or look away from the data while it is being collected. Select Start to begin collecting data. Have the subject compress the syringe as much as possible and sustain the compression for 60 seconds.

3. Stop collecting data. Allow the subject to rest their hand for 10-15 seconds.

4. Identify the maximum pressure at the most stable part of the curve. Record the maximum sustained pressure in Table 2. Use the subject's data table and leave your table blank until it is your turn to be the subject.

5. Repeat Steps 1-4 for a total of five trials.

6. Calculate the subject's average maximum sustained pressure. Record the result in Table 1.

7. Disconnect the syringe from the tubing. Switch roles with your partner and repeat Part 2.

Data Collection

Table 1: Maximum pressure during 10 seconds of sustained compression for the right and left hand

	Trial 1	Trial 2	Trial 3	Average
Right Hand Pressure (kPa)				
Left Hand Pressure (kPa)				

Table 2: Maximum pressure during one minute of sustained compression in the stronger hand

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average
Maximum Pressure (kPa)						
Average Pressure (kPa)						

Questions and Analysis

1. Is the grip strength in your right hand different from your left hand? Explain why you think there is (or is not) a difference.

2. What happens to your grip strength with time? Explain your answer.

3. Force equals pressure times area ($F = p \times A$). Assuming you applied pressure over the same size area for all trials, compare the maximum force exerted by your stronger hand in Part 1 with the maximum force exerted in Part 2. Support your answer with data and explain the results.

4. Do you think that frequently used muscles would tire faster or slower than muscles that are not used as much? Explain your answer.

5. What do you think will happen to your grip strength at the end of two weeks if you perform daily hand-strengthening exercises?