KIN 334 Functional Anatomy and Kinesiology

Lab #1. Electromyography and Applied Anatomy of the Upper Extremity


Introduction

The purpose of this laboratory period is to enhance the student's understanding of various aspects of the upper extremity musculature. Both simple palpation and electromyography (EMG) will be used to assess activity in various muscle groups during simple exercises and movements involving the upper extremity.

Procedures

At least four different experiments will be performed. They are outlined below. Study questions follow respective sections throughout this write-up. You should write up the answers to each question in the space provided, but do not turn in your answers. Instead, be prepared to answer questions about this lab on an upcoming quiz and/or exam.

1. Grip strength as a function of wrist joint position (assessed through palpation). Each student should squeeze the index finger of another student's hand while moving the wrist slowly from extreme hyperextension to full flexion. Notice the strength of the grip varies considerably through the range of wrist motion.

   1a. Why does this happen?

   1b. Which wrist position produces the strongest grip?

Now have a partner observe and palpate both the extrinsic finger flexors and wrist extensors while you grip your own index finger. (Be sure to take turns doing this to each other.) Notice both the extrinsic finger flexors and wrist extensors are active during a tight grip.

   1c. Why are both sets of muscles active?

   1d. What would happen if the wrist extensors were not active?

   1e. Do you expect the extrinsic finger extensors also to be active (in addition to the wrist extensors)? Why or why not?
2. **The role of elbow extensors in elbow flexion.** In groups of three, one person (the subject) should attempt to flex his/her elbow with a partner providing resistance. The third person should palpate the subject’s triceps. The partner should suddenly release the resistance. One should be able to feel a sudden activation of the triceps shortly after the release of the resistance. This same phenomenon can be demonstrated using EMG. The lab assistant will be prepared with a pair of surface EMG electrodes over the biceps and another pair over the triceps. The same procedure (resisting elbow flexion followed by a sudden release of that resistance) will be used while the electrical activity of the two muscles is monitored on an oscilloscope. One can now see a sudden burst of activity in the triceps as the resistance is released.

2a. Why does this sudden triceps activity occur?

2b. What type of muscle action (concentric, isometric, eccentric) is occurring in the triceps? Explain.

3. **The role of the biceps and triceps in supination.** In groups of three again, one person (the subject) holds his/her arm relaxed while shaking hands with a partner. The third person palpates the subject’s biceps and triceps. With the partner providing resistance, the subject should attempt to supinate his/her forearm. One should notice both the biceps and triceps activating suddenly. This same phenomenon will be confirmed using EMG.

3a. Why are the biceps active?

3b. Why are the triceps active?

4. **Effect of pronation and supination on elbow flexion strength.** Each student should palpate his/her own biceps while isometrically “making a muscle,” first with the forearm supinated, and then pronated.

4a. What happens to the “size” and “tightness” of the muscle as the forearm goes from supination to pronation?

4b. What happens to the biceps tendon and its insertion point as the forearm pronates?

4c. What does this do to the length of the biceps?
Next the lab assistant performs one hand curls with a dumbbell, first with the forearm supinated (regular curl), then pronated (reverse curl). Biceps EMG will be monitored on the computer screen.

4d. How does the biceps EMG during reverse curls (pronated) compare with that during regular curls (supinated)? Why does this happen?

4e. What implications does this all have on the ability to perform curls and pull-ups using “overhand” (pronated) vs. “underhand” (supinated) hand positions? What implication does this have on selective strengthening of different elbow flexor muscles? Explain.

5. Additional muscles or movements analyzed (time permitting).

Notes: