EMG during Wrist Flexion and Extension on the Flexor Carpi Radialis and the Extensor Carpi Radialis Longus

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אפקה
המכללה האקדמית להנדסה בתל אביב

INTRODUCTION

- The flexor carpi radialis and extensor carpi radialis longus are crucial forearm muscles for wrist and hand motion.
- They facilitate flexion, extension, and stability during grasping exercises.
- Understanding their roles is essential for managing musculoskeletal disorders affecting the wrist.
- EMG measures muscle activity during dynamic motions.
- It provides insights into the diagnosis and treatment, of disorders such as arthritis.

OBJECTIVES

- To examine changes in muscle activity with added weights using EMG for the flexor carpi radialis and extensor carpi radialis longus during wrist flexion and extension.
- Compare the EMG of persons with arthritis to healthy people one the muscles flexor carpi radialis and extensor carpi radialis longus.

METHOD

Experimental System And Protocol

For both hands, the initial stage is to perform 5 flexion and extension cycles of the wrist without weight, maintaining each position for two seconds, before holding the hand bent until exhausted.
The second phase involves repeating the first process with a 1kg weight.
The third phase involves repeating the first process with a 3kg weight. Overall, the protocol monitors wrist strength and endurance under various weight conditions in both dominant and nondominant arms. (Figure 2 + Figure 3)

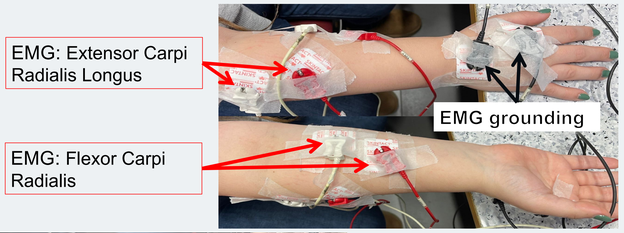

Figure 1

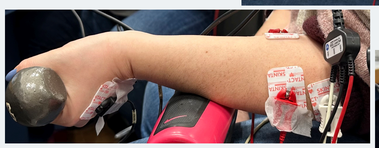

Figure 2

Figure 3

Data Analysis

- The raw EMG signals were segmented for both muscles. (Figure 4A & 4B)
- The mean value for each flexion and extension cycle were calculated from the integrated EMG in both muscles.
- The absolute values of the EMG signals were calculated to ensure positive values for analysis.
- A Butterworth low-pass filter with a cutoff frequency of 5 Hz was applied on both dominant and non dominant hand to remove noise from the signals. (Figure 4E & 4F)

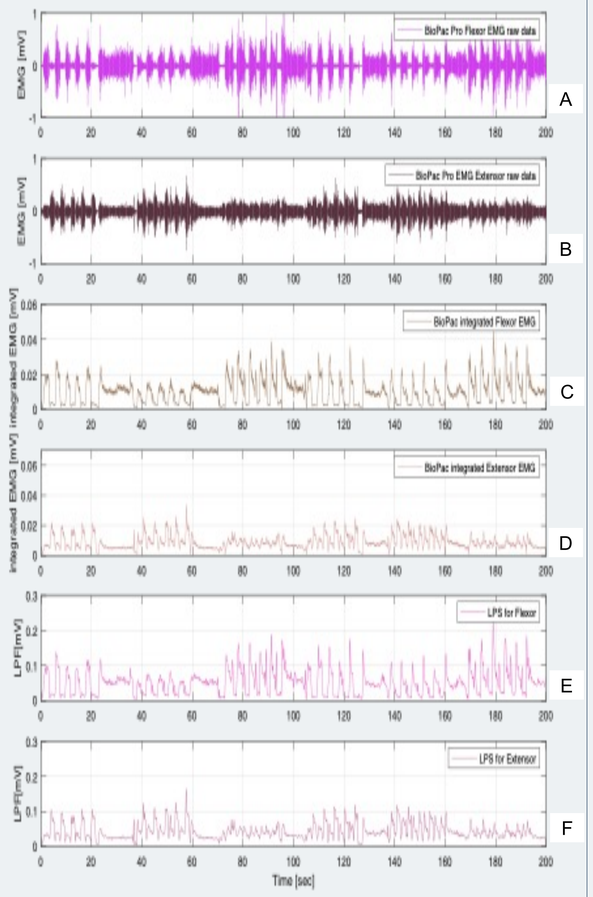

Figure 4

RESULTS

- We can observe from Figure 5 that the dominant muscle in the flexion position was the flexor, which worked the hardest at 3 kg, particularly in Adi's case (0.037 mV).
- Figure 5 shows that in the extension position, the primary muscle in Noam's (0.023 mV) and Ronny's (0.016 mV) case was the extensor, which worked the hardest at 1 kg, even though in Adi's (0.003 mV) instance, this muscle worked the least.

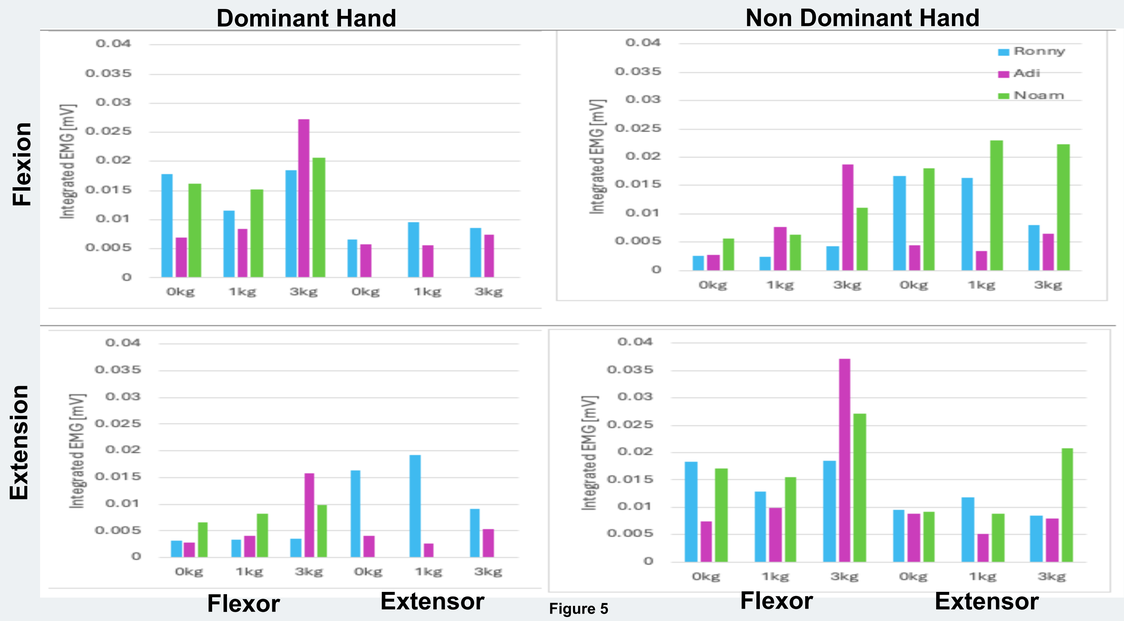

Figure 5

CONCLUSION & DISCUSSION

- The experiment demonstrated that wrist flexor muscles increased activity with larger weights, whereas extensor muscles behaved differently, probably due to individual capacities and limitations.
- Muscle activation differed between dominant and non-dominant hands, with the non dominant hand displaying higher activity levels and faster fatigue, signaling potential changes in muscle efficiency or endurance towards the dominant hand.
- The subject with arthritis (Adi) had unique muscular activation patterns from the other participants. Adi's flexor muscles were more active, most likely compensating for arthritis-related wrist movement limitations, but the extensor muscles were less active, particularly during extension activities.
- The extensor carpi radialis longus muscle has emerged as a stabilizing muscle required for optimal movement performance, particularly during wrist extension exercises. Its continual activation and assistance help to keep wrist motions stable and under control.