Laboratory Exercise 4

Title: Why do the erector spinae muscles switch off during trunk flexion?

Objective: During simple trunk flexion and extension movements the hip extensor and trunk extensor muscles are intimately involved. Nonetheless, as was shown in the paper by Kippers and Parker, there is a period when the erector spinae muscles switch off while trunk flexion or extension continues. The purpose of this lab is to collect some EMG data from the erector spinae and hamstrings muscle and explore this phenomenon.

Protocol: While Kippers and Parker took discreet photographs, we will film the subject as they first flex the trunk as far as possible in a smooth controlled fashion and then return to the erect position in a similar time. EMG data were sampled at as was done in the first three labs. Simultaneous recordings of the markers placed as per Kippers and Parker will be digitized. The sampled kinematic data will be used to compute trunk angle, vertebral column angle, and hip angle. These data will be synchronized with the EMG data. EMG data will be collected from the erector spinae muscle on the left side at the position of the third lumbar vertebra. Also, EMG data will be recorded from the lateral hamstring on the left side. These data will be sampled at 600 Hz.

The subject or participant will be requested to perform two maneuvers. First, the subject will be asked to begin from the upright position and flex until full trunk flexion. A brief pause will be followed by extension of the trunk at the same rate as the flexion movement. This movement should take about 12 seconds.

Analysis: The data are contained in the Excel file lab_4.xls that you can download from the website. The marker data were digitized and then used to compute the three angles outlined by Kippers and Parker, the trunk angle, the vertebral column angle, and the pelvic or hip angle. The EMG data from the two muscles will be overlayed so that the movements and the muscle recruitment can be seen simultaneously.

Data Analysis: Examine the EMG data. Do the muscle exhibit a period of time when they are not active and yet there are changes in the joint angles?

Discussion hints:

1. Did the subjects perform the flexion and extension movement at a constant angular velocity?
2. Explain in detail a mechanism that would control these muscle groups.
3. What possible biomechanical reason could explain the switching off of these muscles?

Suggested Reading

