

Development the Sensor Lock Knee Joint and Evaluation of Its Effect on Walking and Energy Consumption in Subjects With Quadriceps Weakness

Authors : Mokhtar Arazpour

Abstract : Objectives: Recently a new kind of stance control knee joint has been developed called the 'sensor lock.' This study aimed to develop and evaluate 'sensor lock', which could potentially solve the problems of walking parameters and gait symmetry in subjects with quadriceps weakness. Methods: Nine subjects with quadriceps weakness were enrolled in this study. A custom-made knee ankle foot orthosis (KAFO) with the same set of components was constructed for each participant. Testing began after orthotic gait training was completed with each of the KAFOs and subjects demonstrated that they could safely walk with crutches. Subjects rested 30 minutes between each trial. The 10 meters walking test is used to assess walking speed in meters/second (m/s). The total time taken to ambulate 6 meters (m) is recorded to the nearest hundredth of a second. 6 m is then divided by the total time (in seconds) taken to ambulate and recorded in m/s. The 6 Minutes Walking Test was used to assess walking endurance in this study. Participants walked around the perimeter of a set circuit for a total of six minutes. To evaluate Physiological cost index (PCI), the subjects were asked to walk using each type of KAFOs along a pre-determined 40 m rectangular walkway at their comfortable self-selected speed. A stopwatch was used to calculate the speed of walking by measuring the time between starting and stopping time and the distance walked. Results: The use of a KAFO fitted with the "sensor lock" knee joint resulted in improvements to walking speed, distance walked and physiological cost index when compared with the knee joint in lock mode. Conclusions: This study demonstrated that the use of a KAFO with the "sensor lock" knee joint could provide significant benefits for subjects with a quadriceps weakness when compared to a KAFO with the knee joint in lock mode.

Keywords : stance control knee joint, knee ankle foot orthosis, quadriceps weakness, walking, energy consumption

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