What would be the best performance of paraplegic subjects during walking with a RGO orthosis?

Mohammad Taghi Karimi [1], William Spence [2]and Alexander Nicol [3]
[1] PhD student of Bioengineering Unit, Strathclyde University UK.
[2] Lecturer of Bioengineering Unit, Strathclyde University UK.
[3] Professor of Bioengineering Unit, Strathclyde University UK

Introduction

Different types of orthoses have been designed to enable Spinal Cord Injury (SCI) subjects to walk however the functional performance is not high. The main questions posed here are; How much can an orthosis increase the functional performance of paraplegics during walking? And how much room is there for improvement of the orthosis?

Method

The functional performance of three able bodied subjects were gathered in this research. The logic behind this was to establish a benchmark from which the 'best' possible performance hoped to be achieved by a SCI patient could be gauged; by determining the 'best' achievable performance of an able bodied individual whilst wearing the orthosis. The performance of the participants was assessed by measuring the stability of the users in quiet standing, gait parameters and energy consumption during walking with the orthosis using various hip joint configurations.

Results

The walking speed and cadence of the participants were nearly one third and one half, respectively during walking with the orthosis in contrast to those walking normally. The inter-segmental moments around hip joint decreased significantly especially the extension moment. The results of the energy consumption tests showed that it increased between two and three times of that during normal walking. Inserting some degrees of abduction in the hip joint improved energy saving during walking with orthosis.

The amount of stability during standing with orthosis was significantly better than that with normal standing. Restriction hip joint range of motion and allocating some degrees of abduction increased standing stability. Figures 1, 2, 3 and 4 show the hip joint flexion extension excursion and moments during normal walking and in walking with orthosis.

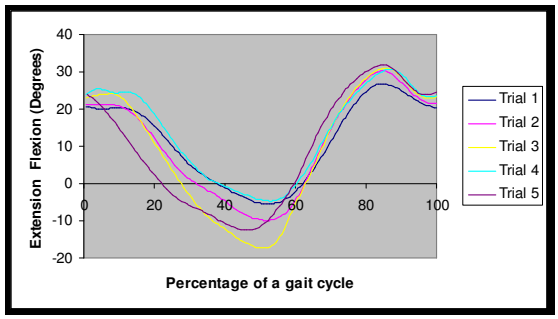

Figure 1: Hip joint flexion extension angle during normal walking

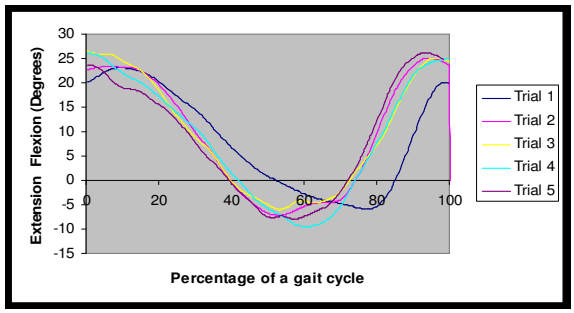

Figure 2: Hip joint flexion extension angle during walking with orthosis

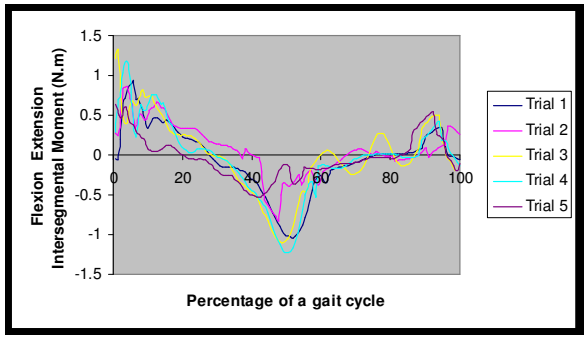

Figure 3: Hip joint flexion extension moment during normal walking

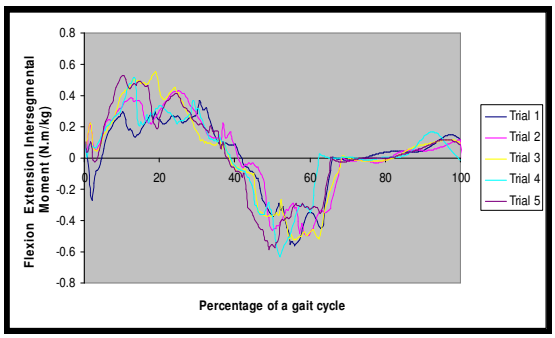

Figure 4: Hip joint flexion extension moment during walking with orthosis

Conclusion

Allocating some degrees of abduction (5 degrees) in the hip joint of the orthosis improved the walking performance and energy saving in walking with orthosis; however it did not influence the mediolateral stability as expected. The amount of the force applied on the crutch could be decreased by using an abduction angle in the hip joints.

The results of this research highlighted the best walking performance that a SCI subject could hope to achieve in walking with this type of orthosis. Inserting an abduction angle and using a special hip joint, which allows users to have a different hip joint range of motion according to their need, could increase the efficiency of the orthosis.

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