

Biomechanical Effects Of using a New Low Cost Assistive Device for Home Exercise of the Lower Limbs

INTRODUCTION

Currently physiotherapists/health professionals use a sliding board and rolls of tubigrip (made into a “nest” or “donut” to house the heel) for exercise treatments for patients that have lower limb rehabilitation needs. The Ortho-Glide lower limb exerciser is a self-treatment device and the first of its type which aims to provide a more effective method of home rehabilitation after lower limb trauma or surgery.

This study investigated different exercise conditions in a randomise order: These were:

- a) Tubigrip bandage donut on a lino surface, b) a sock on a lino surface, c) Ortho-Glide on a lino surface, d) Ortho-Glide on carpet tiles (Figure 1). Such exercises may be conducted in a number of postural positions, these include sitting in a chair, long sitting, and lying supine (Figure 2 a, b, c).



Figure 1: Tubigrip bandage donut and Ortho-Glide

Aim

This aim of this study was to investigate the different methods of exercising the lower limbs in a home environment. This work focuses on the knee flexion extension control and the frictional forces under the different exercise conditions.

METHOD

Objectives

- To investigate the effect of the different conditions on the range of motion and control of knee flexion/extension the knee joint.
- To investigate the effect of the different conditions on the frictional force between the condition and the floor.
- To investigate the effect of the different postural positions on the range of motion and control of knee flexion/extension.
- To investigate the effect of the different postural positions on the frictional force between the condition and the floor.

Background to Biomechanical Testing

No testing on the biomechanics of knee flexion extension exercises with different home treatment rehabilitation devices has been reported in the literature.

Biomechanical testing allows the range of motion of the knee, the control of the angular velocity of the knee and the frictional force present to be quantified during the different test conditions. All test conditions aim to produce a low friction force which is necessary in early rehabilitation.

RESULTS

A repeated measures ANOVA test with Pairwise comparisons was performed for each of the biomechanical parameters. This test examined both the differences in the postural positions and the different treatment methods.

Significant differences in the range of motion were found between the exercises in the three exercise positions (Figure 3).



Figure 2a Sitting

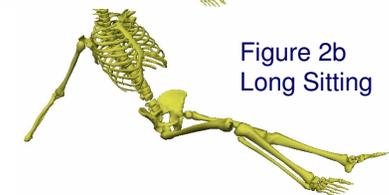


Figure 2b Long Sitting

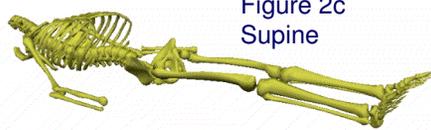


Figure 2c Supine

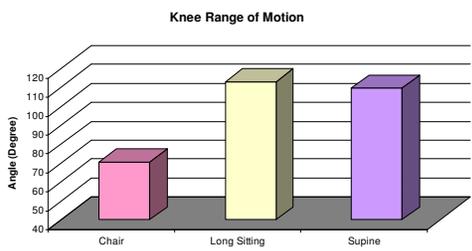


Figure 3

The Ortho-Glide under both lino and carpet conditions showed similar frictional values to the Tubigrip bandage donut in the long sitting and supine positions,

however in the seated position the Ortho-Glide under lino condition showed significantly lower frictional forces than the Tubigrip bandage donut (Figure 4).

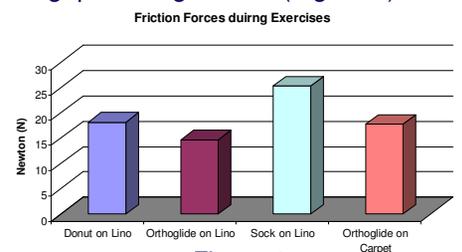


Figure 4

The use of the Ortho-Glide produced significantly lower angular velocities and a more controlled movement pattern during the exercises compared to the use of Tubigrip bandage donut and the sock on the lino surface (Figure 5).

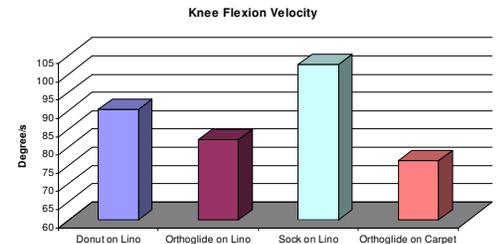


Figure 5

However the Ortho-Glide reduced the total range of motion of the knee during the exercises by between 6-9 degrees.

CONCLUSION

The Ortho-Glide produces a more controlled, lower friction exercise environment under different exercise positions, and offers similar control when used on different surfaces which traditional methods are unable to provide.