Research Report – Azzurro Training

OVERVIEW

Thank you for getting in contact with Birmingham City University and for using our services to conduct this research. We are pleased to confirm that we have carried out a robust single blinded randomised controlled trial using the A-Flex.

This report was completed on 31st October 2022

RESEARCH TITLE

The effect of a self-administered ankle joint mobilisation on dorsiflexion range of motion in healthy individuals.

BACKGROUND

Improving and maintaining ankle dorsiflexion range of motion (ROM) is important in athletes, as there is evidence to suggest that restricted dorsiflexion ROM may alter lower extremity landing mechanics, thus predisposing athletes to injury. Consequently, many recreational and professional athletes implement injury reduction strategies focused on increasing dorsiflexion ROM. Many of the self-administered techniques use elasticated stretch bands, although these are often cumbersome and ineffective, as the angle of pull on the ankle and anatomical accuracy cannot be maintained.

Azzurro is a private company that have developed a training tool, the A-Flex, designed to help facilitate self-administered ankle mobilisations to improve and maintain ankle ROM. Azzurro have contacted Birmingham City University to run a research study examining the effectiveness of their training tool, the A-Flex.

PROJECT AIMS

The aim of this study was to establish if there is an immediate effect on ankle dorsiflexion ROM following the self-administered ankle joint mobilisation, in comparison to standard lunges.

METHODS

Design

The study was a randomised controlled trial. The independent variables were intervention (A-Flex, weight bearing lunges) and the time interval (pre-test, post-test). The dependent variables were great toe distance from the box, and dorsiflexion angle during a Weight Bearing Lunge Test (WBLT).

Participants

A total of 32 physically active individuals were recruited from the student population. We provided a participant briefing that outlined the study. To meet the inclusion criteria, volunteers had to be aged 18 to 35 years and participate in exercise once per week. Exclusion criteria were an injury to the lower limb in the past 6 weeks; lower limb muscular pain; history of ankle surgery; prescribed orthotics; known asymmetry in foot type. One participant was withdrawn from the study as they reported a history of bilateral fractures to the ankle. A second participant

was withdrawn from the study post data collection, and before the unblinding of the interventions, due to measurement errors owing to the foot type. The remaining 30 individuals (age = 20 ± 2.9 years; height = 1.72 ± 0.07 m; mass = 67 ± 11.1 kg; UK shoe size = 7 ± 2) constitute the results in this report.

Protocol

Each of the three stations were overseen by a different researcher.

Station 1: Upon arrival at the laboratory, participants were screened for the inclusion and exclusion criteria, educated on the experimental procedures, gave written informed consent, and were assigned a participant number. Each participant number corresponded to the outcome of two randomisations: 1) the allocation of intervention to each ankle; 2) the order of which intervention would be performed first.

Date of birth, height, mass and UK shoe size were recorded. The mid-point of the anterior tibial border, between the tibial tuberosity and the anterior joint line of the ankle was marked on the skin with a pen, to allow easy location of the inclinometer.

Station 2: The WBLT was performed as seen in Figure 1. The starting setup was for the heel and great toe to be in alignment next to the tape measure, with the great toe at the 10cm starting position. The participant performed the test barefooted. Balance was maintained by allowing contact with the box using two fingers from each hand. The participant was instructed to move their knee to the box over the line of their second toe. The foot was progressed away from the box, until they were unable to touch the box with their knee without lifting the heel from the ground. Once the knee was not able to touch the box, the foot was progressed in smaller increments toward the box, until the knee had contact with the box with the heel in contact with the ground. At this point, the great toe distance from box was recorded, and an iPhone with inclinometer app was placed at the point on the anterior tibial previously marked, and the angle recorded from the vertical. This was repeated twice and an average calculated.

Station 3: participants performed each intervention in a randomised order. Control leg intervention: 2 sets of 10 repetitions of an active lunge aimed at improving ankle mobility – movement similar to the WBLT position. Experimental leg intervention: 2 sets 10 repetitions of the same lunge, performed wearing the A-Flex training device. Participants were instructed to take each lunge "*as far as possible but stopping short of any pain*". The rest period for each set was the duration it took to perform the intervention on the contralateral leg (e.g., control, intervention, control, intervention)—approximately 30-40 seconds. The interventions were performed in socks, to both aid comfort of the A Flex, and to minimise indentations on the foot—this ensured the researcher at station 2 remained blinded to the interventions. Following the interventions, the participants was retested at station 2. The time from the completion of the interventions to performing the repeat objective measures was a mean of 27 ± 8.9 seconds.

Figure 1: WBLT with measurement of dorsiflexion shown.

Statistical Analysis

The average of the two recordings was first calculated and then the change scores between pre and post intervention were used for statistical analysis. Given the data was normally distributed (Shapiro-Wilk, $p>0.05$), a paired samples *t*-test was performed on the change scores for each intervention. The alpha level was set at 0.05. We also calculated standardised effect sizes (Hedges' *g* thresholds: small = 0.2, medium = 0.5, large = 0.8).

RESULTS

The results suggest that there is no significant difference between the interventions ($p=0.062$) when the WBLT was used to measure the changes. The effect size shows a small effect (g = 0.4) of the intervention. See Table 1 and Figure 2.

There is a significant difference between the interventions ($p=0.010$) when the tibial angle was used to measure the changes. The effect size shows a medium effect (g = 0.5) of the intervention. See Table 2 and Figure 3.

Table 1: Great toe distance from box (cm) during a Weight Bearing Lunge Test.

Intervention	Pre Test Mean ± SD	Post Test Mean ± SD	Mean Difference Mean ± SD	*p*-value
Control	12.8 ± 3.9	13.7 ± 3.8	0.9 ± 0.9	0.062
A-Flex	12.8 ± 3.7	14.0 ± 3.9	1.2 ± 1.0	

Table 2: Dorsiflexion angle (°) during a Weight Bearing Lunge Test.

Intervention	Pre Test Mean ± SD	Post Test Mean ± SD	Mean Difference Mean ± SD	*p*-value
Control	46.7 ± 7.8	48.1 ± 8.2	1.5 ± 1.9	0.010*
A-Flex	46.3 ± 7.6	48.9 ± 8.7	2.5 ± 2.4	

*Denotes a significant difference with the alpha level set a <0.05

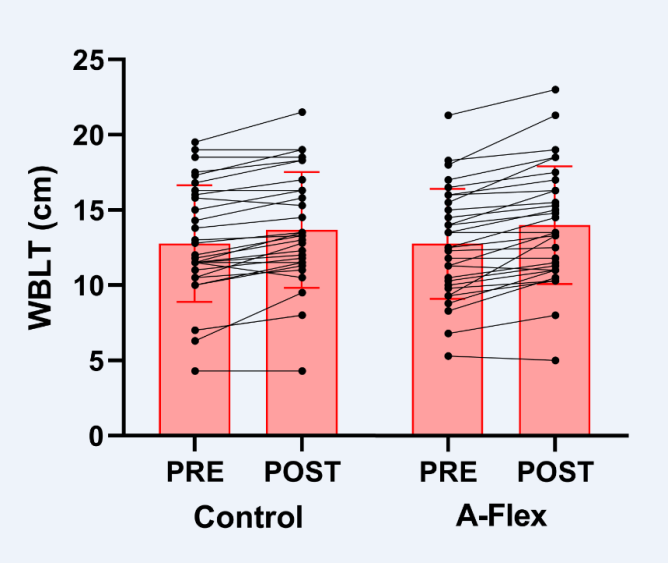

Figure 2: Great toe distance from box (cm) during a Weight Bearing Lunge Test. Individual scores alongside Mean and Standard Deviations.

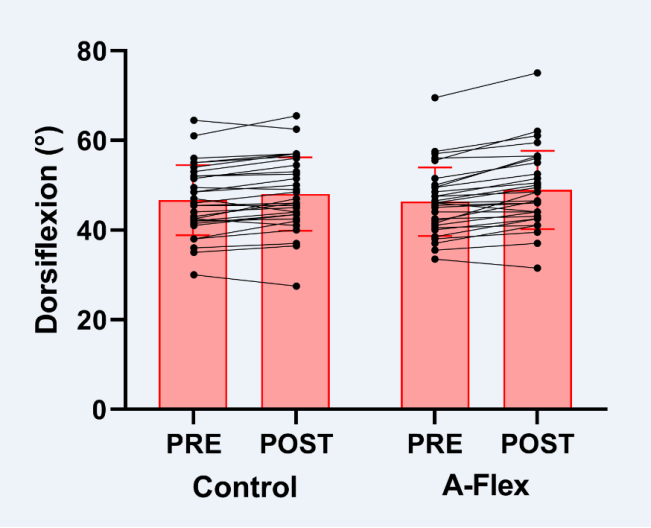

Figure 3: Dorsiflexion angle (°) during a Weight Bearing Lunge Test. Individual scores alongside Mean and Standard Deviations.