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Effect of MobEx Model Intervention Program on Post Lateral Ankle Sprain Functional Outcomes among Athletes

*[1]Mohansundar Sankaravel
[2]Lee Ai Choo
[3]Gunathevan Elumalai

ABSTRACT

Background: Lateral Ankle Sprain (LAS) is one of the common sports-related soft tissue injuries that occur mainly in weight-bearing positions with plantar flexion and inversion mechanism and affects the athlete's functional ability's at ankle joint. Thus this study was aimed to find out the effects of MobEx intervention on functional ability among athletes.

Methods: A total of 27 athletes with unilateral LAS were recruited for this study. The athletes were grouped by randomization into three groups. The experimental group (n=9) underwent MobEx intervention for six weeks, the placebo group (n=9) underwent placebo intervention for six weeks, and the Control group (n=9) with no interventions. The functional ability was measured by Foot and Ankle Ability Measures (FAAM) questionnaire for daily living, and sports subscale activities were assessed before the intervention, six weeks after intervention, and one month after the intervention.

Results: The results revealed a significant difference in athletes' functional ability with a p-value of 0.000 (< 0.05).

Conclusion: MobEx intervention was effective in improving the functional ability both in activities of daily living and sports subscale among athletes.

Keywords: Lateral Ankle Sprain, MobEx, FAAM, Functional ability.

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[2]Faculty of Sports Science and Coaching
Sultan Idris Education University (UPSI), Tanjung Malim, 35900, Malaysia.
[3]Faculty of Sports Science and Coaching
Sultan Idris Education University (UPSI), Tanjung Malim, 35900, Malaysia.

CORRESPONDING AUTHOR

*[1]Mohansundar Sankaravel

Faculty of Sports Science and Coaching
Sultan Idris Education University (UPSI),
Tanjung Malim, 35900, Malaysia.
Email: mohan@fsskj.upsi.edu.my

INTRODUCTION

Lateral Ankle Sprains (LAS) are the second leading sports-related soft tissue injuries [1], and the amount of LAS reinjury is significant [2]. LAS can occur during sports, running on uneven surfaces and landing on uneven surfaces, and landing on unbalanced foot after jumping. When the athletes were happened to land on with plantar flexion and inversion position, these LAS occurs [3]. LAS usually resulted in pain, swelling, and limitations in dorsiflexion range of motion and alterations in proprioceptive ability. Besides, individuals with LAS repeatedly exhibited dysfunctions at both proximal and distal tibiofibular joints [4-6], talocrural joints [7], or subtalar joints [8].

In most cases, patients with previous LAS history have also demonstrated inverter muscle group strength deficits [9]. Researchers also found that insufficiency in ankle dorsiflexion range of motion both an acute stage of LAS and in sub-acute of LAS [10]. Following an initial LAS occurrence, within three years of period [11], an acute LAS's effects eventually lead to Mechanical Insufficiencies and Functional insufficiencies [12].

Pain reduction, improving range of motion, strength deficits, proprioception, and neuromuscular control are the existing conventional physiotherapy management for LAS. In recent days, manual therapy techniques were found beneficial in pain reduction [13], improving range of motion [4, 10, 14-17], and increasing posterior talar glide [10]. Effects of manual therapy on foot and ankle functions were mentioned in few studies. A study has demonstrated that thrust manipulations had more significant foot and ankle functions compared with ultrasound placebo therapy [17]. Though this study has reported positive foot and ankle function outcomes, the other studies did not report the same. The study was done and reported by Cosby et al. [13] that a single bout of anteroposterior talocrural joint mobilization might not directly affect ankle dorsiflexion range of motion, posterior talar translation, or self-reported foot and ankle function.

Conversely, a study done by Beazell et al. [4] reported that proximal or distal tibiofibular joint manipulation had some significant effects on ankle dorsiflexion range of motion but not on foot and ankle functions. These studies have merely investigated the effects of various types of manual therapy application procedures or comparing the different types of manual therapy techniques and other interventions only. However, the short-term and or long-term effects of manual therapy applications on foot and ankle functions are still inconclusive.

To improve proprioceptive deficits and ankle stability, proprioceptive balance training exercises were introduced and showed optimistic post-LAS population results [18-20]. Though the existing literature supports the use of an available range of motion exercises in post-LAS, according to Wester et al. [21], these proprioceptive balance exercises are more beneficial to enhance LAS management. Topical analyses have concluded that proprioceptive training exercises significantly improved the functional outcomes in post-LAS [22]. Few other systematic reviews expressed moderate indication towards the proprioceptive exercises in the functional outcomes and injury reductions [23, 24].

A clinical prediction rule was established and informed that the post-LAS individuals were more likely to be benefited from manual therapy and exercises [25]. However, according to a topical systematic review, there is limited evidence for manual therapy plus exercise to improve outcomes [26]. Thus, Cleland et al. (2103) carried out a study to compare manual therapy and exercise to a home program to manage individuals with an inversion ankle sprain [27]. They utilized a set of manual therapy procedures, including high and low velocity forces on proximal tibiofibular joint and distal tibiofibular joints. They also performed high and low velocity forces on talocrural articulations in their manual therapy procedures and exercises. They have concluded that a combination of manual therapy plus exercises was superior to the exercises alone [27] in terms of pain and functions of foot and ankle among general populations. Though they have reported positive outcomes among general populations by using various sets of manual therapy procedures plus exercises, the effects of manual therapy application plus proprioceptive exercises on athletic populations still need to be explored, especially on foot and ankle functions. As this LAS occurs commonly occurs during sporting activities in a weight-bearing position of ankle joint articulations, this study hypothesized that the manual therapy procedures applied in weight-bearing position and proprioceptive exercises might have positive foot ankle functional outcomes among athletes.

Mobilization with Movement (MWM) is a manual therapy procedure developed and introduced by Brain Mulligan [28]. MWM can be applied in weight-bearing positions to the ankle joint to reduce pain perception and improve the ankle dorsiflexion range of motion by introducing glide to the talus in an anteroposterior direction active ankle dorsiflexion range of motion movement [14, 29]. Many positive findings were reported by various researchers towards the short-term effects of MWM application in LAS on pain reduction, improving ankle dorsiflexion range of motion, and foot and ankle functions [10, 14, 30, 31]. However, scanty evidence is presented in the literature about combining the MWM and proprioceptive exercises on functional outcomes. Thus, the presented study aimed to determine the effects of mobilization with movement plus proprioceptive balance exercise (MobEx) on the functional ability of the foot and ankle among athletes.

METHODOLOGY

This single-blinded control study included both male and female university athletes (n=27) from non-combat sports as study subjects. The athletes with a previous history of unilateral LAS were recruited as subjects. The subjects with bilateral LAS, any surgeries to lower extremities, any other injuries to the lower extremities, and subjects who had received any manual therapy procedures or other interventions recently before the study period were not included in this study. The volunteered subjects involved in this study were recruited by poster advertisement within the university sporting community. Before commencing this study, approval was obtained from the Institutional Review Committee. Helsinki's ethical principles were strictly followed during this study. The study subjects were randomized and assigned into one of the experimental group (EG), placebo group (PG), and control group (CG). The MobEx effects were tested before the intervention (Pre-Test), immediately after six weeks of the intervention (Post-Test 1), and one month after a post-intervention test (Post-Test 2). This study was carried out in the Sports Rehabilitation Laboratory at the Faculty of Sports Science and Coaching, Sultan Idris Education University, Tanjung Malim, Malaysia.

The subjects were asked to sign the informed consent form before the study procedures were initiated. All of the study subjects were provided with their medical history and underwent a screening process in standard physical therapy examinations by an experienced physiotherapist. The included study subjects were asked to complete the self-reported Foot and Ankle Ability Measures (FAAM) questionnaires before the MobEx and placebo interventions. Foot and Ankle Ability Measures for daily living activities (FAAM-ADL) and Foot and Ankle Ability Measures for Sports subscale (FAAM-Sports) were measured as primary outcomes for this study. FAAM questionnaire is a valid and reliable client-centered self-reporting questionnaire with two components [32]. One component is evaluating the subjects' foot and ankle functions during daily living activities, and the other component is evaluating the functions during sporting activities. This is a 5-point Likert scale questionnaire ranging from 4 (no difficulty) to 0 (unable to do the activity). There is a provision for the subjects to blot N/A if they are not fit in any of the listed activities and not considered for the scoring. The number of responded questions was only considered for scoring and multiplied by four to get the highest possible scores. The highest possible score for the FAAM-ADL is 84. To obtain the percentage of the scores for FAAM-ADL, the highest recorded scores were divided by the highest possible scores and multiplied by 100. The highest percentile scores indicate the highest level of functions. The highest possible score for FAAM-Sports is 28. To calculate the percentage of the scores for FAAM-Sports, the same method was used as in FAAM-ADL.

Together with the demographic data, the percentile scores for FAAM-ADL and FAAM-Sports were calculated and recorded before the interventions as Pre-Test scores. The subjects in EG (n=9) were received MobEx intervention for six weeks. The MobEx intervention was a set of interventions that consisted of mobilization with movement and proprioceptive balance exercises. Later to baseline Pre-Test procedures, the subjects were initially received mobilization with movement for the talocrural articulations in standing position. The therapist involved in the application of interventions was blinded and not involved in the randomization process. The subjects were asked to stand on his or her treated lower extremity on a treatment table. The therapist held the subject's mortise region of the treated ankle and applied the mobilizing force over the talocrural articulations. While applying the mobilization force, the subjects were instructed to move the other lower extremity front and back as walking. These procedures were performed in a pain-free environment. Initially, this procedure was started with eight repetitions of three sets and progressed to 15 repetitions of three sets at the end of six weeks. After this, the subjects were received proprioceptive balance exercises for six weeks focused on strength, stability, and agility with progressive difficulty levels. This type of exercise was initially started with easier tasks and proceeded to harder tasks during the six-week course. The subjects in PG (n=9) were received placebo interventions. Placebo interventions have mimicked the mobilization with movement procedure, where subjects received the same treatment except the mobilizing force. After this, the PG subjects were received the same set of proprioceptive balance exercises as in EG for six weeks. The subjects in CG (n=9) were received none of those mentioned above interventions. Before and after the interventions, all the subjects were performed warming-up and cooling down exercises respectively. After six weeks of interventions, the EG subjects, PG, and CG were asked to fill up the FAAM-ADL and FAAM-SS questionnaires again. The sores were calculated and recorded as Post-Test 1 score. After one month of Post-Test 1, these subjects were asked again to fill up the FAAM questionnaires once again, and the calculated scores were recorded as Post-Test 2 scores.

RESULTS

Repeated measures of MANOVA were used to test the statistical significance by using SPSS version 23 (SPSS Inc., Chicago, IL). To test the significant differences across the groups, a post-hoc analysis using THSD were also performed. A priori alpha level for significance was set to $p < .05$. The mean age of the EG were 23.22±0.83, PG were 23.11±1.36 and CG were 22.44±1.13. The FAAM for both FAAM-ADL and FAAM-Sports outcome measures are

Table 1: Foot and Ankle Ability Measures for Activities of Daily living and Sports Subscale

	EG			PG			CG			P value
	Pre-Test	Post-Test 1	Post-Test 2	Pre-Test	Post-Test 1	Post-Test 2	Pre-Test	Post-Test 1	Post-Test 2	
FAAM-ADL	84.12± 4.53	98.72±1.60	97.47±1.93	84.26± 4.83	89.19±5.00	86.60±4.59	83.20±4.67	83.46± 3.88	80.69± 6.06	0.00*
FAAM-Sports	79.86± 7.01	98.61±2.27	97.25±2.44	80.21±5.84	83.70±5.81	80.92±5.73	79.62±7.89	78.51± 6.29	76.05±4.69	0.00**

Note: EG = Experimental Group; PG = Placebo Group; CG = Control Group
FAAM-ADL = Foot and Ankle Ability Measures for Activities of Daily Living
FAAM-Sports = Foot and Ankle Ability Measures for Sports Subscale

displayed in the following Table 1.

The Post-Test 1 analysis showed there were significant differences among the outcome measures for FAAM-ADL, $F (2, 24) = 37.58$, $p < 0.05$ and FAAM-Sports, $F (2, 24) = 37.49$, $p < 0.05$. Since there were significant differences between the groups in terms of post-intervention effect over outcome measures, post-hoc analyses were also performed by using THSD procedure. This post-hoc analysis showed significant differences between EG, PG, and CG. Apart from these results, a significant difference was observed between PG and CG on FAAM-ADL ($p = 0.011$).

The Post-Test 2 analysis also indicated that there were significant differences among the foot and ankle functions outcome measures as following; for FAAM-ADL $F (2, 24) = 31.81$, $p < 0.05$, for FAAM-Sports $F (2, 24) = 54.79$, $p < 0.05$. As there were significant differences between the groups, the post-hoc analysis was also performed. The post-hoc analysis for Post-Test 2 also showed the same results as like Post-Test 1. In this post-hoc analysis, significant differences were found between PG and CG on FAAM-ADL ($p = 0.032$). This is probably because of placebo interventions' positive effect (Proprioceptive Balance Exercises) on the subjects in PG. Nevertheless, the EG has demonstrated improvement in FAAM-ADL and FAAM-Sports in Post-Test 1 and Post-Test 2 compared to the Pre-Test over the subjects. Thus, this result demonstrates the positive impact of the MobEx intervention carried out on subjects in EG.

DISCUSSION

The present study results on effects of MobEx intervention have demonstrated positive effects among athletes with post LAS both after six weeks and even after one month in the functional outcomes equally in activities of daily living and sports-related activities. Though the athletes in the placebo group were exhibited improvements in the FAAM-ADL, the results of the athletes in EG had superior effects together in FAAM-ADL and FAAM-SS. In contrast, a study reported no significant differences between the groups [33]. The positive result of the current study, probably because of the inclusion of the mobilization with movement, is the fundamental reason for not being the same findings between the studies. The present study's result further supports the recommendations from a systematic review done by the researchers [26] that the manual therapy plus exercises effectively reduce pain and foot and ankle functions in the short term. The present study did not aim to find out the effects of MobEx intervention on pain; however, the foot and ankle's functional ability has improved not only after six weeks of intervention but also after one-month follow-ups. This is possibly because of mobilization with movement plus proprioceptive balance exercises in the present study.

Besides that, the present study further supports the study done by Cleland et al. [27] that the functions of the ankle were significantly improved in the MTEX group, where they have applied different types of manual therapy procedures. Although the researchers have reported the home-based exercise program also significantly improved the foot and ankle functions, the MTEX group was superior to the home-based exercise program group over general populations. They have gained those results because of the different types of manual therapy applications based on different articulations in an inversion ankle sprain. However, the current study concentrated mobilization with movements only on the talocrural articulations in weight-bearing positions. This is because it was hypothesized that the nature of the occurrences of LAS its weight-bearing nature. Thus, this study's positive results are attributed to the presence of mobilization with movement in a weight-bearing position. To enhance the effects of mobilization with movement, the present study has included proprioceptive balance exercises. The results have proven their meaning by exhibiting the same foot and ankle functions pattern even after one month.

On the other hand, in this current study, the athletes in placebo group were also shown improvements in daily living activities compared to athletes in the experimental group. This is due to the presence of proprioceptive balance exercises. These proprioceptive exercises have proven their positive effects on functional outcomes in various studies [22-24]. Nevertheless, the improvement of foot and ankle functions in daily living activities and sports-specific activities among athletes in EG is possibly because of the manifestation of the talar glide in talocrural articulations. The mobilization force achieved this talar glide during the application of mobilization with movement. This is perchance explaining the role of arthrokinematic movements during complex activities. Additionally, it's attributable to the plausible neurophysiological nature of manual therapy effects [34. 35]. The application of mobilization with movement might have some stimulating effects on mechanoreceptors around the talocrural articulations and assist in neural feedback mechanisms used to help stabilize the ankle during complex activities and enhanced with the proprioceptive balance exercises. Thus, the athletes could demonstrate improvements in both activities of daily living and sports-specific activities. Though this study had positive effects on the ankle's functional ability, the interventions were limited to talocrural articulations and among athletic populations. Further studies may be carried out over different articulations in weight-bearing positions with various populations together with athletic populations.

CONCLUSION

In this single-blinded control study, the six weeks of MobEx intervention effectively improved the functional ability of the ankle of the university athletes. This suggests that the mobilization with movement in weight-bearing position plus proprioceptive balance exercises can be a part of the management approach for post-LAS athletes to improve the ankle's functional ability.

Conflicts of Interest: There was no conflict of interest to conduct this study.

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