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RESEARCH ARTICLE

EFFECT OF FRICTION MASSAGE VERSUS BALANCE EXERCISE ON PAIN SEVERITY, RANGE OF MOTION, SINGLE LEG BALANCE TEST AND MUSCLE STRENGTH TEST IN ANKLE SPRAIN GRADE II

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ABSTRACT

Ankle sprains injury or articulatiotalocruralisinjury are the most common musculoskeletal injuries seen by health care providers. The most common mechanism for ankle sprain is excessive inversion and planter flexion of the reafoot on the tibia. Sports rehabilitation is an important part of treating such cases. A rehabilitation program aims to return the injured body part to normal function. **Objective**: Subject Effect of Friction Massage Versus Balance Exercise on Pain severity, Range Of Motion, Single Leg Balance Test And Muscle Strength Test In Ankle Sprain Grade II. **Subjects:** Thirty young male athletes with ankle sprain grade II were selected. **Methods:** Patients were divided randomly into 3 groups: the first group(A) consisted of 10 patients received friction massage, the second group (B)consisted of 10 patients received balance exercise and the third group (C)consisted of 10 patients is a control group they treated with Aircast Sport Stirrup. The massage group received 15 minutes friction and effleurage massages on their affected ankles 3 times per week for 8 weeks. The second group received balance exercise 3 times per week for 8 weeks. Patients were assessed before and after treatment: ankle range of motion testing (ROM), pain severity (visual analogue scale), single leg balance test and muscle strength test.. **Results**: There was a significant differences found between the three groups (A&B&C) in ankle pain and ankle ROM in favor of group A&B. There was a significant differences between group A and group B in muscle strength and leg balance test. In favor of group A. **Conclusion:** Balance training and friction massage are an effective training method for rehabilitation of ankle sprain grade II.

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INTRODUCTION

Ankle ligament sprains are the only most typical sports injury, accounting for 19–23% of all sports injuries presenting to accident and emergency (A&E) departments. It's been calculable that (AN) articulatiotalocruralis injury (ankle sprain injury) happens daily per 10000 of the population concerning ninetieth are inversion injuries poignant the lateral ligament complex (Boyce, 2005). Lateral articulatiotalocruralis sprain injury is that the most typical system injury incurred by people World Health Organization participate in sports and recreational physical activities (Gribble, 2016; Gribble, 2016).

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Ankle sprains ordinarily seen in athletes collaborating in football, football, running and dance. Following initial injury, a high proportion of people develop long injury-associated symptoms and chronic articulatiotalocruralis instability. Lateral articulatiotalocruralis sprain injuries keep company with high social economic prices, associated with injury diagnosing, initial management, rehabilitation and reduced work productivity (Prado, 2001). Lateral articulatiotalocruralis sprain injuries have the very best re injury rate of all lower limb system injuries. People World Health Organization incur AN acute lateral articulatiotalocruralis sprain injury have a twofold increased risk of re injury within the year following their initial injury. Re injury coincides with the progression of variety of chronic injury-associated sequelae including: pain, persistent swelling, feelings of ankle instability, ankle joint 'giving-way', perennial injury and reduced useful capability as

illustrated by reduced scores on patient-reported outcome measures questionnaires (Verhagen, 2005; Gribble, 2014). These injury-associated sequelae represent the characteristic options of chronic articulatiotalocruralis instability. High re-injury rates may well be thanks to inadequate rehabilitation, and/or premature come to sport. Hence, reducing the danger of re injury and also the propensity for the event of chronic articulatiotalocruralis instability may be a key priority when acute lateral articulatiotalocruralis (Verhagen et al., 2005; Gribble 2014; Gribble, 2014). About ninety fifth of articulatiotalocruralis sprains involve the lateral articulatiotalocruralis ligaments. The foremost common mechanism for lateral articulatiotalocruralis sprain may be a combination of inversion, planter flexion and medial rotation. The contused ligaments area unit set on the lateral side of the articulatiotalocruralis and embody the anterior talofibular, the posterior talofibular and therefore the calcaneofibular. Whereas in planter flexion, the articulatiotalocruralis mortise is in a very less stable, loose-packed position. This is often thanks to the talar dome being wider anteriorly.

Grade II: may be a partial tear of the anterior talofibular ligament (ATFL) incomplete tear of a ligament, with moderate practical impairment(Fig 1).Symptoms could embody a broader region of tenderness over the lateral side of the articulatiotalocruralis, a painful limp (if ready to walk, patient has pain with weight-bearing and ambulation)moderate pain and swelling, and bruising and localized swelling thanks to tearing of the anterior joint capsule, ATFL, and encompassing soft tissue structures. There is also some loss of perform and loss of strength and proprioception (Gribble 2014; Park et al., 1997). Lower limb injuries, like articulatiotalocruralissprains, area unit believed to have an effect on balance capabilities.as a result of injury cause harm of mechanoreceptors and partial alterations in muscle spindle sensitivity (Arnold, 2009). A rehabilitation program as well as balance exercise aims to come the contused part to traditional perform step by step and facilitate speed up the heal in method. Exercises facilitate improve the articulatiotalocruralis vary of motion. Exercise medical care is commonly associate degree integral element of treatment administered (Postle, 2012). Balance coaching which means any educational program directed to boost bodily property stability (Kummel, 2016).

With balance coaching, muscle activity levels of articulatiotalocruralisstabilising muscles area unit maximally stirred and this cause normalized fasciculus control (Arnold, 2009). Balance exercises wont to improve bodily property management and accelerates the healing method by restoring and strengthening the ligaments, muscles and reflexes that defend the ankle (Karlsson, 1993).Taube et al found that balance coaching occur all told sensory systems that improve bodily property management (Taube, 2008). The balance coaching consisted of balance exercises on each stable and unstable surface, with or while not repeated destabilization throughout performance (Hubscher et al., 2010). Manual therapy techniques are applied to joints, ligaments, tendons, muscles and skin to improve physical structures (Suzanne et al., 2011). Some experts in rehabilitation believe that massage is very benefit for the body prior to participating in training and physical activities. More especially massage is used as pre-exercise activities to improve performance, reduce the risk of exercise and muscle damage and to sport rehabilitation programs. Massage has been defined as mechanical manipulation of body tissues with rhythmical pressure and stroking aiming to improve health (16). Friction massage is a penetrating pressure applied via fingertips to promote circulation of the blood and lymph, relaxation of muscles, relief from pain, restoration of metabolic balance, and sundry other benefits both physical and mental(9).Physical therapists in different parts of the world use therapeutic massage in clinical settings to facilitate relaxation and to treat pain, increase muscle compliance and range of joint movement, decrease stiffness, diminish anxiety, and improve mood state. It has been suggested that the benefits of massage may help healthy people to enhance their dynamic balance (Pornratshane, 2005; Zafar et al., 2015). Friction massage is very good method to increase blood flow to muscles which improve the delivery of oxygen, increase muscles temperature, increase buffer blood pH which aid in performance of exercise, reduce local muscle spasms and loosen adherent fibrous tissues so it is appropriate to rehabilitation program(15,16).Also, use of massage can reduce tissue adhesion and to improve muscle flexibility, which can help to improve injury and remove risk factors (Kaplan et al., 2014; Drust, 2003).

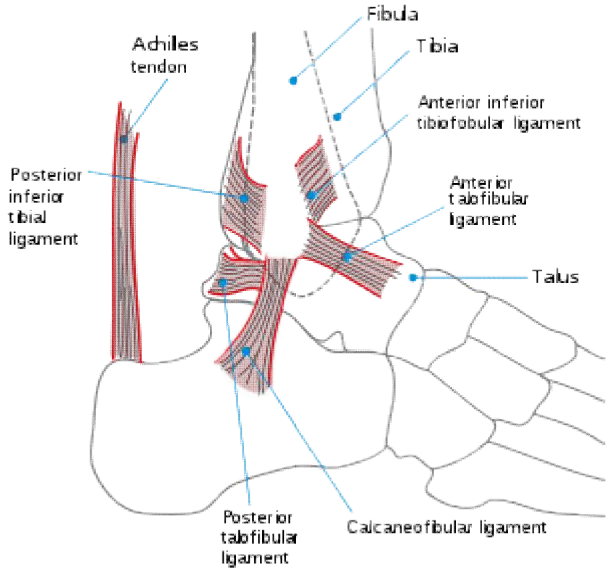

Figure 1. Anterior talo-fibular ligament

Fig. 2. Range of Motion (ROM) for ankle

Study design: This study was conducted in orthopedic physical therapy outpatient clinic, Faculty of medicine, Cairo University, Egypt. Thirty young athletes with ankle sprain grade II were selected. Their age ranged from 18-35 years.

Methods: Patients were divided randomly into 3 groups: the first group consisted of 10 patients received friction massage, the second group consisted of 10 patients received balance exercise and the third group consisted of 10 patients is a control group they treated with Aircast Sport Stirrup. Patients were assessed pre and post treatment.

Range of Motion Assessment: Ankle range of motion testing has done by using goniometer. The first test is evalution of the range of motion (ROM) test. Patients should dodorsiflexion, plantarflexion, inversion and eversion and assess the ROM with goniometric and recordthe results (Fig 2).

Pain Severity Assessment via (visual analogue scale): articulatiotalocruralis pain severity were assessed individually by visual analogue scale (VAS) that could be a valid and reliable tool for measuring pain intensity as reportable by Bush et al. (1992) and brandy (2001).This scale is pictured by a horizontal line, one hundred metric linear unit long, anchored by word descriptors at every finish. The patient was educated to position a mark on it line to point out the severity of pain that he felt. The VAS score decided by mensuration in millimeters from the correct hand finish of the road to the purpose that the patient marks (Bush et al., 1992; Marc, 2001).

Single Leg Balance Assessment: Procedure: The bare-footed, wakeful patient stand on one foot along with his /her arms crossed for up to ten seconds while not external support. The contralateral leg ought to be bent at the knee and not allowed to the touch the weight-bearing leg. The test is considered positive if the patient fails to keep up his balance or states a way of balance loss throughout the take Time started once the foot cames off the ground and concluded when: The patient gots three trials with eyes opened and three trials with eyes closed. We gave five minutes rest between sets.

Age (yrs)	Eyes open (sec)	Eyes closed (sec)
18-39	43.3 (5.1)	9.4 (9.4)

The SLBT has excellent interrater reliability (24)

Muscle Strength Test: that performed utilizing the thera-band and accounts the quantity of repeats in every direction to assess articulatiotalocruralis strength. This test has performed with all the movements of articulatiotalocruralis included: flexion, region flexion, inversion and eversion. Patients were asked to sit down on the ground with straight leg, fordorsiflexion, anchored the band to the wall or chair and wrapped it round the foot. Patient pull his toes toward and slowly come back to the beginning position and repeat. For planter flexion, wrap the band round the patient foot and he hold the tip in his hands. Then the patient was asked to push toes gently and come back to begin position. For inversion and eversion, hooked up band to secure object and finish to animal foot. Pull foot inward and outward and slowly come back and repeat.

Treatment Protocol: The friction massage group (A) received 15 minutes friction and effleurage massages on their affected ankles 3 times per week for 8 weeks. In groupA applied effleurage massage for warm up and then used friction massage across the injured ligaments. The balance exercise group Breceived balance exercise 3 times per week for 8 weeks. Balance activities progress from double-limbed stance to single-limb stance as well as from a firm surface to progressively more unstable surfaces.

These exercises can be progressed by changing arm position, closing the eyes and adding an unstable surface under foot. Patients also, asked to throw and catch weighted balls, perform single leg squats, and perform single limb balance and reaching exercises.

RESULTS

Data were analyzed using the SPSS (version 21.0) statistical analysis program. The paired t-test was used to test the significance of changes following the intervention with each group; the independent t-test was used to test the significance of differences between the three groups. Significance was accepted for values of $p<0.05$. A total of 30 male patients participated in this study, there were divided into three groups :group A which consisted of 10 patients with a mean age of20 ± 0.45 years, mean height of 168.35 ± 4.01 cm, mean weight of 65± 1.71 kg). Group B which consisted of 10 patients with a mean age of21.45 ± 0.39 years, mean height of 166.80± 1.14 cm, mean weight of 65.2± 1.44 kg).Group C which consisted of 10 patients with a mean age of19.78 ± 1.22 years, mean height of 166.08 ± 0.93 cm, mean weight of 63.4± 1.22 kg). Using unpaired t-test showed that were no significant differences between groups before treatment for these demographic data (Table 1).

Effect of Treatment One Leg Standing Test (OLST) (Leg Balance Test): A paired-samples t-test was conducted to compare between 3 groups in 8weeks rehabilitation program. The results of the OLST were investigated for any differences before and after treatment, and for any differences between groups. Group A, showed statistically significant differences in the OLST values before (5.55 ± 1.2 sec) and after (8.01 ± 1.1 sec) the friction massage intervention when supporting the body on the right leg ($p<0.01$). There were statistically significant differences in the OLST values before (4.49 ± 1.0sec) and after (6.25± 1.2 sec) on the left leg. Group B, showed statistically significant differences on both sides ($p<0.01$) before (6.24 ± 1.7 sec) and after (7.88 ± 1.9 sec) the balance exercise group when supporting the body on the right leg ($p<0.01$). There were statistically significant differences in the OLST values before (6.24 ± 1.6sec) and after (8.20± 1.3 sec) on the left leg. Group C, showed statistically no significant differences in the OLST values before (6.24 ± 1.7 sec) and after (6.11 ± 1.9 sec) the control group when supporting the body on the right leg. There were statistically no significant differences in the OLST values before (5.11 ± 1.0sec) and after (5.22± 0.9 sec) on the left leg.

Effect of Treatment Therapy on ankle strength: A paired amplest-test was conducted to compare between group A, group B and control group C in 8 weeks rehabilitation program. There was a significant difference in the results of strength in group A(M=10.01, SD=0. 775)and group C (M=6.58, SD=0.664) conditions; $t(11)= 10.655$, $p = 0.000$.There was a significant difference in the results of strength in group B(M=9.68, SD=0. 566)and group C (M=7.47, SD=0.65) conditions; $t(11)= 9.688$, $p = 0.000$. Hence, based on this finding, there was no significant differences between group A and group B. So, there is significant effect of friction massage and balance exercise onimproves strength in ankle sprain grade II than group C control group.

Table 1. Demographic data of patients

Variable	Group A	Group B	Group C	t-value	P-value
Age (year)	20+-(0.45)	21.45-+(0.39)	19.78(1.22)	0.12	0.69(NS)
Weight(kg)	65+-(1.71)	65.2+(-1.44)	63.4+-(1.22)	0.03	0.98(NS)
Height(cm)	168.35+-(4.01)	166.80+-(1.14)	166.08+-(0.93)	0.6	0.61(NS)
NS: Non significant					

Table 2. One Leg Standing Test(OLST)

	Group A	Group B	Group C
Supported leg	Friction massage	Balance exercise	Control group
Rt Pre	5.55 ± 1.2	6.24 ± 1.7	6.24 ± 1.7
Rt Post	8.01 ± 1.1**	7.88 ± 1.9**	6.11 ± 1.9
Lt Pre	4.49 ± 1.0	6.24 ± 1.6	5.11 ± 1.0
Lt Post	6.25 ± 1.2**	8.20 ± 1.3**	5.22 ± 0.9

Table 3. Comparison between groups pre treatment and post treatment

Variable	Group	Group	Group	t-value	P-value
Ankle Pain	A	B	C		
Pre	7.06(-+0.14)	7.17(-+0.16)	7.01(-+0.18)	0.52	0.60(NS)
Post	3.77(+-0.11)	3.08(+-0.31)	4.01(+-0.20)	2.17	0.03(Sig)

NS= Non significant-Sig= Significant

Fig. 3. Comparison between groups before treatment at pain level

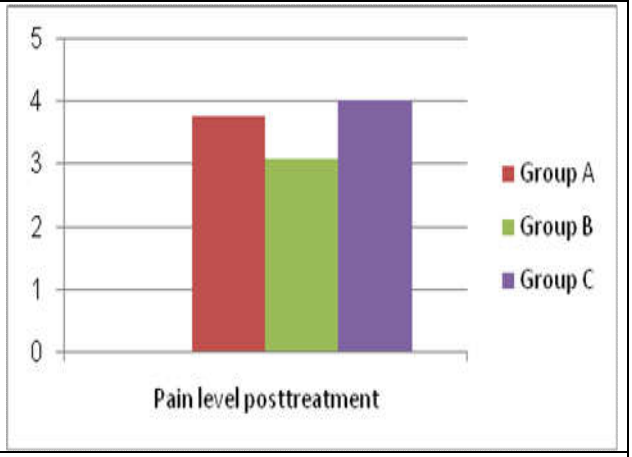

Fig. 4. Comparison between groups posttreatment at pain level

Effect of Treatment Therapy on Ankle Pain: Unpaired t-test was used to detect differences between groups before treatment. There were no significant differences between groups regarding ankle pain (t=052, p=0.60).There was a significant differences in reducing ankle pain (t=2.17, p=0.03) in three groups (Table 3 & Fig 3&4)

Effect of Treatment Therapy on Ankle Range of Motion (ROM): A paired-samples t-test was conducted to compare between three group in 8weeks rehabilitation program. In dorsiflexion: There was a significant difference in the results in group A (M=26.52, SD=0.295) and control group(C)(M=19.87, SD=0. 176) conditions; t (11)=74.561,p = 0.000. And there was a significant difference in the results in group B (M=25.66, SD=0.286) and control group (C) (M=19.66, SD=0.166).

In planter flexion: Also result indicated that there is a significant difference in the results in group A (M=41.501, SD=0.357) and control group(C) (M=36.950, SD=0.143) conditions; t (11)= 35.13, p = 0.000.And there was a significant difference in the results in group B (M=41.61, SD=0.28) and control group (C) (M=36.43, SD=0.142).

In inversion: There is a significant difference in the results in group A(M=17.1833, SD=0.79411) and control group(C) (M=13.6333, SD=0.29644) conditions; t (11)=14.708, p = 0.000.There is a significant difference in the results in group B (M=16.88, SD=0.78) and control group(C) (M=13.11, SD=0.25) conditions; t (11)=13.58, p = 0.000. Moreover the results in eversion: shows that there is a significant difference in group A (M=14.4500,SD=0.23) and control group (C) (M=11.36,SD=0.50) conditions; t (11)= 16.50, p = 0.000.There is a significant difference in the results in group B (M=15.33, SD=0.40) and control group(C) (M=12.11, SD=0.24) conditions; t (11)=16.43, p = 0.000.Hence, based on this finding, there was a significant effect of friction massage (A) and balance exercise (B)on improves ROM in ankle sprain grade II than control group(C).

DISCUSSION

Instability of ankle joint sprain grade II could be a quite common drawback that ends up in chronic physical limitations in sports performance. The useful instability is caused by insufficiencies in proprioception, neuromuscular control,

postural control, and strength. This study aims to research the result of friction massage and balance exercise in treatment ankle joint sprain grade II. Friction massage is believed to learn athletes by enhancing recovery, relaxation and performance. Friction massage is applied directly at the location of injury to mobilize muscle; separate adhesions in muscle, tendon, or scar tissue; and restore fibers to a additional normal alignment for freer movement.

It breaks up muscle adhesions and will increase native circulation by increasing blood flow to muscles and ligaments, in theory it facilitate in removing waste product after exercise and enhance delivery of protein and different nutrients required for muscle repair. Also, massage has direct relation with animal tissue and muscle relaxation, it helps muscle to be more stretched and increase range of motion. In our study we tend to found passive movement of articulatiotalocruralis by applying friction massage altogether directions together with dorsi flexion, planter flexion, inversion and eversion helps ankle joint muscles and ligaments to decrease pain and increase storage by continuous stretching. It's excellent result on the connective tissue and muscle flexibility. As friction massage rising muscle strength and ROM each have direct result after all, mechanical pressure from massage helps in removing adherent muscle spasm. Thus once pain decreased, ROM muscle strength increased stability and balance of articulatiotalocruralis improved. Balance training is otherwise to train dynamic balance for the sprained ankle joint.Therapeutic exercise for ankle sprain grade II includes balance training. Holme et al. (1999) initiated a balance and strength training program within the first week after an acute ankle sprain and found that reinjury rate after 1 year was significantly reduced compared to a control group. Balance training with a wobble board has also been shown to improve functional performance, improve postural control and decrease the risk of recurrence in those with chronic ankle instability (Holme, 1999). With balance training, muscle activity levels of ankle stabilizing muscles are maximally stimulated and this could lead to a normalised neuromuscular control. There is evidence of an improved postural control because of balance training, hence implying a curative and a preventive effect. Balance training could help prevent lateral ankle sprains (Wester, 1996) An explanation, as stated by Asthon-Miller et Al. (2001) could be a higher stimulation of muscle spindles caused by long-term balance training. This increased stimulation would improve neuromuscular control and thus a better functional ankle stability (Ashton-Miller, 2001).

Conclusion

The result of this research showed that there is a significant difference between friction massage and bracing and a significant difference between balance exercise and bracing in treatment of ankle sprain grade II. Friction massage and balance training are more effective in improving pain, ROM, muscle strength and leg balance of the sprained ankle grade II than the bracing. Balance training and friction technique are an effective training method for rehabilitation of ankle sprain grade II.

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