Post-Intensive Physical Therapy Program Functional Changes in Athletic Acute Ankle Sprain

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ABSTRACT

Objective: *To investigate the effectiveness of an early intensive supervised rehabilitation program combined with standard program versus a standard program alone to accelerate ankle functional recovery in the first 3 weeks post-acute mild/moderate ankle sprain.* ***Methods:*** *Forty eight Zagazig University top performance athletes with a mean age of 20.6±2.2 years old mean height 176.4±7.14 cm and mean body mass 74.18±10.17 kg, 36/M and 12/F with a solitary ankle sprain injury of 24 ±16.9 hours participated in this study. Participants were randomly divided into two groups.* ***Group1*** *(study group): Twenty four athletes received intensive physical therapy settings for 3 weeks, 5 times/week combined with a standard program.* ***Group 2*** *(control group): Twenty four athletes received only standard program (RICE) rest, ice, compression and elevation. All athletes were subjected for a followed up at baseline and 3 weeks (at the end of study).* ***Outcome Measures:*** *Patient's functional performance evaluated by a series of hop tests, girth measurement, VAS, and patient's subjective functional satisfaction.* ***Results:*** *There was a significant improvement in all variables during the 3 weeks follow-up assessments for the study group over the control group for all the functional outcomes assisted (P<0.01), and the subjective satisfaction which was maintained through out the study (P<0.01).* ***Conclusions:*** *Intensive physical therapy combined with a standard program is an effective intervention and superior to standard program alone for the functional performance and patient's subjective functional satisfaction at 3 week evaluation for athletes with acute mild/moderate ankle sprain.*

Key wards: *Intensive rehabilitation program, standard program, acute ankle sprain.*

INTRODUCTION

Acute ankle sprains are the single most common sports injuries constitute between 15 and 45% of all sports-related injuries and occur in sports with a high level of jumping and cutting activities, especially in ball sports[6,10,19,22,26,28]. Although such injuries are often regarded as being fairly innocuous, some care should be taken to assure an adequate management and to exclude severe lesions as it incurring a significant cost to both the individual and society, as it account for 75 % of ankle injuries that often lead to recurrent ankle sprain injury and functional ankle instability (FAI)[2,4,5,18]. Contributing factors to FAI are decreased range of motion (ROM), decreased strength of ankle evertors, and a decrease in joint proprioception[3].

However, many patients with ankle injuries do not seek medical attention[10]. Without adequate care, acute ankle trauma can result in chronic joint instability (feeling of giving way), pain during activity and persistent symptoms of weakness[18]. In addition to pain, the earliest symptoms are swelling and restricted dorsiflexion range of motion[26], and also trauma to sensory nerve fibers within the joint capsule which provide feedback from the joint mechanoreceptors to assist in stabilization of the ankle during locomotion[7].

The stability of the ankle is necessary for functional activity of lower extremity,

allowing walking and participation in other high demanding activities like running or jumping[19].

Use of a standardized protocol enhances the management of ankle sprains. In patients with grades I or II sprains, emphasis should be placed on accurate diagnosis, early use of RICE (rest, ice, compression and elevation) and use of an ankle support to minimize the posttraumatic edema and hematoma, maintenance of ROM[18].

Ankle dorsiflexion ROM during weight bearing is also commonly limited following ankle sprain, with consequent high impact on functional activities such as walking, and ascending and descending stairs[26], and resulted in an increase in ankle girth. Such post-traumatic edema may compound the extent of tissue damage, delaying healing, and can even result in some degree of chronic disability[5].

The overall goals of the present study were to investigate the effectiveness of intensive physical therapy programs for competitive athlete with acute mild/moderate ankle sprain in early and effective return to sport with no residual symptoms.

SUBJECTS AND METHOD

Subjects and Methods

A total of 48 Zagazig University top performance athletes recruited for the study with a mean age of 20.6±2.2 years, mean height 176.4±7.14 cm and mean body mass 74.2±6.3 kg. (36 male and 12 female) suffered from mild/moderate acute ankle sprains within the preceding 24 hours with tenderness and observable ankle edema. At the time of the ankle sprain, 22 of the patients were playing soccer, 11 basketball, 10 handball, and 5 volleyball. Twenty-six of the sprains were located in the right ankle. Of these, 23 patients were right-foot dominant. Twenty-two sprains were located in the left ankle. Of these, two patients were left-foot dominant. All subjects were referred from the outpatient department of orthopedic surgery Zagazig University Student Hospital. Subject recruitment began on September 1, 2005 till end of May 2006. To be eligible for inclusion in the study, subjects had to have sustained acute mild/moderate ankle sprain. Subjects testing positive on the anterior drawer test or talar tilt test, multiple injuries, were automatically excluded from the trial. The subjects were randomly assigned to either the study or control group; the study group N: 24 athletes received RICE program plus physical therapy program in the form of intermittent pneumatic compression (IPC) with strengthening and coordination exercise five times a week for a total of 15 sessions. The control group N: 24 athletes received only the standardized RICE program that begun on the day of injury. The two study groups were followed up at baseline and 3 weeks. All subjects were subjected to the following: single hop for distance, cross over hop, measuring swelling by the figure of eight method, VAS and patient's satisfaction.

Anti-inflammatory drugs were stopped during the study because this would probably influence the measurements of the edema. In most patients, the use of two properly fitted crutches was allowed during the initial, most painful period after injury. Standard advice regarding general mobilization exercises and weight bearing will also be given to both groups according to routine treatment program. All participants were advised to avoid activities straining the lateral ligaments of the ankle until daily activities were possible without any pain, and normal nonantalgic gait was advanced as tolerated. Informed consent to participate in the study was obtained from all participants.

Table (1): Demographic and baseline characteristics of all participants.

Variable	Study g N = 24		Control g N=24		P* Value
	Mean	SD	Mean	SD	
Age (years)	20.6	2.2	20.8	2.3	NS
Weight (kg)	74.2	6.2	73.9	6.3	NS
Height (cm)	176.4	7.6	175.9	8.4	NS
Sex M/F	18/6	-	18/6	-	NS
Mean duration of symptoms, h*	23.9	17.1	24.3	15.9	NS
R/L	13/11	-	13/11	-	NS
Dominant limb: R/L	22/2	-	21/3	-	NS

m*: month, R/L: right /left side,

Treatment protocols

Rehabilitation process for acute ankle sprain is divided into four phases according to Zöch et al. (2003)[28]: the duration of each phase depends on the individual healing process.

The initial phase:

Includes analgesic, antiphlogistic effects and swelling reduction. All subjects in both groups received an initial standard treatment; consist of early use of RICE for ankle pain and swelling. Mode of cryotherapy was standardized across groups with standard sized pack according to Bleakley et al. (2007)[5]. Clear plastic commercial ice bags (17 cm × 28 cm) filled with crushed ice and wrapped with a towel, placed over the lateral aspect of the ankle joint, covering an area from the Achilles tendon to the anterior tibialis muscle, with the approximate center of the pack overlying the anterior talofibular ligament (ATFL). To milk edema fluid away from the injured tissues, the ankle was wrapped with an elastic bandage started just proximal to the toes and extended above the level of maximal calf circumference. A piece of "U" shaped felt was applied around the lateral malleolus to increase hydrostatic pressure over the increased swelling area. Next, the injured extremity should be elevated 15 to 25 cm above the level of the heart to facilitate venous and lymphatic drainage until the swelling has begun to resolve.

Patients in the study groups received a course of IPC given once per day for five consecutive days.

Regardless of weight-bearing capacity, Achilles tendon stretching was instituted within 48 to 72 hours after the ankle injury to guard against the tendency of tissues to contract following trauma.

Early rehabilitation phase:

The early rehabilitation phase aims to restore normal ROM of the ankle joints using manual treatment and kinetotherapy (the combined use of cryotherapy and exercise). Gentle passive movement of the talocrural joint increases range of motion in the sagittal plane; self stretching of the ankle ligamentous system with a towel is useful to increase dorsiflexion. Careful attention was given to protect the ankle while the patient progressing through ROM. Weight-bearing was permitted as tolerated, when the patient is able to tolerate full weight bearing, the phase of late rehabilitation is reached.

Late rehabilitation phase:

Muscle-Strengthening Exercises: Once ROM is attained, and swelling and pain are controlled, the participants were progressed to the strengthening phase of rehabilitation, for rapid recovery and reducing reinjury rates. The aim of this phase was to restore strength, especially the peroneal muscles, endurance and neuromuscular performance through functional exercises. Strengthening begins

with isometric exercises performed against an immovable object in four directions of ankle movement. The patient then progressed to dynamic resistive exercises using elastic tubing (Functional PT Products, Heber City, UT), with an internal diameter of 7 mm, external diameter of 16 mm, a length of 185 cm, and a padded foot strap on each end. Toe raises, heel walks and toe walks may also be attempted to regain strength and coordination.

Resistive exercise was performed as described by Rosenbaum et al. (2001)[22] by attaching one end of the elastic tubing to the unaffected foot at the level of the malleoli, while the other end was fixed to a stable attachment. The subject stepped away from the tubing attachment site, stretching the tubing to obtain the desired resistance. The length-tension relationship of the cord was measured and different cord lengths corresponding to the different tensions were marked on the floor. The subjects were instructed to stand at the marked position to ensure that the exercise was performed at the proper tension. The length-tension relationship of the cord was verified each day. *Front Pull*: The subject faced away from the fixed attachment of the elastic tubing so that the tubing pulled the subject backward. Each subject stood on the affected foot with the unaffected foot positioned behind the affected foot with the hip and knee extended. While balancing on the affected foot, the subject flexed the unaffected hip and knee, pulling the tubing forward and then slowly returned to the starting position. *Back Pull*: The subject faced toward the fixed attachment of the elastic tubing. The subject stood on the affected foot, with the unaffected foot positioned ahead of the affected foot with the hip and knee flexed. While balancing on the affected foot, the subject extended the uninjured lower extremity at the hip and knee, pulling the tubing backward and then slowly returned to the starting position. *Crossover:* The subject stood perpendicular to the fixed attachment of the elastic tubing, so that the unaffected foot was closer to the fixed attachment, with the feet slightly wider than shoulder width apart. The subject stood on both lower extremities, with hip and knees flexed. While balancing on the affected foot, the subject adducted the hips by crossing the unaffected foot in front of the affected foot and then slowly returned to the starting position. *Reverse Crossover*: The subject stood perpendicular to the fixed attachment of the elastic tubing with the unaffected foot closer to the fixed attachment with the with hips and knees flexed, adducted and crossed in front of the affected foot. While balancing on the affected foot, the subject abducted the hip until the feet were slightly wider apart than shoulder width and then slowly returned to the starting position. Each exercise consisted of 3 sets of 15 repetitions; with 30-second rest between each exercise and a 2-minute rest between sets. Subjects started each exercise period with a 5- to 10-min warm-up program. The whole program was performed twice to exercise both feet in the same way.

Proprioceptive Training: As the patient achieves full weight-bearing without pain, proprioceptive training is initiated for the recovery of balance and postural control. The simplest device for proprioceptive training is the wobble board, a small discoid platform with a diameter of 350 mm attached to a 50 mm height hemispheric ball base. The particepants was instructed to stand on the wobble board (without shoes) on one foot and shift his or her weight, causing the edge of the wobble board to move in a continuous circular path, for approximately 10 min/session, 5 d/wk. Training can be

advanced by having the patient perform this maneuver at different heights and with closed eyes[15].

Functional phase:

Return to full sports activity-specific training: When the distance walked by the patient is no longer limited by pain, subjects in the study group progressed to a regimen of 50% walking and 50% jogging. Using the same criteria, jogging eventually progresses to running, backward running, circles, figures of 8 and pattern running. The aim of functional training is to preserve the musculature and coordination of the musculature around the ankle joint without stressing the ligaments beyond their limits. The final phase of the rehabilitation process is documentation that the athlete can perform sport-specific exercises pain free and at a level consistent with preinjury status[16].

Assessments Procedure

Figure of eight method for measuring swelling: The protocol used in the current study was based on that described by Mawdsley et al. (2000)[17]. Participants were positioned in long-sitting on a bed with the distal one third of their leg off the plinth and their ankle in a comfortable, plantarflexed position. The following standardized landmarks were marked with a pen prior to measurement: a) the point midway over the anterior ankle between the tibialis anterior tendon and lateral malleolus, b) the navicular tuberosity, c) the base of the 5th metatarsal, and d) the inferior tip of the medial malleolus. One surface of a double-sided retractable plastic tape measure was blackened leaving the zero point visible. The zero point was placed over the mark on the anterior aspect of the ankle and pulled the tape medially over the navicular tuberosity, and then infero-laterally across the medial arch to the proximal aspect of the base of the fifth metatarsal. The tape was then pulled superiorly and medially over the tarsal bones across the inferior aspect of the medial malleolus, and posterolaterally around the Achilles tendon over the distal lateral malleolus to finish at the zero point. The tape measure was tightened and then released tension slightly to ensure there was no indentation of soft tissue, then a clip was placed at the point of intersection between the zero and finish points of the tape. The tape was removed, turned over and the result was recorded to the nearest millimeter. Ankle swelling was quantified by comparing a subject's left and right ankle girth differences as an indication of the size of hematoma and edema. This procedure was performed 3 times for each subject by the same maneuver.

The single hop for distance and *crossover hop* for distance were performed as outlined by Andrea et al. (2007)[1] within the baseline to the 3^{ed} week following acute mild/moderate ankle sprain. In *the single hop for distance* subjects stood on the leg to be tested, hopped, and landed on the same limb. The distance hopped (measured at the level of the great toe) was measured and recorded to the nearest centimeter from a standard tape measure. It was performed 3 times and the best distance was recorded and used as the dependent score. *The crossover hop* for distance was performed over a 15-cm strip on the floor. The subjects hopped forward 3 times while alternately crossing over a marking. The total distance hopped forward was recorded.

A visual analogue scale (VAS) was used to measure pain at each testing session. A score of 0 indicated no discomfort and a score of 10 indicated severe discomfort[13].

The subjective patient functional satisfaction was evaluated as outlined by

James et al**.** (2001)[11], patients were also asked to give a score from 1 to 10 for the functioning of their affected ankles and for their satisfaction with the physical therapy program.

Statistical Methods

SPSS for Windows software was used for data management and statistical analysis. To compare the groups concerning demographic measurements, the paired t test was used in group analyses. For statistical analysis, data of each parameter were transformed to a 'percent of change' formula such as end results-baseline values/baseline×100.

RESULTS

There were no significant differences between the two groups at presentation in terms of age (mean 20.6 and 20.8 years respectively), sex, dominant leg, left or right ankle injured, previous injury, time to presentation (mean 23.9 and 24.3 hours respectively), difference in ankle girth (mean 2.2 and 2.3 cm respectively), and pain scores (mean 6.2 and 6.0 respectively) table (1, 2). None of the subjects complained during the testing and were therefore able to complete the entire set of tests.

The intensive rehabilitation program plus IPC resulted in highly significantly ($P<0.01$) faster rehabilitation during the three-week follow-up in all the parameters studded than did standard program alone.

The single hop test showed 61.7% improvement within the study group from 53.3±8.7cm at baseline to 86.2±6.7cm post treatment follow-up ($P<0.01$) corresponding to a 22.7% improvement at the control group from 52.8±9.1cm at baseline to 64.8±8.3cm post treatment ($P<0.01$) table (2). Comparing both groups for the post-treatment evaluation there was a statistically significant difference for the study group ($P<0.01$) table (3).

The cross over hop test showed 91.2% improvement within the study group from 97.5±17.6cm at baseline to 186.4±9.2cm post treatment follow-up ($P<0.01$) corresponding to a 62% improvement at the control group from 161.3±8.6cm at baseline to 99.6±19.8cm post treatment ($P<0.01$) table (2). Comparing both groups for the post-treatment evaluation there was a statistically significant difference for the study group ($P<0.01$) table (3).

The figure of eight measurement showed a statistically significant improvements for both study and control groups, ($P<0.01$), the study group showed 54.6% improvement from 2.20.2cm to 1.0±0.1cm and the control group showed 30.4% from 2.3±0.2 to 1.6±0.2cm respectively table (2). Comparing both groups for the post-treatment evaluation there was a statistically significant difference for the study group ($P<0.01$) table (3).

The VAS test showed 41.9.2% improvement within the study group from 6.2±2.3 at baseline to 3.6±1.6 post treatment follow-up ($P<0.01$) corresponding to a 20% improvement at the control group from 6±2.2 at baseline to 4.8±2.3 post treatment ($P<0.01$) table (2). Comparing both groups for the post-treatment evaluation there was a statistically significant difference for the study group ($P<0.01$) table (3).

Table (2): Comparison between the Pre-to-post program measurements for both groups.

Variables	Groups	Pre-program		Post-program		Changed %	P Value
		mean	±SD	mean	±SD		
Single Hop (cm)	*Study group*	53.3	8.7	86.2	6.7	61.7	p<0.01
	Control group	52.8	9.1	64.8	8.3	22.7	p<0.01
crossover hop for distance (cm)	*Study group*	97.5	17.6	186.4	9.2	91.2	p<0.01
	Control group	99.6	19.8	161.3	8.6	62	p<0.01
Figure of eight (cm)	*Study group*	2.2	0.2	1.0	0.1	54.5	p<0.01
	Control group	2.3	0.2	1.6	0.2	30.4	p<0.01
VAS	*Study group*	6.2	2.3	3.6	1.6	41.9	p<0.01
	Control group	6.0	2.2	4.8	2.3	20.0	p<0.01
Patients satisfaction	*Study group*	6.1	1.3	8.6	1.4	41.1	p<0.01
	Control group	6.2	1.2	7.4	1.6	19.4	p<0.01

** HS: Highly significant P<0. 01, * S: significant P<0.05, VAS: visual analogue scale,

Table (3): Comparison between both groups for the post program measurements.

Variables	Study group		Control group		P Value
	mean	±SD	mean	±SD	
Single Hop (cm)	86.2	6.7	64.8	8.3	p<0.01
crossover hop for distance (cm)	186.4	5.2	161.3	7.6	p<0.01
Figure of eight (cm)	53.7	3.8	55.2	4.1	p<0.01
VAS	3.6	1.6	4.8	2.3	p<0.01
Patients satisfaction	8.6	1.4	7.4	1.6	p<0.01

** HS: Highly significant P<0. 01, * S: significant P<0.05, VAS: visual analogue scale.

The patients functional satisfaction test showed 41.1% improvement within the study group from 6.1±1.3 at baseline to 8.6±1.4 post treatment follow-up (P<0.01) corresponding to a 19.4% improvement at the control group from 6.2±1.2 at baseline to 7.4±1.6 post treatment (P<0.01) table (2). Comparing both groups for the post-treatment evaluation there was a statistically significant difference for the study group (P<0.01) table (3).

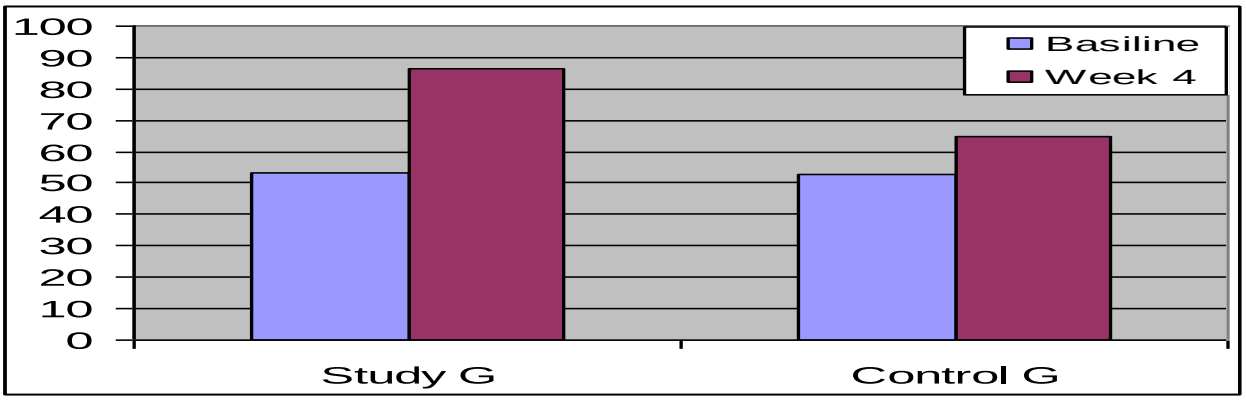

Fig. (1): Mean of single hop for both groups (cm).

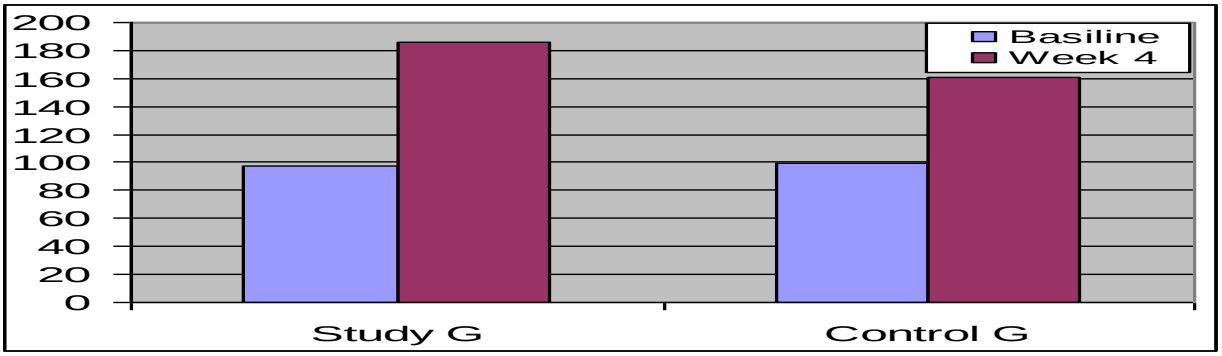

Fig. (2): Mean Crossover hop for both groups (cm).

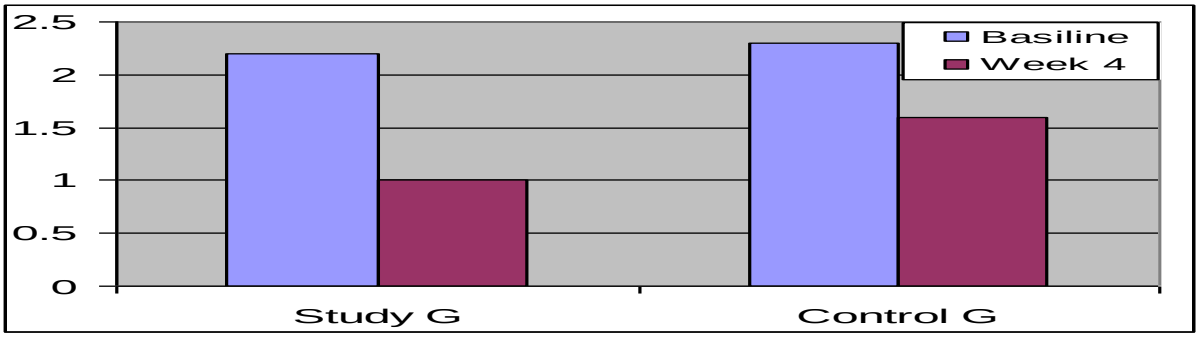

Fig. (3): Mean figure of eight for both groups (cm).

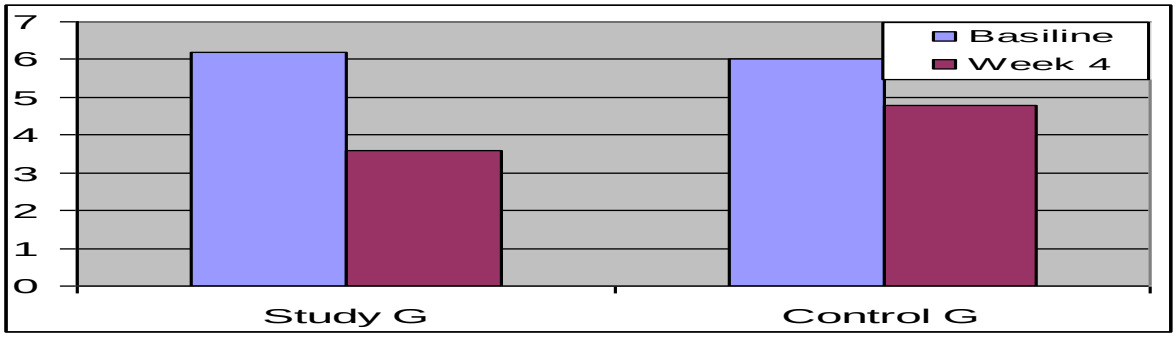

Fig. (4): Mean VAS for both groups.

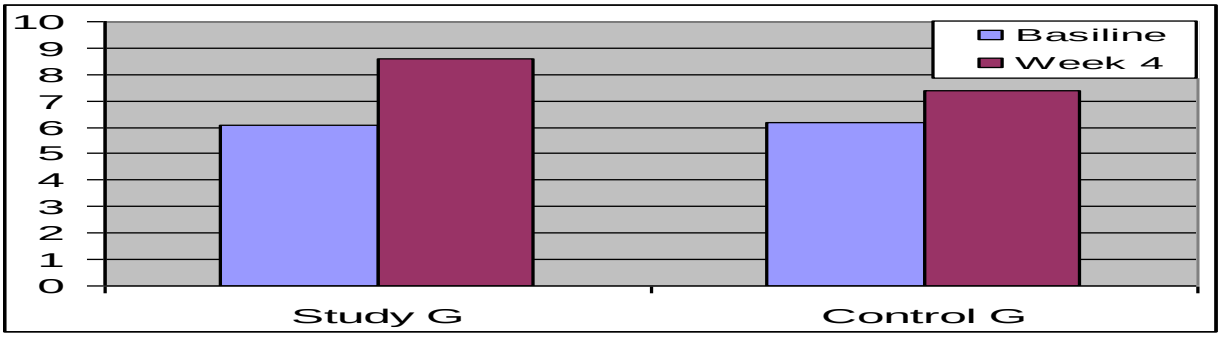

Fig. (5): Mean patients satisfaction for both groups.

DISCUSSION

The major findings of this study were that 3 weeks of early intensive physical therapy program which was designed to assist in reeducating the proprioceptive mechanism, minimize coordination and a balance problem, had a significant effect on the functional performance in athletes with acute mild/ moderate ankle sprain without side effects. On the contrary, it appears that this program achieved a good balance between rest and exercises because impressive functional gains were found in patients of study group without concomitant increases in pain, or loss of joint motion. Parallel to the program of the present study Hale et al. (2007)[8] demonsterated that a 4 weeks of comprehensive rehabilitation program improve the functional performance in individuals with chronic ankle instability. Consistence with our results Wilson et al. (1998)[27] demonstrated a significant improvement in single hop for distance, crossover hop and joint swelling in athletes with acute ankle sprain post only one week of rehabilitation program. Lee (2008)[15] demonstrated that 12 weeks of ankle disk training resulted in minimizing posttraumatic edema, improved bilateral postural control and reducing the number of recurrent distortions in soccer players with a history of partial ankle sprains. Bleakley et al. (2006)[4] study in the application of cryotherapy for acute ankle sprain revealed significant improvement overtime in pain, function and swelling.

The immediate and intensive rehabilitation program applied in the present study are supported by those of Mattacola et al. (2002)[16] who reported that functional rehabilitation should begin immediately with 4 aspects: ROM, strengthening, proprioception, and activity-specific training. Ankle joint stability is a prerequisite to the institution of functional rehabilitation, since grade I and grade II injuries are considered stable. They added also that if the rehabilitation process is effective and the athlete regains preinjury ROM, strength, proprioceptive function, motor control, and the risk of injury is reduced. If the rehabilitation process is not complete or a major component was not incorporated, there may be an increased risk of reinjury. Also Michael et al. (2001)[18] who reported that the importance of proper early functional rehabilitation after an ankle sprain, especially when the debilitating consequences of decreased ROM, persistent pain and swelling, and chronic joint instability are considered. After initial acute treatment, a rehabilitation regimen is pivotal in speeding return to activity and preventing chronic instability. Also in agreement Kannus et al. (2003)[12] who reported that early management in acute ankle injury is effective in promoting speedy recovery and limiting chronic symptoms. Also Boyce et al. (2005)[6] and Kerkoffs et al. (2001)[14] who demonstrated statistically significant differences for the following outcomes after early active mobilization rehabilitation program for ankle sprains are: more comfortable, reduced pain and swelling, improved healing, objective stability at follow-up, ROM, and subjective satisfaction which provide an earlier return to work than treatment with cast immobilization, which may have negative implications in relation to muscle wasting and stiffness. They added also that functional stress stimulates the incorporation of stronger replacement collagen, as it begins on the day of injury and continues until pain-free gait and activities are attained, enhanced collagen fiber growth and realignment and less soft tissue fibrosis, and therefore a decreased likelihood of pain.

The exercise program applied in the present study were supported by those of

Hertel (2008)[9] and Tropp (2002)[24] who recommended the use of balance and coordination training for individuals with a history of ankle sprains to improve neuromuscular performance and to reduce ankle injury rates. Moreover, the study of Mattacola et al. (2002)[16] and Bernier (1998)[3] reported that most ankle rehabilitation programs utilize a combination of strengthening exercises in conjunction with coordination exercises with an ankle disk or wobble board. They came to the conclusion that incorporating a variety of coordination, balance and strength training produces significant improvements not only in measures of strength but also in ankle joint proprioception. Verhagen et al. (2004)[25] reported a significant reduction in the ankle sprain risk for volleyball players with a history of ankle sprains when balance board training was used as a normal part of the daily warm-up. Ross et al. (2006)[23] suggested that during ankle disk coordination training, damaged afferent joint receptors are possibly reeducated while the muscles may be strengthened and reducing functional instabilities. Moreover, the study of Simoneau et al. (2001)[24] study with the 4 elastic resistance exercises training program revealed that it impose a postural control challenge that ankle, knee, and hip joints of the affected limb must effectively resist to maintain balance. They added also that there are many inherent advantages of elastic resistance exercises: ease of use, low cost, safe, effective weight-bearing progressive overload, highly versatile, easily adjusts the resistance in small increments to match the patient's progress by increasing or decreasing the stretch of the elastic tubing and it is effective in reducing the recurrence of ankle sprains.

The application of cryotherapy in the present study are in agreement with those of Bleakley et al. (2007)[5], Ivins (2006)[10], Bleakley et al. (2006) and Michael et al. (2001)[18] who defined cryotherapy as a common treatment modality employed in the management of acute soft tissue injuries especially after mild to moderate ankle sprain. They explained the physiological mechanism of cryotherapy as it thought to decrease oedema formation via induced vasoconstriction, reducing the degree of haemorrhage after injury, decreasing the permeability of local blood vessels, reducing tissue temperature to optimal therapeutic levels and reduce secondary hypoxic damage by lowering the metabolic demand of injured tissues, thereby minimizing the magnitude of the inflammatory response, significantly reduce the level of muscle spasm, subjective pain on activity and recovery time. This could facilitate earlier therapeutic exercise after injury, potentially allowing for a quicker return to activity. The addition of exercise and IPC therapy to the cryotherapy for the study group in the present study brought about better improvement in all the parameters studied than did the cryotherapy alone of the control group. This is going with the study of Michael et al. (2001)[18] who reported that while cold therapy is being used, exercises should be initiated to maintain ROM and assist lymphatic drainage. Bleakley et al. (2007)[5] added also that the addition of exercise to ice application in acute ankle sprain is more effective than ice application alone after various soft tissue injuries, and so facilitating earlier and more aggressive therapeutic exercise. Parallel to this results Ivins (2006)[10] study of compression (IPC) with cryotherapy for acute ankle sprains suggests that patients with focal compression recover function earlier through reducing chronic posttraumatic edema and in relieving pain.

The figure-of-eight measurement applied in the present study to assess ankle edema are going with studies of Watson et al. (2008)[26], Pugia et al. (2001)[21], Mawdsley et al. (2000)[17] and Petersen et al (1999)20 whose demonstrated that the figure-of-eight measurement are currently used in the clinics to record baseline measurements in order to determine the progress of rehabilitation and compare the effectiveness of various treatments techniques. However, change in swelling over time could still be measured by comparing the limb with itself at time. They added also that although the figure-of-eight measurement is indirect method of measuring ankle edema are simple, it is a reliable, inexpensive, accurate, time efficient, hygienic, does not affected by changes in ankle position and correlated closely with the water displacement measurements technique.

Conclusions

The use of early and intensive rehabilitation program in the treatment of acute mild to moderate ankle sprains produces a significant improvement in ankle joint function and allows earlier return to the sports activities compared with standard protocol.

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الملخص العربي

التغييرات الوظيفية عقب برنامج علاج طبيعي مكثف لحالات إصابات أربطة الكاحل للرياضيين

لدراسة فعالية برنامج مكثف من العلاج الطبيعي التأهيلي المبكر والمصحوب ببرنامج تأهيلي تقليدى أو تأهيلي تقليدى فقط لتسريع عملية الشفاء الوظيفي في الأسابيع الثلاثة الأولي عقب حالات الملخ الحاد البسيط والمتوسط لمفصل الكاحل للرياضين. تم إختيار ثمانية وأربعون لاعب من لاعبي المستويات العالية بجامعة الزقازيق ممن يعانون من ملخ بسيط أو متوسط بأربطة مفصل الكاحل لفترة 24 ± 16.9 ساعة وكان متوسط عمرهم 20.6 ±2.23 عام ومعدل الطول 176.4±7.14 سم ومتوسط الوزن 74.18 ±10.17 ، 36 من الذكور و12 من الإناث. تم تقسيم الحالات عشوائيا إلي مجموعتين، المجموعة الأولي (المجموعة التجريبية): 24 مصاب تلقوا برنامج مكون من العلاج الطبيعي المكثف المصحوب ببرنامج تأهيلي تقليدى عقب الإصابة مباشرة لمدة ثلاثة أسابيع بينما تلقت المجموعة الثانية (المجموعة الضابطة) المكونة من 24 مصاب برنامج مكون من التأهيل التقليدي فقط والمكون من الراحة والرفع وكمادات الثلج والضغط فقط لمدة ثلاثة أسابيع عقب الإصابة مباشرة. وتم متابعة الحالات قبل بدء البرنامج مباشرة وثلاثة أسابيع عقب بدء البرنامج لكلتا المجموعتين. وقد تم إختيار إختبارات القفز المتعددة ومقياس الألم ومحيط القدم والكاحل وكذا مقياس الرضا الوظيفي الذاتي لتقييم البرنامج. وقد أظهرت نتائج هذه الدراسة تحسنا ذو دلالة إحصائية لكافة المشاركين بالدراسة في قياس الأسبوع الثالث، وقد أظهرت الدراسة وجود فروق ذات دلالة إحصائية لصالح المجموعة الأولي (المجموعة التجريبية) لإختبارات الكفاءة الوظيفية وإختبار الألم ومحيط القدم والكاحل وكذا لقياس الرضا الذاتي الوظيفي مقارنة بالمجموعة الأخري. وقد أظهرت هذه الدراسة إلي أن برنامج العلاج الطبيعي التأهيلي المكثف والمبكر والمصحوب ببرنامج تأهيلي تقليدى عقب حالات الملخ الحاد البسيط والمتوسط لمفصل الكاحل للرياضين ذو فائدة مرتفعة للمخرجات الوظيفية للكاحل. وقد خلصت هذه الدراسة إلي أن المصابين الذين ينتظمون ببرنامج للعلاج الطبيعي التأهيلي مكثف ومبكر مصحوب ببرنامج تأهيلي تقليدى يحصلون علي معدلات مرتفعة من التحسن الوظيفي المبكر والذى بدوره يؤثر علي الرضا الذاتي الوظيفي للمصابين عن الذين يشاركون ببرنامج تأهيلي تقليدى فقط.