

# Effectiveness of Rehabilitation Programs Following Arthroscopic Partial Meniscectomy in Athletes

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## ABSTRACT

**Objective:** To investigate the effectiveness an early intensive supervised rehabilitation program combined with home program versus a home program or supervised rehabilitation program alone to accelerate knee functional recovery in the first 6 weeks post- arthroscopic partial meniscectomy **Methods:** Sixty Zagazig University top performance athletes with a mean age of  $23.2 \pm 2.4$  years old BMI  $23.2 \pm 2.6$ , 48/M and 12/F with a solitary menisceal injury of  $48.6 \pm 24.5$  days participated in this study. Participants were randomly divided into three groups. **Group (1):** Twenty subjects received intensive supervised physical therapy settings for 6 weeks, 3 times/week combined with a home program. **Group (2):** Twenty subjects received only home program. **Group (3):** Twenty subjects received only intensive supervised physical therapy settings for 6 weeks, 3 times/week. All groups were subjected for an arthroscopic partial meniscectomy technique, followed up for baseline (two days preoperative), 4 and 6 weeks (post-arthroscopic). Outcome measures: Patient's functional performance evaluated by a series of hop tests, VAS, girth measurement, and patient's subjective functional satisfaction. **Results:** There was a significant improvement in all variables during the 6 weeks follow-up assessments for group 1 over the two other groups for all the functional outcomes assisted ( $P < 0.05$ ), and the subjective satisfaction which was maintained through out the study ( $P < 0.05$ ). Subjects in group 3 showed a statistically significant difference over the participants of group 2 for most of the parameters studied. **Conclusions:** Supervised physical therapy combined with a home program is an effective intervention and superior to either supervised physical therapy or home program alone for the functional performance and patient's subjective functional satisfaction at 6 week evaluation after uncomplicated arthroscopic partial meniscectomy.

**Key words:** supervised rehabilitation, program, home program, partial arthroscopic meniscectomy.

## INTRODUCTION

**N**onimpaired meniscus function is essential to distribute knee joint reaction forces during weightbearing, absorb impact shock, serve as a secondary source of noncontractile joint stabilization, provide nutrition to articular cartilage, and facilitate joint gliding and lubrication<sup>23</sup>. Meniscal tears in the knee usually cause pain and swelling, and locking or clicking of the knee during

movement<sup>6</sup>. Many promising sportspersons are disabled due to improper management<sup>10</sup>.

Meniscal injuries are reported to be the most common injury sustained by athletes, but sports injuries account for only 30% of all meniscal lesions<sup>5,10</sup>. Stocker et al. (1997)<sup>20</sup> reported that meniscal injuries accounted for 12% of all football knee injuries The National Athletic Trainers' Association (1997)<sup>15</sup> ranked knee injury frequency second to the combined frequency of hip, thigh, and leg segment injuries, whereas the Puget Sound Sports

Medicine Group ranked knee injuries second only to ankle injuries<sup>21</sup>.

The most common surgical treatment for a torn or worn meniscus is arthroscopic partial meniscectomy<sup>5</sup> which is considered the gold standard procedure for the symptomatic cases<sup>10</sup>. During surgery, only the damaged part of the meniscus is removed from the knee, leaving behind as much healthy tissue as possible. The amount of tissue removed and the nature of the arthroscopic technique means that the procedure is minimally invasive, allowing it to be performed as day surgery<sup>6</sup> followed by a 2- to 6-week outpatient<sup>5</sup>. Despite its minimally invasive nature, studies have shown that patients who have partial meniscectomy surgery experience pain and swelling leading to loss of range of movement and altered function, decreased quadriceps femoris muscle strength, reduced knee-related quality of life<sup>6</sup>, and have a negative influence on the stability of the knee. These factors can influence the results of the intervention<sup>22</sup>.

The athlete with a meniscal injury can be returned to activity quickly and safely with appropriate treatment and rehabilitation<sup>23</sup>. Rehabilitation goals are to control pain and swelling, regain a pain free active range of motion, graduated weight bearing, progressive strengthening within the available range of motion, and return to functional activities/sport<sup>7</sup>.

The main purpose of this study was to assess the benefits of an early intensive course of physical therapy plus written and verbal home program to regain functional capacity of the knee joint post arthroscopic partial meniscectomy.

## SUBJECTS AND METHOD

Sixty Zagazig University top performance athletes with a mean age of 23.2

$\pm 2.4$  years old BMI  $23.2 \pm 2.6$ , 48/M and 12 F with a solitary meniscus injury without any other intra-articular complaints or general pathology of  $48.6 \pm 24.5$  days participated in this study. All subjects were referred to the study from the outpatient clinic of Zagazig University student hospital by orthopedic surgeon. Subject recruitment began on September 1, 2005 till end of July 2006. Subjects were randomized to one of three equal treatment groups. Group (1): 20 subjects received intensive accelerated physiotherapy (PT) rehabilitation program combined with a standardized written and verbal home exercise program that begun on the day of the surgery with a series of 18 supervised every other day PT treatments provided at the outpatient clinic in the 6 weeks postoperative. Group (2): 20 subjects received only a standardized written and verbal advice home exercise program that begun on the day of the surgery. Group (3): 20 subjects received only an intensive accelerated physiotherapy (PT) rehabilitation program for 6 weeks. All groups were followed up for baseline, 4 and 6 weeks. All subjects were subjected to the following: single hop for distance, vertical hop, 6-m timed hop, thigh girth measurement VAS and patient's satisfaction.

Subjects were excluded if they had any concurrent injuries to their contralateral lower extremity that required medical attention.

All surgeries were performed by the same technique and surgeon using a partial arthroscopic meniscectomy. Patients were hospitalized an average of 1 days. Informed consent to participate in the study was obtained from all participants.

## Intervention

The supervised therapy program for groups 1 and 3 was initiated immediately postoperatively and consisted of 2 phases as

outlined by Goodwin et al. (2003)<sup>5</sup>. In the first week, the initial phase concentrated on reducing knee pain and effusion with ice backs, air cuff, early weightbearing as tolerated, transcutaneous electrical nerve stimulation (TENS), electrical stimulation (Zimmer Elektromedizin, Neu-Ulm, Germany) of the quadriceps femoris muscles and pulsed ultrasound (Sonopuls 590 Enraf-Nonus) was applied at a standardized 3 MHz for 2 minutes/10 cm<sup>2</sup> at an intensity of 0.5 W/cm<sup>2</sup>. Regaining knee mobility (performed in the pain-free range of motion), and strengthening the knee flexors and extensors using isometric exercises at 30 and 60 degrees of knee flexion. The second phase began about 10 days after surgery. It included stationary bike starting at 5 minutes per session and increasing up to 30 minutes per session progressed as quickly as were tolerated, hamstring muscle curls, closed kinetic chain as leg presses exercises. Balance or proprioception training using a rocker board, quadriceps femoris muscle extension exercises, Jogging or swimming from 10<sup>th</sup> post operative days, strengthening of muscles around hip, ankle and other limb. From the third week sports specific drills jump, hop, skip, jogging on soft surface with progressive increase in speed and distance. From the fourth week to six<sup>th</sup> week progressive agility drills (backward and lateral running, vertical jumping, cross over, figure 8 running, etc.) with increasing speed and complexity, progressive introduction of sprinting, acceleration and deceleration. At each PT treatment, the patients were supervised and knee joint responses (range of motion, pain, and effusion) were monitored to optimize the effects of the PT treatments and to minimize the possibility of knee joint irritation.

In contrast, athletes of the group 2 had no supervised PT treatments, in addition, home exercises prescribed by the physiotherapist

were taught to the athletes of group 1 and 2 at the day of the surgery. Home program consisted of 2 main sections, one for the first week and the second for the second to six weeks postoperatively. Exercises consisted of ankle movements, knee mobility exercises, isometric contractions of the quadriceps femoris muscles, and 3 sets of 10 straight leg raises without weights on the first postoperative day. The second section consisted of progression of exercises with 0.45-kg weight increments and isotonic quadriceps femoris muscle contractions. Once subjects were able to weight bear without crutches, knee ROM exercises were started from 45 degrees to full extension as well as hamstring muscle curls, hip adduction and abduction exercise in a supine position. Ten repetitions of the exercises were done hourly for the first 3 days. After 2 days of exercising without weights, subjects began isotonic exercises with a weight boot adding 0.45-kg increments per day or as tolerated. Low-impact sports (e.g. slow jogging) were encouraged once 11.34 kg was achieved in the knee extension exercises, and full athletic activity was allowed once 20.41 kg was achieved. Subjects in the group 2 received no other care during the intervention period. All groups were, however, given instructions about the use of crutches, the compressive bandage, and manage their pain and swelling with rest, elevation of the limb, and application of crushed ice backs to the knee for 15 minutes, 4 times per day.

### Functional Outcomes

Baseline evaluations were applied two days preoperative for all study participants. The following tests and measures were administered: knee circumference in order to determine differences between baselines and follow up evaluations.

The single hop for distance was performed as outlined by Andrea et al. (2007)<sup>1</sup> within the 4<sup>th</sup> week following arthroscopic partial meniscectomy. 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. Vertical jump hop was performed as outlined by Vervest et al. (1999)<sup>22</sup>. Subjects stood in a marked out rectangle to standardize the starting position at a right angle to the wall and reached as high as they could with their feet flat on the floor. They then marked the wall with the tip of their chalked middle finger. This mark represented the baseline height. The subjects then hopped as high as they could, re-marking the wall at the highest point of the jump. The distance between the baseline height and the highest chalk mark was considered the maximum height jumped. The timed 6-m hop was performed as outlined by Barber et al. (1990)<sup>3</sup> subjects were instructed to perform large one-legged hops in series over the total distance. A standard stopwatch was used to record time. The stopwatch was started when a subject's heel lifted from the starting position and was stopped the moment that the tested foot passed the finish line. Measurements were recorded to the nearest 10<sup>th</sup> of a second. For both hop tests, the unaffected side was tested first. Tests were considered successful if the subject landed on the test leg without losing balance. The objective effect measurements comprised the height and length of jumps on one leg. All tests were performed with bare feet with the test leg landing on a sponge mat. After a warming-up period of five minutes cycling, each patient attempted three jumps; the highest, fastest and longest distances were

noted. All patients received the same instructions and were encouraged verbally to give their maximal effort during tests.

The circumference measurement of the subjects' thighs was taken at a level 20 cm proximal to the superior border of the patella with the subject in the long-sitting position.

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<sup>5</sup>.

The subjective patient functional satisfaction was evaluated as outlined by James et al. (2001)<sup>9</sup>, patients were also asked to give a score from 1 to 10 for the functioning of their knee and for their satisfaction with the exercise therapy.

### Statistical Methods

SPSS for Windows software was used for data management and statistical analysis. To compare the groups concerning demographic measurements, ANOVA and chi-squared were used in group analyses. The repeated measure analysis of variance (ANOVA) was used to compare the study groups on nominal variables, and paired t test was used to test the changes from baseline. The level of significance was set at 0.05 for all statistical tests.

## RESULTS

**Patient Characteristics:** The age, weight, height and BMI of the patients in all groups was comparable (table 1). Similarities between groups were also found for the side of the injured knee (right/ left: group 1, 9/11, group 2, 8/12 and group 9/11), (Dominant side: group 1, 5/15. group 2, 6/14 and group 4/16). As shown in (Table 1). No significant differences were found between groups in the duration of preoperative symptoms and

surgery. None had intraoperative or postoperative complications. Finally, patients of all groups were evaluated at similar intervals before and after surgery.

During the 4 weeks assessment, all study groups showed marked reduction in all the parameters studied due to surgical intervention effects in the soft tissues and in turn affect the patient's subjective functional satisfaction.

The group 1 showed significantly better results in the functional outcomes than the two other groups regarding the distance jumps, the vertical hop test and the 6-m timed hop score. Moreover, the measurements showed clear progression in favor of the group 1 ( $P < 0.05$ ). Subjects who received only physical therapy also made greater improvements in the functional outcomes over the treatment period as compared with subjects in the home program group on the distance hop test (72.9 cm versus 68.7 cm, respectively), single-leg vertical hop test (28.3 cm versus 25.2 cm, respectively) and the timed 6-m timed hop (2.5 sec versus 2.7 sec).

Mean thigh girth was also measured pre- and post-rehabilitation program and calculated

for each group. The group 1 pre-training thigh girth means equaled 56.2 cm while the post-training mean equaled 59.6 cm. This increase of 3.4 cm represents a 5.7% increase in thigh girth. The group 2 pre-program thigh girths mean equaled 55.8 cm, while the post-program mean was 57.6 cm. This increase of 1.8 cm represents a 3.1% increase in thigh girth. The group 3 pre-program thigh girths mean equaled 56.5 cm, while the post-program mean was 58.7 cm. This increase of 2.2 cm represents a 3.7% increase in thigh girth. The increase in thigh circumference for all groups found to be significant ( $P < 0.05$ ) from the pre-program to the post-program test. Patients in group 1 showed a statistically significant scores over the two other groups ( $P < 0.05$ ) while patients in the group 3 showed superior scores over the subjects of group 2.

Patients in the group 1 were reported to have had significantly less pain for up to 6 weeks postoperative compared to the two other groups ( $P < 0.05$ ), and less pain during activity at all follow-up periods. Patients in the group 3 showed superior scores over the subjects of group 2.

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

| Variable  | G 1 N = 20 |      | G 2 N=20 |      | G 3 N = 20 |      | P*<br>Value |
|---|------------|------|----------|------|------------|------|-------------|
|   | Mean       | SD   | Mean     | SD   | Mean       | SD   |             |
| Age (years)                                       | 23.5       | 2.3  | 23.1     | 2.1  | 22.9       | 2.6  | NS          |
| Weight (kg)                                       | 75.4       | 3.1  | 73.6     | 4.3  | 74.5       | 3.8  | NS          |
| Body mass index ( $\text{kg}\cdot\text{m}^{-2}$ ) | 23.4       | 2.6  | 23.2     | 2.4  | 23.5       | 2.5  | NS          |
| Sex M/F   | 16/4       | -    | 16/4     | -    | 16/4       | -    | NS          |
| Mean duration of symptoms, m*                     | 44.9       | 30.7 | 55.6     | 23.7 | 47.8       | 24.6 | NS          |
| R/L   | 9/11       | -    | 8/12     | -    | 9/11       | -    | NS          |
| Dominant limb                                     | 5/15       | -    | 5/15     | -    | 4/16       | -    | NS          |

m\*: month,

R/L: right /left side

**Table (2): The treatment outcomes: changes from baseline, 4, 8 and 24 Weeks.**

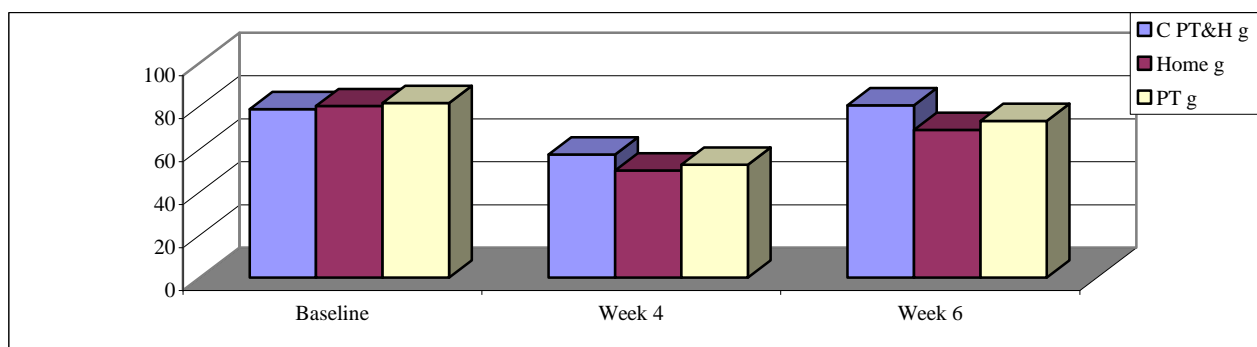
| Test              | Baseline   | Week 4     | Week 6      | % change |
|-------------------|------------|------------|-------------|----------|
| Single Hop (cm)   |            |            |             |          |
| C PT&H g          | 78.4 (6.9) | 57.3 (7.2) | 80.2 (5.8)* | 28.6     |
| Home g            | 79.8 (6.8) | 49.9 (9.4) | 68.7 (9.6)  | 27.4     |
| PT g              | 81.2 (6.4) | 52.5 (8.6) | 72.9 (7.5)  | 27.9     |
| Vertical Hop (cm) |            |            |             |          |
| C PT&H g          | 30.2 (4.2) | 19.5 (8.6) | 31.6 (5.2)* | 38.3     |
| Home g            | 31.1 (4.5) | 15.9 (5.6) | 25.2 (6.2)  | 36.9     |
| PT g              | 31.8 (4.7) | 17.6 (6.8) | 28.3 (5.8)  | 37.8     |
| 6-m timed hop (s) |            |            |             |          |
| C PT&H g          | 2.5 (1.2)  | 2.9 (1.3)  | 2.3(0.5)*   | 26.0     |
| Home g            | 2.6 (1.3)  | 3.1 (1.6)  | 2.7 (1.2)   | 14.8     |
| PT g              | 2.7 (1.2)  | 3.0 (1.5)  | 2.5 (0.7)   | 20.0     |
| Thigh Girth       |            |            |             |          |
| C PT&H g          | 56.2 (4.3) | 57.8 (3.2) | 59.6 (2.9)* | 3.0      |
| Home g            | 55.8 (5.4) | 56.7 (4.7) | 57.6 (4.4)  | 1.7      |
| PT g              | 56.5 (4.7) | 57.3 (4.3) | 58.7 (3.8)  | 2.4      |
| VAS               |            |            |             |          |
| C PT&H g          | 4.9 (1.3)  | 5.6 (1.6)  | 3.9 (1.4)*  | 47.2     |
| Home g            | 4.7 (1.4)  | 6.8 (2.4)  | 4.8 (2.6)   | 41.6     |
| PT g              | 5.0 (1.5)  | 6.1 (2.2)  | 4.2 (2.3)   | 45.2     |
| P S               |            |            |             |          |
| C PT&H g          | 7.4 (2.4)  | 6.7 (1.8)  | 8.3 (1.3)*  | 19.3     |
| Home g            | 6.8 (2.3)  | 6.6 (2.2)  | 7.3 (2.4)   | 9.6      |
| PT g              | 6.9 (2.6)  | 6.4 (2.4)  | 7.6 (1.8)   | 15.8     |

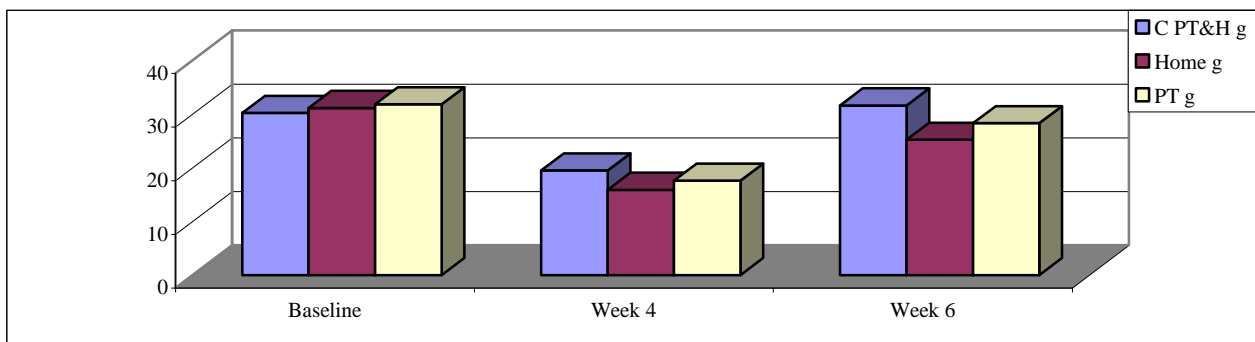
C PT&H g: Combined physical therapy and home program group, Home g: Home treatment group, PT g: physical therapy group, VAS: visual analogue score P S: Patients satisfaction with function

Regarding subjective patient functional satisfaction patients in the group 1 were reported to have had significantly more satisfaction at the end of study ( $P < 0.05$ ), patients of group 3 showed also a significantly

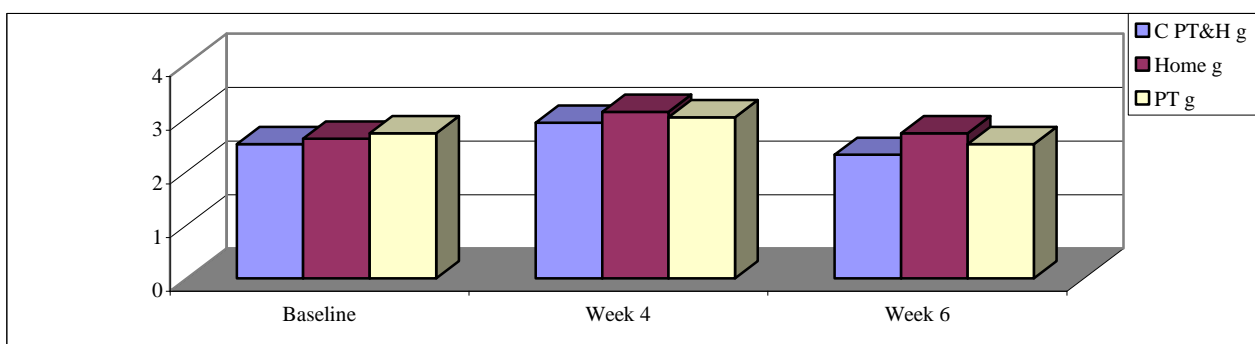
more satisfaction than subjects of group 2 ( $P < 0.05$ ).

With constant patient evaluation and follow-up, clinically successful results have been achieved.

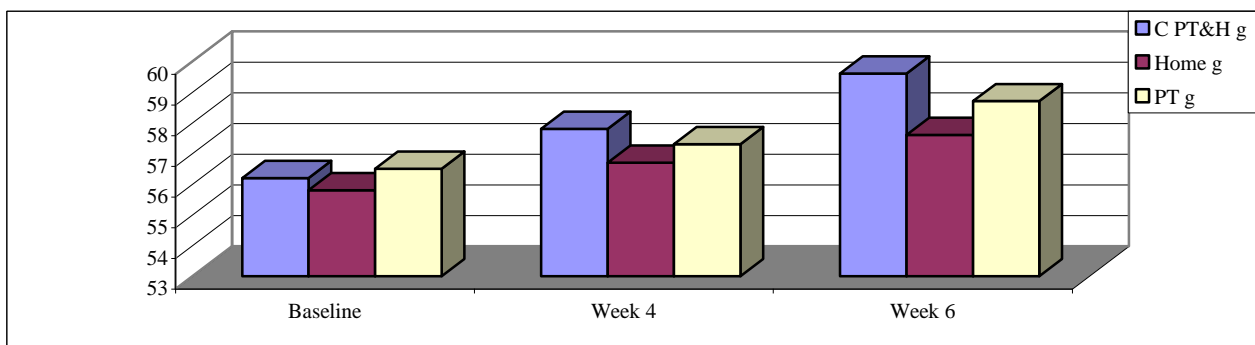
**Fig. (1): Mean of single hop for all groups.**



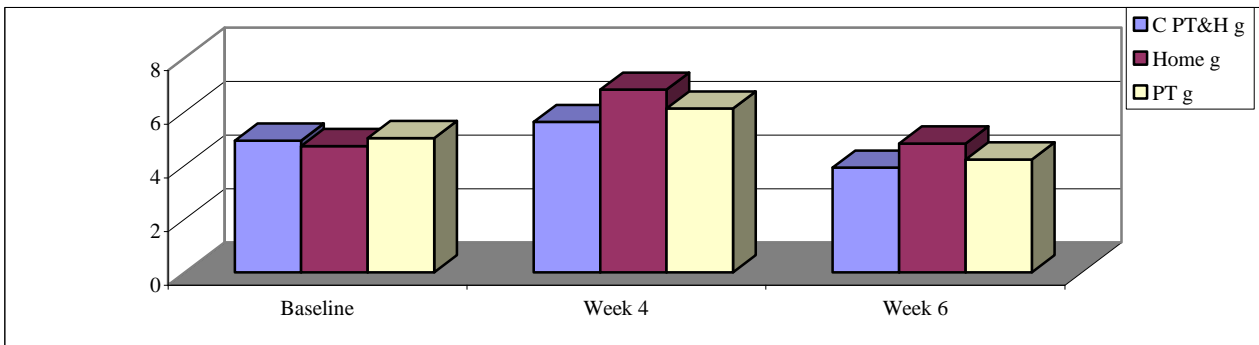
**Fig. (2): Mean Vertical hop for all groups.**



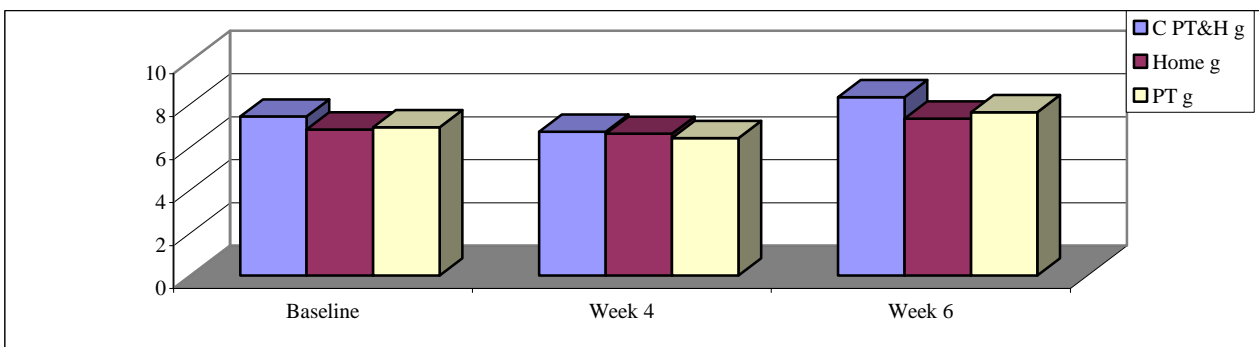
**Fig. (3): Mean 6 m timed hop for all groups.**



**Fig. (4): Mean of thigh girth for all groups.**



**Fig. (5): Mean of VAS for all groups.**



**Fig. (6): Mean of Patients satisfaction with function for all groups.**

## DISCUSSION

The overall results of the present study demonstrate that an early, intensive, supervised physical therapy program combined with a home exercise program, provided in the first 6 weeks after arthroscopic partial meniscectomy in athletes without any other knee pathology, promotes faster knee functional recovery and reduced the pain. Such associated injuries influence functional recovery after arthroscopic meniscectomy. Therefore, the results of this study only apply to patients with a solitary meniscal lesion. The positive effect of the treatment program on the function was impressive after only 18 supervised treatments. The faster rate of functional recovery in patients of both groups 1 and 3 can be attributed to the effect of the PT program because it is not likely that surgical

procedures or other clinical factors biased the postoperative recovery. In parallel with these results St Pierre (1995)<sup>19</sup> says that physiotherapy intervention may be justified for professional athletes where a faster return to preoperative status may be desired. They added also that they believe that a supervised rehabilitation is always desirable after a surgical procedure.

The two groups were highly comparable, which means that the internal validity of the study was high. The inclusion criteria in our study were very strict, which led to a small number of participants.

The early weight bearing advised to all participants in this study were going with that of Timothy et al. (2001)<sup>21</sup> reported that progressive weight bearing and joint stress are necessary to enhance the functionality of the joint; however, excessive shear forces may be



disruptive. Prolonged knee immobilization after surgery can result in the rapid development of muscular atrophy and greater delays in functional recovery. They added also that rehabilitation after partial meniscectomy can generally progress as tolerated with no substantial contra-indications or limitations. They concluded that early and intensive rehabilitation was vital to successful functional outcomes after partial meniscectomy. Barber (1994)<sup>2</sup> reported no differences in healing rates between patients who followed a standard rehabilitation program (protective) and patients who followed an accelerated program that permitted immediate weight bearing, unbraced motion, unlimited exercise performance, and an early return to pivoting-type sports movements.

Matthews and St-Pierre (1996)<sup>12</sup> reported that patients require 4 to 6 weeks for the quadriceps femoris and 4 weeks for the hamstrings to return to preoperative isokinetic strength levels after partial meniscectomy. St-Pierre (1995)<sup>19</sup> suggested that preoperative knee extensor-flexor strength deficits increase the need for supervised rehabilitation.

Joy et al. (2004)<sup>10</sup> reported that patients developing reflex sympathetic dystrophy, severely restricted mobility of patello-femoral joint following arthroscopic surgery. Such morbidity though minimal, frequently questioned the future of the sportsperson. Joint function depends heavily upon the strength and balance of the surrounding muscles. A supervised rehabilitation program can prevent these complications during the early postoperative period. They conclude that arthroscopic partial meniscectomy is usually a straight forward procedure followed by a fairly rapid return to sport after four weeks of rehabilitation, and resulted in a significant reduction of inpatient stay and earlier return to work and sport.

In the present study, the intervention was standardized to all participants as much as possible without it being impracticable to follow. The intervention was based on guidelines of phasic approaches, where treatments can be defined into early, middle, and late phases. Each phase has specific goals (e.g., in the early phase, the goal is to reduce inflammation to decrease pain and increase ROM), and the program cannot be progressed to the next phase until the goals for each phase have been met (e.g., cannot strengthen through full ROM until inflammation has been reduced).

The program of the present study was in parallel with that of Grigor'eva et al. (1996)<sup>8</sup>, their program includes combined use of cryoeffects, aircuff, ultrasound and therapeutic exercise. Their therapeutic complexes proved to be analgesic, effective against local inflammation in the joints, to relax muscular tension and pain contractures, to enhance functional activity of the affected joints. Also Moffet et al. (1994)<sup>13</sup> showing that early and intensive physical therapy consisting of a home exercise program combined with supervised treatments (including electrotherapy, ice, and compression followed by isometric and isokinetic exercises and bicycle ergometry) promotes faster recovery from the deficits found in their study. Lessard et al. (1997)<sup>11</sup> results indicate that the addition of cryotherapy to a regime of exercises following arthroscopic knee surgery produced benefits of increased compliance, improved weight-bearing status, decreasing both knee edema and discomfort and lower prescription medication consumption. Ross, and Berger (1996)<sup>17</sup> came to the conclusion that physical therapy has enabled more subjects to return to sporting activity.

In the present study series of hop tests were chosen to assess the functional outcomes

of all participants according to Andrea et al. (2007)<sup>1</sup> who consider it as an objective functional test, practical, performance based outcome measure that would provide stress to the knee joint while also allowing us to evaluate strength, as it correlates positively with muscular strength and confidence in the tested extremity, and requires minimal equipment and time to administer and provide a reliable and valid performance-based outcome measure for patients undergoing rehabilitation following arthroscopic partial meniscectomy. Goodwin et al. (2003)<sup>5</sup> reported that single-leg hop tests have been found to yield relatively reliable data and representative measurements of knee function during the postoperative period. Barber et al. (1999)<sup>4</sup> and Noyes et al. (1991)<sup>16</sup> mentioned that the tests incorporate a variety of movement principles (i.e., direction change, speed, acceleration-deceleration, and rebound) that mimic the demands of dynamic knee stability during sporting activities and are suggested to prepare the patient for return to such activities.

In the present study both PT groups also received electrical stimulation to the quadriceps 3 times a week. Following the program, both groups demonstrated significant increase in thigh girth compared to preoperative measurements and the group 2. This results goes with that of Goodwin and Matthew (2003)<sup>6</sup> who reported that electrical stimulation provided symptomatic relief to patients who combined it with physical therapy, allowing knee extensor strength to return to preoperative values 3 wk after surgery, 1 month sooner than those who received placebo or no treatment. Ninety three percent of subjects who used ES reported strength improvements and decreased postoperative pain, causing the greatest

reduction in medication required when compared with placebo and control groups.

Goodwin et al. (2003)<sup>5</sup> suggested the criteria for returning to sports as: absence of effusion, full range of motion of knee joint, normal quadriceps/hamstrings strength, normal hip external rotator function, good proprioception, functional exercises performed without difficulties, simulated match situation (continuous cycling for 30 minutes) without subsequent knee pain.

Moffet et al. (1994)<sup>13</sup> suggested one of the explanations for the positive effects of the supervised PT program to that of the Hawthorne effect (i.e., the presence of an observer affecting the behavior of those being observed) may have been responsible for the differences in knee extensor work between the intervention and control groups at 3 weeks postsurgery in their study. It is well known that motivation; self-perception of capabilities, therapist-patient interactions, and the belief in the efficacy of the treatment can influence the physical performance or therapeutic outcome as it provide the patients with the attention and reinforcement. They added also that It is, however, difficult to attribute to nonspecific motivational factors the physiological effects observed in the patients of the PT group. Indeed, the specific positive effects of the modalities used (ice application, TENS, strengthening exercises, bicycle ergometer) in the rehabilitation program have been previously documented and some of the modalities, such as TENS, have been shown to be more effective than a placebo in relieving pain and accelerating strength recovery. There is also a wide body of literature on the specificity of strength training.

An important finding from this study is that an intense and early exercise program has no 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 both PT groups without concomitant increases in pain, or loss of joint motion. In fact, the treated patients had lower prevalence of knee pain during the functional tests than patients of the group 2. Modalities such as TENS, ice applications, ES, and use of a compressive bandage in combination with progressive and adapted exercises most likely helped to control and reduce, especially in the first week post-surgery, the undesirable effects of knee pain and effusion thereby favoring efficient strength training even in the early stage post-meniscectomy. Though a good balance between exercises and rest is essential in an early and intense exercise program, choice of the type of training that will best promote functional gains is also important. For this reason, the exercise program took into consideration the specificity of training that is known to be related to the type of contraction, joint position, and velocity of contraction. Although both static and dynamic contractions are necessary, the program was started with isometric contractions at different angles to minimize the stresses on soft tissues and joint. Then, when pain and effusion were less, progressive resisted exercises and bicycling was introduced to promote improved dynamic control and endurance<sup>13</sup>. These results were in line with that of Goodwin and Matthew (2003)<sup>6</sup> reported that patients who received physical therapy began treatment approximately 3 h after surgery. Three weeks after surgery, they experienced less pain and better knee extensor strength recovery than those patients receiving no treatment. St. Pierre et al (1992)<sup>18</sup> was the only study found that specifically compared the effects of early or delayed rehabilitation (2 or 6 weeks) postoperatively. They found no statistically significant differences in isokinetic knee

strength between the two groups 10 weeks after surgery. In fact, both groups had returned to their preoperative values by 6 weeks<sup>6</sup>.

The patient's subjective functional satisfaction showed a significant difference for group 1 through the follow up evaluations. A significant reduction in all the study groups was noted during the 4 weeks evaluation. This may be due to postoperative pain and dysfunction, followed by a significant increase in the patient satisfaction at 6 weeks evaluation for all groups. Group 1 showed the most significant scores compared to the two other groups, group 3 showed superior results compared to group 2. This may explain the high hop scores of the group 4 at the 6 weeks assessments and explained by the supervised physical therapy program.

Contrary to our results the results of the study of Goodwin et al. (2003)<sup>6</sup> whose results indicate that the supervised physical therapy used in their study is not beneficial for patients in the early period after uncomplicated arthroscopic partial meniscectomy. Also Morrissey et al. (2006)<sup>14</sup> reported that quick recovery occurs in these patients when only a home exercise program is given. The possible explanation of these contradictory may be for the difference in rehabilitation program, difference in sample age and physical state.

## Conclusion

An early intensive and supervised rehabilitation program plus written and verbal instructions was found to be efficient, realistic, well tolerated, in addition, it offers the advantage of being easily applicable by all patients and led to high patient satisfaction though it resulted in large functional improvements in a short period of time.

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### المخلص العربي

#### فعالية برنامج من العلاج الطبيعي التأهيلي بعد جراحات الإستئصال الغضروفي الجزئي بالمنظار للرياضيين

لدراسة فعالية برنامج مكثف من العلاج الطبيعي التأهيلي بعد الجراحة لحالات الإستئصال الجزئي للغضروف باستخدام المنظار الجراحي للرياضيين مصحوب ببرنامج تأهيلي منزلي بأخر للعلاج الطبيعي التأهيلي أو تأهيلي منزلي فقط. تم إختيار ستون لاعب من لاعبي المستويات العالية بجامعة الزقازيق ممن يعانون من إصابة تمزق الرباط الصليبي الأمامي لفترة  $16.2 \pm 28.9$  يوم وكان متوسط عمرهم  $2.4 \pm 23.2$  عام ومعدل مؤشر حجم الجسم  $23.2 \pm 2.6$ . تم تقسيم الحالات عشوائياً إلى ثلاث مجموعات، المجموعة الأولى: 20 مصاب تلقوا برنامج مكون من العلاج الطبيعي المكثف المصحوب ببرنامج تأهيلي منزلي عقب الجراحة مباشرة لمدة ستة أسابيع بينما تلقت المجموعة الثانية المكونة من 20 مصاب برنامج مكون من التأهيل المنزلي فقط لمدة ستة أسابيع عقب التدخل الجراحي مباشرة، وتلقت المجموعة الثالثة برنامج مكثف من العلاج الطبيعي فقط. وتم متابعة الحالات قبل بدء البرنامج مباشرة وبعد أربعة وستة أسابيع عقب التدخل الجراحي لكل المجموعات. وقد تم إختيار إختبارات القفز المتعددة لتقييم البرنامج ومقياس الألم ومحيط الفخذ وكذا مقياس الرضا الوظيفي الذاتي. وقد أظهرت نتائج هذه الدراسة تحسناً ذو دلالة إحصائية لكافة المشاركين بالدراسة في قياس الأسبوع السادس، وقد أظهرت الدراسة وجود فروق ذات دلالة إحصائية لصالح المجموعة الأولى لإختبارات الكفاءة الوظيفية وإختبار الألم ومحيط الفخذ وكذا مقياس الرضا الوظيفي مقارنة بالمجموعتين الأخرين بينما أظهرت الدراسة وجود فروق ذات دلالة إحصائية لقياس الأسبوع السادس لصالح المجموعة الثالثة مقارنة بالمجموعة الثانية لإختبارات القفز العمودي ومحيط الفخذ ومقياس الرضا الوظيفي. وقد أظهرت هذه الدراسة إلى أن برنامج العلاج الطبيعي التأهيلي مصحوب ببرنامج تأهيلي منزلي عقب التدخل الجراحي فقط لحالات الإستئصال الجزئي للغضروف باستخدام المنظار الجراحي للرياضيين ذو فائدة مرتفعة للمخرجات الوظيفية للركبة. وعلي الرغم من تحسن كافة المشاركين بالبرنامج عند قياس الأسبوع السادس فإن نتائج المجموعة الأولى أظهرت تحسن ذو دلالة إحصائية وإرتفاع نسبة الرضا الوظيفي الذاتي عن المجموعتين الأخرتين. وقد خلصت هذه الدراسة إلى أن المصابين الذين ينتظمون ببرنامج مصحوب ببرنامج تأهيلي منزلي يحصلون علي معدلات مرتفعة من التحسن الوظيفي المبكر والذي بدوره يؤثر علي الرضا الذاتي الوظيفي للمصابين عن الذين يشاركون ببرنامج تأهيلي منزلي فقط.