International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Case Report

Effect of Physiotherapy in the Management of Meniscal Injury - Case Study

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Received: 24/02/2016 *Revised: 23/03/2016* *Accepted: 23/03/2016*

ABSTRACT

It has become increasingly more evident that the meniscus plays an important role in contributing to knee joint longevity. Advances in surgical techniques by orthopaedic surgeons to repair traumatized menisci have led to better long term outcomes, decreasing the incidence of articular cartilage degeneration. Advances have also been made in rehabilitative techniques following meniscal repair. These techniques along with sound rehabilitation principles to include a criteria based progression have contributed to excellent outcomes and earlier return to function and sport. The role of the meniscus, recent advances in surgical repair and the current post-operative rehabilitation techniques employed by sports rehabilitation specialists are discussed.

Keywords: Knee, Meniscus Surgery, Rehabilitation.

INTRODUCTION

The population, in general has become more athleticalactive and individuals are staying active longer. Meniscal injuries have become very common among professional and amateur athletes and are one of the most common indications for knee surgery. Although the incidence of Meniscal pathologies difficult to estimate, the increased exposure to athletic activity increases the risk of injury to these structures.

It has become more and more clear in recent decades that meniscal excision leads to articular cartilage degeneration. Degenerative changes have been found to be directly proportional to the amount of meniscus removed. Even partial meniscectomy results in higher than normal stress on the underlying articular cartilage. A vitro study by Seedhom and Hargreaves demonstrated that removal of 16% to34% of the meniscus resulted in a 350%increase in contact forces. [1]

In individuals with combined meniscal repair and ACL reconstruction, good results in 90% of the cases are reported with an aggressive program (no limitations for range of motion, early full weight bearing, and early return to sports). Accelerated protocols for isolated meniscal repair have been described with positive results.5,40 Shelbourne et al showed that patients with repairs of unstable/peripheral longitudinal meniscal tears who underwent an accelerated rehabilitation protocol had a high successful outcome rate (follow-up time, 3.5 years), with return to sport approximately 10 weeks postoperatively. The criteria for return to sport were full ROM, quadriceps strength of 75% (compared to the uninvolved leg), and completion of a functional running program. However, the details of the rehabilitation

program, comprehensive functional outcomes (eg, hamstring strength), the type of sport activity, and the level of this activity (recreational/professional) were not specified. This information may be extremely important to appreciate the impact of accelerated programs on knee function. Among specialists there is concern that by accelerating the rehabilitation, the long-term outcome may be negatively affected. [2]

CASE DESCRIPTION

This is a case a J. M. a 21 y/o, non-HTN, non-DM male patient with C/O pain and swelling on (R) knee, diagnosed as post-op Rt knee medial meniscus injury.

Present condition*:* started while the Pt. was jogging away from play, and internally rotated his flexed Rt knee through force on the planted foot (dominant leg), when he changed direction. In that moment, Pt. hada sudden sharp pain in the inner aspect of the Rt knee, culminating in effusion and popping, which meant that he could not continue playing. As a result, Pt. was brought to a nearby hospital where a conducted X-ray was showed (-) fracture. Pt. was then D/C with 50mg bid for 1 week and was instructed to apply ice and compression for 20mins every 1r. Pt. was also provided with a follow up appointment for the Orthopaedic team the next day, where he was diagnosed with (?) medial meniscus tear on the Rt knee. Moreover, Pt. was scheduled for an MRI following the reduction of knee swelling in order to confirm the functionality of the diagnosis. Indeed, Pt. was referred to physical therapy for further evaluation and management. Overall, the risk factor to cause the footballer's medial meniscus tear is thought to be as a result of inadequate warm-up, poor core stability, muscle weakness and lower extremity strength imbalance. Pt. started his physical therapy on the 3rd day post-injury, which included measures for pain relief, swelling, ROM, and prevention of atrophy. After 14 days of PT Rx, the pain and swelling subsided and Pt. was sent back to the referring orthopedic surgeon who then requested an MRI that ultimately confirmed a tear in the vascular part of the medial meniscus tear on the Rt knee. Subsequently, upon the recommendation of the orthopedic surgeon, Pt. agreed to undergo medial meniscus repair and to have an intensive pre- operative PT Rx. Finally, on 01/05/14, Pt. underwent the medial meniscus repair under Dr. M, and Pt. had bedside PT Rx the following day. Furthermore, Pt. was D/C on 03/05/14 with a follow up appointment for outpatient physical therapy.

Social Hx

Pt. is a professional football player who lives in a 2-storey house with his parents and 3 brothers. Pt. needs to negotiate 3 steps at the entrance and 12 steps going to the 2nd floor where his room is located. The toilet/bathroom is approximately 5 m from the Pt.'s room. Additionally, as of the injury, his brother drives him to the outpatient PT every day, although Pt. wishes to drive himself to his physical therapy sessions soon. Pt. is highly motivated and cooperative, as he desires to return to football and regain his pre-injury skills.

Treatment

The rehabilitation program was split into four separate phases, incorporated different aspects found in the previously analysed approaches of treatment. [2-5] Moreover, in order to include lower leg capability testing, these individual phases functioned around conservative treatment, as well as neuromuscular and proprioceptive training, together with functional rehabilitation. Indeed, during the rehabilitation's initial phase, physical therapy interventions were implemented.

PHASE I (Post-Op Weeks 0 to 4) rehabilitation programme

The knee was in early protection in Phase 1, in order to permit optimum healing, as the aims were to instill active ROM movement of 0-90 degrees, re-initiate pre-injury patellofemoral mobility, reduce the inflammation, and function the overall repair. In total, Phase 1 had duration of 1

month post-operation, as the studied player was gradually encouraged to develop ROM, although not to exceed their pain level. Moreover, the rehabilitation period enabled a reduction from the use of crutches, to provide more weight bearing through personal toleration, while the brace was fixed into position through full extension.

The patient was capable of performing full revolutions while using a stationary bicycle by the end of the First Phase; these were exercised without muscle tightness or discomfort, through a painless unilateral stance using upper-limb support. Moreover, symmetrical circumferential measures at TFJ line. Muscle strength increased to 50% of the contralateral limb, which improved the performance of isometric exercises and SLR for the next stage.

PHASE II (Post-Op Weeks 5 to 9) rehabilitation programme

From weeks 5 - 9, the overall aims of the rehabilitation were to gain full reintegration of ROM, develop strength and neuromuscular control for daily activities, and reinitiate gait. By week 6, the studied subject was to undertake squatting with the flexion of the knee up to 60 degrees while unsupported, although this was to be carried out pain-free. By week 9 the unsupported squatting was to increase knee flexion to 90 degrees, with full, pain-free ROM to be totally restored by week 10, which would highlight distinctly improved motor control, strength and quadriceps tone.

ROM and limitations of flexibility ceased in Phase II through open and closed chain strengthening, which permitted full ROM during functional activities by the end. Likewise, the measure of strength demonstrated 70% muscle strength of the contralateral limb; and the patient while enacting modifications to static proprioceptive training maintained control of posture.

PHASE III (Post-Op Weeks 10 to 16) rehabilitation programme

Through weeks 10 - 16 of rehabilitation, the focus primarily functioned around the progression to complete active participation, as the aim was to restore a practice of full pre-injury training functionality. Indeed, as of week 12, the aim was for the player to undertake squats, as well as closed chain activities through total pain-free ROM. Following this, by the 16th week, the footballer should have been able to use both a treadmill and run on grass, together with pivoting and cutting pain-free movement. Similarly, the patient had to show the capability to throw, as well as perform agility drills in order to prove the refreshed capacity to fulfill the specific demands of football.

The patient gained stable multi-functioning movement by the end of the Third Phase through, while utilizing unstable support. Similarly, landing stability developed back to equal the contralateral leg's level, as all activities of agility and plyometric drills were undertaken, as well as jogging and short sprints without any form of pain or discomfort. Overall, by the 15th week post-operation, the strength of the lower extremity that had been injured previously measured with strength of 90% of the undamaged leg.

PHASE IV (Post-Op Weeks 17 to 20) rehabilitation programme

From week 17 - 20, the rehabilitation focused on the aggression of sport's training, as the aims were to redevelop both running and sprinting to normalization, while enhancing the strength in the legs, which were to be combined with pain-free sport performance of demand. In fact, a functional running program being complete, 100% ROM, and a minimum quadriceps index of 75% for the assessed limb were the specific categorized criteria for evaluating the patient's post-meniscal repair. [6]

Increased strenuous sporting exercises and agility drills exercises were completed by the athlete in Phase IV, as the rehabilitation process enhanced. No sign of discomfort was shown at this stage, and discharge from physical therapy was deemed acceptable after passing various testing procedures: LEFT test, 1 minute and

55 seconds; 300-yard shuttle run measured at 69.2 seconds, which was only 3 seconds slower than the time recorded prior to injury; and the T-test, where the athlete was timed at 12.4 seconds, when previously he had been recorded at 11.66 seconds.

Management modalities:

Knee joint effusion and pain

Pain is increased through effusions of the knee, which impedes the healing process and limits the flexion range of the knee, while decreasing the process of progression that develop rehabilitation phases. Moreover, the effusions retard the hamstrings' and quadriceps' production of torque, and reduce function. In fact, when intra articular pressures are at their maximum, the inhibitions of quadriceps muscle have been shown to be the maximum in knee extension. Hence, during the initial week following operation, a patient is required to elevate their damaged limb and use ankle pumps, whilst resting in order to optimally reduce the swelling. [7]

In order to minimize the swelling of the knee during the first 2 post-operative weeks, and even up to 5 weeks, cryotherapy (or similar cold packs) has been utilized. It has been demonstrated that this process is beneficial in pain reduction and to show the need for analgesic, which may increase potential muscle compliance and weight bearing. [8] Furthermore, in order to initiate the reduction of swelling in the initial phase, isometric exercises are commonly performed, as they induce edema and fluid removal in the damaged area. [9]

Figure 1: Ice pack on affected knee

ROM Limitation & PFJ mobility

Complete extension, together with the recommended degree of flexion, is the requirement that the patient must demonstrate in ROM exercises, as in order to avoid hamstring strain, active knee flexion is restricted to the posteromedial joint. Primarily, through these exercises the footballer is seated in a position of 0° to 90°, while the flexion is gradually increased throughout to 135° until the climax of Phase 2. Until the patient's normal movement is achieved, these exercises have to be performed 3 - 4 times every day for a duration of between 10 and 15 minutes session, with extension being decreed as full when it is at 0°. However, to avoid possible straining of the hamstring in the posteromedial joint, active knee flexion remains limited. Additionally, the exercises for ROM include patellar mobilization, as this has been documented as vital in the development of full knee ROM. [10]

Figure 2: AROM ex's for affected knee

Rt-LE muscle weakness & neuromuscular control

Specific exercises for quadriceps setting are required from the player, as redevelopment of the quadriceps is adhered to from the first day following the operation. Firstly, for the redevelopment of proximal strength in the muscle, a straight leg elevation exercise is encouraged. Secondly, to enhance the proximal strength, when these exercises are tolerated additional

weights are added to develop the progressive resistance exercises, together with the utilization of exercise machines[5]. Consequently, this early re-education of muscle strength in the hamstring would enable the patient to undertake specific sporting activities that required the muscle, as the neuromuscular control strategies would progress. [2] In order to challenge the neuromuscular control during different activities, provide increased demand strength training, and produce additional strain on the lower limbs, progression neuromuscular controls were incorporated into performed closed chain exercises (i.e. loads). [5] To analyze the rehabilitation of patients who suffer from knees that are ACL-deficient, there is proof that the knee joint function can be improved by programs of neuromuscular rehabilitation. [11,12] Similarly, knees that are ACL-deficient, as well as knees following meniscus repair can benefit from comparative approaches of rehabilitation, as they demonstrate analogous impairments and limitations. [13]

Figure 3: Strengthening ex's

Weight bearing

As increased stress affects the meniscus whilst a patient utilizes a brace locked in full extension, it becomes informed to maintain partial weight bearing for a period of 4 weeks through meniscal repair. [13,14] Indeed, through full extension, weight bearing actually aids the activation of quadriceps, as well as maintains the range of knee extension. [7] Following this, weight bearing is progressively increased, as the patient is informed to implement a common gait technique which will avoid a locked-knee position, in order to enable knee flexion normality through undertaking this technique. [10]

Balance & Proprioceptive Input

A patient's balance, coordination abilities, and stability are shown to be challenged by a rehabilitation program post-meniscal injury or surgery. [15] Similarly, it has been demonstrated by Gray (1999) that how a knee joint actively accelerates, reduces velocity, directs and positions relate through proprioceptive input to the menisci. [16] Hence, a dynamic proprioceptive training program may be undertaken in order to develop the capacity and movement of the damaged muscle from the injured joint, whilst also creating body stabilization through various balance and proprioception exercises. [10] Subsequently, the patient was capable of maintaining balance, and regained complete stability during multi-planned movement following the balance and proprioception training program.

Figure 4: Balance training

Conditioning

At the earliest possible opportunity cardiovascular exercise is required to be undertaken, as overall fitness will decrease rapidly through a lack of training to an injured patient. [8] Indeed, a training program that focuses on cardiovascular should be implemented between the 2 - 4 weeks period following operation.

Moreover, at the 5 - 9 weeks state, stationary bicycling commenced, as this would develop fitness to a pre-injury level. This form of cardiovascular exercise was performed a minimum of 3 times per week for a short duration of between 20 and 30 minutes, while functioning with a heart rate of between 60% - 85% of its capability. In addition, throughout the training program, an upper body ergo meter was provided to the patient.

Functional Activities

The patient was permitted to commence with the pivoting development and plyometric exercises following a complete display of full knee extension, improved quadriceps tone, adequate strength of quadriceps, which was demonstrated by the results from 8 isometric tests, and developed neuromuscular control. Consequently, a gradually increased demand of the meniscus was instilled by these activities, as well as an emphasis on increased demand neuromuscular control. [4] Subsequently, the patient developed pre-injury levels of stability, together with control whilst moving in activities, which include: the initiation of jogging, a small degree of sprinting, accelerating and deceleration, and hopping.

Aggressive sport specific training

As the studied patient enhanced his progression, this phase of rehabilitation began to incorporate more specific sporting activities, such as cutting and pivoting. Likewise, he commenced performing running drills that focused around cutting and changing direction, and in regards to throwing exercises he was unrestricted to the level of strength used. Moreover, a 300-yard shuttle run, a T-test, and Lower Extremity Functional Test (LEFT) were incorporated as functional testing at this stage. Firstly, the 300-yard shuttle run to measure muscle capacity, [16] and secondly the T-test to measure agility. [17] Thirdly, multiple lower extremity movement patterns are analysed through the LEFT test. [18] Consequently, total discharge from physical therapy was attained when the patient was able to undertake the entirety of the functional testing through the development of rehabilitation, high demand agility and practice of distinct exercises to his sport.

DISCUSSION

In this particular case, with the athlete's expectations and the team's pressure to have him return as soon as possible, the medical team (surgeon and physiotherapist) was in a dilemma. A conservative rehabilitation approach would have probably compromised the season; on the other hand, the medical team did not feel comfortable using a very aggressive approach with this top athlete. The primary concern was not only the healing of the repaired meniscus, but also the regaining of full knee function. During flexion and rotation, the lateral meniscus has a greater displacement than the medial meniscus. [2]

We believe that the neuromuscular control of the injured knee was a key aspect of this rehabilitation protocol. Several author shave described the innervation of the meniscus and its importance as a source of proprioceptive information. [19-21]

On the basis of this evidence, Gray suggested that rehabilitation exercises after meniscal injury or surgery should challenge the balance, stability, and coordination skills of the patient. [2]

Tyler reported the successful use of a specific neuromuscular training program, including simulated skating strides, with an elite female ice hockey player after ACL reconstruction. [22]

ACL-deficient knees and knees after a meniscus repair show analogous knee impairments/ limitations and therefore may benefit from similar rehabilitation approaches. [13]

CONCLUSION

The sport-specific, criterion-based, supervised rehabilitation program described in this case report showed a safe return to sport and a good long-term outcome. Its conclude high-level athletes significantly improve their short and long-term outcome

using a sport-specific, criterion-based, and highly supervised rehabilitation program.

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How to cite this article: Aljowair FF, Herrington LC. Effect of physiotherapy in the management of meniscal injury - case study. Int J Health Sci Res. 2016; 6(4):573-580.

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