Case Report

International Journal of Research in Pharmaceutical Sciences

Published by JK Welfare & Pharmascope Foundation Journal Home Page: https://ijrps.com

An Innovative Physiotherapeutic Approach Towards the Rehabilitation of a Post-operative Case of Anterior Cruciate Ligament Reconstruction - A Case Report

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Article History:

Received on: 17 Oct 2020
Revised on: 23 Nov 2020
Accepted on: 27 Nov 2020

Keywords:

Anterior Cruciate Ligament, Rehabilitation, Reconstruction, Endurance, Strengthening, Gait training

Abstract

Anterior Cruciate Ligament injuries are one of the commonest injuries related to the knee joint. They can either be a ligament tear or a ligament sprain. They usually occur due to landing from a jump incorrectly, rapidly changing the direction of motion, sports injuries (direct collisions), and stopping suddenly. This type of injury requires conservative treatment and/or Anterior Cruciate Ligament Reconstruction (ACLR) surgery. In both cases, physiotherapy has been proven to be useful in the treatment and rehabilitation of the condition. Physiotherapy treatment aids in relieving the symptoms, strengthening, endurance and gait training. The patient came to the hospital with the complaints of there being a difficulty in walking without support. The pain was present as the patient tried to bend his right knee, the swelling was also present on the right knee and there was a restricted range of motion. All these complaints were present for 15 days. The patient was a post-operative case of ACLR. An X-ray and MRI scan showed these results. Physiotherapy interventions included educating the patient, reducing the swelling, reducing the pain using electrotherapy modalities, Range of Motion exercises for the right knee, strengthening and endurance exercises, and teaching normal gait pattern. The patient eventually gained an improved range of right knee movement, decreased pain, swelling and tenderness, and learned to walk with a normal gait pattern. The questionnaires and tests carried out pre and post-treatment showed a positive result.

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ISSN: 0975-7538

DOI: https://doi.org/10.26452/ijrps.v11iSPL4.4562

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INTRODUCTION

The knee joint is one of the largest and most complex joints in the human body. Injury to the Anterior Cruciate Ligament (ACL) is one of the most common injuries to this region, especially when participating in pivoting or cutting activities (Wellsandt *et al.*, 2020). This type of injury requires either conservative treatment or Anterior Cruciate Ligament Reconstruction (ACLR) surgery. ACLR, though, is considered to be the standard gold treatment, especially in the young population (Failla *et al.*, 2015). Usually, the stability of the knee joint is lost, hence leading to a varying amount of abnormal movements that can be noticed in the patients (Chmielewski *et al.*, 2001) Physiotherapy has been proven to be

useful in both forms of treatments and rehabilitation phase of the condition. The therapeutic program involved educating the patient about his condition and how to go about his life, active and passive range of motion exercises, to the knee and the adjacent joints, progressive resisted training, muscle strengthening, endurance training, cryotherapy as well as electrotherapeutic modalities. A period of nine to twelve months is appropriate for postoperative rehabilitation of the ACL injury (van Melick *et al.*, 2016). Positive results were shown by the end of the program. In this case, the patient was brought to the hospital for the surgery one month after a road traffic accident, when he suddenly was unable to stand (as a result to trying to stand up, his right knee twisted and gave way).

Figure 1: X-ray of the right knee from anterior and lateral views

Patient information

A 26-year-old male, visited the physiotherapy OPD on a wheelchair with the complaints of difficulty in walking without support, pain while flexing the right knee, and hence having restricted range of motion since the last 15 days. On 8/12/19, while driving a moped, the patient met with a road traffic accident and was unable to stand without support because of pain in the right knee. Then he was immediately taken to hospital by bystanders. There, X-ray was done and he was told that he had a soft tissue injury. At the time, the patient had sharp shooting pain and swelling in the right knee slightly 2-3 cm below the patella, which was sudden in onset and lasted 1 week. After 1 month, while having lunch, he stood up when his leg suddenly twisted and he fell down, resulting in the pain in the right knee staring again. Due to this incident, he revisited the same hospital, and X-ray and MRI was done. He was diagnosed with Anterior Cruciate Ligament rupture on the right knee. But in that hospital, ligament reconstruction surgery would not be carried out. So, he came to Acharya Vinoba Bhave Rural Hospital on 12/01/2020 with the chief complains of pain and swelling. Here X-ray was done. He was operated with arthroscopy assisted Anterior Cruciate Ligament Reconstruction of the right knee. After surgery, the patient was given injection Diclotal (Diclofenac by Blue Cross Laboratories Ltd. Lower Parel, Mumbai, Maharashtra, India), and oral drugs including Polydol (Curewin Hylico Pharma Pvt Ltd, Bajara Hills, Hyderabad, India), up to 10 days after the surgery. He was also given vitamin C supplements (Limcee, Abbott Health Care Pvt Ltd, Mumbai, Maharashtra, India).

Figure 2: Sutures on the right knee after ACLR

Figure 3: Anterior view of the patient in a knee brace

Clinical Findings

A week after the ACLR surgery, the patient came to the physiotherapy department. His X-ray is shown

Figure 4: Lateral view of the patient in a knee brace

in the image (a). After taking the appropriate informed consent from him, we carried out a complete evaluation on him.

The subject walked into the department using a standard walker with a brace on his right knee in 0 degrees of flexion. He was walking with a partial weight-bearing 3-point gait, that wasn't consistent. He first placed the walker ahead of him, followed by the affected leg, then the normal leg. The heel strike and mid-stance phases of gait in the affected leg were absent during walking. When asked, the subject reported pain 8/10 on the NPRS Scale on the right knee in the region below the patella. The surgical incisional scar was clean, dry and healing well, as seen in image (b). The swelling was present on the anterior aspect of the knee joint, in the area extending from the supra-patellar region to the base of the patella. Upon palpation, tenderness of grade 2 was present on the medial aspect of the knee below the level of the patella. There was also an increase in temperature around the right knee, in comparison to the unaffected normal left knee. Range of motion goniometric testing and Manual Muscle Testing of the knee joint and the adjacent hip joint revealed that there was a decrease in range of motion as well as decreased strength in the affected knee and hip as well. Patellar mobility was tested and showed that the patella was hypomobile in the anterior-posterior and medial-lateral directions when compared to the normal extremity. Extension lag in the right lower limb was also present. Special tests, including the Anterior drawer test and the Valgus stress test, showed positive results. Figures 1, 2, 3 and 4

To confirm the findings that swelling on the affected limb was present, the girth was measured at the appropriate levels at the knee joint site. The readings were then compared with the readings of the normal, unaffected extremity. This is seen in Table 1.

In addition to these, it was decided to maintain a timeline of events, as seen in Table 2.

Physiotherapeutic intervention

The physiotherapy sessions lasted a total of 5 months. During the sessions, the following took place: educating the patient, active and passive exercises, open and close chain exercises, cryotherapy, compression, the elevation of the affected limb, administration of anti-inflammatory drugs, CPM (Continuous Passive Motion), electrical muscle stimulation, application of braces and gait training.

Week 1

Elevation of the affected limb was done to help in the gravity-assisted draining and hence the reduction of swelling.

Cryotherapy was given to the affected limb to reduce the swelling. Thus was taught to the family members and done multiple times a day (2-3 times/day) for 10 minutes each session.

Mobilization of the patella was also done in both directions; lateral and superior-inferior directions, 4-5 times a day. This was carried out for 8 weeks after the physiotherapy sessions began.

Passive flexion and extension mobilization of the affected limb was done for the first 4 weeks, 2 times a day, in order to maintain and increase the range of motion. The other unaffected body parts were actively adequately moved throughout their ranges of motions as well.

Passive and active mobilization towards flexion is also begun based on the ability of the patient to bear the pain in the process of doing so.

Strengthening exercises for the quadriceps and hamstrings, including the isometrics, were done 2 times a day, 3 repetitions, 10 seconds per repetition.

Knee brace and walker were introduced to the patient by the middle of the first week, as seen in image (c).

Week 3-4

The patient was made to attempt to walk in the hospital seen in image (d). This was done 2 times a day in order to develop his confidence, coordination and strength. He was taught to walk with the knee brace and a walker.

Week 5

Knee brace usage gradually reduced as the patient

Table 1: Girth measurement before the start of physiotherapy rehabilitation

	LEFT	RIGHT
5cm above the patella	37.1cm	39.5cm
At the patella	38cm	41cm
5cm below the patella	33.5cm	35.5cm

Table 2: Timeline of events

Events	Dates of events
The occurrence of injury (road traffic accident)	8 December 2019
The occurrence of injury (knee giving way as the patient tried to stand)	11 January 2020
The occurrence of ACLR surgery	12 January 2020
Start of physiotherapy rehabilitation	19 January 2020

was able to walk longer with an obvious improvement in the gait and knee support.

The hamstrings and quadriceps (vastus medialis) tonification process through close chain exercises were begun, gradually from lighter intensity (50% of maximum force) to an impressive progressive increase to 60-70%. These exercises included bike, leg presses, and steps progressed to squatting. They were done in 2 sessions per day, each session lasted 15 mins, with break intervals in between. They were all based on the ability of the patient to bear the pain and to control the quadriceps. The sessions were stopped if the patient proved incapable of carrying out the activities.

Proprioception and coordination exercises were begun because the overall strength was good. This was done using balance boards, 2 times a day, 10 minutes each session.

Week 10

All kinds of exercises were carried out, isometric and isotonic as well. These included forward, backward and lateral dynamic movements.

Month 3

Activities, including jumping and running, were begun, as they were more functional. Proprioceptive and coordination exercises also become heavier. As proprioceptive and coordination exercises become heavier, quicker changes in direction are possible.

Month 4-5

The final goal was achieved – Maximum strength and endurance of the knee stabilizers, and optimize neuromuscular control with plyometric exercises were capable by the patient. Variations in acceleration and deceleration in running and turning improved the arthrokinetic reflexes.

Follow up and outcomes

Table 3 shows the results of range of motion evaluation.

Table 4 shows the Manual Muscle Testing evaluation.

VAS NPRS improved drastically from 8/10 to 3/10 during rest.

LEFS score showed an improvement from 16.25% to 82.50% maximal functioning.

PSFS showed an improvement from 1/10 to 7/10

Patient's capacity increased in activities like walking, climbing stairs, bathing, using the toilet.

Lower Extremity Functional Scale (LEFS)

Pre score- 13/80, Maximal percentage function 16.25%

Post score- 66/80, Maximal percentage function 82.50%

VAS NPRS- Numeric Pain Rating Scale

Pre score- 8/10

Post score- 3/10

PSFS- Patient-specific functional scale

Pre score— 1/10

Post score – 7/10

DISCUSSION

The patient was a case of post-operative ACLR surgery with the complaints of difficulty in walk-

Table 3: Results of the range of motion evaluation

	Base Line		Discharge	
AROM	Left	Right	Left	Right
1. 1.	0-117	0-63	0-117	0-114
1. 2.	117-0	63-0	117-0	81-0
1. 3.	0-119	0-76	0-120	0-85
1. 4.	119-0	76-0	120-0	85-0

Table 4: Manual Muscle Testing evaluation

	Base Line		Discharge	
	Left	Right	Left	Right
1. 1.	5/5	3/5	5/5	4/5
1. 2.	5/5	3/5	5/5	4/5
1. 3.	5/5	4/5	5/5	5/5
1. 4.	5/5	4/5	5/5	5/5

ing without support and pain while flexing the right knee with a decreased range of motion. The patient's history was taken and it came to our notice that he did not undergo any pre-operative physiotherapeutic sessions and that he was coming to the physiotherapy department for his first official session one week after the surgery had taken place. A rehabilitative plan was then prepared for him, which included cryotherapy, strengthening and close chain exercises exercise for the affected lower limb, patellar mobilizations, proprioception and coordination training. Improvements in the available ranges of motions and muscle strengths are shown in Tables 3 and 4 respectively.

Cryotherapy was done initially for the first week of treatment to reduce the swelling. This caused vasoconstriction to reduce extravasation of fluid and inhibits the conduction of afferent nerve, hence decreases pain and muscle spasm; and prevents the death of cells. This directly reduces the chemical mediator's release of inflammation, edema and pain. Then the further forms of treatment could be focused on. (Brotzman and Wilk, 1996)

Patellar mobilizations were done laterally side to side, and superiorly-inferiorly as well. Patellar mobilizations have shown to prevent the shortening of the patellar tendon or the formation of retinacular contracture, ultimately preventing the loss of motion. (Brotzman and Wilk, 1996)

Closed chain exercises were focused on as a means of strengthening and increasing the range of motion, and for ACLR rehabilitation, close chain exercises are proven to be a better option than open chain exercises because they show to generate a lower shear force anteriorly and lesser displacement of the tibia through most of the flexion motion range. On the other hand, extension in open chain exercises places a significant amount of strain on the

patellofemoral joint and the ACL. CPM was carried out due to the formation of arthrofibrosis. (Brotzman and Wilk, 1996)

Proprioception training was done with a focus on the higher brain center control (carrying out repetitive conscious positioning activities, hence maximizing the sensory inputs directly reinforcing movements with proper joint stabilization), unconscious control (developed by including techniques involving distractions into the activities), brain stem control (implementing the use of postural balance, beginning with visual activities with the eyes open, and gradually progressing to those with closed eyes. (Lephart *et al.*, 1997; Hart *et al.*, 2016)

Rehabilitative brace (transitional brace) was used in the early postoperative period as it protects the donor site during muscle activity, weight-bearing, and movement. (Brotzman and Wilk, 1996)

CONCLUSION

Anterior Cruciate Ligament Reconstruction is a frequent occurrence, especially amongst sports athletes. This particular case, however, did not undergo pre-operative physiotherapeutic sessions and also did not start the post-operative sessions as soon as he should have. Due to the consequences of this poor decision or rather lack of awareness, a rehabilitation program was appropriately designed to bring about the ability to carry out activities of daily living by reducing the swelling, strengthening and increasing the range of motion of the left lower limb's knee joint.

From this case, we learn that patient education about the importance of physiotherapeutic sessions are important in the long run for the rehabilitation and return to the ability to carry out activities of daily living independently.

Patient's consent

Appropriate consent was taken from the patients to write this case report.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

Funding Support

The authors declare that they have no funding support for this study.

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