PHYSIOTHERAPY MANAGEMENT POST RECONSTRUCTION ANTERIOR CRUCIATE LIGAMENT : A CASE STUDY

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Abstract

Introduction: Anterior Cruciate Ligament (ACL) is one of the ligaments present in the knee and serves as a stabilizer of the anterior translation of the femur bone. Non-contact injuries are most common in athletes, usually due to sudden shaft changes resulting in tibia translation of the femur. About 60% of sports injuries are most common in the lower limbs, as many as 16% of injuries are caused by torn ligaments from the knee. Post-reconstruction rehabilitation of ACL aims to prevent complications such as swelling, limited scope of joint motion, muscle weakness, decreased balance and restoration of knee functional abilities

Case Presentation: A 23-year-old patient came to one of the hospitals in Semarang with a diagnosis of sinistra ACL rupture, underwent reconstruction 2 months ago. Currently the patient undergoes a phase 2 physiotherapy program because he still complains of mild pain, joint stiffness when waking up, limited joint movement.

Management and Outcome: Therapy is carried out for 4 weeks, with an exercise program using static bicycle, lunges, single leg, squat, single leg with cone, side step with theraband. Some tests are performed such as pain measurement using NRS (Numeric Rating Scale), measurement of joint sphere of motion using goneometer, and atrophy measurement using meterline.

Discussion: Exercises given in patients post ACL reconstruction aim to improve susceptible joint motion, stimulate blood circulation, maintain muscle elasticity and reduce pain. Significant loss of function as well as inhibition of nerves can lead to atrophy. It causes quadriceps to become weak. To train the strength of the hamstring muscles and quadriceps can use close kinetic chain exercises to produce co-contraction of the muscles around the joints.

Conclusion: In this case, it shows that close kinetic chain exercises can increase the range of motion of the joints, reduce pain, and prevent atrophy

Keyword : Anterior Cruciate Ligament, Rehabilitation, Close Kinetic Chain, Physiotherapy

Introduction

Anterior Cruciate Ligament (ACL) is one of the ligaments present in the knee and serves as a stabilizer of the anterior translation of the femur bone. ACL consists of two bundles namely posterolateral and anteromedial. ACL injury mechanisms are common due to direct contact, indirect contact, and non-contact. Direct contact injury occurs as a result of a person or object hitting the knee directly. Injuries do not occur immediately as a result of a person or object hitting a part other than the knee. Non-contact injuries are most common in athletes, usually due to sudden shaft changes resulting in tibia translation of the femur. Cases of ACL tear in sports injuries occur approximately 64%, this injury results in 120,000-200,000 ACL reconstructions are common in the United States (1). About 60% of sports injuries occur most in the lower limbs, as many as 16% of injuries are caused by tearing of the ligaments from the knee (2). Torn ACL causes unstable knees, damage to joint structure, changes in function, and disrupts daily activities (3).

In case of tearing of the ACL will be performed a procedure to graft the ACL with tendon tissue that can restore the function of fixation and stabilization of the joints. Tendon reconstruction is commonly used for reconstruction, hamstrings, quadriceps, and pattelar. The use of hamstring graft has the advantage of a good return of strength tension, a return to the condition before good surgery, a larger graft diameter as well as the integrity of the extensor muscle mechanism. However, there are some drawbacks to the use of hamstring grafts which require longer recovery, low mechanical strength, and longer bone graft integrity (4). Post-reconstruction rehabilitation of ACL aims to prevent complications such as swelling, limited scope of joint motion, muscle weakness, decreased balance and restoration of knee functional abilities (5). We aim to report the effect of rehabilitation on patients post ACL reconstruction in phase 2.

Case Presentation

A patient named Mr. R aged 23 years who worked as a student underwent a physiotherapy program because he complained of limited scope of joint motion, mild pain when used for knee flexion, and stiffness when waking up. At the end of January 2021 the patient fell into a slip while playing ball, then felt his left leg unstable when used for walking. A few days after the incident, the patient went to the doctor and performed an

MRI, the doctor's diagnosis said that there was a tear in the ACL (figure 1). Then, patients are advised to have surgery on April 24. After the surgery, the patient underwent a physiotherapy program on May 12 and until June was still undergoing an exercise program. By the time the patient has entered the phase 2 exercise program, the goal of this phase 2 exercise is to improve muscle strength, train balance, and improve ROM.

At the beginning of post-reconstruction, the patient complained of pain in the left knee and was unable to bend the knee. After attending the training program for almost 2 months, the patient has been able to bend the knee, the pain has begun to decrease and the functional activity of the knee also begins to increase. From vital sign examination shows that blood pressure 110/80 (normal), pulse rate 82x/min, breathing 20x/min, height 170 cm, and weight 63 kg. During static inspection, there was atrophy in the left quadriceps and traces of incision were visible.

Figure 1. An MRI of the left knee showed a tear in the ACL

Management and Outcome

The post-reconstruction ACL phase 2 rehabilitation program is conducted for 4 weeks with intensity as much as 3 times a week. Pain measurement using Numeric Rating Scale (NRS), joint sphere measurement using goneometer, and atrophy measurement using anthropometry with meterline. Before being given exercise, the patient first warms up to prepare the muscles to avoid cramping during exercise. Instruct exercise movements and explain the benefits of exercise to the patient (6). Here is the exercise program conducted:

1. Static Bicycle

   Performed 3x/week with a duration of 10-20 minutes. It aims to increase muscle strength, endurance, and maintain the scope of joint motion.

2. Lunges

   The position of the sore leg is used as the pedestal, then perform lunges with a 90º flexible knee position. Modification of lunges can be applied to patients, including: forward lunges on the surface are flat, lateral lunges on the surface are flat, forward lunges above bosu, lateral lunges above bosu. The exercise dose is done as much as 20x reps with 2 repetitions..

3. Single Leg Stance

   Aim to strengthen the muscles around the limbs and train balance. Single leg stance can be done on a flat surface or above the bosu. The duration of the exercise is 15 seconds/movement with 10x reps.

4. Squat

   Aims to increase the strength of the muscles of hip and knee extensors. Exercises are given with 20x the count for 2 sets. During exercise, the patient uses theraband for knee stabilization. Squat modification can be given to patients, including: single leg squat, split squat, and dynamic squat by carrying weights.

5. Single Leg Stance With Cone

   The patient is in the intrsuksikan to stand on one leg. Then place the cone in front of the patient, signaling to move the foot forward touching the cone then back to the center. This exercise aims to strengthen the muscles of the limbs as well as train balance. The exercise dose is 10x the count of 5 sets.

6. Side Step With Theraband

   Exercises aim to improve stability and improve hip. Instruct the patient to step aside by 8x the count/10 set.

After the examination, the patient complained that there was still stiffness in the knee when waking up and on the examination of pain with NRS showed mild pain especially when bending the knee.

Table 1. Pain measurement results using NRS

Pain	**Value**
Motionless	0/10
Press	0/10
Motion	3/10

For flexion movements and knee extensions patients have been able to do so, but there are still limitations compared to the healthy side. To measure the movement using a goniometer with the following results :

Table 2. LGS measurement results with Goneometer

	Dextra	**Sinistra**
Active Motion	S: 5°-0°-140°	S: 5°-0°-135°
Passive Motion	S: 5°-0°-145°	S: 5°-0°-140°

To determine the presence of atropy or not, measurements can be taken using anthropometry. Measurements are performed on both limbs, to distinguish on the sick side from the healthy side. The benchmark point used for measurement is the tuberosity of the tibia. To measure the upper limbs, pull the meterline 10 cm, 15 cm, and 20 cm upwards. Then, to measure the lower limbs pull the meterline 10 cm and 15 cm from the tuberositas tibia to the lower limbs, then compare with the other side.

Table 3. Anthropometry measurement results

	Sinistra	**Dextra**	**Difference**
10 cm and above from Tuberositas Tibia	38 cm	37,5 cm	0,5 cm
15 cm and above from Tuberositas Tibia	41 cm	41,5 cm	0,5 cm
20 cm and above from Tuberositas Tibia	48,5 cm	49 cm	0,5 cm
10 cm down from Tuberositas Tibia	32,5 cm	34,5 cm	2cm
15 cm and down from Tuberositas Tibia	30,2 cm	31 cm	0,8 cm

Discussion

Exercise therapy given in post-ACL reconstruction cases aims to improve joint movement, stimulate blood circulation, maintain muscle elasticity and reduce pain (7). The exercise will stimulate motor neurons (brain) with the release of transmitters (acetylcholine) to stimulate cells to activate calcium so that protein integrity occurs. If calcium and troponin C are activated then actin and myosin are maintained so that skeletal muscle function can be maintained so that there is an increase in muscle tone. The contraction mechanism can increase smooth muscles in the extremities. ROM exercises can cause stimuli so that chemical, neuromuscular, and muskuler activity increases. Smooth muscles in the extremities contain actin and myosin filaments that have chemical properties and interact with each other. The interaction process is activated by calcium and ATP, then broken down into ADP to provide energy to the contraction of the extremity muscles. Repetitive exercises can improve quality as best as possible (8).

Muscle strength is influenced by nerves and morphological factors. Significant loss of function as well as inhibition of nerves can lead to atrophy characterized by loss of strength and function. Atrophy and activation failure cause weakness in quadriceps, thus muscle mass resolution and nerve activation are key aspects of ACL rehabilitation (9). To train the strength of the hamstring muscles and quadriceps can use close kinetic chain exercises to produce muscle co-contraksi around the joints and compression in the joints, resulting in increased joint stability (10).

Conclusion

In this case, it shows that close kinetic chain exercises can increase the range of motion of the joints, reduce pain, and prevent atrophy.

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