Indonesian Journal of Medicine (2023), 08(04): 376-384
Masters Program in Public Health, Universitas Sebelas Maret

Case report
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Physiotherapy Rehabilitation for Accelerating the Recovery of Patient with Anterior Cruciate Ligament Total Reconstruction and Meniscal Repair: A Case Report

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Received: 11 July 2023; Accepted: 15 August 2023; Available online: 10 October 2023

ABSTRACT

Background: The Anterior Cruciate Ligament (ACL) is a ligament that functions to limit the movement of the tibia toward the anterior and excessive rotation, while the meniscus serves as shock absorption, load transmission, and as the stabilizer of the knee joint. About 22% to 86% meniscal tear incidences occurring along with ACL injuries is. The study aims to determine the role of physiotherapists in the postoperative rehabilitation process of patients of ACL Reconstruction (ACLR) and meniscal repair in preventing postoperative complications and functional abilities of patients.
Case Report: The patient was a 35-year-old adult male who suffered a complete tear in the ACL and meniscus of the left knee. The patient underwent ACLR and meniscal repair with arthroscopic surgery 2 years after injury with Bone-Pattelar tendon-bone autograph. 2 weeks post-surgery the patient visited the physiotherapy polyclinic with medical conditions of difficulty in bending and straightening the knee, still feeling pain and thick in the knee area.
Results: The physiotherapist program was conducted three times and it was a home program-based exercise. The physiotherapist program and outcomes used in the first phase focused on exercises to improve ROM (Goniometer), oedema management (Medline), pain reduction (Numerical Rating Scale), activation exercises, and surrounding muscle strength (Sphygmomanometer), and improve functional ability (Tegner Lysholm Knee Scale) as well as the provision of home programs Performed by regular monitoring of exercise intensity using isometric, isotonic, and isokinetic exercises, which were given according to the concept of progressive loading.
Conclusion: This case study shows that surgery combined with a comprehensive physiotherapy program plan in ACLR and meniscal repair cases, as well as adding home-based exercise programs with intense monitoring, generate more effective results.

Keywords: physiotherapy rehabilitation, anterior cruciate ligament total, meniscal repair

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Cite this as:
Perdana SS, Kasumbung MT, Larasati P, Setianing R (2023). Physiotherapy Rehabilitation for Accelerating the Recovery of Patient with Anterior Cruciate Ligament Total Reconstruction and Meniscal Repair: A Case Report. Indones J Med. 08(04): 376-384. https://doi.org/10.26911/theijmed.2023.08.04.04.

BACKGROUND

Anterior Cruciate Ligament (ACL) is a ligament in the knee joint that functions to limit the movement of the tibia bone so that it does not move to the anterior and excessive rotation (Lippert, 2011; Filbay and Grindem, 2019; Magee, 2021) While the meniscus is responsible for shock absorption, load transmission, and stability in the knee joint (Mueller et al., 2016) The function of both is very important in the body because most of the body's weights are on the legs, especially on the knee joints and this also makes the incidence of injuries to the ACL and meniscus quite high. According to Teyhen and Robertson (2018) 22% - 86% of meniscal tear incidents occur along with ACL injury. The incidence of ACL injuries in some countries in Europe ranges from 29 to 32 cases per 100,000 people (Singh, 2018) While meniscal tear is 12% to 14% with the incidence of 61 cases per 100,000 people (Teyhen dan Robertson, 2018).

ACL and meniscus injuries generally occur in sports that involve loading the knee joint that moves a lot such as zigzag movements, pivoting, rapid and sudden changes in the direction of motion such as football, basketball, volleyball, futsal and others. In ACL injuries, knee instability occurs because there is nothing could resist anterior movement and rotation. When instability occurs repeatedly and unconsciously the body will put a load on other limbs such as the meniscus so that the meniscus experiences excessive loading and repeated friction on the meniscus which causes the meniscus to be injured (Salem et al., 2018; ; Bustam, 2023).

Meniscal repair performed at the time of ACL reconstruction has a healing rate and clinical success of more than 90%, it is a better result compared to isolated meniscal repair (Adams et al., 2012). Treatment of ACL tear cases is conducted by grafting the ACL with tendon tissue to restore the stabilization function of the ACL ligament in the knee joint. Options for ligament reconstruction include autograft (a grafting process that uses tissue derived from the patient's body) or allograft (a grafting process that uses tissue derived from another person's donor or synthetic material) (Sim et al., 2022) Meniscal repair is performed by arthroscopic fixation technique (Adams et al., 2012).

The selection of grafting is based on the conditions that exist in each patient, each selection of grafting and techniques has its own advantages and disadvantages so that in the subsequent rehabilitation phase it will require a communication between the orthopedic doctors and the physiotherapists who provide programs so that it can be easier to prevent and recover complications that may occur. After the ACL reconstruction and meniscal repair, the patient will enter the rehabilitation phase to restore body function and ability, especially around the knee joint and other joints affected due to the side effects obtained after the procedure, for an athlete, the rehabilitation phase reaches the back to sport phase.

Rehabilitation is the most important component of the recovery process after ACL reconstruction and meniscal repair, the goal of the first phase of rehabilitation is to prevent complications that will occur such as swelling, decreased joint range of movement, muscle weakness and decreased knee function (Cerulli et al., 2013). In the Sanford health guideline for ACL rehabilitation, physiotherapists should continue to make sound clinical decisions regarding the patient's postoperative management based on examination/treatment findings, individual progress, and/or any postoperative complications (Sanford, 2022). So, this is

what will be considered by a physiotherapist in carrying out future actions.

According to the Journal of Orthopedic &; Sports Physical Therapy (JOSPT) on the rehabilitation process of postoperative patients after ACL reconstruction and meniscal repair, the role of physiotherapists is to prevent post-reconstruction complications in reducing edema, increasing thigh muscle strength, knee joint range of movement, improving performance and functional ability of patients (Adams et al., 2012; Melani, Munawwarah and Maratis, 2021).

Based on the previous presentation, the author is interested in publishing a case study entitled A Case Report: Physiotherapy Rehabilitation for Accelerating the Recovery of Patient with Anterior Cruciate Ligament Total Reconstruction and Meniscal Repair in the initial phase of using Journal of Orthopedic & Sports Physical Therapy (JOSPT) guidelines in 2012.

CASE PRESENTATION

The patient was a 58-year-old man who worked as a table tennis coach at the National Paralympic Committee (NPC), The patient suffered a knee injury 2 years ago in his left knee, due to falling during training with the condition of pivoting lower leg. After the incident, the patient could not walk and had to rest for 2 weeks. However, after such a long rest, the patient still felt pain and instability in his left knee. When returning to work to train table tennis, the patient experienced pain and swelling appeared in the left knee after training, the pain felt was a dull pain, in the anterior and medial aspects of the knee, at that time the patient felt pain while walking and subsided while resting, with the pain measurement obtained using NRS was 7.

After 2 years of injury with the pain that was continuously coming and going, the patient decided to go to Prof. Soeharso Surakarta Orthopedic Hospital. The results of MRI examination obtained a diagnosis of total rupture of the ACL and meniscal tear. Furthermore, the patient was scheduled to perform ACL Reconstruction and meniscal repair surgery with arthroscopy techniques using bone to bone patella tendon grafting without slabs and braces. Two weeks post-surgery, the patient visited physiotherapy with a knee condition of semi-flexion position, limited knee extension and flexion, walking using crutches with a two-point gait NWB (Non-Weight Bearing), muscle tension in calf and thigh.

After obtaining informed consent from the patient, a physical examination and examination of vital signs were carried out (Table 1.). Based on the findings of the static inspection examination, it was found that there was oedema in the patient's left knee and lower leg, there was an incise wound in the left knee. During dynamic examination, the patient was seen enduring pain when bending and straightening his knees, and walking using crutches with a two-point gait NWB (Non-Weight Bearing) walking pattern. Based on the findings of these vital signs, the patient showed normal conditions in various aspects such as blood pressure, breathing, pulse, and temperature.

Basic motion tests were performed which included active motion test, passive motion test, and isometric motion test. On active test it was found that there was a limited range of movement in the left knee joint and accompanied by motion pain, thick feeling at the back of the knee, and the passive motion test discovered a limited range of movement in the left knee joint with boggy end feel.

On resisted isometric test, there were contractions and the absence of pain in the thigh muscles while moving. The purpose of the resisted test was to ensure that the pain

felt by the patient did not come from muscle problems, afterward for the findings of palpation there was tenderness in ITB and calf muscle, and also the temperature difference between the left and right knees due to edema in the patient's knee. NRS (Numerical Rating Scale) was used for pain measurement. A sphygmomanometer was used to measure the muscles' ability to performa quad set by placing an inflated sphygmomanometer under the patient's knee after that the patient is instructed to press the sphygmomanometer with a quad set movement as hard as possible, whereas a goniometer was used for measuring the range of movement of the joints. NRS measurement was performed with several pain tests at rest, and pain test during movement (Table.2). A sphygmomanometer was used to measure the muscles' ability to perform a quad set by placing an inflated sphygmomanometer under the patient's knee after that the patient is instructed to press the sphygmomanometer with a quad set movement as hard as possible (Table.3).

Examination of the patient's range of movement, especially in the knee and left ankle joints that have limited movement, was conducted by using a goniometer measuring instrument it was performed by placing the axis in the middle, on the lateral epicondyle of femur then the stationary arm was placed on the midline femur and the moving arm was located on the lateral midline of the fibula (Table.4) and to measure the patient's functional level the Tegner Lysholm Knee Scale was used, which is an instrument consisting of subscales for pain, instability, locking, swelling, limp, stair climbing, squatting, and the need for support (Table. 5). Anthropometry examination for the limb or segment circumference was conducted by using meter line measuring instruments at several points (Table.6).

RESULTS

After undergoing a physiotherapy program at Surakarta Orthopedic Hospital for two weeks with three physiotherapist sessions, the results obtained were decreased pain, increased quad set ability, increased ROM (Range of movement), increased functional ability, and decreased oedema. Pain assessment using NRS at the first assessment with a value of static pain was 4 and motion pain was 8 after routine physiotherapist intervention there was a decrease in pain with the final result in measuring the value of silent pain and motion pain with values 1 and 3.

The results obtained from measuring the ability of the thigh muscle in quad set movement using a sphygmomanometer showed that there was an increase in thigh muscle strength in the quad set position with an increase from a muscle value of 20 mmHg to a muscle value of 65 mmHg. The range of movement of the joints measurement in the patient using goniometers before and after physiotherapy intervention, discovered an increase in ROM in the flexion and extension of the patient's left knee which was originally from the value of S = 00 - 150 - 700 to S = 00 - 50 - 900, there was an increase of 20^{0} in knee flexion and a reduction in the starting point of 10^{0} in the left knee.

The functional ability measurement using the Tegner Lysholm Knee Scale questionnaire discovered a significant increase in functional aspects of symptom reduction, increased sport activity and also functional knees from a value of 17% to 40%. Anthropometric measurement of the limbs on the first to third days showed a decrease in the circle in the area of 10 cm Above Tuberosity of the tibia from 34 cm to 32 cm, from these results it can be concluded that there is a decrease in the level of oedema in the knee joint.

Table 1. Vital Signs

	Vital Signs	Value
1	Blood Pressure	130/80 mmHg
2	Pulse	88x/min
3	Respiration rate	S22x/min
4	Temperature	36.4° C
5	Height	164 cm
6	Weight	69 kg

Table 2. Pain Assessment using Numerical Rating Scale

NRS	T_0
Static pain	4/10
Pain in movement	8/10

Table 3. Quad set assessment using Sphygmomanometer

Treatment	Dextra	Sinistra
T_0	100 mmHg	20 mmHg

Table 4. Range of movement Assessment

Region	Treatment	AROM		PROM	
		Dextra	Sinistra	Dextra	Sinistra
HIP	T_0	S= 15°- 0°- 120°	S= 15°- 0°-90°	S= 20°- 0°- 125°	S= 20°- 0°- 95°
Knee	T_0	S= 0°- 0°- 140°	S= 0°- 20°- 70°	S= 0°- 0°- 140°	S= 0°- 15°- 75°
Ankle	T_0	S= 20°- 0°- 50°	S= 10°- 0°- 50°	S= 25°- 0°- 55°	S= 15°- 0°- 55°

Table 5. Functional Ability Assessment

Treatment	Disability Score
T_0	17% (dissatisfying)

Table 6. Leg Anthropometry Assessment

No	Limb	Left	Right
1	30 cm Above Tuberosity of the tibia	52 cm	54 cm
2	20 cm Above Tuberosity of the tibia	48 cm	49 cm
3	10 cm Above Tuberosity of the tibia	34 cm	34 cm
4	9 cm Below Tuberosity of the tibia	46 cm	48 cm

Timeline: The first meeting was 3 weeks postoperative on 07 November 2022 and the treatment was carried out until 10 November 2022 in the physiotherapy rehabilitation room of Prof. Soeharso Surakarta Orthopedic Hospital.

Diagnostic Assessment

When patients came to the Orthopedic Hospital Prof.Dr.R.Soeharso Surakarta several specific tests were carried out before the surgery such as anterior drawer test, Lachman, and writing, and all three showed positive results. MRI showed a grade 3 ACL tear and tear in the medial meniscus. From the examination conducted, it can be concluded that the patient's medical diagnosis was ACL rupture and sinistra medial meniscal tear.

Therapeutic Intervention

The physiotherapy process was carried out to patients during physiotherapy rehabilitation at the Orthopedic Hospital Prof. Dr. R Soeharso Surakarta and provided several home programs. The objectives of the intervention performed on patients in the early phase rehabilitation after ACLR and meniscal repair were to reduce pain, increase the patient's muscle strength, increase the range of movement of the right knee joint, and also improve the patient's functional ability.

Tabel 7. Protocol Treatment provided for the patient

Intervention	Dose	Result
Treatment 1, 2, 3		
Patellar Mobilization	F: 1 time I: light T: for 5 minutes T: mobilization	Improved Range of movement Outcome: Goniometer
Ultrasound + Tens (Transcutaneous Electrical Nerve Stimulation)	F: 1 time I: Tens: 100 µs US: 1 MHz 1 W/cm², duty 1:2 T: Tens:15 minutes US: 3 minutes T: Physical agent	Reduce pain and facilitation regeneration. Outcome: NRS
NMES (Neuromuscular Electrical Stimulation) + Quad set	F: 1 Kali I: 2500 Hz Burst AC, Symmetrical, 60Hz, Isometric exercise, 10s active: 10s no active, 2 up 1 down. T: 15 times contraction T: Physical agent	Improved Muscle Strength Outcome: Sfigmomanometer
Prone Hang	F: 1 time I: light 0.5 kg T: 1 minute T: ROM exe	Improved Range of movement Outcome: Goniometer
Soft Tissue Release pada culf muscle dan hamstring	F: 1 time/ session I: Toleransi pasien T: 10 repetitions / 2 set T: Release	Improved Range of movement, circulation of muscle, and relaxing muscle
Home Program		
Quad Set	F: 5 times/day I: Hold for 10 seconds rest for 8 seconds T: 10 repetition 2 sets T: Muscle Activation	Activation Muscle Outcome: Sfigmomanometer
Straight Leg Raise flexion, extention, extention, dan abduction.	F: 2 times/ day I: hold for 10 seconds, rest for 8 seconds T: 10 repetitions 2 sets T: Muscle Activation	Muscle Activation
Hells Slide	F: 2 times/day I: light T: 10 repetitions 2 sets T: ROM exe	Improved Range of movement Outcome: Goniometer

Intervention	Dose	Result
Ankle exercise 4 direct	F: 2 times/day I: theraband T: 10 repetitions 2 sets/direction T: ROM exe	Improved Range of movement Outcome: Goniometer
Compress ice	F: 3 times/day I: light T: 10–15 minutes/session T: Icing	Decrease of oedema

F: Frequency, I: Intensity, T: Time, T: Type

DISCUSSION

The duration of the rehabilitation protocol is individualized and depends on the patient's ability to safely return to pre-injury activity levels (Kotsifaki et al., 2023) therefore the physiotherapist program provided for a certain patient must see the patient's condition and activity before the patient is injured because the better the patient's activity and even regularly conduct exercises, the better the pace of recovery.

The physiotherapist program that has been given on ACLR rehabilitation and meniscal repair in this case was aimed at reducing pain and edema, increasing the range of movement of the joints, and also strengthening the muscles to achieve in each stage or subsequent phase. This case report demonstrates the potential for effective recovery after ACLR and meniscal repair, ROM changes in the flexion and extension of the patient's left knee from S = 0^o - 15^o - 70^o menjadi S = 0^o - 5^o - 90^o in 3 meetings and shows better recovery potential.

The protocol we used in the initial phase, concentrated very much on full knee extension recovery, no loading on the knee joint for 4 weeks, swelling control, no knee extension lag when doing straight leg raise movements and quadriceps muscle strengthening , (Adams et al., 2012). The recovery process, the treatment given aims to restore muscle strength with isometric, isotonic, and isokinetic exercises, which are given in accordance with the concept of progressive repetitions loading (David C. Reid et al., 2018).

The provision of modalities in the form of TENS, NMES and US is a modality that is very helpful in the recovery process. According to Kotsifaki et al., 2023 the use of NMES in the earliest phase after surgery is either to stimulate muscle activation or minimize expected disuse atrophy. In the initial phase, NMES can be used during functional activities to further facilitate the acquisition of muscle strength.

The use of TENS aims to relieve pain and then accompanied by exercises it will be easier to relax the quadriceps muscle around the postoperative area making it easier for patients to move the knee joint (Forogh et al., 2017). The use of ultrasound in acute cases of injury and in the inflammatory phase aims to help tissues that are undergoing regeneration in the formation of collagen and increase the regeneration process (Lai et al., 2021).

This case report contains a physiotherapist program plan used after ACL Reconstruction and meniscal repair, including home program exercise planning with two weeks of continuous monitoring and three physiotherapist sessions at Surakarta Orthopedic hospital. The physiotherapy program after ACL reconstruction and

meniscal repair used JOSPT guidelines and other additional protocols in the early stages of rehabilitation to result in pain reduction, decreased edema, increased muscle strength, and can improve the patient's functional ability after ACL reconstruction and meniscal repair.

The good results obtained were supported by the level of patient compliance in visiting the hospital and doing the provided home program so that the things mentioned above could be achieved, therefore it is important to provide education related to the condition he is experiencing, the purpose of treatment and exercise for each physiotherapist session, and what must be done by the patient and what the patient must avoid so that the patient is more enthusiastic and understands what he should do, hence it will also encourage patient's compliance toward the physiotherapist program process.

We recommend that the exercises given should use individual principles, objectivity and sort out exercises that cannot be generalized to all patients. Physiotherapists should continue to make informed clinical decisions regarding the patient's postoperative management based on examination or medication findings, functional progress and/or the presence of postoperative complications.

AUTHOR CONTRIBUTION

The first and fourth authors contributed to the writing of the article, and advised on the analytical procedures used in research methodology. The second and third authors conducted a review of the entire article, and collected data, The first, second, third, and fourth authors all contributed to the writing of this article.

FINANCIAL AND SPONSORSHIP

None.

ACKNOWLEDGEMENT

None

CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

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