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PHYSIOTHERAPY PROGRAM IN NON-OPERATIVE GRADE 2 ANTERIOR CRUCIATE LIGAMENT INJURY : A CASE STUDY

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Abstract

Introduction: An ACL injury is a damage to the anterior cruciate ligament (ACL), which is the strong tissue that helps connect the femur and tibia. ACL injuries most often occur during sports activities such as football, basketball, badminton that have a lot of motion during sudden stops, changes of direction, jumps, and landings. The incidence of ACL injuries is estimated to range from 30 to 78 per 100,000 people annually. Generally, ACL injuries are performed by ACL reconstruction procedures to restore joint motion function in the knee. However, some people with ACL injuries choose not to undergo ACL reconstruction due to various factors that underlie their reasons. Some of them managed to return to some level of function with non-operative management. Therefore, the role of physiotherapy in non-operative ACL management is to prevent more severe tissue damage, restore movement function and maximize strength by modifying the patient's daily movements or activities to become more optimal.

Case Presentation: A 27 years male. He works as a private employee, residing in Solo, Central Java. examinations that have been carried out on the patient found muscle stiffness and tenderness and pain in motion and positive findings were also found during a specific examination using the anterior drawer test and the Lachman test.

Management and Outcome: Physiotherapy modalities with infrared, Kinesio taping myofascial release, and combined with muscle strengthening exercises can reduce pain and muscle spasms in ACL patients with non-operative procedures. Furthermore, to determine the patient's progress, measurement results were used in the form of a Numeric Rating Scale (NRS) to measure pain, Manual Muscle Testing (MMT) to measure muscle strength and Knee injury, and Osteoarthritis Outcome Score (KOOS) to measure knee function.

Discussion: Several studies have revealed that the use of infrared modalities, Kinesio taping, myofascial release by adding muscle strengthening exercises have a positive effect in reducing pain and stiffness in muscles in cases of ACL injuries. The author tries to prove it

by applying several modalities that have been studied previously

Conclusion: The physiotherapy program which was carried out in 3 weeks with the physiotherapy modalities used such as Infrared, Myofacial Release, Kinesio Taping, and Strengthening Exercises was able to reduce pain and restore body functions to carry out daily activities. However, no significant increase in muscle strength was found. It can be concluded that this exercise is effective for the short term and helps restore the patient's functional activity.

Keyword: Anterior Cruciate Ligament, Infrared, Myofacial Release, Kinesio taping, Strengthening Muscle Exercise, Numeric Rating Scale, Manual Muscle Testing, Knee injury and Osteoarthritis Outcome Score



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Introduction

Anterior cruciate ligament (ACL) injuries are a common injury in the young adult population. The incidence of ACL injuries is found in more than 200,000 cases, with 100,000 of these knees undergoing reconstruction each year. References found that amateur sports groups, such as football, basketball, and badminton, had a higher incidence of ACL than the population and lower than among professional athletes. Most people with ACL injuries are younger adults, the long-term risk of ACL injury is highly dependent on poor knee function leading to chronic pain, joint functional limitations decreased quality of life and disability. (Adhitya, 2020)

The main function of the anterior cruciate ligament (ACL) is to prevent anterior translation of the tibia to the femur and also to maintain lateral rotation of the tibia in knee flexion. With this combined function, the ACL provides stability to the knee and is essential during the agility movements required in sports. The ACL usually occurs in non-contact sports injuries that occur suddenly during a landing motion or change of direction. Anterior cruciate ligament reconstruction improved between 1994. (Brown, 2016)

Historically, ACL reconstruction was performed to try to restore normal joint arthrokinematics, increase the patient's potential to return to exercise, and reduce the likelihood of post-traumatic osteoarthritis. However, recent evidence suggests a higher than previously reported rate of second ACL injury, a lower rate of return to sport, and a high incidence of OA, despite ACL reconstruction. Therefore, some patients choose not to undergo ACL reconstruction, with a percentage of them able to return to some level of function with non-operative management. Not all patients are willing to undergo ACL reconstruction, some choose to undergo non-operative treatment after ACL injury with a commitment to activity modification. Patients who lead more sedentary lifestyles and have less physically demanding jobs, choosing to modify activities to participate in sporting activities such as jogging and cycling are more likely to succeed with non-operative courses. (Paterno, 2017)

Based on the ACL Non-Operative Protocol South Sore Hospital (Geary, n.d.) this protocol focuses on maintaining range of motion, flexibility, and leg muscle strength. This focus is suitable to use considering that the patient suffered an injury a year ago which can be categorized as phase 4. The role of physiotherapy in non-operative ACL patients, especially grade 2 is to maintain body movement function, maximize strength by applying protocols regarding the rehabilitation of non-operative ACL injuries by providing several modalities in the form of Infrared, Myofascial Release, Kinesio Taping, and Strengthening Exercise, with the aim of the patient being able to participate in the desired activity without any disturbance of functional instability.

Case Presentation

A 27 years male. He works as a private employee, residing in Solo, Central Java. He complained of pain in the left knee and muscle stiffness in the quadriceps and side areas. The patient has experienced pain for about 3 days, activities that aggravate the patient when carrying out activities that require strength in the legs such as climbing stairs, stepping on car pedals, and exercising. Complaints were reduced when the patient rested. The patient has a penchant for lifting weights with a duration of 5-6 days per week. The patient used to be a basketball player who often participated in competitions, the activity stopped when the patient suffered a knee injury about a year ago, the patient chose not to undergo surgery because several factors caused the patient not to be ready for the surgical procedure.

The goals to be achieved are reducing the pain felt by the patient during activities, increasing and maximizing muscle strength, and optimizing the patient's daily activities so that they can return to activities and exercise again.

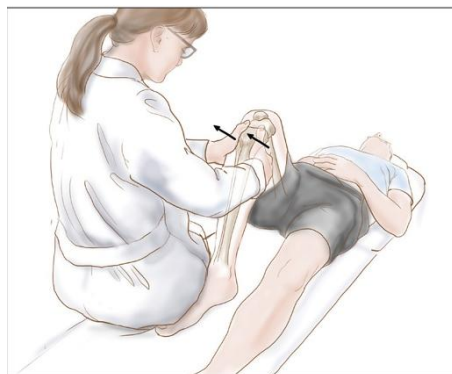
Management and Outcome

The patient underwent a physical examination before undergoing treatment. Physical examination was carried out with IPPA and vital signs. On palpation found muscle spasm in the quadriceps and the patient's left hamstring. On inspection, there was no swelling in the left knee. To check other vital signs such as blood pressure, pulse, respiration, and body temperature in normal conditions.

Basic movement examination is done by examining active, passive, and isometric movements against the resistance of the patient. At the time of active movement in getting limited flexion accompanied by pain. Passive motion examination did not find any limitation of motion or pain. Isometric examination against resistance found limited ROM during flexion and the patient was able to resist resistance during extension.

Furthermore, the physiotherapist performs a specific examination to establish a diagnosis according to the patient's complaints and history, then the Anterior Drawer test is carried

out while the procedure is carried out, namely asking the patient to lie down with one of the legs to be tested bent at 90 degrees then the patient's hands hold on the back of the patient's leg with the therapist's thumbs on the proximal tibia. Then do the movement to bring the leg forward. Positive results from this examination if the patient feels pain when moving forward (Kilinc, 2016).



Picture 1. Anterior Drawer Tes (Koster et al., 2018)

For the second test, the Lachman test was carried out. The patient's position is supine, one of the legs to be tested is bent at 15 degrees. The therapist's hand position is on the distal femur as a fixation then the other hand holds the proximal tibia. Then the therapist moves the tibia anteriorly (Gulick, 2020). Positive results from this examination if you feel looseness or laxity in the knee.

This test has a sensitivity of 94% for the anterior drawer test and 93% for the Lachman test.



Picture 2. Lachman Tes (Koster et al., 2018)

Table 1. Pain measurement was carried out using the Numeric Rating Scale (NRS)

Pain	Score	Interpretation
No movement	0/10	No Pain

Tenderness	5/10	Moderate pain
Motion Pain	5/10	Severe pain

Pain measurement was carried out using the Numeric Rating Scale (NRS). The patient was asked to rate how severe the pain was. The classification of pain is described by a score consisting of (0) no pain (5) moderate pain (10) severe pain

Table 2. Examination of muscle strength performance with MMT

Movement		Score	Interpretation
Flexion	Knee Sinistra	4	There is joint movement, able to resist gravity, and minimal resistance.
Extension	Knee Sinistra	4	There is joint movement, able to resist gravity, and minimal resistance.

Examination of the performance of the patient's left leg muscle strength got a value of 4 in flexion and extension movements which were manifested by joint movement, being able to resist gravity, and minimal resistance.

Functional examination using (KOOS) this instrument is used to measure the ability and complaints of the patient's knee when doing activities in the short and long term. Five patient-relevant subscales were assessed separately: Pain (nine items), Symptoms (seven items), Daily Functional Activities (17 items), Sports and Recreational Function (five items), Quality of Life (four items). Each item has five answer options which are scored from 0 (No problem) to 4 (Extreme problem) and each of the five scores are counted as the number of items included. The score is changed to a scale of 0-100, with zero representing extreme knee problems and 100 representing no knee problems

$$\text{Total} = \frac{(\text{Pain} + \text{Symptoms} + \text{Daily Functional Activities} + \text{Exercise} + \text{quality of life})}{5} = \text{Results}$$

$$\text{Total} = \frac{(69,4 + 94,4 + 72,2 + 69,4 + 77,7)}{5} = 76,62$$

After doing an examination using KOOS, the result is 76.62 which is interpreted by the patient as having a knee problem that is not too severe. (van Meer, 2018)

The program given to the patient starts from the beginning of the patient coming to the clinic until it is finished. The intervention given has the aim of reducing pain levels, reducing spasm, increasing muscle strength, and maximizing the patient's functional ability.

The table below represents the interventions carried out.

Table 1. Physiotherapy Program

Intervention	Dose	Explanation
InfraRed	F: 2-3 times a week I :- T : 10 – 15 Minutes T : Physical agents (4x10 Hz)	
Myofacial Release	F: 2-3 times a week I : According to Patient Tolerance Q: 10-15 Minutes T : Friction	Myofascial release with friction movements in the quadriceps and hamstring muscles. Myofascial release is done until the spasm is reduced
Kinesio Taping	T : 2-3 days (as long as there are no allergies that arise right) T : No stretch	No stretch serves as a stabilizer in the muscles
Strengtening Exercise Walking crab with Theraband	F : 2-3 times a week I : 15 - 20 Reps T : 3 Sets T : No-Weight Isotonic Resistant Strengthening Exercise	



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Discussion

Results

Pain measurement results with NRS

After a physiotherapy examination using NRS for three meetings, the following results were obtained :

Table 1. Pain measurement results with NRS

PAIN	T1	T2	T3
No movement	0	0	0
Tenderness	5	5	4
Motion Pain	5	4	4

Based on the table above, shows a decrease in pain from T1 to T3 from tenderness to motion pain. The use of Infrared, myofascial release, Kinesio taping, and strengthening exercise modalities can reduce pain level in T1 no movement : 0, tenderness: 5, motion pain: 5. To T2 silent pain : 0, tenderness: 5, motion pain: 4. And T3 silent pain: 0, tenderness: 5, motion pain: 4

Muscle strength measurement results

After conducting a physiotherapy examination using MMT for three meetings, the following results were obtained:

Table 2. Muscle Strength Measurement Results

Movement	T1	T2	T3
Flexi Knee Sinistra	4	4	4
Extensi Knee Sinistra	4	4	4

Based on the table above, there was no muscle increase after undergoing therapy for three meetings.

Functional measurement results

Measurements were taken at the beginning of the meeting and evaluated at the end of the meeting, which was carried out for three weeks, so the following results were obtained:

Table 3. Results of Knee Functional Measurement

Indeks KOOS	T1	T3
Total skor	76,2	87,2

Based on the table above, the higher the resulting value indicates the better the functional activity ability after undergoing therapy for three meetings.

Discussions

1. Infrared

Infrared therapy is a physiotherapeutic intervention modality classified under thermotherapy used in the treatment of pain. Infrared is electromagnetic radiation with a longer beam and shorter beam than microwaves but located in the electromagnetic spectrum. IRR rays generate heat when absorbed by matter, between the wavelengths of 4×10^4 Hz and 7.5×10^14 Hz. near-infrared can penetrate under the skin about (5-10mm) (Abdulla, 2018). The heat emitted from IR has been shown to increase tissue extensibility, increase joint range of motion, reduce pain and promote healing of soft tissue lesions. These actions are mediated through the physiological effects of warming that result in a general increase in cell activity and blood flow. and reduced pain levels and decreased metabolites such as bradykinin and histamine. (Ojeniweh, et. al 2019)

2. Myofascial Release Therapy

Myofascial Release Therapy (MRT) is a form of manual therapy with a technique that spreads to parts of the body quickly which aims to restore the optimal length of the disturbed tissue and reduce pain levels by restoring impaired function. (Laimi et al., 2018) Tightened or stiff tissues (due to repetitive microtrauma or acute injury) are considered a source of tension throughout the body causing pain and loss of functional capacity. It is believed that stretching the restricted tissue, can normalize the length of the myofascial tissue as well as release pressure from pain-sensitive structures, and restore joint mobility. (Rodríguez-Huguet, 2018)

3. Kinesio Taping

Kinesio Taping (KT) is a thin elastic band that is applied to the surface of the skin carried out by health professionals in musculoskeletal practice and sports by producing a toning or detonating effect on the muscles to rebalance the affected muscles after an injury. There is evidence from systematic reviews with a recent meta-analysis that Kinesio taping can reduce muscle soreness, pain in the lower back, shoulders, and knees and improve short-term functional outcomes. (Liu, 2019). Kinesio Taping has a thin, elastic, and water-resistant adhesive structure on the skin. The Kinesio property of taping allows the band to be stretched longitudinally to 60% or more of its initial length and worn continuously for 3-5 days to support soft tissues and joints while not restricting movement. (Banerjee, 2019)

4. Strengthening Exercises

Muscle-strengthening exercises sometimes referred to as strength training, are weight-bearing, against resistance. This activity is voluntary which includes the use of weights, exercise bands, grip strength, or own body weight (eg push-ups or sit-ups). When performed regularly, clinical exercise studies show that muscle-strengthening exercises increase strength, power, endurance, and skeletal muscle mass. The addition of muscle-strengthening exercises to physical activity recommendations is due to strong scientific evidence showing that this mode of physical activity has many health benefits. (Bennie, 2020)

For further research, it is expected to be able to add varied exercises and sufficient duration of meeting time to maximize the results expected by patients and therapists.

Conclusion

The physiotherapy program that was carried out in 3 weeks with the physiotherapy modalities used such as Infrared, Myofascial Release, Kinesio Taping, and Strengthening Exercise was able to reduce pain and restore the body's function to carry out daily activities.

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none

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