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Early-Phase Physiotherapy After Posterior Cruciate Ligament Reconstruction: A Case Report

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Abstract

Background: Posterior cruciate ligament (PCL) reconstruction is commonly performed to restore knee stability after severe ligament injury. Early postoperative rehabilitation is essential to reduce pain, improve muscle activation, restore joint mobility, and support functional recovery. However, evidence regarding structured early-phase physiotherapy following PCL reconstruction remains limited.
Objective: This case report aimed to evaluate the short-term clinical outcomes of early-phase physiotherapy rehabilitation following posterior cruciate ligament reconstruction.
Methods: This CARE guideline-based case report involved a 19-year-old female taekwondo athlete with Grade III right PCL rupture who underwent reconstruction surgery. Clinical assessment included pain using the Numeric Rating Scale (NRS), muscle strength using Manual Muscle Testing (MMT), knee range of motion using a goniometer, edema using circumferential anthropometric measurement, and functional ability using the Tegner Lysholm Knee Scoring Scale. The intervention consisted of cryotherapy, quadriceps and hamstring isometric activation, strengthening exercises, and heel-slide range-of-motion exercises administered over four treatment sessions during the early postoperative phase.
Results: Movement pain decreased from 7/10 to 5/10, while medial knee tenderness decreased from 5/10 to 4/10. Quadriceps strength improved from grade 3-/5 to 3/5. Knee flexion range of motion increased from 80° to 92°, accompanied by reduced postoperative edema. Functional ability improved from 55 to 68 points on the Tegner Lysholm Knee Scoring Scale. No adverse events were reported.
Conclusion: Early-phase physiotherapy rehabilitation may provide potential benefits in improving pain, knee mobility, muscle strength, edema, and functional ability following posterior cruciate ligament reconstruction.

Keywords
posterior cruciate ligament; rehabilitation; postoperative care; exercise therapy; cryotherapy

Introduction

The posterior cruciate ligament (PCL) is one of the primary stabilizing structures of the knee joint and plays an essential role in preventing posterior translation of the tibia relative to the femur. In addition to functioning as a primary posterior stabilizer, the PCL also contributes to rotational stability and regulates tibiofemoral biomechanics during dynamic activities involving knee flexion.[1,2] PCL injuries are less common than anterior cruciate ligament injuries; however, they may result in substantial functional impairment, including pain, joint instability, muscle weakness, limited range of motion, altered gait mechanics, and reduced participation in sports and daily activities.[3]

Traumatic PCL injuries commonly occur during sports participation, motor vehicle accidents, or direct impact to the anterior tibia while the knee is flexed, a mechanism frequently referred to as a dashboard injury.[3,4] Epidemiological studies have demonstrated that untreated or inadequately managed PCL injuries are associated with long-term complications, including persistent instability, cartilage degeneration, meniscal injury, and premature knee osteoarthritis.[5] Furthermore, chronic PCL insufficiency may substantially impair quality of life and athletic performance, particularly in young and physically active individuals.[6]

Surgical reconstruction is generally indicated in patients with symptomatic Grade III instability, combined ligament injuries, persistent functional limitation after conservative management, or high functional demands requiring knee stability during sports participation.[7] Despite advances in surgical techniques, postoperative complications following PCL reconstruction remain common and include quadriceps inhibition, postoperative edema, muscle atrophy, arthrofibrosis, joint stiffness, persistent pain, and delayed functional recovery.[8] Therefore, postoperative rehabilitation has become a critical component in optimizing graft healing, restoring neuromuscular control, improving joint mobility, and facilitating a safe return to physical activity and sport participation.[9]

Current rehabilitation principles following PCL reconstruction emphasize early graft protection while progressively restoring knee function through controlled loading, pain management, muscle activation, edema reduction, and range-of-motion exercises.[10] Early-phase rehabilitation is particularly important because excessive posterior tibial translation or inappropriate exercise progression during the initial healing phase may compromise graft integrity and delay recovery.[11] Previous studies have highlighted the importance of quadriceps strengthening, gradual restoration of knee mobility, and neuromuscular retraining as key components of postoperative PCL rehabilitation.[9,12] However, compared with anterior cruciate ligament rehabilitation, evidence regarding standardized early-phase rehabilitation protocols after PCL reconstruction remains limited and heterogeneous.[13,14]

Several recent reviews have emphasized that available evidence regarding postoperative rehabilitation after PCL reconstruction remains insufficient, particularly concerning exercise progression, rehabilitation dosage, and short-term clinical outcomes during the acute postoperative phase.[11,14] Most published studies primarily focus on surgical techniques, graft selection,

long-term functional outcomes, or return-to-sport criteria rather than detailed physiotherapy management during the initial rehabilitation period.[4,15] Consequently, evidence-based guidance for physiotherapists managing patients during the early postoperative phase after PCL reconstruction remains limited. This gap highlights the need for clinically detailed case reports describing rehabilitation reasoning, intervention progression, and short-term functional outcomes during early recovery.

This case is clinically relevant because it describes early-phase physiotherapy management in a young taekwondo athlete following Grade III posterior cruciate ligament reconstruction, focusing on pain reduction, edema management, restoration of knee mobility, quadriceps activation, and improvement of functional ability during the acute postoperative phase. Therefore, this case report aimed to evaluate the short-term clinical outcomes of an early-phase physiotherapy rehabilitation program following posterior cruciate ligament reconstruction in terms of pain intensity, muscle strength, knee range of motion, edema, and functional ability.

Methods

This study used a case report design based on the CARE (CAse REport) guideline to describe the early-phase physiotherapy management of a patient following posterior cruciate ligament (PCL) reconstruction. The report focused on clinical presentation, physiotherapy intervention, and short-term outcomes observed during the initial postoperative rehabilitation phase.

The subject was a 19-year-old female taekwondo athlete diagnosed with Grade III right posterior cruciate ligament rupture who underwent surgical reconstruction and was subsequently referred for physiotherapy rehabilitation. The patient had a body mass index of 21.3 kg/m² and right-leg dominance, with no history of neurological disorders, fracture, systemic musculoskeletal disease, or previous knee surgery. The injury occurred during taekwondo training in December 2024 following direct contact to the anterior tibia while the knee was flexed. Initially, the patient considered the injury minor and continued participating in light activities despite persistent discomfort and instability. However, progressive symptoms including pain, limited knee mobility, and functional impairment prompted further medical evaluation.

Magnetic resonance imaging (MRI) performed in February 2025 demonstrated complete rupture of the posterior cruciate ligament without associated fracture or major meniscal injury. Clinical orthopedic examination conducted prior to surgery demonstrated positive posterior drawer test and posterior sag sign findings, indicating posterior knee instability consistent with Grade III PCL injury. Differential diagnosis including isolated meniscal injury and collateral ligament injury had been excluded through clinical examination and MRI evaluation. Surgical posterior cruciate ligament reconstruction was subsequently performed on July 19, 2025. Following surgery, the patient was instructed by the orthopedic surgeon to perform gentle knee flexion-extension exercises at home during the early postoperative period.

In September 2025, the patient attended physiotherapy rehabilitation due to persistent pain, edema, reduced range of motion, decreased muscle strength, and difficulty performing functional activities, including ambulation without crutch assistance. The patient also reported difficulty ascending stairs, prolonged standing intolerance, and fear of excessive knee movement during weight-bearing activities. Written informed consent for treatment and publication of anonymized clinical information was obtained from the patient prior to participation in this study.

Figure 1 presents the chronological clinical timeline of the patient from the initial sports-related injury to post-intervention reassessment following early-phase physiotherapy rehabilitation. The diagram summarizes diagnostic evaluation, surgical management, referral to physiotherapy, baseline assessment, implementation of rehabilitation interventions, and short-term clinical follow-up.

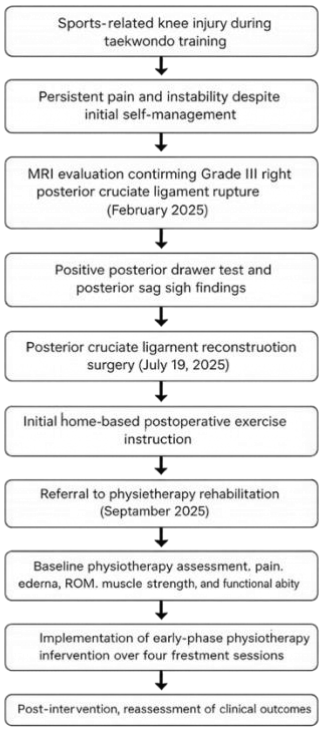

Figure 1. Clinical Timeline of Early-Phase Rehabilitation Following Posterior Cruciate Ligament Reconstruction

At the initial physiotherapy evaluation, the patient presented with movement-related pain, postoperative edema around the right knee joint, limited knee flexion and extension, decreased quadriceps and hamstring muscle strength, and impaired functional activities such as walking and stair negotiation. Ambulation was still assisted using crutches. Quadriceps inhibition and reduced weight-bearing tolerance were also observed during functional assessment.

Pain intensity was assessed using the Numeric Rating Scale (NRS), a valid and reliable instrument commonly used for clinical pain assessment.[16] The NRS uses an 11-point scale ranging from 0 to 10, in which 0 indicates no pain and 10 indicates the

worst imaginable pain. The patient reported movement pain during knee flexion with a score of 7/10 and tenderness over the medial knee with a score of 5/10 at baseline evaluation. The minimal clinically important difference (MCID) for postoperative knee pain outcomes using the NRS has been reported to range between 1.5 and 2 points.

Knee range of motion was measured using a universal goniometer with the patient positioned in supine lying. Goniometric assessment is considered a standard clinical method for evaluating joint mobility and demonstrates acceptable reliability in musculoskeletal assessment.[17] Baseline examination showed knee flexion limitation to 80° and extension limitation of 15°, indicating substantial restriction in sagittal-plane knee mobility.

Muscle strength of the quadriceps and hamstring muscle groups was evaluated using Manual Muscle Testing (MMT), which grades voluntary muscle contraction on a scale ranging from 0 to 5.[18] At baseline assessment, both quadriceps and hamstring muscles demonstrated grade 3-/5 strength, indicating the patient was able to achieve the testing position but unable to maintain movement against gravity consistently. Although MMT is clinically practical during postoperative rehabilitation, the instrument has limited sensitivity compared with instrumented dynamometry for detecting subtle strength changes.

Edema assessment was performed using circumferential anthropometric measurement with a measuring tape at standardized anatomical landmarks, including 5 cm above the patella, mid-patella, and 5 cm below the patella. Circumferential measurement is commonly used in postoperative knee evaluation to objectively quantify swelling and monitor clinical progression over time. Baseline assessment demonstrated greater circumference measurements in the involved knee compared with the contralateral side, indicating postoperative edema.

Functional ability was evaluated using the Tegner Lysholm Knee Scoring Scale, a knee-specific patient-reported outcome measure frequently used in ligament injury and postoperative rehabilitation assessment.[19] The scale evaluates pain, instability, locking, swelling, stair climbing, squatting, limp, and need for support, with total scores ranging from 0 to 100. Scores below 65 indicate poor knee function, whereas higher scores represent improved functional status. The patient obtained a baseline score of 55/100, indicating poor functional ability. Previous studies have reported an MCID of approximately 10 points for clinically meaningful improvement in knee-related functional outcomes using the Lysholm score.

The physiotherapy intervention program was designed according to postoperative tissue-healing principles, baseline clinical findings, patient tolerance, and rehabilitation goals during the acute postoperative phase. Intervention selection emphasized graft protection while progressively improving pain control, edema reduction, muscle activation, joint mobility, and functional recovery. All physiotherapy interventions were administered by a licensed physiotherapist under clinical supervision. Treatment was administered three times weekly over four physiotherapy sessions, with each session lasting approximately 60–90 minutes.

Prior to presenting the intervention details, the following table summarizes the physiotherapy program implemented during the rehabilitation period.

Table 1. Early-phase physiotherapy intervention program following posterior cruciate ligament reconstruction.

Intervention	Dosage and Parameters
Cryotherapy	Frequency: 3 sessions/week; Duration: 10 minutes; Method: ice-pack application around the knee joint
Quadriceps and hamstring isometric activation	Frequency: 3 sessions/week; Intensity: 15-second contraction with 7-second rest interval; Volume: 10 repetitions × 3 sets
Strengthening exercises	Frequency: 3 sessions/week; Progressive loading from no external resistance to 0.5 kg resistance; Volume: 10 repetitions × 3 sets; Exercises: straight leg raise and hip abduction-adduction
Range-of-motion exercises	Frequency: 3 sessions/week; Intensity limited to pain tolerance ≤4/10 on NRS; Volume: 10 repetitions × 5 sets; Exercise: heel slide

Cryotherapy was administered to reduce postoperative pain and edema through vasoconstriction and decreased nociceptive conduction velocity.[20] Isometric quadriceps and hamstring activation exercises were prescribed to minimize muscle inhibition and promote early neuromuscular activation while reducing excessive stress on the healing graft. Strengthening exercises such as straight leg raise and hip abduction-adduction were introduced progressively to improve lower-extremity muscle function and support knee stability. Heel-slide exercises were implemented to gradually restore knee flexion range of motion while maintaining patient comfort and graft protection during movement.

Exercise progression was individualized based on pain response, movement quality, edema reduction, and weight-bearing tolerance during each treatment session. During the first session, exercises were performed without external resistance to prioritize pain control and neuromuscular activation. Low external resistance (0.5 kg) was gradually introduced during subsequent sessions after the patient demonstrated improved movement tolerance and reduced pain response.

Particular precautions during rehabilitation included avoidance of excessive posterior tibial translation, aggressive hamstring loading, forced knee flexion, and high-load weight-bearing activities during the acute postoperative phase to protect graft integrity. The patient also received education regarding home exercise adherence, activity modification, cryotherapy self-management, and safe ambulation using crutches. Home exercise adherence was monitored verbally at each treatment session through patient self-report regarding exercise frequency and symptom response.

Outcome evaluation was performed twice, consisting of baseline assessment before intervention and post-intervention reassessment after completion of all physiotherapy sessions. Data were analyzed descriptively by comparing changes in pain intensity, range of motion, muscle strength, edema measurements, and functional scores before and after intervention. Because this study involved a single-case clinical report, inferential statistical analysis and effect-size calculation were not performed. Clinical interpretation focused on observable functional improvement and short-term rehabilitation response during the early postoperative phase.

This case report was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent for treatment and publication of anonymized clinical information was obtained from the patient prior to participation. Institutional ethical approval was not required for this single-patient case report according to local institutional policy.

Results

The patient completed all four physiotherapy sessions during the early postoperative rehabilitation phase without adverse events or interruption of treatment. Verbal monitoring performed during each treatment session indicated good adherence to the prescribed home exercise program, with the patient reporting regular completion of self-management exercises and cryotherapy application at home. Throughout the intervention period, gradual improvement was observed in pain intensity, knee mobility, quadriceps activation, postoperative edema, and functional ability.

To facilitate a clearer understanding of the patient's clinical progression, the outcome measurements before and after intervention are summarized in Table 2.

Table 2. Clinical outcomes before and after early-phase physiotherapy intervention following posterior cruciate ligament reconstruction.

Variable	Instrument	Baseline Assessment	Post-Intervention Assessment
Pain at rest	Numeric Rating Scale (NRS)	0/10	0/10
Movement pain during knee flexion	Numeric Rating Scale (NRS)	7/10	5/10
Tenderness over medial knee	Numeric Rating Scale (NRS)	5/10	4/10
Quadriceps muscle strength	Manual Muscle Testing (MMT)	3-/5	3/5
Knee range of motion	Goniometer	15°–0°–80°	15°–0°–92°
Circumference 5 cm above patella (right knee)	Anthropometric measurement	41.5 cm	40 cm
Circumference at mid-patella (right knee)	Anthropometric measurement	39 cm	38 cm
Circumference 5 cm below patella (right knee)	Anthropometric measurement	35 cm	34.5 cm
Functional ability	Tegner Lysholm Knee Scoring Scale	55/100	68/100

Pain assessment using the Numeric Rating Scale demonstrated reduction in movement-related symptoms following intervention. Movement pain during knee flexion decreased from 7/10 to 5/10, while tenderness over the medial knee decreased from 5/10 to 4/10. Pain at rest remained stable at 0/10 throughout the rehabilitation period. The reduction in movement pain approached the reported minimal clinically important difference for postoperative knee pain outcomes, suggesting clinically meaningful symptom improvement during functional movement.

Muscle strength assessment using Manual Muscle Testing demonstrated improvement in quadriceps activation and voluntary muscle contraction. Quadriceps strength improved from grade 3-/5 to 3/5, indicating that the patient became capable of performing full movement against gravity after intervention, although resistance tolerance remained limited during the postoperative phase**.** Improved quadriceps activation was also observed qualitatively during functional tasks, particularly during weight-bearing transition and gait activities.

Evaluation of knee range of motion demonstrated improvement in sagittal-plane mobility. Knee flexion increased from 80° at baseline to 92° after completion of the intervention program, whereas extension limitation remained at 15°. Improved knee flexion was accompanied by better movement tolerance during functional activities and exercise performance. Although full knee mobility had not yet been restored, progressive improvement in flexion range suggested favorable short-term adaptation during the acute rehabilitation phase.

Circumferential anthropometric measurements demonstrated reduction in postoperative edema at several anatomical landmarks around the involved knee joint. The circumference measured 5 cm above the patella decreased from 41.5 cm to 40 cm, while mid-patellar circumference decreased from 39 cm to 38 cm. Measurements taken 5 cm below the patella also demonstrated slight reduction from 35 cm to 34.5 cm. These findings indicated gradual improvement in postoperative swelling, which may have contributed to improved movement tolerance and quadriceps activation during rehabilitation.

Functional evaluation using the Tegner Lysholm Knee Scoring Scale demonstrated improvement from 55/100 to 68/100 following intervention. This increase exceeded the reported minimal clinically important difference for the Lysholm score and indicated transition from poor toward fair functional status. Although the patient continued to experience functional limitations and had not yet returned to sports participation, the increase in score indicated improved performance during daily functional activities, particularly mobility-related tasks such as walking and stair negotiation.

Figure 2 illustrates the progression of clinical outcomes observed throughout the early postoperative rehabilitation phase following posterior cruciate ligament reconstruction. The diagram summarizes the sequential improvement in pain, edema, knee mobility, quadriceps activation, and functional ability after implementation of the physiotherapy intervention program.

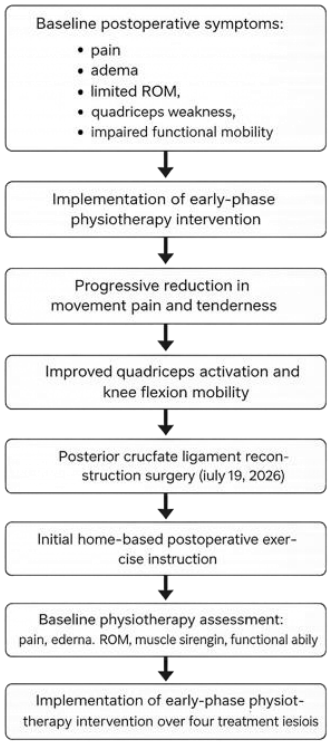

Figure 2. Clinical Outcome Progression During Early-Phase Physiotherapy Rehabilitation

In addition to objective clinical improvement, the patient subjectively reported increased confidence during ambulation and reduced fear of knee movement during daily activities at the end of the intervention period. The overall findings demonstrated short-term clinical improvement across multiple rehabilitation outcomes during the early postoperative phase following posterior cruciate ligament reconstruction. However, residual functional limitation, incomplete restoration of knee mobility, and persistent quadriceps weakness were still observed at the end of the intervention period, indicating the need for continued rehabilitation and longer-term follow-up.

Discussion

This case report described the short-term clinical outcomes of an early-phase physiotherapy rehabilitation program following posterior cruciate ligament (PCL) reconstruction in a young taekwondo athlete. Following four treatment sessions, the patient demonstrated improvement in movement-related pain, postoperative edema, quadriceps activation, knee flexion range of motion, and functional ability. Although the present findings cannot establish treatment effectiveness because of the single-case design and limited follow-up duration, the observed clinical changes suggest potential benefits of structured physiotherapy rehabilitation during the acute postoperative phase following PCL reconstruction.

One of the primary findings observed in this case was the reduction in movement-related pain and postoperative edema following intervention. Pain reduction during the early rehabilitation phase is clinically important because persistent postoperative pain may inhibit quadriceps activation, reduce weight-bearing tolerance, restrict joint mobility, and delay functional recovery.[20] The improvement observed in this patient may be associated with the combined effects of cryotherapy and progressive therapeutic exercise. Cryotherapy is widely used during acute postoperative rehabilitation because cold exposure may reduce local tissue metabolism, inflammatory response, nociceptive conduction velocity, and secondary tissue injury, thereby contributing to analgesic effects and edema control.[21,22] Reduced nociceptive input may subsequently facilitate improved movement tolerance and neuromuscular activation during exercise performance.

The reduction in postoperative edema observed through circumferential measurements may also have contributed to improved quadriceps activation and knee mobility during rehabilitation. Persistent postoperative swelling is associated with arthrogenic muscle inhibition, impaired proprioception, altered gait mechanics, and delayed neuromuscular recovery following knee ligament surgery.[23] Therefore, early edema management is considered essential to optimize joint function and facilitate progression of rehabilitation exercises during the acute healing phase. In the present case, gradual reduction in knee circumference measurements was accompanied by improved movement tolerance and functional mobility, suggesting favorable short-term adaptation during rehabilitation.

Improvement in knee flexion range of motion from 80° to 92° represented another clinically relevant outcome. Restoration of knee mobility during the early postoperative phase is important to prevent arthrofibrosis, maintain soft tissue extensibility, and support progressive functional activity.[11] Excessive immobilization after ligament reconstruction may contribute to prolonged stiffness, delayed functional recovery, and reduced patient satisfaction.[13] Consequently, controlled range-of-motion exercises are commonly introduced during the acute rehabilitation phase while maintaining graft-protection principles**.** Heel-slide exercises implemented in this case allowed gradual restoration of knee flexion within pain tolerance while minimizing excessive posterior tibial translation. The observed improvement is generally consistent with rehabilitation recommendations emphasizing progressive mobility restoration during the early postoperative phase following PCL reconstruction.[10,13]

Despite improvement in knee flexion, extension limitation remained present at the end of intervention. This residual limitation may reflect the relatively short duration of rehabilitation, persistent postoperative inflammation, protective muscle guarding, or ongoing tissue healing during the acute postoperative phase. Previous studies have suggested that restoration of full extension following knee ligament reconstruction often requires longer rehabilitation periods and progressive mobility training.[24] Therefore, the residual extension deficit observed in this case highlights the importance of continued physiotherapy follow-up beyond the initial rehabilitation stage.

Quadriceps muscle strength also demonstrated improvement following intervention, progressing from grade 3-/5 to 3/5 on Manual Muscle Testing. Quadriceps weakness is frequently reported after PCL reconstruction due to postoperative pain, edema, neuromuscular inhibition, and reduced weight-bearing activity.[25] Persistent quadriceps dysfunction may negatively affect knee stability, gait efficiency, and long-term functional outcomes.[26] In the present case, early quadriceps activation exercises and progressive strengthening exercises were implemented to minimize muscle inhibition while protecting the healing graft. Improvement in voluntary muscle activation observed after intervention may indicate early neuromuscular adaptation during postoperative rehabilitation.

The findings of this case are generally consistent with previous rehabilitation studies reporting beneficial effects of progressive exercise therapy following cruciate ligament reconstruction. Lee et al. reported that accelerated rehabilitation programs following cruciate ligament reconstruction improved quadriceps strength and postural stability during postoperative recovery.[14] Similarly, contemporary rehabilitation guidelines emphasize the importance of early quadriceps activation, controlled loading, edema management, and gradual strengthening progression to optimize functional recovery after ligament surgery.[9,10] However, unlike several previous studies involving longer rehabilitation duration and larger patient cohorts, the present report evaluated only short-term outcomes during the acute postoperative phase. Therefore, the current findings should be interpreted cautiously and should not be generalized beyond the context of this single case.

Several biological and biomechanical mechanisms may explain the observed improvements following intervention. Controlled therapeutic exercise may facilitate neuromuscular activation, maintain muscle integrity, improve circulation, and enhance sensorimotor control during tissue healing. Simultaneously, progressive loading within safe tolerance may facilitate collagen alignment and support graft maturation without imposing excessive mechanical stress on the reconstructed ligament.[10] Nevertheless, rehabilitation following PCL reconstruction requires careful balance between mobility restoration and graft protection because excessive hamstring activation or posterior tibial translation during the early phase may compromise surgical outcomes.[11]

Functional ability measured using the Tegner Lysholm Knee Scoring Scale improved from 55 to 68 points following intervention. This increase exceeded the reported minimal clinically important difference for the Lysholm score, suggesting clinically meaningful improvement in knee-related functional status during the rehabilitation period. Although the patient had not returned to sports participation and continued to demonstrate residual limitations, the observed increase suggests improvement in daily functional mobility, particularly during walking and stair negotiation activities. Functional recovery after PCL reconstruction is multifactorial and influenced by pain reduction, muscle performance, neuromuscular control, psychological readiness, and progression of tissue

healing.[27] Therefore, improvement in functional scores during the acute postoperative phase should be interpreted as part of gradual recovery rather than complete restoration of athletic performance.

This case report also provides several clinical implications for physiotherapists involved in postoperative knee rehabilitation. Early-phase physiotherapy management appears to play an important role in addressing postoperative pain, edema, quadriceps inhibition, and mobility limitation following PCL reconstruction. Furthermore, rehabilitation progression should be individualized according to tissue-healing stage, symptom response, and graft-protection principles to minimize excessive mechanical stress during the acute postoperative period. Multimodal physiotherapy interventions combining cryotherapy, muscle activation exercises, progressive strengthening, and controlled range-of-motion exercises may facilitate early functional recovery following ligament reconstruction surgery.

Several limitations should be acknowledged when interpreting the findings of this report. First, this study involved only a single patient with short-term follow-up, thereby limiting generalizability and preventing causal inference regarding intervention effectiveness. Second, no instrumented strength assessment, biomechanical analysis, or ligament laxity measurement was performed. Third, long-term outcomes such as return-to-sport readiness, graft integrity, and sustained functional recovery were not evaluated. In addition, Manual Muscle Testing has lower sensitivity than instrumented dynamometry for detecting subtle strength changes. Finally, home exercise adherence and psychological readiness were monitored subjectively through patient self-report without objective quantification.

Future studies should investigate standardized early-phase rehabilitation protocols following PCL reconstruction using larger samples, longer follow-up duration, objective strength assessment, and longitudinal functional evaluation. Comparative studies investigating exercise progression models and neuromuscular rehabilitation strategies may further strengthen evidence-based physiotherapy management following posterior cruciate ligament reconstruction.

Conclusion

This case report demonstrated that an early-phase physiotherapy rehabilitation program following posterior cruciate ligament reconstruction was associated with improvements in movement-related pain, postoperative edema, quadriceps activation, knee flexion range of motion, and functional ability during the acute postoperative phase. The combination of cryotherapy, neuromuscular activation exercises, progressive strengthening, and controlled range-of-motion training appeared to support short-term functional recovery while maintaining graft-protection principles.

Although the findings should be interpreted cautiously because they are limited to a single patient with short-term follow-up, this report highlights the potential clinical value of structured physiotherapy management during the early rehabilitation phase following posterior cruciate ligament reconstruction. Individualized exercise progression, symptom monitoring, and gradual functional loading may contribute to safer postoperative recovery and improved patient adaptation during the acute healing phase.

Future studies involving larger sample sizes, longer follow-up duration, objective biomechanical assessment, and standardized rehabilitation protocols are needed to strengthen evidence regarding early-phase physiotherapy management following posterior cruciate ligament reconstruction.

Author Contribution

Lida Nurhalisa: Investigation, Data curation, Writing original draft.
Suryo Saputra Perdana: Conceptualization, Methodology, Formal analysis, Writing review and editing, Supervision.
Sigit Saputro: Conceptualization, Formal analysis, Writing review and editing, Supervision.

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Conflict of Interest Statement

The authors declare no conflict of interest.

Funding Sources

This study received no external funding.

Ethics Statement

This case report was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent for treatment and publication of anonymized clinical information was obtained from the patient prior to participation. Institutional ethical approval was not required for this single-patient case report according to local institutional policy.

Patient Perspective

The patient reported subjective improvement in knee comfort, mobility, and confidence during daily activities following participation in the physiotherapy rehabilitation program. The patient also expressed satisfaction with the gradual reduction in pain and improvement in movement ability during the early postoperative recovery phase.

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