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Six-Week Multimodal Physiotherapy Rehabilitation for Patellofemoral Pain Syndrome in a Young Soccer Athlete: A CARE Case Report

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Abstract

Background: Patellofemoral Pain Syndrome (PFPS) is a common overuse-related knee disorder in soccer athletes and is associated with anterior knee pain, impaired biomechanics, and reduced sports performance. Evidence regarding structured multimodal rehabilitation in young soccer athletes remains limited.

Objective: To evaluate the short-term clinical outcomes following a six-week multimodal physiotherapy rehabilitation program in a young soccer athlete with PFPS.

Methods: This CARE-guideline case report involved an 18-year-old male soccer athlete with anterior knee pain aggravated by sprinting, squatting, and resisted knee extension. Clinical assessment included the Numeric Rating Scale (NRS), Range of Motion (ROM), Manual Muscle Testing (MMT), and Kujala Anterior Knee Pain Scale. Primary outcomes were pain intensity and functional performance, while secondary outcomes included ROM and quadriceps strength. The patient underwent a six-week rehabilitation program consisting of Transcutaneous Electrical Nerve Stimulation (TENS), therapeutic ultrasound, progressive strengthening exercises, and neuromuscular training using the FITT principle. Interventions were performed three times weekly for 45–60 minutes.

Results: Pain intensity decreased from NRS 7/10 during functional activity and 6/10 on palpation at baseline to 0–1/10 after six weeks, representing approximately 85–100% improvement. Knee flexion ROM improved from 120° to 135°, quadriceps strength improved from MMT grade 4/5 to 5/5, and Kujala score increased from 90/100 to 100/100. No adverse events were reported.

Conclusion: A six-week multimodal physiotherapy rehabilitation program was associated with reduced pain and improved functional outcomes in a young soccer athlete with PFPS. However, larger studies with long-term follow-up are required.

Keywords

Patellofemoral Pain Syndrome; Exercise Therapy; Rehabilitation; Athletic Injuries; Sports Physical Therapy; Transcutaneous Electric Nerve Stimulation.

Introduction

Patellofemoral Pain Syndrome (PFPS) is one of the most common musculoskeletal disorders affecting the knee joint, particularly among physically active individuals and athletes exposed to repetitive lower-extremity loading. PFPS is characterized by diffuse anterior knee pain that worsens during activities such as running, squatting, jumping, stair negotiation, and prolonged sitting.[1] The condition represents a substantial clinical challenge in sports medicine because it may impair athletic performance, reduce training participation, and delay return-to-sport progression.[2] Among athletic populations, soccer players are considered particularly vulnerable to PFPS because of repetitive sprinting, rapid acceleration-deceleration, cutting maneuvers, and high cumulative mechanical stress imposed on the patellofemoral joint during training and competition.[3]

Epidemiological evidence indicates that knee overuse injuries are highly prevalent in soccer athletes, with PFPS representing one of the leading causes of anterior knee pain in adolescent and young adult players.[4] Persistent PFPS symptoms may negatively affect movement confidence, lower-extremity mechanics, and sport-specific functional performance.[5] Inadequate rehabilitation may further contribute to recurrent symptoms, chronic pain, compensatory movement strategies, and prolonged functional limitation. Consequently, early identification and comprehensive rehabilitation are essential to optimize recovery and facilitate safe return-to-play progression in young athletes.

The etiology of PFPS is multifactorial and involves a complex interaction between biomechanical, neuromuscular, and training-related factors. Current evidence suggests that abnormal patellar tracking, increased patellofemoral joint stress, hip muscle weakness, quadriceps dysfunction, dynamic knee valgus, and impaired lower-extremity kinematics contribute substantially to PFPS development.[6] Deficits in hip abductor and external rotator strength may increase femoral internal rotation and valgus collapse during dynamic tasks, thereby elevating patellofemoral joint loading.[7] Neuromuscular impairments and altered motor control may also compromise lower-limb alignment and movement efficiency during sport-specific activities such as sprinting, jumping, and directional changes.[8] In soccer athletes, repetitive overload caused by intensive training schedules, insufficient recovery, and muscle imbalance may further exacerbate tissue irritation and symptom progression.[9]

Exercise-based physiotherapy is currently recommended as the primary management strategy for PFPS in international clinical guidelines.[10] Previous studies have demonstrated that quadriceps strengthening, hip strengthening, neuromuscular training, and movement retraining may reduce pain and improve functional performance in individuals with PFPS.[11] However, evidence regarding the optimal integration of adjunctive modalities such as Transcutaneous Electrical Nerve Stimulation (TENS) and therapeutic ultrasound remains controversial. Contemporary guidelines generally prioritize active rehabilitation approaches because passive electrophysical modalities alone demonstrate inconsistent clinical benefits.[12] Nevertheless, electrotherapy may still provide short-term analgesic effects that facilitate participation in progressive exercise rehabilitation during the early symptomatic phase.

Although several rehabilitation studies have investigated PFPS management, important gaps remain regarding structured multimodal physiotherapy programs in young soccer athletes. Existing literature predominantly focuses on heterogeneous populations and randomized controlled trials, whereas detailed CARE-oriented case reports describing progressive FITT-based rehabilitation, functional progression, and return-to-sport considerations remain limited. In addition, relatively few reports comprehensively describe serial clinical outcomes, exercise progression, and rehabilitation reproducibility in athletic populations with PFPS. Therefore, clinically detailed case reports remain important to illustrate rehabilitation strategies and functional recovery processes applicable to sports physiotherapy practice.

This case report aimed to evaluate the short-term clinical outcomes following a six-week multimodal physiotherapy rehabilitation program in a young soccer athlete with PFPS. The intervention combined TENS, therapeutic ultrasound, progressive strengthening exercises, neuromuscular training, and functional rehabilitation using a structured FITT-based approach. It was hypothesized that the rehabilitation program would be associated with reduced pain intensity, improved quadriceps strength, enhanced knee mobility, and improved functional performance, thereby supporting safe return-to-sport progression.

Methods

This study was conducted as a CARE-guideline case report involving a young male soccer athlete diagnosed with Patellofemoral Pain Syndrome (PFPS).[13] The report aimed to describe the clinical presentation, rehabilitation process, and short-term outcomes following a structured six-week multimodal physiotherapy program. The study was conducted at the PERSIS Solo Football Academy between September and October 2025. Written informed consent for participation and publication of anonymized clinical data was obtained prior to intervention**.** Formal ethical approval was not required because this report involved a single-patient clinical case without experimental intervention or identifiable patient information.

The patient was an 18-year-old male competitive soccer athlete who had participated in organized soccer training for approximately six years. The athlete routinely trained five sessions per week, with each session lasting approximately 90–120 minutes. The patient primarily played as a midfielder, requiring repetitive sprinting, acceleration-deceleration, directional changes, and high running volume during training and competition. Symptoms began approximately one week before physiotherapy assessment following repeated strengthening exercises and field-training sessions involving high mechanical knee loading.

The patient reported diffuse anterior right knee pain localized around the patellar region, particularly during sprinting, squatting, resisted knee extension, stair activities, and weight-bearing functional movement. Mild swelling was initially reported, although no instability, locking, traumatic injury mechanism, or previous surgical history was identified. The patient denied previous ligament injury, fracture, neurological disorder, systemic disease, or current medication use. Psychosocial screening indicated that the patient was highly motivated to return to sports participation and demonstrated good adherence potential throughout rehabilitation.

Potential contributing factors identified during clinical assessment included repetitive overuse during soccer training, quadriceps weakness, decreased tolerance to high-load activity, and impaired lower-extremity control during dynamic movement. Observation during functional assessment demonstrated mild dynamic knee valgus and reduced single-leg squat control on the affected side. The patient also demonstrated discomfort during squat provocation and step-down testing, suggesting increased patellofemoral loading during dynamic weight-bearing activities. However, formal gait analysis and instrumented biomechanical assessment were not available in the present case and should therefore be considered a methodological limitation.

Clinical examination was performed by a licensed physiotherapist with experience in sports rehabilitation. Physical assessment included observation, palpation, range-of-motion examination, muscle strength testing, pain assessment, and functional evaluation. Pain intensity was measured using the Numeric Rating Scale (NRS), which demonstrates good validity and reliability for musculoskeletal pain assessment.[14] Knee Range of Motion (ROM) was measured using a universal goniometer, whereas quadriceps muscle strength was evaluated using Manual Muscle Testing (MMT) with the standard 0–5 grading system.[15] Functional performance was assessed using the Kujala Anterior Knee Pain Scale, a validated outcome measure commonly used in PFPS assessment.[16]

Primary outcomes included pain intensity and functional performance assessed using NRS and Kujala score, whereas secondary outcomes included knee ROM and quadriceps muscle strength. Outcome measurements were performed at baseline and during weeks 2, 4, and 6 of rehabilitation.

Additional clinical examination was conducted to support diagnostic accuracy and exclude alternative causes of anterior knee pain. Palpation revealed tenderness around the anterior patellar and patellofemoral regions. Pain was reproduced during resisted knee extension in a seated position and during squat provocation testing. The step-down test also reproduced symptoms during dynamic loading. No evidence of ligament instability, meniscal locking, joint effusion, or traumatic structural injury was identified. Differential diagnoses including meniscal injury, ligament injury, patellar tendinopathy, Osgood-Schlatter disease, patellar instability, and fat pad syndrome were considered less likely based on clinical presentation and physical examination findings. Because no traumatic mechanism, instability symptoms, or red-flag findings were identified, imaging examination was not considered clinically necessary during the initial physiotherapy management phase.

Based on symptom severity, functional limitation, and preserved daily activity capacity, the patient was clinically categorized as having mild-to-moderate PFPS with sport-specific functional impairment. From an International Classification of Functioning, Disability, and Health (ICF) perspective, impairments were primarily identified in pain sensation, muscle function, and sport-related activity limitation, particularly during sprinting and dynamic loading activities.

The rehabilitation program was administered for six weeks using the FITT principle (Frequency, Intensity, Time, and Type). Interventions were performed three sessions weekly under physiotherapist supervision, with each session lasting approximately 45–60 minutes. The rehabilitation program consisted of Transcutaneous Electrical Nerve Stimulation (TENS), therapeutic ultrasound, progressive strengthening exercises, neuromuscular control training, and functional rehabilitation.

TENS was administered using conventional mode with a frequency of 80–100 Hz, pulse duration of 100 µs, and sensory-level intensity without visible muscle contraction. Two electrodes were positioned surrounding the anterior patellar region, and stimulation was delivered for approximately 20 minutes per session. Therapeutic ultrasound was applied using a frequency of 1 MHz, intensity of 1.0–1.5 W/cm², pulsed mode (20% duty cycle), and treatment duration of approximately 5–8 minutes over the patellofemoral region using coupling gel.

Exercise therapy constituted the primary rehabilitation component and was progressively modified according to symptom response and functional tolerance. Early rehabilitation focused on pain reduction, quadriceps activation, and restoration of movement tolerance using low-load exercises. Initial interventions included quadriceps setting, straight-leg raise, hamstring stretching, and isometric knee extension. Progressive strengthening exercises targeting the quadriceps, hamstrings, gluteal muscles, and hip stabilizers were subsequently introduced using both open kinetic chain and closed kinetic chain approaches.

To improve reproducibility of the rehabilitation program, exercise progression is summarized in the following table.

Table 1. Progressive Rehabilitation Program Based on FITT Principle

Rehabilitation Phase	Exercise Type	Dosage	Progression Goal
Week 1–2	Quadriceps setting, straight-leg raise, hamstring stretching, isometric knee extension	2 sets × 10 repetitions	Pain reduction and muscle activation
Week 2–3	Mini squat, step-up exercise, bridging exercise	2–3 sets × 10–12 repetitions	Improve movement tolerance and lower-extremity control
Week 4–5	Wall squat, resisted knee extension, lunges	3 sets × 12–15 repetitions	Increase strength and functional loading tolerance
Week 5–6	Functional balance training, return-to-running progression	Symptom-based progression	Improve sport-specific functional performance

Resistance and functional complexity were progressively increased throughout rehabilitation according to patient tolerance. Adherence to the rehabilitation program was monitored during each treatment session through direct supervision and patient feedback, with the patient completing all planned intervention sessions.

To improve transparency of the clinical course, the chronological timeline of assessment and rehabilitation progression is summarized below.

Table 2. Timeline of Clinical Events and Rehabilitation Process

Time Period	Clinical Events and Management
Week −1	Onset of anterior knee pain during strengthening and soccer training
Initial assessment	Physical examination, NRS, ROM, MMT, Kujala evaluation
Week 1	Pain management and low-load strengthening
Week 2–3	Progressive strengthening and neuromuscular training
Week 4–5	Increased functional and sport-specific rehabilitation
Week 6	Final clinical outcome evaluation
Post-intervention	Return to running and sprinting activities without significant pain

Clinical improvement was evaluated descriptively using absolute changes and percentage improvement because statistical analysis was not applicable in a single-case report design**.** Interpretation of clinical improvement considered previously reported Minimal Clinically Important Difference (MCID) values where relevant evidence was available. However, no long-term follow-up assessment was available after completion of the rehabilitation program.

Results

Clinical outcomes were evaluated serially throughout the six-week rehabilitation program to assess changes in pain intensity, knee mobility, quadriceps muscle strength, and functional performance. Overall, the patient demonstrated progressive improvement across all primary and secondary outcome measures without treatment-related adverse events during the intervention period. Improvements were observed consistently from the early rehabilitation phase until the final evaluation.

To improve clarity and objective presentation of clinical progression, serial outcome measurements are summarized in the following tables.

Table 3. Serial Evaluation of Pain Intensity Using Numeric Rating Scale (NRS)

Evaluation Period	Tenderness Pain (NRS)	Functional Activity Pain (NRS)
Baseline	6/10	7/10
Week 2	4/10	5/10
Week 4	2/10	3/10
Week 6	0–1/10	0–1/10

At baseline, the patient reported moderate anterior knee pain during sprinting, squatting, resisted knee extension, and functional weight-bearing activities. Functional activity pain was greater than tenderness pain during palpation. Pain intensity progressively decreased throughout rehabilitation, with functional pain improving by approximately 85–100% from baseline to week 6. No symptom exacerbation was observed during exercise progression.

Serial evaluation of knee joint mobility demonstrated gradual improvement in knee flexion ROM during rehabilitation, whereas knee extension remained within normal limits throughout the intervention period.

Table 4. Serial Evaluation of Knee Range of Motion (ROM)

Evaluation Period	Knee Flexion	Knee Extension
Baseline	120°	0°
Week 2	125°	0°
Week 4	130°	0°
Week 6	135°	0°

Baseline assessment demonstrated mild limitation of knee flexion ROM. Progressive increases in knee flexion were observed during each evaluation period, with final ROM reaching 135° at week 6**.** Overall, knee flexion improved by approximately 15° during the rehabilitation period.

Quadriceps muscle strength was assessed serially using Manual Muscle Testing (MMT). Because the patient initially demonstrated pain-related weakness rather than severe motor impairment, changes in muscle performance were interpreted descriptively according to progressive functional recovery.

Table 5. Serial Evaluation of Quadriceps Muscle Strength

Evaluation Period	MMT Grade
Baseline	4/5
Week 2	4+/5
Week 4	5−/5*
Week 6	5/5

*The notation 5−/5 was used clinically to describe near-normal muscle strength with minimal residual discomfort during maximal contraction.

At baseline, quadriceps muscle strength was graded as 4/5, indicating movement against moderate resistance with associated discomfort. Progressive improvement in muscle strength was observed throughout rehabilitation. By week 6, quadriceps strength returned to normal without pain during resisted contraction or strengthening activity.

Functional performance was evaluated using the Kujala Anterior Knee Pain Scale to assess knee-related symptoms and activity limitation during daily and sports activities.

Table 6. Serial Evaluation of Functional Outcome Using Kujala Score

Evaluation Period	Kujala Score
Baseline	90/100
Week 2	93/100
Week 4	95/100
Week 6	100/100

The baseline Kujala score indicated relatively mild functional limitation despite clinically relevant pain during high-demand sports activity. Progressive improvement in Kujala scores was observed throughout rehabilitation, with a final score of 100/100 at week 6. The patient demonstrated improved tolerance during sprinting, squatting, single-leg activities, and soccer-related functional movement at the end of rehabilitation.

Because the baseline Kujala score was relatively high, the possibility of a ceiling effect should be considered when interpreting the magnitude of functional improvement. Nevertheless, serial improvements remained clinically meaningful because the patient initially experienced substantial pain during dynamic sports activity despite preserved general daily function.

No adverse events, symptom deterioration, or treatment-related complications were reported during the rehabilitation period. The patient completed all supervised rehabilitation sessions and demonstrated good adherence to the intervention program. At the final evaluation, the patient successfully returned to running and sprinting activities without significant pain or functional limitation. However, long-term follow-up evaluation after completion of rehabilitation was not available and should therefore be considered a limitation of the present report.

To summarize the overall rehabilitation progression, the following text-based flowchart illustrates the clinical course observed during the intervention period.

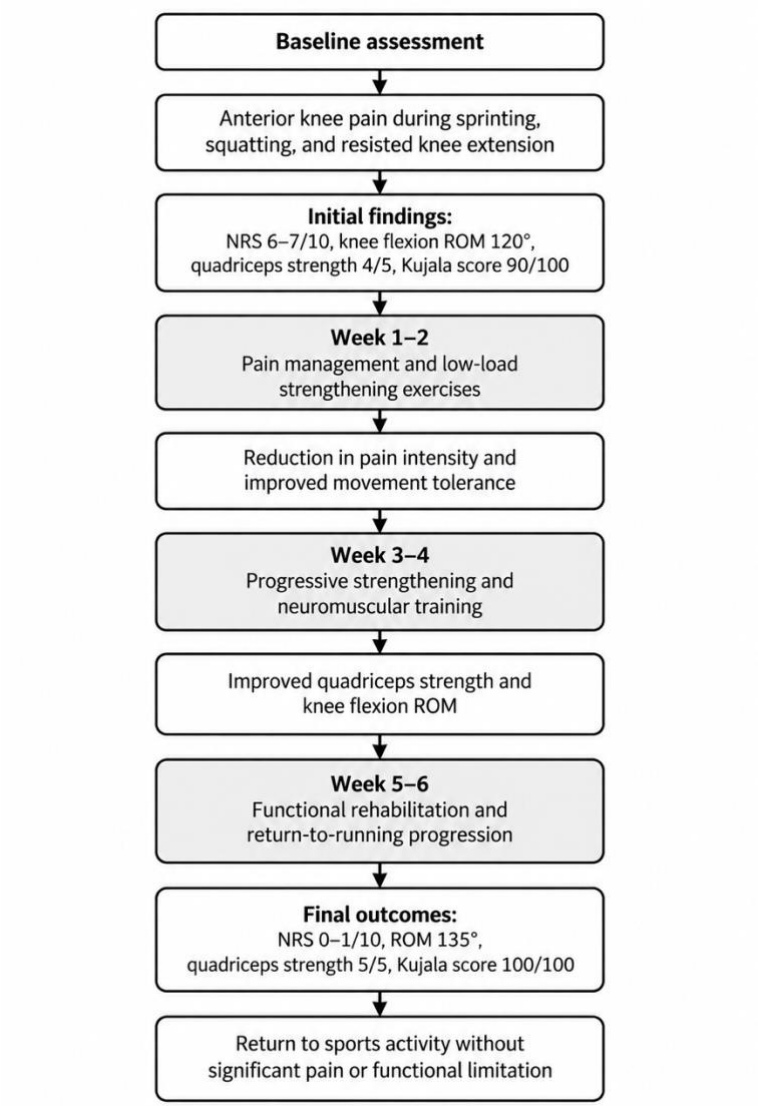

Figure 1. Clinical Progression and Physiotherapy Rehabilitation Timeline for Patellofemoral Pain Syndrome

Discussion

This CARE case report demonstrated that a six-week multimodal physiotherapy rehabilitation program was associated with clinically meaningful improvements in pain intensity, quadriceps muscle strength, knee joint mobility, and functional performance in a young soccer athlete with Patellofemoral Pain Syndrome (PFPS). The patient also successfully returned to running and sprinting activities without significant pain at the end of rehabilitation. Overall, the present findings support the role of structured rehabilitation emphasizing progressive exercise therapy, neuromuscular training, and supportive symptom-management modalities in athletes with PFPS.

The substantial reduction in pain intensity observed during rehabilitation is consistent with current evidence identifying exercise-based physiotherapy as the primary intervention for PFPS management. International clinical guidelines recommend knee-targeted and hip-targeted strengthening programs because these interventions may reduce patellofemoral joint stress, improve lower-extremity mechanics, and enhance neuromuscular control.[10] In the present case, progressive strengthening of the quadriceps, hamstrings, gluteal muscles, and hip stabilizers was associated with progressive reduction in pain during sprinting, squatting, and resisted knee extension activities. The reduction in functional pain from NRS 7/10 to 0–1/10 exceeded commonly reported thresholds for clinically meaningful improvement in musculoskeletal pain conditions, suggesting that the rehabilitation program produced clinically relevant symptom improvement rather than minor fluctuation alone.

The present findings may also be explained by improved neuromuscular control and lower-extremity alignment during dynamic movement. PFPS is strongly associated with abnormal movement patterns involving excessive femoral internal rotation, dynamic knee valgus, altered patellar tracking, and impaired kinetic-chain control during weight-bearing activities.[6,7] In soccer athletes, repetitive sprinting, acceleration-deceleration, cutting maneuvers, and high training loads may substantially increase patellofemoral joint compression forces.[3] The patient initially demonstrated reduced single-leg control and mild dynamic knee valgus during functional assessment, suggesting impaired lower-extremity stabilization during dynamic activity. Progressive strengthening and neuromuscular exercises may therefore have contributed to improved movement efficiency and reduced excessive patellofemoral loading throughout rehabilitation.

Improvement in quadriceps muscle strength represented another clinically important outcome in this case report. Quadriceps dysfunction is frequently associated with PFPS because inadequate force generation and impaired neuromuscular activation may compromise patellar stabilization and shock absorption during movement.[11] Progressive strengthening exercises performed during rehabilitation were associated with gradual restoration of quadriceps performance from MMT grade 4/5 to normal strength at week 6. Improved muscular function may also explain the patient's increased tolerance during weight-bearing and sport-specific activities during later rehabilitation phases.

Serial improvement in knee flexion ROM was also observed during the intervention period. Restricted knee mobility in PFPS may occur secondary to pain inhibition, muscular tightness, and avoidance of painful movement. As pain intensity decreased and muscular performance improved, the patient demonstrated greater tolerance to knee flexion during functional tasks. Improved ROM may therefore have contributed to more efficient squatting mechanics and reduced movement limitation during sports participation.

The progressive increase in Kujala score additionally suggested improvement in sport-related functional performance throughout rehabilitation. However, the relatively high baseline Kujala score (90/100) should be interpreted cautiously because a potential ceiling effect may limit the sensitivity of functional change measurement. Despite preserved general daily activity, the patient initially experienced clinically relevant pain during high-demand sports activities. Therefore, the functional improvements observed during rehabilitation likely reflected enhanced tolerance to sport-specific loading rather than recovery from severe daily disability.

The present report also highlights the importance of return-to-sport rehabilitation in athletes with PFPS. Successful return to sports participation requires not only pain reduction but also restoration of movement confidence, neuromuscular control, lower-extremity stability, and tolerance to repetitive loading. Persistent symptoms during sprinting and dynamic activity may negatively affect athletic performance and increase the risk of recurrent injury if rehabilitation is insufficient. In the present case, gradual progression toward running and sprinting activities was integrated into the rehabilitation program to improve sport-specific movement tolerance and functional readiness.

An additional important aspect of this report involves the role of electrotherapy modalities in PFPS rehabilitation. Current international guidelines generally prioritize exercise therapy and patient education, whereas the effectiveness of passive electrophysical modalities such as TENS and therapeutic ultrasound remains controversial.[12] Several systematic reviews have demonstrated inconsistent additional benefits of electrotherapy when compared with exercise therapy alone. Nevertheless, adjunctive electrotherapy may still provide temporary analgesic effects that facilitate participation in active rehabilitation during the early symptomatic phase. In the present case, TENS and ultrasound were applied primarily to improve pain tolerance and support participation in progressive exercise therapy rather than as isolated interventions. Consequently, the favorable outcomes observed in this patient were more likely associated with the structured exercise-based rehabilitation program than with electrotherapy alone.

Several strengths and limitations should be considered when interpreting the present findings. A major strength of this report was the detailed description of a progressive multimodal rehabilitation program incorporating serial outcome evaluation, neuromuscular rehabilitation, and return-to-sport progression in a young soccer athlete. The report also improved CARE guideline compliance by including patient perspective, rehabilitation timeline, differential diagnosis, and intervention reproducibility.

However, important methodological limitations remain**.** Because this study involved a single patient, the findings cannot be generalized to broader PFPS populations or athletic groups. Formal gait analysis and instrumented biomechanical assessment were not available, limiting objective evaluation of movement mechanics. Imaging examination was not performed because no traumatic injury mechanism or red-flag findings were identified; however, the absence of imaging confirmation limited the ability to completely exclude structural pathology. Placebo effects, observer bias, and the absence of blinding may also have influenced clinical outcomes. In addition, long-term follow-up evaluation was unavailable, preventing assessment of symptom recurrence and sustainability of rehabilitation outcomes after return to sports participation.

Future studies should therefore investigate multimodal physiotherapy rehabilitation for PFPS using larger athletic populations, biomechanical assessment, longer follow-up periods, and randomized controlled designs. Further investigation regarding return-to-sport criteria, neuromuscular adaptations, and the role of adjunctive electrotherapy modalities in PFPS rehabilitation is also warranted.

Overall, the present case report supports current evidence suggesting that progressive exercise-based rehabilitation may contribute substantially to pain reduction and functional recovery in athletes with PFPS. Comprehensive rehabilitation programs emphasizing strengthening, neuromuscular control, load management, and gradual functional progression may facilitate safe return-to-sport participation while minimizing persistent symptoms and recurrent functional limitation.

Conclusion

This CARE case report demonstrated that a structured six-week multimodal physiotherapy rehabilitation program was associated with reduced pain intensity, improved quadriceps muscle strength, increased knee joint range of motion, and enhanced functional performance in a young soccer athlete with Patellofemoral Pain Syndrome (PFPS). Progressive exercise therapy combined with supportive electrotherapy modalities enabled the patient to return to running and sprinting activities without significant pain or functional limitation at the end of rehabilitation.

The present findings highlight the potential clinical value of individualized rehabilitation programs emphasizing progressive strengthening, neuromuscular control, movement retraining, and gradual return-to-sport progression in athletes with PFPS. Although adjunctive modalities such as TENS and therapeutic ultrasound may assist short-term symptom management, exercise-based rehabilitation appears to remain the primary contributor to functional recovery.

However, the findings should be interpreted cautiously because this report involved a single patient without long-term follow-up evaluation. Future studies involving larger athletic populations, biomechanical assessment, longitudinal follow-up, and randomized controlled designs are required to further evaluate the effectiveness and sustainability of multimodal physiotherapy rehabilitation strategies for PFPS.

Patient Perspective

The patient reported progressive reduction in anterior knee pain and improved confidence during sports participation throughout the rehabilitation period. At the end of the intervention, the patient stated that sprinting, squatting, strengthening exercises, and field-training activities could be performed without significant discomfort. The patient also expressed satisfaction with the rehabilitation program and reported increased confidence in returning to soccer participation safely.

Author Contribution

Mutiara Anisah: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing original draft.
Wijianto: Supervision, Validation, Methodology, Writing review and editing.
Muhammad Ali Ramadhani: Supervision, Investigation, Validation, Writing review and editing.

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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 participation and publication of anonymized clinical information was obtained from the patient prior to intervention. Formal ethical approval was not required because this study involved a single-patient clinical case report without experimental intervention or identifiable patient information.

Informed Consent

Written informed consent for participation and publication of anonymized clinical data was obtained from the patient before initiation of the rehabilitation program. The patient agreed to publication of clinical findings, intervention details, and outcome measurements for academic and scientific purposes.

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