



Case Report

ACL reconstruction rehabilitation in an adolescent athlete: A case report

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Abstract

Background: Anterior Cruciate Ligament (ACL) injuries are among the most common knee injuries in athletes, particularly in sports involving pivoting and sudden directional changes such as football. Surgical reconstruction followed by structured rehabilitation is essential for restoring knee stability and functional performance. This case report describes the rehabilitation progression of a 14-year-old male who sustained an ACL tear due to a football-related twisting injury and underwent ACL reconstruction using a hamstring tendon graft. A structured rehabilitation protocol based on the Melbourne ACL Rehabilitation 2.0 program was implemented. The rehabilitation program included early pain management, restoration of range of motion, progressive strengthening, neuromuscular control training, balance exercises, and sport-specific functional training. The patient demonstrated progressive improvement in muscular endurance, balance, and functional performance and successfully progressed toward the return-to-sport phase.

Keywords: Anterior Cruciate Ligament; ACL Reconstruction; Rehabilitation Protocol; Sports Physiotherapy; Knee Stability; Adolescent Athlete; Return to Sport.

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1. Introduction

Anterior Cruciate Ligament (ACL) injuries represent a significant proportion of knee injuries among athletes participating in sports that involve pivoting, cutting, and sudden deceleration. Sports such as football place considerable stress on the knee joint, making athletes more vulnerable to ligamentous injuries. ACL tears often lead to knee instability, reduced functional capacity, and an increased risk of secondary injuries such as meniscal damage if not properly managed. [1]. ACL reconstruction surgery aims to restore mechanical stability to the knee joint and allow athletes to return to their previous level of activity. However, surgical intervention alone is not sufficient to achieve optimal outcomes. Post-operative rehabilitation plays a crucial role in restoring joint mobility, muscular strength, neuromuscular coordination, and overall functional performance. Evidence-based rehabilitation protocols such as the Melbourne ACL Rehabilitation Program emphasize gradual progression through different stages of recovery. This case report

describes the rehabilitation management and functional outcomes of an adolescent athlete following ACL reconstruction.

2. Case Presentation

A 14-year-old male student presented with complaints of knee pain and instability following a football injury. The injury occurred due to a twisting mechanism while playing football, resulting in immediate discomfort and difficulty performing weight-bearing activities. Clinical examination and imaging confirmed an anterior cruciate ligament tear. The patient subsequently underwent ACL reconstruction using a hamstring tendon graft. Following surgery, the patient was referred to for physiotherapy rehabilitation to restore functional capacity and facilitate a safe return to sports activities.

3.1. Rehabilitation Protocol

The rehabilitation program followed the Melbourne ACL Rehabilitation 2.0 protocol and was tailored according to the patient's functional progression. During the early phase of rehabilitation, the primary goals were to reduce pain and swelling, restore knee range of motion, activate the quadriceps muscle, and improve gait patterns. Physiotherapy sessions were conducted on alternate days. Initial interventions included swelling management, gentle range-of-motion exercises, quadriceps activation drills, and gait training with minimal loading on the affected limb. After two weeks, the program progressed to include mobility exercises and gradual strengthening activities [\[2\]](#).

3.2. Mobility Training

A comprehensive mobility program was introduced to improve overall movement efficiency and prevent compensatory patterns. The exercises included shoulder stretching, pectoral stretching, thoracic extension movements, trunk rotation exercises, prone press-ups, knee hugs, figure-four stretches, neurodynamic exercises, frog rock mobility drills, and 90-90 hip mobility stretches. These exercises helped maintain global mobility and improve coordination across the kinetic chain.

3.3. Strengthening and Core Training

Progressive strengthening exercises were introduced to improve lower limb stability and functional performance. The program began with a cycling warm-up followed by mobility exercises. Strengthening exercises included single-leg squats, single-leg bridges, hip thrusts, calf raises, and Copenhagen strengthening exercises. Core stability training was incorporated using plank and side plank exercises to improve trunk control and enhance kinetic chain stability during lower limb movements [\[3\]](#).

3.4. Balance and Neuromuscular Training

Balance and neuromuscular control exercises were incorporated to improve joint stability and reduce the risk of reinjury. Static balance training included single-leg stance and tandem-stance exercises. Dynamic balance training involved reach tasks, the Star Excursion Balance Test (SEBT), BOSU balance exercises, and perturbation training. These interventions helped improve proprioception and neuromuscular coordination around the knee joint.

3.5. Functional and Agility Training

As the patient progressed further in rehabilitation, functional training and sports specific drills were introduced. Agility training involved change-of-direction drills and progressive sport-specific movements. Running mechanics training included A-skips, B-skips, C-skips, and wall running drills to improve movement efficiency and prepare the patient for return to sports. [\[4,5\]](#).

Table 1: Muscular Endurance Test Results

Test	Result
Wall Sit	17 sec
Glute Bridge	36 sec
Hamstring Bridge	48 sec
Calf Raises (60 BPM)	16 repetitions
Copenhagen Hold	9 sec

Table 2: Rehabilitation Phases and Interventions

Phase	Interventions
Early Phase	Pain control, ROM exercises, quadriceps activation
Mobility Phase	Full body mobility drills and stretching
Strength Phase	Single-leg strengthening and hip strengthening
Neuromuscular Phase	Balance and proprioception training
Functional Phase	Running drills and sports-specific exercise

4. Outcome

At the current stage of rehabilitation, the patient has achieved full knee range of motion without extensor lag. Muscular strength and endurance have improved significantly. Functional testing indicates no limitations in daily activities. The patient has progressed to the return-to-sport phase and continues advanced strengthening and agility training.

5. Discussion

Structured rehabilitation following ACL reconstruction is essential for restoring knee stability and preventing reinjury. Progressive strengthening, neuromuscular training, and sport-specific drills are key components of successful rehabilitation programs. Previous research has demonstrated that combining strength training with balance and agility exercises significantly improves return-to-sport outcomes. The present case demonstrates how a structured and progressive rehabilitation protocol can result in excellent functional recovery in a young athlete.

6. Conclusion

A structured and progressive rehabilitation program following ACL reconstruction resulted in excellent functional recovery for this adolescent athlete. Early restoration of mobility, progressive strengthening, neuromuscular training, and sport-specific drills

contributed to the successful rehabilitation outcome and safe progression toward return-to-sport activities.

References

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