Case Report

Early in patient post-operative rehabilitation of right anterior cruciate ligament reconstruction using semitendinosus and gracilis graft in Kabaddi player: A case study

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ABSTRACT

The anterior cruciate ligament (ACL) is a primary stabilizing structure of the knee joint, resisting anterior translation and rotational movement of the tibia relative to the femur. Injuries to the ACL represent one of the most significant knee injuries encountered in young, athletically active individuals, causing immediate functional impairment and long-term sequelae, such as instability, meniscal damage, and early osteoarthritis if inadequately managed. A 17-year-old male Kabaddi player underwent ACL reconstruction using a semitendinosus and gracilis tendon autograft. Post-operative physiotherapy commenced on the 2nd day following a structured protocol aimed at early recovery and graft protection. During the first 2 weeks, rehabilitation emphasized pain and edema control through cryotherapy and elevation, gradual progression of passive knee flexion and extension within a pain-free range, and isometric strengthening of the quadriceps, hamstrings, hip abductors, and gluteal muscles. Active ankle pumps were included to maintain circulation, and the patient was trained in partial weight-bearing ambulation with crutches under physiotherapist supervision. After 2 weeks of structured rehabilitation, the patient demonstrated significant improvement in knee mobility, swelling, pain, muscle activation and extension lag. Knee flexion reached 100°, with full extension and partial weight bearing was achieved with minimum assistance.

Key words: Anterior cruciate ligament reconstruction, Kabaddi player, Knee flexion, Physiotherapy rehabilitation, Semitendinosus–gracilis graft, Sports injury

The anterior cruciate ligament (ACL) is a primary stabilizing structure of the knee joint, resisting anterior translation and rotational movement of the tibia relative to the femur. Injuries to the ACL represent one of the most significant knee injuries encountered in young, athletically active individuals, causing immediate functional impairment and long-term sequelae, such as instability, meniscal damage, and early osteoarthritis if inadequately managed [1]. In ACL reconstruction, the quadruple-stranded semitendinosus (ST) and gracilis graft demonstrates greater strength compared to the bone–patellar tendon–bone graft, though clinical outcomes between the two graft types show no significant differences. The use of a quadruple ST graft can reduce donor site morbidity. In addition, the quadruple ST graft offers certain advantages over the double ST and gracilis (STG) graft [2]. Rehabilitation protocols traditionally follow a phased approach, beginning with pain and swelling control, progressing through range of motion (ROM) and strength restoration, and culminating in sport-specific drills and return-to-play criteria. Despite general guidelines, rehabilitation must be individualized based on the patient's physical demands, goals, and activity type [3]. In sports players, early rehabilitation is even more crucial because of the sport's physical nature. The knee must be strong, flexible, and stable to allow squatting, lunging, and resisting tackles. Skipping or delaying rehab can lead to complications, such as joint stiffness, muscle wasting, poor balance, and a longer time away from sport. Physiotherapists play a key role in designing sport-specific rehab plans. They gradually progress the player from simple movements to advanced exercises, preparing them for the high demands of Kabaddi. The goal is not just to heal the knee, but to ensure the player returns stronger, safer, and more confident.

The present case involves a 17-year-old male Kabaddi player who sustained a full-thickness tear of the ACL of the knee following a twisting injury sustained during the play. This case provides an opportunity to

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explore the injury mechanism in a high-risk contact sport and to discuss the early phases of management with particular emphasis on the initial 2-week rehabilitation protocol. The report will focus on early post-injury and post-operative physiotherapy rehabilitation care aimed at pain and swelling reduction, restoration of joint mobility, activation of hamstring and quadriceps and early weight bearing to improve the patient's outcome.

CASE DESCRIPTION

A 17-year-old male student and Kabaddi player sustained a twisting injury on 23rd July to his right knee while attempting a sudden change of direction with the foot fixed and trunk rotation, resulting in a popping sound, immediate pain, swelling, and inability to continue playing. The numeric pain rating scale (NPRS) scores at rest and during activities were 4/10 and 9/10, respectively. He consulted a local doctor the same day and was advised to have a magnetic resonance imaging, which revealed a full-thickness ACL tear and meniscofemoral ligament tear (Fig. 1).

The patient was posted for right ACL reconstruction and lateral meniscectomy on 14th August under spinal anesthesia (Fig. 2). The patient was in a supine position with the leg hanging, painting, draping done, and the tourniquet inflated. Entry taken with 2 ports, anteromedial and anterolateral; diagnostoscopy done, which showed a complete ACL tear and a meniscofemoral full-thickness tear. The shaver was introduced from the anteromedial part and shaved; a lateral meniscal tear was visualized, and a meniscectomy was done. The lateral ACL was visualized and removed with the help of biter forceps. An anteromedial incision was taken at the level of the tibial tubercle, around 5 cm of skin, and the subcutaneous fascia was exposed. Semitendinous and gracilis release using a stripper, graft preparation done with a triple graft of a 9 mm drill up to a 25 mm graft put in place proximally fixed with a 15 mm endobutton, and a tennisotomy of the graft done and fixed distally with a suture disc. Across wash given, wound closed in a layer, tourniquet deflated, dressing done, and long knee brace applied. The pre-rehabilitation ROM and muscle testing for the right lower limb (August 15, 2025) were shown in Tables 1 and 2.

Post-operatively, the NPRS scores at rest and during activities were 2/10 and 4/10, respectively. The post-rehabilitation ROM and muscle testing for the right lower limb (September 01, 2025) were shown in Tables 1 and 2. The post-operative rehabilitation protocol for the right lower limb is shown in Table 3. The total duration of rehabilitation was 2 weeks (Figs. 3 and 4).

DISCUSSION

The ACL reconstruction in young high-demand athletes aims to restore knee stability and facilitate a safe return to sport; however, it also presents challenges, such as graft failure, donor-site weakness, and the risk of reinjury if rehabilitation is not properly managed. In this case, a 17-year-old male Kabaddi player underwent ACL reconstruction using a ST and gracilis autograft. This graft was selected considering the athlete's sporting demands, as it provides adequate strength while allowing the development of a graft-specific rehabilitation protocol.

The use of hamstring tendon grafts is associated with a temporary reduction in hamstring strength during the early recovery phase compared to patellar tendon grafts. In addition, studies indicate that hamstring grafts in younger individuals exhibit different mechanical properties, such

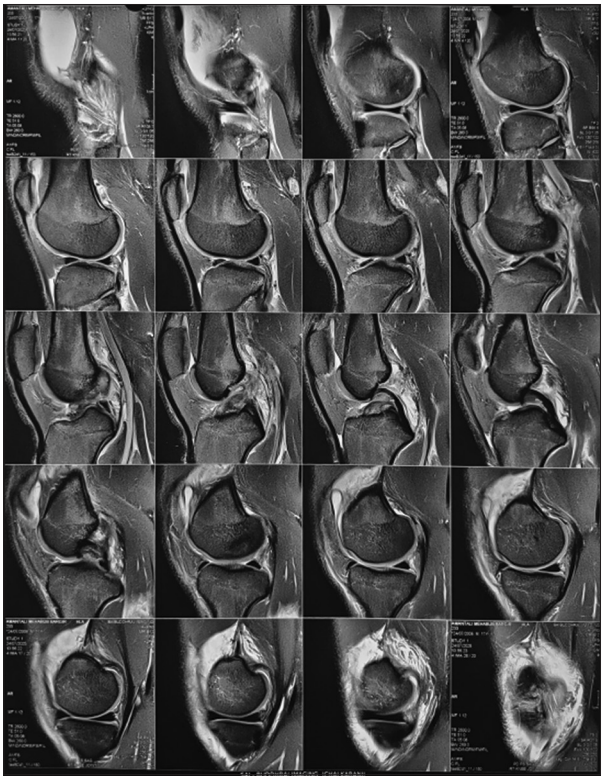

Figure 1: Magnetic resonance imaging of the knee showing medial meniscus posterior horn tear, full thickness tear of anterior cruciate ligament and Grade 2 tear of medial collateral ligament

Figure 2: On August 16, 2025 (Day of surgery), X-ray in the anteroposterior and lateral view of right knee joint, Post-anterior cruciate ligament reconstruction with metallic button fixation at end of tibial and femoral tunnel

Table 1: The pre- and post-rehabilitation range of motion for the right lower limb

Assessment pre and post	Joint	Movement	Normal ROM	Patient ROM	End Feel
Pre-rehabilitation ROM (August 15, 2025)	Hip Joint	Flexion	0°–120°	0°–90°	Soft (soft tissue approximation)
		Extension	0°–20°	0°–20°	Firm (capsular/ligamentous)
		Abduction	0°–45°	0°–35°	Firm (capsular)
		Adduction	0°–30°	0°–15°	Firm (capsular)
	Knee joint	Flexion	0°–135°	0°–30°	Soft (capsular/soft tissue)
		Extension	135°–0°	30°–20° (limited)	Firm (capsular)
Post-rehabilitation ROM (September 01, 2025)	Joint	Movement	Normal ROM	Patient ROM	End Feel
	Hip joint	Flexion	0°–120°	0°–95°	Soft (soft tissue approximation)
		Extension	0°–20°	0°–25°	Firm (capsular/ligamentous)
		Abduction	0°–45°	0°–35°	Firm (capsular)
		Adduction	0°–30°	0°–15°	Firm (capsular)
	Knee joint	Flexion	0°–135°	0°–95°	Soft (capsular/soft tissue)
		Extension	135°–0°	90°–0° (limited)	Firm (capsular)

ROM: Range of motion

Table 2: Pre- and post-rehabilitation manual muscle testing for right lower limb

Muscle group	Primary movement	MMT Grade (pre-rehabilitation) (August 15, 2025)	MMT Grade (post-rehabilitation) (September 01, 2025)
Hip Flexors (iliacus, psoas major, rectus femoris, pectineus, and sartorius)	Hip flexion	Grade 2	Grade 4
Hip Extensors (biceps femoris, semitendinosus, and semimembranosus)	Hip extension	Grade 2	Grade 4
Hip Abductors (gluteus medius, gluteus minimus, and tensor fasciae latae.)	Hip abduction	Grade 3	Grade 4
Hip Adductors (adductor longus, adductor brevis, and adductor magnus, along with the gracilis and pectineus.)	Hip adduction	Grade 3	Grade 4
Knee Flexors (semitendinosus, semimembranosus, and biceps femoris)	Knee flexion	Grade 2	Grade 4
Knee Extensors (rectus femoris, vastus lateralis, vastus medialis, and vastus intermedius).	Knee extension	Grade 2	Grade 4

as variations in Young's modulus, emphasizing the need for early activation alongside careful protection of the donor muscles. Accordingly, this rehabilitation protocol included targeted strengthening exercises for the ST and gracilis [4].

During the first 2 weeks post-surgery, rehabilitation focused on pain and swelling control, graft protection, gradual restoration of knee ROM, prevention of quadriceps muscle wasting, early muscle activation (quadriceps, hamstrings, and gluteal muscles), and safe initiation of weight-bearing and ambulation. Evidence supports early joint mobilization and weight-bearing to enhance functional recovery [5]. Janssen *et al*. reported that early open kinetic chain exercises (around 4 weeks) combined with early weight-bearing improve long-term outcomes [6]. However, Janssen *et al*. (2022) highlighted that accelerated weight-bearing, while improving International Knee Documentation Committee scores, may increase the risk of knee laxity and tunnel enlargement [7].

In this patient, passive ROM was initiated from day 2, along with isometric exercises targeting the quadriceps, hamstrings, hip abductors, and gluteal muscles, supplemented by ankle pumps and supervised partial weight-bearing. The patient demonstrated good tolerance to this early rehabilitation approach, with progressive improvements in knee ROM, muscle activation, and weight-bearing capacity within the first 2 weeks. No signs of excessive pain, swelling, graft compromise, or knee instability were observed during this period. Early knee mobilization helped prevent stiffness (arthrofibrosis), while isometric strengthening minimized muscle inhibition and extension lag. Ankle pumps contributed to improved circulation and reduction of swelling [8,9].

Furthermore, early strengthening of the hip abductors and gluteal muscles enhanced proximal control, which is critical for maintaining knee alignment during sport-specific movements, such as cutting and pivoting in Kabaddi. This aligns with the neuromuscular training model described by Vadala *et al*. (2010), emphasizing early mobility, weight-bearing, and motor control [10].

Overall, the patient showed favorable early functional outcomes, including improved joint mobility, muscle activation, and safe ambulation. This suggests that a graft-specific, accelerated rehabilitation protocol can be effectively implemented when closely monitored. The individualized approach used in this case appears to support faster recovery of strength and function without compromising graft integrity, indicating its potential

Table 3: Post-operative rehabilitation protocol for right lower limb

Accelerated rehabilitation protocol	Traditional rehabilitation protocol
Day 1- non-weight-bearing walking Day 2 to day 4- Dressing • Removal of drain • Passive knee mobilization (pain-free range) • Static quadriceps and static hamstrings • SLR with bracing • Non-weight-bearing walking Day 5- dressing • Passive knee mobilization, knee flexion up to 0-90 in bed side sitting • Static quadriceps and static hamstrings • SLR with bracing • Patellar Mobilisation • Partial weight-bearing walking • Passive knee 90° flexion by the therapist • Full weight bearing • Active and passive ROM exercises to knee • Static and dynamic exercises to knee • Active assisted pendulum exercise for knee flexion beyond 90 degrees in sitting • Prone knee bending with active pressure of the unaffected knee SLR with holds	Day 1- non-weight-bearing walking Day 2 to day 4- Dressing • Removal of drain • Passive knee mobilization (pain-free range) • Static quadriceps and static hamstrings • SLR with bracing • Non-weight-bearing walking Day 5- dressing • Passive knee mobilization, knee flexion up to 0-90 in bed side sitting • Static quadriceps and static hamstrings • SLR with bracing • Non-weight-bearing walking
Day 15- (home program) patient is called for follow up • Removal of sutures • With the above rehabilitation protocol, partial squats progressed to sumo squats by 1 month • Close kinetic chain exercise • Discontinue the use of the brace • Gait training with a proper gait pattern	Day 15- patient is called for follow-up • Removal of sutures • Non-weight-bearing walking • Continue static exercises for the quadriceps and hamstrings • Continue use of braces

ROM: Range of motion, SLR: Straight leg raise

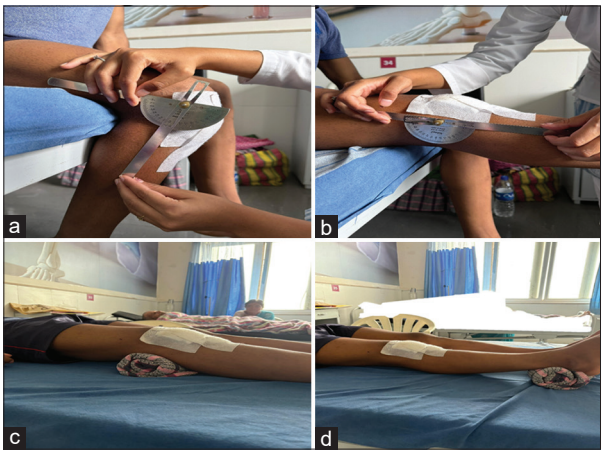

Figure 3: (a) Flexion and (b) extension post-rehabilitation, (c) static quadriceps and (d) static hamstrings

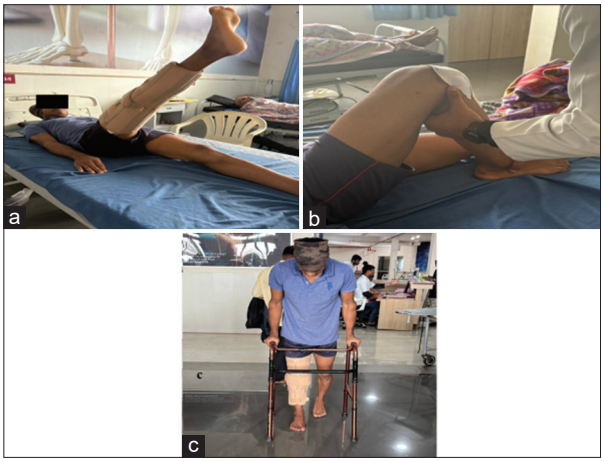

Figure 4: (a) Straight leg raise with brace, (b) Passive knee flexion with pain free range of motion, (c) partial weight bearing

advantage over traditional, generalized rehabilitation protocols.

CONCLUSION

Early implementation of a structured physiotherapy protocol following ACL reconstruction using ST and gracilis autografts can effectively restore knee mobility and muscle function while maintaining graft protection. In this case, achieving 100° of knee flexion within two weeks indicates favorable early functional recovery. Controlled passive ROM, progressive isometric strengthening, and weight-bearing as tolerated proved benefits in facilitating a safe and efficient post-operative rehabilitation process in a young athletic individual.

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