

Case report

CONSERVATIVE REHABILITATION OF PARTIAL ANTERIOR CRUCIATE LIGAMENT TEAR - A CASE REPORT

ABSTRACT

The anterior cruciate ligament is one of the most important ligaments in the knee joint (ACL). The ACL is necessary for appropriate knee joint mobility and mechanics. When the ACL is torn, patients may experience issues with their knee's function, as well as instability and the sensation of 'falling away' while walking. The anterior cruciate ligament acts as a main restraint on tibia-to-femur translation (anterior shear). Depending on the angle of knee flexion, this function is allocated to either anteromedial or posterolateral bundle. When the knee is fully extended, the posterolateral bundle is tense; however, when the knee flexes, the posterolateral bundle loosens and the anteromedial bundle tightens.

We report the case of a 32-year-old man who twisted his leg while jogging, resulting in a partial thickness ACL rupture and mild joint effusion along the periarticular surface of the right knee, as revealed by radiological symptoms and MRI. Conservative rehabilitation in a patient aged 32 year shows good results and so the surgery was not performed. Initially 10 weeks protocol was managed in hospital under the guidance of a therapist including strengthening, stretching and conditioning of lower limb muscles, later on as pain reduced and patient achieved functional pain free range 12 week protocol was further set for home program.

Keywords: partial anterior cruciate ligament tear, joint effusion, periarticular surface, twisting, and conservative management.

INTRODUCTION

Damage to the anterior cruciate ligament (ACL) is a common traumatic injury in sports, accounting for around half of all knee ligament injuries.(1).A partial ACL rupture is a prevalent type of ACL damage, accounting for 10 to 2% of solitary ACL lesions.(2) There are three reasons to save these leftovers for the patient: biomechanical, circulatory, and proprioceptive benefits. A good grade fiber acts as graft protection during the healing process.(3) The vascularization of the ACL augmentation may be aided by the presence of periligamentous and endoligamentous arteries in the native ACL tissue. The remaining mechanoreceptors in the leftover ACL fibers may have a proprioceptive role.(4)

Only a portion of the ACL is torn with a partial ACL tear. In a healthy ACL, the Anteromedial and Posterolateral bundles are present. In a partial damage, only one of the two bundles was ripped.(5).As a result, there is no harm to the second package. Many patients with a partial ACL rupture may be able to resume their daily activities without buckling, instability, or giving way.(6).However, recovering from an injury can take months, and you must also complete the rehabilitation programme. (7).

The concept of repairing only the ligament fibers that have been torn is considerably newer(8). A partial ACL tear is defined by a positive Lachman's test and a positive anterior drawer test with a hard endpoint, as well as modest differential laxity, MRI findings of hyperintensity within the ACL fibers, and arthroscopic findings of a partial tear(9).

. Many practitioners advocate for a cautious approach when treating a partial ACL injury. Rehabilitation is a conservative treatment option for patients who have torn their ACL. Rehabilitation is essentially an exercise regimen that includes both clinically delivered exercises and exercises completed at home. Individual risk variables, such as age, career, hobbies, or prior injury, may influence the combination of exercises used.

The main objective of this case report is to see effect of conservative management in a 32 year old male bio-engineer who while running in the morning hours had a history of twisting of leg.

PATIENT INFORMATION

We present a case of a 32-year old male with a supposed history of twisting of leg while running dated on 03/09/2021, who came to Acharya Vinobha Bhave Rural Hospital (AVBRH) on 05/09/2021, with the complaints of pain and swelling over right knee. He also gave the history that pain was sudden in onset, gradually progressive in nature and dull aching type which got aggravated while walking and relieved by taking rest and medication. Patient is bio-engineer by occupation. Patient started running 40 days prior to injury. The necessary investigations such as radiological findings, MRI and special tests confirmed that he is suffering by partial ACL tear. Then, he was managed conservatively with brace, analgesic medication and rest. The patient was prescribed with medication such as: vitamin-C tablet, pantoprazole, enzoflam tablet, limcee tab, seroace-D tab, pazom 40 tab, provera 50mg tab, thymozen forte tab. The patient also gives the family history of father having hypertension and mother has thyroid issues. He was then referred to physiotherapy for further management. While walking the patient has the limping type of gait with stride and step length reduced (step length: 19.5cm and stride length: 31cm).

TABLE 1: Grading system of partial ACL ruptures. (3)

Table 1: Grading system of partial ACL ruptures.

Grade	Definition
1	Intact ACL sheet with haemorrhage of the synovial ACL tissue.
2	Ruptured synovial ACL sheet without extrusion of ACL tissue.
3	Ruptured synovial ACL sheet with extrusion of ACL tissue.
4	Partial rupture of one ACL bundle with 25-50% remaining ACL structure cave: in case of a two bundle partial ACL rupture, the percentage of the more injured bundle is used for classification.
5	Partial rupture of one ACL bundle with 10-25% remaining ACL structure cave: in case of a Two bundle partial ACL rupture, the percentage of the more injured bundle is used for classification.

TABLE 2: Timelines of events

A timeline of events related to patient's injury and treatment

Event	Dates
Twisting of leg while running	September 03, 2021
Conservatively managed by medication and rest	September 05, 2021
Confirmed Diagnosis with partial ACL tear on right knee	September 11, 2021
Referred to physiotherapy for further management	September 12, 2021

TABLE 2: Timelines of events

CLINICAL FINDINGS

He was examined for his attitude in a supine position with both shoulders at the same level. With a cushion supporting the knee and ankle in plantarflexion, the right leg was abducted and slightly externally rotated, and the knee was slightly flexed. A bulging right knee joint was discovered. Tenderness was palpable above the right knee joint's medial joint line (Grade 2). The Lachman test, a passive accessory mobility test of the knee used to determine the Anterior Cruciate Ligament's (ACL) integrity, came up positive. On the NPRS, he was likewise in pain with a score of six.

TABLE 3: Isometric Strength on date of examination and post treatment (MMT)

Muscles	Pre- Treatment		Post-treatment		
	Left	Right	Right (Affected)		
			Week 1-3	Week 4-10	Week 10-22
Hip					
Flexors	4	3++	3+	3+	4+
Extensors	4+	3-	3+	4-	4+
Abductor	4+	4+	3+	4-	4+
Adductor	4+	4+	3+	4-	4+
Knee					
Flexors	4	2++	3-	3+	4-
Extensors	4	2-	2+	3-	4-
Ankle					
Plantar flexor	4+	3+	3+	4-	4+
Dorsi flexor	4+	3+	3+	4-	4+
Invertors	4+	3+	4-	4+	4+
Evertors	4+	3+	4-	4+	4+

TABLE 4: Range of motion on date of examination and post treatment

Joint	Pre- Rehabilitation				Post- Rehabilitation (Right)		
	Left	Left	Right	Right	Week 1-3	Week 4-10	Week 10-22
	Active	Passive	Active	Passive			
Hip							
Flexion	0-115°	0-120°	0-95°	0-100°	0-105°	0-110°	0-115°
Extension	0-25°	0-30°	0-15°	0-20°	0-20°	0-25°	0-30°
Abduction	0-40°	0-45°	0-30°	0-35°	0-35°	0-40°	0-45°
Adduction	0-40°	0-45°	0-25°	0-30°	0-30°	0-35°	0-40°
Knee							
Flexion	0-120°	0-125°	0-90°	0-95°	0-100°	0-110°	0-120°
Extension	120-0°	125°-0	90-0°	95-0°	100°-0°	110-0°	120-0°
Ankle							
Plantar	0-45°	0-50°	0-25°	0-30°	0-30°	0-35°	0-40°

flexion							
Dorsi flexion	0-15°	0-20°	0-10°	0-15°	0-15°	0-20°	0-20°

FIG.1& 2: MRI lateral view of knee joint

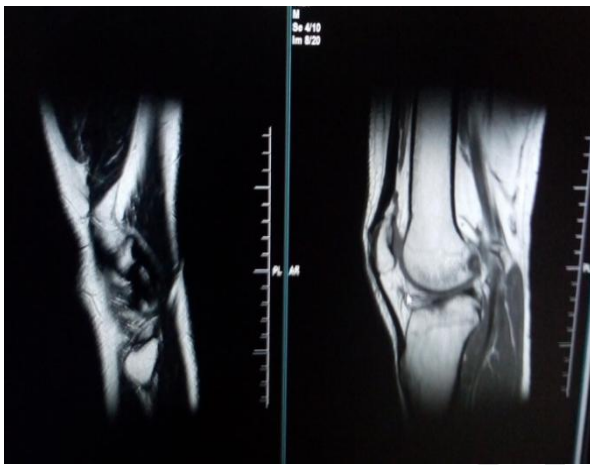


FIG.3: X-ray lateral view of knee joint



FIG.4: Patient knee joint after 10 days of physiotherapy



DIAGNOSTIC ASSESSMENT

A conservative approach was taken, with the patient being advised to use a knee brace to help stabilise the joint, as well as analgesics to relieve pain and a referral to physiotherapy. MRI and radiographic scans confirmed the diagnosis. Special tests, such as the Lachman's test, the anterior drawer test, and the varus stress test, all came back positive.

The radiological impression was not as clear as it is a soft tissue injury and could not be seen in the X-RAY film.

T2/STIR hyperintensity in the medial and lateral condyles of the tibia without bone contusion is shown on MRI. T2/PD fatsat hyperintensity along the ACL with fraying along the tibial attachment s/o partial tear affecting more than 50% of fibres. Joint effusion at the periarticular surface is minimal. Isometric strength and range of motion (ROM) were measured and found to be diminished, albeit this is gradually improving as the patient progresses through the phases of physiotherapy.

The NPRS scale, a numeric pain rating scale that is a unidimensional measure of pain severity in adults, is one of the outcome measures. A respondent chooses a whole number (0-10) to represent the severity of his or her suffering. Pre and post rehabilitation, ROM and strength, i.e. MMT, were also measured.

THERAPEUTIC GOALS:

A. Short Term Goals:

- Pain Relief
- Regain range of motion
- Getting back to a normal functional movement pattern: Gait
- Restored balance and proprioception
- Strengthening Fundamentals
- Eccentric muscle contractions

B. Long Term Goals:

- Progression of Functional exercises
- Strength training

- Return to walking/ jogging/ running
- Eccentric training (active lengthening force production, such as jumping exercise)
- **TABLE 5: Progression in Range of Motion week wise**

Sr. No.	Time since surgery	Rehabilitation program	Frequency of treatment
1.	1 st week	-Long knee extension brace applied in 5 degree knee flexion -Static Quadriceps exercise -Toe touch crutch walking -Straight Leg raising	- 3 hourly with a break of 1 hour - 10 reps * 3 sets - 10-15 footsteps - 10 reps * 3 sets
2.	1-2 weeks	-Gradual flexion up to 40 degrees -others as the previous week	- 10 reps * 3 sets
3.	2-4 weeks	-Gradual flexion up to 120 degrees -Static & dynamic Quadriceps & hamstring exercises -Active muscle strengthening exercise without weight	- 10 reps * 3 sets - 10 reps * 3 sets - 10 reps * 3 sets
4.	4-6 weeks	-Full range of flexion -Partial-weight bearing is allowed	- 10 reps * 3 sets
5.	6-8 weeks	-Full weight bearing with crutches (up to 7 weeks) -Without crutches 7-8 weeks	
6.	8-12 weeks	-Single step at a time stair climbing	
7.	12 weeks onwards	-Normal stair climbing & mini jogging	
8.	6 months onwards	-Squatting, -cycling started	- 10 reps * 3 sets
9.	8 month onwards	-Contact sports allowed	

THERAPEUTIC INTERVENTION:

Early physiotherapy management was instituted in order to prevent further functional loss in the long run. The goal is to reach optimum functional capacity without resorting to invasive procedures. **Phase 1 :DAY 1-7 (Immediate rehabilitation)**

GOALS:Reduce pain and edoema surrounding the joint, increase flexion-extension range of motion, and make the patient self-sufficient. The patient was fitted with an extension brace. Weight bearing was avoided, and walking aids were used to help. Workouts such as 1)ankle pump (10 reps), 2)passive knee extension by applying overpressure, 3)active aided knee flexion up to 90° on day 5, 4)straight leg raise exercise with 5 reps of flexion, abduction, and adduction, 5)isometric quadriceps exercises, and hamstring stretching 6) Continuous Passive Motion (CPM): 0-45/50 degrees to improve range of motion.

Phase 2:week 2-4 (Early rehabilitation)

Goals:Maintain steady passive knee extension, gradually increase knee flexion range of motion, lessen bulging and pain, and improve patella mobility.

Week 2 management:

To allow for movement while protecting the joint, a transitional hinged brace was used. It was stopped when the patient was able to endure the condition after 2-3 weeks. To avoid weight bearing, a walking assist was offered. Full range of motion was maintained passively, and stretching activities were performed 4- 5 times each week. Static quadriceps training for up to 10 reps, straight leg lift exercises for 5 reps, 90 40 degree extension, hamstring curls, and patellar mobilisation were begun. To lessen the edoema .Cryotherapy was applied for 20 minutes, and it was suggested that the limb be elevated above the level of the heart.

Week 3:

Range of Motion (ROM) was increased to reestablish arc of motion and muscular elongation. The previous training programme from the second week was advanced, with the goal of improving passive ROM up to 0-115 degrees, static bicycling for range of motion and endurance for eccentric quadriceps 40-1000, and resistance exercises for progression (begin with 1 kg and addition of half kg each week). The use of walking assistance was discontinued, and full weight bearing began. Proprioception drills and a neuromuscular routine were progressed through weight transfers.

Phase 3: 4th – 10th week (Ambulation period)

Goals : Maintain full range of motion of knee (0-125 degrees), Swelling Control Strengthen the lower extremity, Improve muscular control, proprioception, neural control and balance, Preserve limb attitude and its functionality, Range of Motion: Self-ROM (four to 5 reps everyday with the help of non - affected leg to maintain functionality, focus on maintaining 0° extension passively.

Week 4:

Exercises: Improve your static strengthening programme by extending your knee 90-400 times (10 reps), tightening your hamstrings (10 reps), and moving your hip towards and away from your body (10 reps). Bicycling helps improve cardiac fitness and range of motion, bending and extension of hips (10 repetitions). For proprioception and balance training, 30-degree wall squats for 10 reps were followed by standing on one leg with assistance, lateral lunges (10 reps), and front steps-ups (10 reps).

Weeks 6 and 7:

All of the previous exercises were continued. Side lunges (5 times), side and front step-ups (5 reps), and agility and balance drills on tilt boards

Week 8:

All of the previous activities will be repeated with basic polymetrics.

Increase your range of motion from 120 to 140 degrees using isokinetic training. Bicycling is a great way to build endurance.

Week 10:

All of the previous activities will be repeated with basic polymetrics. Increase your range of motion (ROM) to 120-140 degrees using isokinetic training. Bicycling and stretching for endurance training.

The fourth phase lasts from the tenth to the sixteenth week (Advance activity)

Goals: Normatively strengthen the lower extremities, increase muscle power and endurance, improve muscular stability A variety of sport-specific drills should be carried out. Exercise: Continued training with a gradual increase in intensity is recommended.

Phase 5: Resumption of particular training during the weeks of the 16th and 22nd.

Goals: Return to all sports, which should be unrestricted, gradually. Obtain and maintain the required strength and endurance. Normalization of neuromuscular control is required. Program for skill development.

Exercises: a muscular and neurological control programme, as well as strengthening exercises, should be maintained.

To improve speed and sudden changes in direction, perform lower extremity drills. Training should be sport-specific.

DISCUSSION

In the above case we have seen that the patient was running when suddenly his leg twisted and had Anterior Cruciate Ligament tear. The orthopaedic management goes with the reconstruction of ACL. As early as possible post-operative physiotherapy treatment started, the patient has increased in range of motion and the weight bearing was started after 1 week of surgery. The primary aim was patient education, prevention of secondary complication and maintenance as well as strengthening of quadriceps and hamstrings muscles. The patient has started normal walking pattern and also got the pain relief and without support walking. Pre and post treatment ROM, MMT and pain on NPRS was measured and noted above in the table. NPRS post treatment was noted to be 1 on activity. Being an engineer by profession currently the patient can continue with desk job rather than visiting on field. As visiting on field may be harmful for the patient because the surface on site may be uneven which may

ultimately lead to some balance issues. Home program along with daily visit for rehabilitation was told to perform, which gave us better results and early mobilization out of the bed.

The most important findings from recent research are that active young patients with significant ACL injuries are treated non-operatively. Although the typical patient profile has evolved, nonoperative therapy has its own set of indications and outcomes [6]. Patients' expectations for long-term sports participation have skyrocketed as their lifespans have increased. Furthermore, patients are becoming more aware of how much time they will be out of work or away from their sport, as well as how nonoperative and surgical therapies differ in terms of time.. [2]. According to studies and case reports, a patient with a partial ACL tear can proceed to a complete ACL rupture over time, even with physiotherapy management, thus the case reported by us is to rebuild the torn ligament fibres without arthroplasty. Arthroplasty is the current treatment recommended by research, in which a surgeon sutures the ligament if there is a partial ACL tear. The ACL is repaired utilising tissues from elsewhere in the body when surgical treatment is chosen. This method takes time and has yet to yield a positive result; as a result, the patient treated with conservative therapy progresses more slowly but has a positive outcome.

CONCLUSION

During the therapy term, the patient demonstrated excellent cooperation, and he is now able to keep his consistency in his running practise. Physical therapy intervention resulted in him becoming a better athlete and allowing him to return to his sport.

Ethical Approval:

As per international standard or university standard ethical approval has been collected and preserved by the authors.

Informed Consent:

Informed consent was obtained from all participants in the study, both in writing and orally. All individual individuals whose identifiable information is included in this manuscript provided additional informed consent.

UNDER PEER REVIEW

REFERENCES

1. von Aesch AV, Perry M, Sole G. Physiotherapists' experiences of the management of anterior cruciate ligament injuries. *Phys Ther Sport*. 2016 May;19:14–22.
2. Baumann E, Rice W, Selhorst M. REHABILITATION CONSIDERATIONS FOR AN UNCOMMON INJURY OF THE KNEE: A CASE REPORT. *Int J Sports Phys Ther*. 2018 Jun;(3):511–9.
3. Ambhore S, Dass B, Hotwani R. Effectiveness of Strengthening and Proprioceptive Training in Preventing Anterior Cruciate Ligament Injury and Rehabilitation: A case report. *Ann Romanian Soc Cell Biol*. 2021 Apr ;11651–4.
4. Colombet P, Dejour D, Panisset J-C, Siebold R, French Arthroscopy Society. Current concept of partial anterior cruciate ligament ruptures. *Orthop Traumatol Surg Res OTSR*. 2010 Dec;96(8 Suppl):S109-118.
5. Prasad Risaldar, Akshata Raut, Dushyant Bawiskar, Waqar M. Naqvi. Impact of Physiotherapy rehabilitation program on postoperative ACL tear patient on prognosis leading to maintain consistency in sport. *Int J Res Pharm Sci*. 2020 Aug ;11(3):4821–5.
6. Bele. Impact of fall on anterior cruciate ligament of 33-year-old male [Internet]. [cited 2021 Oct 24]. Available from: <http://www.journaldmims.com/article.asp?issn=0974-3901;year=2020;volume=15;issue=1;spage=132;epage=133;aulast=Bele>
7. Koch M, Mayr F, Achenbach L, Krutsch W, Lang S, Hilber F, et al. Partial Anterior Cruciate Ligament Ruptures: Advantages by Intraligament Autologous Conditioned Plasma Injection and Healing Response Technique—Midterm Outcome Evaluation. *BioMed Res Int*. 2018 Jul;2018:1–9.
8. Gaur¹ VV, Kapoor² AA, Phansopkar³ PA. Hamstring, Flexibility, Stretching, MET, ART, Muscle Force, Pain. P Styletext-Align Left AligncenterShort Term Eff Muscle Energy Tech Vs Act Release Tech Improv Hamstring Flex Pain Patients Acute Anterior Cruciate Ligament ACL Tear - Randomized Control Trialp [Internet]. 2021 Jan [cited 2021 Oct 24];(19692). Available from: https://jemds.com/latest-articles.php?at_id=19692

9. Sonnery-Cottet B, Colombet P. Partial tears of the anterior cruciate ligament. Orthop Traumatol Surg Res OTSR. 2016 Feb;102(1 Suppl):S59-67.

UNDER PEER REVIEW