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Case Report

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# Rehabilitation of spontaneous and bilateral patellar tendon rupture

## Abstract

The knee joint is prone to musculoskeletal injuries, especially in sports. Bilateral patellar tendon ruptures are rare, with limited literature on such cases. This report details the case of a 40-year-old male, a dedicated runner and fitness enthusiast, who suffered simultaneous bilateral patellar tendon ruptures while abruptly stopping during running. The patient underwent surgical intervention, and subsequent rehabilitation, from inpatient to outpatient settings. The rehabilitation program addressed challenges linked to bilateral injuries, focusing on pain control, range of motion gains, muscle strengthening, and gait training and played an essential role in the patient's recovery. The six-month post-surgery assessment revealed significant improvements in joint motion, muscle strength, and functional capacity, enabling the patient to resume daily activities. The patellar tendon is among the strongest in the human body and it is essential to know and identify predisposing factors. In this case, despite the absence of known risk factors, the patient's intense physical activity without supervision raised concerns about potential tendon fragility. The rehabilitation program for bilateral patellar tendon ruptures is challenging, with limited literature providing comprehensive guidance. This report highlights the need for individualized rehabilitation plans, considering bilateral involvement and psychological aspects. The presented case offers insights into the successful rehabilitation of such uncommon injuries, emphasizing tailored rehabilitation strategies.

**Keywords:** patellar tendon, spontaneous rupture, rehabilitation, tendon injuries, knee injuries, musculoskeletal injuries

Volume 9 Issue 1 - 2024

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**Received:** March 25, 2024 | **Published:** April 26, 2024

**Abbreviations:** KOOS, knee injury and osteoarthritis outcome score; PMR, physical medicine and rehabilitation

## Introduction

Our knee is a joint particularly prone to musculoskeletal injuries in a sports context. The quadriceps muscles (rectus femoris, vastus medialis, vastus lateralis, and vastus intermedius), responsible for knee extension, come together in the central region, forming the quadriceps tendon. The superficial fibers of the rectus femoris continue anteriorly to the patella, thickening in its lower region and forming the patellar tendon which, in turn, inserts proximally at the lower pole of the patella and distally at the tibial tuberosity. The patellar tendon is among the strongest in the human body, with complete rupture being rare. Bilateral ruptures are even more uncommon, with only around 50 cases documented in the literature.[1,2] These ruptures are described to occur more frequently in patients with pre-existing weakness in the tendon or its insertion region (e.g., patellar tendinopathy, Osgood-Schlatter disease), after total knee arthroplasty, or after trauma. Additionally, literature identifies risk factors such as inflammatory or autoimmune diseases (rheumatoid arthritis, systemic lupus erythematosus), metabolic conditions, use of testosterone or locally injected corticosteroids, for example, in the context of treating prior tendinopathy, or other medications like antibiotics and statins.[3,4] However, some clinical cases of bilateral patellar tendon ruptures are described to occur in healthy individuals following plyometric efforts. The identified mechanism of injury involves simultaneous knee flexion and quadriceps contraction,[5] more commonly observed in falls, plyometric efforts, and ascending or descending stairs.[6] As far as the authors are aware, bilateral patellar tendon rupture during an abrupt halt in running has been described in at least three case reports.[5,7,8]

## Case description

The case involves a 40-year-old man with no relevant personal history and a routine of intense physical activity: daily aerobic training (10 km/day running), muscle strengthening of all four limbs 5 to 6 times per week, and occasional inclusion of High-Intensity Interval Training or cycling in addition to weekly activities. There were no records of inflammatory, autoimmune, or metabolic diseases, and no history of antibiotic, oral or injectable corticosteroid, or statin use. There were no known traumatic injuries or prior patellar tendon issues. The patient reports experiencing intense and sudden pain in both knees, accompanied by a fall and an immediate loss of walking ability during an abrupt stop while running. In the emergency department, bilateral knee swelling was observed, with tenderness upon palpation, a gap in the infrapatellar region, and an inability to extend the knees. In this context, a radiograph (anteroposterior and lateral views of both knees) was performed, revealing an elevation and lateralization of the patella bilaterally, an indirect sign of patellar tendon rupture, with an Insall-Salvati ratio of 1.46 on the right and 1.41 on the left Figure 1.

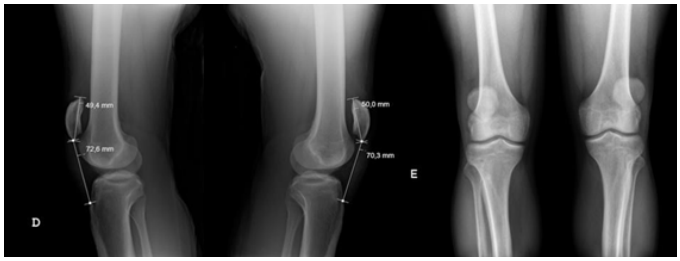


**Figure 1** X-ray conducted in the emergency department – bilateral anteroposterior and lateral views of the knees, including measurement of the Insall-Salvati ratio.

Therefore, the patient underwent surgical intervention, revealing a rupture of the patellar ligament near its insertion at the distal pole of the patella. The patellar tendon was reattached using transosseous tunnels and reinforced with autologous semitendinosus graft, without complications. During the hospitalization, the patient received instructions on wound and scar care, as well as guidance and training on transfers, ankle mobilization exercises (ankle pumps), and isometric quadriceps contractions. Upon discharge, the patient was provided with hinged lower limb orthoses, allowing knee flexion up to 40°, and partial weight-bearing was permitted.

At the three-week postoperative follow-up in the Physical Medicine and Rehabilitation (PMR) appointment, the patient presented with significant bilateral muscle atrophy. Active knee flexion was restricted to 20° on the right and 30° on the left, with a noticeable compensatory hip flexion component. During this visit, the patient granted informed consent for the collection of clinical data, photographs, and videos. Additionally, the patient completed the Knee Injury and Osteoarthritis Outcome Score (KOOS) questionnaire, validated for the Portuguese language, scoring 19. The patient initiated a rehabilitation program aimed at pain management, range of motion improvement, muscle strengthening, and upright mobility and gait training. The progressive increase in flexion range occurred systematically: up to 40° in the first 5 weeks, progressing to 60° by the 6th week, reaching 90° by the 7th week, and discontinuing orthoses at the 9th week, adapting progress based on tolerated amplitudes. During this phase, muscle strengthening involved isometric exercises targeting knee extensors and hip abductors, supplemented with bilateral quadriceps neuromuscular tetrapolar electrostimulation. Verticalization and gait training were contingent on established flexion limits, utilizing crutches on stable ground and gradually adjusting for postural correction. The program integrated core strengthening and upper limb extensor exercises. Each session concluded with analgesic massage and static cryotherapy.

In the follow-up appointment at 10 weeks post-surgery, the patient demonstrated active knee flexion of 90° on the right and 100° on the left, accompanied by a recovery in muscle trophism of approximately 1 cm in thigh and leg circumference bilaterally. The patient progressed in muscle strengthening, gradually incorporating dynamic exercises with increased load through repetition increments and initiated closed kinetic chain exercises and static bicycle routines. Proprioceptive training for the lower limb was integrated into the rehabilitation program at this stage and continued until the conclusion of our intervention. At around 14 weeks postoperative, he commenced walking training with one crutch, progressing to obstacle training. By the 16th week, he retained the crutch only for unstable surfaces, inclines, and declines. Finally, around the 18-week mark, he was deemed capable of safe independent walking. In the final assessment, 6 months post-surgical intervention, compared to the initial evaluation, the patient gained 100º in joint flexion range. He exhibited muscle strength grade 5 (Medical Research Council scale) in both knee extensors and flexors, as well as grade 5 in hip flexors and abductors, accompanied by improved muscle trophism (approximately 10 cm increase in thigh circumference and 6 cm in calf circumference) and enhanced control of the knee. The patient demonstrated the ability to ascend and descend stairs and ramps, maintained unipodal support for over 10 seconds, and performed squats up to 90º. Regarding the KOOS questionnaire, he scored 59, marking a 40-point increase from the initial score. Considering our patient's profession as an electrician, which involves frequent squatting and kneeling, he was still on medical leave upon discharge from the hospital follow-up. The rehabilitation program continued in an outpatient setting, beyond the hospital environment, aiming for a return to sports activities, including the integration of running and plyometric exercises.

## Discussion

The strength required to cause a rupture of the patellar tendon is approximately 17,5 times the body weight. It is generally accepted in the literature that healthy tendons do not rupture under normal circumstances.[9] Nevertheless, some authors posit that injuries can occur in healthy tendons of individuals without identifiable risk factors, especially when associated with an abrupt cessation of activity (running or jumping) during intense physical exercise.[6] Our patient did not present any known risk factors for this injury at the time. However, this does not rule out the possibility of identifying an inflammatory or metabolic condition in the future that could justify it. On the other hand, we are aware that our patient's physical activity was performed without supervision, without technique correction, and that his weekly exercise load was excessive. Therefore, it cannot be ruled out that intense sports practice, combined with poor technical form, may have led to tendon injuries, contributing to increased fragility of the patellar tendon (jumper's knee) and consequently leading to this rupture.[10] The timely diagnosis of patellar tendon rupture relies on identifying the mechanism of injury, a high clinical suspicion due to the inefficiency or failure of the extensor apparatus, and imaging confirmation. The differential diagnosis should be conducted with other injuries to the extensor apparatus, including quadriceps tendon rupture, patellar fracture, or tibial tubercle fracture.[6] The early identification of the rupture allows for prompt surgical intervention, thereby improving the prognosis.[1]

The authors identified some challenges in establishing a rehabilitation program. The bibliography is scarce, and the literature mainly consists of isolated clinical cases focusing on surgical approaches with limited specification of the rehabilitation program beyond general descriptions of mobility or joint ranges. The bilateral nature of the injury, especially in the early phase, required adaptation of strengthening exercises as well as strategies for upright positioning and optimizing gait patterns. Moreover, in a more advanced stage, it hindered the assessment of metrics and progression criteria, as there was no healthy contralateral side for comparison. Additionally, the rehabilitation program for our patient did not always progress as desired, as the evolution or introduction of new types of exercises triggered anxiety in the patient. In the literature, various recovery timelines are presented, with variations among patients, ranging from some achieving 100º knee flexion mobility at 6 weeks to others attaining 80º mobility at 4 months.[8] However, as mentioned earlier, cases are predominantly presented from an orthopedic perspective, lacking detailed specifications in rehabilitation programs that could assist in drawing conclusions or opting for different approaches. To the best of the authors' knowledge, only one article has comprehensively described the rehabilitation program to date.[11]

## Conclusion

In our patient, the gains achieved with the rehabilitation program were evident in terms of joint range of motion, muscular strength, and functionality. The authors believe that the reasons for the positive outcomes in this patient were early surgical intervention, effective coordination with the PMR department for inpatient and outpatient follow-up, and a rehabilitation program that was appropriate and tailored to our patient. This article aims to guide the rehabilitation process for bilateral patellar tendon ruptures. It highlights the challenges of rare clinical scenarios with limited evidence in the rehabilitation field, emphasizing the importance of maintaining an updated and comprehensive knowledge of human anatomy, physiology, and kinesiology.

**Citation:** Silva SR, Ramalho J, Pinto LV, et al. Rehabilitation of spontaneous and bilateral patellar tendon rupture. *Int Phys Med Rehab J.* 2024;9(1):62–64. DOI: 10.15406/ipmrj.2024.09.00375

## Acknowledgments

None.

## Conflicts of interest

The author declares that there is no conflicts of interest.

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