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UP-TO DATE REVIEW AND CASE REPORT • KNEE - PATELLA

Semitendinosus autograft augmentation after bilateral patellar tendon re-rupture: a case report and technique note

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Abstract

Background Acute bilateral patellar tendon rupture is a rare occurrence, especially in young patients in the absence of comorbidities. We describe a case of bilateral patellar tendon re-rupture in a young patient without predisposing factors. Further, we explain a technique for autograft augmented patellar tendon repair with bidirectional fixation using an ipsilateral semitendinosus graft in transosseous patellar and tibia bone tunnels.

Case presentation We present the case of a 40-year-old healthy worker with bilateral acute on chronic patellar tendon rupture maintained following initial trauma and Krackow repair 2 years ago. He underwent bilateral reconstruction using semitendinosus autograft. At 1 year postoperatively, he has maintained the full range of motion and strength without re-rupture.

Conclusion This is the first case describing a new fixation technique after bilateral patellar tendon re-rupture. The use of semitendinosus autograft for reconstruction of the patellar tendon after re-rupture is a viable and effective option.

Keywords Patella tendon rupture · Autograft augmentation technique · Re-rupture · Bilateral

Introduction

Bilateral patellar tendon ruptures (PTRs) are rare injuries, especially among patients with no predisposing factors for tendinopathy, such as diabetes mellitus, rheumatologic disease, lupus erythematosus, chronic renal insufficiency or chronic steroid use [3, 26, 31]. Nearly all cases conferred in the literature occurred in patients with predisposing factors to tendinopathy [23]. Despite the good clinical outcome after acute repair [16, 29], re-rupture rates up to 50% have been described in monolateral injuries [9]. Different augmentation strategies have been developed to decrease strain across the repair site [19, 21]. A bilateral patellar tendon re-rupture in a healthy adult without risk factors has not been described previously.

Case history

We present the case of a 40-year-old healthy man. He fell off a ladder (approximately 2.5 m) and landed with both knees in flexion. There was no definite direct impact to the knee. The diagnosis of bilateral patellar tendon rupture was made based on the clinical and radiological findings, and a bilateral one-staged surgical approach was carried out ex domo. An open repair with additional tension band wiring was performed, followed by immobilization in braces locked in extension to allow the physiotherapist to mobilize and gradually increase the ROM. One year postoperatively, the patient presented at our outpatient department with poor knee function and pain without trauma. Physical examination affirmed bilateral patella alta with a palpable infrapatellar gap. There were no clinical signs or laboratory findings indicating inflammation. The range of motion was 0/10/130° at the left knee and 0/20/120° at the right knee. The patient's main complaints were the limitation of knee extension, loss of strength in extension

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and the inability to carry weight on either of his legs for a long duration. X-rays of both knees confirmed superior patellar migration and further small calcification avulsions of the inferior poles of both patellae (Fig. 1).

MRI examination of the left knee demonstrated a high-riding patella and defects of the patellar tendon with a sequester in the osteotendinous junction under the inferior patellar pole. MRI of the right knee revealed an elongated patellar tendon with a few remaining continuous parts (Fig. 2).

Accordingly, based on the clinical and radiological findings, the diagnosis of bilateral patellar tendon re-rupture was made. We used a two-step surgical approach using a modified technique described by Scott et al. [25] on both sides starting with the right knee and continuing with the left knee after complete rehabilitation.

The patient was placed in the supine position with a tourniquet on the upper thigh. We used a midline incision from approximately 4 cm above the mid-patella to the tibial tubercle. After sharp dissection down to the tendon level, the tendon defect was exposed (Fig. 3). Both patellar tendons

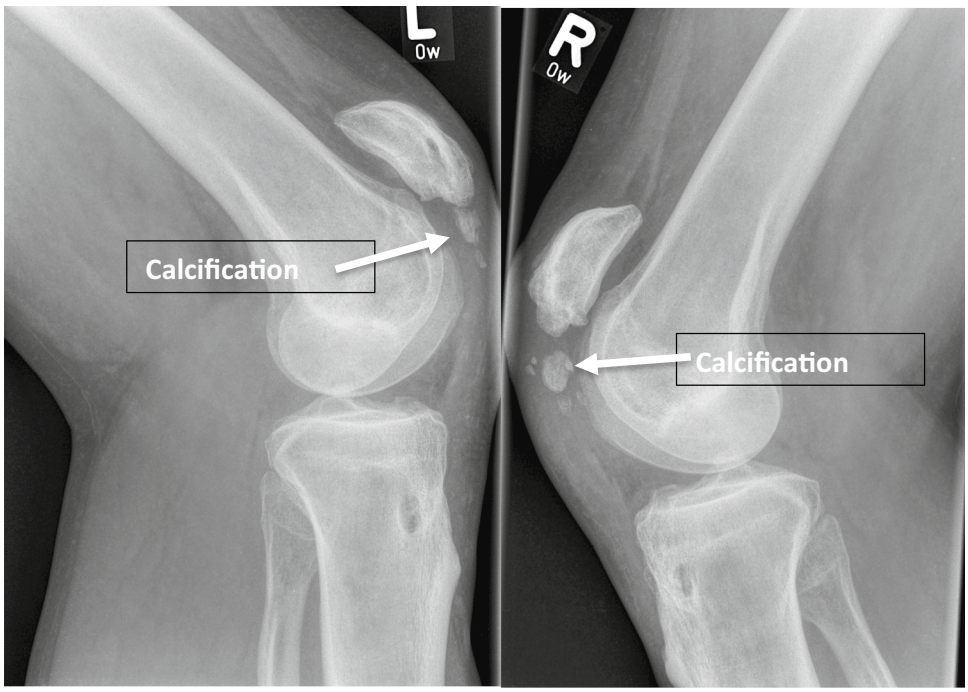

Fig. 1 Lateral X-ray in 30 degrees flexion on the left knee and right knee showing subpatellar calcifications (white arrow) on both knees and a patella alta with an Insall–Salvati index > 1.2

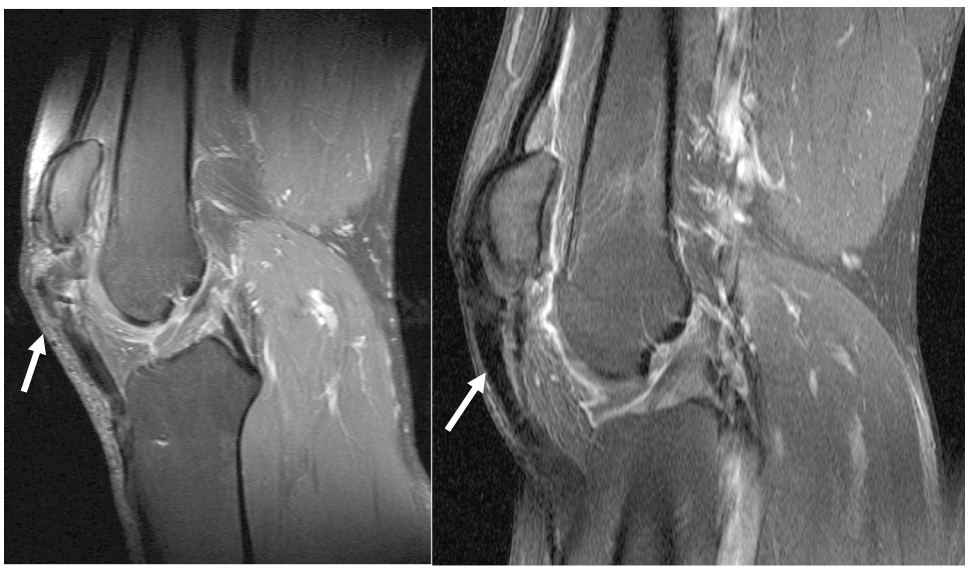

Fig. 2 MRI with bilateral patellar tendon rupture (white arrow) (left side left knee, right side right knee)

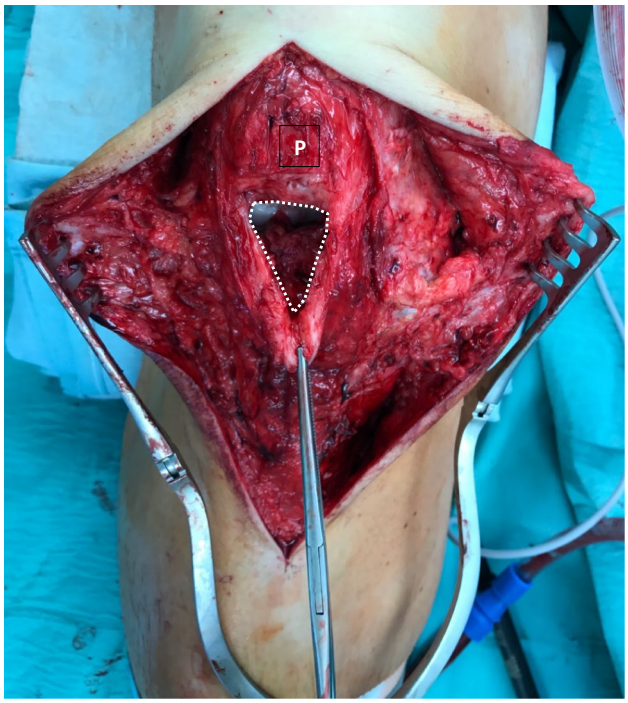

Fig. 3 Intraoperative image illustrating the large defect (white line) in the right patellar tendon after debridement (P is the patellar tendon, and top of the image is cranial for orientation)

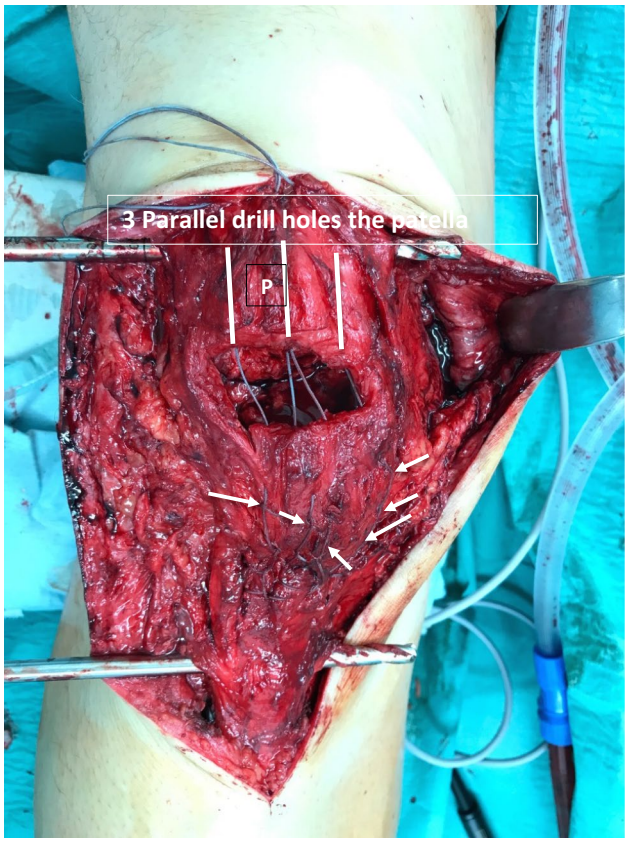

Fig. 4 Right knee: intraoperative image illustrating the tendon repair using the Krackow suture technique (white arrows) and the parallel drill holes in the patella (white lines) (P is the patellar tendon, and top of the image is cranial for orientation)

showed massive avulsion with scar tissue without any native tendon tissue 2.5 cm proximal in origin. Therefore, granulations as well as a tendon sequester were removed, and biopsies of the synovium and tendon were sent for histology. The tendon ends were debrided of all necrotic and frayed tissue and mobilized to achieve the maximized length using sharp dissecting scissors, leaving an approximately 2.5 cm gap. A rongeur was used to debride the inferior pole of the patella, removing soft tissue remnants and providing a healthy bleeding bone surface. A semitendinosus tendon graft was taken from the ipsilateral knee, whipstitched and measured.

For transosseous repair, the remaining tendon was whipstitched with the Krackow technique with two fiber wires (no. 2) and channeled through three parallel drill holes (2 mm diameter) made in the patella from distal to proximal to adapt the remaining tendon tissue (Fig. 4).

For the circumferential semitendinosus graft, transverse drill holes were made through the center of the patella and the tuberositas tibiae using a cannulated 6-mm drill according to the harvested tendon graft diameter. To avoid over-tightening the repair and avoiding a patella baja, we obtained an intraoperative lateral roentgenogram. The harvested semitendinosus tendon was brought through the predrilled transosseous patellar tunnel and the transosseous tibial tunnel (6 mm), forming a circle, which was sewn together. The patella height was determined by setting the inferior pole of the patella to the roof of the intercondylar notch in 45° flexion [25]. In this position, the transosseous sutures and the circumferential graft were fixed. Additionally, the graft was sewed into the remaining proximal patellar tendon using a continuous 2.0 PDS suture filling the remaining defect. The repair was augmented using a 4.0 Kirschner wire as a McLaughlin cerclage (Fig. 5) through a 4-mm cannulated screw below the 6-mm graft tunnel through the tibia and transtendinous graft and through the quadriceps tendon above the patella (Fig. 6).

Postoperatively, the knee was placed in a brace (DonJoy, DJO Global, Vista, CA, USA) and locked in extension for 2 weeks. Weight bearing was tolerated with the support of crutches. After 2 weeks, the brace was adjusted to permit passive movement between 0 and 30 degrees. Every 2 weeks, flexion was increased by 30 degrees. The brace was removed after 8 weeks. The removal of the McLaughlin cerclage was performed 12 weeks postoperatively. The patient missed the appointment and presented 4 months after the operation with a broken McLaughlin cerclage during regular follow-up, which was then removed without any complications.

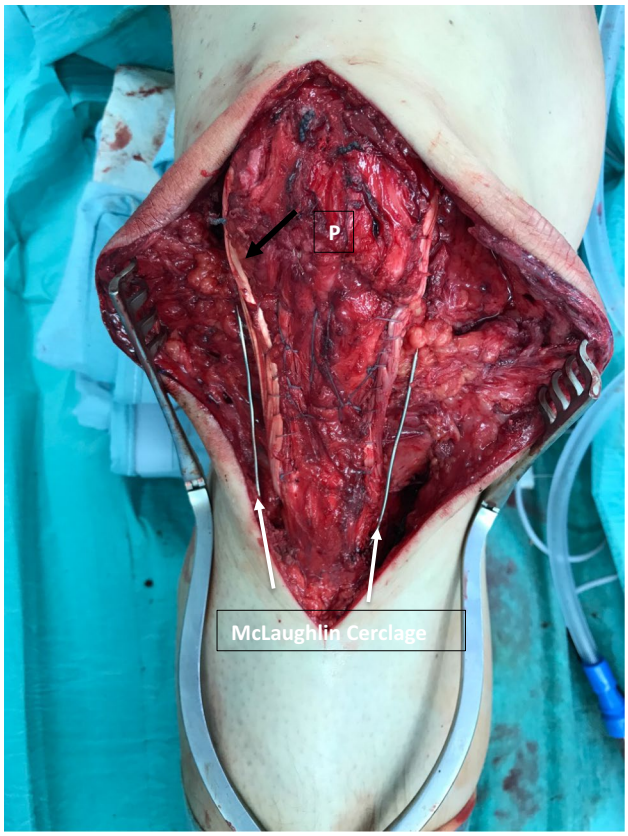

Fig. 5 Right knee: fixation after autograft augmentation (black arrow) and McLaughlin cerclage (white arrow) (P is the patellar tendon, and top of the image is cranial for orientation)

After full recovery, we continued with the left knee. Intraoperatively, we found massive scar tissue causing a non-redressable patella alta. After adhesiolysis and removal of a 2.50-cm tendon sequester, we used the above-mentioned technique for tendon reconstruction. The collected biopsies confirmed the absence of chronic infection and showed scar tissue. Two years after the first surgery (1.5 after the second), he regained a satisfactory range of motion in both knees (0° extension and 135° flexion on the left knee; 0° extension and 130° flexion on the right knee) and normal muscle status. We used the Tegner Lysholm Knee Scoring Scale (TLS) [10, 16] and modified Cincinnati rating score (MCRS) to assess the functional outcome [3, 12]. Both scores showed a good result with 85 points and 76 points. The last radiological follow-up (Fig. 7) shows slight bilateral patella alta without functional impact.

Discussion

The patellar tendon is an integral part of the extensor mechanism of the knee, and a rupture is an incapacitating injury [23]. According to Carmada et al. [3], 71% of PTRs are spontaneous predisposed ruptures. Patients with comorbidities such as rheumatoid arthritis, diabetes mellitus, connective tissue disease, smoking or long-term steroid use are at risk of suffering a patellar tendon rupture [8, 14, 15, 33]. We describe the rare case of a bilateral patellar tendon re-rupture after bilateral traumatic PTR without any predisposing factors. Acute traumatic PTRs are commonly unilateral and more likely to occur in active male adults who are slightly younger (under the age of 40) than our patient [3, 11, 16]. A

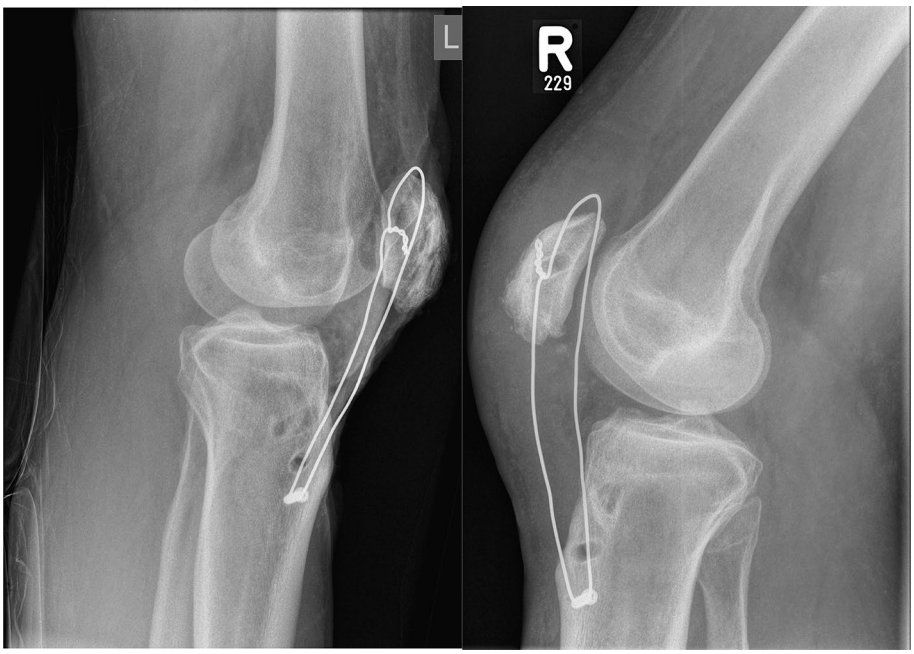

Fig. 6 Intraoperative lateral X-ray confirming physiological patella position (left side left knee, right side right knee)

Fig. 7 Lateral X-ray showing the radiological outcome 2 years after the first operation and hardware removal (left side left knee, right side right knee)

healthy regular patellar tendon requires an extensive force to be disrupted and should not rupture under physiological loads, and the most common mechanism for PTR is a fall from great heights, as described in our case (fall from 2.5 m) [2]. The diagnosis of a patellar tendon rupture can be difficult, as clinical findings are often less impressive with a preserved range of motion [3]. Because of a complete or incomplete discontinuity in the extensor mechanism, patients are unable to actively extend the knees from any flexed position or perform a straight leg raise in both knees, as described in our case [11, 17]. In case of a bilateral re-rupture, the diagnosis could be even more demanding due to the missing severe hematoma that very often strikes along acute rupture as a crucial diagnostic sign. Furthermore, the patient showed a less eye-catching bilateral palpable infrapatellar gap due to scar tissue [6, 12]. Lacking the option of a comparison to the healthy side in case of bilateral rupture makes the clinical diagnosis of bilateral PTR challenging. Therefore, in addition to the clinical findings enhanced by the application of ultrasound, we used plain radiographs to prove the diagnosis by presenting a patella alta. Further MRI scans can confirm the diagnosis and provide further information about tendon quality, sequester and possible muscular atrophy or degeneration. In addition to assessing the degree of tendon rupture-associated injuries such as meniscal tears or tibial plateau fractures can be excluded before surgical intervention [32]. The objective of surgical intervention must be to restore normal knee function. Frequently, this is achieved with end-to-end sutures in acute repair. However, this reinsertion technique might not be sufficient in cases of degenerative changes, chronic ruptures or re-ruptures [25]. The delayed or neglected diagnosis does not correlate with a tendon re-rupture, but a prolonged interval (> 2 weeks) between trauma and surgery correlates with a negative outcome [3, 22, 27]. The reason for delayed treatment might be a late diagnosis: Siwek and Rao stated that 38% of acute patellar tendon ruptures were initially misdiagnosed [27]. Furthermore, Camarda et al. [3] noted that 10 out of 44 patients had a delayed diagnosis. Patients who undergo delayed repair are at risk of decreased quadriceps strength and quadriceps contractures, which lead to tendon retraction and cause extensor dysfunction and diminished knee flexion [22, 29]. These degenerative changes affect patellar mobility, resulting not only in pain but also in a more challenging surgical reconstruction [7]. In our case, the initial trauma was > 2 years ago, and the initial repair failed, causing advanced degenerative changes in the remaining tendon accompanied by bilateral patella retraction. For these situations, reconstruction can be achieved using autografts, allografts, synthetics or a combination thereof [13, 17, 20]. Some authors suggest gradual transpatellar traction prior to reconstruction [7, 27]. Dejour et al. [4] propose the use of an autologous contralateral graft of tendon–bone–tendon–bone to benefit from solid bone anchorage and reported favorable outcomes in 77% of chronic PTR repairs. Most reports address reconstructive procedures of monolateral chronic ruptures or re-ruptures. Goldstein et al. described a 49-year-old woman (morbid obesity, hypertension, diabetes mellitus and rheumatoid arthritis) who presented a re-rupture of the patellar tendon after total knee arthroplasty. Two years previously,

she underwent revision of her left knee for patellar tendon rupture and revision of her right knee for patellar component loosening as well as extensor mechanism disruption [10]. Due to poor tendon quality and bilateral injury, Talia et al. preferred using a LARS ligament in a patient with chronic tendinitis and ipsilateral partial rupture 9 years ago. The TLS score was 80 and MCRS was 77, compared to 85 and 76 in our case [28]. Our case of a bilateral patella tendon re-rupture illustrates that augmentation via allograft is a useful option to build a secure and functional extensor mechanism.

The currently described technique offers the possible benefits of bone anchorage described by Dejour et al. [4] without the possible disadvantage of a contralateral bony defect in the case of tendon–bone–tendon graft harvesting. We used an autograft to decrease the gap and allow an earlier weight bearing. This need for augmentation is supported by some cadaveric studies which favored augmented repairs [24].

Nevertheless, due to the rare incidence of bilateral PTR, large-scale trials have never been performed, and no gold standard exists for its treatment. We did not encounter known complications such as re-rupture, wound healing disorders or septic complications in our case. The patient underwent hardware removal 10 weeks after surgery as a result of a cerclage breakage. The cerclage may break when massive force is applied or the knee is flexed more than 90 degrees. Lazaro et al. [18] described hardware removal as a result of prominent and symptomatic implants because of breakage or steady soft tissue irritation in 37% of their patients. The average time to hardware removal is 17 weeks (range 7–132 weeks) postoperatively, and in 78% of cases, the cerclage was already broken [11]. We recommend removal after 12 weeks to avoid this. Even though the second surgery did not affect the good functional results, in order to spare the patient of this further surgery, a PDS cord could be used alternatively [5]. In case of revision surgery, we preferred the more invulnerable cerclage. Furthermore, delayed treatment can result in osteoarthritis and patellofemoral arthrosis [14, 30]. Negrin et al. described 29% of patients with a higher rate of retropatellar arthritis, and Ahberg and Josten described 50% in the smaller PTR patient group compared to the healthy contralateral knee [1, 22]. Because our patient had a bilateral PTR, the post-traumatic changes could not be assessed by comparison with the contralateral leg. Nevertheless, radiographic findings at follow-up showed radiographic signs of osteoarthritis but without any clinical impact. This might still be a concern in long-term follow-up.

Limitations

The method of case reporting and technical notes is not able to prove any cause–effect relationship nor deliver quantitative data or allow generalizations. But in a rare case like a bilateral patellar tendon re-rupture, it may help to accumulate scientific data and serve as educational tool.

Conclusion

We found this case of particular interest for different reasons. Firstly, there were no predisposing risk factors for bilateral tendon rupture. Secondly to our best knowledge, a case of a bilateral re-rupture without predisposing risk factors has not been described in the literature yet. Finally, we describe a treatment concept for this very rare case of a bilateral re-rupture. The patient made a good recovery following open repair with semitendinosus autograft augmentation, a stepwise focused rehabilitation program and hardware removal.

Compliance with ethical standards

Conflict of interest Alexander von Glinski, Emre Yilmaz, Valentin Rausch; Matthias Koenigshausen, Thomas Armin Schildhauer, Dominik Seybold and Jan Gessmann declare that they have no conflict of interest.

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