

Platelet-Rich Plasma Injection for Quadriceps Tendinopathy: A Case Report

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ABSTRACT

Introduction: Platelet-rich plasma (PRP) is a promising treatment for persistent symptoms caused by various musculoskeletal injuries, including tendinopathies.

Case Presentation: A 47-year-old woman presented with chronic left knee pain following a motor vehicle accident. Magnetic resonance imaging (MRI) revealed distal quadriceps tendinosis and a partial tear of the vastus intermedius tendon. She failed extensive conservative management. A PRP injection was performed at the distal quadriceps tendon. In combination with physical therapy, there was substantial improvement of symptoms and corresponding decreased tendinosis on follow-up MRI.

Discussion: Successful use of PRP has been documented in the literature for a variety of chronic orthopaedic conditions including, but not limited to, patellar tendinopathy, lateral epicondylitis, and gluteal tendinopathy. To our knowledge, this is the first reported case of the treatment of chronic quadriceps tendinopathy with a PRP injection.

Conclusion: This case expands the treatment options for chronic quadriceps tendinopathy and highlights another use of PRP within the field of regenerative orthopaedics.

INTRODUCTION

The advent of nonsurgical cellular therapy has altered the approach and treatment of common musculoskeletal pathologies, such as chronic tendinopathy and osteoarthritis. Conservative treatment with physical therapy, activity modification, anti-inflammatory medications, and rest remain beneficial and effective.¹ Despite compliance, some patients continue to experience symptoms, including pain, loss of range of motion, and limited function.

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Platelet-rich plasma (PRP) has emerged as an option to treat damaged tendon and cartilage, which are at times refractory to healing because of hypovascularity and various other factors.² Comprised of an increased platelet concentration, PRP contains an abundance of growth factors (ie, TGF- β 1, PDGF, bFGF, VEGF, EGF, IGF-1) that, when introduced at the site of injury, complement the natural healing process.³

Current literature describes the efficacious use of PRP for lateral epicondylitis,¹⁻⁴ knee osteoarthritis,³ patellar tendinopathy,³ and other various tendinopathies; however, there remains an absence of reported use in quadriceps tendinopathy. We report what we believe is the first case of chronic distal quadriceps

tendinopathy treated with an ultrasound-guided PRP injection in conjunction with a specific physical therapy program. There were clinical and radiographic improvements at 2 months and 19 months post-procedure, respectively.

CASE PRESENTATION

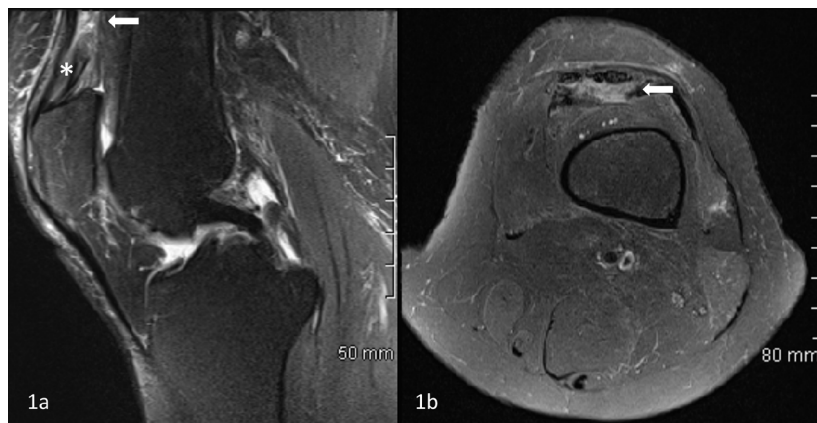
A 47-year-old woman was referred to our sports medicine clinic for consultation of chronic left knee pain. Her symptoms began 4 years prior from injuries sustained in a rollover motor vehicle crash. She reported persistent deep and aching generalized left knee pain. Ascending stairs and squats aggravated the pain. At its worst, she reported her knee pain at an 8 out of 10 on the visual analog scale (VAS). She denied any associated numbness or tingling in the leg. Initial treatment by an outside physician included analgesics, over-the-counter knee braces, and physical therapy for

4 months totaling 31 visits. Upon review of the physical therapy notes, the patient was treated for both chronic knee and low back pain. She reported compliance with her home exercise program. On physical examination, inspection of her left knee revealed no joint effusion. She had no tenderness to palpation over the medial or lateral joint line or the popliteal fossa. Patellar compression and distal quadriceps palpation reproduced pain. All ligamentous testing revealed a firm endpoint. McMurray's test was negative. Manual muscle testing of the left lower extremity was significant for weak hip abduction, 4/5, and knee extension, 4+/5. No neurovascular deficits were noted. The contralateral knee exam was normal. The patient had a nonantalgic gait. Knee radiographs obtained were unremarkable for any significant degenerative joint narrowing.

Due to persistent pain and weakness despite extensive conservative care, magnetic resonance imaging (MRI) of the left knee was obtained. Increased T2 signal intensity and thickening throughout the distal portion of the quadriceps tendon was compatible with tendinosis. The deep portion of the quadriceps tendon (vastus intermedius) was partially torn 2.0 cm (0.02 m) proximal from the patellar attachment (Figure 1). The patella was positioned normally within the femoral groove. All ligamentous, menisci, and osseous structures were intact. Results were discussed with the patient, and physical therapy for 1 day per week with a home exercise program 5 days per week focusing on quadriceps and hip abductor strengthening was recommended.

The patient followed up in clinic 3 months later after completion of her physical therapy regimen. She reported a minimal improvement in symptoms with continued pain in the distal quadriceps region, limiting her function. Physical examination remained consistent as described above. Treatment options were discussed with the patient, including continued physical therapy, PRP injection, and surgical consultation. She elected to proceed with a PRP injection and was instructed to hold anti-inflammatories for 7 days prior to the procedure. Whole blood (60 cc) was collected and centrifuged for 17 minutes using the Arthrex Angel system: spin 1 at 3500 rpm and spin 2 at 3000 rpm. Three cc of 1% lidocaine was used to anesthetize the local skin only. Under sterile technique and ultrasound guidance, 3 cc of leukocyte (neutrophil)-rich PRP (LR-PRP) (7% hematocrit) was injected into the pathological portion of the left distal quadriceps tendon (Figure 2). A tenotomy was performed with a 22-gauge needle in this area simultaneously. She was recommended to be non-weight

Figure 1. Sagittal (a) and Axial (b) T2-Weighted Fat Saturated Magnetic Resonance Imaging of the Left Knee



Images demonstrate thickening and hyperintense signal in the distal quadriceps tendon (asterisk). Vastus intermedius contribution of the tendon is torn approximately 2 cm from the patellar attachment (arrow).

Figure 2. Transverse Plane Ultrasound Image of the Distal Quadriceps Tendon With a 22-Gauge Needle (asterisk) in the Vastus Intermedius Tendon (arrow)



bearing on the left lower extremity for the next 3 days and then slowly wean off the crutches as pain tolerated over the following week. She was instructed to avoid anti-inflammatory medications for 6 weeks. Physical therapy was started at 2 weeks with isometric quadriceps strengthening, followed by eccentric strengthening at 6 weeks with weekly physical therapy appointments.

Two months following the PRP injection, the patient presented for follow-up in the clinic. She reported a significant improvement of her knee pain—at worse a 2 out of 10 on the VAS. On exam, she had less pain with palpation of the distal quadriceps tendon. Her knee range of motion improved. Initial knee flexion was 130 degrees; post-procedure it was 140 degrees. She was advised to continue her home exercise program and follow up as needed.

The patient presented to the clinic 19 months after her PRP

procedure with a new complaint of acute left knee pain following a mechanical fall. Tenderness to palpation over the medial joint line with a positive McMurray's test was remarkable on physical examination. A knee MRI was obtained to evaluate for a medial meniscus tear. MRI imaging confirmed a nondisplaced, horizontal tear involving the posterior horn of the medial meniscus with an intrameniscal cyst of the left knee. Interestingly, in comparison to the left knee MRI done 21 months prior (as described above), there was marked improvement in the T2 signal of the MRI in the area of the quadriceps tendon insertion (Figure 3).

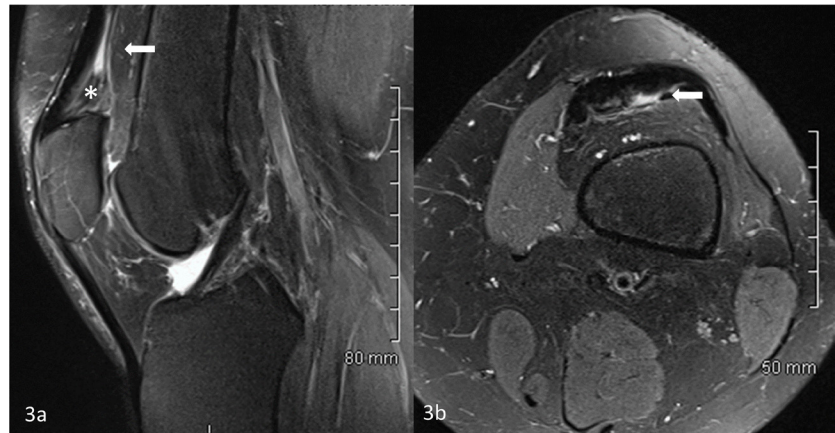
DISCUSSION

We describe the first known published case of PRP for quadriceps tendinosis, thereby expanding the scope of PRP as it relates to the field of orthopaedics. Musculoskeletal pathology involving ligaments and tendons can significantly affect an individual's quality of life. Both conservative management and surgical intervention have proven to provide relief; however, refractory pain and discomfort can endure.⁴ The drive to bridge this gap has resulted in the exponential use of orthobiologics as a regenerative option for orthopaedic care. Prepared by centrifugation of whole blood, PRP is comprised of an autologous increased concentration of platelets containing growth factors and cytokines with the ability to regeneratively heal and decrease inflammation related to ulcers, burns, bone diseases, and tendinopathies.^{2,4-6} Systematic reviews and meta-analyses have documented pain relief with PRP in lateral epicondylitis,¹⁻⁴ osteoarthritis of the knee,³ patellar tendinopathy,³ plantar fasciitis,³ and rotator cuff injuries.⁴

Clinical evaluation of PRP has focused on the treatment of tendon injuries and tendinopathies. Healing of tendon and ligaments occurs through a complex series of stages involving inflammation, proliferation and tissue remodeling.^{3,6} Numerous cytokines found in PRP play pivotal roles in the signaling pathways that occur during the healing process. PRP also may stimulate neovascularization, which may not only increase the nutrients and blood supply required for cells to regenerate damaged tissue, but also remove debris from injured tissue.^{3,6} Such characteristics are particularly advantageous in chronic tendinopathies, where the biological conditions make tissue healing challenging.^{3,6}

Despite its efficacy, there remains no general consensus regarding the optimal cellular composition of PRP preparations. Variability in collection protocols and concentration of blood components, including leukocyte content, has created chal-

Figure 3. Sagittal (a) and Axial (b) T2-Weighted Fat Saturated Magnetic Resonance Imaging of the Left Knee



Images demonstrate decreased thickening and hyperintense signal in the distal quadriceps tendon (asterisk) compared to prior imaging (Figure 1). The vastus intermedius tear (arrow) remains visible, but with a more chronic appearance compared to Figure 1.

lenges in interpretation of the literature.⁶ Current literature suggests that PRP with a higher leukocyte (neutrophil) concentration—LR-PRP—is associated with pro-inflammatory effects.^{3,6} Commercial systems are diverse in their platelet capture efficiency, speed of centrifugation and the type of collection tube mechanism.^{3,6} Patient specific factors, such as medications taken, also influence the specific anatomy of PRP injectate.^{3,6} Determination of the optimal PRP composition for tendinopathies remains a focus of current research.

The dominant extensor mechanism of the lower extremity—the quadriceps tendon—is composed of the superficial rectus femoris, the deep vastus intermedius, vastus medialis, and vastus lateralis. Though uncommon and generally occurring in patients older than 40 years, injuries to the quadriceps tendon typically illicit the triad of anterior knee pain, weakened active extension, and a suprapatellar gap.^{7,8} Despite careful physical examination, quadriceps injuries are sometimes overlooked. Nonsurgical management is the mainstay of treatment for incomplete or partial quadriceps tendon ruptures.⁹ Ilan et al recommend management of partial quadriceps tears with knee immobilization for 6 weeks in full extension, followed by range of motion and strengthening exercises.⁹ Once the straight-leg raise is pain-free and the quadriceps muscle becomes more stable, the immobilizer can gradually be removed and the patient can return to training.⁹ In comparison, our post-PRP protocol weans the patient from crutches at day 3 and initiates isometric quadriceps strengthening at week 2. Early movement, instead of prolonged immobilization, is advantageous for the patient, allowing for quicker rehabilitation and decreased atrophy and stiffness.

Our case focuses specifically on the vastus intermedius, which

originates on the anterior femoral shaft and inserts on the superior border of the patella. Our literature review found only 3 cases describing an isolated vastus intermedius partial tear or rupture.¹⁰⁻¹² Two of the cases describe successful, nonsurgical treatment with 4 weeks of immobilized, progressive graduated knee flexion followed by a stretching and proprioception therapy program in weeks 5 and 6.^{10,11} A third case series outlines both conservative and operative management.¹² In contrast, our patient continued to report knee pain and weak knee extension despite bracing and focused physical therapy. Due to the persistent nature of her symptoms, PRP was recommended. Within 2 months following PRP, she reported significant clinical improvement, with noticeably increased knee extensor strength. Repeat MRI obtained 19 months after PRP injection revealed decreased tendinosis in the distal quadriceps tendon.

CONCLUSION

Within the past decade, cell-based therapies for orthopaedic conditions have increased considerably in the United States.¹³ Incorporating these products into clinical practice requires a thorough understanding of the indications for their use.^{4,14} While the results are encouraging, further studies, such as randomized controlled trials, are needed for PRP and its role in the treatment of chronic tendinopathy.

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