Knee Surg Sports Traumatol Arthrosc (2013) 21:2035–2039
DOI 10.1007/s00167-013-2549-1

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Progression of patellar tendinitis following treatment with platelet-rich plasma: case reports

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Received: 7 January 2013 / Accepted: 23 May 2013 / Published online: 1 June 2013

Abstract
Purpose The use of platelet-rich plasma (PRP) is becoming more attractive given its favourable side effect profile and autologous nature, leading to rapid clinical adoption in the absence of high-level evidence. We are presenting three patients who developed a progression of patellar tendinitis following treatment, which to our knowledge is the first report of worsening of patellar tendinitis following PRP therapy.
Methods The records of three patients with symptom exacerbation of patellar tendinitis following treatment with PRP were reviewed. IRB exemption was obtained. Clinical and operative records, radiographs, and MR imaging were reviewed for all patients.
Results Three patients reported to our clinic for a second opinion with symptoms of anterior knee pain consistent with patellar tendinitis. Each patient had previously been treated with PRP therapy due to prolonged symptoms. Clinical and radiological findings following treatment included patellar tendon thickening, worsening pain, discontinuation of athletic participation in all three patients, and osteolysis of the distal pole of the patella in one patient identified during surgical intervention.
Conclusions Growing interest in the use of autologous products for the management of chronic tendinopathies has led to widespread clinical implementation with minimal scientific support. It is tempting to apply a new treatment for management of a difficult clinical entity, especially when the risk/benefit ratio appears favourable. However, caution must be exercised as unexpected results may be encountered.
Level of evidence Case reports, Level V.

Keywords Platelet-rich plasma · PRP · Patellar tendinitis · Biologics · Complications

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Introduction

Advances in orthopaedics are growing at a rapid rate, with the implementation of new technologies frequently driven by patient demand, treatment of high-profile celebrities, and anecdotal evidence prior to widespread clinical experience and publication of well-controlled studies [20]. Biologically active therapies such as platelet-rich plasma (PRP) represent a new frontier in orthopaedic discovery, promising the possibility of accelerated healing of acute and chronic injuries and potentially precluding the need for surgery [9, 17]. In addition, these treatments are perceived to have a favourable risk/benefit ratio and low side effect profile given their autologous nature. Basic science studies have already demonstrated positive results with PRP in the treatment of ACL graft and donor site healing, rotator cuff healing, and articular cartilage injury models [3, 4, 13]. Unfortunately, current clinical studies have yet to reflect the consistently positive results obtained in the basic science literature [21–23]. Recently, a small series of patients have presented with recalcitrant patellar tendinitis that developed symptomatic and radiographic progression following PRP treatment. To our knowledge, this is the first report of potentially adverse clinical findings after PRP therapy for patellar tendinitis. The purpose of this report is to share this clinical experience with PRP therapy and to create awareness on the potential outcomes after its use.

Case report

Case 1

Case 1 is a 26-year-old former collegiate swimmer with a 5-year history of progressive bilateral anterior knee pain localized to the proximal patellar tendons. He was diagnosed with patellar tendinitis in 2008 following an MRI demonstrating a patellar tendon thickness of 3.4 mm (Fig. 1a). After failure of physical therapy, activity modification, and use of non-steroidal anti-inflammatory drugs (NSAID), he was administered by injection into the bilateral patellar tendons under ultrasound guidance with a combination of PRP and abdominal fat cells. The PRP was prepared by centrifuging 60 mL of blood to obtain 10 mL of PRP. This was combined with 0.3 mL of recombinant thrombin and 6 mL of abdominal adipose tissue harvested in a percutaneous fashion through a 2.4-mm cannula (Tulip Medical Products, San Diego CA). Post-procedure, the patient was restricted from working for 5 days followed by gradual return to activity. A formal rehabilitation programme was not prescribed. One week later, he reported a progressive increase in his bilateral anterior knee pain.

The patient presented to our clinic several months after PRP treatment due to persistent symptoms. Physical examination demonstrated significant hamstring tightness and palpable patellar tendon thickening with focal tenderness. Bilateral knee MRIs were obtained, demonstrating marked patellar tendon thickening (14 mm on the right and 11 mm on the left) (Fig. 1b, c). A course of oral NSAIDs and a focused lower extremity flexibility and eccentric strengthening programme was initiated. The patient was reimaged 4 months later demonstrating interval improvement in patellar tendon thickness (left 9.2 mm, right 11.1 mm), correlating with moderate clinical improvement.

Case 2

Case 2 is a 26-year-old professional volleyball player with a 5-year history of left patellar tendinitis and a 2-year history of right patellar tendinitis. Initial treatment included physical therapy and eccentric quadriceps strengthening, laser treatment, TECAR radiofrequency massage, ultrasound, and cryotherapy. Her symptoms required heavy NSAID dosages or mild narcotics for competition. An MRI was obtained in March 2010 for the left knee demonstrating thickening and partial tearing of the proximal patellar tendon (Fig. 2a). In June 2011 she was administered by PRP injections (GPS III, Biomet, Warsaw, IN) into the bilateral patellar tendons with 3 mL of PRP. After 4 weeks she was allowed to begin running and cycling, at which point she began to develop bilateral anterior knee swelling and difficulty with quadriceps stretching activities. Clinical examination revealed bilateral swelling over her patellar tendons and marked bilateral vastus medialis obliquus atrophy. Interval MRIs were obtained in August and September 2011 demonstrating marked thickening of the entire patellar tendon with heterogenous signal change and tissue oedema (Fig. 2b).

An ultrasound revealed thickening of the midportion of the patellar tendon with marked hypervascularity. However, the proximal patellar tendon insertion appeared nearly normal without hypervascular change. A course of ultrasound shockwave therapy was initiated (radial shock wave—2,000 impulses at 2.5 bar) and repeated at 4 and 6 weeks in conjunction with an eccentric training programme. At her most recent clinical follow-up, the symptoms on the right knee have almost completely resolved, and the left knee had improved considerably with mild residual swelling and stiffness.

Case 3

Case 3 is a 15-year-old high school basketball player who experienced 18 months of right anterior knee pain. An MRI demonstrated proximal patellar tendinitis with a partial

Fig. 1 **a** Case 1 right knee MRI obtained in 2008 demonstrating a patellar tendon thickness of 3.4 mm. **b** MRI obtained 5 months following PRP therapy demonstrating marked thickening of the patellar tendon to 14 mm with low-grade interstitial changes. **c** The left knee demonstrated similar thickening to 11 mm of the patellar tendon following PRP treatment

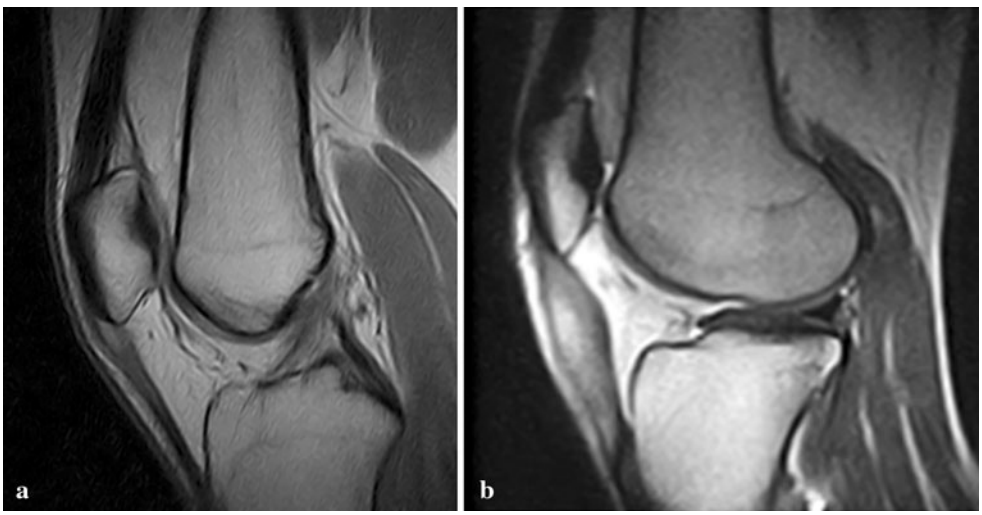

Fig. 2 **a** Case 2 MRI of the left knee demonstrating evidence of patellar tendinitis. **b** Repeat MRI 2 months following PRP injection demonstrating marked thickening of the patellar tendon

entheseal tear involving the dorsal-central 20 % of the tendon substance (Fig. 3a). After a failure of physical therapy, rest, and nitric oxide patch application, she was administered by injection with PRP [autologous conditioned plasma (ACP), Arthrex, Naples, FL, USA] into the proximal patellar tendon at the area of pathology. The procedure was repeated 1 week later. A physical therapy programme was initiated following 7 days of rest.

After 8 weeks of physical therapy focusing on oedema control, hamstring flexibility, and eccentric quadriceps strengthening, the patient attempted to resume playing basketball. She quickly redeveloped symptoms of severe anterior knee pain causing her to miss multiple games. A subsequent MRI demonstrated markedly increased cystic change adjacent to the patellar tendon with intrasubstance tearing and osseous oedema at the distal pole of the patella (Fig. 3b). Surgical options were discussed due to her persistent symptoms and failure of non-operative management. During arthroscopy, a large amount of disorganized inflammatory tissue was encountered at the proximal patellar tendon. The distal pole of the patella was noted to be very soft and easily debrided with a standard arthroscopic shaver. A debridement of the diseased tissue and a gentle 2–3-mm osteoplasty of the distal patellar pole were performed. Following routine post-operative care, she was allowed to return to unrestricted basketball activities at 4 months post-operatively and currently reports resolution of her anterior knee pain at the time of publication.

Discussion

Chronic insertional tendinopathies of the lower extremity such as patellar tendinitis present a challenging problem to the orthopaedist and can often lead to a prolonged and frustrating clinical course for the patient. The aetiology of

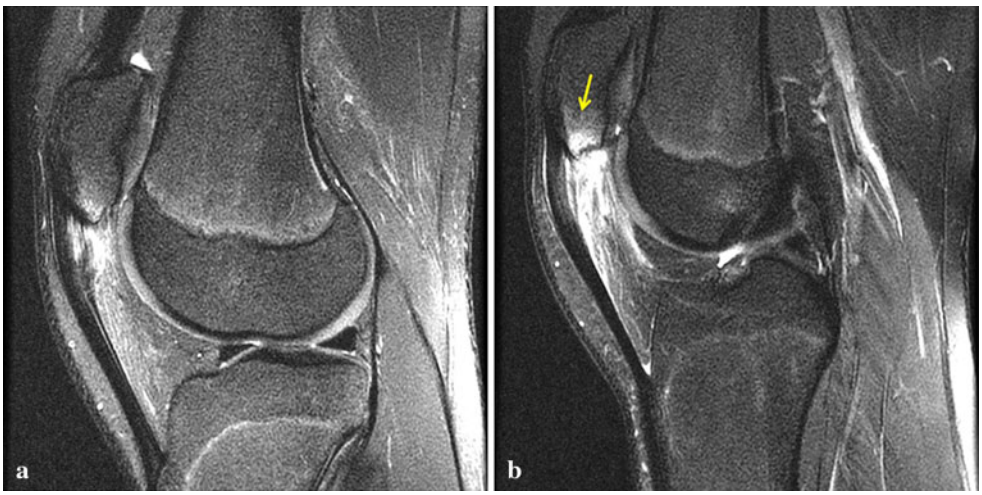

Fig. 3 **a** Case 3 underwent an MRI identifying evidence of patellar tendinitis with a partial tear at the central 20 % of the tendon. Patella alta and fat pad oedema are also evident. **b** Following treatment with PRP, reactive oedema and osteolysis developed at the distal pole of the patella

patellar tendinitis is not completely known, but histopathologic findings include tendon widening, neovascularization, disturbed collagen distribution, and increased cellularity [1, 7, 14]. Non-operative management is the mainstay of treatment including physical therapy, icing, activity modification, and NSAIDs [16]. Persistent cases are additionally treated with ultrasound, shockwave therapy, sclerosing injections, and needling in an attempt to stimulate a healing response [1, 11, 12]. Eccentric quadriceps strengthening has recently been shown to be the single most effective exercise for successfully treating symptoms non-operatively [16]. Surgical intervention is reserved for chronic and persistent symptoms after failure of non-operative management [18].

Given the growing body of basic science research demonstrating the positive effects of PRP in the treatment for tendinopathies, its clinical use could potentially bridge the spectrum between surgical and non-surgical options [25]. However, there currently exists a paucity of well-designed clinical studies evaluating its efficacy in the management of patellar tendinitis [5, 6, 15]. Two small case series from the same institution evaluated patients with chronic patellar tendinitis, reporting a significant improvement in patient-reported outcomes (Tegner, EQ VAS, and SF36) at 6 months following PRP treatment compared with physical therapy alone. No complications or adverse effects were reported during the study period [6, 15]. An additional case report demonstrated a superior outcome following ultrasound-guided PRP injection compared to a conventional physical therapy programme at 8-month follow-up [2]. More recently, a prospective cohort study demonstrated significant improvement in subjective outcomes following PRP therapy for patients with refractory patellar tendinitis compared to those who had not received any prior treatment [8]. Although these studies have demonstrated promising initial results, there has been only one published randomized clinical trial comparing PRP therapy to shockwave therapy for patellar tendinitis. This study demonstrated no significant difference in pain relief or VISA-P scores at 2 months between PRP and shockwave therapies, but at 6 and 12 months, PRP therapy resulted in significantly improved outcomes. They did not report any adverse events in their 23-patient cohort receiving PRP injections aside from local discomfort from injection [24].

The structural effect of PRP on the healthy patellar tendon is not completely understood. Recent animal studies have demonstrated multiple histological changes following PRP injection on normal connective tissues including calcium deposition, local necrosis, tendon and ligament thickening, and fibroblast proliferation [10]. It is also unknown whether similar radiologic changes would be observed in patients "successfully" treated with PRP for patellar tendinitis. Each patient was treated utilizing different plasma concentrating systems and injection protocols, suggesting that these reactions may transcend individual variations in PRP preparation. Additionally, the possibility exists that the observed radiologic changes may be attributed to the physical injection volume or represent isolated reactions to the treatment provided. These differences underline one of the greatest challenges in developing a well-designed research protocol for any study: PRP is not one and the same product [19].

To our knowledge, this is the first report of worsening symptoms of patellar tendinitis following PRP therapy. We acknowledge that these are individual cases from an unknown total number of patients undergoing a similar intervention, and it is not possible to determine whether

these findings are directly attributed to the use of PRP, inappropriate or incomplete use of more established treatment modalities, or simply the natural course of the disease. Providers should be aware that clinical deterioration is possible following any treatment for chronic tendinopathies and that any intervention that is "strong enough to help" may also be "strong enough to hurt." These cases highlight the need for continued investigation in order to further define the role of these new therapies in the management of patellar tendinitis.

Conclusion

Treatment with autologous blood products holds many theoretical advantages, and recent basic science and clinical studies have demonstrated promising in vitro and in vivo results. However, the paucity of clinical evidence combined with the potential adverse effects should caution clinicians considering the use of PRP for the management of patellar tendinitis.

References

1. Alfredson H, Ohberg L (2005) Neovascularisation in chronic painful patellar tendinosis–promising results after sclerosing neovessels outside the tendon challenge the need for surgery. Knee Surg Sports Traumatol Arthrosc 13(2):74–80
2. Brown J, Sivan M (2010) Ultrasound-guided platelet-rich plasma injection for chronic patellar tendinopathy: a case report. PMR 2(10):969–972
3. Carofino B, Chowaniec DM, McCarthy MB et al (2012) Corticosteroids and local anesthetics decrease positive effects of platelet-rich plasma: an in vitro study on human tendon cells. Arthroscopy 28(5):711–719
4. Cervellin M, de Girolamo L, Bait C, Denti M, Volpi P (2012) Autologous platelet-rich plasma gel to reduce donor-site morbidity after patellar tendon graft harvesting for anterior cruciate ligament reconstruction: a randomized, controlled clinical study. Knee Surg Sports Traumatol Arthrosc 20(1):114–120
5. de Vos RJ, van Veldhoven PL, Moen MH, Weir A, Tol JL, Maffulli N (2010) Autologous growth factor injections in chronic tendinopathy: a systematic review. Br Med Bull 95:63–77
6. Filardo G, Kon E, Della Villa S, Vincentelli F, Fornasari PM, Marcacci M (2010) Use of platelet-rich plasma for the treatment of refractory jumper's knee. Int Orthop 34(6):909–915
7. Gisslen K, Alfredson H (2005) Neovascularisation and pain in jumper's knee: a prospective clinical and sonographic study in elite junior volleyball players. Br J Sports Med 39(7):423–428
8. Gosens T, Den Oudsten BL, Fievez E, van 't Spijker P, Fievez A (2012) Pain and activity levels before and after platelet-rich plasma injection treatment of patellar tendinopathy: a prospective cohort study and the influence of previous treatments. Int Orthop 36(9):1941–1946
9. Hammond JW, Hinton RY, Curl LA, Muriel JM, Lovering RM (2009) Use of autologous platelet-rich plasma to treat muscle strain injuries. Am J Sports Med 37(6):1135–1142
10. Harris NL, Huffer WE, von Stade E, Larson AI, Phinney S, Purnell ML (2012) The effect of platelet-rich plasma on normal soft tissues in the rabbit. J Bone Joint Surg Am 94(9):786–793
11. Hoksrud A, Ohberg L, Alfredson H, Bahr R (2006) Ultrasound-guided sclerosis of neovessels in painful chronic patellar tendinopathy: a randomized controlled trial. Am J Sports Med 34(11):1738–1746
12. Housner JA, Jacobson JA, Morag Y, Pujalte GG, Northway RM, Boon TA (2010) Should ultrasound-guided needle fenestration be considered as a treatment option for recalcitrant patellar tendinopathy? A retrospective study of 47 cases. Clin J Sport Med 20(6):488–490
13. Jo CH, Kim JE, Yoon KS, Shin S (2012) Platelet-rich plasma stimulates cell proliferation and enhances matrix gene expression and synthesis in tenocytes from human rotator cuff tendons with degenerative tears. Am J Sports Med 40(5):1035–1045
14. Knobloch K (2008) The role of tendon microcirculation in Achilles and patellar tendinopathy. J Orthop Surg Res 30(3):18
15. Kon E, Filardo G, Delcogliano M et al (2009) Platelet-rich plasma: new clinical application: a pilot study for treatment of jumper's knee. Injury 40(6):598–603
16. Larsson ME, Kall I, Nilsson-Helander K (2011) Treatment of patellar tendinopathy-a systematic review of randomized controlled trials. Knee Surg Sports Traumatol Arthrosc 20(8):1632–1646
17. Majewski M, Ochsner PE, Liu F, Fluckiger R, Evans CH (2009) Accelerated healing of the rat Achilles tendon in response to autologous conditioned serum. Am J Sports Med 37(11):2117–2125
18. Marcheggiani Muccioli GM, Zaffagnini S, Tsapralis K (2012). Open versus arthroscopic surgical treatment of chronic proximal patellar tendinopathy. A systematic review. Knee Surg Sports Traumatol Arthrosc 21(2):351–357
19. Mazzocca AD, McCarthy MB, Chowaniec DM et al (2012) Platelet-rich plasma differs according to preparation method and human variability. J Bone Joint Surg Am 94(4):308–316
20. Reider B (2009) Proceed with caution. Am J Sports Med 37(11):2099–2101
21. Rodeo SA, Delos D, Williams RJ, Adler RS, Pearle A, Warren RF (2012) The effect of platelet-rich fibrin matrix on rotator cuff tendon healing: a prospective, randomized clinical study. Am J Sports Med 40(6):1234–1241
22. Sheth U, Simunovic N, Klein G et al (2012) Efficacy of autologous platelet-rich plasma use for orthopaedic indications: a meta-analysis. J Bone Joint Surg Am 94(4):298–307
23. Taylor DW, Petrera M, Hendry M, Theodoropoulos JS (2011) A systematic review of the use of platelet-rich plasma in sports medicine as a new treatment for tendon and ligament injuries. Clin J Sport Med 21(4):344–352
24. Vetrano M, Castorina A, Vulpiani MC, Baldini R, Pavan A, Ferretti A (2013) Platelet-rich plasma versus focused shock waves in the treatment of jumper's knee in athletes. Am J Sports Med 41(4):795–803
25. Zhang J, Wang JH (2010) Platelet-rich plasma releasate promotes differentiation of tendon stem cells into active tenocytes. Am J Sports Med 38(12):2477–2486