Efficacy of Platelet-Rich Plasma in Management of Advanced Posterior Tibial Tendinopathy in Active Patients: Two Treatment Protocols

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Statement of Purpose

Surgical management of advanced posterior tibial tendinopathy has demonstrated reasonable long-term outcomes, but often at the expense of high impact activities. For active patients, the functional limitations with traditional surgical management of posterior tibial tendon dysfunction (PTTD) may not be acceptable. These case studies illustrate two alternative, autologous approaches and their long-term results in managing advanced posterior tibial tendinopathy in active patients.

Literature Review

The posterior tibial (PT) tendon serves as the primary stabilizer of the foot's medial longitudinal arch as it attaches to the sustentaculum tali, navicular, three cuneiforms, and first through third metatarsal bases[1]. During heel strike, it resists pronation and internal tibial rotation, while at heel rise, it serves as a locking force of the medial column and rearfoot to convert the foot into a rigid lever[2]. However, several extrinsic and intrinsic factors can lead to PTTD and subsequent pain.

The PT tendon is prone to interstitial tears, specifically at the retromalleolar area. According to Steplen, as the tendon glides around the medial malleolus at approximately a 90 degree angle, an intrinsic hypovascular zone 1.4 centimeters distal to the tip of the medial malleolus is present and predisposes the tendon to injury[3]. However, this is disputed by Prado et al, who state that failure at this zone is due to excessive extrinsic mechanical stresses, not ischemia[4]. As a result of these collective strains on the tendon, it degenerates and a progressive collapse of the midfoot, abduction of the forefoot, and valgus positioning of the hindfoot occurs.

Depending on where the patient falls in the spectrum of the Johnson and Strom[5] classification system and modification by Myerson[6], conservative and surgical management options can be considered. A review of the literature reveals conservative choices for milder disease involve patient education, weight loss programs, ice, rest from aggravating activities, taping, an orthotic device, ankle foot orthosis, eccentric stretching, physical therapy, anti-inflammatory and analgesic pharmacotherapy, and temporary immobilization[2, 7, 8]. Surgical management includes tenosynovectomy, primary PT tendon repair, flexor hallucis longus (FHL) tendon transfer, flexor digitorum longus (FDL) tendon transfer, Achilles tendon lengthening, spring ligament repair, calcaneal osteotomy, lateral column lengthening, and individual or multiple hindfoot arthrodesis[9, 10]. Despite its use in other tendinous pathologies, autologous therapy has not been classically recommended for PTTD.

Over the past decade, the efficacy of platelet-rich plasma (PRP), an autologous blood product, has been heavily debated in the literature. While no consensus has yet been determined, PRP has aided in patient's suffering from symptoms of Achilles tendinopathy, plantar fasciosis, elbow tendinopathy, patellar tendinopathy, and knee osteoarthritis[11]. It has also been used successfully as an augment to surgical tendon repair. As PRP contains four to six times the baseline concentration of platelets, which contain a large amount of growth factors and cytokines, it improves soft tissue repair by synthesis of regenerative proteins and down regulation of inflammatory mediators[11]. This enhances the healing mechanisms that the body already has in place.

Based on leukocyte, fibrin, and platelet composition, PRP can be categorized into P-PRP (pure-PRP), L-PRP (leukocyte-PRP), P-PRF (pure platelet-rich fibrin), and L-PRF (leukocyte and platelet-rich fibrin)[12]. Other components to PRP are calcium chloride, which delays the platelet activation period to seven days, and fibrin, which activates the PRP and allows it to precipitate into a gel form[13].

Due to no standardization in PRP preparation or definition of the optimal number of platelets needed for enhanced healing, evaluation of this autologous therapy has been challenging. However, foot and ankle studies focused on plantar fasciosis and Achilles tendinopathy have demonstrated some positive results. One double blinded, randomized control study of 25 patients with plantar fasciosis found that PRP was just as or more effective in improving VAS and AOFAS scores compared to corticosteroids[14]. Another study found improved Tegner, VISA-A, and EQ-VAS scores 4.5 years after receiving three separate, ultrasound-guided PRP injections in 34 patients with chronic mid-substance Achilles tendinopathy[15]. Because of the success with PRP injections in these particular foot and ankle soft tissue pathologies, we were curious how PRP could impact those with posterior tibial tendinopathy.

Case Series

A case series is presented to illustrate the impact of biological therapy on chronic posterior tibial tendon pathology.

Case 1: A 56-year-old physically active male presented to clinic with a chief complaint of two years of progressive left medial ankle pain. No direct trauma occurred, but the patient played competitive soccer several days per week. The rest of the patient's medical history was unremarkable. Upon physical exam, the patient had a pronated foot type and pain along the PT tendon, distal to the medial malleolus. The patient had seen multiple other providers and exhausted all conservative measures. Magnetic resonance imaging (MRI) of the ankle revealed severe posterior tibial tendinopathy with a longitudinal tendon tear at the medial malleolus (Figure 1). Multiple providers recommended that the patient undergo a calcaneal osteotomy and FHL tendon transfer for treatment of his symptoms.

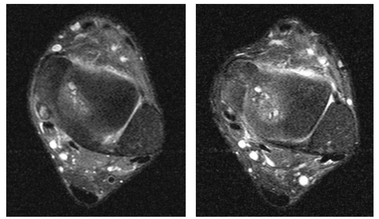

Figure 1 – Case 1, Pre-Op MRI: Hypertrophied PT tendon

Figure 2 – Case 1, 9mo Post-Op MRI: Improved signal intensity within PT tendon

As an alternative to flatfoot reconstruction, an isolated primary tendon repair and PRP injection was suggested to the patient. Prior to the procedure, the patient was informed that there were no long-term outcome studies, and if ineffective, he may need additional surgery. Accepting these limitations, the patient elected to move forward with the proposed surgical procedure.

A ten centimeter curvilinear incision was made along the course of the PT tendon, proximally from the medial malleolus, distally to the navicular tuberosity. A "U-shaped" periosteal flap was raised off of the medial malleolus as a reference point for closure. The longitudinal tear mentioned in the MRI was identified along the medial malleolus. Any frankly degenerative tendon was debrided. Thirty milliliters of blood were drawn from the antecubital fossa of the patient and added to three milliliters of ACD-A (citrate anticoagulant). The mixture was then spun through a system that recovers about 90% of the available platelets. After the one time, 15 minute centrifuge process was complete, half of the finished product was combined with thrombin to produce a PRP gel formation. This was placed into the intra-tendinous defects. The tendon was repaired over the PRP gel with a continuous running 4-0 polyester fiber suture. The remaining portion of the platelet concentrate suspension was injected into the tendon, proximally and distally to the identified tear. The "U-shaped" periosteal flap was then repaired with a suture anchor into the medial malleolus. Closure by layers was then performed.

After surgical intervention, the patient was strictly non-weight bearing in a posterior splint. At four weeks post-operatively, the patient was allowed to begin passive sagittal plane ankle range of motion, with partial weight bearing in a walking boot at six weeks post-operatively. Physical therapy and full weight bearing occurred twelve weeks after surgery, and the patient was back to his original sport without restrictions thirty-one weeks post-operatively.

Subsequent serial MRIs demonstrated improved PT tendon appearance with decreased inflammation and no tear. The patient underwent an MRI nine months post-operatively, which demonstrated improved health of the tendon compared to the study prior to surgery (Figures 2, 3). Five years after this alternative surgical approach, the patient was still playing soccer competitively and a repeat MRI demonstrated a normal posterior tibial tendon (Figure 4).

Case Series

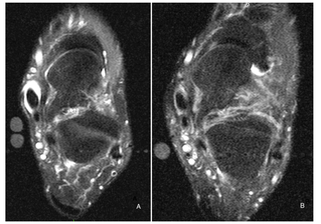

Figure 3 – Case 1, Comparison of the Pre-Op (A) and 9 mo Post-Op (B) MRIs: Significant decrease in the fluid within the tendon sheath

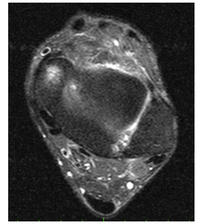

Figure 4 – Case 1, 5 years Post-Op MRI: Near complete resolution of tenosynovitis

Case 2: A 71-year-old otherwise healthy male presented to clinic with medial left ankle pain, which was progressive over a ten-week period. The patient was an avid runner and participated in a variety of athletic activities. As a result of his left ankle pain, his mobility was significantly affected. Physical exam revealed tenderness with palpation of the left medial ankle retromalleolar area and weakness and pain with foot inversion against resistance. Standing biomechanical exam demonstrated increased medial column collapse and hindfoot valgus, compared to the contralateral limb, in addition to inability to perform the single and double-leg heel rise exam. The patient was placed into a lace-up ankle stabilization brace and further evaluated with an MRI.

The ankle MRI demonstrated moderately advanced tendinopathy with interstitial degeneration and longitudinal interstitial tearing from the musculotendinous junction to the navicular bone (Figure 5). The patient was placed in a controlled ankle motion (CAM) walking boot. Due to no improvement in symptoms, despite being immobilized for one month, the patient was offered a PRP injection. Surgical intervention was also discussed with the patient, including an in-situ tendon transfer and calcaneal osteotomy. However, the patient wished to proceed with the injection first, prior to considering surgical correction.

The same platelet concentration system was used as in Case 1 and four milliliters of PRP suspension were injected distally from the medial malleolus into the PT tendon under ultrasound guidance. The patient was immediately weight bearing in a CAM boot. The patient gradually returned to his activities, which he did with substantially less discomfort than before. An MRI performed nine months after the PRP injection was found to have "notably improved appearance of the posterior tibialis tendinopathy" (Figure 6). Twelve months after the PRP injection, patient was pain free and had returned to his normal activities.

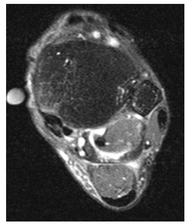

Figure 5 – Case 2, Initial MRI: Moderately advanced tendinopathy

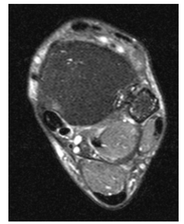

Figure 6 – Case 2, 9 mo post-PRP injection: Improved appearance of PT tendon

Analysis and Discussion

Regenerative medicine is a component of sports medicine that is rapidly expanding. Tendon complaints account for at least 30% to 50% of all sports lesions occurring in professional and recreational athletes[16], and patients are in search of new and quicker ways to return back to their activity. Traditional treatment options for PTTD are not practical or acceptable to these patients. One study evaluating stage 2 PTTD in patients under 50 years old, showed improved SF-36 physical subcomponent and AOFAS scores after an FDL tendon transfer and calcaneal osteotomy. However, only 5 of the 30 patients were able to return to running or moderate athletics after the average final follow up of 44.5 months[17]. Autologous PRP may be able to assist with their goal, as demonstrated in our case series.

In PTTD, degeneration and disruption of the collagen bundle structure and orientation occurs, which was seen in our initial MRIs (Figures 1, 5). While not a usual method for treating PTTD, the autologous blood product has resulted in not only pain relief and improved function clinically, but also in tendon appearance, as seen on advanced imaging in our small patient population. The cytokines and growth factors secreted by PRP produce IGF-1 and TGF-beta 1, which in turn, trigger the synthesis and accumulation of collagens to improved tendon structure and morphology[18].

Due to its current labeling as "investigational", PRP is expensive and not typically covered by healthcare insurance plans. However, other than a few reports of minor localized epidermal reactions, PRP has a good safety profile. Patients will, at best, experience a boost in their natural healing mechanisms to counteract the degenerative processes occurring, or, at worst, they will incur short term analgesia through a minimally invasive technique which does not preclude any subsequent surgical intervention.

In conclusion, PTTD is a highly prevalent progressive disease with a spectrum of management techniques. While PRP is controversial and further prospective studies with a standardized PRP preparation protocol need to be completed, these case studies detail two patients' experiences after biological intervention for PTTD. These demonstrate that while not a traditional indication for PRP, it can have long term success. Our goal in this presentation is to illustrate that biological therapy, with or without surgical tendon repair, can allow for patients with PTTD to return to high level activities without restrictions and restore normal tendon appearance with advanced imaging in mid-long-term outcomes. Life expectancy is increasing with advances in medical science. Our population is aging in a manner that desires a more active lifestyle. Biologic solutions for PTTD is consistent with these trends.

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