One practice's success with platelet-rich plasma therapy

The 3 cases presented here represent the kind of success that one pain center is having with platelet-rich plasma therapy for the treatment of musculoskeletal pain.

Wendi Lundquist, DO, FAAPMR, DABPM
Active Life Physical Medicine & Pain Center, PLLC
Avondale, Ariz
Midwestern University, Glendale, Ariz

Ray Stanford, BS, MS-II
Midwestern University, Glendale, Ariz

Photo: Paul Rapson / Science Source

In primary care and orthopedic clinic settings in the United States, common musculoskeletal injuries account for nearly 100 million office visits annually.[1] Many orthopedic, primary care, and sports medicine physicians view platelet-rich plasma (PRP) therapy as an emerging treatment option for tendon, muscle, and bone injuries. PRP therapy appears to accelerate the healing process, reducing patients' pain and improving function. And our experience at Active Life Physical Medicine & Pain Center bears that out. We have administered PRP therapy to more than 400 patients for various tendinopathies, ligament strains, meniscal tears, degenerative joint disease, and other nonhealing painful areas with favorable results.

Disclosure
Dr. Lundquist reported that in October 2012, she was paid to speak on behalf of RS Medical, a distributor of a platelet concentrate system. Mr. Stanford reported no potential conflict of interest relevant to this article.

In this article, we share what is known about this emerging therapy, and we describe 3 cases in which patients were successfully treated with PRP therapy.

How PRP therapy boosts the healing process

Platelets, the tiny cell fragments almost exclusively associated with blood clots, conjointly perform a fundamental role in tissue repair. Their foremost function, clotting, is the first step in the healing process. Once activated, platelets release a host of factors that include additional adjuncts in clot formation and several growth factors.[1] These growth factors significantly increase the proliferation of tenocytes, fibroblasts, chondrocytes, osteoblasts, and mesenchymal stem cells.[2-4] The tissue-healing process takes place over 3 intricate and overlapping phases: inflammation, proliferation, and remodeling (FIGURE).[5]

Injecting platelets into the area of pathology is thought to kick-start and accelerate the healing cascade, enabling the body's healing mechanism to regenerate a new matrix of tissue. In a study to assess the effects of different PRP separation methods on human muscle, bone, and tendon cells, researchers compared PRP preparations produced by 3 different methods (2 single-spin and one double-spin process) from blood collected from 8 subjects.[6] Human cells (osteocytes, myocytes, and tenocytes) from discarded tissue samples were treated with the 3 PRP preparations. All 3 PRP preparations produced increases in platelet concentration compared with native blood, but wide variation occurred within the same individual's blood draws, depending on the target cells studied.[6]

Clinical applications. In a randomized controlled clinical trial of 28 patients with chronic lateral epicondylitis, patients received either autologous whole blood or a PRP preparation under ultrasound guidance. PRP therapy was superior to autologous whole blood in the short term (6 weeks), based on an evaluation using a pain visual analog scale (VAS) score.[7]

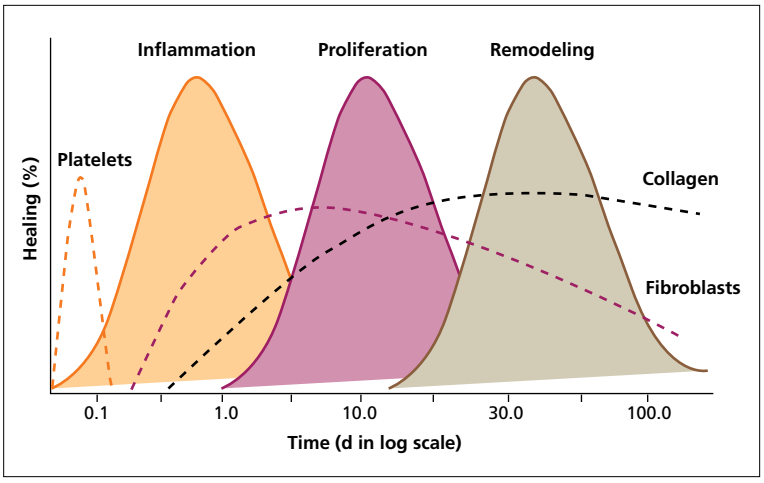
PRP injections have also produced superior therapeutic results compared with injections of hyaluronic acid and corticosteroids.[8,9] In a prospective cohort study with a control group, Spakova and colleagues treated 120 patients with grade 1, 2, or 3 knee osteoarthritis with either 3 intra-articular injections of a PRP preparation or 3 injections of hyaluronic acid.[8] At the 3- and 6-month follow-up, the PRP-treated group had significantly better results as measured by the Western Ontario and McMaster Universities Osteoarthritis Index and Numeric Rating Scale score.[8]

Similarly, Peerbooms et al compared injection treatment with a corticosteroid to a PRP preparation in a randomized controlled trial of 100 patients with lateral epicondylitis.[9] The researchers defined treatment success as more than a 25% reduction a VAS pain score or DASH (Disabilities of the Arm, Shoulder and Hand) Outcome Measure score at one year. Study results showed that PRP injections were superior to cortisone injections, with 73% of the PRP group treated successfully compared with 49% of the corticosteroid group. While the corticosteroid-treated group showed improvement initially and then declined, the PRP-treated group improved progressively.[9]

A controversial therapy

PRP therapy is considered controversial because high-level clinical evidence is lacking for many indications. A 2009 systematic review of the orthopedic surgery and sports medicine

FIGURE: The wound-healing cascade



This graph depicts the 3 overlapping phases of wound healing: inflammation (platelets create a clot, and platelet activation results in release of growth, hemostatic, and other factors); proliferation (characterized by angiogenesis, collagen deposition, granulation tissue formation, epithelialization, and wound contraction); and remodeling (collagen maturation and apoptosis of excess cells).

Understanding the fundamentals of healing is essential to understanding the rationale behind platelet-rich plasma (PRP) therapy: It takes an average of 100 days for complete healing to occur. Collagen activity and fibroblast healing activity peak between Days 5 and 30, on average. At the platelets' peak in the initial hours after injury, signals are occurring to recruit the necessary healing factors. Injecting PRP into the injured area is thought to kick-start this healing cascade and accelerate tissue repair.

Source: Reprinted, with permission from the *American Journal of Roentgenology*, from Lee KS, Wilson JJ, Rabago DP, et al. Musculoskeletal applications of platelet-rich plasma: fad or future? *AJR Am J Roentgenol.* 2011;196:628-636.[5]

literature, for instance, noted that few controlled clinical trials had adequately evaluated the safety and efficacy of PRP treatments; the authors concluded that PRP is a promising but not proven therapeutic option for patients with joint, tendon, ligament, and muscle injuries.[10]

That said, smaller studies have found support for its use. Specifically, PRP therapy has been found efficacious in knee joint osteoarthritis, patellar tendon healing, and plantar fasciitis.[8,9,11-13] The treatment is also helpful as an adjunct in arthroscopic rotator cuff repair with mesenchymal stem cells and dermal allografts.[14]

The most widely used application for PRP, however, is in treating lateral epicondylitis. One study of 140 patients with elbow epicondylar pain showed a 60% improvement of pain 8 weeks after PRP injection, compared with a 16% improvement in control patients; the PRP-treated patients reported an 81% improvement at 6-month follow-up.[11]

The FDA weighs in. Although there is some debate as to whether the actual product (the patient's own blood) for PRP injection requires approval by the Food and Drug Administration (FDA), centrifuge devices involved in processing the blood must be FDA approved. Several of the PRP preparation systems available have been FDA 510(k) approved for point-of-care preparation since 1999, with the caveat that the device's labeling must indicate that "The safety and effectiveness of this device for in vivo indications for use has not been established."[15]

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When to consider PRP therapy

Given that many patients with musculoskeletal injuries respond well to conservative treatments, such as physical therapy, nonsteroidal anti-inflammatory drugs (NSAIDs), and/or corticosteroid injections, the Active Life Physical Medicine & Pain Center where I [WL] work generally offers the option of PRP injection to those who have an isolated injury and for whom the risk of cortisone therapy or no treatment outweighs the risk of PRP therapy. Treatment-related complications of PRP therapy include soreness at the injection site, short-term stiffness, and increase in usual pain, which varies in length from one day to one month. Practice physicians also encourage patients to speak with their insurance carriers to determine coverage; most do not cover the procedure because it is considered investigational. The approximate cost for one PRP treatment is $600 to $800 per body region, including the materials and labor for preparing the platelets.

When not to use PRP therapy. The International Cellular Medicine Society (ICMS) has published guidelines on the use of PRP therapy and lists the following as absolute contraindications to its use: platelet dysfunction syndrome, critical thrombocytopenia, hemodynamic instability, septicemia, local infection at the procedure site, and patient unwillingness to accept risks.[16]

In addition, relative contraindications include use of NSAIDs within 48 hours of the procedure, corticosteroid injection at the treatment site within one month, systemic use of corticosteroids within 2 weeks, tobacco use, recent fever or illness, cancer (especially hematopoietic or bone), hemoglobin <10 g/dL, or a platelet count <105/µL.[16]

How the PRP solution is prepared and administered

Although different concentrations of PRP are commonly used, a preparation with 5 times the platelet concentration of whole blood has become standard.[17] Various PRP separation methods (ie, single-step or 2-step procedures) are also used; single-step procedures can produce sufficient concentrations.[18]

The basic steps for preparing the solution involve drawing approximately 20 to 60 cc of venous blood from the patient's antecubital vein and placing it in an FDA-approved centrifuge device that separates the PRP from platelet-poor plasma and red blood cells. The process takes about 15 minutes and typically generates about 3 to 6 cc of PRP, which is withdrawn by syringe from a port on the device. The physician then positions the patient, instills local anesthesia with lidocaine, uses image guidance (ultrasonography or fluoroscopy) to direct the needle into the site of pathology, and injects the PRP preparation.

At the 4-week postprocedure appointment, physical therapy follow-up should be initiated if neuromuscular re-education is needed. Most patients, however, do not require this. That said, I [WL] do initiate physical therapy for the professional athletes I treat with PRP therapy because of the expected physiologic stress that their training will put on their bodies.

One injection or more? In my [WL] experience, one injection is often sufficient, as seen in the 3 cases described on pages S13 and S14. At this time, however, neither the optimal

CASE #1 Active older woman with elbow pain

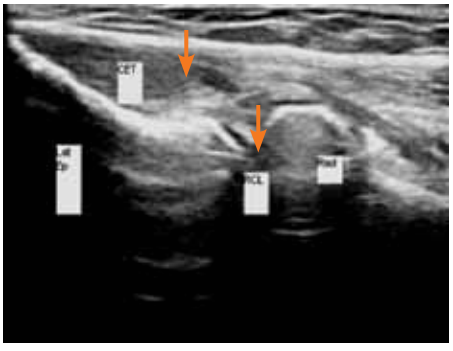
A 74-year-old active, right-handed woman who, for many years, had progressive lateral epicondyle pain with activities involving wrist extension presented to the clinic to explore other conservative therapeutic options. She had previously tried physical therapy, bracing, cortisone injections, activity modification, NSAIDs, and various other pain medications without sustained relief. Her goal was to have her pain reduced and to be able to return to playing boccie.

Magnetic resonance imaging (MRI) and ultrasound studies showed evidence of a common extensor tendon tear and radial collateral ligament tear.

PRP injection, under ultrasound guidance, was done once. Local anesthesia was used, and approximately 2 to 3 cc of PRP concentrate was injected.

At follow-up 2 months later, the patient's symptoms of tenderness, swelling, and pain with wrist extension/gripping had resolved. Repeat ultrasound examination revealed tendon healing. The patient was able to return to playing boccie.

Extensor tendon tear: Ultrasound scan at patient's first visit shows evidence of a common extensor tendon tear (arrow, left) and radial collateral ligament tear (arrow, right).



Tendon repair at 2 months post–PRP treatment: Ultrasound scan after one injection of PRP shows healed tendon (arrow, left) and radial collateral ligament (arrow, right).

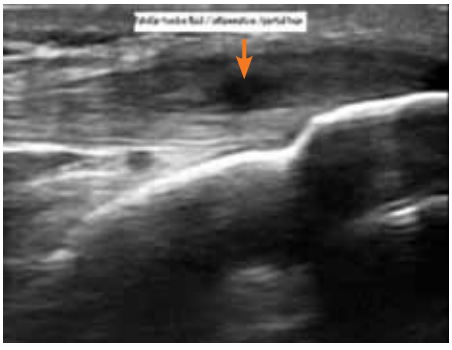
CASE #2 Athletic man with debilitating knee pain

A 38-year-old man came to the clinic with patellar tendonitis. He had pain that was impacting his workout routines with squats. Physical therapy, modification of workout routine, and NSAIDs were all unsuccessful.

Ultrasound scan revealed evidence of a partial tear (50%) and fluid accumulation.

The patient underwent one injection with PRP concentrate utilizing a technique similar to that described for Case #1.

At the patient's 3-month follow-up visit, he reported experiencing only slight pain upon performing deep knee bends. Ultrasound was done at that time and revealed nearly complete healing of the tear and resolution of fluid.



Patellar tendon partial tear: Ultrasound scan shows partial tear (50%) of the patellar tendon and fluid accumulation (arrow).

Healing at 3 months post–PRP injection: Ultrasound image after one injection of PRP concentrate shows almost complete healing, with a patellar tendon thickness increase of 5 mm (arrow).

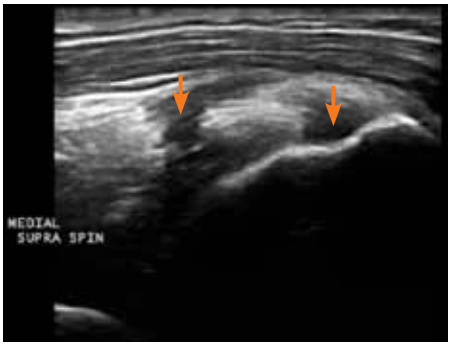
Ultrasound scans courtesy of Wendi Lundquist, DO, and Dale Glassley, MS, BA, NHE, ASMU.

CASE #3 Older woman with painful shoulder

A 70-year-old right-handed woman came to our practice with a 15-month history of shoulder pain with abduction and evidence of a near full thickness tear of the supraspinatus muscle. She had been treated previously with an 8-week course of physical therapy, NSAIDs, ice, and cortisone injections without obtaining relief or functional improvement.

The patient was treated with one injection of PRP concentrate under ultrasound guidance.

At the 2-month follow-up exam, the patient reported that her pain with abduction had resolved. Ultrasound showed that the tear had healed.



Supraspinatus muscle tear: Ultrasound scan of the shoulder shows a near full thickness tear of the supraspinatus muscle in 2 places (arrows).

Healed muscle 2 months after PRP therapy: Ultrasound scan after PRP therapy shows healed supraspinatus muscle (arrows).

Ultrasound scans courtesy of Wendi Lundquist, DO, and Dale Glassley, MS, BA, NHE, ASMU.

We have found that younger, nonsmoking patients who have a very specific problem respond best, while older patients who smoke and have more diffuse pain tend to have less benefit.

number of PRP injections needed nor the optimal time between injections has been determined. Although no definitive protocol has been established, the consensus at conferences and among practitioners that I have spoken with is that 2 to 4 weeks between injections is standard. This interval is derived from the understanding of the healing cascade[5] (FIGURE).

Who benefits most?

As noted earlier, at the Active Life Physical Medicine & Pain Center we have administered PRP therapy to more than 400 patients for various tendinopathies, ligament strains, meniscal tears, degenerative joint disease, and various other nonhealing painful areas. Clinically, we have found that younger, nonsmoking patients who have a very specific problem respond best, while older patients who smoke and experience more chronic, diffuse pain tend to have less benefit. Also, non–weight-bearing areas are more responsive in our clinical experience. We have seen only 3 cases that came to follow-up without some degree of positive response, either functionally or in pain improvement.

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