

Training & Conditioning



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Bloody Good Move

Many athletes today are asking for platelet-rich plasma therapy when they are injured. But is it a good move?

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Platelet-rich plasma therapy (PRP) has been a hot topic in the sports world over the past few years. High-profile athletes who have undergone this cutting edge treatment have generated many headlines, leading injured athletes at all levels to wonder if PRP might be right for them.

In 2009, Pittsburgh Steelers players Hines Ward and Troy Polamalu reportedly used PRP before winning the Super Bowl. Tiger Woods had PRP injections after knee surgery the same year. Tennis player Tom Mendenhall and MLB pitcher Takashi Saito have undergone the treatment on their elbows. NBA star Brandon Roy used PRP to help heal an injured hamstring last year. And that's just a short list of professional athletes who have used the therapy.

PRP is not a novel treatment. It has been used for more than 20 years, mainly outside the sports medicine field. In fact, the first clinical application of PRP appeared in the treatment of cutaneous ulcers to promote wound healing.

Since then, PRP has been utilized and studied in multiple fields, including plastic surgery, oral implantology, maxillofacial surgery, orthopaedics, and sports medicine. With athletes, PRP has been used for treatment of epicondylitis, achilles and patellar tendinopathy, ligament sprains, knee osteoarthritis, and muscle strains. Additionally, orthopaedic surgeons have utilized PRP as an intra-operative measure not only to promote healing, but also to aid in bone and cartilage growth.

The PRP movement is gaining steam because of its potential to get injured athletes back in action faster. Through a fairly simple injection (which should always occur in a clinical setting), doctors are finding that PRP can promote muscle and tendon healing. This is not to say that PRP is a panacea--studies are not conclusive on its efficacy, sports medicine providers have utilized PRP with varying degrees of success, and it only works in conjunction with a closely followed rehab plan--but it's clearly something sports medicine professionals should know about.

HOW IT WORKS

Understanding how PRP works starts with taking a look at its inherent healing and growth-promoting factors. Normal blood contains plasma and platelets that travel throughout the body and spring into action when an injury occurs. Platelets primarily promote blood clotting, tissue proliferation, healing, and remodeling by triggering growth factors and cytokines from within their alpha granules. The idea behind PRP is to use high concentrations of platelets to promote healing.

Most PRP preparations contain a concentration of three to five times more platelets and growth factor concentrations up to 25 times that of normal blood. This rich concentration is achieved through collecting the patients' own blood and using varying substrates, filters, and centrifugation to produce the platelet-rich solution. The particular method of concentrating the PRP solution produces different concentrations of cells and growth factors.

Treatment with PRP can be used on many different types of injuries, but we have found that PRP works best for muscular injuries. We've seen great success with hamstring injuries in particular, with no reoccurrences of pain or disability after treatment. PRP also works well for tendon injuries, likely because of the normally limited blood supply to tendons. These are purely anecdotal findings. Study results have been mixed at best. Unfortunately, it is not fully clear why PRP works well in some cases and not in others.

PRP PROCEDURE

In the first step of PRP graft formation, a volume of whole blood is drawn from the patient, which can range from 10 to more than 60 cubic centimeters, depending on the separation system being used. Following the draw, the blood must be separated into its various components. There are several separation techniques available including:

gravitational platelet sequestration (centrifugation), standard cell separators, or plasmapheresis.

The most common technique is centrifugation. Using gravity, a centrifuge separates the blood into its component layers based on molecular weight and size of cell types. Most centrifuge systems work in a similar manner, with the end product varying according to the centrifuge timing and speed.

Once spun, the cells form distinct layers. The top layer of red blood cells (RBC) will have both platelets and plasma and is usually yellow in color. Next, the buffy coat layer, which is cloudy yellow, contains both highly concentrated platelets and white blood cells (WBC). The bottom layer is the red cell layer, and is a red color.

The medical community is still debating the best concentration of the different components since clinical studies are in the early stages of providing a definitive answer. Most physicians continue to experiment with PRP preparation.

Some physicians use plasma-based systems, in which only the top layer is used for the PRP graft. Others opt for a buffy coat-based system, in which the top layer may or may not be used. The highly concentrated buffy layer is taken with a small amount of the accompanying RBC layer. Based on the initial volume of blood taken and the preparation system used, final platelet concentrations will vary from 1.7 times baseline to greater than 10 times the patients' baseline platelet values with variable amounts of both WBC and RBC contained in the final preparation.

Because the different preparation techniques lead to significant variations in the final product, Alan Mishra, MD, has created a PRP classification template. The template divides PRP into types based on three factors: the presence of WBC, whether the WBC are activated, and the absolute platelet concentration.

In addition to the differences already mentioned, there exist other variations among how the PRP preparations are implemented. Some require the addition of anti-thrombotic agents during the preparation phase and others call for the use of an activator at the time of application.

It is critical for any physician using this technique to be very knowledgeable about the various PRP preparations and how they work. For example, TGF-beta found in PRP that promotes fibrosis at too high a concentration has been shown to increase re-injury rates. In addition, the final PRP treatment graft will vary according to the preparation technique applied to the patients' whole blood.

After deciding on the PRP type, the timing and number of injections must be carefully considered. Currently, no formalized recommendations exist. For example, some providers advocate the use of up to three injections two weeks apart while others are much more conservative.

Our experience has been that a single injection will typically accomplish the treatment goal. If a second injection is necessary, we wait at least one month after the rehabilitation process. An exception to this recommendation is for the treatment of athletic pubalgia, which requires two injections separated by one week.

In many cases, these decisions are often guided by the patients' financial situation. Because most insurance companies do not cover PRP treatments, patients need to weigh the cost before making a choice. Each injection costs between \$500 and \$2,000.

We advocate that PRP injections be performed under ultrasound guidance. In order to maximize recovery, the PRP must be injected into the damaged area properly. This outcome is best achieved with the help of ultrasound to guide us.

Tendon injections typically require the provider to not only inject the injured area, but also use the needle to make several holes into the injured tendon (fenestration). The hole openings will help facilitate an increased inflammatory response, which further promotes healing. Treatments into ligaments, muscles, bones, and joints do not require needle fenestration.

REHAB PHASE

Following the injection procedure, the treated area is typically protected by using a brace, sling, or crutches for 24 to 48 hours. After this, the rehabilitation phase begins, and typically takes four to six weeks. This is perhaps the most important element of the PRP treatment process. We believe the particulars of the rehabilitation phase account for much of the variability in PRP study outcomes.

The rehabilitation phase should start with gentle range-of-motion activities and move to strengthening of the opposing muscle groups, at which point the muscle tendon unit should be attended to. The treated unit should be strengthened slowly, allowing adequate time for the tendon to continue the healing process, while stress on the unit is increased.

Athletic trainers must pay attention to the flexibility and strength of opposing muscle groups. If not properly managed, re-injury will usually occur. We are careful to progress our patients to the next level only when they are able to perform the exercises and use the modalities without pain.

TREATMENT OUTCOMES

The use of PRP in clinical practice has increased tremendously. As a result, there is currently far more clinical experience, anecdotal evidence, and uncertainty than there is high-quality data from well-designed clinical trials. However, there are some published results that can help guide us in the use of PRP for specific injuries.

Note that this article is not meant to serve as an exhaustive summarization of the literature. Additionally, because there is no consensus regarding the most appropriate concentration, preparation or administration procedures, or post-administration

protocols for PRP therapy, there is significant variation in the published literature with regards to what PRP therapy entails. However, general trends are emerging.

Tendinopathies: The safety and efficacy of autologous blood injections was demonstrated in a 2002 study in rabbits, and since that time additional research has assessed the potential therapeutic value of PRP in various tendinopathies. Some of the strongest evidence favoring PRP therapy has come from studies of patients with chronic lateral epicondylitis (tennis elbow) recalcitrant to conservative therapies. Research published in 2010 demonstrated PRP was superior to corticosteroid injections in such a patient population, while a 2006 study found PRP to be more beneficial than bupivacaine injections in these patients.

Patellar tendinopathy has been studied less in humans, but recent research shows promise. A study showed decreased pain and improved activity level in patients treated for refractory chronic patellar tendinopathy with PRP and physical therapy compared to a control group that received only physical therapy. Other uncontrolled human studies have suggested efficacy in this setting as well.

PRP treatment has shown mixed results in the treatment of Achilles tendinopathy. One small case control study found more rapid recovery in range of motion and return-to-training for surgical patients augmented with PRP injections when compared to surgical patients who did not receive PRP injections. Another showed improvement in a small case series. However, a recent randomized controlled trial failed to show significant benefit with a combination of PRP injection and eccentric exercise program versus eccentric exercise alone.

Studies of PRP therapy for rotator cuff tendinopathy have also been inconsistent. While one suggested improved functional scores in patients who received PRP therapy after arthroscopic repair of rotator cuff tears with some benefit continuing beyond the immediate post-operative window, other studies have been unable to confirm this benefit.

Acute muscle injuries: Although no high-quality human studies of PRP treatment for acute muscle tear or strain injuries have been done, there is some evidence of rat models demonstrating shortened recovery time after PRP injection as compared to platelet-poor plasma injection and no injection. Anecdotally, our group has found PRP treatment for hamstrings, quadriceps, and other muscular injuries brings good results and more rapid return to play.

Ligamentous injuries: The potential for PRP therapy to improve outcomes in patients with ligamentous injury has also been explored. A study over a decade ago demonstrated improved mechanical strength in injured rabbit MCLs treated with PRP. In addition, recent anecdotal reports suggested athletes can return to play earlier than expected when these injuries are treated with PRP. However, no compelling data to this effect has been published.

When it comes to surgical repair of ACL tears, several randomized controlled trials have failed to show any benefit of autologous platelet-rich products. One non-human study did find improved mechanical strength three months post-operatively in the ACLs of pigs treated with a PRP-supplemented collagen scaffold.

Other soft tissue conditions: In a small 2004 case series, researchers assessed the efficacy of PRP injections for treatment of chronic, refractory plantar fasciitis. Seven of the nine patients achieved complete resolution of symptoms after treatment with PRP.

Bone and cartilage conditions: PRP therapy has also been performed in conditions other than soft tissue injuries. Weak evidence from a prospective study demonstrated mild improvement in certain patient populations with knee osteoarthritis from intra-articular PRP injections.

In term of meniscal injuries, one study involving rabbits showed improved healing when treated with sustained-release PRP from gelatin hydrogels.

The evidence for treatment of chondral defects exists largely as animal data, with studies demonstrating improved cartilaginous healing with various platelet-rich therapies. There also exists a published case report of a good outcome in a child with a chondral avulsion lesion who was treated with PRP.

Hopefully, future studies will shed more light on how and when to use PRP. In the meantime, we are finding anecdotal evidence that the procedure will help decrease return-to-play times after injury, as long as a proper post-PRP therapy protocol is carefully followed.