Platelet Rich Plasma

CLINICAL BRIEF

Introduction
As physicians continue to seek biologic solutions to improve healing of soft tissue pathologies, worldwide interest in the use of platelet rich plasma (PRP) for sports medicine applications has risen (14). PRP is a platelet concentrate derived from autologous whole blood, with platelet concentrations elevated several fold above baseline whole blood levels (4). PRP contains a high concentration of bioactive factors that are believed to impact healing (3). Although clinical evidence for PRP is still evolving, PRP has recently been widely applied in both surgical and non-surgical orthopedic applications including tendinopathy, acute and chronic soft-tissue injuries, enhancement of healing after ligament reconstruction, and knee osteoarthritis (1, 14).

From the physician perspective, PRP provides a means of enhancing tissue healing, either in combination with surgery or as a standalone therapy. It provides physicians another option in the treatment of complex pathologies such as tennis elbow and osteoarthritis. From the patient perspective, PRP can potentially speed recovery time from injury, help to decrease pain and in many cases avoid surgery. Finally, PRP is safe because the patient’s own cells and proteins are used, thereby avoiding many adverse effects and drug interactions (2).

This value analysis brief presents information on the clinical benefits of PRP, based on data from published clinical trials.

Mechanism of Action
Platelets are cellular components of blood that are responsible for clot formation at sites of vascular injury and for releasing bioactive factors that initiate and stimulate the healing process (3). When injury occurs in vascular tissue, blood can seep from the vasculature into the surrounding damaged tissue where platelets can coordinate the healing cascade (8). In tissues that are poorly vascularized such as tendons, ligaments, and cartilage, the limited bleeding following injury may explain in part the protracted healing times and low repair capability of these tissues (5, 7). By concentrating platelets into PRP, a large reservoir of autologous growth factors is generated, which if administered appropriately can establish an optimal environment for accelerated healing, and reduction of pain and inflammation (6).

The normal healthy concentration of platelets is approximately 150,000 to 350,000 platelets/μL of blood. A working definition of PRP has been suggested as at least 3 fold increase in platelets.

The platelets in PRP are activated by contact with tissues in a process known as degranulation, which results in the release of more than 300 bioactive factors and cytokines (9). Platelets contain three types of granules (lysosomes, dense and alpha granules) that may be released during degranulation (10). Alpha granules are the largest and most prevalent granule type in the platelet. These granules contain a variety of hemostatic factors, growth factors and cytokines that serve as effectors of the healing cascade (9, 10).

The cocktail of platelet growth factors released from alpha granules is largely responsible for the role that platelets play in directing injury repair and wound healing (8). These growth factors include platelet derived growth factor (PDGF), vascular endothelial growth factor (VEGF), transforming growth factor beta (TGF-β), fibroblast growth factor (FGF), and insulin-like growth factor (IGF) (8, 9, 10). PDGF stimulates angiogenesis, and fibroblast proliferation (1). TGF-β has an important role as a growth factor in cell differentiation and extracellular matrix synthesis (1), and also serves as a potent anti-inflammatory and immune regulatory cytokine (11). IGF stimulates fibroblasts and myoblasts and mediates skeletal muscle repair and growth. VEGF promotes angiogenesis, migration of endothelial cells, and neovascularization (6). Platelets release their alpha granule contents with an initial burst and then continue to produce limited quantities of growth factors throughout their lifespan (9, 10).

Preparation and Delivery of PRP
PRP is typically produced by centrifuging a sample of a patient’s own blood to separate it into its cellular and non-cellular components. Platelets, red blood cells (RBC), and white blood cells (WBC) or leukocytes, all have different sizes and densities, leading to the formation of distinct layers during centrifugation (4). A test tube of optimally centrifuged blood contains three layers: platelet poor plasma (PPP) on top, RBC on the bottom, and the so-called “buffy coat”, a thin layer between the PPP and RBC layers that contains the highest concentration of platelets and leukocytes (4).

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High quality PRP results from the isolation of the buffy coat with as little of the adjacent layers as possible. A number of commercially available systems have been developed to facilitate PRP recovery (12). Typically, these systems comprise of centrifuges that are heavy and not easily portable, and disposables that require multiple manipulations by the user.

PRP can be delivered by injection into virtually any tissue in the body. It can be delivered arthroscopically into a surgical site, injected directly into diseased soft tissue, or delivered via intra-articular injection (2, 3, 4, 6, 7, 12).

**PRP Classification System**

Numerous devices and methodologies exist for the generation of platelet rich plasma, and it is crucial to note that not all PRP preparations are the same. For example, there are devices that generate PRPs that contain only platelets in a small volume of plasma, while others generate PRPs that contain various concentrations of platelets, white blood cells and red blood cells (13, 14). Equally important is whether the material has been activated with thrombin and/or calcium ions to initiate platelet degranulation. Activation of PRP prior to administration has been recommended in wound healing literature (15). However, recent studies indicate that activation is unnecessary, and PRP without activation may promote a better healing response (14, 15). Because of the different formulations of PRP, it is difficult to compare and evaluate its efficacy in the current clinical literature. This fact has led to the development of a PRP classification system (table below) that comprises 4 types of PRP based on platelet content, white blood cell concentration, and activation status (14). Such classification will permit investigators and clinicians to replicate findings and standardize the use of different formulations for various conditions.

<table>
<thead>
<tr>
<th>Type</th>
<th>White Blood Cells</th>
<th>Activated?</th>
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<tr>
<td>1</td>
<td>Increased Over Baseline</td>
<td>No</td>
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<tr>
<td>2</td>
<td>Increased Over Baseline</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Minimal or No White Blood Cells</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Minimal or No White Blood Cells</td>
<td>Yes</td>
</tr>
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A: Platelets >5X Baseline  
B: Platelets <5X Baseline

**Sports Medicine Applications of PRP**

Recent studies have reported clinical outcomes in a variety of non-surgical and surgical sports medicine applications.

**Non-surgical PRP applications**
- Chronic Tendinopathy
  - Elbow Tendinopathy
  - Achilles Tendinopathy
  - Patellar Tendinopathy
  - Shoulder (Supraspinatus) Tendinopathy
  - Plantar Fasciopathy
  - Osteoarthritis of the Knee
- Acute Muscle Tears

**Surgical PRP applications**
- Anterior Cruciate Ligament Reconstruction
- Rotator Cuff Repair
- Achilles Tendon Repair
- Meniscal Repair

**Preparation and Delivery of PRP**

**Chronic Tendinopathy:**
Collagen fibrils are the basic structural unit of tendons, and ordered arrays of bundled fibrils confer the emergent properties of healthy tendons including tensile strength and elasticity (5, 16, 17). In general, tendinopathies are thought to develop as a result of repetitive overuse or overloading of the tendon, which causes collagen fibrils to tear, fray, and become disarrayed (5, 16).
This tendon damage triggers an adaptive response from tendon fibroblast-like cells called tenocytes, in which frustrated remodeling of the damaged tendon leads to degeneration rather than healing (5, 19). This degenerative state has been described as “angiogenic hyperplasia,” where fibroblasts and vascular elements invade and further damage the tendon architecture causing it to become a grayish, immature granular scar tissue that conspicuously lacks inflammatory infiltrates (18, 19). It is noteworthy that this degenerative state of tendinosis can occur in normal tendons after corticosteroid injections (19). In fact, the role of inflammation in tendinopathies is unclear and may actually benefit the healing process (20). Therefore, an emerging caution is that corticosteroids may serve only to inhibit healing and further reduce the tensile strength of the injured tendon, predisposing it to spontaneous rupture (19, 21). Despite the lack of inflammation associated with tendinopathies, patients still present with significant pain.

During the response to tendon injury, as with damage to essentially any tissue, there is a requirement for cellular components from the blood, particularly platelets and white blood cells, to provide the necessary growth factors to program the healing cascade (5, 22). However, mature tendons are poorly vascularized, and regions of hypovascularity within the tendon are particularly susceptible to degeneration and rupture (5, 20). Therefore, tendons have a naturally slow healing rate and a limited capability of intrinsic repair compared with other tissues. Because of these properties of tendons, this tissue is particularly well suited to benefit from platelet rich plasma therapy, as type 1a PRP injections deliver a high concentration of both platelets and white blood cells directly to the site of tendon injury (14, 15).

**Lateral Epicondylosis:**

Lateral epicondylosis, also called tennis elbow, is a painful condition involving the common tendon complex where extensor muscles of the forearm and wrist originate on the lateral epicondyle of the humerus. The typical symptoms include lateral elbow pain, pain with wrist extension, and weakened grip strength. The most commonly affected extensor tendon is the ECRB (extensor carpi radialis brevis) (16, 18, 19).

There are currently 7 randomized trials in the literature comparing the use of PRP against an active control for elbow tendinopathy (15, 23-29). Although one of the studies was inconclusive due to early attrition in all treatment arms (25), PRP was shown to be superior in four of the trials (15, 24, 26, 27, 28) and non-inferior in the other two (23, 29). In particular, a level 1 clinical evidence study conducted by Peerbooms et al. (26) and continued by Gosens et al. (24) included 100 patients over the course of 2 years following injection with either corticosteroids or PRP.

As evidenced in the figures below, compared to the transient pain relief experienced by patients treated with corticosteroids, the effect of PRP was found to be significantly greater beginning at the 12 week follow up, and patients persistently improved to the final time point at 2 years post treatment. The same trend was observed for functional improvement outcomes where PRP patients rapidly regained use of their affected arm, and this marked improvement was sustained to the final time point at 2 years post treatment. In contrast, steroid treated patients reported an initial transient improvement...
followed by a rapid decline back toward their original baseline measures.

The sustained effect of PRP treatment led the authors to propose that PRP could stimulate healing of the tendon. In fact, as shown in the graph below, more than 80% of the chronic tennis elbow patients treated with PRP were considered successful at the 2 year follow up, while nearly 60% of the steroid treated patients were considered treatment failures. This level of treatment failures in the steroid group was not completely unexpected as the majority of the study participants (approximately 70% in both arms) had previously received a steroid injection as the standard of care and required further treatment due to their chronic and relapsing tendinopathy.

The value of steroids as a treatment option has recently been called into question, as systematic reviews consistently show that the benefits of pain relief with steroid injections are short term, and medium to long term outcomes appear worse compared to conservative and non-interventional approaches (21). This may be in part due to acute overuse damage resulting from immediate pain and symptom relief although the underlying tendon pathology remains unimproved. Alternatively, it has been found that steroid treatment may result in adverse structural changes that are potentially detrimental to tendon integrity (21). Overall, the clinical evidence has demonstrated that the use of PRP in patients with chronic elbow tendinopathy is beneficial in reducing pain and enhancing physical function. Although PRP may take 3 to 6 months to show superiority over active controls such as tenotomy, steroid, or local anesthetics, the pain relief, functional improvements and healing stimulated by PRP injection can continue out to 2 years (24).

In contrast to steroid injection, the safety profile of PRP is favorable with no significant complications being reported in any of the clinical studies sited. Moreover, companies that make devices to purposefully eliminate white blood cells from PRP argue that leukocytes are deleterious when present in the injectate (14, 15). However, the clinical evidence does not support this argument as each of the randomized clinical trials using PRP to treat lateral epicondylitis utilize leukocyte rich PRP, and although these studies generally report good patient benefit, none report adverse events related to therapy.

Other Tendinopathies:
PRP injections have also been studied for the non-surgical treatment of rotator cuff, patellar and Achilles tendinopathies, as well as for the treatment of plantar fasciopathy. Clinical evidence for rotator cuff and Achilles tendinopathy treatment is limited. For both pathologies, small randomized, controlled trials have shown mixed results, with some patients reporting significant symptomatic relief for up to 2 years. A number of case studies have reported positive results for single and multiple injections of PRP for RC and Achilles pain. There is more compelling clinical evidence for the use of PRP in patellar tendinosis (jumper’s knee) and plantar fasciosis. Two RCTs reported significant pain relief from patellar tendinosis, ranging from 12 weeks to one year, with eight case studies reporting consistently positive results from PRP injections. Similarly, two plantar fasciosis RCTs have demonstrated superiority of PRP to steroid injections for up to 2 years, with eight case studies reporting symptomatic relief for up to one year.

PRP injections for acute muscle tears reduce pain, improve function, and accelerate healing and the return to full activity.

There is only one randomized clinical trial that evaluated the effectiveness of PRP in acute muscle injury (thigh, foot/ankle, and shoulder). Patients were randomly assigned to one PRP injection plus conservative therapy or conservative treatment alone. Outcomes assessed included pain, muscle function, range of motion, and return to sporting activity. The authors concluded that
injections of PRP under ultrasound guidance had a significantly higher level of pain relief, physical recovery, and faster regeneration compared with conventional conservative treatment in acute muscle trauma in professional athletes.

To date, the majority of PRP research in orthopedics has focused on its potential in non-surgical applications such as chronic tendinopathy and osteoarthritis of the knee. However, there is growing interest on the use of PRP in the intraoperative setting during surgical repair of acute soft tissue injuries. The concept of PRP therapy as a natural source of growth factors and other bioactive molecules involved in tissue healing is the basis for PRP applications in the surgical repair of acute injuries to tendons, muscles, and ligaments.

The concomitant use of Type 1A PRP in the intraoperative setting during surgical repair of acute tissue injuries may improve function, enhance healing, and accelerate recovery time.

### Surgical PRP Applications

#### Anterior Cruciate Ligament Reconstruction:

Anterior cruciate ligament (ACL) reconstruction is commonly performed following rupture to provide patients with knee stability during movement, especially sports. The grafts that are most often used to reconstruct the ACL include patellar, hamstrings, quadriceps, and Achilles tendons. The challenge with using these tendons, whether autograft or allograft, is that these grafts take time to incorporate in the bone tunnels as well as mature to have sufficient strength to provide knee stability during activity. Improvements continue to be made in the positioning of the graft, fixation devices, and graft preparation but there still remains a need to increase the healing rate and accelerate the maturation time to allow for faster return to activity.

There are currently 8 randomized trials in the literature on the use of PRP in ACL reconstruction procedures (31–38). The results of these PRP studies have been somewhat mixed. Studies suggest potential of PRP to enhance the maturation of the tendon graft but evidence doesn’t support increased graft integration in bone tunnels.

Radice and colleagues conducted a prospective single-blind study of 50 patients undergoing ACL reconstruction surgery in which one group had a high concentration PRP (Type 1A) with a Gelfoam collagen sponge added to the graft intraoperatively and the control group did not (31). At 1-year follow-up for patient receiving bone-patellar tendon-bone (BPTB) or hamstring autografts, PRP was found to significantly accelerate the time to graft maturation by 48% as measured on MRI when compared to the control group (179 days to maturation in PRP group vs. 369 days in control group; p<0.001). Graft maturation was defined as time to homogenization of the intra-articular portion of the graft as assessed by MRI.

| Time (Days) to Homogenization for Soft Tissue and BTTB Grafts |
|-----------------|-----------------|-----------------|
| Group           | Soft Tissue Graft | BTTB Graft      |
| 1               | 177              | 109             |
| 2               | 369              | 363             |

Similar findings were observed in a single blinded, prospective randomized study by Orrego and colleagues evaluating the effect of high concentration, Type 1A PRP on healing in ACL reconstruction procedures (32). Their MRI analyses showed no differences between the PRP and control groups at 3 month post-op but observed differences between the groups at 6 months. They defined maturation as showing a low intensity signal in MRI.

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<th>Presence of Mature Graft at the Femoral Tunnel</th>
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<td>Group</td>
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<tr>
<td>Control</td>
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<td>PRP</td>
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The current evidence suggests that the addition of PRP to ACL reconstruction procedures may have a beneficial effect on graft maturation (with potential improvements 20–30% on average). Reproducible PRP concentration and improvements in the preparation of the graft with PRP may be necessary for consistent clinical outcomes. The most likely mechanism of action is that treatment with platelets accelerates graft repopulation and remodeling in the postoperative period.

#### Anterior Cruciate Ligament Reconstruction- Patellar Tendon Donor Site:

Autologous bone-patellar tendon-bone graft is thought to provide the best healing in the bone tunnel due to the bone-to-bone healing that is possible between the graft bone plug and the tunnel wall. Unfortunately, this graft harvest is associated with donor site morbidity, which can include the following symptoms: anterior knee pain, loss of joint function, and pain on bending (REF#). PRP has been evaluated in prospective, randomized studies to determine if it can be used to reduce this complication.

Cervellin and his colleagues performed a randomized clinical study with 20 patients receiving a Type 1A PRP clot at the patellar bone defect-tendon insertion site and 20 patients receiving no PRP (39). VAS (Visual Analog Score) was used to evaluate pain and VISA (Vicentorian Institute Sports Assessment) scale was utilized to quantify knee pain/function. At 12 mo follow-up, there was a statistical improvement in VISA scores for the PRP group compared to the control group. There was no statistical difference in VAS scores between the two groups. Since ACL reconstruction with BPTB grafts is still widely used, the authors concluded that PRP may be useful to reduce pain associated with the harvest site.

de Almeida and colleagues conducted a randomized study evaluating the effect of PRP on donor site healing and clinical outcomes in 27 patients undergoing ACL reconstruction procedures with a BPTB autograft. The PRP group had significantly lower scores of pain and function at 1 year follow-up compared to the control group (36). They defined maturation as showing a low intensity signal in MRI.

| | Time (Days) to Homogenization for Soft Tissue and BTTB Grafts |
|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 1               | 177              | 109             | 177              | 109             | 177              | 109             |
| 2               | 369              | 363             | 369              | 363             | 369              | 363             |

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<tr>
<td>Group</td>
<td>3 Month Post-op</td>
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</tr>
<tr>
<td>Control</td>
<td>12/27 (44%)</td>
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<tr>
<td>PRP</td>
<td>12/26 (46%)</td>
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reconstruction with a patellar tendon graft (40). Twelve patients who received 20 to 40 mL of high concentration PRP gel at the patellar tendon defect were compared with 15 patients who did not receive PRP. At the 6-month follow-up MRI examination, the patellar tendon gap area was found to be significantly smaller in the PRP group (P = 0.046) which indicates that PRP enhanced tendon healing. Additionally postoperative VAS pain scores were lower in the investigational group than in the control group (P = 0.02). The authors concluded that PRP can have a positive effect on patellar tendon harvest site healing on MRI after 6 months and also can reduce pain in the time period following surgery. Unfortunately, this improvement in healing did not show any differences in clinical and functional scores, which may be due to the sample size of the study.

Rotator Cuff Repair:
A rotator cuff tear is a common cause of pain and disability in adults with more than 750,000 rotator cuff repairs performed annually in the United States. There are currently 7 randomized trials in the literature on the use of PRP in rotator cuff repair. Most of these studies determined the rate of retear after arthroscopic rotator cuff repair with and without the use of PRP. Shoulder-specific outcomes measures included the total Constant score, Simple Shoulder Test (SST) score, American Shoulder and Elbow Surgeons (ASES) score, UCLA Shoulder score, and Single Assessment Numeric Evaluation (SANE) score.

The results of these PRP studies have been somewhat mixed, with some studies demonstrating potential clinical benefits (i.e., decreased pain, improved shoulder range of motion, and enhanced healing and recovery time) and some studies demonstrating no benefit of PRP in rotator cuff repair.

Osteoarthritis
Osteoarthritis (OA) is a degradative disease of the articulating joint, caused by a cascade of events that can ultimately lead to joint destruction. While it is commonly regarded as a cartilage disease, all of the tissues in the joint can be affected, including cartilage, subchondral bone, synovial membrane, and synovial fluid. Osteophytes (bone spurs) are a hallmark of advanced OA. Synovial inflammation is present in up to 70% of OA patients and is considered a major driver of the inflammatory cascade.

Intra-articular PRP injections have shown efficacy in mild-to-moderate osteoarthritis of the knee.

Due to its demonstrated ability to dampen inflammation and accelerate the repair of damaged tissue, intra-articular PRP injections have been studied as a treatment for OA. A growing body of clinical literature suggests that PRP is an effective therapy for many patients with mild-to-moderate knee OA, providing symptomatic improvement over baseline pain and/or function scores. Published studies include five randomized trials, four comparative trials, and ten case studies. There is considerable variability among these trials in PRP formulation (platelet concentration, leukocyte content, PRP volume, centrifugation parameters), injection regimen (single vs multiple, weekly vs monthly) and comparator (saline vs hyaluronic acid). However, despite this lack of consistency, all studies to date have reported statistically significant improvement over baseline clinical symptoms, typically for up to six months and for as long as one year. This is consistent with the conclusions of several meta-analyses. In some trials, PRP has proven more efficacious than a hyaluronic acid (HA) comparator, while in others PRP and HA give similar results.

While platelet concentration factors (improvement over whole blood) or PRP volumes are often highlighted as key individual predictors of efficacy, it is important to consider the total number of cells delivered to the joint. Based on the PRP volumes and platelet concentrations reported in the literature, the number of platelets delivered to the joint per injection ranges from 1.25 billion to 7.25 billion, assuming a whole blood platelet concentration of 250,000 cells/µL. As such, it is reasonable to expect that low volume PRP injections can be just as efficacious as high volume injections, provided the platelet concentration factor is sufficiently high to achieve the desired platelet load to the joint. For example, a 3 cc injection of PRP with 7X platelet concentration delivers a platelet load of approximately 5 billion cells. This is very close to the average platelet loads reported in the literature for the intra-articular treatment of OA.

Safety of PRP

Platelet rich plasma (PRP) is prepared from autologous blood and injected into the area of treatment, so as with any injection there is always the small risk of infection or injury to nerves or blood vessels. Since it is autologous, PRP is inherently safe and therefore there are no concerns over rejection or transmittable diseases. PRP is no different in substrate than the blood clot that is formed in every wound. Risk of contamination only comes from failure to use PRP devices in accordance to their Instructions for Use and not following aseptic technique when needed. In order to ensure minimal risk to the patient, it is important to use a device with minimal processing steps and interactions. If local anesthetics are used, such as bupivacaine with your PRP injection, though uncommon, an adverse reaction to the agent may be triggered. It is also usual that there may be some pain during and following the injection.

If incidence of further intervention (i.e., surgery or other injections such as steroids) can be reduced or delayed, a healthcare system may realize overall cost saving.

Although the body of clinical evidence is rapidly increasing for the use of PRP in both non-surgical and surgical applications in sports medicine and orthopedics,
there still remains a paucity of economic evidence supporting the value of PRP. As of January 2016, there are no published cost-benefit analyses or cost-effectiveness studies evaluating the economic implications of using PRP in sports medicine applications.

Improvement in activities of daily living may reduce costs associated with caregiving.

When patients are unable or have difficulty performing their daily activities, caregivers often are called upon for assistance. In many cases, these caregivers are spouses or other family members. But, in some cases, paid caregivers may need to be employed. In both OA in general and knee OA specifically, paid and unpaid caregiving is common and may contribute substantially to the overall cost of disease. Therefore, improving patient functioning should decrease the reliance on, and costs associated with, formal and informal caregiving.

Conclusions

PRP shows significant promise in several sports medicine applications including chronic tendinopathy, cartilage healing, and surgical repair of acute soft tissue injuries. PRP and platelet-rich fibrin constructs allow for the local delivery of increased concentrations of growth factors involved in the healing response and regeneration of connective tissues. Evidence from randomized clinical studies suggests that PRP injections:

- Reduce pain, enhance function, improve the structure of the tendon, and accelerate the time to recovery for patients with chronic tendinopathy;
- Achieve symptomatic pain relief and improve function for patients with osteoarthritis or cartilage defects; and
- Enhance healing and accelerate recovery time for patients undergoing surgical repair of acute soft tissue injuries.

Based on the current clinical literature, the most promising applications of PRP include elbow tendinopathy, osteoarthritis of the knee, and bone-tendon interface healing in anterior cruciate ligament reconstruction surgery.

Although the body of clinical evidence is rapidly increasing for the use of PRP in both non-surgical and surgical applications in sports medicine and orthopedics, there still remains a lack of economic evidence supporting the value of PRP. Future cost analyses should focus on the overall cost-savings that may be realized if the incidence of further intervention (i.e., surgery or re-injection) can be reduced or significantly delayed with PRP injections.

Citations

effect of Platelet
rapy in resistant elbow
T. Positive
endon healing with platelet
py
32.
31.
30.
29.
27.
26.
25.
24.
23.
20.
2008; 24(12):1373
of hamstring tendons in a bone tunnel. Arthroscopy
platelet concentrate and a bone plug on the healing
Orrego M, 2010;
platelet
cruciate ligament grafts with and without autologous

tendinosis with buffered
Mishra A, Pavelko T. Treatment of chronic elbow
Rheumatologist. 2012;34:43
randomized clinical trial. The Egyptian
treatment of lateral epicondylitis and plantar fasciitis:
Omar AS, Maha EI, Amal SA, et al. Local injection of
corticosteroid injection with a
corticosteroid, or saline: a randomized, double-
blind randomized controlled trial with 2-year follow-
Krogh TP, Fredberg U, Stengaard-Pedersen K, Christensen R, Jensen P, Ellingsen T. Treatment of lateral
epicondylitis with platelet-rich plasma,
gluccorticoid, or saline: a randomized, double-
Mar;41(3):325-35.
Peerbooms JC, Sluimer J, Bruijn DJ, Gosens T. Positive
effect of an autologous platelet concentrate in
lateral epicondylitis in a double-blind randomized
controlled trial: platelet-rich plasma versus
corticosteroid injection with a 1-year follow-up. Am J
Platelet-rich plasma versus autologous whole blood for
the treatment of chronic lateral elbow
epicondylitis: a randomized controlled clinical trial.
Raeissadat SA, et al. Effect of Platelet-rich plasma
(PRP) versus autologous whole blood on pain and
function improvement in tennis elbow: a randomized
clinical trial. Pain Research and Treatment. 2014;
2014:191525
29.  Omar AS, Maha EI, Amal SA, et al. Local injection of
autologous platelet rich plasma and corticosteroid in
treatment of lateral epicondylitis and plantar fasciitis:
randomized clinical trial. The Egyptian
tendinosis with buffered platelet-rich plasma. Am J
magnetic resonance imaging findings in anterior
cruciate ligament grafts with and without autologous
platelet-derived growth factors. Arthroscopy
platelet concentrate and a bone plug on the healing
of hamstring tendons in a bone tunnel. Arthroscopy
2008; 24(12):1373-1380.
resonance imaging evaluation of the integration and
maturation of semitendinosus-gracilis graft in anterior
cruciate ligament reconstruction using autologous
34.  Mirzataoloofi F, Alamdari MT, Khalkhali HR. The impact
of platelet-rich plasma on the prevention of tunnel
widening in anterior cruciate ligament reconstruction
using quadrupled autologous hamstring tendon: a
35.  Nin JR, Gasque GM, Azcárate AV, et al. Has platelet-
rich plasma any role in anterior cruciate ligament
of tendon grafts treated with an endogenous
preparation rich in growth factors: Gross morphology
factors in ACL surgery: preliminary study. J Orthopaed
platelet gel on early graft revascularization after
anterior cruciate ligament reconstruction: a
prospective, randomized, doubleblind, clinical trial.
Eur Surg Res. 2010;45:77-85.
platelet-rich plasma gel to reduce donor-site
morbidly after patellar tendon graft harvesting for
anterior cruciate ligament reconstruction: a
40.  de Almeida AM, Demange MK, Sobrado MF, et al.
Patellar tendon healing with platelet-rich plasma: a
prospective randomized controlled trial. Am J Sports
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