Orthopedic Growth Factors

PRP- Platelet-Rich Plasma

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Biologic treatment modalities are just starting to be introduce for orthopedic disorders. Platelets are particles found in blood that are rich in factors that can influence the healing of degenerative and injuried soft tissues. PRP is a concentration of platelets. It is postulated that injecting PRP into areas of soft tissue injury could facilitate repair and shorten recovery times.

With the advent of bioengineering new modalities are being evaluated for the treatment of orthopedic injuries. These techniques are being publicized by the press and some health care professionals leading to some misinformation and confusion. This article will try and clarify what is known and what is not concerning one of these new modalities, platelet-rich plasma or PRP.

Research into the biology of soft tissue healing has led to the development of a variety of products to stimulate the body's own biologic factors and speed healing. Platelet-Rich plasma (PRP) is a product that has been studied since the 1970s. Platelets are small structures in blood that promote the clotting of blood and facilitate tissue repair. Inside platelets are a number of bioactive factors that regulate wound healing. It is thought that by concentrating platelets, and injecting them into areas of cartilage, tendon, bone, and ligament injuries that this will accelerate the healing process.

Platelet-rich plasma (also known as platelet-rich concentrate, platelet gel) contains a 3 to 5 fold increase in growth factor concentrations. The factors that are thought to assist in healing are various growth factors such as transforming growth factor, fibroblast growth factor, epidermal growth factor, endothelial cell growth factor, and vascular growth factor. Platelets also have other bioactive factors that effect wound healing. After tissues have been injured the three stages of healing are inflammation, proliferation and remodeling. The inflammatory stage begins with tissue injury, which draws platelets into the area due to their clotting ability. This natural concentration of platelets brings in these factors that promote and assist with new cell formation followed by tissue remodeling to a more normal state. It is thought that a concentrated dose of platelets, with these various healing factors, injected into an area of injury could speed up the repair process.

Formation of PRP

Platelet-rich plasma is formulated from one's own blood. Approximately 30 to 60 mL of blood is drawn and then placed in a centrifuge. This separates serum (clear liquid part of blood) and the cells (white blood cells, red blood cells, platelets). Another centrifugation step further

concentrates the platelets, producing the PRP. The PRP must then be clotted and this is accomplished using either thrombin (a clotting agent) or calcium chloride.

Effects of PRP on soft tissues

In theory PRP should have an effect on tendon, ligament, and muscle healing. The growth factors, and non-growth factors assist in the proliferation and remodeling of tissues. A number of animal studies have shown promising results but large randomized clinical (human) studies have yet to be performed. Smaller nonrandomized trials and case studies have shown some positive results but solid conclusions cannot be drawn from this information. I will discuss what is known concerning the effects of PRP on soft tissue healing.

Tendon Disorders

Elbow Tendinopathy
Lateral Epicondylitis
Tennis Elbow

Lateral epicondylitis or tennis elbow is a condition in which a partial tear occurs in one of the tendons on the outer aspect of the elbow. This partial tear does not completely heal and causes pain when gripping objects or picking something up. Initial management includes physical therapy, stretching, medications and frequently a steroid injection into the area of the partial tear. If these modalities are not successful then surgery to debride the tear and initiate a healing response is an option.

Injections of PRP have been used in patients that have refractory tennis elbow that has failed to respond to conservative management. Some physicians have tried injections of PRP into the area of tendon damage. This injection can be painful, as it requires a large needle to facilitate delivery of the PRP into the area of tendon damage. Following the injection, therapy is usually recommended and a gradual return to activities occurs over the next 6 to 8 weeks.

There have been two small clinical (human) studies evaluating the efficacy of these injections. In one study of 20 patients, 15 patients underwent PRP injection while five patients received a placebo injection of local anesthetic. Results at the final follow-up (12-38 months) revealed that 93% of the PRP patients noted improvement. Of the five patients that received placebo, three of the patients dropped out of the study at two months. So although the PRP patients noted improvement, there was not a large group of patients to make a comparison. Another study evaluated a group of 28 patients with this disorder however they were injected with just their own blood and not concentrated platelets. Although the treatment appears to be promising due to the limited number of studies and the small number of patients treatment recommendations cannot be made.

Achilles tendinopathy

Achilles tendinopathy is a degenerative change within the substance of the Achilles tendon. Thickening, softening, and discoloration of the tendon characterize it. It is thought that a small tear occurs within the tendon and it does not undergo a complete repair process. It is postulated that injecting PRP into an area of Achilles tendinopathy that this can reestablish and facilitate the repair process. There've been no randomized or large studies to evaluate this procedure. Anecdotal individual case studies have shown some promise. Further well-controlled scientific studies into this modality will be beneficial but at this point no conclusions can be drawn.

Planter fasciitis

The planter fascia is tissue that attaches to the heel bone to the area around the toes. This tissue supports the arch of the foot. Plantar fasciitis is a disorder in which the area at the attachment to the heel is damaged. It is characterized by heel pain that is worse in the morning and with activities. PF is a treated initially with stretching, medication and

modalities are not successful then surgery with partial release of the fascia may be indicated.

PRP injections have been evaluated for plantar fasciitis. This involves an injection into the area of the damaged fascia. One small study evaluated nine patients with this disorder. At one year, approximately 80% of patients had complete resolution of their pain. Although the results look promising this is a very small sample size and did not have a control group and therefore scientific conclusions cannot be made. Further studies would be helpful.

Patellar Tendinopathy

The patellar tendon is the tendon that goes from the lower portion of the kneecap to the tibia (lower bone). Patellar tendinopathy is a disorder in which a partial tear occurs at the attachment site of the tendon on the lower portion of the kneecap and incompletely heals. It frequently occurs in athletes involved in jumping sports such as basketball, and volleyball and is characterized by pain just below the kneecap. Initial treatment for this disorder includes medication, rest, physical therapy and ice. If after several months these modalities are not successful then surgery is an option. Surgery involves either removing the area of the tear and/or initiating a repair response. The postoperative course involves rest, therapy and a gradual return to activities over a 3 to 6 month period.

It is been postulated that PRP can be effective in initiating a healing response of the partially torn tendon. Animal studies have shown that a healing response can occur in the tendon. There have not been any published clinical trials evaluating its effect in humans. At this point it is considered experimental and further studies will need to be performed.

Ligament injuries

Ligaments are tissues that attach bone to bone. In the knee there are four major ligaments. The ligament on the inside aspect of the knee, the medial collateral ligament, is frequently hurt in soccer and football. At the time of injury tension is placed on the ligament and a partial or complete tear occurs. This particular ligament rarely requires surgical management and can be treated in a brace; however, it can take 4 to 10 weeks before full athletic activities may be performed.

PRP has been evaluated with this type of injury. In a small-unpublished study in soccer players with partial medial collateral ligament injuries a single injection of PRP was compared to a control group (no injection performed). The return to play time was shortened by 27% in the PRP group compared to the control group. Conclusions from this study are limited due to its small sample size (22 patients) and it's retrospective design.

Muscle injuries

Partial and complete muscle tears occur frequently in athletes. The most common lower extremity muscles that are injured are the quadriceps, hamstrings and groin. These injuries can keep athletes from participating in their sport for a varying period of time and reinjuries occur frequently. There was an article in the New York Times in 2009 concerning a football player who used PRP to shorten his injury time and allow him to return to play in the Superbowl. This article increased the public awareness of PRP and other growth factors.

Although, there have been laboratory studies that have shown growth factors can influence muscle regeneration after injury there have been no significant human studies. One small study reveals a 50% reduction in return to play in athletes receiving an injection of PRP. There are some theoretical concerns that PRP derivatives can induce a fibrotic healing response in muscle tissues, which could increase the risk for reinjury. Further research into this specific indication is warranted before any recommendations can be made.

Surgical Indications

PRP has been used in various orthopedic procedures. In total knee replacements it has been used in an effort to reduce postoperative bleeding and transfusions. In small studies it does appear that can reduce bleeding after this type of surgery. It has also been trialed with anterior cruciate ligament reconstructions. It is thought that placing PRP on the tendon graft tissue this may improve its biomechanical properties. There are no human studies that support its use with this procedure. It has also been used with Achilles tendon repairs. In a small study the results revealed that those that those receiving PRP were able to resume light activities sooner. Rotator cuff repairs are another surgery that it has been postulated that PRP may have a beneficial effect. The rotator cuff are tendons that surround the ball the shoulder and is frequently torn in older people. Surgery involves reattaching the tendon with sutures to bone. It is postulated that placing PRP between the tendon and bone that this will improve and shorten the healing process. There had been no published studies evaluating this but presently studies are being performed.

Conclusion

Platelets are small particles found in blood that have various growth and non-growth factors which can influence the repair of damaged and degenerative soft tissues. It is thought that by creating platelet-rich plasma and concentrating these factors that this will facilitate a repair process and shorten healing time. PRP may provide some benefit in the treatment of various tendinopathies, which may reduce the need for surgery. Small non-randomized studies in humans and laboratory studies in animals have shown some promise but specific treatment recommendations cannot be made due to the limited number of studies and the small number of patients. Future studies should provide additional information so that sound treatment recommendations can be made.

If you have further questions with this topic or other orthopedic conditions please visit my website www.davidostermd.com or call the office for an appointment and evaluation (303-214-4500).

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