Biologics: PRP and "Stem" Cells

by Dr. Steven Chudik

During the past decade, there has been a lot of excitement regarding the use of "biologics" such as growth factors and stem cells and their claimed ability to cure almost any musculoskeletal (bone, tendon, muscle or joint) condition. There are anecdotal stories about famous athletes with sprained joints, torn tendons, and damaged cartilage travelling to special clinics or doctors to receive injections of platelet rich plasma (PRP), stem cells or now even amniotic fluid. There are many reports crediting these injections for allowing athletes and other patients to return to their activities more quickly than traditional treatments alone. Unfortunately, many companies that sell these biologics provide misinformation through direct-to-consumer marketing about these largely unproven "biologic" treatments.

Despite the growing publicity, popularity and use, there are many unanswered questions and a lack of proof that biologic treatments actually work. The composition and bioactivity are variable and the mechanism of action is unknown. Biologics require more study and should include a minimum of reported information for the consumer just as packaged food labels provide the ingredients and the amounts of nutrients.

What is PRP?

Blood consists of fluid called plasma and solid components including red blood cells, white blood cells, platelets and other circulating proteins. The platelets are most known for their role in clotting blood to stop active bleeding. To initiate a cascade of events in the healing process, they contain hundreds of small proteins called growth factors which are released from platelets during bleeding from injuries.

PRP is created by drawing a sample of blood from a patient and placing it in a centrifuge apparatus which spins the blood to help separate the platelets from the blood. The separated component of plasma concentrated with platelets is obtained, placed in a syringe and injected back into the patient at the desired injury site. There are different methods of preparation that result in either less platelets and less white blood cells and others that have more platelets, but also more white blood cells. The blood drawing and PRP injection procedure can be performed in the office and is often repeated multiple times (up to three) at one-week intervals. Alternatively, surgeons may also choose to perform the blood draw and PRP injection procedure in the operating room and inject the PRP at the surgical repair site. It is not known exactly how PRP works but theoretically, by injecting more platelets to release more platelet-derived growth factor around healing tissues, doctors hope it stimulates a stronger healing response to repair tissues faster and stronger.

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PRP

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What conditions are treated with PRP?

Research is currently being conducted to evaluate the effectiveness of PRP treatment. Reviews of the literature reveal a need for better research and at this time, the results of these studies are inconclusive. There are many factors that can influence the effectiveness of PRP treatment including:

- The composition of the PRP, different in different patients and with different types of preparation
- The type of injury or condition treated
- The overall health of the patient
- Whether the injury is acute (such as from a fall) or degenerative (an injury developing over time)

Common applications, uses for PRP

Chronic tendon injuries

- According to the research studies currently reported, PRP is potentially most effective in the treatment of chronic tendon injuries of the elbow, particularly lateral epicondylitis or tennis elbow.
- PRP for other chronic tendon injuries such as chronic Achilles or patellar tendinosis at the knee (jumper's knee) has not shown to be more effective than traditional treatment.

Acute ligament, muscle injuries

- PRP injections have received much publicity regarding the treatment of acute sports injuries, such as ligament and muscle injuries. PRP has been used to treat professional athletes with common sports injuries like pulled (sprained) hamstring muscles in the thigh and knee sprains. However, there is no definitive scientific evidence PRP therapy improves the healing process in these types of injuries.

Surgery

- PRP has also been used during surgery to help tissues heal, particularly in shoulder surgery to repair torn rotator cuff tendons. However, the studies show little or no benefit when PRP is used in these types of surgical procedures.
- PRP has also been used in surgery to repair torn knee ligaments, particularly the anterior cruciate ligament (ACL). At this time, there appears to be little or no benefit from using PRP during ACL surgery.

Knee Arthritis

PRP has been injected into the arthritic knee. It is still too soon to determine whether PRP injections are any more effective than current treatment methods.

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Fractures

PRP has also been used in a limited way to attempt to speed up the healing of broken bones. It has not shown any significant benefit so far.

Is PRP effective? The jury is still out

Current research studies do not support the extraordinary claims made in the media about the effectiveness of PRP. Although PRP may appear to have some effect on pain in the treatment of chronic tendon injuries about the elbow, more scientific studies without bias are needed to determine whether PRP therapy actually works.

What are "STEM" cells, or rather what is cell therapy?

Consensus recommendations from the 2018 American Academy of Orthopaedic Surgeons/ National Institute of Health (NIH) U-13 Conference opined that the minimally manipulated autologous cell preparations (a patient's own cells drawn for reinjection) should more accurately be referred to as "cell therapy" rather than "stem" cells. True stem cells have unique characteristics that are not met by these cell therapies being widely marketed in the United States. As defined by the NIH, "Stem cells differ from other kinds of cells in the body. All stem cells have three general properties: they are capable of dividing and renewing themselves for long periods; they are unspecialized; and they can give rise to specialized cells" such as muscle, tendon, bone, or cartilage cells. Virtually all of the current cell therapies offered in the United States for orthopaedic conditions involve the transplantation of adult cells obtained through harvest and minimal preparation of native tissues like blood, bone marrow and fat. These preparations contain stem cells, but they are the least abundant cell type. Depending on the tissue from which it was harvested, only one-in-one-thousand to one-in-one -million cells harvested from healthy tissues are actually stem cells capable of differentiating into one or more connective tissues such as bone, cartilage and fat in the right environment. The efficacy of cell therapies also is dependent upon the cell source, processing technique and setting in which they are applied. Theoretically, the harvested and re-injected cells could migrate to an injury site and differentiate into the desired cells to promote healing. But in reality, there is currently a lack of studies proving these injected cell therapies actually work and practically, it does not seem plausible that an injection of cells (containing a minimum of actual stem cells) into an osteoarthritic joint can adhere to the worn out bone surfaces in the joint and regenerate a new layer of the complex cartilage tissue in such a mechanically challenging environment.

In conclusion

Biologics like PRP and cell therapy may play a big role in the future with healing of acute and chronic musculoskeletal injuries and conditions. Unfortunately, the process is still in its infancy and scientific research on the use and effectiveness of PRP and cell therapy for orthopaedic injuries and surgeries does not support widespread clinical use to suggest orthopaedic surgeons abandon other current standards of treatment