Treating tendons, bones, and cartilage with PRP

By Kaye Daugherty and Mary Ann Porucznik

A report from the AAOS Now PRP Forum

Versions of platelet-rich plasma (PRP) have been used to treat everything from plantar fasciitis to rotator cuff repair. But its effects differ, depending on the musculoskeletal structure and the composition of the PRP itself. Understanding how PRP affects the healing processes of various musculoskeletal tissues is critical to determining the appropriate type of PRP for specific injuries.

The PRP Forum, sponsored by AAOS Now and held on Feb. 14, 2011, in San Diego, brought together approximately 50 of the most knowledgeable and experienced clinicians and researchers in the field of PRP therapy. This is the third in a series of articles reviewing the material presented and summarizing the results of the Forum.

PRP and chronic tendinopathy

The pathophysiology of tendinopathy—the term used to refer to chronic inflammation of the tendon (as distinguished from tendinitis, which refers to the acute inflammatory state)—remains elusive. Chronic tendinopathies include conditions such as Achilles tendinosis, lateral/medial epicondylitis, plantar fasciitis, patellar tendinopathy, and chronic rotator cuff injuries.

According to Pietro Randelli, MD, of the University of Milan, several studies have examined the effects of PRP on chronic tendinopathy, with mixed results. Although most of the published reports have been case studies, ”four randomized controlled studies and two prospective comparative studies have been conducted, evaluating the treatment of chronic tendinopathy with PRP. Four of them were favorable to PRP,” he said.

James R. Andrews, MD, medical director of the American Sports Medicine Institute, in Birmingham, Ala., pointed out that the effectiveness of PRP in treating tendinosis has not been scientifically proven in human trials. Dr. Andrews recommended that PRP injections should be used in conjunction with other treatments, including rest, ice, anti-inflammatory medication, and physical therapy, in a multimodal plan to promote symptom relief and tendon healing.

PRP has been proposed to augment reconstruction of the anterior cruciate ligament (ACL) in two ways. At the
midsubstance of the tendon, PRP appears to harbor ACL cell viability and function in vitro, leading to enhanced histologic repair. When used to enhance bone healing at the graft-bone interface, however, PRP did not demonstrate any clinical or biomechanical effects at a 2-year follow-up in a level 1 randomized clinical trial. Whether these findings are applicable to other ligaments in the knee (medial or lateral collateral ligaments) is not known.

**PRP and bone healing**

"PRP has been proposed as an alternative to autograft in a variety of spinal arthrodesis environments," reported Wellington Hsu, MD, assistant professor in the departments of orthopaedic and neurologic surgery at the Northwestern University Feinberg School of Medicine. These include the posterolateral lumbar interbody, the anterior lumbar interbody, and the anterior cervical interbody fusions.

"But animal and clinical studies do not demonstrate any benefit with the use of PRP in augmenting spine fusion," he said. "In fact, in some situations, PRP has been observed to inhibit bone formation."

Although the mechanism of action for this is unclear, PRP may contain inhibitory factors that counteract the effects of the stimulatory growth factors also present in the concentrate.

In discussing the use of PRP in treating fractures, Dr. Hsu noted that some in vitro and animal studies suggest that PRP promotes new bone formation, and appears to be safe and feasible. But no clinical evidence supports PRP use in acute or delayed fracture healing.

**PRP and cartilage defects**

Platelets, noted Elizaveta Kon, MD, of the Rizzoli Orthopaedic Institute in Bologna, Italy, provide an autologous source of growth factors for healing and tissue regeneration. In addition, use of a platelet gel can be a positive influence in clinical situations that require rapid healing and tissue regeneration.

Studies of the use of PRP for cartilage degeneration have shown more consistently favorable results. The largest study (115 knees) found PRP injections effective at improving pain, function, and quality of life in patients with chondral injuries and early or advanced osteoarthritis, and a comparison of PRP and hyaluronan injections for osteoarthritids of the knee found improved scores with the use of PRP.

The problem, said Dr. Kon, is that different procedures for producing PRP yield different concentrates and different results. Although her own research has shown that intra-articular knee injections of PRP produced favorable results on degenerative cartilage lesions, she called for "better knowledge about how PRP affects healing, and more biologic and randomized clinical trials."

**Other uses**

One of the early uses of PRP in orthopaedics was the addition of a PRP fibrin sealant added to total knee arthroplasties. Both a retrospective chart review and a comparative study have found less postoperative blood loss, less narcotic use, and earlier hospital discharge with the use of PRP. A recent laboratory study has confirmed that PRP exerts an antimicrobial action against both gram-negative and gram-positive bacteria.

To receive an electronic copy (PDF) of the Forum agenda book, including selected abstracts covering more than 30 studies on the efficacy of PRP, e-mail aaoscomm@aaos.org.

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**About the PRP Forum**

Cochaired by AAOS Now Editor-in-Chief S. Terry Canale, MD, and AAOS Now editorial board member Frank B. Kelly, MD, the PRP Forum, held on Feb. 14, 2011, in San Diego, featured a series of presentations, followed by break-out group discussions, resulting in a series of recommendations for future study of PRP.

Presenters included Steven P. Arnoczky, DVM; Freddie H. Fu, MD; Wellington Hsu, MD; Elizaveta Kon, MD; Allan K. Mishra, MD; Nicola Maffulli, MD, PhD; Pietro Randelli, MD; and Scott A. Rodeo, MD. Support for the PRP Forum was provided by unrestricted educational grants from Arteriocyte Medical Systems and Zimmer, Inc.

**Resources:**


concentrate and a bone plug on the healing of hamstring tendons in a bone tunnel. *Arthroscopy* 2008; 24:1373-80.


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Cartilage and Bones. General things about cartilage. Cartilage is about 60-80% water. Imagine you have a container of cartilage from other animals: it would be very squishy and it tends to be resilient with holding its shape. There are no blood vessels or nerves, similar to epithelial tissue. (I thought epithelial tissue was innervated though? I need to double-check this). Cartilage is made of chondrocytes (created from chondroblasts) that are isolated in spaces/chambers called lacunae through a ground substance of water and sugar. Cartilage is located in very specific places, usually between two bones. We have 3 types of cartilage tissue: Hyaline cartilage is made of collagen and has a distinctive glassy appearance. It is found inside of joints and inside the respiratory system. Cartilage could be described as smooth elastic tissues or a rubber-like padding that is covering and protecting the long bones, from the ends at the joints, however, it is a structural component of the ear, nose, rib cage bronchial, inter-vertebral disc, the tubes, the other body components also have cartilage. It is not hard or rigid but is less flexible than the muscles, the main purpose of the cartilage is to hold the tubes open in the body, it is less flexible than muscles or it is stiffer. Cartilage damage most commonly affects the knees, wrist, ankle, shoulder etc. Other body parts example hips joints can also be affected. Utilising platelet-rich plasma (PRP) to treat tendon, ligament and skeletal muscle has shown variable results across many studies with the current evidence base for the efficacy of PRP in treating sports injuries remaining inconclusive. More uniformly positive results have been observed by various studies for PRP in OA knee in comparison to hyaluronic acid, other intra-articular injections and placebo than in other musculoskeletal tissue. However, methodological concerns as well as satisfactory PRP product classification prevent the true characterisation of this treatment.