

## Tissue engineering with platelet-rich plasma and stem cells: New frontier in rheumatology?

**Figure 2** – Stem cells may be used with platelet-rich plasma (PRP) for the management of osteoarthritis (OA). A trochar is in place for fenestration and introduction of stem cells and PRP for OA of the knee.



proper environment. Multiple studies have demonstrated that this is a potentially feasible option for managing OA.<sup>8</sup> One study even demonstrated that a minimally invasive stem cell procedure could be superior to microfracture.<sup>22</sup>

Because effective disease-modifying and structure-improving treatments for OA are scarce, we are investigating a combined autologous stem cell-PRP approach to knee OA. We harvest bone marrow from the iliac crest and concentrate, and we isolate a stem cell concentrate consisting of 1 million to 5 million cells. We also draw peripheral blood to obtain the PRP.

The area for consideration is prepped sterilely. Using ultrasonographic needle guidance with local anesthetic, we “irritate” the area of concern with either a needle or trochar, depending on the specific site. Once enough local injury has been established, alternating infusions of stem cell concentrate and PRP are given, along with a tissue-activating agent, which helps a gel scaffold to be formed (Figure 2).

Currently, we are measuring patient response using both subjective measures (eg, Western Ontario and McMaster Universities Index, patient and physician visual analog scale scores) and objective measures (eg, 50-foot walk, ultrasonographic measurement of cartilage thickness, skier’s-view knee films). The preliminary results are very encouraging.

The combination of PRP with stem cells could increase the biological property of stem cells but also could decrease it. However, the evidence to date indicates that growth factors from PRP are stimulatory to stem cell replication and division. In addition, the combination of stem cells with TGF- $\beta$  may lead to scar tissue. However, scar tissue is not necessarily a bad thing, particularly in that it indicates healing rather than ongoing damage. ■

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*Anecdotal experience points to potential musculoskeletal applications*

## Tissue engineering with platelet-rich plasma and stem cells: New frontier in rheumatology?

**ABSTRACT:** Anecdotal and uncontrolled experience suggests that platelet-rich plasma (PRP) can be used for soft tissue injuries and autologous stem cells used in combination with PRP may be effective for tissue repair and cartilage regeneration. Large multicenter controlled studies of PRP are lacking, but there is enough anecdotal evidence to encourage its use as a “matrix tissue graft.” Injuries that respond to PRP include enthesopathies, such as epicondylitis and plantar fasciitis. A second phase of regenerative technique involves using PRP in tandem with stem cells. Study results suggest that the therapeutic use of mesenchymal stem cells for regeneration of cartilage in patients with osteoarthritis is feasible. Randomized clinical trials may be instituted in the not too distant future. (*J Musculoskel Med*. 2009;26:256-262)

The ability to heal soft tissue injuries and regenerate cartilage is the Holy Grail of musculoskeletal medicine. With advances in cell biology and technology, practicing physicians now may accomplish more in this area than ever before: platelet-rich plasma (PRP) can be used for multiple soft tissue injuries, and autologous stem cells used in combination with PRP may be effective for tissue repair (eg, rotator cuff tears) as well as cartilage regenerative processes.

Much curiosity and excitement have

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surrounded the topic of tissue engineering recently. In this article, I address some key issues as they relate to rheumatologic disorders, based on anecdotal and uncontrolled experience. This experience clearly is not a substitute for randomized clinical trials, but they may be instituted in the not too distant future.

### PLATELET-RICH PLASMA

Treatment with PRP allowed Pittsburgh Steelers wide receiver Hines Ward to play in Super Bowl XLIII this year even though he had a severe medial collateral ligament injury. Among the first to see and use PRP were practitioners of musculoskeletal medicine, particularly those skilled in prolotherapy. PRP has been used in a

number of specialties but appears to have its greatest application in managing musculoskeletal injuries.<sup>1,2</sup>

### PRP as a matrix graft

Large multicenter controlled studies of PRP are lacking, but there is enough anecdotal evidence to encourage its use as a “matrix tissue graft” to regenerate injured tissue, relieve pain, and reduce related dysfunction.<sup>3</sup> The review of literature on this subject is frustrating for analytical physicians, such as rheumatologists; what makes it so is an astounding number of “labels” given to tissue grafts that makes comparison of studies difficult, if not impossible. In addition, practitioner skill in incorporating proper injection technique with ultrasonographic

