Editorial Commentary: Orthobiologics—The Evolution From Symptom to Structural Modification in the Treatment of Articular Cartilage Defects

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Abstract: The race is on to identify the optimal recipe for the treatment of focal cartilage defects. Although many attempts had been made, beyond the use of osteochondral allografts, the restoration of pristine hyaline cartilage still seems distant and out of reach. The fundamental assumption is that cartilage restoration constructs must provide both structural integrity and adequate biological features that provide the optimal environment for hyaline cartilage formation. Augmentation of biologic scaffolds and grafts with orthobiologic agents may attend to both needs by improving defect fill and integration to the host articular cartilage interface.

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Chondral lesions are a common cause of knee pain and disability that can be found in as many as 63% of patients undergoing knee arthroscopy.[1] Autografts, allografts, and biologic scaffolds had been traditionally used to manage such lesions, perhaps leading to a healing response to "fill" a cartilage defect. Although these may provide structural integrity, biological properties that induce repair are lacking. On the other hand, the use of orthobiologic agents alone (e.g., platelet-rich plasma [PRP], platelet-rich fibrin, and cell-based therapies) may be symptom modifying but not structure modifying.[2]

Most clinical studies evaluating the effect of augmenting cartilage restoration procedures with orthobiologic agents have focused on bone marrow aspirate concentrate (BMAC) and have shown relative safety and mostly positive outcomes with the use of BMAC.[3] Clinical literature supporting or opposing augmentation with PRP or platelet-rich fibrin in this setting is limited.

In the article "Growth Factor Delivery to a Bovine Cartilage Defect Using Leukocyte-Rich Platelet-Rich Concentrates on a Hyaluronic Acid Scaffold," Titan, Schär, Hutchinson, Demange, Chen, and Rodeo[4] have performed a well-executed, high-quality in vitro investigation to assess whether human leukocyte-rich tissue platelet-rich plasma (L-PRP) or platelet-rich fibrin (L-PRF) delivered on a hyaluronic acid (HA) scaffold would improve tissue formation in a bovine chondral defect model. They found that both the HA scaffold combined with L-PRP and the HA scaffold combined with L-PRF showed greater biomechanical durability in vitro than the HA scaffold alone. They also found that although L-PRF augmentation was associated with a greater degree of cellularity and collagen production, L-PRP augmentation facilitated the greatest amount of sulfated glycosaminoglycan.

As with many in vitro studies evaluating the effect of PRP on cartilage,[5] the translatability of the results of Titan et al.[4] may be limited by several factors: the small size of the lesions, use of several human blood donors, lack of a biomechanical evaluation of axial compressive or horizontal shearing forces, and more. Nevertheless, this study is unique in terms of the rigorous methodology used, and its outcomes suggest that HA scaffolds augmented with L-PRP or L-PRF may play a role in

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improving cartilage healing (both biomechanically and biologically).

This focused biomechanical analysis of the native−restorative cartilage interface reminds us that in many cases of repair, related or unrelated to the human body, the interface is most commonly the weakest link (and that, in this case, chondrocytes may swim but they cannot jump). Therefore, we support the use of press-fit fixation when possible to minimize gaps at the margins. We also support and routinely perform augmentation of cartilage restoration procedures with orthobiologic agents. Although our preferred approach at this time is to augment osteochondral allografts with BMAC and BioCartilage (Arthrex) and/or minced autologous cartilage with PRP, other than an intuitive foundation based on early in vitro work, we have no high-quality data to support this as of yet.

More high-quality, fundamental studies, such as the one published by Titan et al.,[4] will provide a deeper understanding of the true merit of orthobiologic agents used in conjunction with cartilage restoration procedures. We envision that to achieve optimal outcomes, the formulation of the orthobiologic agents will need to be precisely tailored not just to a specific pathology but also to the individual patient.

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