



The Applications of Biologics in Orthopedic Surgery

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As orthopedic surgeons, we have done a great job continually trying to improve the outcomes of our patients. During the first decade of the 21st century, many of these advances centered on strengthening the biomechanics of constructs used to repair patients' pathologies. Trauma surgeons incorporated minimally invasive osteosynthesis with locked plates; shoulder surgeons began using double-row and transosseous-equivalent rotator cuff repairs. As a result of these shifts in treatment methods, healing rates and outcomes have improved. Unfortunately, to take rotator cuff repair as an example, healing rates have still not achieved 100%. To reach this goal in the future, biologic manipulation of the healing milieu will play a critical role.

This issue of *The American Journal of Orthopedics* features an article on the "Analysis of Intermediate Outcomes of Glenoid Bone Grafting in Revision Shoulder Arthroplasty" by Dr. Schubkegel and colleagues. While not as cutting edge or in vogue as growth factors or stem cells, bone graft is one of the original biologics used by orthopedic surgeons. The authors review the midterm results of glenoid bone grafting secondary to failed total shoulder arthroplasty and find that bone grafting resulted in good functional outcomes. Studies such as this one highlight the important role that biologics play, particularly in challenging or revision cases.

Platelet-rich plasma (PRP) is another biologic that is presently available for use. Reviewing its use as it pertains to orthopedics highlights both the potential benefits as well as the difficulties associated with incorporating biologics into everyday practice. In 2006, Mishra and col-

leagues¹ published one of the first studies that looked at the potential benefits of using PRP to treat lateral epicondylitis. While, from a purist's standpoint, it wasn't the best-designed study, it did provide cause for optimism with regard to a novel treatment option for an age-old problem. Since that time, hundreds of studies have been done on PRP looking at its potential treatment uses in everything from tennis elbow to rotator cuff repairs.

Study designs have improved, and with that, so have our indications for using PRP. Interestingly though, the more we study PRP (and other exogenous growth

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factors), it almost seems as if more questions are raised than answered. For instance, preparing PRP from a given patient will result in different concentrations of the PRP depending on what time of the day the patient's blood is drawn. What is the ideal time to prepare the PRP? Additionally, PRP prepared using different companies' systems results in different concentrations of growth factors. So, not only is a given patient's PRP different at different times of day, but these differences get magnified by using different preparation systems.

One of the main issues with tendon healing is that the tissue heals via reactive scar formation instead of truly regenerating new tendon. In this scenario, it is possible that adding PRP or other growth factors to the repair construct may only increase scar formation. Along these lines, newer work is focusing on cellular solutions to healing problems. Stem cells, which are undifferentiated, unspecialized cells, have shown potential to improve healing when added to injury/repair sites. Thus far, unfortunately, there is very little clinical data per-

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Author's Disclosure Statement: Dr. Dines wishes to disclose that he is a paid consultant to Arthrex, Inc.

Am J Orthop. 2014;43(5):203-204. Copyright Frontline Medical Communications Inc. 2014. All rights reserved.

taining to their use in orthopedic surgery. Compounding this problem are the US Food and Drug Administration's regulations on manipulating stem cells.

In the future, it is likely that growth factors, cytokines, PRP, and cellular approaches will be used to enhance healing. For now, a significant amount of preclinical work is being done to figure out the most

advantageous ways to use such adjuvants. This is an extremely exciting field with ample opportunities to answer well-designed research questions. Future issues of this journal will likely highlight such studies. ■

Reference

1. Mishra A, Pavelko T. Treatment of chronic elbow tendinosis with buffered platelet-rich plasma. *Am J Sports Med.* 2006;34(11):1774-1778.

2014 Resident Writer's Award

The 2014 Resident Writer's Award competition is sponsored by DePuy Synthes Institute. Orthopedic residents are invited to submit original studies, reviews, or case studies for publication. Papers published in 2014 will be judged by *The American Journal of Orthopedics* Editorial Board. Honoraria will be presented to the winners at the 2015 AAOS annual meeting.

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