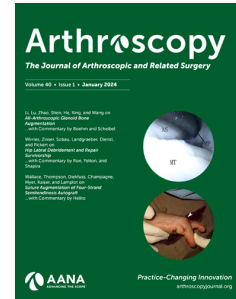


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Biologic Augmentation of Rotator Cuff Repair: PRP May Be of Significant Benefit, Whereas Atelocollagen Can Not Be Recommended

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## Biologic Augmentation of Rotator Cuff Repair: PRP May Be of Significant Benefit, Whereas Atelocollagen Can Not Be Recommended

### Abstract:

The field of orthobiologics continues to advance at a rapid pace, and theoretically holds some promise to augment the biologic healing response in rotator cuff repair. However, the clinical evidence for use of substances such as platelet-rich plasma for rotator cuff repair remains inconclusive. Atelocollagen, as a synthetic collagen substitute, has been proposed as another alternative to provide more collagen substrate for healing, but outcomes data with this technique is lacking. As biologic augmentation options continue to push the envelope on indications, due diligence is required to carefully examine options for safety and efficacy. Evolutions in rotator cuff repair should also continue to motivate sports medicine surgeons and researchers to seek out further innovations to improve patient outcomes. In contrast, (biologic) platelet rich plasma (PRP) has been well-studied, does not show adverse outcomes, and has been shown to improve healing of large-to-massive tears as well as RCR outcomes. That said, PRP outcome improvement for RCR is not definitive and requires further study. RCR can humble even the best of surgeons, and demands that we continue to look for ways to improve outcomes.

Nurse: "Dr. Jobe, how can you do a surgery that you're not sure is going to work?"

Dr. Jobe: "Would you rather have me do a surgery I *know* isn't going to work?"

- Centinela Hospital  
Los Angeles, CA  
September 25, 1974

This anecdote related by my mentors during fellowship is a personal favorite because it provides a glimpse into the innovative spirit of one of the true legends of sports medicine. Similar to ulnar collateral ligament tears at the time, rotator cuff tears in the present day still present a significant clinical challenge for optimizing treatment and ultimately outcomes. The field of sports medicine has taught us that difficult scenarios often require innovative treatments and a desire to think outside the box.

It is with that innovative spirit that the study by Kim, Kim, Park, Kim, Kim, Lee, and Yoo seeks to utilize a novel approach to optimizing the treatment of rotator cuff tears<sup>1</sup>. Recurrent rotator cuff tears are an unfortunate reality for any surgeon who performs rotator cuff repair. Despite our best efforts and most meticulous surgical techniques, an unacceptably high percentage of repairs ultimately fail, with a commonly quoted and quite shocking rate of 94% having been reported previously<sup>2</sup>, although this data is now nearly 20 years old and current rates are much lower. In our quest to solve this riddle, orthobiologics have become the new players on the scene, tantalizing us with the possibility of improving outcomes through injectables. Options such as platelet-rich plasma have been studied previously with mixed results. In fact, rotator cuff repair is one of the most common applications for PRP in clinical practice<sup>3</sup>. Recent meta-analyses have shown reduced re-tear rates, particularly for large-to-massive tears, and improved patient-reported outcomes with intra-operative application of PRP<sup>4,5</sup>. However, many of these individual studies are limited by variability of techniques utilized and outcomes reported, making broad generalizations difficult<sup>6</sup>.

One possible explanation for the high re-tear rates is that the repaired tendon-bone interface has been shown to contain scar tissue high in type III collagen as opposed to native type I collagen, resulting in an

insertion that is mechanically inferior to the native rotator cuff insertion<sup>7,8</sup>. So is improved collagen the answer? Prior studies have examined the use of atelocollagen, a synthetic collagen substrate, in rotator cuff repair with mildly encouraging results. The application of atelocollagen in a rabbit model of rotator cuff repair was shown to result in improved histologic scores and higher load to failure<sup>9</sup>. Kim *et al.* reported that type I atelocollagen injection for partial thickness rotator cuff tears was associated with improved clinical and functional scores as well as decreased size of tear on follow-up MRI at 6 months<sup>10</sup>.

In their current study “Atelocollagen Injection During Arthroscopic Rotator Cuff Repair for Small to Medium-Sized Subacute or Chronic Rotator Cuff Tears Enhances Radiographic Tendon Integrity: A Propensity Score-Matched Comparative Study”, Kim *et al.* present a well-designed investigation to analyze the use of atelocollagen injected at the site of rotator cuff repair<sup>1</sup>. A total of 181 matched pairs of patients were enrolled and multiple outcomes analyzed, including patient-reported outcome scores, Sugaya classification on MRI and clinical range of motion. The only statistically significant finding was a slightly improved Sugaya grade, but this by itself is of uncertain clinical significance. Although the Sugaya classification is felt to have reasonable reliability, previous studies have shown significant inter-observer variability in Sugaya grade classification, further calling into question how much confidence can be placed in this finding<sup>11</sup>. In addition, the MRI appearance of healing rotator cuff tears at 6 months is known to be highly variable<sup>12</sup>. Although re-tear rates were higher in the control group (10.5% vs 6.6%), this did not reach significance. What’s more, active motion was significantly decreased in the atelocollagen group compared to controls, raising concern that this type of injection may be detrimental to functional outcomes instead of beneficial. The study was limited by relatively short-term follow-up with MRI at 6 months post-op and clinical exam at 1 year, which may not be adequate to fully evaluate maximum improvement particularly after large-to-massive rotator cuff repairs.

What are we to make of these results? If our ultimate goals are to improve patient symptoms and reduce re-tear rates, it would appear that the routine use of atelocollagen does not accomplish either one of these. Although the MRI appears to improve, the addition of collagen to the repair construct does not result in any obvious patient benefit. In the current health care environment, another reality many surgeons are faced with is cost-containment. As we are being asked to be conscious of cost of products and implants, we need to look critically at treatments to determine if the outcome justifies the financial investment. Perhaps studies with larger patient populations or longer follow-up can shed more light on whether there is some clinical benefit to incorporating this type of injection, but without more promising initial results we can be confident that the search for the Holy Grail of biological augmentation does not conclude here.

The authors are commended for their investigation of a novel approach to this difficult problem. This is one of the very few studies to examine the use of a collagen product in rotator cuff repair, and it is the largest study to date of its kind in terms of patient sample size. Since the year 2024 marks the 50<sup>th</sup> anniversary of the first “Tommy John” surgery by Dr. Jobe, it is a good reminder to appreciate the spirit of innovation and ingenuity that has pushed the field of sports medicine to astounding heights over the last few decades. Thanks to the work of these authors and many others like them, we can continue to explore revolutionary options to offer patients to improve their function and their well-being. With the spirit of innovation also comes the duty to carefully evaluate new techniques to determine which hold promise and which are not yet ready for primetime. One thing remains clear: rotator cuff surgery is a finicky beast that can humble even the best of surgeons, and demands that we continue to look for ways to improve outcomes for the sake of our patients...and our own sanity.

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## References

1. Kim HG, Kim SC, Park JH, Kim JS, Kim DY, Lee SM and Yoo JC. Atelocollagen Injection During Arthroscopic Rotator Cuff Repair Enhances Tendon Healing in Small to Medium-

- Sized Subacute or Chronic Rotator Cuff Tear: A Propensity Score-Matched Comparative Study. *Arthroscopy* 2024; Manuscript in process
2. Jost B., Zumstein M., Pfirrmann C.W.A., Gerber C. Long-term outcome after structural failure of rotator cuff repairs. *J Bone Joint Surg Am.* 2006;88(3):472–47
  3. Charles MD, Christian DR, Cole BJ. The role of biologic therapy in rotator cuff tears and repairs. *Curr Rev Musculoskelet Med.* 2018;11(1):150–161.
  4. Zafar Ahmad M.D., Swee Ang M.D., Neil Rushton M.D., Adrian Harvey M.D., Kash Akhtar, Sebastian Dawson-Bowling M.D., Ali Noorani M.D. Platelet-Rich Plasma Augmentation of Arthroscopic Rotator Cuff Repair Lowers Retear Rates and Improves Short-Term Postoperative Functional Outcome Scores: A Systematic Review of Meta-Analyses. *Arthroscopy, Sports Medicine, and Rehabilitation* 2022; 4(2): e823-e833
  5. Xu W, Xue Q. Application of Platelet-Rich Plasma in Arthroscopic Rotator Cuff Repair: A Systematic Review and Meta-analysis. *Orthop J Sports Med* 2021; 9(7): online publication.
  6. DeClercq MG, Fiorentino AM, Lengel HA, et al. Systematic Review of Platelet-Rich Plasma for Rotator Cuff Repair: Are We Adhering to the Minimum Information for Studies Evaluating Biologics in Orthopaedics? *Orthopaedic Journal of Sports Medicine* 2021; 9(12): online publication.
  7. Isaac C, Gharaibeh B, Witt M, Wright VJ, Huard J. Biologic approaches to enhance rotator cuff healing after injury. *J Shoulder Elbow Surg.* 2012;21(2):181–190
  8. Kovacevic D, Rodeo SA. Biological augmentation of rotator cuff tendon repair. *Clin Orthop Relat Res.* 2008;466(3):622–633.
  9. Suh DS, Lee JK, Yoo JC, et al. Atelocollagen enhances the healing of rotator cuff tendon in rabbit model. *Am J Sports Med.* 2017;45(9):2019–27.
  10. Kim JH, Kim DJ, Lee HJ, Kim BK, Kim YS. Atelocollagen Injection Improves Tendon Integrity in Partial-Thickness Rotator Cuff Tears: A Prospective Comparative Study. *Orthop J Sports Med.* 2020 Feb 21;8(2): online publication.
  11. Ma J, Sahoo S, Imrey PB, Jin Y, Baker AR, Entezari V, Ho JC, Iannotti JP, Ricchetti ET, Polster JM, Winalski CS, Derwin KA. Inter-rater agreement of rotator cuff tendon and muscle magnetic resonance imaging parameters evaluated preoperatively and during the first postoperative year following rotator cuff repair. *J Shoulder Elbow Surg.* 2021 Dec;30(12):e741-e752.
  12. Crim J, Burks R, Manaster BJ, Hanrahan C, Hung M, Greis P. Temporal evolution of MRI findings after arthroscopic rotator cuff repair. *AJR. American journal of roentgenology* 2010; 195:1361–6

**Declaration of interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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