Editorial Commentary: Long-Term Outcomes of Fresh-Frozen Meniscal Allografts—Shrinkage Progresses, but Is It Clinically Significant?

Brian J. Cole, M.D., M.B.A., Eric D. Haunschild, B.S., and Jorge Chahla, M.D., Ph.D., Editorial Board

Abstract: Meniscal allograft transplantation has been reported to be an excellent treatment for young patients with symptoms related to meniscal deficiency. To date, several studies reporting on extrusion or shrinkage after a meniscal transplant have failed to correlate these findings with clinical outcomes. However, longevity, graft durability, and overall joint health have yet to be determined in the context of graft extrusion and shrinkage. Given a growing body of evidence showing varying degrees of shrinkage over time with no effect on functional outcome, allograft morphologic changes may not be as clinically important as once thought from a clinical standpoint.

See related article on page 2887

Meniscal allograft transplants (MATs) have repeatedly shown favorable clinical outcomes in select patients with meniscal deficiency and intact chondral surfaces, independent of graft extrusion and morphology. In the study entitled "A Magnetic Resonance Imaging Analysis of Shrinkage of Transplanted Fresh-Frozen Lateral Meniscal Allografts Over a Minimum Follow-up of 8 Years," Park, Bin, Kim, Lee, Lee, Son, and Lee[1] elegantly address morphologic changes and their clinical implications through a retrospective analysis of 20 patients who received isolated lateral fresh-frozen MATs. The authors compared magnetic resonance imaging scans 1 year and at least 8 years postoperatively to quantify the incidence of graft shrinkage and used Lysholm scores and joint space width on weight-bearing radiographs to assess long-term clinical and radiographic outcomes. Interestingly, they found that most transplanted allografts did have progressive shrinkage on magnetic resonance imaging that was more prominent in the midbody portion of the meniscus than in the posterior or anterior horn. Despite this observed shrinkage, clinical and radiographic outcomes remained unaffected at long-term follow-up. A number of previous investigations have shown radiographic evidence of shrinkage of fresh-frozen allografts at various short-term and midterm time points.[2-4] This study, along with previously published long-term data, supports a lack of correlation between the degree of shrinkage and outcomes.[1,5,6]

Conversely, it has been reported that there is a narrow anatomic window to place transplants anatomically without significantly altering the pressure distribution across the meniscus.[7] Nonanatomic placement of meniscal allografts has also been shown as a significant predictor for graft extrusion after lateral MAT.[8] Given this evidence, precise anatomic placement of the graft is an important operative consideration as it pertains to long-term changes in graft morphology. Ultimately, further investigation is required to assess whether nonanatomic graft placement has any effect on long-term outcomes.

Importantly, consensus is lacking related to which type of meniscal preservation technique leads to superior outcomes. Similarly to the investigation of fresh-frozen grafts by Park et al.,[1] a previous long-term investigation of cryopreserved allografts showed functional outcome improvement despite a high incidence of graft shrinkage.[9] Although further research is necessary to clarify these

Rush University Medical Center (B.J.C., E.D.H.)

The authors report no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

0749-8063/19749/$36.00
https://doi.org/10.1016/j.arthro.2019.06.011

issues, this study supports the enduring viability of fresh-frozen MATs as a valid approach for meniscal deficiency. Reports of long-term outcomes of MAT are limited but appear encouraging, with a recent study showing persistent functional outcome improvement and a high survival rate (93.3%) at 15 years postoperatively.[10] Other estimates have been more modest, with a 10% to 20% failure rate at an average of 4.6 years postoperatively.[11] The heterogeneity in surgical technique and study design limits the ability to generalize long-term outcomes, but the widespread findings of favorable outcomes across all studies are encouraging as to the long-term viability of MATs.

Although Park et al.[1] should be commended on this well-performed study, there are some limitations to this study in that only 20 patients met the inclusion criteria. Whereas the findings are encouraging, there may be inadequate power to find significance in the radiographic and clinical outcomes referenced. Moreover, this study only included patients with isolated lateral fresh-frozen MATs. These limitations were noted and necessary to complete this retrospective analysis, but the application of these findings to patients undergoing other MAT techniques or concomitant knee procedures is unclear.

The findings of the study by Park et al.[1] reinforce our preference to use fresh-frozen MATs in the appropriate patient population with symptomatic meniscal deficiency. This study helps address questions that we have long held about the extent of long-term shrinkage and its impact on clinical outcomes. Use of fresh-frozen grafts is still our preferred method because of their established efficacy, as well as easier processing, lower immunogenicity, and lower cost.[12-14] Further investigation is necessary to corroborate the findings of this study in a greater number of patients undergoing long-term follow-up, but we are encouraged that the degree of shrinkage appears to be mild with minimal changes in outcome over a long postoperative interval. We applaud the authors on a well-designed analysis of MAT outcomes and encourage other research groups to validate these findings.

References

1. Park J-G, Bin S-I, Kim J-M, et al. A magnetic resonance imaging analysis of shrinkage of transplanted fresh-frozen lateral meniscal allografts over a minimum follow-up of 8 years. *Arthroscopy* 2019;35:2887-2895.
2. Carter T, Economopoulos KJ. Meniscal allograft shrinkage-MRI evaluation. *J Knee Surg* 2013;26:167-171.
3. Lee BS, Chung JW, Kim JM, Cho WJ, Kim KA, Bin SI. Morphologic changes in fresh-frozen meniscus allografts over 1 year: A prospective magnetic resonance imaging study on the width and thickness of transplants. *Am J Sports Med* 2012;40:1384-1391.
4. Stollsteimer GT, Shelton WR, Dukes A, Bomboy AL. Meniscal allograft transplantation: A 1- to 5-year follow-up of 22 patients. *Arthroscopy* 2000;16:343-347.
5. Kim JH, Lee S, Ha DH, Lee SM, Jung K, Choi W. The effects of graft shrinkage and extrusion on early clinical outcomes after meniscal allograft transplantation. *J Orthop Surg Res* 2018;13:181.
6. Lee BS, Bin SI, Kim JM, Lee CR, Choi YH, Kwon YH. Early and delayed meniscal shrinkage after fresh-frozen lateral meniscal allograft transplantation: Magnetic resonance imaging study with a midterm follow-up. *Arthroscopy* 2018;34:3216-3223.
7. Sekaran SV, Hull ML, Howell SM. Nonanatomic location of the posterior horn of a medial meniscal autograft implanted in a cadaveric knee adversely affects the pressure distribution on the tibial plateau. *Am J Sports Med* 2002;30:74-82.
8. Choi NH, Yoo SY, Victoroff BN. Position of the bony bridge of lateral meniscal transplants can affect meniscal extrusion. *Am J Sports Med* 2011;39:1955-1959.
9. Hommen JP, Applegate GR, Del Pizzo W. Meniscus allograft transplantation: Ten-year results of cryopreserved allografts. *Arthroscopy* 2007;23:388-393.
10. Kim JM, Bin SI, Lee BS, et al. Long-term survival analysis of meniscus allograft transplantation with bone fixation. *Arthroscopy* 2017;33:387-393.
11. Mascarenhas R, Yanke AB, Frank RM, Butty DC, Cole BJ. Meniscal allograft transplantation: Preoperative assessment, surgical considerations, and clinical outcomes. *J Knee Surg* 2014;27:443-458.
12. McCormick F, Harris JD, Abrams GD, et al. Survival and reoperation rates after meniscal allograft transplantation: Analysis of failures for 172 consecutive transplants at a minimum 2-year follow-up. *Am J Sports Med* 2014;42:892-897.
13. Saltzman BM, Bajaj S, Salata M, et al. Prospective long-term evaluation of meniscal allograft transplantation procedure: A minimum of 7-year follow-up. *J Knee Surg* 2012;25:165-175.
14. Lee SR, Kim JG, Nam SW. The tips and pitfalls of meniscus allograft transplantation. *Knee Surg Relat Res* 2012;24:137-145.