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BS Structured Summary

Article: Fibrin-Based Scaffold Augmentation During Meniscal Repair May Enhance Healing and Functional Outcomes: A Systematic Review

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Structured Summary: Fibrin-Based Scaffold Augmentation During Meniscal Repair May Enhance Healing and Functional Outcomes: A Systematic Review

Original Article: Limited evidence on the use of fibrin clot as an adjunct to meniscal repair with sutures: A systematic review

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INTRODUCTION / BACKGROUND

Meniscal preservation has stopped being a preference and become a mandate. We know meniscectomy alters contact mechanics, accelerates compartment degeneration and brings arthroplasty closer; repair, by contrast, restores load distribution and defers that outcome. The trouble is that not every tear heals the same: the meniscus receives blood only in its peripheral third, the so-called red zone, and complex, chronic, radial or horizontal cleavage tears in the avascular zone challenge the biology of suture alone.

Hence the race for biologic augmentation. PRP, stem cells and marrow stimulation have been proposed, but run into cost, technical complexity and operative time. The fibrin clot emerges as the practical, cheap alternative: intrinsic coagulation of the patient's own blood, with no specialized processing. The idea is not new — Arnoczky described the exogenous clot over three decades ago — but the technique has matured, and this review sets out to gather, comprehensively for the first time, what fibrin-based methods actually deliver in healing, complications and functional scores.

OBJECTIVE

To evaluate, by systematic review, the healing rate, complication rate and patient-reported outcome scores after meniscal repair augmented with fibrin-based scaffolds. The hypothesis was that augmentation would be associated with high healing rates, improved functional scores and low complication rates.

METHODS

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A PRISMA-guided search of PubMed, Embase and Ovid MEDLINE through October 15, 2025, with two independent reviewers and a third for disagreements. Studies of any design evaluating fibrin in meniscal tear repair were included, excluding root tears, meniscal transplantation and revision repair; when concomitant ACL reconstruction was present, outcomes were reported separately where possible. Primary outcomes: healing (complete, partial or failed, by MRI or second-look arthroscopy) and complications. Secondary: IKDC, Lysholm and Tegner.

Of 757 screened studies, 15 met the criteria — comprising 438 patients and 461 menisci, of which 345 received augmentation. Four fibrin methods were identified: fibrin clot from peripheral venous blood (FC-PVB; n=252), fibrin clot from bone marrow aspirate concentrate (FC-BMAC; n=30), platelet-rich fibrin (PRF; n=15) and PRF combined with platelet-rich plasma (PRF+PRP; n=48). Quality was assessed by JBI and modified Coleman; the set was mostly prospective case series, with only one randomized trial.

MAIN RESULTS

In the FC-PVB group, at a minimum 2-year follow-up, 77.5% of menisci healed completely, 12.2% partially and 10.3% failed. Restricting to isolated meniscal repair studies — no concomitant ACL — complete healing rose to 86.2%. In direct comparison with the non-fibrin clot, one study showed significantly higher healing in the fibrin group (91.7% vs 70.4%; P<.05).

Complications occurred in 8.2% of FC-PVB patients — paresthesia, effusion and reinjuries, in some cases requiring implant removal or further debridement — and persistent knee pain in 2.6%. FC-BMAC had complications in 5 patients (positive Barrett criteria, joint line tenderness, effusion), while PRF and PRF+PRP reported none.

The functional chapter holds the most instructive finding. FC-PVB studies showed significant improvement in IKDC and Lysholm, but NOT in Tegner. FC-BMAC augmentation improved Tegner and Lysholm; PRF and PRF+PRP improved IKDC, Lysholm and the combined score. One study examining the minimal clinically important difference (MCID) found that 87% of FC-PVB patients reached the Lysholm threshold, but only 65.2% the Tegner one. In other words: fibrin relieves symptoms and recovers function, but return to the prior activity level is less guaranteed.

The authors offer a biologic substrate for fibrin's advantage. The clot polymerizes slowly, concentrates platelets at roughly ten times the baseline density, and sustains cytokine activity and cell migration; as a scaffold, it preserves the elongated morphology of meniscal cells, critical for tissue regeneration. Over time the clot transitions from fibroconnective to fibrocartilaginous tissue, as reparative cells are drawn in by chemotactic signals. A recurring technical detail makes a practical difference: placing the clot into the repair site before tying the suture produces a more watertight closure than marrow venting alone, in which clot formation only occurs after suturing.

AUTHORS' CONCLUSION

Fibrin-based augmentation demonstrated high healing rates, low complication rates and consistent improvement in clinical scores after meniscal repair. Compared with

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nonaugmented repair, fibrin scaffolds achieved better healing and function. FC-PVB enhanced symptom relief and functional recovery, while only FC-BMAC showed a gain in activity level. The authors hold that these results support fibrin as an effective strategy to enhance meniscal healing.

💬 BS DISCUSSION

This paper interests me because the fibrin clot is the “democratic” augment — cheap, drawn from the patient's own blood, no centrifuge, no kit, no cost that rules it out in a public system. And the good news is direct: it heals well. 77.5% complete healing with FC-PVB, and 86.2% when you isolate the repair without concomitant ACL, is a number that makes you consider offering fibrin routinely in the at-risk tear — the complex, the chronic, the white-zone tear that suture alone cannot hold. The head-to-head study (91.7% vs 70.4% against the non-fibrin clot) is the kind of data that pushes practice.

But the point that struck me most is not the healing — it is the dissociation of scores. FC-PVB lifted IKDC and Lysholm and did not move Tegner. It looks like a statistical detail, but it is pure clinic. IKDC and Lysholm measure knee symptoms and function; Tegner measures the level of sporting activity. The message I read is: fibrin heals the meniscus and takes the pain away, but does not guarantee the person plays again at the level they played. And the MCID data reinforce it — 87% crossed the clinically relevant threshold on Lysholm, only 65% on Tegner. For anyone operating on athletes, this distinction is not academic: it is the difference between “your meniscus healed” and “you are the athlete you were.”

And here is a reading the paper offers elegantly: only FC-BMAC moved Tegner. Marrow aspirate is biologically richer — more bFGF, TGF-beta, SDF-1 — and perhaps that is what makes the difference in return to activity level, not just in healing. The hypothesis is seductive: peripheral venous blood closes the tear, but marrow's biologic potency is what brings the athlete back. Beware the enchantment, though — it is 30 FC-BMAC patients against 252 FC-PVB, and no direct head-to-head. It is hypothesis-generating, not verdict, and FC-BMAC charges the price of invasive marrow harvest.

Where I pump the brakes, and the authors are honest: level 4, a single randomized trial among fifteen studies, large heterogeneity in tear type, location and chronicity. Worse: few studies stratified by tear type, which is exactly what we need to know. Fibrin in a complex radial tear is one conversation; in a red-zone longitudinal it is another — and the review cannot separate who gains most. Add the variability in clot volume (1.5 mL to 120 mL, unstandardized) and delivery technique, and it is clear the “it works” is still coarse, not refined.

What I take to the resident is practical: in the biologically at-risk meniscal tear — complex, chronic, white zone — augmenting with a fibrin clot is cheap, safe and improves the chance of healing, and that alone justifies adopting it. But do not promise the athlete a return to the same level just because the meniscus healed; Tegner did not follow. The question the paper leaves open, and that deserves a well-stratified prospective study, is which fibrin for which tear — and whether marrow's biologic richness pays for its invasive harvest when the goal is returning the athlete to the field.

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