BS Structured Summary

Article: Fibrin Clot Augmentation in Meniscal Repair — Promising Signal, Limited Evidence

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Structured Summary: Fibrin Clot Augmentation in Meniscal Repair — Promising Signal, Limited Evidence

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

Authors: De Azevedo LAC, De Novaes RCT, Del Campo GPLRA, Junqueira MFP, de Oliveira DE, Jorge PB

Journal: JEO – Journal of Experimental Orthopaedics

Ano: Vol. 12, Issue 3 — 2025, article e70503

DOI: 10.1002/jeo2.70503

INTRODUCTION / BACKGROUND

Meniscal tears are among the most common knee injuries and are increasingly treated with suture repair rather than meniscectomy, in order to preserve joint biomechanics and delay chondral degeneration. Clinically, tears fall into two groups with distinct prognoses. Degenerative tears predominate in older patients, are usually horizontal, complex or flap-type, and frequently involve the avascular white–white zone, where intrinsic healing potential is limited. Traumatic tears occur in younger, active individuals after acute trauma, are often vertical longitudinal, radial or bucket-handle, lie in the more vascularised red–red or red–white zones where healing potential is greater, and are frequently associated with anterior cruciate ligament (ACL) injury.

Despite technical refinement, meniscal repair still fails at a meaningful rate. A meta-analysis of 3,829 repairs reported an overall failure rate of 14.8%, higher in medial repairs and in knees without concomitant ACL reconstruction; a systematic review with a minimum 5-year follow-up found roughly 19% revision, with many failures occurring after the second postoperative year. Tear pattern, location, chronicity and joint instability are the main prognostic factors — radial, horizontal, degenerative and white–white lesions failing more than peripheral longitudinal red–red tears.

Because meniscal healing depends heavily on vascular supply, biological augmentation has emerged as a strategy to improve outcomes. Autologous fibrin clot implantation, first described by Arnoczky et al. in 1988 for avascular zones, is a low-cost, technically simple scaffold rich in growth factors that supports cell adhesion, angiogenesis and tissue integration. Interest has been renewed for complex or avascular tears, but the literature remains dominated by small, heterogeneous, retrospective series, and high-quality comparative data are scarce. The clinical benefit — particularly confirmed healing and failure rates — remains uncertain.

OBJECTIVE

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To critically appraise and synthesise the available evidence on autologous fibrin clot as a biological adjunct to suture-based meniscal repair, focusing on healing rates, failure rates and the methodological quality of the studies. The authors hypothesised that fibrin clot augmentation would be associated with higher healing and lower failure rates, particularly in tears with limited intrinsic healing potential.

METHODS

PRISMA-guided systematic review, prospectively registered in PROSPERO (CRD42024614021). PubMed, Embase and Scopus were searched up to April 2025 using the Boolean string ('fibrin clot' OR 'blood clot' OR 'fibrin glue') AND (meniscus OR meniscal) AND (repair OR suture).

Eligible designs were randomised controlled trials (RCTs), non-randomised controlled studies, cohorts and case series, in patients of any age, undergoing meniscal repair with fibrin clot augmentation and reporting: healing rates (clinical examination, arthroscopy and/or MRI); failure rates (reoperation, re-tear or persistent symptoms); and validated functional scores (IKDC, Lysholm). Case reports, narrative/systematic reviews and repairs without fibrin clot were excluded.

Two reviewers independently screened and extracted data, with a third resolving disagreements. Given substantial heterogeneity in designs, populations, tear types and locations, techniques, outcome definitions and follow-up, meta-analysis was not feasible and a qualitative descriptive synthesis was performed. Risk of bias was assessed with the Cochrane RoB 2 tool (RCTs), ROBINS-I (non-randomised studies) and the NIH tool (case series).

MAIN RESULTS

The search yielded 457 records (Embase 192, Scopus 175, PubMed 90); after duplicate removal, 222 were screened, 36 full texts assessed, and 11 studies included. The evidence was dominated by retrospective case series with small, heterogeneous samples; healing rates ranged from 43% to above 90% with inconsistent outcome definitions, and most studies carried a critical risk of bias.

The single RCT (Biedert 2000), using a commercial fibrin sealant (Tissucol) for degenerative grade II intrasubstance lesions, had the worst outcomes (healing 43%, failure 57%), with partial meniscectomy performing best. By contrast, autologous-clot studies reported high healing: Kale (2022) 96.6%, Hashimoto (2021/2022, bone marrow, avascular zone) 93.3%, Henning (1990) 92%, Chrysanthou (2024) 91.7%, Ra (2013, complete radial tears) 91.6%, Nakayama (2017, avascular zone) 91.3% and Davies (2024) 90.2%.

Outcomes were more variable in degenerative tears — Nakayama (2020, degenerative medial) 75%, with varus malalignment identified in 100% of failures, and Kamimura & Kimura (2014, degenerative horizontal) 70%, with about 30% incomplete healing on MRI — while Van Trommel (1998, avascular radial) reported 60%.

The most common clot was autologous, from intraoperative venous blood (50–60 mL) left to coagulate for 5–15 minutes; Hashimoto used a bone-marrow-derived clot. Five application

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strategies were described: inside-out suturing with clot insertion during fixation; instrument-assisted manual insertion followed by inside-out suturing; direct insertion into the lesion cavity with subsequent suturing; circumferential suturing with inside-out insertion; and suture-shuttling of a pre-moulded clot. Technique was tailored to tear type, zone and surgeon preference.

Safety was favourable, with low complication rates and no significant adverse event attributable to the clot. Failures were predominantly persistent or recurrent symptoms; minor complications (saphenous nerve paraesthesia, transient stiffness) related to the arthroscopy or suture rather than the clot. For context, avascular-zone results (≈91–93%) compare favourably with historical 20–40% failure without augmentation; among biologics, fibrin clot stands out for accessibility, cost-effectiveness and safety versus PRP, scaffolds and marrow stimulation; findings align with Zaffagnini et al., who found insufficient evidence for routine biologic augmentation.

AUTHORS' CONCLUSION

Autologous fibrin clot as a biological adjunct to meniscal repair is conceptually attractive and technically feasible, but current clinical evidence is limited and methodologically weak, precluding definitive conclusions. There is insufficient evidence to support or refute its routine use; application should remain selective and guided by clinical judgement — particularly for complex or avascular tears with limited intrinsic healing — until high-quality RCTs with standardised protocols, validated outcomes and long-term follow-up become available. Level of Evidence: IV.

💬 BS DISCUSSION

This review — co-authored from our own group (Santa Casa de São Paulo / Hospital Sírio-Libanês) — lands on a deliberately humble message: after decades of use and eleven studies, we still cannot say that fibrin clot works. The headline is not a number; it is the gap between biological plausibility and evidence. Worth pausing on for BS: how often do we adopt a low-cost, “harmless”, biologically attractive adjunct precisely because it is cheap and seems risk-free, without the data to support routine use?

Where the clot does seem to earn its place is the avascular zone. Ra at 91.6% and Hashimoto at 93.3% in white–white and radial tears, against a historical 20–40% failure, is the most clinically meaningful pattern in the paper. If there is one BS take-home, it is this: consider the clot selectively for the complex, avascular tear you would otherwise be tempted to resect — not as a routine add-on to every red–red longitudinal repair that would heal anyway.

The autologous-versus-commercial split is instructive. The only RCT (Biedert) used a commercial sealant and had the worst results (43% healing), while every high-performing study used autologous clot (peripheral blood or bone marrow). For our labs, the practical message is to standardise the autologous preparation (50–60 mL of venous blood, 5–15 minutes of spontaneous coagulation) rather than reach for an

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off-the-shelf sealant — the biology of the autologous clot (cells plus growth factors) appears to matter.

Why the evidence is weak, and why that matters at the bedside: no control groups, tiny samples, short follow-up, subjective scores, little second-look arthroscopy, and the well-known problem that postoperative MRI can mimic a tear for months — with concomitant ACL reconstruction adding a confounder. The honest counsel to a patient is something like: this is a low-cost, safe addition with a plausible mechanism and encouraging but unproven results, especially useful in avascular tears. Anything stronger oversells the data.

One risk factor worth carrying into practice: Nakayama's degenerative cohort found varus malalignment in 100% of failures — a reminder that, in degenerative medial tears, alignment may matter more than the biologic. For BS practice and for our Summit and Lab discussions, the technique to standardise and teach is the autologous clot in the avascular tear; the trial we still need is a proper RCT. Until then, selective use, clear patient counselling and 24-month follow-up (where most failures appear) are the defensible standard.

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