BS Structured Summary

Article: All-Inside (Suture Implant) vs. Suture Hook for Meniscal Ramp Lesions

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Structured Summary: All-Inside (Suture Implant) vs. Suture Hook for Meniscal Ramp Lesions

Original Article: Comparison of All-Inside Suture Implant Versus Suture Hook Technique for Meniscal Ramp Lesions: A Systematic Review and Meta-analysis

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INTRODUCTION / BACKGROUND

Medial meniscus ramp lesions are specific tears at the posteromedial meniscocapsular junction, first described by Strobel in 1988. They involve disruption of the posterior horn of the medial meniscus and its peripheral capsular attachments at the meniscotibial junction. The proposed mechanism involves increased anterior tibial translation in the context of ACL injury, with secondary forces on the posterior horn of the medial meniscus. Historically this pathology has been underdiagnosed because of its location in the posteromedial "blind spot" of the knee when visualized through standard anterolateral and anteromedial arthroscopic portals.

In recent years, recognition of ramp lesions has become standard practice during surgical approach to ACL injuries. Studies report a 16% to 40% prevalence of ramp lesions concomitant with ACL rupture. Biomechanical work such as DePhillipo et al. (2018) demonstrated that ramp lesions involving the meniscocapsular and meniscotibial junctions result in significant anterior tibial translation, rotational instability, and the pivot-shift phenomenon. These data consolidated the practice of careful diagnosis and appropriate repair to optimize postoperative outcomes.

Various repair techniques have been described. Among them, the all-inside approach has gained popularity over recent years as the preferred option, offering advantages over traditional inside-out techniques — lower technical demand and minimally invasive approach, without need for a posteromedial portal. The all-inside repair can be performed by (1) a posteromedial working portal with curved suture hook (SH technique) or (2) by an

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anteromedial approach using an all-inside meniscal repair system (suture implant technique — SI).

Despite the growing popularity of the SI technique, comparative literature between SI and SH is limited. Variability in degree of instability, lesion size, and concomitant pathology makes direct comparison difficult. The primary objective of this meta-analysis was to compare failure rates between all-inside SI and all-inside SH for ramp lesion treatment. Secondary objectives included comparison of patient-reported outcomes (PROMs) and assessment of failure-associated factors. The hypothesis was that SI would have failure rates comparable to SH, with similar PROMs between groups.

OBJECTIVE

To compare overall failure rates, failure rates by type (secondary meniscectomy vs. failure to heal), and functional outcomes between the all-inside suture implant technique (SI — predominantly the Fast-Fix device from Smith & Nephew) and the all-inside suture hook technique (SH) in the treatment of medial meniscus ramp lesions associated with ACL reconstruction.

METHODS

Systematic review and meta-analysis conducted according to PRISMA guidelines. Multidatabase search of PubMed, EMBASE, Cochrane Library, and Google Scholar (pages 1-20), covering database inception through February 3, 2025. MeSH terms and Boolean operators: (Ramp Lesion OR Ramp lesions OR Ramp meniscus tear OR posteromedial meniscus tear) AND (all-inside OR all inside OR Fast Fix).

Inclusion criteria: studies reporting on patients with ramp lesions undergoing surgical repair that directly compared clinical outcomes and complication rates between all-inside SI and all-inside SH. Excluded studies that were not peer-reviewed, focused on other meniscal tear types, comparisons with nonoperative treatment, or studies without direct comparison. All SI studies used the Fast-Fix device (Smith & Nephew), with polyetheretherketone (PEEK) anchors and nonabsorbable 2-0 ultra-high molecular weight polyethylene suture.

Two independent reviewers (B.K., K.C.V.) screened records, with discrepancies resolved by consensus and arbitration of the senior author (Y.R.). Data extraction (M.M., B.K.) included study design, publication year, demographics, sample size, functional outcomes, and complications. Quality assessment via ROBINS-I Version 2 (Risk Of Bias in Non-Randomized Studies of Interventions) across seven domains.

Functional outcomes assessed: IKDC score (International Knee Documentation Committee), Tegner activity scale, Lysholm score, return-to-sport rates, and repair failure as defined in each individual study. Statistical analysis in SPSS Version 29.02. Mean differences with 95% CIs for continuous variables; odds ratios (OR) for dichotomous variables. Heterogeneity assessed by Q-test and I^2. Random-effects model for substantial heterogeneity ($P \leq 0.05$ or $I^2 > 50\%$); otherwise, fixed-effects model. Significance at $P \leq 0.05$.

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MAIN RESULTS

From an initial search of 511 studies, 5 met final inclusion criteria (2 case-control and 3 retrospective cohorts), totaling 901 patients — 388 undergoing SI repair and 513 SH repair. Mean age 28.71 years; minimum follow-up 12 to 18 months (Cheng et al.) and 24 months in the others. Risk of bias: 4 studies with low risk and 1 (Cheng et al.) with moderate risk.

Overall repair failure — central finding: significant difference between groups, with 99 failures out of 388 cases (25.5%) in the all-inside SI group vs. 55 failures out of 513 cases (10.7%) in the SH group (OR 2.36; $p<0.01$). Mean Kaplan-Meier 4-year survival was 0.74 for SI and 0.86 for SH, evidencing substantial and durable SH advantage.

Stratified analysis by failure type: all-inside SI was associated with a statistically significant 2.40-fold increase in odds of requiring secondary meniscectomy compared with SH (OR 2.40). There was no significant difference in odds of failure to heal between the techniques — the differential lies in surgical endpoint (secondary meniscectomy), not in healing parameters proper.

Patient-reported outcomes (PROMs): no significant difference between techniques in Tegner score (5.06±1.96 vs. 5.33±2.02; $p=0.48$), Lysholm score (88.27±13.19 vs. 89.22±11.31; $p=0.97$), or return-to-sport rate (76.5% vs. 83.5%; $p=0.22$). Modest numerical difference in IKDC (-3.22 favoring SH), without statistical significance ($p=0.09$).

Failure risk factors: preoperative side-to-side laxity >7 mm did not significantly increase failure risk. Age ≤20 years was also not an isolated risk factor for failure. This finding is particularly relevant for the pediatric and adolescent population, often associated with higher Beighton score and potential increased laxity — suggesting technique choice should not be determined by these criteria alone.

AUTHORS' CONCLUSION

The all-inside suture implant (SI) technique for ramp lesions is associated with significantly higher overall failure rates and secondary meniscectomy rates than the all-inside suture hook (SH) technique. Functional outcomes (Tegner, Lysholm, return-to-sport) are largely comparable between the two techniques. These results should be interpreted with caution, as outcomes strongly depend on surgical technique, visualization, suture configuration, and rehabilitation protocol. More high-quality studies — preferably randomized clinical trials with standardized definitions, matched cohorts, and uniform postoperative protocols — are needed to define the optimal repair strategy.

💬 BS DISCUSSION

This meta-analysis directly addresses a technical decision we make every week in the OR: when we identify a ramp lesion associated with ACL reconstruction, which technique should we use for repair? The answer from this work — surrounded by important nuances — is provocative: SH outperforms SI on hard endpoints (failure and

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secondary meniscectomy), with no loss in PROMs. The numbers are striking: 25.5% vs. 10.7% overall failure, OR 2.36, and 4-year survival of 0.86 (SH) vs. 0.74 (SI). A difference no one can ignore.

The most interesting point for BS practice lies in the biomechanical and technical explanation the authors propose for SH superiority. First, the posteromedial portal coupled with a transnotch viewing portal provides DIRECT and complete visualization of the lesion — critical in Thaunat type 3 lesions (partial inferior tear, "hidden lesion"), where inspection through conventional anterior portals is insufficient. Second, SH allows suture passage PERPENDICULAR to the longitudinal meniscal fibers, ensuring better fixation. Third, the SH point allows circumferential compression both above AND below the meniscus, replicating anatomy. The all-inside SI, especially with older-generation plastic devices, often fails to achieve this fixation quality.

The authors also bring forth two concepts that deserve to enter our daily surgical vocabulary: the "Thaunat classification" of ramp lesions (types 1 through 5, based on location and stability) and the "Tachibana effect." On classification: types 1 and 2 (peripheral meniscocapsular separation within the synovial sheath and partial superior tear) are generally stable and may benefit from less demanding techniques; types 3, 4, and 5 (unstable) likely require SH rigor for anatomic restoration. On the Tachibana effect: it refers to iatrogenic tears generated by needle and suture passage during repair. Multiple passes with all-inside devices can degrade already-damaged tissue to a point that makes secondary repair unfeasible — partially explaining the higher secondary meniscectomy rate in the SI group.

For the BS surgeon, there is a clear call: invest in mastering the SH technique. Yes, it is technically more demanding, with a significant learning curve, longer operative time, need for a skilled assistant, arthroscopic knot tying, and small risk to the saphenous nerve and vein. But the gain in repair durability justifies the investment — especially for unstable lesions or young patients with high athletic demand. On the other hand, in stable lesions (Thaunat types 1 and 2), all-inside SI may remain a valid option — particularly when the surgeon does not master the posterior technique. The decision should be guided by lesion type, surgeon experience, and patient demand, not by universal technical preference.

The study's limitations are honest and should temper definitive conclusions. Only 5 included studies, none RCT, some with small sample sizes, all conducted outside the US (limiting generalization to other practices), variable failure definitions, lack of standardization for chronicity, concomitant pathology, graft choice, postoperative protocols, and sex. Crucially, included studies predominantly use older-generation plastic devices (Fast-Fix) — not the modern "all-suture" devices (without plastic component) gaining ground. It is plausible, even expected, that contemporary all-suture devices with more sophisticated suture configurations will narrow this performance gap. Finally, two studies (Thaunat and Saint-Etienne) come from the same institution, with theoretical possibility of partial patient overlap. For BS Papers, the recommendation stands: openly discuss with colleagues whether our current SI/SH ratio reflects the best available evidence, or if it is worth rethinking the protocol — particularly for young patients,

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athletes, and unstable lesions. This is the kind of meta-analysis that turns OR coffee-room discussion into practice change.

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