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Medial meniscus root tear: Don't just leave it or remove it, rather repair it, a key to prevent osteoarthritis

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Abstract
Background: Medial meniscus root tears disrupt meniscal hoop stresses, leading to altered joint biomechanics and accelerated degenerative changes. Root repair has been proposed as a joint-preserving alternative.
Objective: To assess clinical and functional outcomes of medial meniscus posterior horn root repair through suture pull out technique.
Materials and Methods: This Retrospective study was conducted at Civil Hospital, Ahmedabad, for operated patients from October 2022 to September 2024. Thirty-five patients with symptomatic medial meniscus root tears underwent arthroscopic suture pull out repair. Demographic data, comorbidities, and intraoperative findings were documented. Functional outcomes were assessed pre- and post-operatively using the Visual Analogue Scale (VAS) for pain and Lysholm Knee Score. Statistical significance was set at $p< 0.05$.
Results: The mean age was 46.1 years, with female predominance (85.7%). Pre-operative mean VAS (7.9) significantly improved to 1.2 at final follow-up ($p< 0.001$). Mean Lysholm score increased from 55.3 to 91.4 ($p< 0.001$). Grade II-III chondral changes were common intraoperative findings. No major complications were observed.
Conclusion: Arthroscopic medial meniscus root repair yields significant pain relief and functional recovery, particularly in middle-aged women. This technique should be considered the treatment of choice in appropriately selected patients.

Keywords: Medial meniscus root tear, arthroscopic repair, suture pull out technique

Introduction
The posterior root of the medial meniscus is critical for load distribution and knee stability. Root tears render the meniscus non-functional, simulating a subtotal meniscectomy, and are strongly associated with rapid progression of medial compartment osteoarthritis [2]. Traditional management with partial meniscectomy or conservative therapy has shown limited benefit.
Recent advances in arthroscopic repair techniques have enabled anatomic restoration of root function, thereby preserving joint mechanics. This study evaluates functional outcomes following medial meniscus root repair in an Indian cohort.

Aims and Objectives
To evaluate clinical outcome of arthroscopic transtibial suture pull out repair of medial meniscus posterior horn root tear in form of VAS Score and functional [patient reported] outcome in form of LYSHOLM Score.

Materials and Methods
- **Study Design:** Retrospective observational study.
- **Sample:** Thirty-five consecutive patients who underwent medial meniscus posterior horn root repair (Transtibial suture pull out technique) from October 2022 till September 2024.

Inclusion Criteria
1. Patients with age between 20 years and 65 years.

2. Traumatic/ Degenerative Medial meniscus posterior horn Root tear

Exclusion Criteria

1. Varus Malalignment of knee>5 degree
2. Osteoarthritis knee with Kellgren-Lawrence grade 3 or 4
3. Associated with other ligament injuries
4. Associated with any bone fracture.
5. Any past history of surgery over ipsilateral knee.

Patients with clinically having medial joint line tenderness and radiological MRI confirmed medial meniscus root tear (i.e. Ghost sign, meniscal truncation) were operated with arthroscopic transtibial suture pull out repair.

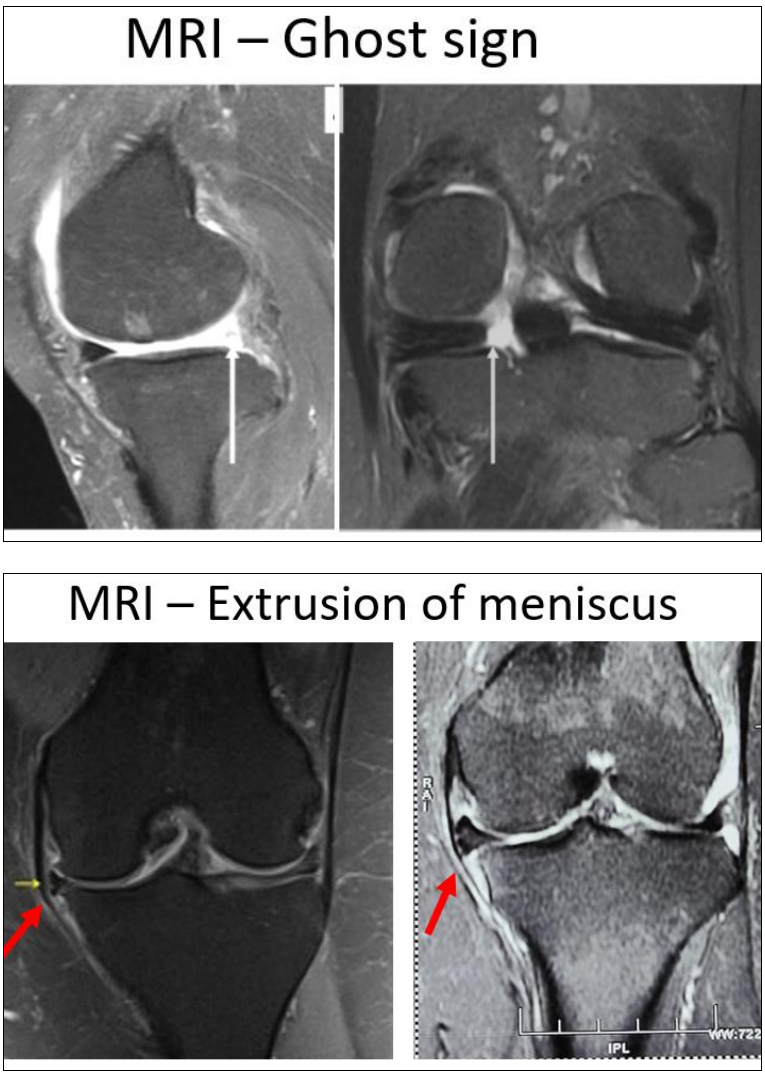

Fig 1: MRI - Ghost sign with extrusion of meniscus

Surgical Technique: Under spinal anesthesia in supine position, through standard arthroscopy portals, arthroscopic evaluation was done, Status of the cruciate and menisci were noted. Chondral changes over medial compartment of the knee joint were graded according to ICRS classification. In patients with difficulty in passing instruments to the posterior root while placing a valgus force on the knee, the medial collateral ligament was fenestrated using a spinal needle.

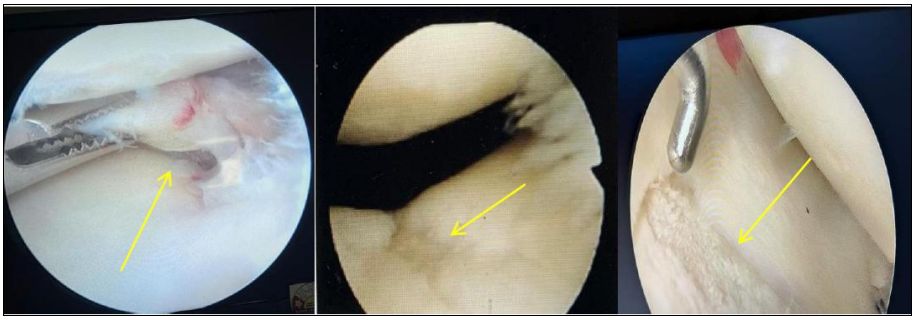

Fig 2: Meniscal Root tear ICRS Grade 2 changes ICRS Grade 3 changes

Base of the root prepared using curette to expose fresh cancellous bone. Using appropriate root repair jig, 2.4mm tunnel drilled towards the base of the root from anteromedial surface of tibia and then overdrilled with 4.5mm drill bit. Bites taken off the root using suture passer devices and 2 No.2 fibre wires passed through the medial root of the meniscus

and locked with cinch knot. Wires shuttled through the tunnel and fixed over anteromedial surface of tibia using titanium suture disc.

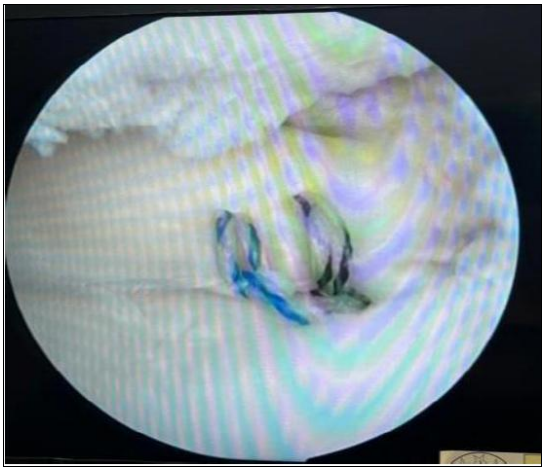

Fig 3: Arthroscopic image of the medial meniscus posterior root after transtibial repair

Postoperative protocol: Static quadriceps exercises, Passive knee ROM exercises started next day. Non weight bearing walking is allowed upto 6 weeks. Weight bearing is started after 6 weeks.

Patients were followed up till 6 months post-surgery and Post-operative pain and functional outcome were assessed in form of VAS scale and Lysholm score.

Statistical Analysis: Paired t-tests were applied; significance set at $p< 0.05$.

Results

Patient Demographics: The study included 35 patients. The mean age was 46.1 years (range: 32-62 years). A strong female predominance was observed with 30 females (85.7%) and 5 males (14.3%). Most patients were housewives, and hypertension was the most common comorbidity.

Clinical Outcomes

Mean pre-operative VAS was 7.9, which improved to 1.2 post-operatively ($p< 0.001$). Mean pre-operative Lysholm score was 55.3, which improved to 91.4 post-operatively ($p< 0.001$). Almost all patients reported substantial pain relief and functional improvement.

Table 1: VAS Score

Grade of Pain (VAS SCORE)	Pre-operative Score (No. of patients)	Pre-operative Score (%)	Post-operative Score (No. of patients)	Post-operative Score (%)
No Pain (0)	0	0 %	13	37.2 %
Mild Pain (1–3)	0	0 %	19	54.2 %
Moderate Pain (4–7)	13	37.2 %	3	8.6 %
Severe Pain (8–10)	22	62.8 %	0	0 %

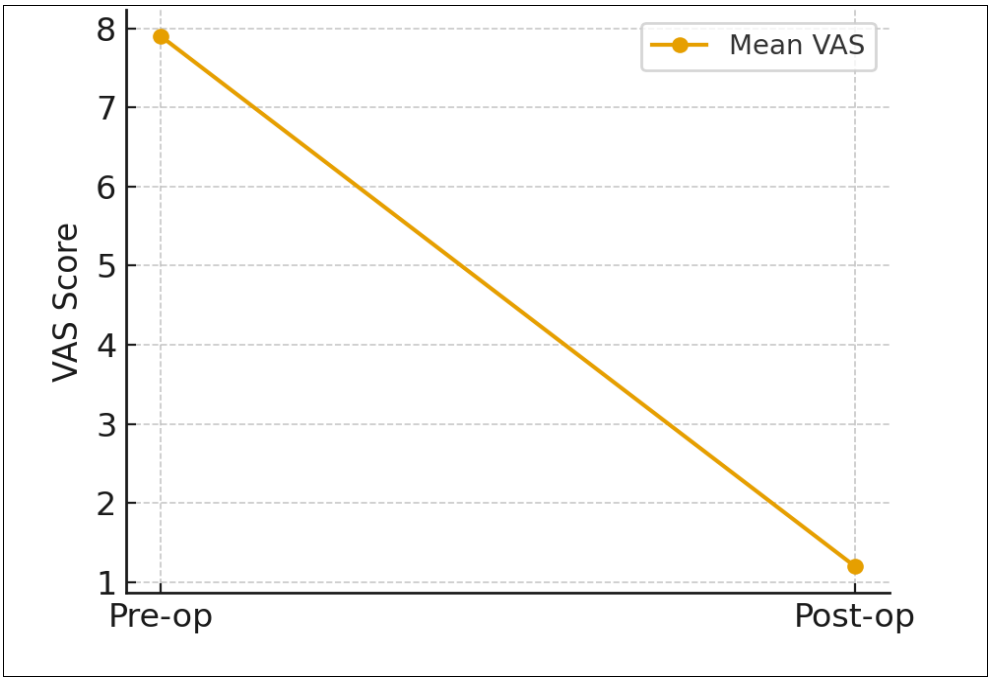

Fig 4: VAS score improvement after medial meniscus root repair

Table 6: Patient Reported Outcome Based on Lysholm Knee Scoring Scale

LYSHOLM SCORE	Pre-operative (No. of patients)	Pre-operative (%)	Post-operative (No. of patients)	Post-operative (%)
Poor (<65)	30	85.7 %	0	0 %
Fair (66–83)	5	14.3 %	3	8.6 %
Good (84–94)	0	0 %	18	51.4 %
Excellent (95–100)	0	0 %	14	40 %

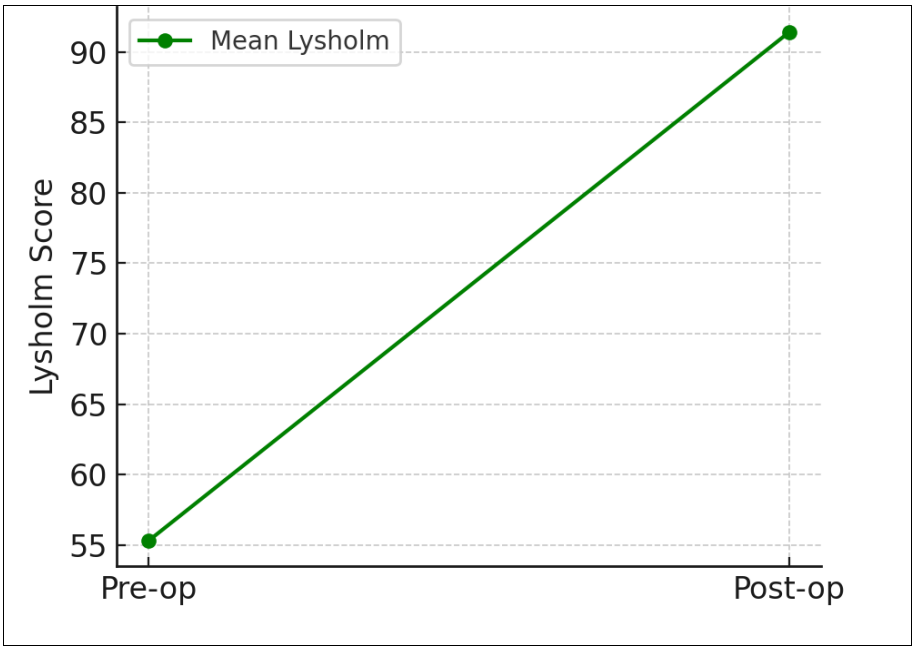

Fig 5: Lysholm score improvement after medial meniscus root repair.

Intraoperative Findings: Synovitis along with ICRS grade II-III chondral changes over medial compartment were frequently observed.

Complications: One patient developed abscess over suture disc site after 4 months and was operated with incision and drainage and removal of disc under local anesthesia. Post-operative she had no complaints and her VAS score improved from 7 to 2 and Lysholm score from 57 to 88 at final follow up.

Discussion

This study demonstrates that arthroscopic medial meniscus root repair provides significant pain reduction and functional recovery. The marked improvements in both VAS and Lysholm scores confirm the clinical value of restoring meniscal root continuity.

Biomechanically, a posterior root tear is equivalent to a total meniscectomy, as it abolishes hoop stress and increases tibiofemoral contact pressures, accelerating cartilage degeneration [2]. Several cadaveric studies have shown that anatomic root repair restores near-normal joint mechanics [7]. Our results, showing significant improvements in functional outcomes, corroborate these findings.

The predominance of middle-aged women in our series (85.7%) is consistent with epidemiological studies. Degenerative medial root tears have been strongly associated with varus alignment, female sex, and obesity [4, 5]. This demographic similarity suggests that our cohort is representative of global trends.

Comparisons with published literature highlight similar postoperative outcomes. Chung *et al*. [5, 6] and LaPrade *et al*. [7] reported postoperative Lysholm scores between 85-95 and substantial reductions in pain scores after transtibial pullout repair. In line with these findings, our study achieved a mean postoperative Lysholm of 91.4, reflecting excellent restoration of function.

The clinical importance of root repair lies not only in pain relief but also in its ability to prevent or delay progression to osteoarthritis. Studies have shown that partial meniscectomy or non-operative management leads to rapid joint space narrowing and higher conversion rates to knee arthroplasty [8, 9]. Conversely, root repair demonstrates improved long-term joint preservation [10, 13, 15].

Emerging surgical modifications, such as suture-anchor techniques and augmented pullout fixation, have shown equivalent biomechanical strength [11, 12]. However, long-term randomized controlled trials are still limited. Our study adds to the growing body of evidence supporting root repair as a superior treatment option compared with meniscectomy.

Limitations of our study include its single-center design, relatively small sample size (35 patients), and short-term follow-up. We also did not evaluate radiographic or MRI outcomes, which could provide additional evidence of joint preservation. Despite these limitations, the consistency of results across multiple cohorts suggests high external validity.

Implications for practice: Early recognition and prompt repair of medial meniscus root tears, especially in middle-aged women with changes of early osteoarthritis may prevent premature degenerative arthritis and reduce the need for arthroplasty.

Conclusion

Arthroscopic medial meniscus root repair provides substantial improvements in pain relief and functional recovery, particularly in middle-aged female patients. This technique should be favored over meniscectomy in appropriately selected cases.

Conflict of Interest

Not available.

Financial Support

Not available.

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