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FUNCTIONAL OUTCOMES OF TRANSTIBIAL PULLOUT TECHNIQUE OF MENISCAL ROOT REPAIR

Orthopaedics

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ABSTRACT

Objectives: This study aimed to evaluate the functional outcomes of the knee in patients undergoing meniscal root repair using transtibial pullout technique. **Materials and Methods:** Conducted as a prospective study, this research included 26 patients with meniscal root tears who were treated through arthroscopic repair. Follow-up assessments were carried out at 6 weeks, 3 months, and 6 months post-surgery. Functional outcomes were measured using the Visual Analog Scale (VAS) and the Lysholm Knee Score. **Results:** The preoperative VAS score averaged 7.46. Postoperative VAS scores were 4.23 at 6 weeks, 3.12 at 3 months, and 1.19 at 6 months. These reductions were statistically significant with a p-value < 0.001. Most patients experienced excellent improvements in the range of motion, with the overall enhancement being statistically significant (p-value < 0.001). The Lysholm Knee Scores also showed significant improvement: the preoperative score was 68.52, which increased to 81.72 at 6 weeks, 85.72 at 3 months, and 92.23 at 6 months postoperatively. These improvements were statistically significant with a p-value < 0.001. **Conclusion:** The study found that sports-related injuries were more common, particularly among young males. Post-meniscus repair, a good range of motion can be restored if an appropriate postoperative physiotherapy rehabilitation protocol is followed, allowing many patients to regain knee function.

KEYWORDS

Meniscus Tear, Root Repair, Arthroscopy, VAS, Lysholm Knee Score

INTRODUCTION:

One of the primary weight-bearing joints in the lower extremities is the knee joint. Until the second half of the twentieth century, the knee menisci were believed to be functionless remnants of developing leg muscles [1]. However, it was soon realized that these structures are crucial for preventing the onset of osteoarthritis and maintaining joint health [1]. Studies to evaluate the precise structure and function of the menisci began in the 1970s and 1980s. This research led to a shift in treatment protocols, emphasizing meniscus preservation [2].

The aim of surgical therapy for knee injuries is to restore function by preserving the mechanical axis and ensuring ligament stability. This allows the knee joint to function painlessly and with a proper range of motion [3,4]. The menisci are two fibrocartilaginous structures in the knee essential for proper knee function and joint preservation. They bear between 40 and 70 percent of the stress transmitted through the knee. Additionally, the menisci play a critical role in maintaining knee stability. Intact menisci can convert the axial strain from tibiofemoral contact into hoop stress, thereby preserving the integrity of the knee joint [5].

The integrity of the meniscal root insertion is crucial for maintaining proper knee kinematics and preventing degenerative changes. Injuries to the meniscal attachments can lead to increased cartilage stress, meniscal extrusion, reduced contact surface, and ultimately, articular degeneration [6]. Rapid degeneration of the knee can result from a total meniscectomy. Clinical and biomechanical evidence indicates that meniscal root tears and avulsions are functionally equivalent to a total meniscectomy. Lateral root tears often occur in conjunction with knee ligament sprains and tears, while preexisting knee arthritis can lead to more chronic medial root tears.

When a meniscal root tear is detected in a knee with minimal to no arthritis, it is recommended to perform meniscal root repair. In cases where chronic root tears are due to osteoarthritis, conservative treatment is preferred. The anterior cruciate ligament (ACL), the most frequently injured among the major knee ligaments, is highly susceptible to injury. Meniscus damage is associated with 50% of acute ACL tears and increases to 90% in chronically ACL-deficient knees. Failure to address meniscal root tears concurrently with ACL tears can exacerbate symptoms of instability and adversely affect the outcomes of ACL reconstruction. Therefore, our study aimed to evaluate the functional outcomes of arthroscopic meniscal root repair.

MATERIALS AND METHODS

We conducted a prospective study involving 26 patients who were diagnosed with meniscal root tears and treated with arthroscopic repair between march 2022 and September 2023. The patients were followed up at 6 weeks, 3 months, and 6 months postoperatively.

Inclusion Criteria:

1. Patients diagnosed with a meniscal root tear who underwent arthroscopic repair.
2. Patients with confirmed meniscal root tear during surgery.
3. Age range: 18 to 50 years.

Exclusion Criteria:

1. Patients who declined arthroscopic repair.
2. Patients with osteoarthritis.
3. Patients with significant comorbidities that made them unsuitable for surgery.

Methodology

Clinical examinations were performed postoperatively at 6 weeks, 3 months, and 6 months to assess patient progress and outcomes.

Operative Procedure

Positioning: After anesthetic induction, the limb was prepared and draped following standard aseptic techniques. The application of a thigh tourniquet was routine. The knee was flexed to at least 90 degrees, ideally achieved by hanging the affected leg off the edge of the table.

Operative procedure of meniscal root repair:

Standard medial and lateral parapatellar arthroscopic portals were created. After identifying the meniscal root tear, we meticulously prepared the attachment site of the meniscal root. The tibial footprint where the root attaches was decorticated to expose the bone before suturing the meniscal root. This careful preparation aimed to create an optimal environment for the meniscal root to heal and reattach to the tibial plateau. Our approach followed the principles of transtibial meniscal root restoration, which is increasingly recognized as the gold standard procedure for restoring the large footprint at the native attachment site of the meniscal root and maintaining normal joint contact pressures. When access into the medial joint space was limited, pie crusting the femoral side of the MCL from outside-in with a spinal needle was employed to enhance the working space. A No. 2 non-absorbable suture was then passed through the meniscus root using a suture passing device, specifically a Knee Scorpion (Arthrex, Naples, FL), or FIRSTPASS MINI (Smith & Nephew), for suture passage.

An Anterior Cruciate Ligament (ACL) guide was introduced from the medial portal, and centered on the root footprint. A 3-cm incision was then made adjacent to the tibial tubercle on the ipsilateral side to the meniscal tear. A guide pin was advanced from the proximal medial tibia to the ACL guide tip. Over the guide pin, we drilled a 4.5 mm tunnel, carefully breaching the tibial surface. We then inserted the suture loop into the joint through the tibial tunnel using the reverse end of a guide pin and retrieved it through the anteromedial portal. The sutures that had been previously passed through the meniscal root were then pulled through the tibial tunnel using the suture loop. Finally, these sutures were secured over a screw or cortical button.

Rehabilitation protocol:

1. Non-Weightbearing Phase (First 6 Weeks):

- Remain non-weightbearing for at least 6 weeks.
- In the first 2 weeks post-surgery, engage in early joint range of motion exercises to promote joint nutrition. Limit knee flexion to 90 degrees to avoid increasing peak contact pressure and posterior extrusion forces on the meniscal root.
- Perform knee flexion passively for the first 6 weeks to avoid hamstring pulling forces, particularly through the semi membranosus attachment at the posterior knee joint capsule.

2. Gradual Weight bearing Phase (Weeks 6-9):

- At 6 weeks, if progressing well, start gradually moving toward full weight bearing over a 2-3 week period.
- Consider using an unloader brace to modulate medial compartment loading.

3. Activity Restrictions (First 4 Months):

- Avoid aggressive resisted hamstring curls and deep squatting beyond 70 degrees of knee flexion to prevent excessive tension and loading on the healing meniscus root.

Follow up:

Duration after surgery: 6 weeks/ 3 months/ 6 months

RESULTS:

In this study, it was found that most of the 26 patients were between the ages of 40 and 50. The average age of the patients was 40.3 years, with a standard deviation of 9.37 years. Regarding gender distribution, the majority of the patients were male, comprising 69.23% (18 patients), while females accounted for 30.77% (8 patients).

In this study, we evaluated the modes of injury among 26 cases and found that 1 case (3.85%) was due to fall from height, and 2 cases (7.69%) were due to road traffic accidents (RTA). The remaining 23 cases involved knee twisting, with 10 of these (38.46%) occurring during sports activities and 13 cases (50%) resulting from minimal twisting. Additionally, when evaluating the side of surgery, we observed that the majority of patients (17, or 65.38%) had right-sided injuries. Furthermore, among the 26 cases, 23 patients had medial meniscus root tears and 3 patients had lateral meniscus root tears, all of which were posterior root tears.

In the present study assessing the range of motion before surgery, it was found that 53.85% of the patients experienced a mild restriction in their range of motion (Table 1).

Table 1: Pre-operative range of motion.

Pre-operative ROM	Number of patients	Percentage of patients
Less than 80 degrees	1	3.85
80 – 90 degrees	13	50
90 – 120 degrees	9	34.62
More than 120 degrees	3	11.54

In the present study evaluating the range of motion following surgery, most patients achieved a good range of motion of 130 degrees, with 6 patients (23.08%) reaching this benchmark (Table 2). Overall, the improvement in the range of motion was statistically significant, with a p-value of less than 0.001.

Table 2: Post-operative range of motion

Post-operative ROM	Number of patients	Percentage of patients
Less than 80 degrees	1	3.85
80 – 90 degrees	0	0
90 – 120 degrees	19	73.08
More than 120 degrees	6	23.08

In the present study evaluating complications following surgery, it was found that most patients experienced no complications. However, 1 patient (3.85%) developed knee stiffness post-surgery.

In the present study evaluating the LYSHOLM Knee Score, there was a significant difference between the pre-operative and post-operative scores at each follow-up. The pre-operative score was 68.52, while the post-operative scores were 81.72 at 6 weeks, 85.72 at 3 months, and 92.23 at 6 months. Compared to the pre-operative scores, the difference at the end of 6 months was statistically significant, with a p-value of less than 0.001 (Table 3).

Table 3: LYSHOLM Knee Score

LYSHOLM Knee score	Pre-operative score	Post-operative score		
		6 weeks	3 months	6 months
Mean	68.52	81.72	85.72	92.23
SD	4.37	3.91	3.91	2.27
P value		< 0.001	0.046	0.031

In the present study evaluating the VAS Score, there was a significant difference between the pre-operative and post-operative scores at each follow-up. The pre-operative VAS score was 7.46, while the post-operative scores were 4.23 at 6 weeks, 3.12 at 3 months, and 1.19 at 6 months. Compared to the pre-operative scores, the difference at the end of 6 months was statistically significant, with a p-value of less than 0.001 (Table 4).

Table 4: VAS Score

VAS Score	Pre-operative score	Post-operative score		
		6 weeks	3 months	6 months
Mean	7.46	4.23	3.12	1.19
SD	0.86	0.91	0.521	0.40
P value		< 0.001	0.02	0.015

Following surgery, there was an excellent outcome in 19 cases based on the LYSHOLM Knee Score (Table 5).

Table 5: Outcomes Post-Operative based on LYSHOLM Knee score

Results	Number of patients	Percentage of patients
Excellent	19	73.07
Good	6	23.07
Fair	0	0
Poor	1	3.85

DISCUSSION:

In this research, we assessed the effectiveness of functional meniscal root repair and compared our results with those from other studies. When examining the age distribution of our 26 cases, we discovered that the majority of patients were within the 40-50 year age range. The average age was 40.03 years with a standard deviation of 9.37 years. Our findings were then compared to those in other studies (see Table 6).

Table 6: Comparison of the Age distribution with other studies.

	Study year	Age distribution (mean age)
Venkata RiteshAkarapu [7]	2018	18-40 (27.5)
Dandy et al [8]	2004	10-78 (38.4)
Simpson et al [9]	1986	7-67 (30.7)
Tregonning et al [10]	1983	15-54 (27)
G. Ramesh et al [11]	2015	10-40 (27.05)
Present Study	2023	18-50 (40.03)

In our current study on gender distribution, we found that among the 26 cases, the majority were males (18 patients, 69.23%). Meniscal injuries are more prevalent in males, likely due to their higher participation in aggressive sports and manual labor, which increase the risk of rotational knee injuries. For females, the most common cause of meniscus injury was twisting the leg at home.

Table 7: Comparison of the Gender distribution with other studies.

	Study year	Males	Females
Venkata Ritesh Akarapu [7]	2018	16 (80%)	4 (20%)
Simpson et al[9]	1986	90%	10%
Tregonning et al[10]	1983	40	5
G. Ramesh et al [11]	2015	17 (85%)	3 (15%)
Present Study	2021	18 (69.23%)	8 (30.77%)

In our current study evaluating the side of surgery, we found that among the 26 cases, the majority of patients had right-sided injuries (17 patients, 65.38%) (see Table 8).

Table 8: Comparison of side of surgery distribution with other studies.

	Study year	Right	Left
Venkata Ritesh Akarapu [7]	2018	13	7

Simpson et al[9]	1986	50%	50%
Tregonning et al[10]	1983	22	23
G. Ramesh et al [11]	2015	17	3
Present Study	2021	17 (65.28%)	9 (34.62%)

In our study evaluating the LYSHOLM Knee Score, we observed a significant difference between preoperative and postoperative scores at each follow-up. The preoperative score was 68.52, while the postoperative scores were 81.72 at 6 weeks, 85.72 at 3 months, and 92.23 at 6 months. The improvement from preoperative scores to those at the 6-month mark was statistically significant, with a p-value of less than 0.001.

Comparatively, in Schimmer et al.'s study, 94.8% of patients achieved excellent to good results, and 5.2% had fair to poor outcomes. Ramesh's series reported excellent outcomes in 70% of cases, good outcomes in 25%, and fair outcomes in 5%. Meanwhile, Rao's study found 80% excellent outcomes, 10% good, and 10% poor.

In our current study evaluating the VAS Score, we observed a significant difference between preoperative and postoperative scores at each follow-up. The preoperative VAS score was 7.46, while the postoperative scores were 4.23 at 6 weeks, 3.12 at 3 months, and 1.19 at 6 months. The improvement from preoperative scores to those at the 6-month mark was statistically significant, with a p-value of less than 0.001. Post-surgery, most cases showed excellent outcomes in terms of the range of motion, with overall improvement being statistically significant, also with a p-value of less than 0.001.

CONCLUSION:

In our current study, we found that sports-related twisting injuries were more prevalent, particularly among males and young adults. Following meniscus root repair, patients can achieve a good range of motion postoperatively, with significant improvements in both LYSHOLM and VAS scores, provided that appropriate postoperative physiotherapy is initiated at the right time.

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