

# Evaluation of Functional Outcome of Arthroscopic Meniscal Repair of Knee Joint

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## Abstract

**Background:** Knee joint is the largest and complex weight-bearing joint of the human body. The meniscus is a crescent-shaped fibrocartilaginous tissue in the knee joint. Meniscal tears are the most frequently encountered and treated injuries in the knee joint. This study aimed to evaluate the clinical and functional outcomes for a series of patients who underwent meniscal repair using all-inside technique for meniscal injuries.

**Materials and Methods:** All patients attended to the Department of Orthopaedics, Mysore Medical College and Research Institute, with peripheral meniscal tear operated by arthroscopic meniscal repair by all-inside technique and were evaluated for functional outcome using Lysholm score. Twenty-three cases of knee trauma diagnosed by clinical evaluation and magnetic resonance imaging were recruited for the study.

**Results:** A total of 23 subjects were included in the final analysis. The mean age was  $32.39 \pm 9.24$  years in the study population. A significant portion (47.8%) of the study population belonged to 30–39 years age group. About 82.6% of the study participants were male. Among the study population, 11 (47.8%) participants had good functional outcome, and 12 (52.2%) participants had excellent functional outcome at 12 months. Among the 23 subjects, 8 (34.80%) had isolated meniscal tear, and 15 (65.20%) had either anterior cruciate ligament (ACL) or posterior cruciate ligament plus meniscal injury.

**Conclusion:** The study concluded that arthroscopic meniscal repair is a very effective method of treating meniscal injuries. It gave painless functional knee postoperatively with a good range of movements and increased quality of life. Patients with simultaneous ACL reconstruction had a better outcome than an isolated meniscal repair. However, the comparative statistical analysis could not be made with isolated meniscal repair due to a small study group. Our results were comparable with the various studies with respect to the Lysholm scoring and the outcome.

**Keywords:** Knee joint, Meniscal injuries, Arthroscopic meniscal repair.

## Introduction

The knee joint is the largest and complex weight-bearing joint of the human body. At the same time, its location and absence of thick muscular covering for its protection makes it more prone to injuries, which include twisting injuries. Tearing of meniscus and ligaments is important consequences of twisting knee injuries [1]. Meniscus is a crescent-shaped fibrocartilaginous tissue in the

knee joint. It is important for proper functioning of knee joint as it helps in force transmission, shock absorption, joint lubrication, and maintains joint stability. The establishment of these functions of meniscus has made it an important structure to be preserved by repair or resection following its tear due to knee injury rather than removing it completely which was one of the most preferred treatment options previously followed for meniscal tears [2].

Diagnosis of meniscal tears can be done with clinical examination and confirmed using arthroscopy or magnetic resonance imaging (MRI) imaging techniques. Various studies have established the importance of meniscal

repair instead of meniscectomy because of various functions which are essential for proper functioning of knee joint. Higher contact pressures between articular surfaces are observed when a meniscectomy is performed in comparison with an intact meniscus [3]. Meniscectomy has also been found to be strongly associated with the progression of articular cartilage damage. The benefit of meniscal repair therapy for athletes regarding osteoarthritis prophylaxis and sports activity resumption has been demonstrated. Therefore, the treatment option selected for meniscal tears should be able to preserve as much meniscus tissue as possible. For preserving meniscus, suturing is the best treatment

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option [4].

The advantages of repairing menisci using all-inside technique with fast fix were their ease of use, adaptability to numerous tear patterns, shorter operative times, and decreased surgical morbidity.

Suturing which was earlier done by open surgery now can be done using arthroscopy which has several advantages compared to open surgery. Arthroscopy is a minimally invasive surgery offering advantages such as decreased risk of surgical complications and infections, rapid healing, and less pain. Arthroscopy helps patients to return back to their normal life very quickly.

The aim of this study was to evaluate the 1-year functional outcome of all-inside repair technique using the fast-fix device and to assess the efficacy of this repair technique.

The study also evaluates

- The type and location of meniscal injury and associated ligament injuries
- To study the correlation between the duration from trauma to surgery and its relation with outcome of the surgery.

### Materials and Methods

Twenty-three cases of knee trauma with meniscal injuries, diagnosed by clinical evaluation and MRI which are treated at Mysore Medical College and Research

Institute (MMC and RI) are considered as the study population.

The study was a prospective observational study conducted between January 2018 and June 2019.

### Inclusion criteria

- Patients aged between 17 and 55 years of both genders
- Full-thickness and vertical longitudinal tears greater than 1 cm in length or bucket handle tears in the red-red to the red-white zone.

### Exclusion criteria

- Patients with signs of acute and chronic infections
- Cases with osteoarthritis
- In skeletally immature patients.

### Methodology

All patients attending the Department of Orthopaedics, MMC and RI, with peripheral meniscal tear operated by arthroscopic meniscal repair by all-inside technique and are evaluated for functional outcome using Lysholm score.

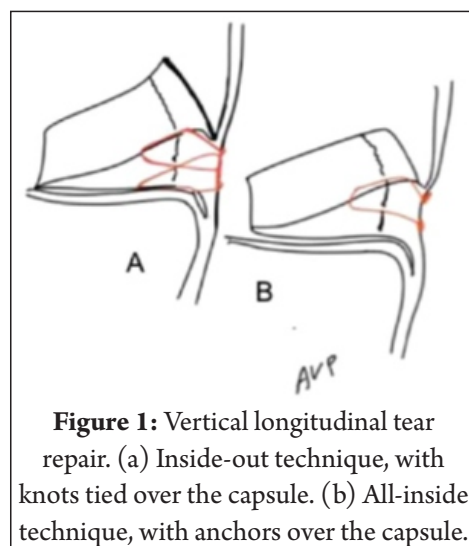
### Lysholm score

The Lysholm score was validated in patients with anterior cruciate ligament (ACL) injuries and meniscal injuries [5, 6]. It has also been validated as a patient-administered instrument to measure symptoms and function in patients with a

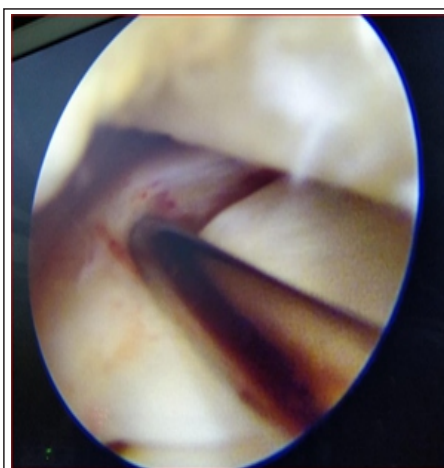
variety of knee injuries [7, 8, 9, 10, 11]. The Lysholm scale does measure the domains of symptoms and complaints and does measure functioning in daily activities slightly, but does not measure the domain of functioning in sports and recreational activities. This scale consists of eight items. It is scored on a scale of 0–100, with higher scores indicating fewer symptoms and higher levels of functioning.

### Surgical procedure

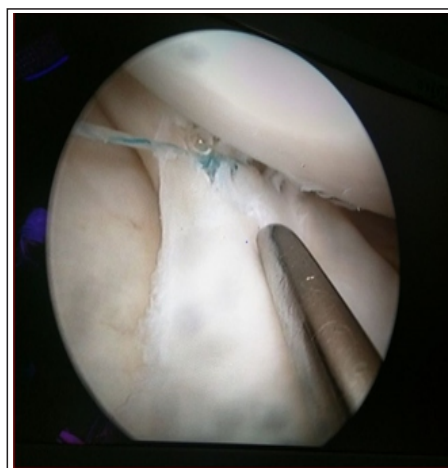
All the arthroscopic procedures were performed under spinal anesthesia. Per operative findings were documented. A 4 mm diameter, 30° angle lens arthroscope through the anterolateral portal was used through which almost all the structures within the joint could be seen. Anchor or suture fixator is introduced from inside the joint through the capsular fragment of the tear until it rests over the capsule. The second implant is introduced through the central fragment of the tear and the capsule. It also rests over the external wall of the capsule. The device was then removed from the joint and the fast-fix knot pusher was used to tension the knot and the suture was then cut. When placing multiple implants, combinations of patterns, including placement of implants inferior to the meniscus, were performed to better reduce the meniscus and to approximate the normal anatomy.



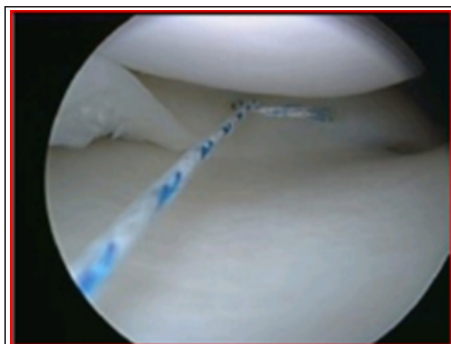
**Figure 1:** Vertical longitudinal tear repair. (a) Inside-out technique, with knots tied over the capsule. (b) All-inside technique, with anchors over the capsule.



**Figure 2:** Posterior horn of medial meniscal tear.



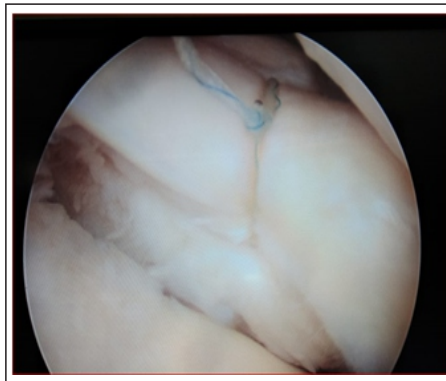
**Figure 3:** Medial meniscal repair by all-inside technique using fast fix.



**Figure 4:** All-inside technique performed for horizontal tear of medial meniscus.



**Figure 5:** Mid substance lateral meniscus tear.



**Figure 6:** Lateral meniscus repair done using all-inside technique.

The meniscal repair was performed using all-inside technique in full-thickness and vertical longitudinal tears greater than 1 cm in length or bucket-handle tears in the red-red to the red-white zone.

After performing a thorough arthroscopy of the knee, the pathological lesion was identified and further surgery was carried out accordingly (meniscal repair for meniscal tear, ACL reconstructions for ACL tears) (Fig. 1-6).

**Post-operative protocol**

The rehabilitation regimen after meniscal repair was divided into three phases. Phase 1 was from surgery up to 4 weeks, during which range of motion (ROM) brace was applied and was fixed at 60° of flexion and 0° of extension with toe touch weight bearing with crutches for the first 2 weeks and partial weight-bearing for the next 2 weeks; Phase 2 was during the 5th–6th weeks when 90° of flexion and 0° of extension were allowed with full weight-bearing with crutches. Patients underwent physiotherapy

treatment with passive joint motion, isometric muscle exercises in the closed chain. Phase 3 was after 6 weeks when full ROM was allowed with full weight-bearing without crutches. When stable repair has been obtained, we allow the patient to return to sport at approximately 3 months, provided that complete return of function has been obtained (Phase 3 criteria were met).

**Statistical methods**

Functional outcome was considered as primary outcome variable. Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables. Data were also represented using appropriate diagrams like bar diagram. The mean functional outcome score at different follow-up periods was compared using the one-way repeated measures analysis of variance. Statistical significance of the pairwise differences was assessed by paired t-test. P < 0.05 was considered as statistically

significant difference. IBM SPSS statistical software version 21 was used for data analysis.

P < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis [12].

**Results**

A total of 23 subjects were included in the final analysis. The mean age was 32.39 ± 9.24 years in the study population, minimum age was 17 and maximum age was 54 in the study population (Table 1). Among the 19 males, 9 (47.37%) were in the age groups of 30–39 and among 4 females, 2 (50%) belonged to this age group (Table 2). Among the study population, the most common mechanism of injury was road traffic accidents followed by other mechanisms of injury (Fig. 7).

The mean of Lysholm score at 6 weeks, 9 weeks, 12 weeks, and 12 months was 72.17 ± 6.83, 82.17 ± 4.78, 88.04 ± 3.18, and 91.26 ± 2.16 in the study population, respectively (Table 3).

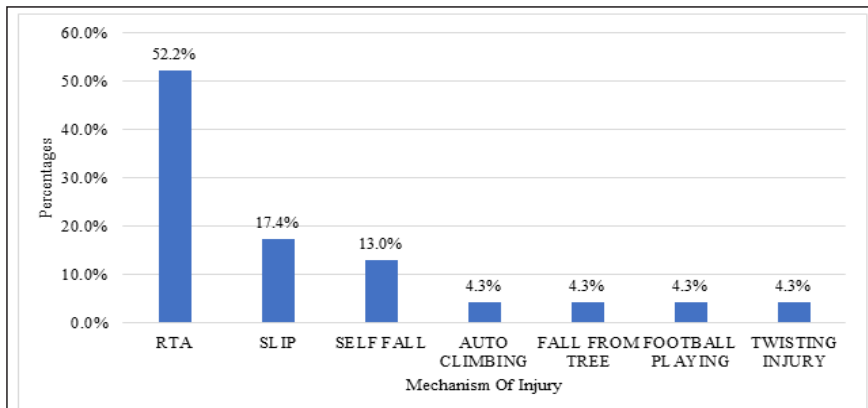
**Table 1: Descriptive analysis of age in the study population (n=23)**

Parameter	Mean±SD	Minimum	Maximum	95% CI	
				Lower	Upper
Age	32.39±9.24	17	54	28.39	36.39

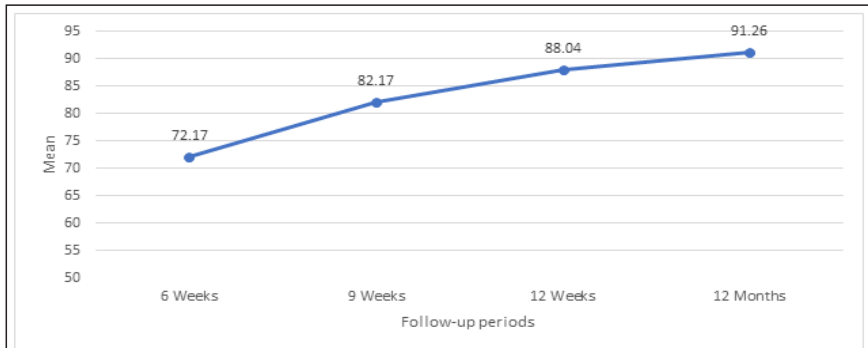
**Table 2: Comparison of age in group between genders (n=23)**

Age in group	Gender (%)	
	Male (n=19)	Female (n=4)
<20	1 (5.26)	1 (25)
21–29	5 (26.32)	1 (25)
30–39	9 (47.37)	2 (50)
40–49	3 (15.79)	0 (0)
>50	1 (5.26)	0 (0)

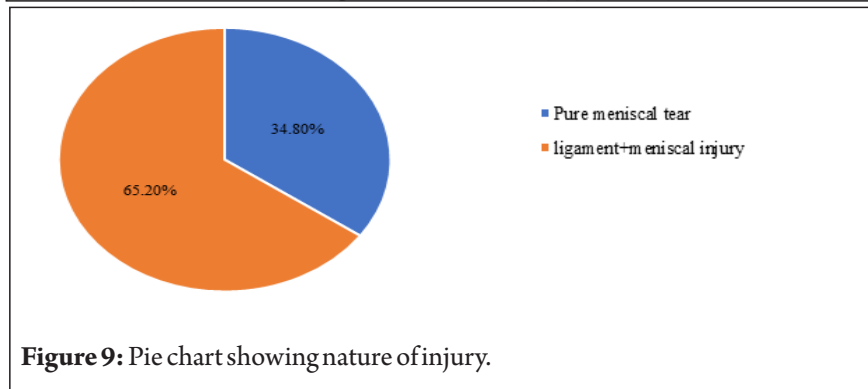




**Figure 7:** Bar chart of mechanism of injury in the study population (n=23)



**Figure 8:** Line diagram of functional outcome at 6, 9, and 12 weeks, and 12 months (Lysholm knee scoring scale) in the study population (n=23).



**Figure 9:** Pie chart showing nature of injury.

Among the study population, 11 (47.8%) participants had good functional outcome and 12 (52.2%) participants had excellent functional outcome at 12 months (Table 4).

The mean of functional outcome at 6 weeks was  $72.17 \pm 6.833$ . By taking the 6 weeks as baseline, the mean difference at 9 weeks was 10.00 and was statistically significant ( $P < 0.001$ ), it was 15.87 in 12 weeks and was statistically significant ( $P < 0.001$ ), it was 19.09 in 12 months and was statistically significant ( $P < 0.001$ ) (Table 5 and Picture 8).

Among the 23 subjects, 8 (34.80%) had isolated meniscal tear and 15 (65.20%)

had both ACL and posterior cruciate ligament (PCL) injuries with meniscal injury (Fig. 9).

**Discussion**

Preserving meniscus by repairing is very important for the functions performed by meniscus and also to prevent development of osteoarthritis in future [13].

Based on these facts, this prospective study of internal derangements of knee aims to evaluate clinical and functional outcomes for patients undergoing meniscal repair using all-inside technique. In addition to this primary

objective, this study also evaluates type and location of meniscal injury and associated ligament injury caused in different types of knee derangements, common mechanisms of knee derangements and correlates duration from trauma to surgery and its relationship with outcome of surgery.

This technique has been implemented extensively in the authors’ practices. This has led to a significant reduction in the necessity to perform the standard inside-out repair with posterior incisions.

This prospective study of 23 patients has shown that this all-inside meniscal repair technique affords a relatively technically simpler procedure with clinical successful rates of repair comparable to those described for traditional inside-out techniques. We are optimistic about the longer term results, but recognize the necessity to evaluate the longer term follow-up.

**Nature of injury**

Among the 23 subjects, 8 (34.80%) had isolated meniscal tear and 15 (65.20%) had both ACL and PCL plus meniscal injury. This finding can be compared with findings in a study by Cipolla et al. [14] where in patients with ACL injuries, in 43.2% of cases, medial meniscectomy was done and medial repairs were done in 21.3% of patients for meniscal injuries. In another study by Nikolić [15], 72.7% lateral meniscal tear were found associated with ACL tears. In another study by Al Saran [16], 59.7% of patients had medial meniscal tears, 30.9% had lateral meniscal tears, and 9.5% had both medial and lateral tears along with ACL tears. This also is similar to the finding in the present study.

**Functional outcome at 12 months**

Among the study population, 47.8% of participants had good functional outcome and 52.2% of participants had excellent functional outcome at 12 months. The mean Lysholm score was  $72.17 \pm 6.833$  at 6 weeks and was

**Table 3: Functional outcome at 6, 9, and 12 weeks, and 12 months (Lysholm knee scoring scale) in the study population (n=23)**

Parameter	Mean±SD	Median	Minimum	Maximum	95% CI	
					Lower	Upper
6 weeks	72.17±6.83	76	63	86	69.22	75.13
9 weeks	82.17±4.78	82	71	90	80.11	84.24
12 weeks	88.04±3.18	89	80	95	86.67	89.42
12 months	91.26±2.16	91	89	95	90.33	92.19

**Table 4: Descriptive analysis of functional outcome at 12 months (Lysholm knee scoring scale) in the study population (n=23)**

Functional outcome at 12 months		
Good (84–90)	11	47.80%
Excellent (>90)	12	52.20%

**Table 5: Comparison of mean of functional outcome score (Lysholm knee scoring scale) at 6, 9, and 12 weeks, and 12 months across the parameter (n=23)**

Follow-up periods	Mean±SD	Mean difference	95% CI		P-value
			Lower	Upper	
6 weeks	72.17±6.83	11.957	9.183	14.73	<0.001
9 weeks	82.17±4.78	10	7.89	12.11	<0.001
12 weeks	88.04±3.18	15.87	13.48	18.26	<0.001
12 months	91.26±2.16	19.09	16.08	22.09	<0.001

statistically significant ( $P < 0.001$ ), it was  $82.17 \pm 4.783$  in 9 weeks and was statistically significant ( $P < 0.001$ ), it was  $88.04 \pm 3.183$  in 12 weeks and was statistically significant ( $P < 0.001$ ), and it was  $91.26 \pm 2.158$  in 12 months and was statistically significant ( $P < 0.001$ ).

The above results show that there is improvement in outcome after meniscal repair over a period of time. This finding is similar to that noted in many studies like study by Higuchi et al. [17] where 79% of patients had a satisfactory outcome after a period of about 12 years, a study by Egli et al. [18] where 90% of patients were found to have normal knee function and 10% had nearly normal knee function in a follow-up after 7.5 years of meniscal repair, in a study by Johnson et al. [19] where clinical success rate was found to be 76% in a follow-up after about 10 years of meniscal repair. In a study by Majewski et al. [20], 64

patients achieved a mean Lysholm score of 94 points after a period of 5 years. This finding can be compared to the mean Lysholm score of  $91.26 \pm 2.158$  which was found at a period of 12 months, 47.8% of study participants had a Lysholm score between 84 and 90, and 52.2% of participants has a Lysholm score above 90 at the end of 12-month study period. The excellent functional outcome noticed in the study participants gradually increased over a period of time and this finding is similar to many studies like study by Nakayama et al. [21] in which 91.3% of participants showed satisfactory outcome after meniscal repair in a follow-up done at a period of 12–33 months, in a study by Pujol et al. [22], 23 patients did not show any signs of osteoarthritis, 6 patients showed Grade 1 arthritis, and only 2 patients showed Grade 2 arthritis and it was concluded that arthroscopic

meniscal repair will help in having long-term protective effects even if initial healing is incomplete. In another study by Stein et al. [23], where functional outcome of meniscal repair and meniscectomy was compared at two periods, one at 3.8 years and other at 4.4 years and it was found that pre-injury activity level was obtained in 96.2% after repair compared with 50% after meniscectomy and no signs of osteoarthritis were seen in 80.8% of cases of meniscus repair as against 40% of cases of meniscectomy.

In the study, the functional outcome in participants did not vary with their age as participants in wide range of age groups were included in the study. This finding can be compared with a finding in the study by Rothermel et al. [24] where no relation between functional outcome after meniscal repair and age of a patient was noted.

The finding that inside-out techniques were considered as the gold standard for large repairs on mid-body and posterior parts of the meniscus in a study by Vaquero-Picado and Rodríguez-Merchán [25], to the findings in the present study as all the participants included in the study had peripheral meniscal tear operated by arthroscopic meniscal repair by all-inside technique were evaluated. The excellent functional outcomes observed in the study are also similar to that found in a study by Weber et al. [3] in which it was noted that partial meniscectomy is advantageous for only short-term relief and fast rehabilitation, whereas improved functional outcome and restoration of meniscal integrity were possible only by arthroscopic meniscal repair.

### Conclusion

The study concluded that arthroscopic meniscal repair is a very effective method of treating meniscal injuries. It gives painless knee postoperatively with good range of movements.

However, the statistical comparative analysis could not be made with isolated meniscal repair due to small study group. Our results were comparable with the various studies showed above with respect to the Lysholm scoring and the outcome.

### Clinical Relevance

The study is very clinically relevant as we prove that arthroscopic meniscal repair is a very effective method of treating meniscal injuries as it has shown good functional outcome by restoration of meniscal integrity.

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Conflict of Interest: NIL  
Source of Support: NIL

### How to Cite this Article

Darshan CK, Patil NV, Rao HRM, Manjunath DN | Evaluation of Functional Outcome of Arthroscopic Meniscal Repair of Knee Joint | Journal of Karnataka Orthopaedic Association | August-September 2020; 8(2): 28-33.