

Original Research Article

Evaluation of functional outcome of bucket handle medial meniscus repair along with anterior cruciate ligament reconstruction

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ABSTRACT

Background: Bucket-handle meniscus tears (BHMT) are often displaced and unstable and comprise nearly 10% of all meniscus tears and commonly affect the young male population. Displacement of the free segment can lead to significant pain and disability, necessitating reduction and surgical treatment. The aim of present prospective longitudinal cohort study was to evaluate the functional outcomes of bucket handle medial meniscus repair along with anterior cruciate ligament (ACL) reconstruction at 2 years follow up.

Methods: Between January 2017 to December 2018, 30 patients who underwent ACL reconstruction along with bucket handle medial meniscus repair were included in the study. Meniscus repair was done using the all inside, outside in, inside out or hybrid techniques. All patients were evaluated clinically at pre op and at 2 year follow up using knee injury and osteoarthritis outcome score and compared. Meniscal healing was assessed clinically using Barrett's criteria.

Results: The study comprised 30 patients with a mean age of 27.47 years (range from 13 to 49 years) with 66.67% males. According to clinical examination and Barrett criteria's the clinical failure rate was 6.67% (2 out of 30 patients) who underwent partial meniscectomy later. We also compared functional outcomes of sedentary and active peoples and also between meniscal repair of less than 3 cm and more than 3 cm's. There was no statistically significant difference in the functional outcomes in both the groups; however range of motion was significantly higher in tear length 3 cm or less compared to more than 3 cm.

Conclusions: Meniscal repair should be aggressively considered in young patients to enhance functional recovery and durability of the knee joint, if the meniscus is repairable.

Keywords: Bucket handle medial meniscus tear, Knee joint, Meniscus repair, Fast fix, Knee injury and osteoarthritis outcome score, Barrett criteria

INTRODUCTION

The meniscus deepens the tibial articular surface, stabilizes the knee joint, allows load transmission, reduces articular contact stress and aids in lubrication.¹ Preservation of the menisci is therefore imperative.

Meniscal repair is preferable over partial or total meniscectomy as the aim is to restore the functional meniscus and prevent early degenerative changes. In biomechanical studies, peak contact pressure was shown

to increase by up to 235% after total meniscectomy and by up to 165% even after partial meniscectomy.^{2,3} In contrast, the contact pressure after meniscal repair decreases almost down to the intact level.³⁻⁵

Anterior cruciate ligament (ACL) ruptures are commonly associated with meniscus tears. The prevalence of associated meniscus injuries in patients with ACL ruptures has been found to be 65% in acute injuries and 90% in chronic injury of ACL.^{6,7}

Meniscus repair performed simultaneously with ACL reconstruction can give additional stability to the knee joint⁸ and positively influence the meniscal healing by bone marrow stimulation.⁹⁻¹¹

Meniscal repair can be performed either with an open or arthroscopic technique. Arthroscopic meniscal repair has advantages over open repair in terms of minimal incision, early recovery and rehabilitation.¹²⁻¹⁴

Arthroscopic repair techniques can be divided into 4 categories: inside-out techniques, outside-in techniques, all-inside techniques and hybrid techniques that combine multiple techniques.¹⁵

A bucket handle meniscal tear (BHMT) has been described as a vertical or oblique tear extending longitudinally and the inner portion is prolapsed into the intercondylar notch.¹⁶

Bucket-handle tears of the meniscus comprise nearly 10% of all meniscus tears and commonly affect the young male population.¹⁷

There are many studies related to meniscal repair in the literature but those showing results of bucket handle medial meniscus repair along with ACL reconstruction are rare. The aim of present prospective longitudinal cohort study was to evaluate the functional outcomes of bucket handle medial meniscus repair along with ACL reconstruction at two years follow up.

We also compared functional outcomes of sedentary and active peoples and also between meniscal repair of tear length less than or equal to 3 cm and more than 3 cm.^{18,19}

METHODS

The present study was conducted on patients of orthopaedic department of hospital in central India (Sri Aurobindo Institute of Medical Sciences and Post-graduate Institute, Indore). It was done over a period of 2 years from January 2017 to December 2018. 145 patients underwent arthroscopic ACL reconstruction along with meniscal repair. Out of which 78 were medial meniscus repair and 34 out of 78 were bucket handle medial meniscus repair.

This prospective longitudinal cohort study included 30 patients of ACL reconstruction along with bucket handle medial meniscus repair as 4 patients lost to follow up. Approval of this study was granted by the institutional review board and informed consent was obtained from all the patients. MRI was done in all patients preoperatively to aid surgical decision.

The inclusion criteria were as follows: an arthroscopic bucket handle medial meniscus repair along with ACL reconstruction, injury due to trauma or sports activities, a repair involving a displaced or non-displaced bucket

handle tears and a rupture involving the red-red (RR; within 3 mm of meniscocapsular junction) or red white (RW; 3 to 5 mm from the meniscocapsular junction) zones. Patients were excluded if they had a previous knee surgery, a follow up duration less than 24 months, pathological conditions in addition to meniscus and ACL rupture like posterior cruciate ligament rupture, medial collateral ligament or lateral collateral ligament rupture etc.

Surgical method

Arthroscopic procedures were performed by the same surgeon under regional or general anaesthesia. After completing diagnostic arthroscopy attention was turned to the medial meniscus. After the meniscal disorder was defined both edges of the tear were refreshed using shaver and rasp and a repair was performed by any of the four methods described earlier. For all inside repair technique fast fix anchors (fast fix 360, Smith and Nephew) or Scorpion device were used. Outside in or inside out repairs were performed using fibre wire. For hybrid repairs fast fix anchors were placed posteriorly and additional inside out or outside in sutures were used for anterior horn.

After meniscal repair single bundle ACL reconstruction was performed using semitendinosus and gracilis hamstring tendons through transportable technique. graft fixation was done with endobutton (fixed loop insta button) on femoral side and interference screw (Biosure PK interference screw) on tibial side.

Postoperative rehabilitation

All patients were allowed to mobilize with support. Toe touching was allowed until sixth post-operative week. Isometric quadriceps exercises and range of motion exercises were commenced in all patients before discharge at post-operative day one. Quadriceps exercises with weights were started three weeks post operatively and full weight bearing was allowed six weeks post operatively. Resumption of sports activities was allowed at the end of sixth to eighth months according to healing and rehabilitation status.

Assessments

All patients were examined clinically at follow up. Patient reported outcomes were assessed preoperatively and post operatively using knee injury and osteoarthritis outcome score (KOOS) knee scoring system and Tegner activity level.²⁰ In addition, Barrett's criteria were used for clinical assessment.

A negative outcome (defined as having at least one positive Barrett criteria) or need for revision surgery indicated clinical failure.

Statistical analysis

Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0.

Continuous variables are presented as mean ± SD and categorical variables are presented as absolute numbers and percentage. The comparison of normally distributed continuous variables between the groups were performed using Student's t test. Nominal categorical data between the groups were compared using Chi-squared test or Fisher's exact test as appropriate. For within the group comparisons, paired t test and between two groups unpaired t test was used to test the significant change in symptoms, pain, functionality living score etc. P<0.05 was considered statistically significant.

RESULTS

Out of 145 patients who underwent ACL reconstruction and meniscus repair 78 underwent medial meniscus repair and 34 out of which underwent bucket handle medial meniscus repair. Four patients lost to follow up. The mean

age of patients was 27.47 years (range from 13 to 49 years) with 66.67% males. Distribution of zone of tear, mode of injury, length of tear, side affected and activity level of patients are described in Table 1.

Table 1: Demographic distribution of patients.

Demographic distribution	
Sex distribution (male/female)	20/10
Side involved (right/left)	19/11
Mode of injury (RTA/sports and others)	12/18
Zone of injury (RR/RW)	10/20
Length of tear (≤3 or >3 cm)	11/19
Activity level of patients (sedentary/active)	12/18

RTA: road traffic accident, RR: red red zone, RW: red white zone.

Table 2: Comparison of preoperative KOOS knee score with two year follow up score.

	Symptoms	Pain	Daily routine	Sports	Quality of life
Pre-op	25.72	28.25	18.58	4.33	9.37
At 2 years	93.22	94.91	96.37	82.17	75.62
P value	0.0001	0.0001	0.0001	0.0001	0.0001
R square coefficient	0.9832	0.9883	0.978	0.946	0.930

Table 3: Comparison of KOOS knee at 2 year follow up in sedentary and active peoples.

At 2 year follow up	Symptoms	Pain	Daily routine	Sports	Quality of life
Sedentary	91.97	94.22	95.1	80.83	75
active	94.05	95.37	97.22	83.06	76.04
P value	0.4448	0.594	0.096	0.755	0.85

Table 4: Comparison of KOOS knee at 2 year follow up in patients with tear length 3 cm or less and more than 3 cm.

At 2 year follow up	Symptoms	Pain	Daily routine	Sports	Quality of life
Less than or equal to 3 cm tear	92.5355	93.94	96.52	86.36	79.545
More than 3 cm tear	93.61	95.47	96.287	79.74	73.355
P value	0.69	0.489	0.872	0.358	0.271

Table 5: Comparison ROM at 2 year follow up in patients with tear length 3 cm or less and more than 3 cm.

At 2 year follow up	Less than or equal to 3 cm tear	More than 3 cm tear	P value	R square value
ROM	134.5	125.8	0.0004	0.3633

Table 6: Comparison of Tegner activity level in ACL reconstruction and bucket handle medial meniscus repair preoperatively and postoperative at two year follow up.

Tegner score	Pre-operative	Post-operative	P value
ACL reconstruction and meniscus repair	1.8±0.7	5.3±1.2	<0.0001

Table 7: Comparison of Tegner activity level in ACL reconstruction and bucket handle medial meniscus repair in sedentary and active people's post-operative at two year follow up.

Tegner score	Sedentary	Active	P value
At 2 year follow up	5.33±0.8	5.38±1.3	0.9

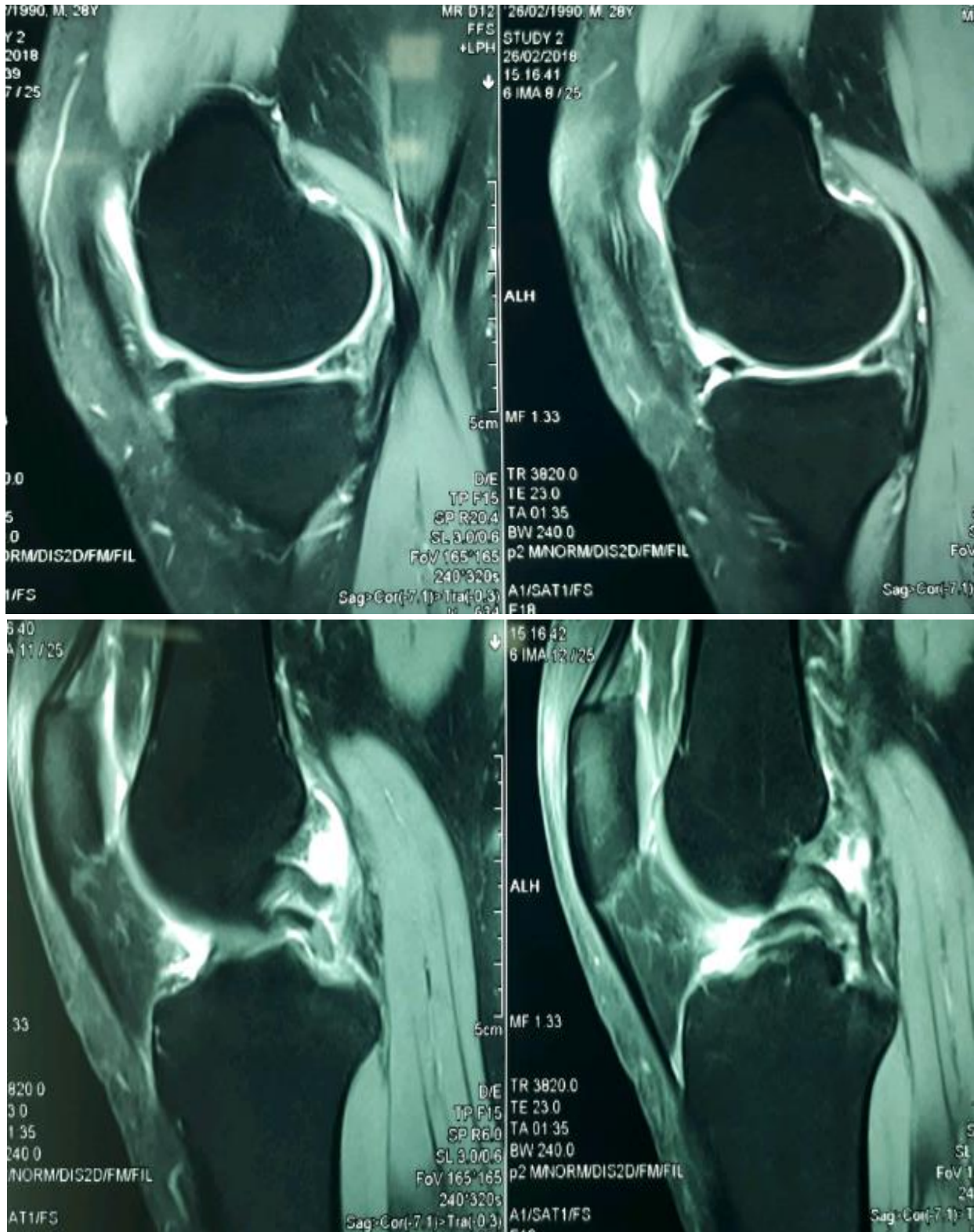


Figure 1: Saggital and coronal MRI images suggestive of bucket handle medial meniscus tear along with ACL tear.



Figure 2: Locked bucket handle medial meniscus.



Figure 3: Well positioned repaired BHMT with four sutures.

Clinical assessments

KOOS knee scoring system and Tegner activity level were used to assess patient's pre operatively and post operatively

at 2-year follow up. There was a highly significant statistical difference in all criteria's of KOOS knee scores (p value 0001) and Tegner activity level (p value 0.0001) on comparing pre-op score with two year follow up scores (Table 2 and 6 respectively). According to clinical examination and Barrett criteria's the clinical failure rate was 6.67% (2 out of 30 patients). Both these patients required partial meniscectomy later. Additionally, asymptomatic unhealed tear was observed in two more patients. One patient treated with outside in technique had superficial infection around the suture material on the capsule which settled with soft tissue debridement and oral antibiotics.

Subgroup analysis

All patients were further divided into two subgroups based on length of tear (less than or equal to three cms or more than three cms) and activity level of patients (sedentary versus active). Table three and four shows functional results of both the subgroups comparing KOOS knee score at two year follow up and table seven and eight shows Tegner activity level in both subgroups at two year follow up. There was no statistically significant difference in the functional outcomes in both the groups (Table 3, 4 and 7); however, ROM was significantly higher in tear length 3 centimeter or less compared to more than 3 cm as shown in Table 5.

DISCUSSION

Meniscal tears are common injuries treated by orthopedic surgeons. Long-term follow-up studies have demonstrated increased arthritic changes after partial meniscectomy when compared with the anatomically normal contralateral knee.²² The load transmitted across knee joint increases with the amount of meniscus removed. As such, meniscal repairs are attempted in suitable patients (young; active) with suitable tears (simple longitudinal tears especially in the red-red/red-white zone) to try and restore the natural function and avoid early arthritic changes.²³ The present study exclusively focused on the clinical outcome of bucket handle medial meniscal repair along with ACL reconstruction. During the study period, indication of meniscal repair was expanded including degenerative tears and chronic tears.

The outcome of meniscal repair in BHMT was successful in our study. All meniscus tears were healed clinically except in two patients who ultimately required partial meniscectomy. Consequently, the follow-up examination of the study subjects showed that more than 90% of the patients could go back to their routine activity level. BHMT are often displaced and unstable, requiring inside-out suture repair for accurate reduction, stabilization and coaptation of the tear edges followed by all-inside or combined repair.²⁴ To avoid the neurovascular complication risk so that the all-inside technique was used in the posterior part of meniscal tears and the inside out technique was used in the middle part of the meniscal tears

because of technical simplicity and to reduce unexpected complications and to provide the cost-effectiveness.

Different success rates of meniscal repair have been reported from 66.1% to 100% but few reports have evaluated BHMT.^{25,27,29-32} Success rates of 83-89.6% have been reported after repair of BHMT.^{26,27,32-34} The high success rate of the current study can be considered to be due to some factors such as the vascularity of the meniscus, concomitant ACL reconstruction and fixation strength. The patients included in this study had red-red and red-white zone tears. Although the healing capacity of the white-white zone tears was low, O'Shea et al reported high healing success of white-white zone BHMT repair. He reported 5 failed in 43 repaired patients with BHMT.²⁶ In combined repairs reported in literature, all have used the all-inside technique in posterior meniscal tears.^{25,27,35}

Many factors, such as a young age, acute tear, rim width less than 3 mm and concomitant ACL reconstruction at the time of meniscal repair, influence the outcome of meniscal repair positively according to reports in literature.^{32,36,37} Time period from injury to repair was not taken much in consideration in our study and we repaired chronic tears also which was supported by recently published study revealed high success rate (83%) in repair of chronic BHMT according to Barrett's criteria at a mean follow-up of 48 months.³⁶ No significant difference was determined in the KOOS scores between less than 3 cm tear and more than 3 cm tear in the patients in our study. Morgan et al reported a 92% failure rate for posterior medial meniscus tears and concluded that meniscal repair failure was strongly associated with an original location in the posterior horn of the medial meniscus and that incomplete healing was also associated with posterior horn repair of the medial meniscus as well as Ahn et al reported.^{29,35} Potential reasons for a higher reoperation rate after repair of the medial meniscus include the fact that the medial side of the meniscus is anchored more tightly to the tibial plateau and that the medial side sees higher biomechanical loads.³⁸ However Ahn et al reported only 3.6% failed healing of medial meniscus posterior horn tears with ACL reconstructions.³⁹ The most important issue is that if residual laxity persists after ACL reconstruction, the medial meniscus may be exposed to greater stress because it is a secondary stabilizer to anterior tibial translation. This may put a repaired medial meniscus under more stress, potentially contributing to more failures.

The all-inside technique is technically more demanding than the inside-out technique and is more expensive compared to inside out technique, so we used combined method of repair in larger tear length and financially weak patients.

We have taken two year follow up in the current and long-term follow-up is needed to make a decision and this can be considered as a limitation of this study. Furthermore, the status of the meniscus could not be seen directly with

second-look arthroscopy in all patients to give accurate results.

CONCLUSION

Meniscal repair should be aggressively considered in young patients to enhance functional recovery and durability of the knee joint, if the meniscus is repairable. It is important for the surgeon to be equipped with familiarity with the operative indications and techniques and full knowledge of the anatomy and prescribe appropriate rehabilitation to produce good outcomes and avoid complications.

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