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Original Research Article

Functional outcome after arthroscopic mosaicplasty for localized osteochondral defects in the knee

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ABSTRACT

Background: Articular cartilage is complex tissue that is able to withstand tremendous amount of force over many cycle but does not have the ability to heal even after minor injury. Treatment recommendation for articular cartilage injury and arthritis includes non-operative and operative management. Mosaicplasty is a reconstructive osteochondral grafting procedure for the treatment of articular defects of the knee. Mosaicplasty entails transplantation of small cylindrical osteochondral grafts from the non-weight bearing area of the femoral condyles and transplanting them in a mosaic like fashion into a prepared defect site on the weight-bearing surfaces of the same knee.
Methods: The present study was carried out in 30 patients in our hospital prospectively to determine the functional outcome results after arthroscopic mosaicplasty for localized osteochondral defects in the knee. We conducted a prospective study on 30 patients of osteochondral defect of knee. Patients were presented with pain and recurrent swelling in the knee after sustaining twisting injury in the knee. Diagnostic arthroscopy was done and the osteochondral defects is localized and treated with mosaicplasty. The graft is harvested arthoscopically from the non-weight bearing part of the femoral condyles using a harvester. Follow up of these patients is done according to Tenger Lysholm knee scoring scale at 03 months, 06 months after surgery.
Results: In our study 93.33% patients showed good to excellent results and 7% patients had fair and poor results.
Conclusions: Advantage of arthroscopic mosaicplasty includes implantation of hyaline cartilage without the need for any suture or adhesive, need for smaller incision minimally invasive and very less complications. Associated injuries like ACL/PCL or meniscal tear can be addressed in the same procedure. To conclude arthroscopic mosaicplasty is excellent procedure to address the focal articular cartilage injuries of knee.

Keywords: Mosaicplasty, Arthroscopy, Osteochondral defect

INTRODUCTION

Articular cartilage is complex tissue that is able to withstand tremendous force over many cycles but does not have the ability to heal even after minor injury. Articular cartilage has a unique composition and arrangement of extracellular matrix with characteristic regional variations that influence its mechanical properties and function. When articular cartilage is damaged there is associated joint swelling and pain.[1] This swelling can persist leading to irritation of the synovium, excessive secretion of synovial fluid and further swelling.[2] Over the time cartilage damage can progress leading to osteoarthritis.[1,3]

Treatment recommendation for articular cartilage injury and arthritis includes nonoperative and operative management. Non operative treatments involve decreasing the load of joint having the patients lose weight, alter the activities and strengthen the muscles across the joint. Orthoses or brace are also beneficial, as are analgesics and anti-inflammatory medications.

Mosaicplasty is a reconstructive osteochondral grafting procedure for the treatment of articular defects of the knee. In general, treatment of articular defect of the knee by mosaicplasty entails transplantation of small cylindrical osteochondral grafts (4 to 10 mm in diameter, 15 to 20 mm deep) from the less /non weight bearing area of the femoral condyles and transplanting them in a mosaic-like fashion into a prepared defect site on the weight-bearing surfaces of the same knee. The advantage of mosaicplasty is the implantation of hyaline cartilage without the need for sutures or adhesive, this technique can be used for both small and medium sized lesions. Although a promising surgical procedure, there is potential for donor-site morbidity (even though the grafts are taken from the non-weight bearing part of the knee).[4] There are also limits to the amount of donor cartilage available to treat larger and multiple lesions. Further limitations include difficulty in matching the contour of the host cartilage and marginal cell death that can precipitate graft degeneration and failure while the disadvantage includes lack of lateral integration with the surrounding cartilage.[5]

The aim of this study was to assess the functional outcome after arthroscopic mosaicplasty for localized osteo-chondral defects in the knee.

To assess the ease achieved in daily living following arthroscopic mosaicplasty using Lysholm knee scoring scale at the end of serial post operative visit.

METHODS

Study site

The study carried out at department of orthopedics, MMIMSR, Ambala, Haryana.

Study population

Consecutive patients amongst those attending the orthopedic OPD at department of orthopedics, MMIMSR, Ambala, Haryana, as per inclusion and exclusion criteria.

Study design

It was a prospective observational study.

Arthroscopic mosaicplasty used for the treatment of localized osteochondral defects in knee joint improves the functional outcome measured in terms of Lysholm knee scoring scale as compared to preintervention values.

Null hypothesis

The null hypothesis to be rejected here is that there is no difference in pre and post intervention values for Lysholm knee scoring scale after arthroscopic mosaicplasty for the treatment of localized osteochondral defects in knee joint.

Duration of study

Study conducted from November 2022 to February 2024.

A prospective and observational study was conducted by identifying patients attending the orthopedic OPD aged 15 to 55 years.

The patients were admitted, and undergone preoperative evaluations which include a detailed history taking and physical examination of the affected knee joint with regard to joint line tenderness, range of motion, laxity of the joint. A pre-op radiological survey in form plain radiographs, MRI and preoperative investigational protocol for assessment of pre-anesthesia check were performed.

All the patients with localized osteochondral defect were treated with arthoscopic mosaicplasty and the cases were followed for a minimum period of six months.

Statistical analysis was done using suitable biostatistical technique on each variable in same patient. Statistical screening of treatment effect was measured by relative risk reduction, absolute risk reduction with adjustment for a small sample size and confounders in the study. Paired the test and other appropriate tests was applied to check for presence of significant difference in outcome variable in pre and post op status. P>0.5% was considered significant.

Inclusion criteria

Patients with age 15-55 years with localized osteochondral defects in knee (MRI proven or incidental detection during arthroscopy) and patient has disabling symptoms limiting the ambulation that have not been relieved by appropriate non-surgical therapies were included in study.

Exclusion criteria

Patients with age less than 15 and more than 55 years, concomitant other medical illness such as malignancy, vascular insufficiency of the lower limb and global articular cartilage changes i.e. tri-compartmental changes were excluded from the study.

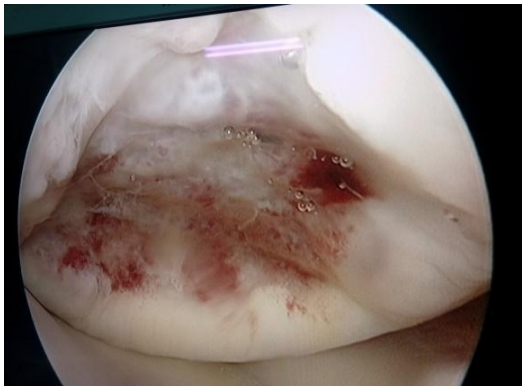

Figure 1: Osteochondral defect.

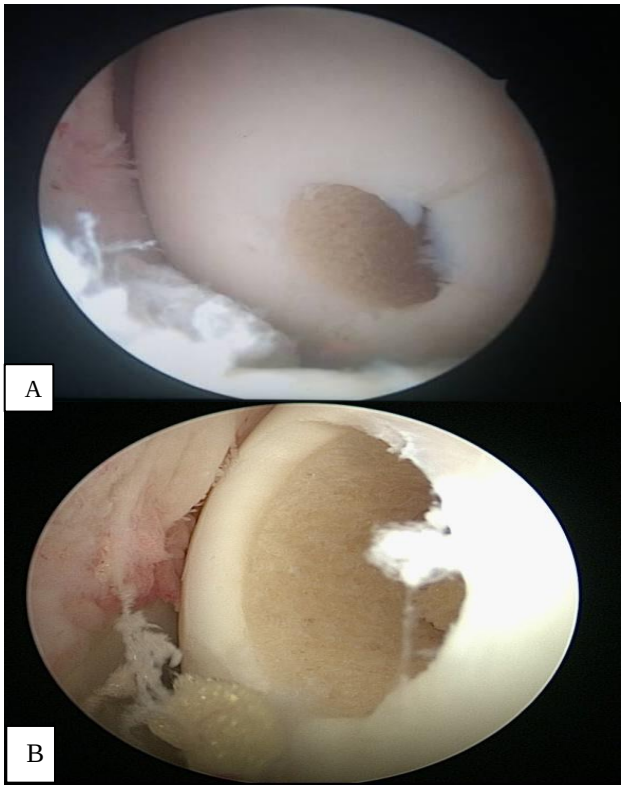

Figure 2 (A and B): Prepared recipient site.

Figure 3: Harvesting the graft.

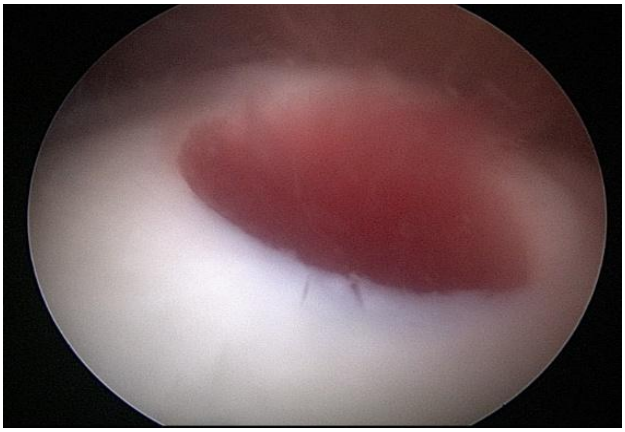

Figure 4: Donor site.

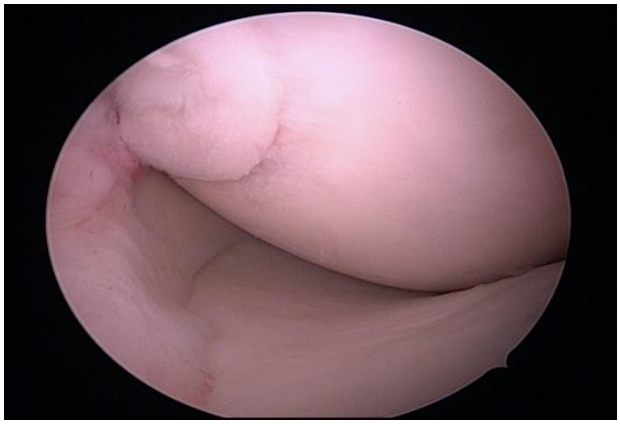

Figure 5: After mosaicplasty.

RESULTS

All the data from cases were collected. Data was studied in references to age, gender distribution, clinical sign and symptoms, mode of injury, laterality, affected bone i.e., femur, tibia or patella, condyle of the femur, arthroscopic findings, other injuries, size of the lesion, no of peg used, any additional procedure performed, complication, and Lyshom knee functional score at 6 weeks, 3 and at 6 months.

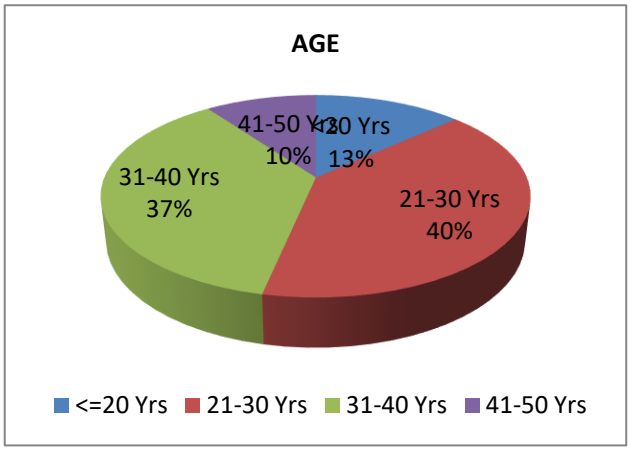

Figure 6: Age distribution.

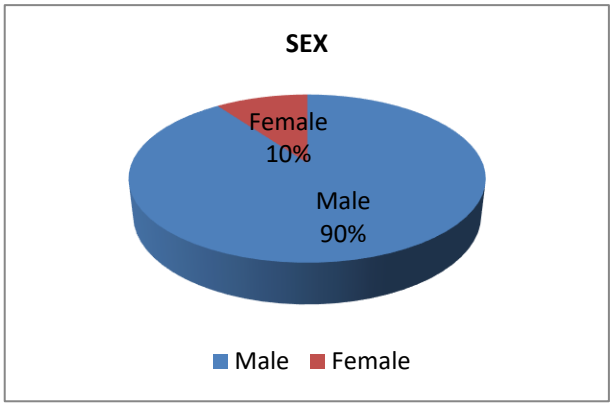

Figure 7: Gender distribution.

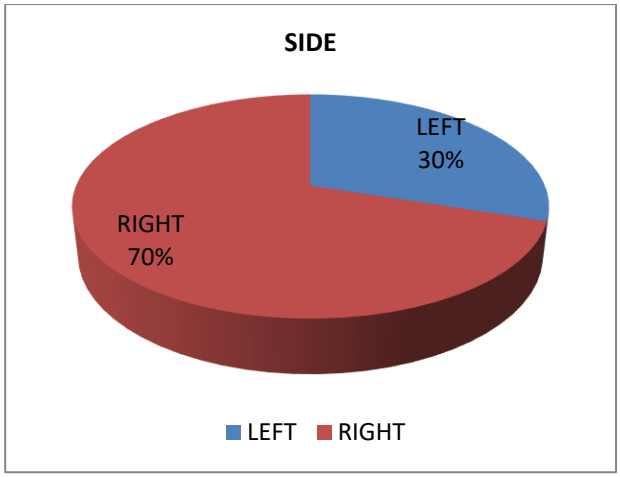

Figure 8: Side affected in study population.

Presenting complain

In our study most commonly patient presented with complain of pain in the knee. This complain was present in all the patients. Complain of laxity of the joint was present in 7 patients i.e., in 30% of the patients, 8 patient i.e., 26.7% were also complaining of locking of the knee.

Size of the lesion

In our study the size of the lesion had varied from 8 to 16 mm^2. Mean size of the lesion was 10.13 mm^2.

No of peg used

In our study 1 peg of different sizes was used in most of the patients, 90% of the patient was treated with 01 peg, in 1 patient 2 peg were used and 2 patient 3 peg were used.

Donor site

In our study non weight bearing surface of femoral condyle was taken as donor site. In 25 (83.3%) patients non weight bearing surface of lateral femoral condyle was taken as donor site. In 16.7% of the patient non weight bearing surface of medial femoral condyle was use as donor site.

Additional procedure performed

Additional procedures performed were shown in Table 1.

Table 1: Additional procedures.

Additional procedure	N	Percentage (%)
ACL reconstruction	9	30
Medial meniscectomy	6	20
Lateral meniscectomy	3	10
Loose body removal	1	3.33
Multiple debridement	1	3.33

Complication

In our study 2 patient had a complication. 1 patient had a complication in form of surgical site infection and another one has failed ACL reconstruction.

Lysholm knee functional score

In our study Lysholm knee functional score was taken to measure the functional outcome. Lowest preoperative score noted was 34 and maximum was 69. Mean score was 56.97. Progressive improvement was seen in most of the patient in score on subsequent visits. Mean score at 6 weeks, 3 months and 6 months were 70, 81.30 and 92.10 respectively with $p<0.001$ which was significant.

Table 2: Lysholm knee scoring.

Paired t test		Mean	N	SD	Mean difference	T value	P value
Pair 1	LKSS pre-op	56.97	30	9.86	-13.03	8.603	<0.001
	LKSS 6 weeks	70.00	30	9.34			
Pair 2	LKSS 6 weeks	70.00	30	9.34	-11.30	16.143	<0.001
	LKSS 3 months	81.30	30	7.91			
Pair 3	LKSS 3 months	81.30	30	7.91	-10.80	20.444	<0.001
	LKSS 6 months	92.10	30	7.82			
Pair 4	LKSS pre-op	56.97	30	9.86	-24.33	14.51	<0.001
	LKSS 3 months	81.30	30	7.91			
Pair 5	LKSS pre-op	56.97	30	9.86	-35.13	18.442	<0.001
	LKSS 6 months	92.10	30	7.82			
Pair 6	LKSS 6 weeks	70.00	30	9.34	-22.10	24.948	<0.001
	LKSS 6 months	92.10	30	7.82			

DISCUSSION

In the treatment of localized osteochondral defect, the goals are- 1) to reduce the pain, 2) to improve the function and 3) to treat the associated injuries like ACL/PCL tear and meniscal injuries. For treatment of localized osteochondral defect, mosaicplasty is an excellent treatment modality. In this study we included 30 patients which were clinically or, MRI proven or incidentally found during diagnostic arthroscopy.

In our study the minimum size of the lesion was 8 mm^2 and maximum was 16 mm^2 in 3 patients. Average size of the lesion was 10.13 mm^2. Nho et al retrospectively evaluated twenty-two patients (mean age-thirty years) followed for a mean of twenty-five months after plug transplantation.[6] A systematic review conducted by Farr et al which included 77 articles, provided some recommendations and strategies for joint cartilage repair, in accordance with the current evidence.[7] He has recommended mosaicplasty for the osteochondral defect of femur measuring less than 2.5 mm^2 with good results. In our study single peg of different sizes were used to fill the defect in 90% of the patients. In 2 patients 3 peg were used and in 1 patient 2 donor peg were used. In our study maximum sized graft used was of 10 mm^2.

Ivănescu et al in their study states that in mosaicplasty group, average area of osteochondral lesion covered with autologous osteochondral transplantation ranged from 0.8 to 6 cm^2 (average: 2.13 cm^2). Diameter of the grafts used ranged from 6 to 10 mm and 1 to 6 grafts were used in each case to achieve >90% covering of the defect area.[8] In our study non weight bearing surface of femoral condyle was taken as donor site. In 25 (83.3%) patients non weight bearing surface of lateral femoral condyle was taken as donor site. In 16.7% of the patient non weight bearing surface of medial femoral condyle was taken. Theoretically an area with low stress whose curve and thickness are similar to that of the recipient site is the ideal site for harvesting.

Garretson et al in their study based on contact pressure on the sides of the trochlea. recommended that, smaller grafts should be harvested from the medial trochlea and larger grafts from the low lateral trochlea.

Ahmad et al in their study recommended that restoring the curvature of the condyle is important to obtain good distribution of stresses over grafted articular cartilage. Two cadaveric studies have shown that the medial or lower lateral trochlea (above the intercondylar groove) provides the best curve for condyles because the upper section is more convex.[10,11] The rim of the groove is flat and can be used to restore the trochlea.

Mode of harvesting

In our study graft was harvested both arthroscopically as well as through mini arthrotomy. In 24 (80%) patient graft was harvested arthroscopically and in 20% of the patient it was done through mini-arthrotomy.

Ivănescu et al used the mini-open technique. Grafts were harvested from the lateral or medial edge of the trochlea. The depth of the donor osteochondral plug ranged from 12 to 15 mm and the recipient site was drilled to such a depth so as to compensate for any potential subchondral bone loss and at the same time allow for some bone impaction.[8]

Lysholom knee functional score

In our study Lysholom knee functional score was taken to measure the functional outcome. Lowest preoperative score noted was 34 and maximum was 69. Mean score was 56.97. Progressive improvement was seen in most of the patients in score on subsequent visits. Mean score at 6 weeks, 3 months and 6 months were 70, 81.30 and 92.10 respectively with $p<0.001$which was significant.

At the 6 month follow up 25 patients (83.33%) had excellent Lysholom knee functional score. 83.33% patients had score more than 90 at 6 month follow up. 3 patients had a good score (84 to 90) at 6 month follow up. One patient had fair and 1 has developed SSI which leads to poor score at 6 months follow up.

Many authors had used the Lysholom knee scoring scale for measuring the clinical outcome in patients treated for osteochondral defects.

Horas et al in 40 patients with a femoral condyle injury, performed a prospective and randomised study comparing ACI and mosaicplasty patients' group.[12] After two years, the functional results were similar in the two groups, although the Lysholm score was better after mosaicplasty.

In the comparative, randomized multicentre study by Dozin et al one third of the enrolled patients improved just with a previous debridement.[13] In the 23 patients left, there was a complete recovery (Lysholm knee scoring) in 88% of the patients treated with mosaicplasty and 68% of those treated with ACI.

Limitations

Even with the limited number of patients, shorter follow up time and the limitations we had during the study period, the results of this prospective observational study support the available published results indicating that mosaicplasty had a definite role in the management of focal articular lesion of the knee. Although a promising surgical procedure, there are few disadvantages also. It can lead to donor-site morbidity (even though the grafts are taken from the non-weight bearing part of the knee) in form of pain and crepitation in joint. Further limitations include difficulty in matching the contour of the host cartilage, limitation of no of donor plug availability and had steep learning curve.

CONCLUSION

It was a prospective observational study of the functional outcome after arthroscopic mosaicplasty for localized osteochondral defects of knee, 30 patients had participated in study and patients were evaluated using Lysholom knee scoring scale. There is no gold standard procedure described in literature for management of these injuries. Arthroscopic mosaicplasty is a single stage procedure to address these injuries. Advantage of arthroscopic

mosaicplasty includes implantation of hyaline cartilage without the need for any suture or adhesive, need for smaller incision minimally invasive and very less complications. Associated injuries like ACL/PCL or meniscal tear can be addressed in the same procedure. To conclude arthroscopic mosaicplasty is excellent procedure to address the focal articular cartilage injuries of knee.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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