



RESULTS OF SUBTOTAL RESECTION OF DISCOID LATERAL MENISCUS

Orthopaedics

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ABSTRACT

Introduction: Discoid Lateral Meniscus (DLM) is an infrequent congenital anomaly of the knee in which the lateral meniscus is discoid in shape rather than normal semilunar configuration. It is seen in 1% to 3% of the normal population with a higher frequency in Asians. It can be complete, incomplete or of Wrisberg type. Symptomatic patients usually with mechanical derangement, tear and degenerative changes require surgical treatment. The traditional treatment of total or subtotal meniscectomy has been considered to lead to an increased risk of degenerative arthritis and therefore, partial meniscectomy has been recommended. **Material and methods:** This is a retrospective study of 18 knees of symptomatic DLM in 17 patients treated during 2019 and 2020 with arthroscopic subtotal resection of the DLM. Tapper and Hoover grading system as well as Modified Lysholm 17 score were used to assess the results. The average follow-up of the series was 28.33 months, ranging from 24 months to 33 months. **Results:** The average Modified Lysholm score for the series at the time of last follow-up was 89.38, ranging from 76 to 96. Of the 18 knees 8 (44.44%) had an excellent result, 9 (50%) had a good result, 1 (5.56%) had a fair result and none had a poor result in the medium-term follow-up of a minimum of 2 years. **Conclusion:** Subtotal resection of DLM for symptomatic cases is an entirely acceptable form of treatment where partial meniscectomy is not feasible. In this study we have seen better results of subtotal resection of DLM in younger patients (adolescent patients and those who have not attained skeletal maturity) than in older patients (post-adolescent patients and those who have attained skeletal maturity), and also better results in male patients than in female patients.

KEYWORDS

Discoid Lateral Meniscus, Subtotal Meniscectomy, Partial Meniscectomy

INTRODUCTION

DLM is a congenital variant of lateral meniscus of the knee. The deformed meniscus can be unstable. DLM was first reported in 1889 by Young¹⁸ following cadaver dissection. Its incidence ranges from 0.4% to 17%, while discoid medial meniscus is rarely detected with an incidence of 0.06% to 0.3%. A higher prevalence of DLM has been reported in the Asian populations (10–15%) than in the Western populations (3–5%)⁵. Bilateral involvement is observed in 15–25% of the patients with DLM⁵. However, Ahn et al.¹ studied MRI of contralateral knees in patients with unilateral symptomatic DLM and reported that 97% of the patients had a complete or incomplete DLM.

Watanabe et al.¹⁵ classified the DLM as complete, incomplete and Wrisberg type DLM, according to the degree of coverage of the lateral tibial plateau and presence of normal posterior attachment. Wrisberg type DLM (type III) is more normally shaped but is unstable because it does not have the usual posterior attachments (coronary ligament or popliteo-meniscal fascicles) and has the posterior menisco-femoral ligament (Wrisberg ligament) only and hence it is hyper-mobile. Klingele et al¹ classified DLM based on the morphology, peripheral rim stability, and presence or absence of meniscal tears as seen on arthroscopy. Ahn et al.¹ classified DLM into four categories based on MRI (no shift, antero-central shift, postero-central shift, and central shift) based on the concept of meniscal shift caused by peripheral detachment of the DLM.

DLM is thicker than normal lateral meniscus and it has enlarged surface and decreased peripheral vascularity. It has heterogeneous and disorganized circumferential network of collagen. Thus, it is prone to tearing. Patients usually present with complaints of clunk in the knee, snapping, locking, giving way, knee pain, limited/painful extension and flexion.

The pain can be due to the internal mechanical derangement caused by the DLM or a tear in the body or peripheral attachment of the DLM as it is prone to injury due to the abnormal shape. Children younger than 10 years of age usually present with snapping/clunking and inability to

achieve full extension, whereas adults present with pain, swelling and giving way of the knee.

Asymptomatic patients do not need treatment. Total or subtotal resection of DLM can lead to degenerative changes of the lateral compartment and therefore for symptomatic patients with DLM, meniscal reshaping such as partial meniscectomy, saucerization, with-or-without debulking and with-or-without repair has been considered better.

MATERIAL AND METHODS

This is a retrospective study of 18 knees of symptomatic DLM in 17 patients treated as shown in Table 1. All these knees were treated during 2019 and 2020 by the senior author. One patient had bilateral DLM, Cases 5 and 6 in Table 1.

Of the 18 knees in this study 11 were in male patients and 7 were in female patients. 12 knee in this study were in adolescent patients and 6 knees were in post-adolescent patients. 8 knees in this study were in patients who had not attained skeletal maturity and there were 10 knees where the patients had attained skeletal maturity with closed distal femoral and proximal tibial physes as seen on MRI scans.

All knees in this study had normal alignment of physiological valgus with female knees having 1-2 degrees more valgus than male knees as in normal population, and there were no knees with either pathological genu valgum or genu varum deformity. All of the knees with DLM in this study were symptomatic and were hence considered for operative treatment. The complaints of these patients included knee pain, clunking, snapping, popping, locking, giving way of the knee, limited painful extension and limited painful flexion.

All the knees in this study had MRI scan done pre-operatively to confirm the diagnosis of DLM. However, MRI scan was not used in this study to classify the DLM preoperatively. MRI also confirmed that all knees in this study had intact ligaments (ACL, PCL, MCL and LCL) and intact articular cartilage in all compartments of the knee. In one case MRI showed tear of the medial meniscus also (Knee 1 in Table 1).

Table 1.

Case Number	Age/ Sex	Side	Symptoms	DLM Type	Follow-Up In Months	Complications	Modified Lysholm Score At Last Follow-Up	Result As Per Modified Lysholm Score And Tapper & Hoover Grading
1	23Y/Male	Right	Knee pain, clunking, giving way and swelling.	Medial meniscus posterior horn tear and Complete DLM with tear.	26	None	89	Good
2	13Y/Male	Right	Knee pain, giving way, popping.	Complete DLM.	31	None	91	Excellent
3	19Y/Female	Right	Knee pain, giving way, snapping.	Complete DLM with tear.	29	None	87	Good
4	18Y/Male	Right	Knee pain, swelling.	Incomplete DLM with tear.	24	None	85	Good
5	15Y/Male	Right	Knee pain, painful terminal, giving way, flexion/extension.	Complete DLM.	27	None	96	Excellent
6	15Y/Male	Left	Knee pain, clunking and painful terminal extension.	Complete DLM.	33	None	94	Excellent
7	22Y/Female	Left	Knee pain, giving way, swelling.	Incomplete DLM with tear.	31	None	87	Good
8	10Y/Male	Right	Knee pain, swelling, giving way	Complete DLM.	28	None	93	Excellent
9	25Y/Female	Left	Knee pain, painful terminal flexion, locking.	Complete DLM with tear.	25	None	86	Good
10	11Y/Male	Left	Knee pain, giving way.	Complete DLM.	28	None	94	Excellent
11	17Y/Female	Right	Knee pain, clunking.	Complete DLM with tear.	31	None	86	Good
12	16Y/Male	Right	Knee pain, giving way.	Complete DLM.	24	None	88	Good
13	20Y/Female	Left	Knee pain, limitation of terminal extension, locking.	Incomplete DLM.	26	None	87	Good
14	15Y/Male	Left	Knee pain, clunking.	Complete DLM.	30	None	94	Excellent
15	18Y/Male	Right	Knee pain, giving way.	Complete DLM with tear.	27	None	95	Excellent
16	20Y/Female	Right	Knee pain, swelling.	Complete DLM with tear.	29	None	89	Good
17	26Y/Male	Left	Knee pain, giving way, popping.	Complete DLM with tear.	32	None	76	Fair
18	13Y/Female	Right	Knee pain, painful terminal flexion and extension.	Complete DLM.	29	None	92	Excellent

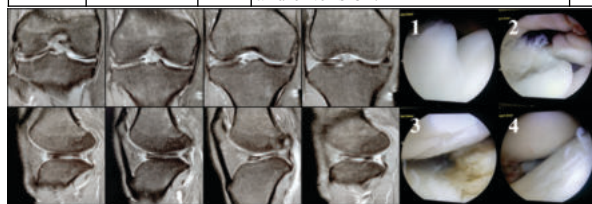


Figure 1: MRI and Arthroscopy Photos of a case of complete DLM in a skeletally mature patient of the DLM. Arthroscopy Photos 1,2,3 and 4 in that order show the complete DLM, beginning of partial resection of the DLM, after partial resection of the DLM showing extensive intra-substance degeneration of posterior portion of the DLM and finally after subtotal resection of the DLM.

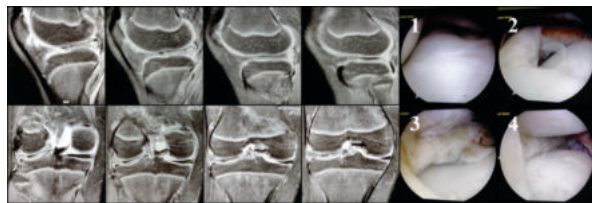


Figure 2: MRI and Arthroscopy Photos of a case of complete DLM in a skeletally immature patient showing degeneration of the DLM. Arthroscopy Photos 1,2,3 and 4 in that order show the complete DLM, beginning of partial resection of the DLM, after partial resection of the DLM showing extensive horizontal cleavage type of degenerative tear of posterior portion of the DLM and finally after subtotal resection of the DLM.

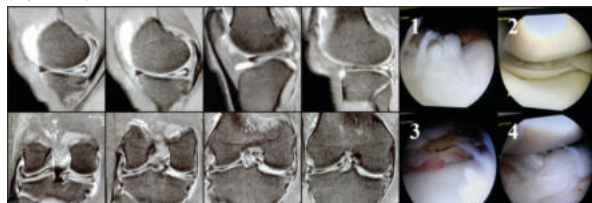


Figure 3: MRI of a case of complete DLM in a skeletally mature patient showing degeneration and tear of the DLM and also tear of the medial meniscus. Arthroscopy Photos 1,2,3 and 4 in that order show the complete DLM, medial meniscal tear, after partial resection of the DLM showing extensive horizontal cleavage type of degenerative tear of posterior portion of the DLM and finally after subtotal resection of the DLM.

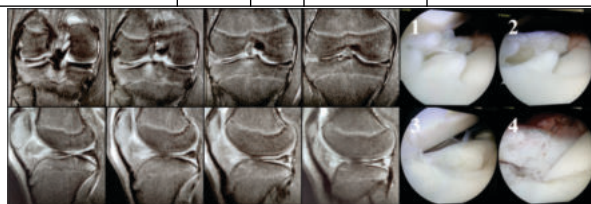


Figure 4: MRI of a case of incomplete DLM in a skeletally immature patient showing degeneration and tear of the DLM. Arthroscopy Photos 1,2,3 and 4 in that order show the complete DLM with tear, different view of the DLM with tear, after partial resection of the DLM showing extensive horizontal cleavage type of degenerative tear of posterior portion of the DLM and finally after subtotal resection of the DLM.

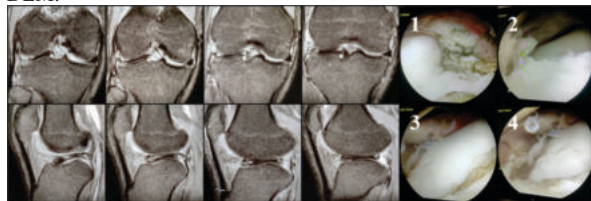


Figure 5: MRI of a case of complete DLM in a skeletally mature patient showing degeneration and tear of the DLM. Arthroscopy Photos 1,2,3 and 4 in that order show the complete DLM, after partial resection of the DLM showing extensive horizontal cleavage type of degenerative tear of posterior portion of the DLM, after subtotal resection of the DLM and finally picture showing the extent of anterior horn left behind after subtotal resection of the DLM.

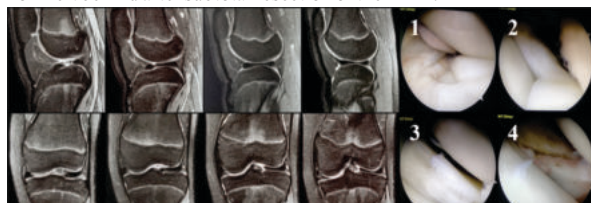


Figure 6: MRI of a case of complete DLM in a skeletally immature patient showing degeneration and tear of the DLM. Arthroscopy Photos 1,2,3 and 4 in that order show the complete DLM, different view of the complete DLM, after partial resection of the DLM showing extensive horizontal cleavage type of degenerative tear of posterior portion of the DLM and after subtotal resection of the DLM.

All knees were treated with arthroscopic subtotal resection of the meniscus by the senior author¹. Classification of the DLM in these knees was based on arthroscopic findings. Of the 18 knees in this series, 15 were of Watanabe Type I (Complete Type), 3 were of Watanabe Type II (Incomplete Type) and there were none of Watanabe Type III (Wrisberg type). Of the 15 knees of Complete Type, 7 had tear of the meniscus and 8 had intact meniscus, and of the 3 knees of Incomplete Type, 2 had tear of the meniscus and 1 had no tear.

Arthroscopy of the knee was done with tourniquet control under spinal anaesthesia. Lateral compartment of the knee was accessed with the leg in a figure-of-4 position. Diagnostic arthroscopy was carried out using a standard anterolateral parapatellar portal using a standard 30 degree arthroscope. A standard anteromedial parapatellar portal was used for probing and instrumentation. The DLM was assessed for any peripheral instability and for any tears.

Using a standard straight arthroscopic punch, partial resection of the DLM was carried out beginning at the medial free edge of the DLM. Saucerization of the DLM was considered complete once 8-10 mm of peripheral meniscal tissue was left behind in the posterior and lateral portions of the DLM for adolescent or adult patients and 6-7 mm for pediatric patients. The anterior horn portion was difficult to resect with a punch forceps and hence leaving behind slightly larger portion of the anterior portion was accepted. After completion of partial resection, the remaining meniscus was probed for stability and degenerative tears.

Of the 18 knees in this series 15 were of Watanabe Type I (Complete Type), 3 were of Watanabe Type II (Incomplete Type) and there were none of Watanabe Type III (Wrisberg type). Of the 15 knees of Complete Type, 7 had tear of the DLM extending to its surface or its medial edge and 8 had no such obvious tear, and of the 3 knees of Incomplete Type, 2 had tear of the DLM extending to the surface of its medial edge and 1 had no such obvious tear. In 14 of 18 knees degeneration of the DLM in the form of horizontal cleavage was evident during partial resection with the meniscus having a superior and an inferior leaflet. In the other 4 knees probing of the DLM left behind showed some degeneration of the thick peripheral lateral and posterior portions.

In the DLM with a horizontal cleavage degeneration, the loose and irregular tissue within the leaflets of the remaining DLM was resected using a punch forceps, a shaver or a RF wand. The remaining portion of the DLM was then assessed for stability by probing its peripheral attachments and for feasibility of repair as well as its thickness.

In 11 cases debulking of the thick DLM was done by resection of the upper leaflet. At the end of all this, in none of the 18 knees thus operated, the reshaped DLM was considered suitable for leaving behind or for repair either due to its degeneration, its irregular shape or due to its instability. Thus all of the 18 knees ended up with subtotal resection of the DLM where most of the posterior portion was resected, some of the lateral portion was resected and a substantial amount of anterior portion was preserved. On completion of the operation, the arthroscopy portals were closed in a standard fashion. Postoperatively, the patient was allowed to weight-bear and to flex the knee as tolerated.

RESULTS

Patients were followed-up at 2 weeks, 6 weeks, 3 months, 6 months and after 2 years.

No patient had infection or any other post-operative complication. All knees had full range of movement and all patients were full weight-bearing without any pain at 3 months.

Four grades of activities classified by Tapper and Hoover¹³ as well as Modified Lysholm¹⁷ score were used to assess the result at the time of last follow-up. Patients were asked about the level of their activities. All results were then graded into Excellent, Good, Fair or Poor as per Tapper and Hoover grading system (Table 2) and Modified Lysholm score.

Of the 18 knees 8 (44.44%) had an excellent result, 9 (50%) had a good result, 1 (5.56%) had a fair result and none had a poor result in the medium-term follow-up of a minimum of 2 years. The average follow-up of the series was 28.33 months, ranging from 24 months to 33 months.

The average Modified Lysholm score for the series at the time of last follow-up was 89.38, ranging from 76 to 96.

Of the 7 knees in female patients 1 (14.28%) had an excellent result and 6 (85.71%) had a good result. Of the 11 knees in male patients 7 (63.63%) had an excellent result, 3 (27.27%) had a good result and 1 (9.09%) had a fair result.

Of the 12 knees in adolescent patients 8 (66.67%) had an excellent result and 4 (33.33%) had a good result. Of the 6 knees in post-adolescent patients none had an excellent result, 5 (83.33%) had a good result and 1 (16.67%) had a fair result.

Of the 8 knees in patients who had not attained skeletal maturity 7 (87.5%) had an excellent result and 1 (12.5%) had a good result. Of the 10 knees in patients who had attained skeletal maturity, 1 (10%) had an excellent result, 8 (80%) had a good result and 1 (10%) had a fair result.

Table 2 The Tapper & Hoover Grading System

Excellent	An effective and completely normal knee.
Good	A knee giving minor symptoms, but no disability, i.e. the knee is functional in all activities including vigorous sports, but with some ache or swelling afterwards.
Fair	A knee giving definite symptoms and some disability, preventing vigorous sports.
Poor	A knee giving symptoms, e.g., aching while kneeling or climbing stairs, which interferes with daily activities. Definite mechanical symptoms, e.g., locking, also indicates a poor grade.

DISCUSSION

All the knees in this study had subtotal resection of the DLM where most of the posterior portion was resected, some of the lateral portion was resected and a substantial amount of anterior portion was preserved. Most of the knees had an excellent or good result at follow-up of 2 years. Of the 18 knees 8 (44.44%) had an excellent result, 9 (50%) had a good result, 1 (5.56%) had a fair result and none had a poor result.

In adolescent patients there were more excellent results 8/12 (66.67%) than good results 4/12 (33.33%); whereas in post-adolescent patients there were no excellent results, and there were good results in 5/6 (83.33%) and fair result in 1/6 (16.67%). Also, in patients who had not attained skeletal maturity there were more excellent results 7/8 (87.5%) than good results 1/8 (12.5%); whereas in patients who had attained skeletal maturity there were less excellent results 1/10 (10%) than good results 8/10 (80%) and 1/10 (10%) had a fair result. This is attributable to the fact that younger patients have greater potential for recovery and less degenerative changes in the knee.

In male patients there were more excellent results 7/11 (63.63%) than good results 3/11 (27.27%) and 1 (9.09%) had a fair result; whereas, in female patients there were less excellent 1/7 (14.28%) than good results 6/7 (85.71%). This was possibly because of the average age at presentation of female patients in this series being higher (19.42 years) as compared to that of male patients (16.36 years). Also, this could be due to knees in female patients having a slightly greater angle of physiological valgus than male patients, thus causing higher degree of stress in the lateral compartment of the knee.

It has been reported in the literature that total or subtotal meniscectomy can lead to an increased risk of degenerative arthritis of the knee in the long term. However, on review of literature one can find different and conflicting opinions about the clinical and radiological outcomes following total or subtotal meniscectomy as opposed to partial meniscectomy and meniscoplasty.

Smuin et al.¹² carried out a systematic review of outcomes of symptomatic DLM after total meniscectomy, saucerization and suture repair of tears of the DLM at short-term and long-term follow-up. They stated that long-term data demonstrated significantly improved patient reported outcomes in favor of saucerization over total meniscectomy and that suture repair of tears of DLM did not demonstrate improved outcomes over partial meniscectomy without repair. However, Dae-Hee Lee et al.⁹ carried out meta-analysis to compare the clinical and radiographic results between partial and total meniscectomy in patients with symptomatic DLM, and they concluded that the radiographic outcomes of DLM were better with partial

meniscectomy with or without repair than with total meniscectomy, but their clinical outcomes were similar.

Washington et al.¹⁴ reported total of 18 meniscectomies in 15 patients performed for a DLM with excellent for 10 knees, good for 3 and fair for 5 at an average of 17 years of follow-up, and no degenerative changes were evident on the roentgenograms of the eight patients (9 knees) for whom they were made at the latest follow-up evaluation.

Räber et al.¹¹ reported the long-term results of total meniscectomy performed in 17 knees (14 children) to treat a DLM with mean duration of follow-up of 19.8 years. 7 knees were normal, 6 were nearly normal, 3 were abnormal and 1 was severely abnormal at the latest follow-up evaluation. Radiographs were available for 15 of the knees at the latest follow-up evaluation of which 11 of the treated knees could be compared with the uninvolved, contralateral knee as regards osteoarthritic changes such as flattening of the lateral femoral condyle, formation of a ridge along the lateral femoral condyle and spurring and sclerosis of the tibial plateau.

Lee et al.⁶ reported mid-to-long-term clinical and radiological outcomes after an arthroscopic partial meniscectomy for symptomatic DLM in young patients and to determine whether degeneration of the residual meniscus and articular cartilage progresses during the follow-up period using MRI. Of the 73 knees (66 patients) the reoperation rate was 32.9%, progression of arthritis of the lateral compartment was observed in 68.5% (49 knees) on radiographs and MRI analyses showed that degeneration of the residual meniscus had progressed in 52.9% (34 knees) and significant degenerative changes in articular cartilage were observed in both lateral femoral and tibial condyles.

Lee et al.⁷ also reported a study of 20 patients (21 knees) to assess the change in the thickness and width of the residual meniscus using MRI in patients who underwent arthroscopic partial meniscectomy for DLM, to assess the degeneration of the articular cartilage in the lateral compartment of the knee progressed and to assess the clinical results. At an average follow-up period of 6.8 years they found that the thickness and width of the residual meniscus decreased over time and the arthritic change of the lateral compartment of the knee progressed.

Ahn et al.¹ reported the long-term clinical and radiographic results of arthroscopic reshaping with or without peripheral meniscus repair for the treatment of symptomatic DLM in 38 children (48 knees) with the mean follow-up period of 10.1 years (range 8 to 14 years). Arthroscopic partial meniscectomy was performed in 22 knees (group A), partial meniscectomy with repair in 18 knees (group B) and subtotal meniscectomy in 8 knees (group C). At the final follow-up 94% of all cases showed excellent or good results clinically, although radiographic evaluation showed the development of minor osteophytes in the lateral compartment of 18 knees and moderate joint space narrowing with spur formation in 1 knee. In addition, degenerative changes were observed in 23% of cases in group A, 39% of cases in group B and 88% of cases in group C. Group C showed significantly greater progression of degenerative changes than group A or B.

Ng et al.¹⁰ reported the mid-term to long-term outcomes of meniscopeplasties in 24 knees for DLM. Based on the Ikeuchi score pre-operatively, 15 knees were rated as poor (62.5%), 7 knees were rated as fair (29.2%) and 2 knees were rated as good (8.4%). Also, there was no apparent difference in the improvement in Lysholm score or Ikeuchi score when comparing between patients who had meniscopeplasty alone and patients who had concomitant meniscal repair, as well as when comparing between patients who had meniscopeplasty alone and patients who had concomitant partial meniscectomy.

Yang et al.¹⁶ reported regarding postoperative effect of arthroscopy in the treatment of symptomatic DLM in 502 patients. They concluded that with the increase of BMI, work intensity, age of onset, duration of symptoms and the severity of cartilage lesion and in female patients, the postoperative results were worse. They also concluded that compared to total meniscectomy, meniscopeplasty with a repair was an unfavourable factor for the outcome.

Atay et al.² evaluated radiographic evidence of degenerative changes after arthroscopic partial resection of DLM. 34 symptomatic DLM with tears in 33 patients were analyzed at an average follow-up of 5.6 years. Based on Ikeuchi's grading, 39% of the knees had an excellent

result, 46% had a good result and 15% had a fair result; none of the results was poor. They concluded that at an average 5-year follow-up, partial meniscectomy in patients with a Watanabe complete or incomplete discoid meniscus showed 85% good or excellent clinical results, although a significant percentage of patients showed degenerative changes such as femoral condyle flattening on radiography.

Aichroth et al.³ reviewed results of 52 children with 62 DLM at an average follow-up of 5.5 years. 48 knees with symptomatic torn DLM underwent open total lateral meniscectomy, 6 had arthroscopic partial meniscectomy and eight knees with intact discoid menisci, were left alone. Based on Ikeuchi's grading, 37% of the knees had an excellent result, 47% had a good result and 16% had a fair result; none was poor. They concluded that arthroscopic partial meniscectomy was recommended only when the posterior attachment of the DLM is stable and a total meniscectomy is indicated for unstable DLM and the Wrisberg-ligament type of DLM with posterior instability.

Haskel et al.⁴ examined the long-term clinical outcomes of arthroscopic partial meniscectomy for the treatment of DLM in 21 children that underwent arthroscopic meniscal saucerization. With an average follow-up of 11 years 45.4% had an excellent result, 16.7% good, 25% fair and 16.7% poor result. In total, 36.8% (7 of 19) of knees underwent at least one subsequent surgical procedure. They also concluded that clinical outcome scores decline over time in patients treated with arthroscopic partial meniscectomy for symptomatic DLM with an increased incidence of knee pain and mechanical/functional limitations, and that the overall modest, long-term results of the study illustrated the need for improved operative treatments for symptomatic DLM in children to prevent progressive, long-term clinical decline in these patients.

In all the knees in our study although the arthroscopic procedure was started with the aim of performing partial meniscectomy / saucerization with-or-without debulking and with-or-without repair of the DLM, it was not considered feasible, and therefore subtotal resection of the DLM was carried out in all cases. At 2 years follow-up we found the results to be entirely satisfactory in most of the cases. Considering the results of our study and also, varied opinions about the clinical and radiological outcomes following total or subtotal meniscectomy as opposed to partial meniscectomy reported in various studies discussed above, we feel that subtotal resection for symptomatic cases of DLM is an entirely acceptable form of treatment.

CONCLUSION

Subtotal resection for symptomatic cases of DLM is an entirely acceptable form of treatment, especially where partial meniscectomy is not feasible. In this study we have also seen better results of subtotal resection of DLM in younger patients (adolescent patients and those who have not attained skeletal maturity) than in older patients (post-adolescent patients and those who have attained skeletal maturity), and also better results in male patients than in female patients.

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