



Single-leaf partial meniscectomy in extensive horizontal tears of the discoid lateral meniscus: Does decreased peripheral meniscal thickness affect outcomes? (Mean four-year follow-up)



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ABSTRACT

Background: To evaluate whether single-leaf partial meniscectomy in horizontal tears along the entire discoid lateral meniscus has any advantages in clinical and radiological results compared with other meniscectomies in discoid lateral meniscus.

Methods: A total of 145 patients with a horizontal tear pattern in symptomatic lateral discoid meniscus were retrospectively reviewed. Twenty-seven patients had undergone full-extent single-leaf partial meniscectomy (group A), 60 had undergone conventional partial meniscectomy (saucerization) maintaining peripheral meniscal height (group B), and 58 patients had undergone total meniscectomy (group C). Each patient was evaluated with the Lysholm knee score, International Knee Documentation Committee (IKDC) subjective grading, and modified Kellgren–Lawrence grade in plain radiography at their last follow-up.

Results: Group C had inferior functional results to groups A and B on the Lysholm knee score and IKDC subjective score. There was no significant difference between groups A and B. Group C fared significantly worse than groups A and B ($p = 0.003$, $p < 0.001$) by modified Kellgren–Lawrence grade.

Conclusion: With regard to clinical and radiological evaluations in lateral discoid meniscus tears, the full-extent single-leaf partial meniscectomy group had no adverse results compared with the total meniscectomy group and was not significantly different compared to the conventional partial meniscectomy group.

Study design: Cohort study.

Level of evidence: Level III, therapeutic study. See Guidelines for Authors for a complete description of levels of evidence

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1. Introduction

Discoid menisci are more prone to mechanical trauma due to relatively insufficient vascularization, weak attachments to the posterior capsule, and their thickness [1]. A study has shown that discoid menisci have decreased amounts of collagen fibers and that the fibers are arranged heterogeneously, which may contribute to the vulnerability of the discoid meniscus [2]. Because of its abnormal structure, the discoid meniscus sustains increased stress, which increases the incidence

of tears and cystic degeneration [3]. The reported prevalence of discoid menisci has ranged from 0.4 to 17%, and the reported prevalence is 15.3% in Koreans and 16.6% in Japanese [4–9]. Many cases of discoid lateral meniscus (DLM) were found incidentally. In such an asymptomatic DLM, there has been a general consensus that it requires no treatment other than observation [8,9]. However, surgical treatment should be considered when symptoms, including pain, extension limitations, snapping, or giving way, are present [4,9–11]. A horizontal tear pattern is relatively common in DLM tears. In a study of 71 DLM tears, six (8.5%) were classified as horizontal tears and 27 (46.5%) as complex tears with a horizontal component [12].

When treating a horizontal meniscus tear, a surgeon must decide whether to resect one or both leaves of the tear. A conventional partial meniscectomy resecting both leaves could retain the horizontal cleft, which may cause a recurrence of the tear [13]. In contrast, a single-

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leaf partial meniscectomy resecting the unstable leaf has the advantage of preserving more meniscal tissue, even if it could decrease the meniscal peripheral height to some extent. Thus, single-leaf partial meniscectomies resecting the unstable leaf have been on the rise when horizontal tears are resected.

There is only one article that has demonstrated the biomechanical properties of single leaf meniscectomies for horizontal tears [19]. In their study of a sheep knee model, sparing one leaf of a posterior third tear maintained a portion of the load-distributing function of the intact meniscus, however, for horizontal tears spanning the extent of the meniscus, sparing one leaf showed similar biomechanical results compared with total meniscectomy and provided no benefit over the resection of both leaves. Researchers attempted to prove the correspondence of the former result to clinical outcomes in a recent study, although the subject of the study was not lateral discoid meniscus but medial meniscus. However, the correspondence between the latter result and clinical outcomes has not yet been evaluated in single-leaf sparing for horizontal tears spanning the full extent of the meniscus.

Therefore, the purpose of the current study is to demonstrate the functional and radiologic outcomes of single-leaf sparing partial meniscectomies of horizontal tears spanning the extensive extent of the meniscus in DLM, and to compare these outcomes with those of conventional partial meniscectomies (saucerization) and total meniscectomies. We hypothesized that the outcomes of single-leaf sparing partial meniscectomies would be similar to those of total meniscectomies, rather than those of conventional partial meniscectomies, in accordance with the results of the aforementioned biomechanical study.

2. Materials and methods

From January 2004 to December 2010, the medical records of 352 patients who had undergone arthroscopic surgery for symptomatic DLM were retrospectively reviewed after approval by the institutional review board of our institution. All surgeries were performed or supervised by the senior surgeon (SJK).

Patients who met the following criteria were included in the present study: (1) symptomatic lateral meniscus tear treated with arthroscopic surgery; (2) widest width of the peripheral meniscus remaining after meniscectomy of less than three millimeters (total meniscectomy) or narrowest width more than five millimeters (partial meniscectomy) [14]; subtotal meniscectomies were not included for a clear separation between the partial meniscectomy group and the total meniscectomy group, and inter-observer bias was decreased by measuring the meniscal width with a graduated probe; (3) minimal arthritic change on radiographs; and (4) a minimum follow-up duration of two years. The exclusion criteria were as follows: (1) repair of torn meniscus; (2) previous operations or concomitant knee surgeries, such as ligament reconstruction, chondral lesion (>ICRS (International Cartilage Repair Society) grade 3A), or medial meniscectomy of the affected knee; (3) consequent meniscal allograft transplantation surgery; (4) contralateral discoid meniscal surgery within the follow-up period; and (5) younger than age 18.

After excluding 19 patients (four patients in group A, seven patients in group B, and eight patients in group C) who were lost to follow-up, 194 patients were selected according to the inclusion criteria. From these 194 patients, 45 patients, including 18 with previous operations or concomitant knee surgeries, such as ligament reconstruction, chondral lesion (>ICRS grade 3A), or medial meniscectomy of the affected knee, were excluded. Four additional patients were excluded: two due to patellar fractures and anterior cruciate ligament tears caused by new trauma during follow-up and two with postoperative complications (one incidence of complex regional pain syndrome and one superficial skin infection at the suture site). Therefore, 145 patients were included in the current study. The patients were divided into three groups according to the state of their meniscus remnants after meniscectomy.

If there was a horizontal tear pattern under arthroscopic visualization, both leaves of a torn meniscus were examined by probe. Intraoperative probing determined which leaf was unstable and needed to be removed. The surgeons worked to preserve as much of the width of the peripheral rim as possible, but some total meniscectomies were unavoidable, depending on the tear patterns. In the cases of horizontal tears, the tear margins were trimmed with a motorized shaver close to the peripheral rim for a smooth margin to prevent re-tearing. Then, the peripheral width of the remaining meniscus was measured by graduated probe and recorded (Figure 1).

Twenty-seven patients (27 knees) received single-leaf resection partial meniscectomies for horizontal tears that extended to the peripheral margin across the full extent of the meniscus. These patients were classified as group A. Partial meniscectomy was defined as a meniscectomy with more than five millimeters at the narrowest width of the remaining peripheral meniscus. Group B consisted of 60 patients (60 knees) who underwent partial meniscectomies without horizontal tearing (conventional saucerization). As in group A, the remaining meniscus was greater than five millimeters wide, but the remaining menisci in group B were thicker than those in group A due to the horizontal resectioning in group A. Group C contained 58 patients (58 knees) who underwent total meniscectomies, defined as less than three millimeters at the widest width of the remaining peripheral meniscus (Figure 2).

3. Assessments

Preoperative evaluations were performed the day before surgery for each parameter. Postoperative clinical assessments were performed at three months, six months, and then annually by a physical examination, a questionnaire, and a radiographic inspection, which were used to evaluate clinical function and radiological findings. The preoperative values were compared with the postoperative values measured at the latest annual follow-up after surgery. If a patient did not visit our outpatient clinic according to an annual schedule, we called and asked him or her to visit the clinic for follow-up.

Clinical outcomes were evaluated using Lysholm scores [15] and International Knee Documentation Committee (IKDC) subjective scores [16] at both preoperative and final follow-up. Radiologic evaluation was performed using the lateral compartment-specific modified Kellgren–Lawrence grading system. This is based on the classification of the Kellgren–Lawrence scale [17]: grade 0 = no osteophytes, no joint space narrowing (JSN), and no sclerosis; grade 1 = possible osteophytes and doubtful JSN; grade 2 = definite osteophytes and possible JSN; grade 3 = moderate multiple osteophytes, definite JSN, sclerotic features, and possible bone contour deformity; grade 4 = large osteophytes, marked JSN, severe sclerosis, and bone contour deformity. Estimation errors are possible with the Kellgren–Lawrence grade system because meniscectomy always decreases joint space height to some degree, and the grades use ambiguous terms, such as questionable, possible, and definite. Therefore, we arbitrarily limited the Kellgren–Lawrence grades to the lateral compartment of the knee joint and applied the following definitions: a decrease (from preoperative joint space to postoperative joint space) of less than 10% was defined as no JSN; doubtful JSN was defined as a decrease between 10% and 25%; definite JSN was defined as a decrease between 25% and 50%; marked JSN was defined as a decrease of more than 50%; possible osteophyte was defined as no bony protrusion; definite osteophyte was a bony protrusion less than two millimeters with lipping; moderate or multiple osteophytes were one or more bony protrusions with less than two millimeters tibial or femoral margins; marked osteophytes were one or more bony protrusions with more than two millimeters at tibial or femoral margins.

We evaluated preoperatively on the day before the operation and immediately postoperatively, as well as checking at a regular visit three months after the operation, and also evaluated the last follow-up radiographs. Double-leg weight-bearing radiographs of anteroposterior, lateral, and posteroanterior views at 45° of flexion and Merchant views

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