Combined Meniscal Saucerization and Repair Versus Subtotal Meniscectomy for Symptomatic Discoid Lateral Meniscal Tears in Children and Adolescents

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Abstract:

Background: Meniscal saucerization combined with repair of a symptomatic discoid lateral meniscus (DLM) has been expanding. However, the significance of meniscal saucerization with repair involving complex or degenerative tears remains uncertain.

Purpose/Hypothesis: To assess the radiological and clinical outcomes of saucerization with repair performed for symptomatic DLM tears in children and adolescents in comparison to a historical control cohort that underwent subtotal meniscectomy. It was hypothesized that saucerization with repair would lead to superior outcomes compared to subtotal meniscectomy.

Study Design: Retrospective comparative study; Level of evidence, 3.

Methods: This study group was composed of 27 knees in 21 patients that underwent saucerization with repair (SR group) from 2011 to 2018, while the historical control group included 22 knees in 20 patients that underwent subtotal meniscectomy (SM group) between 2005 and 2011. Patient age at the time of surgery ranged from 4 to 18 years (mean 12.1 years). Clinical outcome was assessed using the Lysholm score. The Tapper and Hoover classification based on Rosenberg view radiographs was adopted, and lateral joint space width (LJSW) was measured as a parameter for cartilage/meniscus

preservation. Clinical and radiographic results were evaluated preoperatively, 2 years post surgery, and up until the final follow-up.

Results: The mean follow-up period was 50.6 ± 17.0 months in the SR group and 62.3 ± 41.0 months in the SM group. The Lysholm scores were significantly improved postoperatively in both groups (P < .001). As for radiological evaluation, a progression in the Tapper and Hoover classification grade and a significant increase in JLSW (< .0001) between the right and left sides were observed in both groups at 2 years postoperatively, with no significant differences between groups. Complications included postoperative re-tearing in 5 cases (18.5%) from the SR group and osteochondritis dissecans (OCD) developed after surgery in one knee (3%) in the SR group and 6 knees in the SM group (27%), with a significantly higher incidence in the SM group (P = .036).

Conclusion: Both groups showed progressive postoperative radiographic degeneration, but clinical outcomes also improved in both groups. Based on the incidence of OCD development, saucerization with repair for complex DLM tears showed advantages over subtotal meniscectomy.

Key words: Discoid lateral meniscus ; Saucerization with repair; Subtotal meniscectomy; Osteochondritis dissecans.

What is known about the subject: Conventionally, total or subtotal meniscectomy had been a primary surgical option, however, concern has been raised over postoperative progression of osteoarthritis and the development of osteochondritis dissecans (OCD), which has led to the loss of meniscal function. As a result, meniscal saucerization has emerged as an alternative to (sub)total meniscectomy in order to avoid these problems and preserve meniscal function. Indication of repair in our current practice has been expanded to include previously unsalvageable tears.

What this study adds to existing knowledge: The difference in postoperative OCD incidence observed in this study suggests that saucerization with repair for symptomatic DLM tears—including complex or degenerative tears—is superior to subtotal meniscectomy in preserving meniscal function.

Introduction:

Discoid lateral meniscus (DLM) is a congenital anatomical abnormality of the lateral meniscus. Previous literature has reported that DLM occurs in 0.4 to 17％ of the population, with a higher prevalence among Asian populations.[9,13] DLM is mechanically

69 vulnerable because of its morphological and structural properties, and associated with a
70 higher frequency of meniscal tears that present with related symptoms such as pain,
71 clicking, and limited extension.[2,27]

72 With regard to the treatment of symptomatic DLM, non-operative management leads
73 to a fairly high failure rate[19] and surgery is indicated for those with prolonged or marked
74 symptoms and functional impairment. Conventionally, total or subtotal meniscectomy has
75 been a primary surgical option,[4,10,28,30] and there have been studies reporting satisfactory
76 clinical outcomes.[4,10,28] However, postoperative progression of osteoarthritis secondary
77 to loss of meniscal function has been raised as a long-term problem.[17,20,30] In addition,
78 changes in mechanical force transmission after discoid lateral meniscectomy may induce
79 the development of osteochondritis dissecans (OCD) as another postoperative
80 complication.[23,30]

81 In order to avoid these problems and preserve meniscal function, meniscal
82 saucerization has emerged as an alternative to (sub)total meniscectomy. There have been
83 some studies comparing clinical and radiological outcomes of saucerization (with or
84 without repair) versus (sub)total meniscectomy of a symptomatic DLM.[3,4,19,36,40] Smuin
85 et al. conducted a systematic review of these studies and stated better long-term results

for the knee after saucerization.[32] However, reported results are varied from study to study, and the clinical significance of meniscal preservation in saucerization remains to be clarified.

Most symptomatic DLM tears exhibit a complex tear type, which involve peripheral tears and rim instability.[6] In such cases, (sub)total meniscectomy has been the conventional surgical option, but in recent years, a combination of meniscal saucerization and repair has been advocated to preserve meniscal function.[1,3,8,29,31,36,38,39] Unstable (inferior) leaves of horizontal or degenerative tears, which were subject to resection in previous relevant studies,[33] are now being expanded in our current practice to include previously "unsalvageable" tears as well as indications for repair. However, the significance and clinical outcomes of meniscal saucerization with repair for symptomatic DLM tears including complex or degenerative tears still remain uncertain.

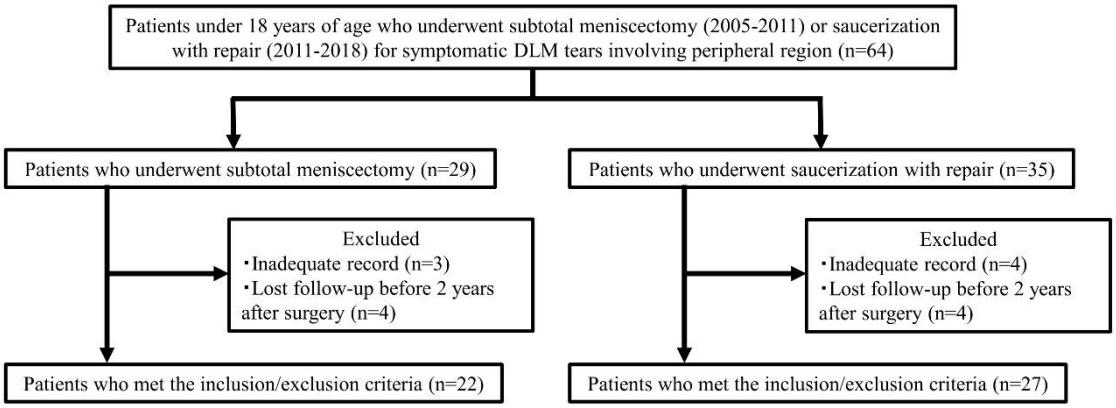
In our practice, the primary surgical option for symptomatic DLM changed from meniscectomy to saucerization in 2011. The purpose of this study was to assess the radiological and clinical outcomes of saucerization with repair performed for symptomatic discoid lateral meniscus (DLM) tears in children and adolescents compared to a historical control cohort that underwent subtotal meniscectomy. It was hypothesized

that compared to subtotal meniscectomy, saucerization with repair would yield superior clinical and radiological results.

Patients and Methods:

Study population and design

A consecutive series of patients with symptomatic DLM injuries who underwent surgery at a single institution from April 2005 to December 2018 were eligible for the study. Inclusion criteria was limited to patients who were 18 years of age or younger at the time of surgery and had meniscal tears involving the peripheral region or those with peripheral instability that underwent subtotal meniscectomy from 2005 to 2011 and saucerization with repair from 2011 to 2018. Exclusion criteria were concomitant surgical procedure to the index knee, combined injury to the cruciate ligament, inadequate documentation, and patients lost to follow-up before 2 years postoperatively (Fig.1).



DLM, discoid lateral meniscus.

Figure 1. Flowchart of the patient selection process

This study was approved by our institutional review board (No.4028) and written informed consent was obtained from all patients and families.

Surgical options and procedures

All surgeries were performed by one of the two senior surgeons (S.Y and H.N). Surgery was indicated if persistent mechanical pain or meniscal related symptoms persisted despite 3 months of conservative treatment.

Arthroscopic surgery was performed under general anesthesia. First, the type of DLM (location, type of tear, and presence of concomitant intra-articular lesions) was confirmed by arthroscopic examination and determined based on the Watanabe classification.[37] When a meniscal tear or instability at the meniscocapsular region was

identified, a subtotal meniscectomy was performed from 2005 to 2011, but since 2011, saucerization with meniscal repair has been the primary surgical option for all types of tears, including complex and degenerative tears. Subtotal meniscectomy was defined as a meniscectomy in which the remaining peripheral meniscus was less than 3 mm wide.[16,17] During the saucerization with repair procedure, first, the central portion of the meniscus was resected and the peripheral portion was truncated to 6 to 8mm in width.[3] If there was significant displacement at the peripheral tear site, a temporary reduction with one or two sutures was performed by meniscal repair prior to resection. After partial central meniscectomy, careful arthroscopic evaluation for meniscal instability and presence of tears were repeated by probing the remaining rim and body of the DLM. Even if horizontal or complex tears were present in the remaining meniscal substance, the tear site was repaired as a whole, while only a portion with severe damage and degeneration was minimally resected. After debriding the edge of the meniscus and capsule at the repair site using a rasp, the torn ends were approximated with multiple sutures using an inside-out technique with zone-specific cannula (Smith & Nephew, Andover, MA) used for the central and posterior regions. Sutures were placed vertically, approximately 4-mm apart, with one end directed inferiorly and the other

147 superiorly. This suture configuration effectively closed the gap between apposing edges
148 of the tear. Using the Meniscal Mender system (Smith & Nephew, Andover, MA),
149 anterior segment tears were repaired using an outside-in technique with vertical,
150 braided, non-absorbable sutures (Fig. 2). In the repair of the combined intrasubstance
151 (horizontal) and degenerative tears, an autogenous fibrin clot was prepared
152 intraoperatively and implanted into the repair site as biological augmentation.[25]
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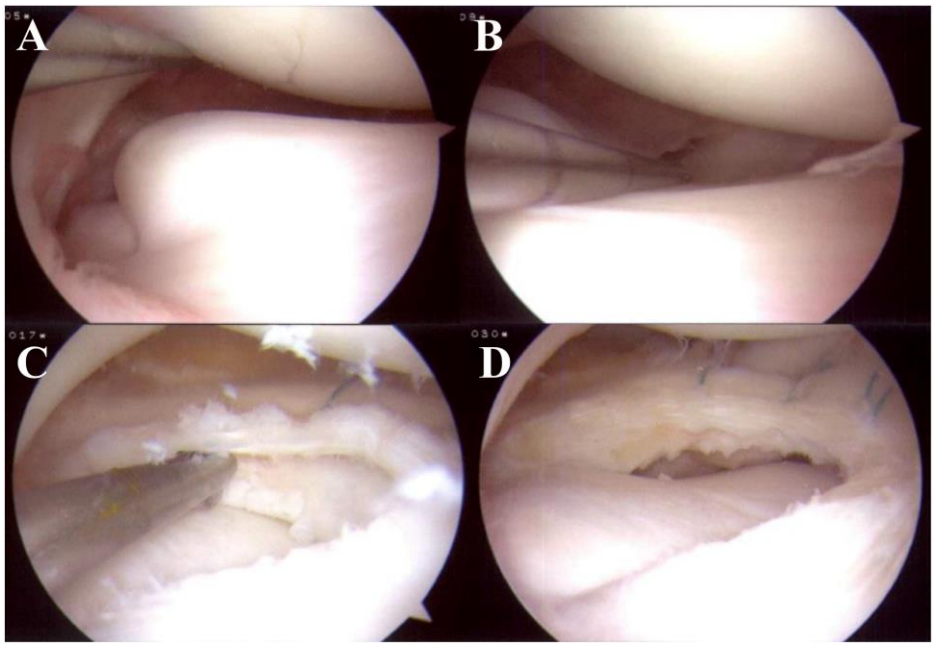

Figure 2A,2B,2C,2D. A 12-year-old boy. (A) Complete discoid lateral meniscus of the left knee. (B) Peripheral tear at the posterolateral area. (C) Probing of the horizontal tear after saucerization. (D) Postoperative view after saucerization with repair.

154

155 ***Postoperative rehabilitation***

156 After subtotal meniscectomy, range-of-motion exercises were initiated immediately after
157 surgery, and full weight-bearing was allowed the following day as tolerated by the patient.
158 Return to sports activities was permitted at 2-3 months post surgery.

159 In cases of saucerization with repair, the operated knee was immobilized with a brace
160 and weight-bearing was prohibited for 3 weeks. Partial weight-bearing with crutches
161 supporting half of the patient's body weight began in the third week postoperatively and
162 with progressed to full weight-bearing by the fourth week. Return to sports activities was
163 permitted 6 months postoperatively.

164 ***Evaluation***

165 Preoperative clinical and radiological evaluations were performed immediately prior to
166 surgery, and comprehensive postoperative evaluations were performed 2 years
167 postoperatively, with subsequent periodic (yearly) follow-ups.

168 Clinical results were assessed using the Lysholm knee score as an outcome measure.
169 Radiological evaluation was conducted with postero-anterior weight-bearing radiographs
170 using the Rosenberg view. The Tapper and Hoover classifications were applied to assess

171 postoperative degenerative changes, and lateral joint space width (LJSW) was measured
172 as a parameter of the combined thickness of the cartilage and meniscus. Sequential
173 changes in the Tapper and Hoover classification grade and left-right difference in LJSW
174 were examined by comparing the pre- and postoperative results. The Tapper and Hoover
175 classification used to determine grade was as follows: grade 0: normal radiographs; grade
176 I: squaring of the tibial margin; grade II: flattening of the femoral condyle, squaring and
177 sclerosis of the tibial plateau; grade III: narrowing of the joint space and hypertrophic
178 changes; and grade IV: a more severe degree of all of these changes.[35] In the assessment
179 of postoperative LJSW changes, 8 patients (subtotal: 2, repair: 6) who underwent bilateral
180 surgery were excluded from the analysis because a side-to-side comparison was not
181 feasible for those knees.

182 During the follow-up period, information regarding surgical failures and complications
183 such as decreased range of motion of the knee joint, re-tear of the repaired meniscus,
184 development of OCD, and additional surgery was extracted from the patient records until
185 the final follow-up. Revision meniscal surgery was indicated for persistently symptomatic
186 re-tear. Regarding the treatment of postoperative OCD lesions, conservative treatment
187 with activity restriction was applied for the first 3 months, and surgical treatment such as

drilling, internal fixation, and autologous osteochondral transplantation were indicated for those with failed conservative treatment.[21]

Statistical Analysis

All statistical analyses were performed using JMP (version 15, SAS Institute Inc., Cary, NC, USA). The normality of the data distribution was assessed by the Shapiro-Wilk test. Based on the results of the data distribution evaluation, differences among demographic parameters were analyzed with the Mann–Whitney U test, and those among categorical variables were analyzed with the Chi-square test. The pre- and postoperative values of the Lysholm score and radiographic parameters were compared in a paired t-test. Fisher's exact test was used for statistical analysis of the incidence of postoperative complications and the Tapper and Hoover classification. Statistical significance was assumed with a p-value of less than 0.05.

Results:

Patient Demographic Data

Initially, a consecutive series of 64 knees in 54 patients were eligible for inclusion of this study. However, as shown in Fig. 1, 15 knees were subsequently excluded from the analysis, bringing the final study population to 41 individuals and 49 knees. Subtotal

meniscectomy was performed on 20 patients with 22 knees (SM group) and saucerization with repair on 21 patients with 27 knees (SR group). Although every attempt was made to repair any type of tears since 2011, there was one knee with a severely complex degenerative tear extending to the peripheral region that was deemed unsalvageable and underwent subtotal meniscectomy. The patient demographic data for each procedure group are shown in Table 1.

	Subtotal meniscectomy (n = 22)	Saucerization with repair (n = 27)	*P* value
Male/Female (%)	12 / 10 (53 / 47)	16 / 11 (59 / 41)	.740
Age at operative, y (Mean ± SD)	11.9 ± 3.4 [4-18]	12.2 ± 2.8 [4-17]	.685
Complete / Incomplete (%)	20 / 2 (90 / 10)	23 / 4 (85 / 14)	.543
Right / Left / Bilateral (%)	12 / 6 / 2 (60 / 30 / 10)	8 / 7 / 6 (38 / 33 / 29)	.240
Open / Closed Physis (%)	21 / 1 (95 / 5)	25 / 2 (93 / 7)	.677
Follow-up, months (Mean ± SD)	62.3 ± 41 [24-164]	50.6 ± 17 [25-96]	.793
Predominant tear type Peripheral / Horizontal / Complex tear (%)	8 / 8 / 6 (36 / 36 / 28)	15 / 2 / 10 (56 / 7 /37)	.043

Values are expressed as mean and standard deviation.

α Values are presented as No. (%).

Table 1 Demographic data of the patients in the groups with subtotal meniscectomy and saucerization with repair

214

215 ***Clinical and Radiologic Outcomes***

216 Lysholm scores improved significantly after both procedures (P < .001). In a comparison

217 of the two groups, the overall score at 2 years postoperatively was significantly higher in

218 the SR group (96.5 vs. 93.3 on average, P =.036) (Table 2).

219

	Subtotal meniscectomy	Saucerization with repair	*P* Value
Pre-op	79.1 ± 6.8	76.0 ± 7.3	.151
Post-op	93.3 ± 4.2	96.5 ± 4.0	.036
P Value	<.001	<.001	

220 Table 2 Comparisons of the Lysholm scores between the groups and the time points

221

222 The results of the Tapper and Hoover classification are shown in Figure 3. The

223 majority (90%) of the knees did not exhibit any changes before surgery. During the

224 postoperative 2 years, no appreciable change in the radiological grade was noted for 55%

225 of cases in the SM group and 40% in the SR group. Postoperative progression of 2 grades

226 or more was observed in 9% of the SM group and 7% of the SR group. Statistical analysis

227 showed no significant differences between groups.

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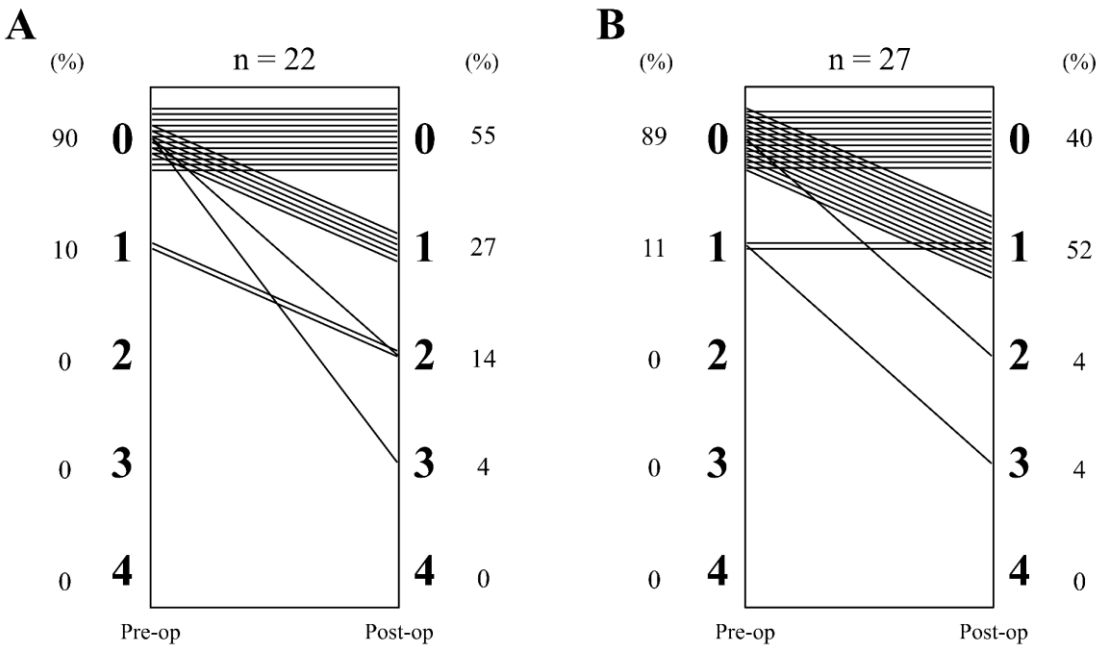

Figure 3A,3B. Postoperative change in Tapper and Hoover classification grade, shown as a line plot with each line representing a single patient. Numbers on the Pre-op and Post-op axes indicate Tapper and Hoover classification grades at the pre- and postoperative evaluations, respectively. (A) Subtotal meniscectomy (B) Saucerization with repair

In the LJSW measurement of the operated knee, the values taken at the 2-year follow-up were significantly lower in both groups compared to their respective preoperative values ($P < .001$). As for the side-to-side difference in LJSW, significant increases in the calculated values were noted at 2 years postoperatively in both treatment groups with no significant intergroup difference (Table 3).

240

		Subtotal meniscectomy	Saucerization with repair	*P* Value
LJSW (mm)	Pre-op	7.65 ± 2.2	7.30 ± 1.9	.574
	Post-op	4.91 ± 1.4	5.08 ± 1.5	.692
	P Value	**<.001**	**<.001**	
Side-to-side difference in the LJSW* (mm)	Pre-op	0.39 ± 2.2	0.03 ± 2.0	.608
	Post-op	1.71 ± 1.6	1.44 ± 1.5	.641
	P Value	**.022**	**.003**	

LJSW, lateral joint space width

*In comparison of the postoperative LJSW side-to-side difference, 8 patients (subtotal : 2, repair : 6) who underwent bilateral surgeries were excluded.

241 Table 3 Comparisons of the lateral joint space width between the groups and the time points

242

243 Postoperative complications were as shown in Table 4. There were 5 cases in which
244 symptoms recurred due to re-tearing of the repaired meniscus, requiring repeat
245 arthroscopy. In three of these cases, repeat repair was attempted, and in two cases,
246 meniscectomy was performed. As for complications related to the index surgical
247 procedure, a mild restriction on the range of motion was noted in one case, but did not
248 require revision surgery, while no other postoperative complications such as infection
249 were found. With regard to the occurrence of OCD, one patient in each group presented

with preoperative OCD lesions before surgery. After surgery, OCD occurred in 6 knees in the SM group and one knee in the SR group, with a significantly higher incidence in the SM group (27% vs. 3%, P = .036). In addition, all patients in the SM group who developed OCD postoperatively required surgical treatment, while one patient in the SR group was able to be treated conservatively (Table 5).

	Subtotal meniscectomy (n = 22)	Saucerization with repair (n = 27)	*P* Value
Re-tear (%)	0 (0)	5 (18)	.056
Subsequent treatment of re-tear			
Repair (%)	0 (0)	3 (11)	.242
Meniscectomy (%)	0 (0)	2 (7)	.495
Postoperative OCD* (%)	6 (27)	1 (3)	**.036**
Subsequent treatment of OCD			
Surgical treatment (%)	6 (27)	0 (0)	.005
Conservative treatment (%)	0 (0)	1 (3)	>.99
Restriction of range of motion (%)	0 (0)	1(4)	>.99

OCD, Osteochondritis dissecans.

*Two patients (subtotal : 1, repair : 1) with preoperative OCD were excluded.

Table 4 Postoperative complications

Age (y)	Sex	Watanabe classification	Physis	Surgery	Location	Duration from surgery (m)	Treatment	Outcome
9	M	Complete	Open	SM	LFC	34	1) Drilling 2) OATS	Healed
4	M	Complete	Open	SM	LFC	47	Drilling	Healed
8	M	Complete	Open	SM	LFC	19	1) Drilling 2) Internal fixation 3) OATS	Healed
7	M	Complete	Open	SM	LFC	36	Drilling	Healed
15	F	Complete	Open	SM	LFC	19	Drilling	Healed
12	F	Complete	Open	SM	LFC	10	1) Drilling 2) OATS	Healed
7	M	Complete	Open	SR	LFC	21	Conservative treatment	Healed

F, female; M, male; SM, subtotal meniscectomy; SR, saucerization with repair; LFC, lateral femoral condyle; OATS, osteochondral autologous transplantation surgery.

Table 5 Clinical features of the knees that developed osteochondritis dissecans after surgery

Discussion:

This study compared clinical and radiological outcomes 2 years postoperatively between saucerization with repair and subtotal meniscectomy in the treatment of DLM tears involving the peripheral region. The most important study findings were that despite no significant differences in the rate of postoperative progression of radiographic degenerative changes between the two groups, meniscal saucerization with repair was associated with a significantly lower incidence of postoperative OCD (3% vs. 27%). In addition, 2-year clinical outcomes assessed by the Lysholm score were significantly better

268 in the SR group. These results suggest that saucerization with repair may be more
269 advantageous than subtotal meniscectomy in terms of preserving meniscal function.

270 Previously, total meniscectomy was the primary surgical option for symptomatic
271 DLM tears, with satisfactory outcomes reported in both short- and long-term follow-up
272 studies.[11,30] However, in consideration of meniscal function preservation, partial
273 meniscectomy with saucerization was proposed as an alternative.[5,18] Several studies have
274 since compared the surgical outcomes between (sub)total resection and partial resection
275 (saucerization) of symptomatic DLM.[15, 34] In these studies, the type of tear determined the
276 surgical procedure, with complex or severely degenerative tears resulting in total
277 meniscectomy. This issue raises concerns about selection bias. Smuin et al. conducted a
278 systematic review of relevant studies and concluded that long-term data demonstrated
279 improved patient-reported outcomes with saucerization over (sub)total meniscectomy.[32]
280 However, they also stated that the heterogeneity of nonrandomized studies makes the
281 analysis of the pooled data less reliable.

282 The predominant types of DLM tears are peripheral tears and intrasubstance
283 horizontal or complex tears.[6] In the case of peripheral tear or peripheral rim instability,
284 the gold standard in recent years has been arthroscopic meniscal saucerization with

285 repair.[1,3,8,29,30,31,36,38,39] These studies compared the surgical outcomes of various surgical
286 procedures, including saucerization alone, saucerization with repair, and (sub)total
287 meniscectomy. In general, there were no clear differences among the three techniques,
288 neither were there notable improvements in the clinical scores attained after surgery.
289 Previous studies report that complex or degenerative tears and peripheral tears with
290 substantial separation were once deemed irreparable, and meniscectomy was the selected
291 method for surgical treatment. In addition, the inferior leaf of a horizontal tear and the
292 degenerative fragment were resected prior to suture repair. At our institution, the current
293 surgical option is to repair the remaining portion of the meniscus after partial central
294 meniscectomy as a whole, including any horizontal or degenerative tears. In this study,
295 the results of saucerization with repair were compared to those of historical control group
296 that underwent (sub)total meniscectomy for DLM tears involving the peripheral region.
297 Therefore, the type of tears in the two treatment groups were comparable. To our
298 knowledge, no prior study has compared the surgical outcomes of saucerization with
299 repair and (sub)total meniscectomy for symptomatic DLM tears that included complex
300 tears with consistent indications.

Clinical evaluation showed significant improvement in the postoperative Lysholm score in both groups, but the indications for meniscal repair, which had been considered irreparable in previous related studies, have since been expanded at our institution.[36,38,39] The Lysholm score at 2 years postoperatively was statistically superior in the SR group compared to the SM group, however, a difference of 3.2 on the Lysholm scale is of questionable clinical significance. Based on the results obtained, the clinical advantage of saucerization with repair remains unclear.

Regarding radiographic changes after DLM meniscectomy, several clinical follow-up studies have noted a high rate of postoperative osteoarthritic progression.[20,30] Räber et al. showed that 10 of 11 knees had osteoarthritic changes compared to the uninvolved, contralateral knee.[30] Aglietti et al. reported the development of minor osteophytes and a joint space narrowing of < 50% in the lateral compartment of 8 and 11 of 17 knees, respectively.[1] Sabbag et al. reviewed a geographic database of surgically treated DLM and reported that progression to symptomatic lateral compartment degenerative change was identified in 50% of cases at 8 years postoperatively.[31] In the present study, there were no significant differences in radiographic outcomes between the two groups as assessed by Tapper and Hoover classification system. The LJSW was adopted as another

parameter for radiological assessment. Milewski et al. reported that the knees of children are likely to exhibit a narrower LJSW with age as the skeletal maturity and ossification near the joint space increases. Therefore, the side-to-side difference was measured and used in the analysis of this study, as opposed to the postoperative change in LJSW. The LJSW evaluation also again showed no significant difference between the two groups. As a result, contrary to our hypothesis, the advantage of meniscal preservation by saucerization and repair was not confirmed by radiological evaluation. This finding may be attributed to progressive meniscal extrusion and a reduction in size following saucerization, as reported in some studies.[14,22,26]

OCD has been reported as a complication after DLM resection and may significantly affect clinical prognosis. There have been a few papers investigating the incidence and factors related to its occurrence.[11,12,23,24] Hashimoto et al.[12] reported that 7.8% of 103 knees (mean age 12.1 years) were complicated by OCD at a mean follow-up of 4.2 years after surgery for symptomatic DLM, and that subtotal meniscectomy and patient age of 11 years or younger at the time of surgery were considered high risk factors. Mochizuki et al.[24] reported that postoperative OCD occurred in 19% of 18 patients (mean age 12 years) with a mean follow-up of 23.7 months, and that younger age, subtotal

meniscectomy, and a shorter meniscal width were predictive factors for postoperative OCD. In this study, postoperative OCD was found in 6 knees (27%) in the SM group and 1 knee (3%) in the SR group. All of these lesions were located at the contact area from extension to mild flexion in the lateral femoral condyle. All knees that developed OCD after subtotal meniscectomy required surgical intervention after conservative treatment failed. As discussed in the case report by Stanitski et al.,[33] overloading of the lateral femoral compartment after meniscectomy with a marked increase in peak local contact pressure and repetitive microtrauma over time may have induced postoperative OCD lesions. The difference in postoperative OCD incidence observed in this study suggests that saucerization with repair may be superior to subtotal meniscectomy in preserving meniscal function.

Limitations

There are some limitations in this study. First, this was a retrospective comparative study using historical control data with a relatively short follow-up period. As a result, the evolution of surgical technique and instrumentation during the study period was not taken into account in the analysis, and the time to final follow-up in the histological cohort (subtotal meniscectomy) was longer than the saucerization/repair group. In addition, the

352 criteria for peripheral instability have been broadened with better understanding of rim
353 instability over the years,[6,39] which may explain the difference in the distribution of tear
354 types between the two study cohorts (more peripheral tears in the more recent cohort).
355 Second, the follow-up period was short and the study population in each group was
356 comprised of a small number of patients. This study may be too underpowered to detect
357 differences in outcomes between the two treatment groups. There seems to be a need for
358 further investigations with a longer follow-up period and larger sample size (using pooled
359 data from multiple sites) to confirm the advantages of meniscal saucerization with repair
360 in preserving meniscal function as well as the effect of meniscal surgery on progressive
361 degeneration over time. Further studies with a longer follow-up period and larger sample
362 size are needed to clarify the advantages of meniscal saucerization with repair in
363 preserving meniscal function. Third, the Lysholm score was used in the clinical evaluation.
364 Although reliability and validity of the Lysholm score have been confirmed in evaluation
365 of patients with meniscal injury, unacceptable ceiling effects have also been shown in
366 some domains of this scoring system.[7] Use of comprehensive patient-reported outcome
367 measures such as KOOS or IKDC subjective scores may have been preferable; however,

the data based on these scoring systems were not available for patients during the early study period.

Conclusion:

Although progression of the postoperative radiographic degeneration was noted in both groups in the surgical management of DLM tears involving the peripheral region, the clinical outcomes were improved in both groups. Based on the 2-year clinical outcomes and the incidence of OCD development, saucerization with repair for complex DLM tears had advantages over subtotal meniscectomy.

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