Second-Look Arthroscopic Evaluations of Meniscal Repairs Associated With Anterior Cruciate Ligament Reconstruction

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Purpose: To examine the healing status of meniscal repair performed concomitantly with anterior cruciate ligament (ACL) reconstruction with our current indication and surgical procedure based on second-look arthroscopic results. Additionally, the significance of the demographic and clinical factors that can potentially influence the healing rate was statistically assessed. **Methods:** Between January 2009 and January 2015, second-look was performed for patients who opted to have tibial screw removal and agreed to have concomitant arthroscopy. The healing status of the repaired meniscus was classified into 3 conditions: healed, incompletely healed, and not healed. In addition, clinical outcomes were evaluated at a minimal 1-year follow-up. The effects of patient factors on the meniscal healing rate were statistically assessed. **Results:** A total of 217 knees underwent arthroscopic meniscal repair concomitant with ACL reconstruction, while second-look was performed for 105 knees. The average period from index surgery to second-look was 15.0 months. Clinical evaluation was conducted at a mean of 17 months (12-50 months). Based on the second-look arthroscopic findings, 64 menisci, 22 menisci, and 29 menisci were categorized as healed, incompletely healed, and not healed, respectively. When the not healed condition was defined as failed repair, a Tegner activity score of 8 or more, recurrent instability, tears in the red-white to white-white zones, and time from injury to surgery of 4 months or longer were identified as clinical factors significantly correlated with failure ($P < .01$). **Conclusions:** Meniscal repair in ACL reconstructed knees with expanded indications achieved a healing rate (including incomplete healing) of 75%. Clinical factors such as high sports activity level, recurrent ACL instability, poor vascularity of the repaired site, and long duration from injury to surgery were shown to impair the healing status. **Level of Evidence:** Level IV, therapeutic study, case series.

Arthroscopic meniscal repair has been established as the standard surgical management for concrete meniscal tears in vascular regions, yielding a healing rate of >80%.[1,2] In our clinical practice, meniscal repair is performed as an isolated procedure or as part of combined reconstructive procedures such as meniscal repair concomitant with anterior cruciate ligament (ACL) reconstruction.

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When determining the surgical option for meniscal tears, preservation of meniscal function should be taken into consideration to improve patient-reported outcomes and prevent secondary rates of osteoarthritis. The meniscus provides several vital mechanical functions in the knee joint, and loss of meniscal function by meniscectomy may lead to instability and secondary injuries to articular cartilage.[3,4] Therefore, in the surgical management of combined ACL/meniscal injuries, the significance of meniscal preservation by meniscal repair has been addressed in previous literature,[5,6] and indications for meniscal repair have been expanded to include tears located in the red-white and white-white zones as well as tears of complex configuration.[7]

It has been reported that the healing rate of the repaired menisci is higher when concomitantly performed with ACL reconstruction compared with that of repair for isolated meniscal tears, and previous studies reported a 10-year success rate ranging from 85% to 90%.[1,8] In our practice, we have attempted to save the

meniscus whenever feasible and further expanded the indication for repair of associated meniscal tears in ACL-injured knees, including those with white-white zone and tears with complex configuration or degeneration. Meniscal repair of red-white lesions has been described and studied in a systematic review, with success rates in the red-white zone of 81% to 86%[9]; however, the healing rate of meniscal repair using second-look arthroscopy with the expanded indication has not been clarified. In addition, the surgical technique and instruments for meniscal repair, as well as ACL reconstruction, have been refined and evolved over the years. Consequently, the meniscal tear site can be securely fixed and the anatomical structure of the native ACL can be closely reproduced in our current reconstructive procedures. Although the evolution of surgical techniques for ACL reconstruction has been shown to be associated with improved clinical outcomes,[10] the healing rate of concomitant meniscal repair with expanded indications and technique has not been reported.

The purpose of this study was to examine the healing status of meniscal repair performed concomitantly with ACL reconstruction with our current indication and surgical procedure based on second-look arthroscopic results. Additionally, the significance of the demographic and clinical factors that can potentially influence the healing rate was statistically assessed. We hypothesized that improved meniscal repair technique and restoration of anatomical ACL structure in our clinical practice would result in a comparable healing rate to what has been reported for meniscal repair with conventional indications, despite the expansion of the indication for tears extending into the red-white and white-white zones and those with complex configuration or degeneration. Furthermore, we anticipate that selected demographic and clinical factors such as patient age, tear length, or tear site of the medial or lateral meniscus will influence the healing rate of the repaired menisci.

Methods

Study Population

Knees that underwent arthroscopic meniscal repair concomitant with primary ACL reconstruction during the period of January 2009 to January 2015 were initially enrolled in the study. Thereafter, subjects with the following features were excluded from the study population: concomitant osseous or ligament surgeries, deficiency of follow-up data for a minimum of 1 year, and lack of second-look arthroscopy results.

Meniscal repair was indicated for unstable meniscal tears including those extending into the white-white zone as well as tears with complex configuration or degeneration. Repair was attempted whenever feasible except for swaying flap tears located in the white-white zone or those with severe damage and/or degeneration.

Indications for second-look arthroscopy were as follows: (1) patients without meniscal symptoms who preferred tibial post screw removal with consent to second-look arthroscopy and (2) patients who were suspected to have intra-articular treatable lesions such as meniscal and cyclops lesions. Hardware removal was performed at least 1 year after surgery based on the patient's decision. Those who had discomfort or pain at the screw head site preferred to have the screw removed. For patients who underwent second-look arthroscopy due to cyclops or meniscal symptoms, surgical timing was variable. Consequently, the time period from the primary meniscal surgery to the second-look arthroscopy averaged 15.0 months, ranging from 7 to 15 months. The study was approved by the Institutional Review Board of our institution, and informed consent was obtained from each patient included in the study.

Surgical Technique

All surgeries were performed by 1 of the 3 senior authors (M.Y., A.M., K.S.) under general anesthesia. After identifying a tear indicated for repair, a rasp or shaver was used to stimulate the healing response of the tissue along the length of the tear and the adjacent meniscal tissue. The inside-out technique was used as the primary repair technique.[2,7,11] Repairs were performed with multiple nonabsorbable no. 2-0 Fiber Wire sutures (Arthrex) that stacked vertically in both the superior and inferior surfaces (vertical mattress suture). The stitches were placed at 5-mm intervals to ensure secure fixation and apposition of the torn rims. Although vertical stacked suture fixation was used as the principal technique, combined vertical and horizontal suture configuration was used for radial, horizontal, and complex type tears. The all-inside technique using FasT-Fix 360 was used alone for short longitudinal tears or used as supplemental fixation in conjunction with inside-out repair when difficulty in accessibility was encountered.

Reconstruction of the ACL was performed using the anatomic double-bundle procedure with hamstrings tendon autografts. An autogenous semitendinosus tendon was harvested and prepared as 2-stranded grafts for each of the anteromedial (AM) and posterolateral (PL) bundle grafts. As for the tunnel placement, the center points of the AM and PL femoral aperture were intraoperatively determined using the resident's ridge as an anatomical landmark.[12] Both AM and PL femoral tunnel apertures were placed behind the resident's ridge, while the PL tunnel aperture was placed at a more posterior and distal position in relation to the AM tunnel. Graft fixation was achieved by an EndoButton-CL (Smith & Nephew) for the femur, while the tibial end of the graft construct was fixed to a screw post. The

graft was fixed with manual maximum tension applied while the knee was in extension position during the PL bundle fixation and in a mild knee flexion position (20°-30°) for the AM bundle.

Postoperative Rehabilitation Protocol

After surgery, the operated knee was immobilized with a brace in extension, and no weight bearing was permitted for the initial 2 to 3 weeks after surgery to protect the ACL graft and repaired meniscus. Afterward, range-of-motion exercises and partial weight bearing were started and gradually increased to full weight bearing allowed by 4 to 6 weeks after surgery. Although a fairly aggressive postoperative rehabilitation program was used, progression of the program was delayed for knees with degenerative/complex tears considering the inferior tissue healing capability. Full squatting and deep flexion were prohibited for at least 2 months to avoid excessive stress applied to the repair site. Running was started at 4 months. At 8 months postoperatively, patients were permitted to return to full athletic activity once a patient demonstrated satisfactory anterior and rotational instability, full muscle strength, and neuromuscular coordination.

Arthroscopic Evaluation for Healing at the Repair Site

Second-look arthroscopic evaluation for healing status of the repaired meniscus was conducted by the surgeon who performed the initial meniscal repair procedure. For assessment of healing at the repair site, standard arthroscopic portals were used. The arthroscopic evaluation criteria proposed by Morgan et al.[13] were followed for the arthroscopic assessment of the healing status of the repaired meniscus. According to those criteria, healing status at the repair site was graded as healed, incompletely healed, or not healed (failure; Fig 1). A healed repair represents no defect or areas of hypermobility upon probing at the repair site. An incompletely healed repair had a partial defect of 50% of the original repair length or height that was stable to probing. When either an unstable meniscus fragment secondary to retear at the original repair site or a second tear in the meniscal substance in an area different from the original repair site was identified, the repaired site was graded as "not healed." Tear zones were classified according to Cooper's classification[14] as follows: red-red zone, which included the outer third of the meniscus; red-white zone, which included the middle third; and white-white zone, which included the inner third of the meniscus.

Clinical Assessment

After primary surgery, the patients were periodically tracked at 1, 3, 6, 9, and 12 months and subsequent regular follow-ups afterward. The comprehensive clinical evaluation including physical examination and clinical outcome assessment using validated subjective assessment measures (Lysholm and Tegner activity scores) was conducted at 12 months and subsequent annual checkups. Patient data related to recurrent meniscal symptom and second-look arthroscopy results were obtained from retrospective chart review. In addition, at the last visit before second-look arthroscopy, a clinical evaluation was conducted for signs and symptoms indicative of repair failure including recurrent effusion, locking or catching, localized joint line tenderness, and positive McMurray test.[15] Stability of the reconstructed ACL was evaluated based on KT-1000 arthrometric measurement (side-to-side difference) and pivot-shift test results under anesthesia immediately before second-look arthroscopy. The KT-1000 results were assessed as a continuous variable, while pivot-shift test was evaluated as a binary variable (− or +).

Assessment of Clinical Factors Influencing Meniscal Healing

Potential prognostic factors analyzed in the study are as follows: age, gender, anterior stability, pivot-shift test, tear type/location, number of meniscal sutures, side of the meniscus, time from injury to surgery, and postoperative Tegner activity score. Failure of repair graded as "not healed" was defined to be of failed repair, and the relationship between each of the aforementioned demographic/clinical parameters and the prognosis was statistically assessed.

Statistical Analysis

Comparison of pre- and postoperative clinical results was performed using the Mann-Whitney *U*-test with the significance level set at $P < .05$. Statistical analysis of potential risk factors for repair failure was initially performed with a univariate analysis using Fisher's exact test. Subsequently, factors that were found to have values of $P < .1$ in the univariate analysis were further analyzed by the multivariate logistic regression analysis. Consequently, the statistical results are presented by odds ratios, 95% confidence intervals, and P values. All P values were 2-sided, and $P < .05$ was considered statistically significant. Statistical analyses were performed using SPSS (ver. 19, SPSS) software.

Results

During the study period, 596 knees underwent isolated primary ACL reconstruction, and a total of 392 meniscal tears in 352 (59%) knees were surgically managed. Regarding the surgical option, concomitant arthroscopic meniscal repair was performed for 231 menisci in 217 knees in 214 patients, while partial meniscectomy and rasping were performed for 43 and

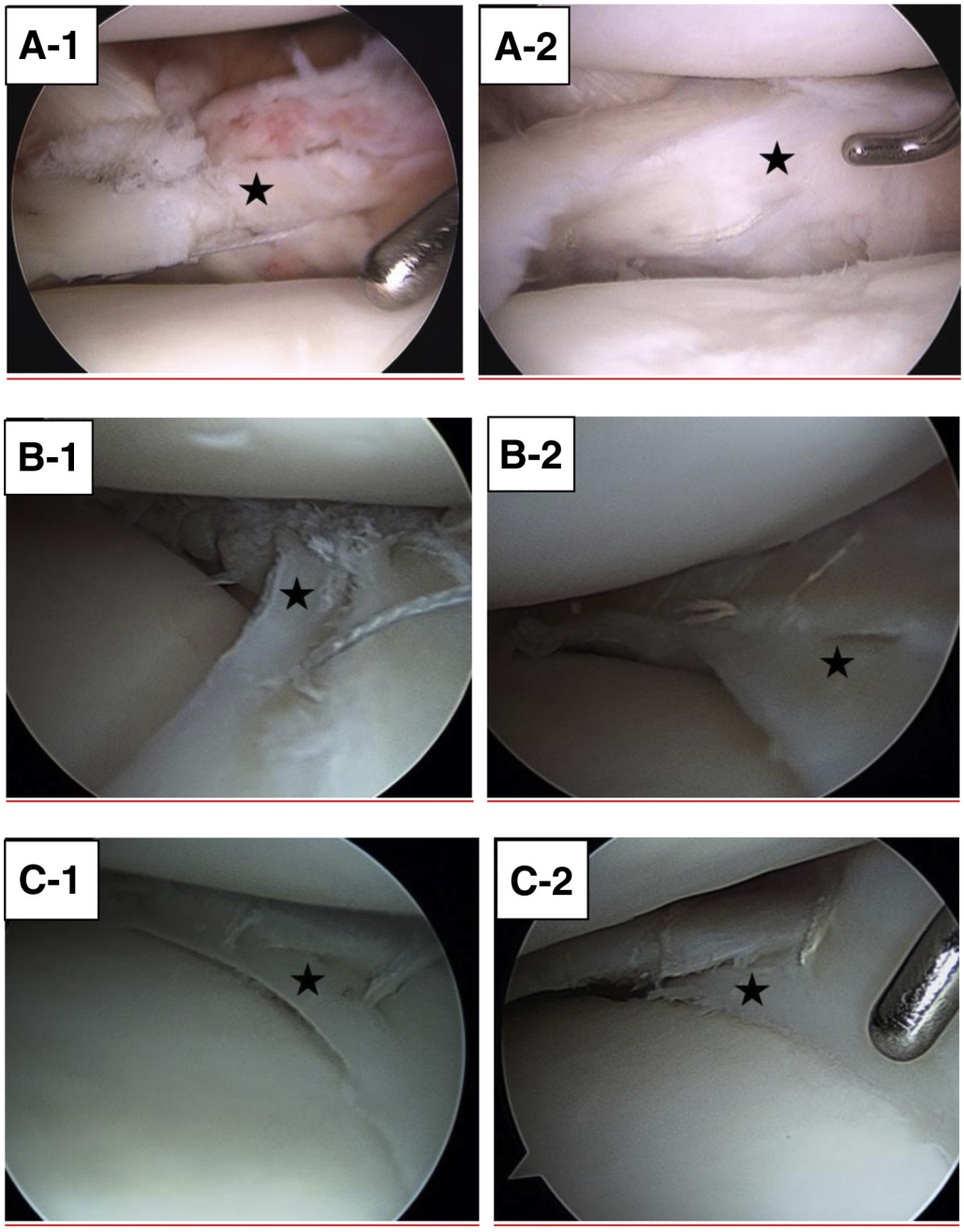

Figure 1. Arthroscopic evaluation of the repaired meniscus. The patient is placed in the supine position on a standard operating table. The lower extremity is placed into a holder, and a tourniquet is applied around the proximal thigh. (A-1) Repair of the complex tear at the popliteal hiatus region of the lateral meniscus using combined horizontal and vertical sutures (star; right knee, viewing portal: anterolateral). (A-2) Second-look arthroscopic examination at 12 months after the meniscal repair. The meniscus was classified as healed (star). (B-1) Repair of the complex tear at the middle part of the medial meniscus (star) using combined vertical and "hay bailer" type stitches (right knee, viewing portal: anterolateral). (B-2) Second-look arthroscopic examination at 14 months after the meniscal repair. The meniscus was classified as incompletely healed (star) because a 1- to 2-mm indentation remained observable at the repair site. (C-1) Repair of the tear in the red-white and white-white zones of the medial meniscus using multiple vertical sutures (star; right knee, viewing portal: anterolateral). (C-2) Second-look arthroscopic examination at 14 months after the meniscal repair. The meniscus was classified as not healed (star).

118 menisci. Among the 217 knees that underwent meniscal repair, 14 knees and 98 knees were excluded from the study subjects due to the deficiencies of 1-year minimal follow-up data and second-look arthroscopy results, respectively. Finally, 105 knees in 104 patients (48.6%) met the inclusion/exclusion criteria and remained eligible for the study analysis (Fig 2).

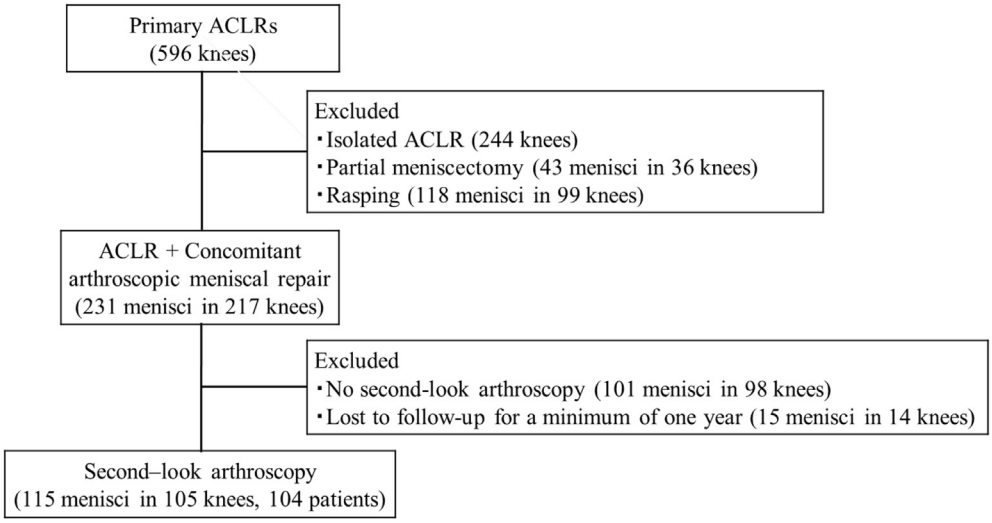

Figure 2. Flowchart showing the selection process of the patient population. ACL, anterior cruciate ligament; ACLR, anterior cruciate ligament reconstruction.

Patient Profiles

The average time from injury to the combined ACL/meniscus surgery was 6.9 months (range, 3 weeks to 60 months), and the average time from the index surgery to second-look arthroscopy was 15 months (range, 7-50 months). The follow-up period for clinical evaluation averaged 18 months (range, 12-50 months). There were 40 male patients and 64 female patients (bilateral surgeries in 1 female patient) with a mean age of 24.0 ± 9.9 years (range, 15-52 years). Patient demographic data are shown in Table 1. Meniscal repair was performed for 76 medial and 39 lateral menisci.

Tear Type and Location

The most frequent tear type was the longitudinal tear seen in 71 menisci (51 medial, 20 lateral) (61.7%). In regard to the tear location, the most frequent region was the red-red zone, accounting for 67.8% (78 of 115 menisci; Table 2).

Second-Look Arthroscopic Evaluation

Second-look arthroscopy was performed for 115 repairs with a total of 105 knees. Based on the arthroscopic findings, 64 menisci (40 medial, 24 lateral), 22 menisci (15 medial, 7 lateral), and 29 menisci (21 medial, 8 lateral) were categorized as healed, incompletely healed, and not healed, respectively. In total, healing of the repaired site (including incomplete healing) was achieved in 86 of the 115 repaired menisci (75%). There were 9 patients who underwent repeat arthroscopy for assessment and treatment of symptomatic knees. Among the 9 knees, the repaired site did not heal in 8 knees, and the 1 remaining knee was included in the incomplete healing category.

For the 29 knees in the "not healed" category, revision meniscal repair combined with fibrin clot implantation was attempted in 1 knee, while meniscal procedures, such as meniscectomy (n = 20) and radiofrequency treatment to reshape or smooth the roughed/frayed meniscal edges (n = 8), were performed in the remaining 28 knees at the second-look arthroscopy.

Table 1. Patient Demographic Data

Parameter	Value
No. of patients/knees	104/105
Sex, male/female	40/64
Age, years	24.0 ± 9.9 (range, 15∼52)
Time from injury to index surgery (median)	6.9 ± 10.6 months (3 months)
Time from index surgery to second-look arthroscopy	15 ± 5.6 months

Clinical Assessment

Upon clinical examination at a mean of 18 months (range, 12-50 months) after primary ACL reconstruction, 9 knees presented with symptoms caused by meniscal retear as described above. In these knees, 8 knees had joint line tenderness on the medial or lateral sides with a positive McMurray test, and 1 knee had recurrent locking and catching.

Clinical assessment based on the Lysholm score at 12 months showed clinically significant improvement with more than minimal detectable change (10 points) in 104 of the 105 knees (99%)[16-18] (Fig 3). The Tegner activity score averaged 6.7 ± 1.5 (6.2 ± 1.5 in the healed group, 6.5 ± 1.4 in the incomplete healed group, and 7.7 ± 0.9 in the not healed group). The mean side-to-side difference in the KT-1000 examination under anesthesia immediately before the second-look arthroscopy was 1.1 ± 1.3 mm (range, 0-6.0 mm).

Table 2. Location/Region/Laterality of the Meniscal Tears

	Medial Meniscus (%)	Lateral Meniscus (%)	Total (%)
Location of meniscal tears			
Red-red	51 (67.1)	20 (51.3)	71 (61.7)
Red-white	15 (19.7)	11 (28.2)	26 (22.6)
Red-white + red-red	4 (5.3)	0 (0)	4 (3.5)
White-white	0 (0)	0 (0)	0 (0)
White-white + red-white	4 (5.3)	6 (15.4)	10 (8.7)
White-white + Red-white + Red-red	2 (2.6)	2 (5.1)	4 (3.5)
Type of meniscal tears			
Longitudinal	51 (67.1)	27 (69.2)	78 (67.8)
Bucket handle	16 (21.1)	1 (2.6)	17 (14.8)
Horizontal	0 (0)	1 (2.6)	1 (0.9)
Radial	0 (0)	3 (7.7)	3 (2.6)
Complex	9 (11.8)	7 (17.9)	16 (13.9)

Assessment of Prognostic Factors

When the nonhealed condition was deemed to be of failed repair, potential risk factors with a *P* value of <.1 in the univariate analysis were a high activity level with a Tegner activity score of 8 or more, recurrent instability after ACL reconstruction with positive pivot-shift test and side-to-side difference in KT of 3 mm or more, tears in the red-white to white-white zones, and time from injury to surgery of 4 months or longer (Table 3). In the subsequent multivariate logistic regression analysis, a high activity level with a Tegner activity score of 8 or more (odds ratio, 22.2 [95% confidence interval (CI), 4.4-112.1]), recurrent instability after ACL reconstruction with side-to-side difference in KT of 3 mm or more (odds ratio, 11.0 [95% confidence interval (CI), 2.2-56.6]), tears in the red-white to white-white zones (odds ratio, 10.6 [95% CI, 2.5-44.8]), and time from injury to surgery of 4 months or longer (odds ratio, 4.9 [95% CI, 1.4-17.8]) were identified as prognostic factors that significantly correlated with failed repair ($P < .05$; Table 4).

Discussion

The results of this study showed that a healing rate of 75% could be attained for meniscal repair

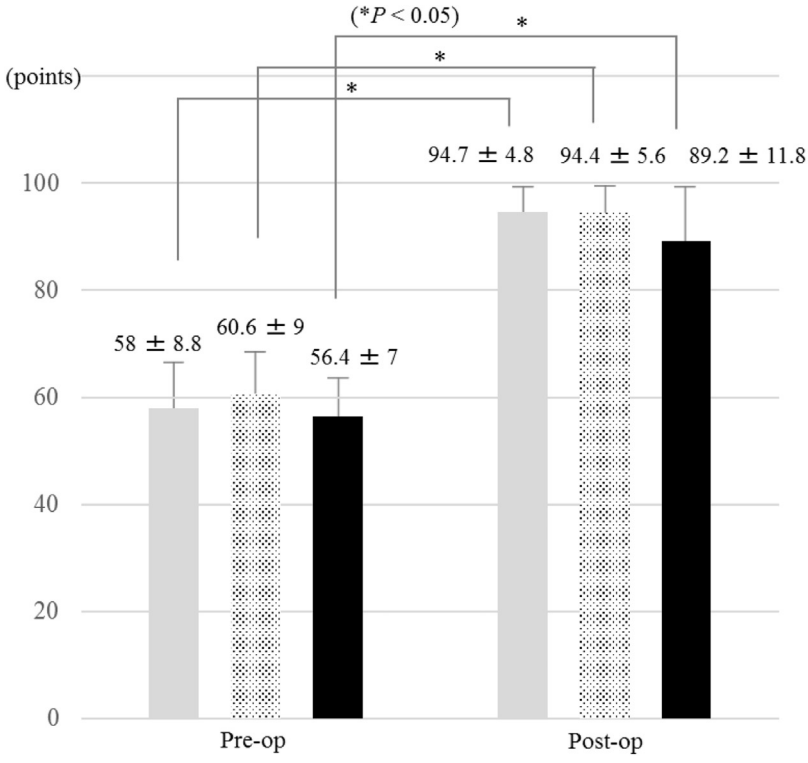

Figure 3. Pre- and post-operative Lysholm scores.

Table 3. Univariate Analysis of Potential Risk Factors Using Fisher's Exact Test

Factors	Success			Total	*P* Value
	Healed (%)	Incompletely Healed (%)	Failure, Not Healed (%)		
N	64 (55.7)	22 (19.1)	29 (25.2)	115	
Sex:					.51
Female	34 (47.2)	18 (25)	20 (27.8)	72	
Male	30 (69.8)	4 (9.3)	9 (20.9)	43	
Age, younger:					1.00
<18	23 (51.1)	10 (22.2)	12 (26.7)	45	
≥18	41 (58.6)	12 (17.1)	17 (24.3)	70	
Age, older:					.90
<35	53 (55.8)	18 (18.9)	24 (25.3)	95	
≥35	11 (55.0)	4 (20.0)	5 (25.0)	20	
Pivot-shift test:					.007*
Positive	5 (27.8)	4 (22.2)	9 (50)	18	
Negative	59 (60.8)	18 (18.6)	20 (20.6)	97	
KT-1000 side-to-side difference, mm:					.056*
<3	57 (57)	21 (21)	22 (22)	100	
≥3	7 (46.7)	1 (6.6)	7 (46.7)	15	
Time period from injury to surgery, months:					<.001*
<4	53 (69.7)	13 (17.1)	10 (13.2)	76	
≥4	11 (28.2)	9 (23.1)	19 (48.7)	39	
Vascularity at the repair site:					<.001*
Red-red zone	52 (73.2)	10 (14.1)	9 (12.7)	71	
Red-white to white-white zones	12 (27.3)	12 (27.3)	20 (45.4)	44	
Tegner activity score:					<.001*
<8	57 (63.3)	19 (21.1)	14 (15.6)	90	
≥8	7 (28)	3 (12)	15 (60)	25	
Side of the meniscus:					.50
Medial	40 (52.6)	15 (19.8)	21 (27.6)	76	
Lateral	24 (61.5)	7 (18)	8 (20.5)	39	
No. of meniscal sutures:					.74
<4	15 (46.9)	4 (12.5)	13 (40.6)	32	
≥4	49 (59.0)	18 (21.7)	16 (19.3)	83	

*Factors that were found to have values of $P < 0.1$ in the univariate analysis.

concomitantly performed with anatomic double-bundle ACL reconstruction. Regarding the clinical factors potentially affecting the healing of the repaired menisci, postoperative activity level, recurrent instability after ACL reconstruction, vascularity at the repaired site, and chronicity of the tear were identified as factors significantly affecting the healing rate.

It has been reported that meniscus injuries are found in approximately 70% of cases of ACL injury.[19] However, according to a review of the literature, meniscectomy accounts for 65% of the meniscal surgeries concomitantly performed with ACL reconstruction.[20] The importance of meniscus functionality has been clearly demonstrated, and emphasis has recently been placed on conservation of the meniscus as much as possible. Brophy et al.[18] assessed the status of the articular cartilage in 725 patients from the Multicenter ACL Revision Study (MARS) group undergoing revision ACL reconstruction. They reported that the articular cartilage damage in patients who underwent meniscectomy at the time of primary ACL reconstruction was more severe than that following combined meniscal repair/ACL reconstruction. Jones et al.[21] found less joint space narrowing after meniscal repair compared with meniscectomy in a large cohort study for ACL reconstruction (MOON study).

After considering those study results, indication of meniscal repair has been expanded to include meniscus injuries in the red-white zone and complex tears. Refinement and evolution of surgical techniques for meniscal repair and ACL reconstruction have provided the basis for the increased attempts to repair meniscal tears with less favorable biological/biomechanical conditions.

Table 4. Risk Factors Associated With Failed Repair As Determined by Regression Analysis

Factors	Odds Ratio	95% Confidence Interval	*P* Value
Pivot-shift test, positive	2.5	0.57-10.6	.23
KT side-to-side difference, ≥3 mm	11.5	2.2-56.6	.004*
Time period from injury to surgery, ≥4 months	4.9	1.4-17.8	.015*
Vascularity at the repair site, tears in the red-white to white-white zones	10.6	2.5-44.8	.001*
Tegner activity score (≥8)	22.2	4.4-112.1	<.001*

*$P < 0.05$.

In previous studies dealing with healing of meniscal repair, clinical symptoms/signs along with magnetic resonance imaging (MRI) findings were often adopted as measures to evaluate the healing status of the repaired site. Asahina et al.[22] evaluated 98 meniscal repairs by second-look arthroscopic surgery and reported that 15% of clinically asymptomatic patients had incompletely healed menisci at an average of 16 months after ACL reconstruction and meniscal repair. Therefore, clinical assessment with MRI evaluation alone does not provide definite information for the healing status. In addition, MRI assessment remains equivocal as signal changes at the repair site could not be distinguished between scar tissue and the remaining tear.[23-25] By contrast, arthroscopic assessment enables evaluation of synovial coverage on the repair site and stability using probes. Thus, second-look arthroscopy has been considered the gold standard for evaluating the healing status of the repaired menisci.[9,15,26-28] The strength of the present study was arthroscopic evaluation of healing status at the repair site for a large number of subjects.

In this study, only 9 knees out of the 29 knees with failed repair were symptomatic, while failure of meniscal repair was incidentally identified at the time of second-look arthroscopy concomitantly performed with hardware removal in 20 of the 29 knees. These results indicate that clinical evaluation alone missed approximately 70% of the failed repairs and there were a number of asymptomatic repair failures. Therefore, evaluation of healing at the repair site based on clinical evaluation alone may lead to overestimation of the healing rate. In this study, several clinical features related to failed repair following arthroscopic meniscal repair have been identified: high sports activity level, recurrent ACL insufficiency, long time interval from injury to surgery, and poor vascularity at the tear site. High activity level and ACL insufficiency are biomechanical factors leading to excessive stress applied at the repair site, and these factors have been reported to reduce the healing rate.[28-31] In addition, chronicity and vascularity of the tear were shown to be factors related to failed repair in the study. These factors are considered biological factors affecting the healing capability at the repair site. Although some previous studies have reported the relationship between the meniscal healing rate and patient age as well as tear length or tear site of the medial or lateral meniscus,[11] this study found no correlation between the healing rate and age or tear site.

In 2010, Tachibana et al.[27] published the results of second-look arthroscopy for 62 meniscal repairs concomitantly performed with ACL reconstruction. They reported an 88.7% healing rate (including incomplete healing in 14.5% of the subjects) on arthroscopic evaluation at 14.3 months after surgery on average. Indication for meniscal repair in their study was limited to tears in red-red and red-white zones, all were longitudinal or double longitudinal tears, and tears were repaired with an all-inside technique using FasT-Fix (Smith & Nephew Endoscopy, Andover, MA) for all cases. In addition, procedure for concomitant ACL reconstruction was not specified in the context. Although the reported healing rate in their study is higher than the rate in this study (75%), there are differences in the indication, repair technique, and concomitant ACL reconstructive procedure between their and our studies. Therefore, the 2 study results may not readily be compared with each other. An overall healing rate of 75% was attained in our patient population, which is similar to the value reported in previous relevant studies with conventional indications and other surgical techniques. Consequently, it was shown that relatively favorable results can be expected for repair of tears with unfavorable healing conditions such as poor vascularity and complex tear configuration; however, when the study results are critically examined, complete healing was accomplished in only 56%. When making treatment decisions for knees with combined ACL and meniscal injuries, surgeons should counsel patients regarding the expected outcome of meniscal repair and determine the surgical option based on consideration of clinical characteristics that could potentially influence the healing rate for each patient.

Limitations

There were some limitations to this study. First, the presented results represent less than half (48.6%) of the total population who underwent combined meniscal repair and ACL reconstruction due to the lack of second-look arthroscopy and minimal 1-year follow-up results. This issue can be associated with substantial potential selection and nonresponder bias. Second, the follow-up period (minimum of 1 year) is too short, and it is possible that the failure rate would be elevated with a longer follow-up period. Third, since second-look arthroscopy was solely used as an assessment measure, other measures, such as clinical evaluation and MRI, were not included in the assessment of healing at the repaired site. Fourth, there is significant variability and heterogeneity in repair pattern, tear pattern, meniscus laterality, tear size and location, and individual surgeon. Additionally, meniscal repair surgery as well as arthroscopic evaluation of meniscal healing was performed by 1 of the 3 surgeons, and this issue may induce biases in performance and assessment. Finally, this paper represents the results of meniscal repair performed for various tear patterns/locations using varied repair techniques and suture configurations. Therefore, optimal surgical option for specific tear pattern/location may not be well substantiated based on the study results.

Conclusions

Meniscal repair in ACL reconstructed knees with expanded indications achieved a healing rate (including incomplete healing) of 75%. Clinical factors such as high sports activity level, recurrent ACL instability, poor vascularity of the repaired site, and long duration from injury to surgery were shown to impair the healing status.

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