

Mechanical Symptoms and Arthroscopic Partial Meniscectomy in Patients With Degenerative Meniscus Tear

A Secondary Analysis of a Randomized Trial

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Background: Recent evidence shows that arthroscopic partial meniscectomy (APM) offers no benefit over conservative treatment of patients with a degenerative meniscus tear. However, patients who report mechanical symptoms (sensations of knee catching or locking) may benefit from APM.

Objective: To assess whether APM improves mechanical symptoms better than sham surgery.

Design: Randomized, patient- and outcome assessor-blinded, sham surgery-controlled, multicenter trial. (ClinicalTrials.gov: NCT00549172)

Setting: 5 orthopedic clinics in Finland.

Patients: Adults (aged 35 to 65 years) with a degenerative medial meniscus tear and no knee osteoarthritis.

Intervention: APM or sham surgery.

Measurements: Patients' self-report of mechanical symptoms before surgery and at 2, 6, and 12 months after surgery.

Results: 70 patients were randomly assigned to APM, and 76 were assigned to sham surgery. Thirty-two patients (46%) in the APM group and 37 (49%) in the sham surgery group reported

catching or locking before surgery; the corresponding numbers at any follow-up were 34 (49%) and 33 (43%), with a risk difference of 0.03 (95% CI, -0.06 to 0.12). In the subgroup of 69 patients with preoperative catching or locking, the risk difference was 0.07 (CI, -0.08 to 0.22).

Limitation: Analyses were post hoc, and the results are only generalizable to knee catching and occasional locking because few patients reported other types of mechanical symptoms.

Conclusion: Resection of a torn meniscus has no added benefit over sham surgery to relieve knee catching or occasional locking. These findings question whether mechanical symptoms are caused by a degenerative meniscus tear and prompt caution in using patients' self-report of these symptoms as an indication for APM.

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* For a list of Finnish Degenerative Meniscal Lesion Study group members, see the **Appendix** (available at www.annals.org).

Arthroscopic surgery to treat knee pain attributed to a degenerative meniscus tear is the most common orthopedic procedure—an estimated 700 000 such operations are done each year in the United States alone (1). However, recent evidence from randomized, controlled trials has questioned this strategy because knee arthroscopy has been reported to be no better than sham surgery or physical therapy for patients with degenerative knee disease (meniscus tear with or without osteoarthritis) (2, 3). Despite these findings, subgroups of patients may benefit from arthroscopic partial meniscectomy (APM). Patients reporting “mechanical symptoms,” the sensation of knee catching or locking, are the group most commonly asserted to benefit from surgery (4–8). This assertion is plausible because knee catching or locking is attributed to a mechanical blocking mechanism in the knee. Because degenerative meniscal tears are very common—if not the most common—pathologic alterations found by arthroscopy in the knee joints of patients with degenerative knee disease (9), trimming the torn meniscus should improve the apparent mechanical derangement.

However, a surgical outcome, particularly for essentially subjective symptoms, is a cumulative effect of placebo effects, a critical therapeutic element, and non-specific effects (most important, the normal variation in the course of the disease and the regression-to-the-

mean phenomenon) (10). The critical element is the component of the surgical procedure that is believed to provide the therapeutic effect (such as the partial resection of the torn meniscus), which is distinct from aspects of the procedures that are diagnostic or required to access the disease being treated (such as knee arthroscopy). Given that surgery produces a profound placebo response, a “true” therapeutic effect is impossible to distinguish from the nonspecific (placebo) effects, such as the patients' or researchers' expectations of benefit, without a placebo comparison group (11). Such bias is particularly inherent in open-label trials with subjective end points (12).

To our knowledge, no study has previously assessed the success of arthroscopic surgery in alleviating mechanical symptoms of degenerative knee disease. The evidence gap is also apparent in clinical practice guidelines: Some advocate arthroscopy for patients with mechanical symptoms (13, 14), and others refrain from making any recommendations about this patient group (15). Therefore, using the data from our

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EDITORS' NOTES**Context**

Whether arthroscopic partial meniscectomy (APM) is an effective treatment of mechanical symptoms of knee locking and catching associated with degenerative meniscal tears is unclear.

Contribution

In this secondary analysis of a randomized, controlled trial comparing APM with sham surgery for degenerative meniscal tears, similar proportions of patients in both groups reported mechanical symptoms during the 1-year follow-up. Analyses restricted to patients who reported preoperative mechanical symptoms yielded similar results.

Caution

The trial was not originally designed to examine this question.

Implication

Arthroscopic partial meniscectomy is not worthwhile in patients with degenerative meniscal tears and mechanical symptoms.

recently published sham surgery-controlled study, FIDELITY (Finnish Degenerative Meniscal Lesion Study) (16), we assessed the effect of APM on mechanical symptoms in a post hoc analysis. In essence, if APM is effective, it should provide a clinically important improvement in these symptoms compared with a sham surgical procedure.

METHODS**Study Sample**

The design and conduct of FIDELITY was described in detail previously (16, 17). In brief, the study was a multicenter, randomized (1:1), double-blind, sham surgery-controlled efficacy trial involving 146 patients aged 35 to 65 years who had knee pain (for >3 months) that was unresponsive to conventional conservative treatment and who had clinical findings consistent with a medial meniscus tear. We excluded patients if they had an obvious traumatic onset of symptoms or had knee osteoarthritis as defined with clinical criteria (American College of Rheumatology) (18) or radiographic criteria (Kellgren-Lawrence grade >1) (19). In addition, patients with a locked knee (objectively verifiable inability to fully straighten the knee) were excluded, whereas patients reporting sensations of knee catching or locking were included. After confirmation of the diagnosis of an isolated medial meniscus tear (both magnetic resonance imaging and arthroscopic verification), the patients were randomly assigned to APM or sham surgery (Figure). The trial began in a single orthopedic center for the first 2 years but was expanded to 4 more centers to improve recruitment and

generalizability. The local ethics committees approved the study, and all patients provided written informed consent. The study adhered to the Declaration of Helsinki.

In this study, we report results from the following 2 post hoc analyses: a full sample analysis to determine the influence of APM on the prevalence of mechanical symptoms and a subgroup analysis of patients who reported mechanical symptoms before the intervention to determine the efficacy of APM in alleviating them.

Presence of Mechanical Symptoms

As part of the initial eligibility screening for the trial, an orthopedic surgeon carefully examined all patients to exclude those who could not fully straighten the knee (that is, a true locked knee). Patients reporting recent episodes of a locked knee were also excluded. On the day of surgery (baseline), all patients were asked about mechanical symptoms (sensations of catching and locking) using a slightly modified version of the "locking domain" of the Lysholm knee score (20) to make the instrument applicable as a patient-administered question (Appendix Table 1, available at www.annals.org). The Lysholm knee score (20) is a condition-specific outcome measure and has been validated for patients with meniscus injury (21). In brief, we asked patients to choose 1 out of 5 following responses that best reflected the status of their knee: no locking or catching, catching but no locking, occasional locking, frequent locking, or locked at present. The question was repeated at each follow-up (2, 6, and 12 months after surgery), and responses were primarily classified into those reporting no locking or catching and those reporting 1 of the other 4 types of mechanical symptoms.

The test-retest reliability of the "locking" question was determined in an independent sample of 40 patients with a mean age of 56 years (range, 28 to 73 years) (17 women and 23 men), all of whom had a degenerative meniscus tear verified later by arthroscopy. The question was asked twice within 2 weeks because this interval has been shown to provide the most reliable estimate of test-retest ability (22). Thirty-three of the 40 patients gave identical assessments at the 2 visits (5 differed by 1 category, and 2 differed by 2 categories), which resulted in a reliability of $\kappa = 0.72$ (95% CI, 0.50 to 0.95) for the dichotomized response options (no symptoms vs. any symptoms) and $\kappa = 0.75$ (CI, 0.56 to 0.89) for the full 5-item discrimination, as defined by the κ statistics according to Landis and Koch (23). Appendix Table 2 (available at www.annals.org) shows the individual responses of the test-retest assessment.

Knee Arthroscopy

We performed diagnostic knee arthroscopy on all patients by using anterolateral and anteromedial portals and a standard 4-mm arthroscope under spinal or general anesthesia (1 site) according to the normal practice of the respective hospitals. Arthroscopic evaluation included recording the presence of intra-articular pathology (meniscus tears and loose bodies) and characterizing chondral lesions of both the tibio-

femoral and patellofemoral chondral surfaces (Appendix Table 3, available at www.annals.org).

Randomization and Blinding

After diagnostic arthroscopy in which the existence of a degenerative tear of the medial meniscus but no other intra-articular pathology requiring surgical intervention was confirmed, the surgeon asked a research nurse to open an envelope containing the group assignment (APM or sham surgery). The assignment was not revealed to the patient. The sequentially numbered, opaque, sealed envelopes were prepared by a statistician with no involvement in the patients' clinical care. Randomization was done in a 1:1 ratio with a block size of 4 (known only to the statistician) and involved stratification according to study site, age (35 to 50 years or 51 to 65 years), sex, and the absence or presence of minor degenerative changes on a radiograph (Kellgren-Lawrence grade 0 or 1, respectively). Only the orthopedic surgeon and other staff in the operating room were aware of the group assignment, and they did not participate in further treatment or follow-up.

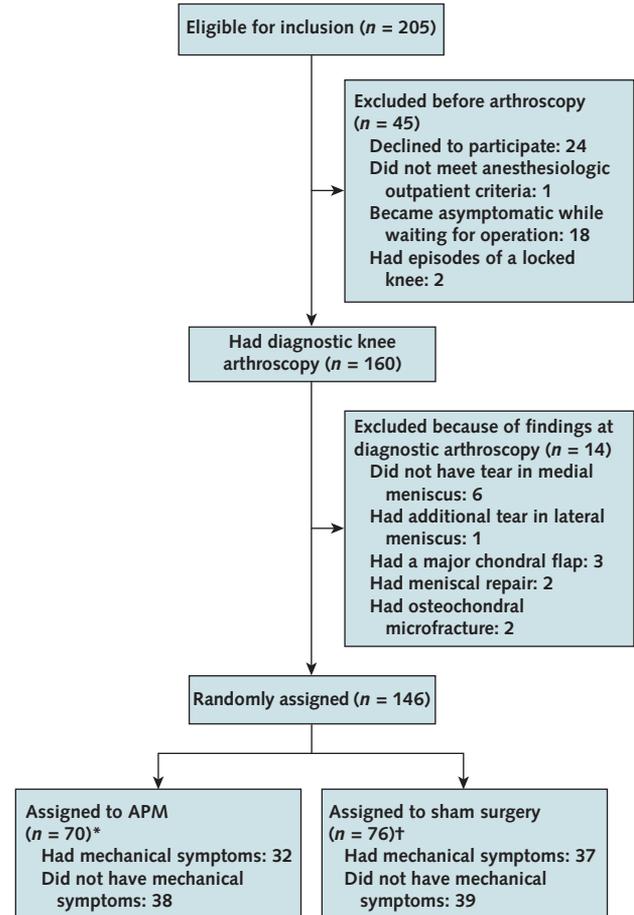
In the APM group, the damaged and loose parts of the meniscus were removed with arthroscopic instruments (a mechanized shaver and meniscal punches) until solid meniscal tissue was reached. The meniscus was then probed to ensure that all loose and unstable fragments had been successfully resected, preserving as much of the meniscus as possible. No other surgical procedure was done.

In the sham group, a standard APM procedure was simulated (after diagnostic arthroscopy). To mimic the sounds and sensations of a true APM, the surgeon asked for all instruments, manipulated the knee as if an APM procedure was being done, pushed a mechanized shaver (without the blade) firmly against the patella (outside the knee), and used suction. The patient was kept in the operating room for the amount of time required to perform an actual APM procedure.

Statistical Analysis

In this post hoc analysis to determine the effect of APM versus sham surgery on the risk for mechanical symptoms, the outcome was the presence or absence of mechanical symptoms (binary) assessed at 2, 6, or 12 months after surgery (3 measurements). We used generalized estimating equations (Stata [Stata, version 13, StataCorp] command `xtgee`) to estimate the risk difference (using the binomial family and identity link function) and risk ratio (using the binomial family and logit link function) for mechanical symptoms. We assumed a within-person exchangeable correlation structure and used robust SEs. The analysis was adjusted for the follow-up time and the baseline randomization stratification factors (study site, age [35 to 50 years or 51 to 65 years], sex, and absence or presence of minor degenerative changes on a radiograph [Kellgren-Lawrence grade 0 or 1]). To obtain the adjusted risk ratio from the logit model, the method of marginal standardization (24) was used. The estimates are reported with bootstrap bias-corrected 95% CIs obtained from 1000 rep-

Figure. Study flow diagram.



APM = arthroscopic partial meniscectomy.

* 70 patients were included in the 12-mo assessment.

† 76 patients were included in the 12-mo assessment.

lications with the person as the resampling unit. The sham surgery group was considered the reference, and accordingly, a risk difference greater than 0 or a risk ratio greater than 1 denoted an increased risk for mechanical symptoms after surgery in the APM group.

To determine efficacy in alleviating mechanical symptoms, the success of APM versus sham surgery was compared in the 69 patients (32 in the APM group and 37 in the sham group) who reported preoperative mechanical symptoms by repeating the previously mentioned analysis (without adjustment for the site because of sparse data). This subgroup analysis is likely to be underpowered.

All analyses were done according to the intention-to-treat principle in which all patients were included in the group to which they were assigned, regardless of whether they completed the trial in that group. The frequency of crossover was low (1 in the APM group and 4 in the sham surgery group).

Statistical analysis was done by using Stata, version 13.

Table 1. Demographic and Clinical Characteristics of the APM and Sham Surgery Groups*

Characteristic	Complete Sample (n = 146)		Subgroup With Preoperative Mechanical Symptoms (n = 69)	
	APM (n = 70)	Sham (n = 76)	APM (n = 32)	Sham (n = 37)
Women, n (%)	28 (40)	29 (38)	16 (50)	13 (35)
Mean age at enrollment (SD), y	52.1 (6.7)	52.0 (7.2)	49.9 (7.2)	53.7 (6.5)
Median duration of symptoms (IQR), mo	10.0 (6.6–14.0)	9.7 (6.4–16.0)	11.8 (7.0–15.9)	12.0 (5.9–16.1)
Mean body mass index (SD), kg/m ²	26.9 (4.0)	27.9 (4.0)	27.5 (4.7)	27.9 (3.7)
Radiographic disease severity grade, n (%)†				
0	35 (50)	36 (47)	18 (56)	18 (49)
1	35 (50)	40 (53)	14 (44)	19 (51)
Positive result of McMurray test, n (%)‡	16 (23)	15 (20)	8 (25)	9 (24)
Pain provoked by forced flexion, n (%)	50 (71)	59 (78)	24 (75)	31 (84)
Pain provoked by palpation, n (%)	63 (90)	74 (97)	29 (91)	36 (97)
Onset of symptoms, n (%)				
Gradual	48 (69)	48 (63)	24 (75)	26 (70)
After exercise or hard work	12 (17)	14 (18)	6 (19)	5 (14)
Suddenly or after twisting	10 (14)	14 (18)	2 (6)	6 (16)
Locking item of Lysholm knee score, n (%)§				
No locking or catching	38 (54)	39 (51)	-	-
Catching sensations but no locking	25 (36)	25 (33)	25 (78)	25 (68)
Occasional locking	4 (6)	10 (13)	4 (13)	10 (27)
Frequent locking	3 (4)	2 (3)	3 (9)	2 (5)
Locked at present	0 (0)	0 (0)	0 (0)	0 (0)
Site, n				
Hatanpää Hospital, Tampere	39	41	-	-
Helsinki University Central Hospital	3	6	-	-
Turku University Hospital	8	9	-	-
Central Hospital, Jyväskylä	8	6	-	-
Kuopio University Hospital	12	14	-	-

APM = arthroscopic partial meniscectomy; IQR = interquartile range.

* Percentages may not sum to 100 due to rounding.

† Using the Kellgren-Lawrence grading system, for which grade 0 denotes no abnormalities and grade 1 denotes minor degenerative changes (doubtful narrowing of the joint space or possible osteophytic lipping).

‡ Results are positive for a meniscus tear if the examiner feels a “click” over the medial tibiofemoral joint line during flexion and extension of the knee under varus stress.

§ The score is a condition-specific outcome measure with 8 domains. The presence of mechanical symptoms was assessed using the locking domain of the score with a minor modification (extension) to be applicable as a patient-administered question (Appendix Table 1, available at www.annals.org).

|| All operations were done by a single orthopedic surgeon at all sites except the Helsinki University Central Hospital, where 2 orthopedic surgeons did the procedures.

Role of the Funding Source

FIDELITY was funded by the Academy of Finland. The funding source had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; or preparation, review, or approval of the manuscript.

RESULTS

Patient Characteristics

We randomly assigned 70 patients to the APM group and 76 to the sham surgery group (Figure). The mean age of patients was 52 years (SD, 7) in both groups. The mean body mass indices were 26.9 kg/m² (SD, 4.0) in the APM group and 27.9 kg/m² (SD, 4.0) in the sham surgery group. Preoperative mechanical symptoms were reported by 32 (46%) and 37 (49%) patients, respectively. The 2 treatment groups within the subgroup reporting preoperative mechanical symptoms were similar with respect to age, sex, body mass index, and the severity of preoperative mechanical symptoms (Table 1). Table 1 shows the distribution of patients across the 5 recruiting centers and the number of orthopedic surgeons treating the patients.

All 70 patients in the APM group and 76 in the sham surgery group completed the study (Figure). Two patients in the APM group and 5 in the sham surgery group had additional surgery during the 1-year follow-up due to persistent symptoms after the index procedure. Of the 2 patients who had further knee surgery after APM, 1 had a total knee replacement and the other had a repeated resection of the meniscus, whereas 4 out of 5 patients who had additional surgery in the sham surgery group had APM and 1 patient had proximal tibial osteotomy.

Risk for Mechanical Symptoms

Of the 146 patients, 34 (49%) in the APM group and 33 (43%) in the sham surgery group reported mechanical symptoms at least once during the 12-month follow-up (Table 2). The risk difference for having mechanical symptoms (APM vs. sham surgery) was 0.03 (CI, -0.06 to 0.12) with a corresponding relative risk of 1.06 (CI, 0.75 to 1.59). The severity and frequency of the different types of mechanical symptoms were also similar between groups during follow-up (Appendix Tables 4 and 5, available at www.annals.org).

Table 2. Course of Mechanical Symptoms After APM or Sham Surgery ($n = 146$)*

Mechanical Symptoms	Before Surgery		2 mo		6 mo		12 mo	
	APM	Sham	APM	Sham	APM	Sham	APM	Sham
Present, n	32	37	17	24	16	14	19	15
Absent, n	38	39	53	52	54	62	51	61
Absolute risk	-	-	0.24	0.32	0.23	0.18	0.27	0.20
Risk difference (95% CI)	-	-	-0.07 (-0.22 to 0.07)		0.04 (-0.09 to 0.18)		0.07 (-0.06 to 0.21)	
Relative risk (95% CI)	-	-	0.77 (0.42 to 1.34)		1.24 (0.68 to 2.58)		1.38 (0.73 to 2.83)	

APM = arthroscopic partial meniscectomy.

* Results are expressed as the numbers and unadjusted risks (95% CIs) of patients with a degenerative meniscal tear who still have mechanical symptoms at 2, 6, and 12 mo after APM ($n = 70$) or a sham surgery procedure (diagnostic arthroscopy followed by simulated APM) ($n = 76$).

Efficacy of APM in Alleviating Mechanical Symptoms

In the subgroup of 69 patients with preoperative mechanical symptoms, 23 (72%) in the APM group and 22 (59%) in the sham surgery group reported these symptoms at least once during the 12-month follow-up. The risk difference for having mechanical symptoms was 0.07 (CI, -0.08 to 0.22) with a corresponding relative risk of 1.12 (CI, 0.73 to 1.65). These estimates remained essentially the same when each time point of evaluation was analyzed separately (Table 3). Only 9 of 32 patients (28%) in the APM subgroup and 15 of 37 (41%) in the sham surgery subgroup did not have mechanical symptoms at all 3 follow-up points.

DISCUSSION

According to this secondary analysis of FIDELITY, we found no evidence that the critical therapeutic element of APM, resection of the torn meniscus, provides any clinically important effect on the course (prevalence) of symptoms of knee catching or locking or resulted in any greater relief of these symptoms than a sham surgical procedure in patients with a degenerative meniscus tear and no radiographic osteoarthritis. Therefore, our findings question whether these symptoms are caused by a degenerative meniscus tear and prompt caution in using patients' self-report of mechanical symptoms as an indication for performing APM.

Why do orthopedic surgeons consider arthroscopy the treatment of choice for patients with sensations of mechanical symptoms and degenerative knee disease? The most obvious answer is that a true locked knee is usually caused by a traumatic "bucket handle" type of meniscus tear, and this kind of injury can be cured by

removing or repairing the lesion arthroscopically. Therefore, it is intuitive to assume that a similar approach of addressing the internal derangement would work identically in patients with a degenerative meniscus tear. Given the broad consensus about the validity of preoperative mechanical symptoms as an indication for knee arthroscopy in patients with a degenerative meniscus tear (4-6, 13), the paucity of evidence supporting such a policy is remarkable. The only existing evidence for the utility of APM for persons with mechanical knee symptoms and a degenerative meniscus tear come primarily from before-and-after studies. In 1 study that included 65 patients (68 knees) older than 40 years, the reported prevalence of knee catching or locking decreased from 31% to 17% approximately 8 years after partial meniscectomy (25), whereas another study reported alleviation of locking symptoms in only 1 of 6 patients (17%) with a degenerative meniscus tear during 35 months of follow-up (26). In contrast, in patients with a nondegenerative meniscus tear, the success rate of APM in curing mechanical symptoms has been reported to range from 76% (13 of 17) (26) to 100% (21 of 21) (27). These findings highlight the importance of distinguishing between degenerative and nondegenerative meniscus tears, a distinction that is made only sparsely in the existing literature.

One strength of FIDELITY is that it compared APM with sham surgery using an "efficacy design" (28, 29). Because the patients were rigorously selected to provide a sample that potentially would have an "optimal response" to APM and were blinded to the interventions they received, we had the opportunity to distinguish the possible effects, if any, of APM from the knee arthroscopy itself.

Table 3. Efficacy of APM in Alleviating Mechanical Symptoms ($n = 69$)*

Mechanical Symptoms	2 mo		6 mo		12 mo	
	APM	Sham	APM	Sham	APM	Sham
Present, n	14	17	12	9	10	10
Absent, n	18	20	20	28	22	27
Absolute risk	0.44	0.46	0.38	0.24	0.31	0.27
Risk difference (95% CI)	-0.02 (-0.26 to 0.21)		0.13 (-0.09 to 0.35)		0.04 (-0.17 to 0.26)	
Relative risk (95% CI)	0.95 (0.56 to 1.66)		1.54 (0.72 to 3.55)		1.16 (0.50 to 2.33)	

APM = arthroscopic partial meniscectomy.

* Results are expressed as the numbers and unadjusted risks (95% CIs) of patients with a degenerative meniscus tear who still have mechanical symptoms at 2, 6, and 12 mo after APM ($n = 32$) or a sham surgery procedure (diagnostic arthroscopy followed by simulated APM) ($n = 37$).

Our study has important weaknesses. First, these are post hoc analyses: The study questions were not included a priori as primary or secondary objectives of the original trial. However, because patients with mechanical symptoms have been—and still are—widely proposed as the group to benefit from APM (4–6, 13, 30) and such a proposal is backed by a credible biological rationale, we believed that this analysis based on a single symptom or outcome of high clinical relevance fulfilled the criteria of a relevant post hoc analysis.

Second, the study was not powered to address the success in alleviating mechanical symptoms. However, the point estimates of effect did not suggest any benefit of APM over the sham procedure, and the CIs for the risk difference exclude, in our opinion, a clinically important difference.

Third, there is no universal consensus on the definition of the terms *mechanical symptoms*, *catching*, or *locking*; therefore, our method for eliciting presence or absence of mechanical symptoms could be criticized. However, we used expanded symptom definitions in our questionnaire (a recently advocated policy [31]), and our method is probably at least as good as those used to elicit these symptoms in daily clinical practice, which suggests good generalizability. Although persons may comprehend the terms differently, this was unlikely to influence between-group comparisons. It should also be noted that the mechanical symptoms reported by our trial patients were primarily from the “milder end” of the mechanical symptom spectrum. Thus, our findings are directly applicable only to persons reporting sensations of knee catching or occasional locking (as well as those without mechanical symptoms), and we advise caution in generalizing our findings to those with truly frequent locking and particularly those with locked knees.

Finally, one could argue that our findings are not generalizable because of our highly selected (efficacy) population (28, 29). However, the results of our prospectively collected cohort of 888 consecutive patients who had APM in 1 of the 5 FIDELITY centers corroborate the general findings of this study: Patients with preoperative mechanical symptoms have more advanced degenerative knee disease and report less improvement and satisfaction than those without mechanical symptoms at the 12-month follow-up (32). Taken together, our findings support the evolving concept that degenerative meniscal tears represent an early sign of knee osteoarthritis, rather than a clinically important entity in their own right (9, 33).

The presence of “mechanical symptoms” in middle-aged persons with knee pain has traditionally been attributed to an internal mechanical derangement (typically, a meniscus tear) and believed to represent an indication for operative intervention. However, our post hoc analysis of a sham-controlled trial of APM for persons with a degenerative meniscal tear with or without mechanical symptoms has provided evidence that the critical therapeutic element of APM (the resection of the meniscus tear) provides no benefit over a sham surgical procedure in relieving sensations of knee catch-

ing or occasional locking. Our findings should prompt caution in using patients' self-report of mechanical symptoms as an indication for performing APM.

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Reproducible Research Statement: *Study protocol and data set:* Available from Dr. Järvinen (e-mail, teppo.jarvinen@helsinki.fi). *Statistical code:* Available from Ms. Turkiewicz (e-mail, aleksandra.turkiewicz@med.lu.se).

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Appendix Table 1. Question Used to Elicit the Presence/Absence of Mechanical Symptoms

1. Do you experience a sensation of locking in your knee?
(By locking, we mean that you are not able to straighten your knee normally)
- No locking or catching sensations
 - Catching sensation but no locking
 - Occasional locking
 - Frequent locking
 - The knee is locked at present

Appendix Table 2. The Test-Retest Reliability Data for an Independent Group of 40 Patients Who Responded to the Question on Locking* Twice Within a 2-wk Interval

Patient Number	First Assessment†	Second Assessment†
1	1	1
2	1	1
3	3	2
4	1	1
5	3	3
6	1	1
7	1	2
8	1	2
9	2	2
10	2	4
11	3	3
12	2	2
13	1	1
14	3	3
15	2	2
16	2	2
17	2	2
18	1	2
19	2	2
20	4	4
21	3	3
22	1	1
23	1	1
24	3	3
25	1	1
26	1	1
27	2	1
28	2	2
29	2	2
30	1	3
31	2	2
32	3	3
33	1	1
34	3	3
35	2	2
36	3	3
37	1	1
38	4	4
39	2	2
40	3	3

* See Appendix Table 1.

† 1 = no locking or catching; 2 = catching sensations but no locking; 3 = occasional locking; 4 = frequent locking; and 5 = locked at present.

Appendix Table 3. Arthroscopic Findings of the Study Patients

Variable	Complete Sample		Subgroup With Preoperative Mechanical Symptoms	
	APM (n = 70)	Sham (n = 76)	APM (n = 32)	Sham (n = 37)
Tear characteristics, n (%)*				
Bucket handle	2 (3)	3 (4)	1 (3)	1 (3)
Longitudinal	4 (6)	6 (8)	1 (3)	5 (14)
Flap	30 (43)	33 (43)	19 (59)	17 (46)
Radial	14 (20)	21 (28)	3 (9)	9 (24)
Horizontal	24 (34)	24 (32)	11 (34)	8 (22)
Complex	36 (51)	36 (47)	16 (50)	17 (46)
Mean affected meniscal segments (SD), n†	3.6 (1.4)	3.5 (1.2)	3.8 (1.3)	3.5 (1.1)
Chondral degeneration, n (%)‡				
None or mild	14 (20)	25 (33)	4 (13)	11 (22)
Early OA	38 (54)	30 (40)	23 (72)	16 (57)
OA	18 (26)	21 (28)	5 (16)	10 (22)

APM = arthroscopic partial meniscectomy; OA = osteoarthritis.

* The percentages do not add up to 100% because a meniscus could have >1 type of tear.

† In the meniscus tear classification system described by Cooper and colleagues (34), the meniscus is divided into 9 segments. The number of affected segments was determined at arthroscopy.

‡ Chondral lesions were first graded at arthroscopy according to International Cartilage Repair Society classification (35): 0 = none; 1 = superficial/softening; 2 = <50% of the cartilage thickness; 3 = through the entire cartilage thickness; 4 = extension into subchondral bone. Patients were then divided into 3 groups according to the severity of chondral degeneration as follows: none or mild = maximum grade 1 lesion in 1 compartment; degenerative changes = grade 1 lesion in at least 2 compartments or a single grade 2 lesion; osteoarthritic = grade 3 or 4 lesion in 1 compartment.

Appendix Table 4. Frequency and Severity of Mechanical Symptoms in Both Study Groups of the Full Sample (n = 146) During the Study Period*

Variable	Before Surgery		2 mo		6 mo		12 mo	
	APM	Sham	APM	Sham	APM	Sham	APM	Sham
No locking or catching	38 (54)	39 (51)	53 (76)	52 (68)	54 (77)	62 (82)	51 (73)	61 (80)
Catching sensations but no locking	25 (36)	25 (33)	16 (23)	19 (25)	14 (20)	13 (17)	16 (23)	11 (15)
Occasional locking	4 (6)	10 (13)	0	3 (4)	2 (3)	1 (1)	3 (4)	4 (5)
Frequent locking	3 (4)	2 (3)	0	2 (3)	0	0	0	0
Locked at present	0	0	1 (1)	0	0	0	0	0

APM = arthroscopic partial meniscectomy.

* Data are expressed as numbers (percentages).

Appendix Table 5. Frequency and Severity of Mechanical Symptoms in Both Study Groups of the Subgroup of Patients With Preoperative Mechanical Symptoms (n = 69) During the Study Period*

Variable	Before Surgery		2 mo		6 mo		12 mo	
	APM	Sham	APM	Sham	APM	Sham	APM	Sham
No locking or catching	0	0	18 (56)	20 (54)	20 (63)	28 (76)	22 (69)	27 (73)
Catching sensations but no locking	25 (78)	25 (68)	13 (41)	13 (35)	10 (31)	9 (24)	8 (25)	7 (19)
Occasional locking	4 (13)	10 (27)	0	3 (8)	2 (6)	0	2 (6)	3 (8)
Frequent locking	3 (9)	2 (5)	0	1 (3)	0	0	0	0
Locked at present	0	0	1 (3)	0	0	0	0	0

APM = arthroscopic partial meniscectomy.

* Data are expressed as numbers (percentages).

Web-Only References

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