

# Arthroscopic Partial Meniscectomy in Patients With Kellgren-Lawrence Grade 3 Osteoarthritis Shows Clinically Meaningful Improvement in Outcomes



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**Purpose:** To evaluate patient-reported outcome measures (PROMs) following arthroscopic partial meniscectomy (APM) in patients with Kellgren-Lawrence (KL) grade 3 on preoperative knee radiographs and a symptomatic meniscal tear. **Methods:** This was a retrospective study design using prospectively collected data from a single institution. Patients were included if they had KL grade 3 osteoarthritis on preoperative radiographs of the knee and completed a trial of nonoperative treatment for at least 6 weeks prior to APM. Patients were excluded if they had inflammatory arthritis, incomplete preoperative and/or 1-year postoperative follow-up data, repeat knee arthroscopy, and concomitant ligamentous injury. Statistical analyses used PROMs, preoperatively and up to 2 years postoperatively, to assess improvement utilizing scales with previously established thresholds, including minimal clinically important difference (MCID) and substantial clinical benefit (SCB). **Results:** Eighty-two patients met the eligibility criteria (49 women [60%], mean [SD] age, 53.1 [9.3] years). At the 1-year follow-up, most patients achieved MCID: 73% in Knee Injury and Osteoarthritis Outcome Score (KOOS) Pain, 66% in KOOS Symptoms, and 78% in KOOS Activities of Daily Living (ADL). These improvements were similar at the 2-year follow-up: 75%, 72%, and 79% in each subscale, respectively. SCB was also demonstrated 1 year postoperatively, with 56%, 73%, and 71% achieving SCB for the KOOS Pain, Symptoms, and ADL subscales, respectively. These results largely persisted at the 2-year follow-up. Visual analog scale scores for pain also improved at 1- and 2-year postoperative periods with mean improvements from baseline of 2.80 and 2.87 points, respectively. Marx Activity Score decreased on average from baseline to 1- and 2-year follow-up. **Conclusions:** At a minimum of 1-year follow-up, most patients with KL grade 3 and a meniscal tear achieved MCID and SCB in KOOS Pain, KOOS Symptoms, and KOOS ADL, indicating meaningful outcome improvement for these patients. **Level of Evidence:** Level IV, therapeutic case series.

**K**nee osteoarthritis (OA) is a degenerative disease that causes joint pain, stiffness, and a decline in knee function and is the most common joint disorder in the United States.<sup>1</sup> Knee OA increases in incidence with age and is more prevalent in women than men. Other risk factors of knee OA include obesity, knee injury,

prior knee surgery, repetitive use of joints, and joint laxity.<sup>1,2</sup> Treatment of knee OA is multidisciplinary and includes both conservative and surgical management. Total knee arthroplasty (TKA) is performed to relieve pain and improve physical function in patients with severe, end-stage osteoarthritis.<sup>3-7</sup> However, younger age and less severe osteoarthritis have been shown to be associated with increased risk for adverse outcomes and revision surgery, as well as dissatisfaction after TKA.<sup>8-13</sup> Historically, arthroscopic procedures (including lavage and/or debridement) have also been performed for osteoarthritis of the knee. However, their efficacy has been debated within the literature. Some studies support the use of arthroscopy to treat knee OA, demonstrating benefit,<sup>14-18</sup> whereas others, including 2 prospective randomized controlled trials (RCTs), showed no additional advantage to arthroscopy compared with sham procedures or physical therapy.<sup>19,20</sup> Current guidelines, from the American Academy of Orthopedic Surgeons (AAOS),<sup>21</sup> recommend

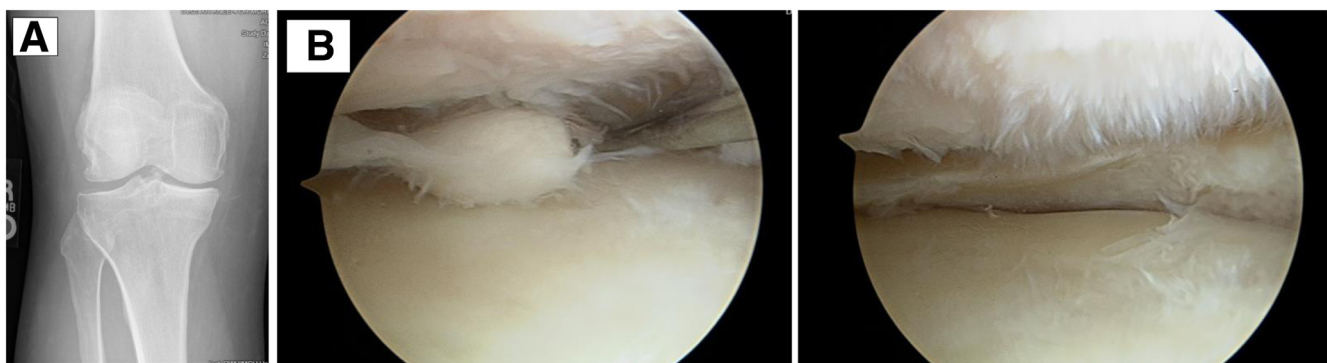
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**Fig 1.** “Gray zone patient” presenting with a symptomatic meniscal tear and osteoarthritis. This patient is not ready for total knee arthroplasty and not considered an ideal candidate for arthroscopic partial meniscectomy and is therefore classified to be within the “gray zone”: (A) Kellgren-Lawrence grade 3 on right knee radiograph and (B) arthroscopy images showing meniscal tear.

against the use of arthroscopy with lavage and/or debridement in patients with a primary diagnosis of osteoarthritis based on the findings of the 2 aforementioned RCTs and 2 additional studies by Kalunian et al.<sup>22</sup> and Saeed et al.<sup>23</sup> However, AAOS guidelines recommend that arthroscopic partial meniscectomy (APM) can be used in the treatment of meniscal tears in patients with concomitant mild to moderate osteoarthritis who have failed physical therapy or other nonsurgical treatments based on the findings of 3 RCTs.<sup>24-26</sup> Patients with a symptomatic meniscal tear and osteoarthritis are often not ready for TKA and not considered ideal candidates for APM. Therefore, physicians classify them as patients within the “gray zone” (Fig 1). The purpose of this study is to evaluate patient-reported outcome measures following APM in patients with Kellgren-Lawrence (KL) grade 3 on preoperative knee radiographs and a symptomatic meniscal tear. We hypothesized that most patients would demonstrate meaningful outcome improvement at 1 and 2 years postoperatively.

## Methods

### Study Design

The patient cohort utilized in this study was obtained as a subset of a larger population described in Lowenstein et al.<sup>27</sup> Informed consent was obtained from all patients, and institutional review board approval was acquired before study initiation (Protocol 2011P002663). Patients undergoing a primary APM with or without chondroplasty by a single surgeon (E.M.) at an academic medical center were prospectively enrolled into a Health Information Portability and Accountability Act–compliant global registry database (Surgical Outcome System) from August 2012 to October 2020. Patients were retrospectively identified in this database. To be included in this study, patients must have complete 1-year data and preoperative

radiographs with KL grade 3 osteoarthritis. Patients were excluded if they had inflammatory arthritis, incomplete preoperative and/or 1-year postoperative follow-up data, repeat knee arthroscopy, and concomitant ligamentous injury. Patients presented with symptoms of knee pain upon physical examination. Meniscal tears were confirmed on magnetic resonance imaging prior to APM. All patients chose to have an APM after a trial of nonoperative treatment, with no improvement, for at least 6 weeks. Nonoperative treatment was standard for all patients and included activity modification, physical therapy, nonsteroidal anti-inflammatory drugs, and optional corticosteroid injection.<sup>28</sup> All patients had a discussion with the surgeon (E.M.) regarding their pathology to include meniscal tear and knee OA.

All patients followed a uniform postoperative rehabilitation protocol. They were sent home after the procedure with an ACE wrap bandage, allowed to weight bear as tolerated, and given crutches to use as needed. They were instructed to start physical therapy approximately 2 weeks postoperatively and followed a standard postoperative knee arthroscopy protocol.

Demographic information was collected, reporting on age, sex, body mass index (BMI), race, ethnicity, history of diabetes mellitus, preoperative narcotic use, smoking status, and workers’ compensation status. Validated clinical outcome instruments were collected and included the visual analog scale (VAS) for pain; the Knee Injury and Osteoarthritis Outcome Score (KOOS), specifically Pain, Symptoms, and Activities of Daily Living (ADL) subscales; and the Marx Activity Score (MAS). Preoperatively but following consent and study enrollment, patients were e-mailed a link to an electronic survey with 1 e-mail reminder and/or phone call from a research assistant (N.L.) to ensure compliance with data collection. The surgeon (E.M.) documented intraoperative findings and confirmed the presence of meniscal tear(s).

**Table 1.** Preoperative Description of Cohort: Demographics and Clinical Characteristics

Characteristic	Mean (SD) or n (%)	Median (Range)
Age, mean (SD), y	53.1 (9.3)	53 (61)
Sex, n (%)		
Female	49 (59.8)	
Male	33 (40.2)	
BMI, <sup>†</sup> mean (SD)	32.6 (6.1)	31.65 (25.1)
Race, n (%)		
White	75 (91.5)	
Black or African American	4 (4.9)	
Other	1 (1.2)	
Patient declines to specify	2 (2.4)	
Ethnicity, n (%)		
Hispanic or Latino	2 (2.4)	
Not Hispanic or Latino	78 (95.1)	
Patient declines to specify	2 (2.4)	
Duration of symptoms, mean (SD), mo	14.2 (40.5)	6 (287.9)
Workers' compensation, n (%)		
Yes	3 (3.7)	
No	79 (96.3)	
Meniscal tear, n (%)		
Yes	82 (100.0)	
No	0 (0.0)	
Diabetes diagnosis, n (%)		
Yes	6 (7.3)	
No	76 (92.7)	
Smoking status, n (%)		
Yes	4 (4.9)	
No	78 (95.1)	

BMI, body mass index.

<sup>†</sup>Two subjects missing BMI value. Thirteen subjects missing symptom duration value.

As described by Lowenstein et al.,<sup>27</sup> research team members (N.L., E.M.) reviewed the medical records from the study population for the purpose of collecting and examining the most recent preoperative radiograph. The KL score was utilized to grade these radiographs, determining the severity of OA on a scale of 0 to 4, with grade 3 indicating moderate or severe joint space narrowing (Fig 1).<sup>29</sup> The team members underwent several training sessions to ensure images were evaluated uniformly. Each x-ray was graded separately by at least 2 reviewers (E.M., N.L.), and an orthopaedic surgeon (E.M.) determined the final score if there were any inconsistencies.<sup>27</sup>

### Statistical Analysis

Means, standard deviations, and medians are presented for continuous variables. Numbers and percentages are presented for categorical variables. Overall change in patient-reported outcomes from preoperative baseline to 1- and 2-year postoperative

follow-up intervals was computed and assessed. The first analysis assessed the change in VAS scores; KOOS Pain, Symptoms, and ADL subscales; and MAS from baseline to specific follow-up intervals. The second analysis assessed the extent to which patients achieved minimal clinically important difference (MCID) and substantial clinical benefit (SCB) in KOOS Pain, Symptoms, and ADL subscales at both 1- and 2-year postoperative follow-up intervals. Utilizing previously established MCID thresholds, clinical improvement was outlined as a discrepancy  $\geq 10$  for all KOOS subscales or an aggregated score of 90 or greater at the 1-year postoperative checkmark. Similarly, SCB thresholds were obtained from antecedent literature, and clinical improvement was outlined as  $\geq 22$  for the KOOS Pain subscale,  $\geq 7$  for the KOOS Symptoms subscale, and  $\geq 17$  for the KOOS ADL subscale. An improvement with an aggregated KOOS score of 90 or greater at the 1-year postoperative checkmark was also considered sufficient in determining clinical improvement.<sup>27,30</sup> The third analysis assessed mean improvement in VAS scores; KOOS Pain, Symptoms, and ADL subscales; and MAS from baseline to 1 and 2 years postoperatively. Descriptive statistics were used to analyze the data. As such, we have included no formal statistic testing. All analyses were conducted using SAS version 9.4 (SAS Institute).

## Results

### Demographic and Clinical Characteristics

Of the 468 patients, 386 were excluded for having a KL score of 0, 1, or 2. This resulted in a final cohort of 82 patients. This eligible cohort consisted of 49 women (60%) and 33 men with a mean (SD) age of 53.1 (9.3) years and a mean (SD) BMI of 32.6 (6.1). The mean (SD) duration of symptoms preoperatively was 14.2 (40.5) months (Table 1). APM for a meniscal tear was confirmed during arthroscopy in 100.0% of patients.

### Patient-Reported Outcomes

In the analytic cohort, there were significant improvements in KOOS Pain, Symptoms, and ADL subscales over 1- and 2-year postoperative periods (Table 2). At 1-year follow-up, most patients achieved the MCID: 73% in KOOS Pain, 66% in KOOS Symptoms, and 78% in KOOS ADL. These improvements were similar at the 2-year follow-up: 75%, 72%, and 79%, in each subscale, respectively. SCB was also demonstrated 1 year postoperatively, with 56%, 73%, and 71% achieving SCB for the KOOS Pain, Symptoms, and ADL subscales, respectively. These results largely persisted at the 2-year follow-up: 62%, 77%, and 66% in each subscale (Table 3). VAS scores also improved at 1- and 2-year postoperative periods with mean improvements from baseline of 2.80 and 2.87 points,

**Table 2.** Descriptive Statistics of Continuous Patient-Reported Outcome Measures of Interest

PRO	Baseline	2 Weeks	6 Weeks	3 Months	6 Months	1 Year	2 Years
VAS	82 5.26 (2.49)	81 3.09 (2.18)	82 2.2 (1.98)	77 1.99 (2)	76 2.26 (2.09)	82 2.47 (2.4)	63 2.37 (2.43)
KOOS Pain	82 50.64 (15.01)			77 74.39 (15.73)	74 74.74 (16.48)	82 72.59 (18.43)	61 75.18 (19.07)
KOOS Symptoms	82 49.26 (13.9)			77 69.43 (15.69)	74 71.72 (16.2)	82 67.33 (18.93)	61 68.62 (20.71)
KOOS ADL	82 60.72 (17.45)			77 82.09 (14.53)	74 83.41 (14.71)	82 80.15 (17.63)	61 81.99 (17.94)
Marx Activity Score	82 4.46 (5.54)					82 2.63 (4.09)	61 2.75 (4.04)

NOTE. Cells indicate n (number of patients available) and mean number of patients (SD).

ADL, Activities of Daily Living; KOOS, Knee injury and Osteoarthritis Outcome Score; PRO, patient-reported outcome; VAS, visual analog scale.

respectively. MAS decreased on average from baseline to the 1- and 2-year follow-up (Table 4).

### Discussion

In this study, we found that most patients with KL grade 3 osteoarthritis and concomitant meniscal tear achieved clinically significant improvement in symptoms from preoperative baseline as measured by validated clinical outcome instruments affirming our hypothesis. Not only did patients achieve the MCID, but a portion also realized SCB following arthroscopy. At 2 years postoperatively, 75% of the patients achieved MCID and 68% SCB for overall KOOS scores. Additionally, there was an overall improvement in knee pain, as measured by the VAS pain score from preoperative baseline. These findings suggest that knee arthroscopy is a viable option in patients with moderate OA with coexisting meniscal pathology.

Moseley et al.<sup>20</sup> performed an RCT that demonstrated that knee arthroscopy was no better than a placebo procedure in improving knee function and decreasing pain in patients with osteoarthritis of the knee. Similarly, Kirkley et al.<sup>19</sup> found that arthroscopy of the knee provided no additional benefit compared to nonsurgical management, including physical and medical therapy, in pain reduction and knee function in patients with knee OA. These studies contributed to the AAOS

clinical guidelines that currently recommend against the use of knee arthroscopy with lavage and/or debridement in treatment of patients with primary knee osteoarthritis.<sup>21</sup> However, these guidelines do not extend to patients who have moderate to severe knee OA and a concomitant meniscal tear. This leaves a “gray zone” with inconclusive evidence and no clear direction for patients who do not have severe enough osteoarthritis for knee arthroplasty but also have had unsuccessful conservative management and may benefit from knee arthroscopy to address their meniscal injury.

Multiple studies have examined the efficacy of knee arthroscopy in comparison to conservative management for the treatment of meniscal tears, with or without osteoarthritis. Sihvonen et al.<sup>31,32</sup> conducted an RCT comparing knee outcomes in patients without knee osteoarthritis undergoing APM or sham surgery for degenerative medial meniscus tear and demonstrated no difference in outcomes at the 12-month and 5-year follow-up. Additionally, Katz et al.,<sup>25</sup> van de Graaf et al.,<sup>26</sup> and Noorduyn et al.<sup>33</sup> compared outcomes after APM versus physical therapy and demonstrated noninferiority of physical therapy compared with surgery in knee function improvement. Numerous systematic reviews have also examined the efficacy of arthroscopic surgery in comparison to conservative management for meniscal injury with or without

**Table 3.** Achievement of Clinical Benefit Defined by MCID and SCB in KOOS

PRO	1 Year: Achieved MCID or SCB, n (%)		2 Year: Achieved MCID or SCB, n (%)*	
	No	Yes	No	Yes
KOOS Pain—MCID	22 (27)	60 (73)	15 (25)	46 (75)
KOOS Pain—SCB	36 (44)	46 (56)	23 (38)	38 (62)
KOOS Symptoms—MCID	28 (34)	54 (66)	17 (28)	44 (72)
KOOS Symptoms—SCB	22 (27)	60 (73)	14 (23)	47 (77)
KOOS ADL—MCID	18 (22)	64 (78)	13 (21)	48 (79)
KOOS ADL—SCB	24 (29)	58 (71)	21 (34)	40 (66)

ADL, Activities of Daily Living; KOOS, Knee injury and Osteoarthritis Outcome Score; MCID, minimal clinically important difference; PRO, patient-reported outcome; SCB, substantial clinical benefit; VAS, visual analog scale.

\*Twenty-one subjects missing KOOS Pain, Symptoms, and ADL values at 2 years.



**Table 4.** Descriptive Statistics of Change in Continuous Patient-Reported Outcome Measures of Interest

Characteristic	Mean	SD	Median	Range
VAS: Change BL to 1 year	2.80	2.95	2.72	11.41
VAS: Change BL to 2 years	2.87	2.95	3.05	11.36
KOOS Pain: Change BL to 1 year	21.95	19.55	22.22	102.78
KOOS Pain: Change BL to 2 years	23.77	19.71	25.00	88.89
KOOS Symptoms: Change BL to 1 year	18.07	21.00	17.86	92.86
KOOS Symptoms: Change BL to 2 years	19.44	21.07	21.43	96.43
KOOS ADL: Change BL to 1 year	19.42	20.53	20.59	98.53
KOOS ADL: Change BL to 2 years	20.47	21.05	20.59	107.35
Marx Activity Score: Change BL to 1 year	1.83	4.61	0.00	25.00
Marx Activity Score: Change BL to 2 years	2.23	4.79	0.00	26.00

ADL, Activities of Daily Living; BL, baseline; KOOS, Knee injury and Osteoarthritis Outcome Score; VAS, visual analog scale.

osteoarthritis and similarly conclude there is little to no benefit of surgery in producing improved knee function and lessened knee pain.<sup>34-38</sup> In light of these findings, many of these authors advocate for conservative management as first-line treatment of degenerative meniscal injury with or without OA instead of/prior to pursuing surgical intervention. These findings are in accordance with multiple expert consensus. In 2017, the European Society of Sports Traumatology, Knee Surgery and Arthroscopy concluded that APM should not be proposed as first-line treatment for degenerative meniscal lesions as a patient's symptoms may also be attributable to early-onset osteoarthritis.<sup>39</sup> Furthermore, an expert consensus statement from a group led by Hohmann et al.<sup>40</sup> in 2020 supports the use of nonoperative treatment initially for symptomatic degenerative meniscal tears. This recommendation is in agreement with the stepwise escalation in intervention given to patients in our study, as all participants completed a trial of conservative treatment for at least 6 weeks before having their arthroscopic procedure.

The findings in our study suggest that patients with moderate osteoarthritis with concomitant meniscal injury who have failed nonoperative management may benefit from an arthroscopic procedure with lasting effect 2 years following their surgery. Giri et al.<sup>41</sup> similarly looked at the role of arthroscopy in functional and objective knee outcomes of patients with moderate to severe osteoarthritis of the knee and found that patients with meniscal and chondral pathology benefitted more from arthroscopic treatment. This study differed from ours as only 10 patients had KL grade 3 osteoarthritis (compared with 100% in our study), and overall the study was fairly limited in

sample size as only 30 patients were enrolled. Furthermore, Figueroa et al.<sup>42</sup> found that patients with meniscal injury in the setting of osteoarthritis benefited from arthroscopic treatment as 76% of patients who fit this description had good or excellent results, as measured by the change in the validated Lysholm score from preoperative baseline. Our study serves to bolster the literature demonstrating the improvements in knee function and symptoms in the specific subset of patients with moderate osteoarthritis and meniscal injury. The results of this study allow surgeons to provide patients in the "gray zone" (KL grade 3 and meniscal tear) with some data to decide whether or not they want to proceed with a knee arthroscopy procedure, understanding that OA symptoms will not resolve but over 70% of patients either had SCB or minimal clinically significant difference in knee function and symptoms.

### Limitations

There are noteworthy limitations to this study, including the small sample size of 82 patients from a single surgeon at a single academic medical center. This small sample size precluded us from developing an algorithm to predict patients likely to have a favorable response. Although 2 trained reviewers independently determined the KL grades from preoperative radiographs and all discrepant radiographs were resolved by the senior author, there is still potential for grading errors. The number of patients who did or did not have a knee arthroplasty procedure after a 2-year follow-up was not recorded. Finally, this study only included a minimum of 1-year follow-up data, which may not be long enough to accurately evaluate the results.

### Conclusions

At a minimum of 1-year follow-up, most patients with KL 3 and a meniscal tear achieved MCID and SCB in KOOS Pain, KOOS Symptoms, and KOOS ADL, indicating a meaningful outcome improvement for these patients.

### Disclosures

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: E.M. is on the Editorial Board for *Arthroscopy Journal* and has received speaking and lecture fees from Arthrex. All other authors (T.W., N.L., J.M., J.C.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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