

## Systematic Review

# Does Arthroscopic Partial Meniscectomy Result in Knee Osteoarthritis? A Systematic Review With a Minimum of 8 Years' Follow-up

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**Purpose:** Our purpose is to test the hypothesis that arthroscopic partial meniscectomy results in knee osteoarthritis at long-term follow-up. **Methods:** We systematically reviewed PubMed search terms “meniscus AND arthritis AND knee” and “meniscectomy AND arthritis AND knee” and included English-language, Levels I to IV evidence studies reporting either radiographic or clinical osteoarthritis outcome measures with a minimum of 8 years' follow-up after partial arthroscopic meniscectomy. **Results:** Five studies met the inclusion criteria. All reported both radiographic and clinical measures. All studies compared the normal, contralateral knee as a radiographic control, but none included a clinical control group. Follow-up ranged from 8 to 16 years. In all studies operative knees showed a statistically significant incidence of radiographic signs of osteoarthritis compared with control knees. However, clinical symptoms of osteoarthritis were not observed. Furthermore, clinical outcomes did not correlate with radiographic findings. **Discussion:** Our results show that radiographic signs of osteoarthritis are significant at 8 to 16 years' follow-up after knee arthroscopic partial meniscectomy, but clinical symptoms of knee arthritis were not observed. Limitations include absence of clinical control groups and heterogeneity of reported outcome measures. Future research of higher levels of evidence and with longer-term follow-up is required to determine whether the radiographic signs ultimately foreshadow clinical symptoms in patients after arthroscopic partial meniscectomy. **Conclusions:** Radiographic signs of osteoarthritis are significant at 8 to 16 years' follow-up after knee arthroscopic partial meniscectomy, but clinical symptoms of knee arthritis are not significant. **Level of Evidence:** Systematic review of Level IV clinical evidence and Levels II and III radiographic evidence.

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Arthroscopic partial meniscectomy is meniscal sparing because as much of the meniscus that can be preserved is, in fact, preserved, and it is one of the most common orthopaedic procedures performed in the United States.<sup>1,2</sup> The rationale for arthroscopic

partial meniscectomy is that open total medial or lateral meniscectomy leads to degenerative changes in the knee over time.<sup>3-9</sup> However, whereas the short-term results of arthroscopic partial meniscectomy are favorable,<sup>10-14</sup> evidenced-based evaluation of the long-term effects requires review. The purpose of this study is to evaluate the long-term results of arthroscopic partial meniscectomy with regard to knee osteoarthritis. Our hypothesis is that at long-term follow-up, arthroscopic partial meniscectomy results in knee osteoarthritis.

## METHODS

In February 2009 we searched PubMed to identify publications in the English language assessing long-term

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results of arthroscopic partial meniscectomy. The search terms consisted of "meniscus AND arthritis AND knee" and "meniscectomy AND arthritis AND knee."

Inclusion criteria were studies of Levels I to IV evidence reporting knee osteoarthritis outcome measures by use of radiographic, clinical, or functional scoring systems and, critically, a minimum of 8 years' follow-up. No limits were placed on the date of publication.

Exclusion criteria consisted of follow-up of less than 8 years, nonhuman studies, biomechanical studies, review articles, expert opinion articles, and case reports.

Bibliographies of the articles identified, as well as the bibliographies of any review articles identified, were examined to ensure a complete search.

Data extracted from each study included level of evidence, number of patients, cohort demographics, operative procedure, length of follow-up, and clinical and radiographic outcome measures.

Analysis of reported outcome measures, both clinical and radiographic, was performed in an attempt to form comparisons between studies.

## RESULTS

A total of 403 studies were identified as a result of the search, and 5 met the study inclusion and exclusion criteria.<sup>15-19</sup>

Cohorts in all 5 studies were drawn from a consecutive series of patients undergoing arthroscopic partial meniscectomy. Patients with knee instability or prior surgery on the operative and/or contralateral knee were excluded from each study. One study excluded patients aged greater than 60 years and in poor general health,<sup>15</sup> one study also included patients who had subtotal open meniscectomy,<sup>19</sup> and a third study excluded patients aged greater than 23 years.<sup>19</sup>

Follow-up ranged from 8 to 16 years. Results are summarized in Table 1. All studies reported results of radiographic examination. Radiographic results are summarized in Table 2.

One study included prospective data,<sup>17</sup> and 4 were retrospective.<sup>15,16,18,19</sup>

Considering levels of evidence, we distinguish between clinical and radiographic results. Clinical methods were a case series with no control group (Level IV evidence) in all studies. Radiographic methods used a control of the contralateral normal knee in all 5 studies. The level of evidence of radiographic criteria is Level II (prospective comparative) in 1 included study and Level III (retrospective comparative) in the other 4 included studies. We are unable to report results of a quantitative meta-analysis because none of the included studies was of Level I evidence.

Mean patient age combining all studies was 36.1 years. All reported both radiographic and clinical out-

TABLE 1. Summary of Methods and Outcome Measures

Study	Level of Evidence: Clinical/Radiographic	No. of Patients	Location of Meniscectomy	Mean Patient Age (yr)	Mean Length of Follow-up (yr)	Outcome Measures
Burks et al. <sup>15</sup>	IV/III	146*	Medial: 78% Lateral: 19% Bilateral: 3%	38.5 (<60)	14.7 (13.8-16.4)	Modified Lysholm score Tegner activity scale Subjective satisfaction index Physical examination Radiographic examination IKDC scoring form
Chatain et al. <sup>16</sup>	IV/III	471 <sup>†</sup>	Medial: 362 Lateral: 109	38.5 ± 12 (MM) 35 ± 12.5 (LM)	11 (10-15)	Patient satisfaction Repeat surgery Radiographic examination Lysholm score Physical examination
Fauno and Nielsen <sup>17</sup>	IV/II	136	Lateral: 17% in flap tear group 10% in bucket-handle tear group	35.2 ± 7 (flap tear) 31.6 ± 10 (bucket handle)	8.5 (7.9-11.6)	Repeat surgery Radiographic examination IKDC score
Hulet et al. <sup>18</sup>	IV/III	57 (74 knees)	Medial: 100%	36 ± 11	12 ± 1	KT-1000 testing Physical examination Radiographic examination Lysholm score
Rockborn and Gillquist <sup>19</sup>	IV/III	43 (44 lesions)	Medial: 25 Lateral: 19	19 (15-22)	13 (11-15)	Tegner activity scale Physical examination Joint fluid analysis Radiographic examination

\*Only 111 returned for radiographic and physical examination.

†Only 448 returned for radiographic examination.

**TABLE 2.** Summary of Radiologic Outcome Measure Methods and Results

Study	Radiographic Views	Grading	Results
Burks et al. <sup>15</sup>	Weight-bearing AP, weight-bearing flexion PA	0-4 scale	Operative knee, 0.59 Nonoperative knee, 0.36 $P = .002$
Chatain et al. <sup>16</sup>	Weight-bearing AP, weight-bearing flexion AP, long leg, skyline	IKDC grading	Rate of change after medial meniscectomy, 21.5% Rate of change after lateral meniscectomy, 37.5%*
Fauno and Nielsen <sup>17</sup>	Weight-bearing AP	Fairbank changes	>1 Fairbank change: Operative knee, 24% Nonoperative knee, 8% <sup>†</sup>
Hulet et al. <sup>18</sup>	Weight-bearing AP, weight-bearing flexion PA, lateral	IKDC grading	Rate of change: Operative knee, 26% Nonoperative knee, 11%
Rockborn and Gillquist <sup>19</sup>	Weight-bearing flexion AP, lateral	Ahlback grading Fairbank changes	Fairbank changes: 20/33 operative knees 5/33 nonoperative knees $P = .003$

Abbreviations: AP, anteroposterior; PA, posteroanterior.

\*Significant only when knees with normal contralateral knee considered.

<sup>†</sup>Statistically significant increase in arthritic changes in nonoperative knees of patients with flap tears. Significantly significant increase in arthritic changes in control and medially resected knees with varus alignment.

come measures. Outcome measures included Lysholm score,<sup>15,17,19</sup> Tegner activity scale,<sup>15,19</sup> International Knee Documentation Committee (IKDC) score,<sup>16,18</sup> subjective satisfaction score,<sup>15,16</sup> and physical examination findings (e.g., joint line tenderness).<sup>15,17-19</sup> In addition, each of the following outcome measures was recorded in 1 study: KT-1000 testing (MEDmetric, San Diego, CA),<sup>18</sup> joint fluid analysis,<sup>19</sup> repeat surgery for osteoarthritis,<sup>16</sup> and repeat surgery for reasons other than osteoarthritis.<sup>17</sup>

#### Burks et al.,<sup>15</sup> 1997

**Clinical Summary:** Burks et al.<sup>15</sup> evaluated results of arthroscopic partial medial and lateral meniscectomy.

Overall results were classified as excellent, good, and poor based on a score derived from the modified Lysholm score and side-to-side radiographic differences. Results of subjective scoring in stable knees showed a mean Lysholm score of 94, a subjective satisfaction score of 8.8 (range, 1 to 10), and a Tegner change of 0.3. Overall, patients with stable knees had 57% excellent, 31% good, and 12% poor results.

**Radiographic Summary:** Radiographic grading of degenerative changes showed a significantly worse score in the operative versus the nonoperative knees (0.59 v 0.36,  $P = .002$ ). In an attempt to stratify results, the only significant differences shown were worse radiographic side-to-side differences in women

compared with men and worse radiographic side-to-side differences in varus compared with valgus knees.

**Additional Results:** Thirty-five patients were found to have an anterior cruciate ligament-deficient knee at the time of surgery, and the results of meniscectomy for these patients were analyzed separately.

#### Chatain et al.,<sup>16</sup> 2003

**Clinical Summary:** Chatain et al.<sup>16</sup> sought to compare long-term results of lateral versus medial arthroscopic partial meniscectomies and evaluated prognostic factors.

Significant differences were found in the IKDC subjective assessment scores of patients undergoing medial versus lateral meniscectomy, with 90.2% and 85.9%, respectively, rating their knee as normal or nearly normal. However, the difference between groups in the overall IKDC score was not significant, with 85.8% of the medial meniscectomy group and 79.7% of the lateral meniscectomy group being free of any symptoms. Approximately 95% of patients were satisfied or very satisfied with their knees using the subjective satisfaction rating.

**Radiographic Summary:** Significant also was the rate of radiographic changes, defined as IKDC grades 2 and 3, in the treated compartment when compared with the nonoperative contralateral knee. Patients undergoing medial meniscectomy had a 21.5% rate of change,

whereas those undergoing lateral meniscectomy had a 37.5% rate of change. This difference between lateral and medial was significant when only patients with a normal contralateral knee were considered. The authors conclude that the radiologic results, though more severe, do correlate with the clinical results.

**Additional Results:** Independent, significant predictors of poor clinical outcomes in the medial meniscectomy group included female gender and rim involvement. Independent, significant predictors of poor radiologic results in this group included varus alignment, age, nonvertical tear, and cartilage damage. In the lateral meniscectomy group, only age and rim involvement were shown to have a significant, independent effect on radiologic outcomes. The authors also point out that only 0.2% of patients underwent reoperation for osteoarthritis (1 patient with high tibial osteotomy).

#### **Fauno and Nielsen,<sup>17</sup> 1992**

**Clinical Summary:** Fauno and Nielsen<sup>17</sup> compared results between 2 groups of patients: those with bucket-handle tears ( $n = 54$ ) and those with flap tears ( $n = 82$ ).

The only significant finding in the subjective clinical assessment was more knee pain after exercise in the flap tear group. Seventeen percent of patients had a Lysholm score less than 90. They report a 15.4% reoperation rate on the same meniscus, with most of these occurring in the flap tear group. This reoperation rate is not specifically a result of osteoarthritis.

**Radiographic Summary:** By use of the classification of Fairbank,<sup>6</sup> 77% of patients had at least Fairbank type 1 changes in the operative knee, with 53% having only 1 Fairbank change. In comparison, 30% of control knees also showed at least Fairbank type 1 changes, with 22% having 1 Fairbank change. The difference in radiographic changes between the 2 groups of meniscal tears was not significant. However, patients with flap tears had a significantly increased amount of radiographic arthrosis in the nonoperative knee. There was a significantly greater amount of arthrosis in the control knees and medially resected knees with varus alignment. Control knees of patients aged older than 40 years had significantly higher rates of arthrosis.

#### **Hulet et al.,<sup>18</sup> 2001**

**Clinical Summary:** Hulet et al.<sup>18</sup> retrospectively evaluated 74 stable knees in 57 patients and gave patients a grade of A, B, C, or D based on their IKDC scores. Intraoperatively, cartilage lesions were graded according to the French Arthroscopic Scale.

Most of the patients in this study sustained traumatic meniscus tears. Only 5% of patients had complex tears of

the medial meniscus. No grade IV chondral lesions were identified. The most severe chondromalacia occurred in the patellofemoral compartment. There was a significantly greater amount of anterior knee pain in those patients in the lower-activity group.

Subjectively, 95% of patients were very satisfied or satisfied at 12 years' follow-up. Objectively, all patients were either normal or nearly normal (grade A or B).

**Radiographic Summary:** Using IKDC compartmental grading, the authors found radiographic changes in 26% of operative knees. Actual narrowing was present in 21% of operative knees and 11% of contralateral knees. Among the 49 patients with a radiographically normal contralateral knee, degenerative changes were present in 16% of the operative knees. Significance for either group was not addressed. Women had worse radiographic outcomes than men, and this was statistically significant.

**Additional Results:** The authors attempted to correlate age, gender, level of activity, and chondral damage to the clinical results but either found no significant difference or did not comment on significance. The study involved a small number of patients, and no power analysis was performed.

#### **Rockborn and Gillquist,<sup>19</sup> 1995**

**Clinical Summary:** Rockborn and Gillquist<sup>19</sup> reported on 43 stable knees at a mean of 13 years after arthroscopic partial or subtotal meniscectomy.

Subjective self-assessment was performed by use of a 100-point scale, with 100 representing severe disability. Sixteen patients rated themselves between 10 and 40. The mean Lysholm score was 91; however, 7 patients had a score less than 84. The authors analyzed partial and subtotal meniscectomy separately, identifying a significantly lower score in the latter group.

**Radiographic Summary:** Radiographic results showed significantly more knees with Fairbank changes in the operated knee compared with the contralateral knee (20 of 33 operative knees v 5 of 33 nonoperative knees). As with clinical results, significantly more degenerative changes were seen after subtotal meniscectomy. Chondromalacia at the time of surgery did not correlate with radiographic results.

#### **Summary of Results**

**Clinical Summary:** Synthesizing the findings of the 5 studies cited previously, the 8- to 16-year clinical outcomes show a normal or nearly normal knee in 80% to 100% of patients with patient satisfaction of greater than 95%.

**Radiographic Summary:** In all studies operative knees showed a statistically significant incidence of

radiographic signs of osteoarthritis with the normal contralateral knee being used as a control group (Table 2). However, clinical symptoms of osteoarthritis were not observed. Furthermore, clinical outcomes did not correlate with radiographic findings, except in 1 study.<sup>16</sup>

## DISCUSSION

As noted previously, we distinguish between clinical and radiographic results. Our results show satisfactory clinical results yet concerning radiographic results after long-term follow-up of arthroscopic partial meniscectomy.

Clinical results show a normal or nearly normal knee in 80% to 100% of patients. Ninety-five percent of patients were satisfied or very satisfied with their knees.

Radiographic results show some evidence of degenerative change after arthroscopic partial meniscectomy in 20% to 60% of patients. (As expected, the series including subtotal [open] meniscectomy<sup>19</sup> resulted in a higher incidence of radiographic changes.) The data reflected in all studies support a concern previously published in studies of shorter-term follow-up<sup>6,20,21</sup> evaluating radiographic outcome of arthroscopic partial meniscectomy: radiographic osteoarthritic changes occur in some patients after arthroscopic partial meniscectomy.

In a similar review, Fabricant and Jokl<sup>1</sup> reviewed outcome of arthroscopic partial meniscectomy to assess independent risk factors (age, alignment, gender, and pattern of tear) resulting in poor outcome.<sup>15,17,22-24</sup> Age and gender had no significant association; medial partial meniscectomy resulted in greater progression of osteoarthritis in older patients and in varus knees, but there was no overall difference in medial versus lateral meniscectomy overall. The review is limited because included studies reported heterogeneous outcome measures for clinical osteoarthritis.

Our study has similar limitations because of heterogeneity of reported outcome measures in the included studies. In addition, whereas Lysholm and Tegner scores are validated as acceptable outcome measures after meniscal injury,<sup>25</sup> they are not specific for measuring functional disability due to osteoarthritis. In addition, our review is limited by selection bias because patient populations and exclusion criteria varied among the 5 studies. Finally, none of the 5 studies included a clinical control group or was randomized.

In the future, clinical studies of higher levels of evidence are recommended to evaluate the effect of

arthroscopic partial meniscectomy. Furthermore, studies of even longer-term follow-up may be required to determine whether the radiographic signs of osteoarthritis foreshadow future clinical symptoms.

## CONCLUSIONS

Radiographic signs of osteoarthritis are significant at 8 to 16 years' follow-up after knee arthroscopic partial meniscectomy, but clinical symptoms of knee arthritis are not significant.

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