Ten-Year Survivorship After Knee Arthroscopy in Patients With Kellgren-Lawrence Grade 3 and Grade 4 Osteoarthritis of the Knee


**Purpose:** The purpose of this study was to document 10-year outcomes and total knee arthroplasty (TKA) rate after arthroscopic treatment of knee osteoarthritis and compare survivorship of patients with Kellgren-Lawrence (KL) grade 3 and 4 knees.

**Methods:** Eighty-one knees in 73 patients (49 male, 32 female; mean age, 58 years; range, 37 to 79 years) that underwent an arthroscopic regimen for knee osteoarthritis between August 2000 and November 2001 were included in this institutional review board-approved study. The inclusion criterion was Kellgren-Lawrence (KL) grade 3 or 4 radiographic changes. A TKA had been recommended to all patients; however, none wished to undergo arthroplasty. All patients underwent arthroscopic treatment. Endpoint was defined as TKA for survivorship analysis. Outcomes were collected at a minimum follow-up of 10 years (Lysholm, Tegner, patient satisfaction, and WOMAC scores).

**Results:** Of 81 knees, 7 were in patients who died and 2 in patients who refused to participate, leaving 72 knees available for follow-up. Follow-up was obtained for 95% of patients (n = 69). Forty-three knees (62%) were converted to TKA at a mean of 4.4 years (range 1.0 to 9.6) after index arthroscopy. Mean survival time was 6.8 years (95% confidence interval [CI], 5.9 to 7.6 years). Survivorship was 60% at 5 years and 40% at 10 years. Patients with KL grade 4 osteoarthritis were 5.3 times more likely to fail (95% CI, 1.3 to 23.4) than those with KL grade 3 (P = .012). Mean survival time for patients with KL grade 4 was 5.7 years (95% CI, 4.5 to 6.9), and mean survival time for those with KL grade 3 was 7.5 years (95% CI, 6.2 to 8.7) (P = .022). For 26 knees that did not undergo arthroplasty, the mean Lysholm score was 74 (95% CI, 67 to 80), the median Tegner activity scale score was 3 (range, 0 to 8), the median patient satisfaction with outcome was 9 (range, 1 to 10), and the mean WOMAC score was 18.5 (95% CI, 13 to 24) at 10 years of follow-up.

**Conclusions:** The mean survival time after arthroscopic treatment of osteoarthritis was 6.8 years. Forty percent delayed arthroplasty for a minimum of 10 years. Patients with KL grade 4 changes in their knee had a higher risk of conversion to arthroplasty and a significantly lower mean survival time.

**Level of Evidence:** Level III, retrospective comparative study.

Recent guidelines published by the American Academy of Orthopaedic Surgeons regarding knee arthroscopy for the treatment of knee osteoarthritis (OA) reinforce the controversy of this topic, especially in the face of symptomatic meniscus tears or loose bodies.1,2 Prospective randomized studies, like those published by Moseley et al.3 and Kirkley et al.,4 have recently cast doubt on the value of knee arthroscopy in patients with Kellgren-Lawrence (KL) grade 3 and KL grade 4 osteoarthritis; however, it is unclear if these studies would have the same results with patient selection criteria based on patients likely to benefit from arthroscopy.

Although it is difficult to compare published studies because of the differences in patient populations, procedures, and rehabilitation protocols, there have been several studies that have reported short- and medium-term benefits of knee arthroscopy in patients with OA. Patients with mechanical symptoms or low-grade OA have been reported to respond well to knee arthroscopy.3,6 Several studies have documented predictors of improved outcome.7-9 Other factors related to favorable outcomes include less malalignment, younger age, no tibial osteophytes, and limited joint...
space narrowing. Although successful treatments have been published, the variability in treatment groups and lack of long-term data make it difficult to educate patients on the risks and possible outcomes of this procedure. Regardless of symptoms, active patients younger than 60 years with moderate to severe OA are frequently looking for treatment options for their symptomatic OA, even if only a temporizing measure.

After exhausting conservative treatments, a knee arthroplasty is a predictable and reasonable surgical treatment for end-stage OA. However, this option may not be ideal for all patients. Only 20% of patients return to higher-impact sports, like tennis, after total knee arthroplasty (TKA). Most patients after a TKA return to an activity level equivalent to biking regularly. In fact, a survey from The Knee Society recommended against high-impact activity such as racquetball, squash, climbing, soccer, tennis, volleyball, basketball, and jogging after TKA. Low-impact activities, not moderate- or high-impact activities, are strongly recommended after a TKA.

Although much literature regarding this topic exists, there are limited data documenting long-term survivorship of a native knee after a knee arthroscopy. Moreover, most previous studies have not emphasized a systematic approach to knees with advanced OA or the importance of postoperative rehabilitation. The purpose of this study was to evaluate the 10-year survival of native knees with Kellgren-Lawrence (KL) grade 3 and KL grade 4 arthritis treated with our comprehensive knee arthroscopic package. Our hypothesis was that patients with KL grade 4 knees would be more likely to require TKA at 10 years.

Methods

This study was approved by the institutional review board. From August 2000 to November 2001, 81 knees in 73 patients (49 male and 32 female) who underwent knee arthroscopy for symptomatic and advanced OA were identified. Early outcomes for these patients have previously been reported.

Patients were included in the study if they failed conservative treatment for OA and had KL grade 3 or grade 4 radiographic changes. Conservative measures included activity modification, physical therapy, anti-inflammatory medication, weight reduction, bracing, viscosupplementation/corticosteroid injections, and oral glucosamine. All patients were required to have symptoms associated with OA of the knee and not limited only to mechanical symptoms. Most patients were referred to our clinic for arthroscopic consideration because of their age and activity level and recommended for TKA. Patients with coronal malalignment were not candidates for realignment osteotomies. Exclusion criteria included traumatic chondral lesions, mild osteoarthritis (KL grades 0 to 2), and incomplete radiographic studies.

Standard knee radiographic studies including a weight bearing anteroposterior (AP) view in extension, weight bearing posteroanterior view at 45° of flexion, lateral views, patellar views at 30° and 60°, and a long-standing lower-extremity view to assess overall alignment were obtained for each patient. Radiographic inclusion criteria were KL grade 3 or 4 changes with multiple osteophytes, definite joint space narrowing, sclerosis, and deformity of bone ends. Long-standing AP radiographs were obtained for all patients to determine knee alignment. Malalignment was measured as a percentage deviation from neutral position when standing. The weight bearing line (WBL) was established by drawing a vertical line from the center of the femoral head to the center of the tibial plafond. If this line intersected the exact middle of the knee joint, the WBL was said to be neutral. Deviation in either direction that increased medial or lateral compartment loading was measured on a 0% (neutral) to 100% (absence of space on tibial plateau) scale in either direction leading to varus and valgus knee malalignment and producing a percentage of shift in the WBL from neutral (Fig 1). The WBL was neither an inclusion nor exclusion criterion for the original study. All patients underwent a comprehensive arthroscopic package for treatment of knee OA. A procedure included in this protocol is insufflation to expand the joint space. An 18-gauge needle and a 60-mL syringe

![Fig 1. Percentage of patients demonstrating a shift in the weight bearing line of the knee.](image-url)
are used to inflate the joint with a saline solution. Next, any unstable cartilage and loose bodies are removed, along with fragments and particulate in the joint. If it has any unstable edges, the meniscus is trimmed to a stable rim. Anterior osteophytes are removed if they cause a deficit in extension. The synovium is often inflamed and may become hypertrophic. Hypertrophic synovium is ablated using thermal ablation. Infra-patellar and suprapatellar plica often contribute to tightness within the joint and loss of joint volume, and are also removed. An anterior interval release is also performed if there is scarring between the infrapatellar fat pad and patellar tendon anteriorly and the anterior border of the tibia and the transverse meniscal ligament posteriorly. If the suprapatellar pouch is compartmentalized by scar tissue, this is also released.

It is the conviction of the senior author that a strict postoperative rehabilitation program is vital to the success of this procedure. Maintenance of joint volume and prevention of scar formation constitute the overall goal of postoperative rehabilitation. Maintaining strength is a secondary goal. For these patients, a 3-phase program was initiated. The first phase focused on passive and active-assisted range of motion, patellar mobility, and stretching. Patients were instructed to limit weight bearing for 1 to 2 weeks after surgery. A continuous passive motion machine was used for the first postoperative week. After 6 weeks, patients began to work on functional strength training including treadmill walking and biking. At 4 months, weight training exercises and a return to full activity were allowed.

At 10 years of follow-up, all patients were contacted by phone, email, or mail to determine if they had undergone conversion to a TKA on the study knee. If patients had not undergone TKA, they were mailed or emailed a subjective questionnaire. The questionnaire documented symptoms, function, and satisfaction with the knee, as measured by insufflation at index arthroscopy. There were 13 women and 30 men (P = .083). Patients who were converted to TKA were older (59.8 years) than those who did not undergo TKA (52.8 years) (P = .013). Patients who were converted to TKA were more likely to have had grade KL grade 4 at index arthroscopy (24) than KL grade 3 (19) (P = .015). More patients with “kissing” lesions failed (36) than those without (7) (P = .003). There was no difference based on the compartment within which the WBL fell (26 medial and 8 lateral) (P = .547). Factors that significantly differed in comparison of patients with KL grade 3 with patients with KL grade 4 are documented in Table 1.

To analyze survivorship, a Kaplan-Meier survival analysis was performed. Survivorship was defined as not having undergone TKA at final follow-up. For all patients, survivorship was 60% at 5 years, 47% at 7 years, and 40% at 10 years (Fig 2). There was no

Statistical Analysis

All data, except for Tegner Activity Scale and patient satisfaction scores, were normally distributed as tested with the one-sample Kolmogorov–Smirnov test. Comparison of continuous variables for binary categorical variables was performed using the independent sample t test, and for multiple (>2) categorical variables, using the one-way ANOVA. Comparison of Lysholm score improvement for continuous variables was performed using Pearson’s correlation coefficient. Comparisons between categorical variables were performed using the Fisher exact test. For data that were not normally distributed, nonparametric statistics were used. The Mann-Whitney U test was used for comparison of 2 groups, and the Kruskal–Wallis analysis was used for comparison of multiple groups. Spearman’s rho correlation coefficient (r) was used for assessing associations between continuous variables.

Survivorship data were calculated using the Kaplan-Meier method. Regression analyses using Cox proportional-hazards modeling were performed to determine which factors had an impact on the outcome of TKA at 10 years after arthroscopy. Statistical analysis was performed using the PASW (Version 18.0, IBM, Armonk, NY) software package. All reported P values are 2-tailed, with an α level of 0.05 indicating statistical significance.

Results

Of the 73 knees, 7 were in patients who died and 2 in patients who refused to participate, leaving 64 patients with 72 knees (38 KL grade 3, 34 KL grade 4) available for follow-up. Follow-up data were obtained on 95% of patients (61/64). The 3 patients lost to follow-up all had KL grade 4 OA. Average age was 57 years (range, 37 to 78). Fifty-one knees had WBLs that fell within the medial compartment, at an average WBL of 41% (95% CI, 30 to 52), and 21 fell within the lateral compartment at an average WBL of 36% (95% CI, 24 to 47). The medial compartment knees had an average medial joint space of 2.6 mm (95% CI, 1.9 to 3.2), and the lateral compartment knees had an average lateral joint space of 4.5 mm (95% CI, 3.5 to 5.5). Mean volume of the knee, as measured by insufflation at index arthroscopy, was 160 mL (95% CI, 140 to 180 mL).

Of the 69 knees, 43 (62%) were converted to TKA at an average of 4.4 years (range, 1.0 to 9.6) after index knee arthroscopy. There were 13 women and 30 men (P = .083). Patients who were converted to TKA were older (59.8 years) than those who did not undergo TKA (52.8 years) (P = .013). Patients who were converted to TKA were more likely to have had grade KL grade 4 at index arthroscopy (24) than KL grade 3 (19) (P = .015). More patients with “kissing” lesions failed (36) than those without (7) (P = .003). There was no difference based on the compartment within which the WBL fell (26 medial and 8 lateral) (P = .547). Factors that significantly differed in comparison of patients with KL grade 3 with patients with KL grade 4 are documented in Table 1.
association between failure and gender or malalignment. Age was associated with failure. Failures were significantly older than survivors (mean difference, 8.8 years; 95% CI, 2.7 to 14.9; \( P = .005 \)). Patients who had KL grade 4 OA had a significant lower mean survival time (5.9 years; 95% CI, 4.6 to 7.1) than patients with KL grade 3 OA (7.5 years; 95% CI, 6.2 to 8.7, \( P = .032 \)) (Fig 3). For patients who underwent TKA, analysis of factors for patients with KL grade 3 versus KL grade 4 was performed, and the results are summarized in Table 2.

Twenty-six knees did not undergo arthroplasty at 10 years postarthroscopy. Patient outcome scores at 10 years are listed in Table 3. There were no significant differences between men and women in Lysholm Knee Scale, Tegner Activity Scale, or patient satisfaction with outcome scores (\( P > .05 \)). Age did not correlate with Lysholm, Tegner, or patient satisfaction scores (\( P > .05 \)). Outcome scores of patients who did not undergo arthroplasty are listed in Table 3.

### Discussion

Arthroscopic treatment of the knee in patients with OA has been used to relieve symptoms and delay arthroplasty. This study showed that a high percentage of patients were able to delay arthroplasty for 5 years, but by 10 years, 60% of patients had undergone TKA. KL grade 3 knees had significantly higher survivorship than KL grade 4 knees. Avoiding a TKA for 5 to 10 years may be desirable for many patients to retain a satisfactory activity level without compromising the longevity of the TKA. In our study, younger patients and patients with moderate OA at the time of arthroscopy were more likely to delay arthroplasty for a longer period than were older patients or patients with severe OA.

Two randomized studies have reported that arthroscopy for knee OA provides no significant benefit.\(^3\),\(^4\) In the study by Kirkley et al.\(^4\), the effects of arthroscopy were compared with those of conservative treatments. No difference was seen in WOMAC score and physical component of the SF-36 at a minimum of 2 years after treatment. Although this study reported no difference in outcomes, it is difficult to interpret the results

### Table 1. Factors That Significantly Differ Between Patients With Kellgren-Lawrence Grade 3 and Those With Kellgren-Lawrence Grade 4

<table>
<thead>
<tr>
<th></th>
<th>KL Grade 3</th>
<th>KL Grade 4</th>
<th>( P ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n )</td>
<td>38</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Age at index surgery</td>
<td>56</td>
<td>60</td>
<td>.219</td>
</tr>
<tr>
<td>Gender (M/F)</td>
<td>17/21</td>
<td>28/6</td>
<td>.001</td>
</tr>
<tr>
<td>Medial joint space</td>
<td>4.1</td>
<td>2.0</td>
<td>.001</td>
</tr>
<tr>
<td>Lateral joint space</td>
<td>5.2</td>
<td>6.7</td>
<td>.010</td>
</tr>
</tbody>
</table>

### Table 2. Analysis of Knees Converted to Total Knee Arthroplasty

<table>
<thead>
<tr>
<th></th>
<th>KL Grade 3</th>
<th>KL Grade 4</th>
<th>( P ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n )</td>
<td>18</td>
<td>26</td>
<td>.008</td>
</tr>
<tr>
<td>Age</td>
<td>61</td>
<td>61</td>
<td>.691</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>8/10</td>
<td>5/21</td>
<td>.098</td>
</tr>
<tr>
<td>Kissing lesions</td>
<td>12</td>
<td>25</td>
<td>.013</td>
</tr>
<tr>
<td>Joint volume (mL)</td>
<td>171</td>
<td>174</td>
<td>.691</td>
</tr>
<tr>
<td>Survivorship at 5 years</td>
<td>70%</td>
<td>54%</td>
<td></td>
</tr>
<tr>
<td>Survivorship at 10 years</td>
<td>53%</td>
<td>19%</td>
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because multiple surgeons \((n = 7)\) performed the arthroscopies and large meniscal tears were excluded, potentially creating a variability in outcomes.\(^4\) Also, although patients underwent an optimized rehabilitation program, Kirkley et al. used arthroscopic procedures different from those used in our study. Moseley et al.\(^3\) reported on a debridement group, a lavage group, and a placebo group. The study showed no differences in pain levels at 12 and 24 months. This study was limited by the selection bias of the study group and the nonvalidated outcome score used as the primary outcome measure.\(^3\)

The type of rehabilitation program, if any, that patients in the Moseley et al. study underwent after surgery is unclear.\(^3\) For the benefits of arthroscopy to be maintained, we believe that the improved joint space and motion of the knee must be maintained through rehabilitation, with a focus on maintenance of the joint mobility gained in surgery. Increasing joint volume was emphasized in our treatment protocol. Studies have shown that volume loss may alter joint mechanics with increased patellofemoral and tibiofemoral joint reaction force.\(^23\) These changes often lead to anterior knee pain. Dragoo et al.\(^24\) reported that insufflation of the knee and releases of adhesions and scar tissue can restore knee volume to near-normal values. The restoration of joint volume to near-normal values was associated with improvement in pain in patients who did not improve with nonoperative treatments.\(^24\)

Our arthroscopic goal was to establish a healthy environment to prolong the life of the native knee. In our study, patients underwent a very strict postoperative rehabilitation program to maximize success of arthroscopy. Our patients focused on both patellofemoral and tibiofemoral range of motion during the early postoperative weeks to avoid recurrence of scarring or adhesions. Previous studies have reported similar findings, documenting improved outcomes and lower complication rates. Dubljanin-Raspopović et al.\(^25\) conducted a study in which patients were divided into 2 groups: an intensive rehabilitation group and a conservative rehabilitation group. This study reported higher Lysholm scores, lower complication rates, and no incidence of arthrofibrosis when the intensive rehabilitation protocol was implemented after arthroscopic anterior cruciate ligament reconstruction.\(^25\)

Patients in this study had a desire to avoid TKA, not only to retain their activity level, but to also avoid a revision TKA surgery caused by potential early deterioration of the TKA implant. Patients were also thoroughly counseled that this procedure was not a cure for arthritis, but a temporizing treatment. Although there is controversy surrounding arthroscopy in older patients with KL grade 3 or 4 OA, many patients in this population benefited from arthroscopic intervention by delaying TKA, while maintaining a satisfactory activity level. Patients in this study were able to maintain an average activity level, which allowed them to participate in recreational sports on average. The value in maintaining activity level has been well documented.\(^26-28\) As limitations are placed on physical activity, quality of life has been shown to decrease over time. Various studies have shown that physical activity is correlated to increases in general health.

**Limitations**

This study has some limitations. The study is retrospective and lacks a control group; however, all data were collected prospectively to avoid bias. Also, these data may not represent the general population. All of the patients in this study were treated at a referral sports medicine facility, which may introduce selection bias. At 10 years, only 26 patients remained for follow-up and were available for our outcome measures.

**Conclusions**

The mean survival time after arthroscopic treatment of osteoarthritis with a defined protocol, was 6.8 years. Forty percent delayed arthroplasty for a minimum of 10 years. Patients with Kellgren-Lawrence grade 4 changes in their knee had a higher risk of conversion to arthroplasty and a significantly lower mean survival time.

**References**