Meniscal Impingement Syndrome

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Summary: The meniscal impingement syndrome consists of three elements: impaction on the anterior medial femoral condyle by the leading edge of the medial meniscus, articular cartilage damage of at least Outerbridge grade 3, and knee hyperextension of at least 5°. This report reviews this condition in a series of seven knees with an average follow-up of 39 months. The time from the onset of symptoms until surgery averaged 45 months. Treatment consisted of a thorough arthroscopic knee evaluation and debridement of the articular cartilage fragmentation and any impinging synovitis. Postoperative rehabilitation includes extension block bracing, hamstring strengthening, and closed-chain exercise. With this regimen, there was improvement in the Tegner scores and a reduction in postoperative knee hyperextension. Identification of this uncommon condition requires a complete evaluation of the medial femoral condyle in patients with knee hyperextension. Key Words: Hyperextension—Chondromalacia—Meniscus.

Anterior medial knee pain has many potential origins. We have observed a pattern of anterior medial knee pain in conjunction with articular cartilage damage of varying depths on the anterior medial femoral condyle. Other associated symptoms mimic an impingement or plica syndrome, or a meniscal tear. Initially, the source of this injury and its symptoms was not readily apparent; however, two consistent features were noted in this group: the anatomic location of the lesion and the presence of knee hyperextension. The abnormal contact between the femoral condyle and the anterior meniscal rim appeared to produce the articular cartilage injury in these patients. The purpose of this report is to describe this clinical entity of knee hyperextension producing abnormal contact pressures between the anterior horn of the medial meniscus and the femoral condyle with resulting articular cartilage damage.

METHODS

All patients identified by arthroscopic examination to have a combination of anterior medial femoral condyle articular damage, impaction of the leading edge of the medial meniscus on the anterior medial femoral condyle, and knee hyperextension defined to be at least 5°,1 were reviewed for this study. The patients’ anterior knee pain was unresolved after a trial of physical therapy and anti-inflammatory medication. Only those with a minimum follow-up of 12 months were included. Demographic data as well as preoperative and postoperative objective and subjective data were analyzed. Specifically, Lysholm knee scoring scales and Tegner activity level scores were collected. Physical examination data including results of meniscal and instability tests, the presence of atrophy, effusion, and range of motion were recorded.

All motion measurements were made by one examiner (D.A.M.) using a goniometer. The patient was supine with the ankle supported with a knee ligament test platform (MEDmetric Corp, San Diego, CA) under the Achilles tendon. Arthroscopic findings were confirmed by review of videotapes of all cases. Articular cartilage damage was classified using the Outerbridge system.2 Grade-1 defects show softening and swelling. Grade-2 defects have fragmentation and fissuring in an area of less than one cm. Grade-3 defects have fragmentation and fissuring over an area >1 cm. Grade-4 defects include erosion of the articular cartilage to the bone. Osteochondral lesions with a defect including bone loss were specifically excluded, limiting the condition to only symptomatic chondral de-
fects. Patients were excluded because of inadequate follow-up, a history of trauma, associated ligament instability, or patellar instability.

**Surgical Procedure**

The arthroscopic examination was carried out by one surgeon (D.A.M.) viewing through the standard anterior lateral portal and probing through the standard anterior medial portal. The area of the anterior medial femoral condyle articular cartilage damage was often hidden or obscured by inflamed synovium or the fat pad. This could be lifted out of the way with a probe and observed by viewing the condyle as the knee is moved from extension to flexion. It sometimes required the use of the motorized shaver to gain an adequate visualization of the area in question. After a thorough evaluation, the chondral fragments and fraying were debrided with the shaver as well as any inflamed synovium on the leading edge of the meniscus. The meniscus itself was not debrided, but before termination of the procedure, enough damaged chondral material was removed to allow full knee extension without impaction by the meniscus on the femoral condyle. A complete evaluation of the remainder of the knee was also carried out. The wounds were injected with bupivacaine. No steroid was instilled into the joint.

**Postoperative Rehabilitation**

Closed-chain exercises were used to strengthen both the quadriceps and hamstring muscles. The coactivation of these muscle groups minimizes the tendency for hyperextension that might otherwise occur with open-chain knee extension exercise.3 Special attention should be directed to the hamstring muscles because they restrain the quadriceps extension force and prevent anterior displacement of the tibia, which could increase the likelihood of femoral condyle impingement by the leading edge of the medial meniscus. In the terminal stage of extension, the hamstrings become active roughly 9° before full extension.3 Specific emphasis is given to avoiding all hyperextension positions whether standing, sitting, or lying. A hyperextension blocking brace is provided for daytime use during the initial 2 months after surgery; it is then used as comfort dictates. No patient continued to use the extension blocking brace at the time of final follow-up.

Statistical comparisons of categorical variables were performed using paired two-sample Z tests while continuous variables were compared by the Student’s t test. All data summaries and statistical comparisons were performed by Statistical Analysis System (SAS) with statistical significance determined to be at P < .05.

### Table 1. Mechanism of Injury

<table>
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<tr>
<th>Patient</th>
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<td>L</td>
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<td>Twist</td>
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<tr>
<td>2</td>
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<td>L</td>
<td>29</td>
<td>Twist</td>
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<tr>
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<td>R</td>
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<tr>
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<td>F</td>
<td>L &amp; R</td>
<td>16</td>
<td>Chronic</td>
</tr>
</tbody>
</table>

**RESULTS**

Seven knees (six patients) were identified that met the inclusion criteria. These included four female and two male patients. One female patient had bilateral knee involvement. The average age at arthroscopy was 33 years (range 16 to 49 years). Average follow-up was 39 months (range 17 to 70 months). The time from the onset of symptoms until arthroscopy averaged 45 months. No specific injury was identified in three knees (Table 1).

Preoperative symptoms reported by these patients included anterior knee pain, posterior knee pain, and joint line tenderness. Physical findings included effusion, medial joint line tenderness, and atrophy. No signs of ligamentous instability, patellofemoral instability, or inflammatory disease were present. Postoperative pain resolution was complete in all patients at final follow-up.

Both Lysholm and Tegner scores were obtained preoperatively and at the most recent follow-up visit. Average preoperative Lysholm scores of 46 increased to 50 postoperatively. This was not statistically significant. Tegner activity levels averaged 1.6 preoperatively and 2.3 postoperatively (P < .05). Preoperative hyperextension measured under anesthesia averaged 6° in the male patients and 15° in the female patients. There was no change in the males’ extension measurements postoperatively. However, in the female patients, this decreased postoperatively to 5° of hyperextension (range 3° to 6°, P < .05). This is a remarkable decrease because two knees had 25° of hyperextension and one 20° hyperextension initially (Fig 1).

Arthroscopic findings were categorized as to chondral damage and meniscal tears. All knees were found to have at least Outerbridge grade-3 chondral damage on the anterior medial femoral condyle (Fig 2). Six knees had grade-3 damage and one had grade-4 damage. Only one knee had an anterior horn flap tear of the medial meniscus. This was associated with a grade-3 injury.
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Consequently, reliance on the radiographic evaluation is not justified. The arthroscopic surgeon can obtain a meaningful determination of the knee extension in the operating room with the patient under anesthesia, by resting the heel on a Mayo table and using a goniometer. Should the index of suspicion be high preoperatively, a lateral radiographic examination, with the heel supported by a device such as the knee ligament test platform, can be conducted in the office.

The elements of this condition are three: hyperextension of at least 5°, articular cartilage injury of the medial femoral condyle of at least Outerbridge grade 3, and impingement by the leading edge of the meniscus. Hyperextension is not uncommon in the general popu-

FIG 1. Lateral radiograph shows hyperextension of the knee and suggests impaction by the leading edge of the meniscus on the femoral condyle.

DISCUSSION

The meniscal impingement syndrome is an uncommon condition and must be suspected before it can be found. This lesion, when present, will often be hidden by the fat pad and synovium overlying the medial femoral condyle. Because arthroscopy often focuses on the search for potential meniscal pathology, the possibility that the meniscus may cause damage to another structure may be underappreciated. If a diligent search of the entire medial femoral condyle surface is not undertaken in every case, chondral damage may be overlooked.

This condition is frequently found serendipitously. Once the lesion is identified, a careful measurement should be made of knee extension under anesthesia by a goniometer. Preoperative radiographic examination of the hyperextension is not often obtained in these

FIG 2. Arthroscopic views of the Outerbridge grade-3 damage on the anterior medial femoral condyle with the knee in (A) 0° extension, and (B) 10° of hyperextension.
lation. Knee hyperextension can be a component of the hypermobility syndrome or a feature of many hereditary connective disorders.4-8 Neurological disorders both congenital and acquired may develop joint hypermobility.9 Several studies report an incidence of hypermobility in the general public of between 2% and 10%.6,10 Some studies of young individuals have identified hyperextensible knees in 20%.11 Women have hyperextensible joints twice as often as men.7,11 This observation is consistent with our series of patients in which women predominated and had a degree of hyperextension much greater than the men. A postoperative reduction in this hyperextension was also only noted in the women. As a rule, hyperextension decreases with age in both men and women. Women tend to lose their hypermobility by age 40 to 45 years, whereas men experience a decrease in hypermobility starting at age 25.11 In this group of patients, the greatest hyperextension was observed in two women, one 49 years old and one 39 years old, suggesting that a pathological process may have delayed this decrease in hypermobility.

Knee hyperextension is not necessarily an incidental finding of little clinical significance. It can predispose the knee to meniscal tears, ligament injuries, effusions, patellar dislocations, and osteoarthritis.12,13 However, a review of the literature failed to find any reference to a condition in which knee hyperextension was reported to have caused meniscal impaction with significant articular cartilage damage on the medial femoral condyle.

In this clinical group, hyperextension was measured by goniometer in a standardized fashion with the patient supine and the Achilles tendon supported on a heel rest. The use of a standard device to elevate the heel is helpful. By resting the Achilles tendon on a rounded platform, the weight of the leg is distributed over a greater area and is less likely to produce the pain that occurs when resting the heel on a flat hard object. Measurement of patients in a sitting position may evoke partial activation of the hamstrings, thereby reducing knee extension.

The second element, anterior medial femoral chondral damage, may be localized and of variable depth. This probably reflects chronic repetitious impacts by the meniscus. Only the more advanced (grade-3 and grade-4) chondral damage, as graded with the Outerbridge classification,12 was considered for inclusion in this syndrome. Higher grade lesions may be related to greater age or longer exposure, because the only grade-4 lesion was in the oldest patient. This patient also possessed the greatest degree of hyperextension.

The third feature of this condition is impingement of the anterior edge of the medial meniscus on the femoral condyle (Fig 2). This situation was verified arthroscopically in every case. This impaction did not have any apparent destructive effect on the meniscus. The only case with an associated meniscal tear involved an anterior horn flap tear of the middle meniscus.

During arthroscopic examination, the characteristic lesion appears on the medial femoral condyle. This can be observed by viewing the condyle as the knee is moved from extension to flexion. Often, the lesions are not visible in the typical field of view used to examine the posterior horn of the medial meniscus because they are hidden by the fat pad. Occasionally a portion of the fat pad must be resected to adequately visualize all aspects of the femoral condyle. A thorough and specific examination of the medial femoral condyle articular cartilage is required to identify mild cases. An analysis of the relationship between both femoral condyles and the meniscus with the knee in hyperextension should be done with every knee arthroscopy.

Symptoms included anterior knee pain, posterior knee pain, and meniscal injury–like pain; these symptoms resolved by the final examination. All patients with a history of trauma, joint instability, and patellar instability were excluded from this report to exclude the possibility that the articular cartilage damage was caused by a source other than the anterior edge of the medial meniscus.

The arthroscopic surgical treatment for this condition is a debridement of the articular cartilage damage and a debridement of the synovium and fat pad at the anterior edge of the medial meniscus. The postoperative rehabilitation should concentrate on the reduction of hyperextension. This should include extension blocking bracing as well as an emphasis on hamstring strengthening exercise. Only closed-chain exercises should be used to avoid the unopposed contraction of the quadriceps and take advantage of coactivation of the hamstrings.

In conclusion, this condition is uncommon. Its three elements are knee hyperextension >5°, damage to the chondral surface of the anterior medial femoral condyle, and medial meniscus impaction on the femoral condyle. Symptoms of pain with guarding preoperatively may preclude an accurate appreciation of the full amount of knee hyperextension. When this condition is suspected before surgical intervention, repeated thorough physical examinations and a prolonged trial of nonoperative therapy are indicated. This should include anti-inflammatory medications, hamstring strengthening exercises, and
bracing to reduce the hyperextension. The arthroscopic examination should carefully include the entire articular surface to avoid missing this condition.

Acknowledgment: The authors gratefully appreciate the technical assistance provided by Heather Sanders in the compilation of data.

REFERENCES