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Reliability of Clinical Findings and Magnetic Resonance Imaging for the Diagnosis of Chondromalacia Patellae

By Harri K. Pihlajamäki, MD, PhD, Paavo-Ilari Kuikka, MD, Vesa-Veikko Leppänen, MD, Martti J. Kiuru, MD, PhD, and Ville M. Mattila, MD, PhD

Investigation performed at the Centre for Military Medicine and the Department of Orthopaedic Surgery, Central Military Hospital, Helsinki, Finland

Background: This diagnostic study was performed to determine the correlation between anterior knee pain and chondromalacia patellae and to define the reliability of magnetic resonance imaging for the diagnosis of chondromalacia patellae.

Methods: Fifty-six young adults (median age, 19.5 years) with anterior knee pain had magnetic resonance imaging of the knee followed by arthroscopy. The patellar chondral lesions identified by magnetic resonance imaging were compared with the arthroscopic findings.

Results: Arthroscopy confirmed the presence of chondromalacia patellae in twenty-five (45%) of the fifty-six knees, a synovial plica in twenty-five knees, a meniscal tear in four knees, and a femorotibial chondral lesion in four knees; normal anatomy was seen in six knees. No association was found between the severity of the chondromalacia patellae seen at arthroscopy and the clinical symptoms of anterior knee pain syndrome (p = 0.83). The positive predictive value for the ability of 1.0-T magnetic resonance imaging to detect chondromalacia patellae was 75% (95% confidence interval, 53% to 89%), the negative predictive value was 72% (95% confidence interval, 56% to 84%), the sensitivity was 60% (95% confidence interval, 41% to 77%), the specificity was 84% (95% confidence interval, 67% to 93%), and the diagnostic accuracy was 73% (95% confidence interval, 60% to 83%). The sensitivity was 13% (95% confidence interval, 2% to 49%) for grade-I lesions and 83% (95% confidence interval, 59% to 94%) for grade-II, III, or IV lesions.

Conclusions: Chondromalacia patellae cannot be diagnosed on the basis of symptoms or with current physical examination methods. The present study demonstrated no correlation between the severity of chondromalacia patellae and the clinical symptoms of anterior knee pain syndrome. Thus, symptoms of anterior knee pain syndrome should not be used as an indication for knee arthroscopy. The sensitivity of 1.0-T magnetic resonance imaging was low for grade-I lesions but considerably higher for more severe (grade-II, III, or IV) lesions. Magnetic resonance imaging may be considered an accurate diagnostic tool for identification of more severe cases of chondromalacia patellae.

Level of Evidence: Diagnostic Level I. See Instructions to Authors for a complete description of levels of evidence.

Anterior knee pain is a very common disorder in adolescents and young adults1,2. However, the pathophysiology underlying anterior knee pain is controversial. It has been previously thought to be caused by chondromalacia patellae. Patellar tendinopathy, patellofemoral malalignment3, or an imbalance in tissue homeostasis4 have also been suggested to cause similar symptoms. The typical clinical symptoms of anterior knee pain syndrome include a deep-seated ache and retropatellar pain that worsens when climbing stairs, sitting with the knees flexed, and rising from a sitting position. Extending the knee against resistance may also cause pain, and a sense of insecurity may be felt during weight-bearing5. The importance of a reliable diagnosis is emphasized by the fact that the symptoms of anterior knee pain syndrome may re-
semble those of other conditions, such as a meniscal tear. There is a substantial difference in the required treatment for these disorders, especially with regard to the potential need for surgical management. Physical signs of anterior knee pain, such as effusion, quadriceps wasting, and retropatellar crepitus, have been claimed to be more informative in the diagnosis of chondromalacia patellae. However, none of these signs is considered specific for chondromalacia patellae.

Radiographs have not proven to be useful in the diagnosis of chondromalacia patellae until the disease is in the advanced stages. A reliable diagnosis can be reached by using arthroscopy, as it allows a good view of the patellofemoral joint. However, surgical treatment of chondromalacia patellae is indicated in <10% of patients, and the initial treatment of chondromalacia consists of a period of rehabilitation. There is evidence that physical therapy can alleviate patellofemoral pain. Arthroscopic smoothing of fibrillated and traumatized areas of articular cartilage has been used for grade-II, III, and IV chondromalacia, although the positive treatment outcomes may deteriorate over time. If the arthroscopic examination does not reveal any arthroscopically treatable lesion, it may seem to be a costly diagnostic method unnecessarily consuming our limited health-care resources. Moreover, arthroscopy causes short-term functional disability, pain, and stress and involves risks related to anesthesia and surgery.

It would be beneficial if magnetic resonance imaging, which is a noninvasive diagnostic method, could confirm the diagnosis of chondromalacia patellae. It is a more comfortable procedure for the patient, and the risk of complications is lower than that associated with diagnostic arthroscopy. However, it is unclear whether magnetic resonance imaging can help to confirm the correct diagnosis of chondromalacia patellae in patients with anterior knee pain. In previous reports, the overall sensitivity of magnetic resonance imaging for the diagnosis of chondromalacia patellae has ranged between 26% and 100%, the specificity has ranged between 50% and 94%, and the diagnostic accuracy has ranged between 77% and 90%. These studies have varied widely with regard to the imaging methods, patient samples, and grading systems utilized, which probably explains the different results. Several authors have reported that magnetic resonance imaging is more sensitive for detecting deep chondral lesions than it is for demonstrating superficial ones.

The purpose of the present study was to assess the correlation between clinical symptoms of anterior knee pain syndrome and chondromalacia patellae. We also assessed the reliability of 1.0-T magnetic resonance imaging, by comparing the results with those of arthroscopy, for the diagnosis of chondromalacia patellae in young adults. The hypothesis of this study was that magnetic resonance imaging would ensure the diagnosis of chondromalacia patellae at least in patients with more severe chondral lesions.

**Materials and Methods**

This prospective diagnostic study was performed during a three-year period at the authors’ institution, which provided all surgical services for the entire armed forces of Finland at that time. All male citizens in Finland become eligible for mandatory military service at the age of eighteen years, and the majority of recruits are nineteen years old at the beginning of their basic training. The patients selected for this study were young military trainees who had been deemed healthy enough to pass the entry medical examination and were able to perform physically demanding military training. Physical and combat training for the recruits includes physical exercise causing increased loads on the lower limb and especially on the knees because kneeling and crawling are often included in the training activities. Combat training, marching, and other physical training activities were performed almost daily throughout the service period. Thus, anterior knee pain may interfere markedly with the performance of such military training and may threaten the ability to complete military service. Participation in this study was voluntary, and written informed consent was obtained from each patient. The study protocol was approved by the local ethics committee.

The inclusion criteria consisted of nontraumatic, prolonged anterior knee pain causing problems that interfered with military service. An orthopaedic surgeon performed physical examinations according to the standard policy of the institution. These examinations consisted of a systematic and methodical examination that included inspection; palpation; measurements of motion, muscle strength, limb lengths, and muscle girth; functional tests to assess walking gait, stationary running, hopping, and squatting; tests to detect mechanical or meniscal problems such as the McMurray test or Apley test; and evaluations of ligament stability, the extensor mechanism, and the popliteal space. Plain radiographs, including anteroposterior, lateral, and sunrise views, were made. The clinical symptoms of anterior knee pain syndrome were divided into three categories for assessment of their relationship with chondromalacia: (1) diffuse pain in the anterior part of the knee as a single symptom, (2) typical clinical anterior knee pain syndrome without patellofemoral crepitus or pain on manipulation of the patella, and (3) typical clinical anterior knee pain syndrome with patellofemoral crepitus and/or pain on manipulation of the patella. The exclusion criteria included a previous fracture, surgical procedure, or injury in the knee region.

The initial treatment for all patients experiencing anterior knee pain was nonoperative, consisting mainly of activity restrictions or rest and nonsteroidal anti-inflammatory drugs when necessary. In addition, before arthroscopy was considered, the patients were instructed and encouraged to perform exercises supervised by a physiotherapist. These included lower-extremity muscle strengthening with a concentration on the quadriceps. Arthroscopy was chosen when the response to nonoperative treatment was insufficient and when a reliable method was needed to verify the suspected diagnosis of chondromalacia patellae or to differentiate between chondromalacia patellae and other internal derangements of the knee. The only deviation from the standard policy of the institution was that magnetic resonance imaging of the knee was performed for all of the patients included in the study. Most patients underwent
the scan one day prior to the scheduled arthroscopy date. For patients who had already undergone magnetic resonance imaging of the knee as part of the normal clinical assessment and policy of the department, the scan was repeated for the purpose of the study to minimize the delay between the magnetic resonance imaging and the arthroscopy.

Plain radiographs, including anteroposterior, lateral, and sunrise views, were routinely made of all of the patients before the physical examination by an orthopaedic surgeon. In order to evaluate possible anatomic deviations of the patellofemoral joint, the following measurements and assessments were performed. On the sunrise radiographs, the patellar angle was measured between a line connecting the anterior aspects of the femoral condyles and a second line drawn along the lateral facet of the patella. The sulcus angle was measured between lines extending from the deepest point of the intercondylar sulcus, medially and laterally, to the tops of the femoral condyles. A line bisecting the sulcus angle was compared with a line drawn from the apex of the sulcus angle through the lowest point of the articular ridge of the patella (the congruence angle) to detect possible lateralization of the patella. The sulcus angle was considered to be flat if it was <138°.

The magnetic resonance imaging performed for all patients prior to the knee arthroscopy was carried out with a 1.0-T scanner (Signa Horizon; GE Medical Systems, Milwaukee, Wisconsin) with a standard knee coil and a field of view of 10 to 16 cm. The slice thickness was 3 to 4 mm, with a 0.5 or 1.0-mm intersection gap. Sagittal T1 and T2*-weighted images, coronal proton density images with fat suppression, and axial three-dimensional T1-weighted fast spoiled gradient-recalled images with fat suppression were obtained routinely. A musculoskeletal radiologist on duty initially evaluated the images with use of a standard protocol for interpreting magnetic resonance images. For the purpose of this prospective study, another musculoskeletal radiologist (M.J.K.) who was blinded to the previous magnetic resonance imaging and arthroscopy findings then reevaluated the images. These reevaluations differed from the original interpretation in three cases, and a decision was reached by consensus. The magnetic resonance images were recorded as showing either normal cartilage thickness or a loss of cartilage. Grading of chondromalacia with use of the magnetic resonance imaging was based on the arthroscopic grading system described by Shahriaree (Table I). When the results were calculated for grade-I chondromalacia patellae, only arthroscopically detected grade-I lesions were taken into account as positive results (the gold standard). A single table analysis was used to calculate the positive and negative predictive values as well as the sensitivity, specificity, and diagnostic accuracy of magnetic resonance imaging. The Fisher exact test was used in two-way tables. Ninety-five percent confidence intervals were calculated with the Wilson method. When the results were calculated for grade-I chondromalacia patellae, only arthroscopically detected grade-I lesions were taken into account as positive results (the gold standard) for chondromalacia, and they were compared with the magnetic resonance imaging results (with grade 0 on the images considered negative and grades I through IV considered positive). Results for grades II, III, and IV were calculated with arthroscopically detected grade-II, III, and IV lesions considered positive and compared with the magnetic resonance imaging results (with grade 0 on the images considered negative and grades I through IV considered positive).

Statistical Methods
To determine the validity of the 1.0-T magnetic resonance imaging for the diagnosis of chondromalacia patellae, the magnetic resonance imaging findings were compared with the arthroscopic findings, which served as the gold standard. A single table analysis was used to calculate the positive and negative predictive values as well as the sensitivity, specificity, and diagnostic accuracy of magnetic resonance imaging. The Fisher exact test was used in two-way tables. Ninety-five percent confidence intervals were calculated with the Wilson method. When the results were calculated for grade-I chondromalacia patellae, only arthroscopically detected grade-I lesions were taken into account as positive results (the gold standard). A single table analysis was used to calculate the positive and negative predictive values as well as the sensitivity, specificity, and diagnostic accuracy of magnetic resonance imaging. The Fisher exact test was used in two-way tables. Ninety-five percent confidence intervals were calculated with the Wilson method. When the results were calculated for grade-I chondromalacia patellae, only arthroscopically detected grade-I lesions were taken into account as positive results (the gold standard) for chondromalacia, and they were compared with the magnetic resonance imaging results (with grade 0 on the images considered negative and grades I through IV considered positive). Results for grades II, III, and IV were calculated with arthroscopically detected grade-II, III, and IV lesions considered positive and compared with the magnetic resonance imaging results (with grade 0 on the images considered negative and grades I through IV considered positive).

Source of Funding
There was no external funding source for the investigation.

Results
Fifty-six patients (fifty-four men and two women) met the inclusion criteria for the present study. The median age of the patients was 19.5 years (range, eighteen to twenty-five years). Twenty-one patients had only one knee examined, and the remaining thirty-five had both knees examined. Altogether, ninety-one knees were examined but, in bilateral cases, one knee was randomly selected for the study in order to ensure the independence of the observations.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Fibrillation</td>
</tr>
<tr>
<td>II</td>
<td>Fissure formation</td>
</tr>
<tr>
<td>III</td>
<td>Fragmentation</td>
</tr>
<tr>
<td>IV</td>
<td>Crater formation and eburation</td>
</tr>
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</table>

TABLE I Classification of Chondromalacia Patellae According to the System Described by Shahriaree

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Fibrillation</td>
</tr>
<tr>
<td>II</td>
<td>Fissure formation</td>
</tr>
<tr>
<td>III</td>
<td>Fragmentation</td>
</tr>
<tr>
<td>IV</td>
<td>Crater formation and eburation</td>
</tr>
</tbody>
</table>
All of the fifty-six patients were determined to have anterior knee pain on the basis of the clinical examination by an experienced orthopaedic surgeon. Arthroscopy confirmed the presence of chondromalacia patellae in twenty-five (45%) of the fifty-six knees. Twenty knees (36%) had signs of chondromalacia patellae on the magnetic resonance images (Figs. 1-A and 1-B). With regard to the detection of chondromalacia patellae, the positive predictive value of magnetic resonance imaging was 75% (95% confidence interval, 53% to 89%), the negative predictive value was 72% (95% confidence interval, 56% to 84%), the sensitivity was 60% (95% confidence interval, 41% to 77%), the specificity was 84% (95% confidence interval, 67% to 93%), and the diagnostic accuracy was 73% (95% confidence interval, 60% to 83%). Of eight patients with a grade-I lesion on arthroscopy, one had a true-positive finding on magnetic resonance imaging, so that magnetic resonance imaging had a sensitivity of 13% (95% confidence interval, 2% to 49%) for the detection of grade-I lesions. The number of true-positive magnetic resonance imaging findings was higher for grade-II, III, or IV lesions (fourteen of seventeen patients), and the sensitivity was 83% (95% confidence interval, 59% to 94%) for detection of those lesions. The results of magnetic resonance imaging and arthroscopy for the different grades of chondromalacia are presented in Table II. The kappa value for the overall measure of agreement across the five levels was 0.368 (p < 0.001).

Figs. 1-A and 1-B A nineteen-year-old man reported chronic activity-related pain in the left knee. Clinical examination revealed patellofemoral crepitus suggestive of chondromalacia patellae. Fig. 1-A An axial fat-suppressed T1-weighted magnetic resonance image of the knee showed intact cartilage surfaces (arrows). Fig. 1-B Subsequent arthroscopy showed changes suggestive of grade-I chondromalacia on both facets of the patella (arrows). Probing revealed softening of the cartilage. On the femoral side, the cartilage surfaces were normal, and gliding of the patella in the sulcus was unobstructed.

<table>
<thead>
<tr>
<th>Magnetic Resonance Imaging Grade</th>
<th>Arthroscopy Grade</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 (Negative)</td>
<td>I (Positive)</td>
</tr>
<tr>
<td>0 (negative)</td>
<td>26</td>
<td>7</td>
</tr>
<tr>
<td>I (positive)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>II (positive)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>III (positive)</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>IV (positive)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>8</td>
</tr>
</tbody>
</table>
eight were grade III, and none were grade IV (Figs. 2-A and 2-B). In eight knees, diffuse anterior pain was the only symptom. The typical clinical picture of anterior pain without patellofemoral crepitus or pain on manipulation of the patella was present in twelve knees, and the typical clinical picture of anterior pain with patellofemoral crepitus and/or pain on manipulation of the patella was found in thirty-six knees. No association was found between the severity of chondromalacia patellae seen on arthroscopy and the clinical symptoms of anterior knee pain syndrome ($p = 0.83$).

Of the fifty-six knees with anterior knee pain, twenty-five (45%) had a synovial plica; four, a meniscal tear; four, a femorotibial chondral lesion; and six, normal anatomy without any abnormal arthroscopic findings. All arthroscopic findings (one or more per knee) and their correlation with the clinical symptoms and physical signs are shown in Table III.

Plain radiographs were made of forty-three knees with anterior knee pain, and they showed normal findings in thirty-six of them (Table IV). Subluxation or lateralization of the patellae was found in six knees, a flat sulcus angle was found in three knees, Osgood-Schlatter disease was detected in one knee, and surface irregularity of the patellar facets was seen in one knee. The subsequent arthroscopy performed for the current study demonstrated chondromalacia patellae in fourteen of the thirty-six knees with normal radiographic findings.

<table>
<thead>
<tr>
<th>TABLE III Symptoms and Physical Signs, and Arthroscopic Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms and/or Physical Signs</td>
</tr>
<tr>
<td>Diffuse anterior knee pain as single symptom ($n = 8$ patients)</td>
</tr>
<tr>
<td>Typical clinical symptoms without patellofemoral crepitus or pain on manipulation of patella ($n = 12$)</td>
</tr>
<tr>
<td>Typical clinical symptoms with patellofemoral crepitus and/or pain on manipulation of patella ($n = 36$)</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
TABLE IV Radiographic and Arthroscopic Findings

<table>
<thead>
<tr>
<th>Findings on Plain Radiographs</th>
<th>Chondromalacia Patellae in Same Knee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal radiographic findings</td>
<td>36</td>
</tr>
<tr>
<td>Subluxation/lateralization</td>
<td>6</td>
</tr>
<tr>
<td>Flat sulcus angle</td>
<td>3</td>
</tr>
<tr>
<td>Osgood-Schlatter disease</td>
<td>1</td>
</tr>
<tr>
<td>Surface irregularity</td>
<td>1</td>
</tr>
</tbody>
</table>

**Discussion**

The purposes of this study were to assess the correlation of clinical symptoms of anterior knee pain syndrome and chondromalacia patellae and to define the reliability of 1.0-T magnetic resonance imaging in the diagnosis of chondromalacia patellae in young adults. Our hypothesis was that magnetic resonance imaging would confirm the diagnosis of chondromalacia patellae at least in the case of more severe, deeper chondral lesions. In our study, chondromalacia patellae was found in less than half of the patients with anterior knee pain and 1.0-T magnetic resonance imaging was accurate in identifying more severe cases of chondromalacia patellae.

The principal finding of the present study was that there is no correlation between the presence of softened articular cartilage (chondromalacia patellae) and clinical symptoms of anterior knee pain syndrome. This finding is supported by previous reports in the literature that also alluded to the absence of pathognomonic symptoms. According to our results, diffuse anterior knee pain as the sole symptom seems to exclude a diagnosis of chondromalacia patellae fairly reliably because the diagnosis was confirmed in only one of eight patients with that symptom alone. Chondromalacia patellae was seen in only half of the patients with typical clinical symptoms without patellofemoral crepitus or pain on manipulation of the patella. Our results correspond with those of Leslie and Bentley, who found that only 60% of patients with clinically diagnosed anterior knee pain and retropatellar crepitus had chondromalacia. Thus, the association between symptoms and the identification of chondromalacia patellae with arthroscopy is not clear. In addition, an important finding was the lack of an association between the severity of chondromalacia patellae and the clinical symptoms, which contradicted the observations reported by Kettunen et al., who reported that patients with more severe cartilage lesions of the patella or the femoral trochlea had more subjective symptoms and functional limitations than those without lesions or with small cartilage lesions. The findings of the present study suggest that chondromalacia patellae cannot be distinguished by symptoms and signs on physical examination.

In addition to chondromalacia patellae (softening of the patellar articular cartilage), a medial synovial plica of the knee was a common arthroscopic finding in patients experiencing anterior knee pain. It was previously suggested that a medial synovial plica can cause symptoms, possibly by generating chondromalacia. In the present sample, a medial synovial plica was detected arthroscopically in nearly half of the knees, but its association with symptoms must also be evaluated critically. Previous reports showed no correlation between the size of the plica and the severity of the symptoms and that even smaller plicae may impinge on the adjacent cartilage of the femoral condyle. Moreover, recent reports suggest that, although aspects of the pathomechanism of plica syndrome remain unclear, arthroscopic resection should be considered if incapacitating knee pain is accompanied by an arthroscopic finding of a medial plica of the knee.

In the study by Lee et al., the sensitivity of magnetic resonance imaging in detecting all of the grades of chondromalacia patellae was 57%, which is close to the sensitivity of 60% found in our study. Using T2-weighted magnetic resonance imaging, McCauley et al. found a slightly higher sensitivity (72%), an almost equal specificity (87%), and a slightly higher accuracy (79%) compared with what we found in our study. Using T2-weighted magnetic resonance imaging, Handelberg et al. reported an accuracy (82%) similar to that reported by McCauley et al. However, it has also been reported that T2-weighted magnetic resonance imaging may produce many false-negative results. Other results in the literature have deviated more substantially from those in our study. The highest sensitivity (100%) was achieved with T2-weighted spin-echo pulse sequences in the sagittal and axial planes and with a three-dimensional fast sequence in the sagittal plane. An almost equally high sensitivity (99%) was reported for three-dimensional spoiled gradient-recalled imaging with fat suppression after intravenous injection of contrast medium. However, the combination that provided the highest sensitivity led to poorer specificity (50%). The highest specificity (94%) was achieved with spectral presaturation with inversion recovery sequences.

On the basis of the differences among the chondromalacia patellae grades, with a sensitivity of only 13%, grade-I chondral defects cannot be reliably detected with use of 1.0-T magnetic resonance imaging. The imaging sensitivity was considerably higher (83%) for grades II and III. Although no patients in the study had grade-IV chondromalacia patellae, our results clearly indicated that the sensitivity was highest for the deepest lesions. This finding is consistent with those presented previously. Gagliardi et al., using the same chondromalacia patellae grading system that we used, reported a sensitivity of 0% for grade-I chondromalacia patellae with all of their imaging sequences. For grade-II and III lesions, the sensitivity was between 13% (proton-density-weighted magnetic resonance imaging) and 47% (T2-weighted imaging), and, for grade-IV lesions, it was between 50% (spoiled gradient-recalled imaging) and 75% (T1-weighted, T2-weighted, and proton-density-weighted imaging). The sensitivities reported by Gagliardi et al. for all of the sequences that they used were lower than the sensitivities found in the present study. Murphy
used T2*-weighted three-dimensional gradient-echo magnetic resonance imaging and reported results very similar to ours, with a sensitivity of 83% for grade-III and IV lesions. Lee et al. reported a higher sensitivity—94% for grade-III and IV chondromalacia patellae with use of axial inversion recovery-fast spin-echo imaging. However, on the basis of the present study, magnetic resonance imaging should be considered instead of arthroscopy for patients with prolonged anterior knee pain.

Plain radiographs have been considered inadequate for the identification of early cartilage damage. However, it has been suggested that chondromalacia patellae might frequently be accompanied by subluxation of the patella or a flat sulcus angle. Contrary results have been reported in studies concerning anterior knee pain and arthroscopically diagnosed chondromalacia patellae. Although our results seem to support the latter studies, no conclusion can be drawn from the abnormal findings reported here because of their small number. For example, although it may seem that chondromalacia patellae is accompanied by a flat sulcus angle, the very small number of cases with such an angle and the seemingly normal articular surfaces on these images do not support such a conclusion.

Our study has several noteworthy strengths, including the prospective design and the homogeneity of the study population. Our study sample consisted of young military trainees between eighteen and twenty-five years of age, who all were deemed healthy enough to pass their military entry medical examination. All were expected to have attained, after completion of their military basic training, a physical level enabling them to march or ski, while carrying a full military pack weighing 25 kg and a rifle, a distance of 15 km on two consecutive days while maintaining fitness for battle. Due to the compulsory nature of the military service, the study participants reflect the young adult male population of the country. Moreover, the age group that we studied is optimal because individuals in that group do not normally have degenerative chondral changes such as osteoarthritis. This relatively large group of skeletally mature young adults underwent a uniform examination and treatment for anterior knee pain according to the policy of one institution. The standard methods and protocols of the institution were used for the evaluation of clinical symptoms, plain radiographs, magnetic resonance images, and arthroscopic findings. Magnetic resonance imaging was ordinarily performed on the day prior to the arthroscopy to avoid possible bias caused by any delay.

The strength of the magnetic resonance imaging field used in the present study (1.0 T) may be considered a limitation, although it is unclear whether higher field strength might have resulted in a more reliable diagnosis of chondromalacia patellae. As mentioned in the Results section, a total of ninety-one knees were examined but, in cases of bilateral findings, only one knee was randomly selected for the study. This limited the number of the knees in the present study and can be considered a limitation.

In conclusion, chondromalacia patellae cannot be diagnosed on the basis of symptoms or with current methods of physical examination. The present study demonstrated no correlation between the severity of the chondromalacia patellae and the clinical symptoms of anterior knee pain syndrome. Thus, these symptoms should not be used as an indication for knee arthroscopy. The sensitivity of magnetic resonance imaging for the detection of grade-I lesions was low and could not confirm the diagnosis of chondromalacia patellae. However, the sensitivity of magnetic resonance imaging was considerably higher for the detection of more severe (grade-II or III) lesions, and 1.0-T magnetic resonance imaging may be considered an accurate diagnostic tool for the identification of more severe cases of chondromalacia patellae. In addition to chondromalacia patellae, a medial synovial plica of the knee was a common arthroscopic finding in young adult patients experiencing anterior knee pain.

References