Articular Cartilage Lesions in 993 Consecutive Knee Arthroscopies

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Background: Traumatic articular cartilage injuries heal poorly and may lead to development of osteoarthritis at a young age. This study estimates the number of patients who may benefit from one of the surgical methods of cartilage repair.

Methods: All patients undergoing knee arthroscopy during a 6-month period at three collaborating hospitals were consecutively evaluated according to the International Cartilage Repair Society (ICRS) knee form. The material consists of 993 consecutive knee arthroscopies in patients with median age of 35 years.

Results: Preoperative radiographs demonstrated degenerative changes in 13% of the knees. Articular cartilage pathology was found in 66% and a localized cartilage defect was found in 20% of the knees. A localized full-thickness cartilage lesion (ICRS grade 3 and 4) was observed in 11% of the knees. Of the localized full-thickness lesions, 55% (6% of all knees) had a size above 2 cm^2.

Conclusion: Eleven percent of all knee arthroscopies show cartilage defects that may be suitable for cartilage repair procedures. However, the natural history of these lesions and the number of patients that will benefit from a cartilage repair procedure are so far unknown.

Keywords: articular cartilage lesions; knee; arthroscopy; cartilage defect score

Studies concerning knee joint cartilage lesions have resulted in an impressive volume of orthopaedic literature. This is illustrated in several review articles published in the past 3 years.[10-12,19] The majority of these articles conclude that a treatment breakthrough has not yet occurred. Several techniques are available: microfracture, periost transplantation, autologous chondrocyte transplantation, and mosaic arthroplasty.[2,4,6,9,15-17] If these techniques are proven to be successful, they will be used on relatively wide clinical indications since the alternatives are few. From a health economics point of view, it will be important to have information about the size of this problem. To our knowledge, no articles have been published to document the incidence, size, and severity of knee cartilage injuries using a standardized international classification system for cartilage injuries. This study was designed to estimate the frequency of localized cartilage lesions suitable for any of the "new techniques" of cartilage repair.

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MATERIALS AND METHODS

Three hospitals collaborated in the study. All knee arthroscopic procedures were registered consecutively during a period of 6 months. All patients were informed about the ongoing study preoperatively, and the study was carried out in accordance with the World Medical Association Declaration of Helsinki. A total of 993 patients, 612 men and 381 women, with a median age of 35 years (range, 10 to 86) were included in the study. During the 6-month period, a total of 1005 knee arthroscopies were performed. Twelve patients (1%) were not included in the study due to missing data or according to their own will.

At the Symposium of the International Society for Cartilage Repair in 1997, a working group presented The Cartilage Standard Evaluation Form, adapted from the International Knee Documentation Committee system.[1] This evaluation form was used in the study. Patient data such as cause of injury, age at the occurrence of injury, onset of symptoms, sporting activities, knee pain, subjective knee function (percentage of function compared to the normal knee), previous surgery, and activity level were included. According to this system, the depth of cartilage defects is ranked on a 4-grade scale. The size and the anatomical localization further describe the defects.

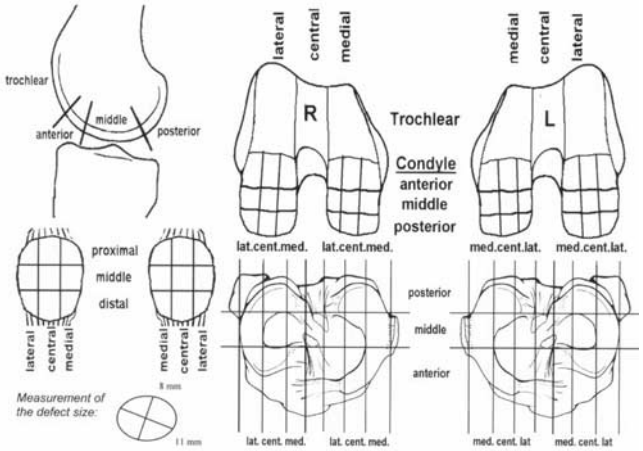

Figure 1A. International Cartilage Repair Society evaluation form showing the grid map of the knee. Published with permission from the ICRS.

The defects are also outlined by the surgeon on standard grid maps including frontal and lateral views of the articular surfaces of the knee. Figure 1A and 1B show two of the pages in the evaluation form available from the International Society for Cartilage Repair. This article focuses on full-thickness cartilage lesions, which mean International Cartilage Repair Society (ICRS) grade 3 and 4. ICRS grade 3 is a full-thickness lesion in which fibrillations in the articular cartilage extend down to the subchondral bone, while grade 4 means penetration of the subchondral bone. Other injuries diagnosed under the arthroscopic procedure are also documented.

Our objective was to find the number of localized cartilage lesions. The surgeon was given the opportunity to classify the cartilage lesions as either a localized lesion surrounded by normal cartilage or as degenerative changes. If a combination of these two existed, the knee was considered as degenerative, except in those cases in which only slight changes of the patellofemoral joint (ICRS grade 1) were noted.

According to the ICRS form,[1] ratings of radiographic findings are ranked into one of four subgroups according to the degree of degenerative changes. In this study, grouping of radiographs was carried out by the presence or absence of degenerative changes as evaluated by the orthopaedic surgeon. The radiographs of the injured knee were obtained as standard anteroposterior and lateral views. A standing x-ray was the standard procedure, although this was not always obtained due to a locked knee or because the patient brought his or her own private x-rays, which often were nonstanding. Preoperative MRI examinations were done in 29% of the knees, and this was the only preoperative radiological investigation in 7% of the knees. MRI of the injured knee was evaluated by an experienced radiologist. The orthopaedic surgeons filled out the ICRS forms immediately after surgery.

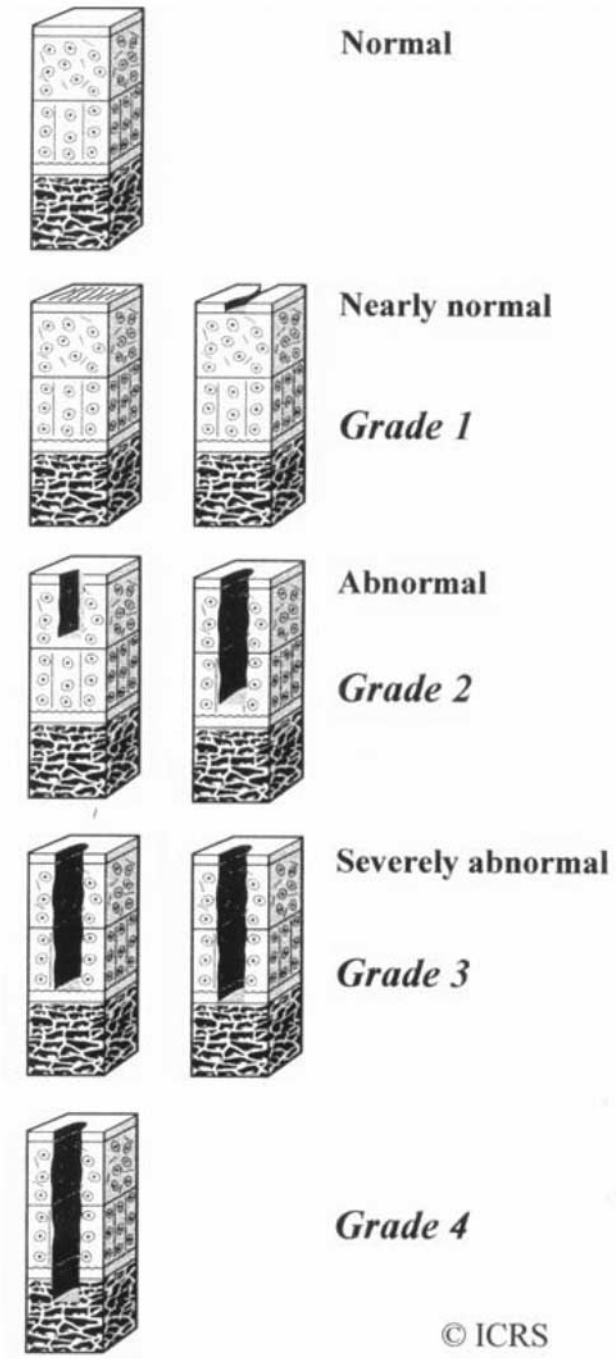

Figure 1B. Anatomical grading of the depth of the cartilage injury according to the International Cartilage Repair Society. Published with permission from the ICRS.

STATISTICAL ANALYSIS

A Microsoft Access database was used for this study. Statistical analysis was performed with the Statistical Package for Social Science 9.0 version (SPSS Inc.,

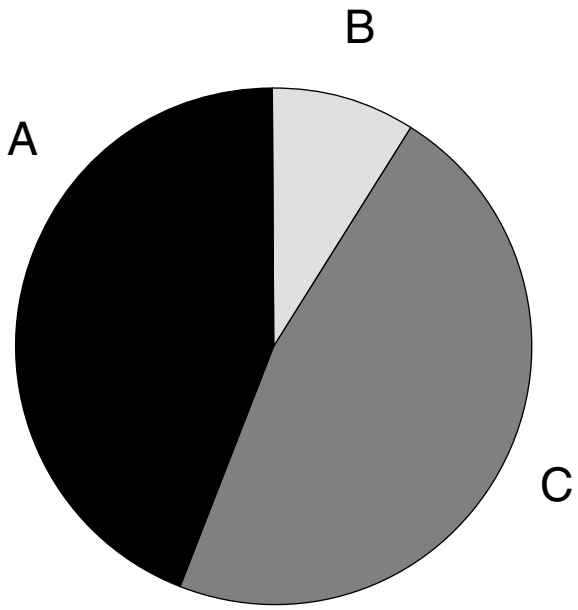

Figure 2. Different types of localized cartilage lesions (n = 203) of the knee. A, Localized partial-thickness cartilage lesions 44%; B, Osteochondritis dissecans lesions 9%; C, Localized full-thickness cartilage lesions 47%.

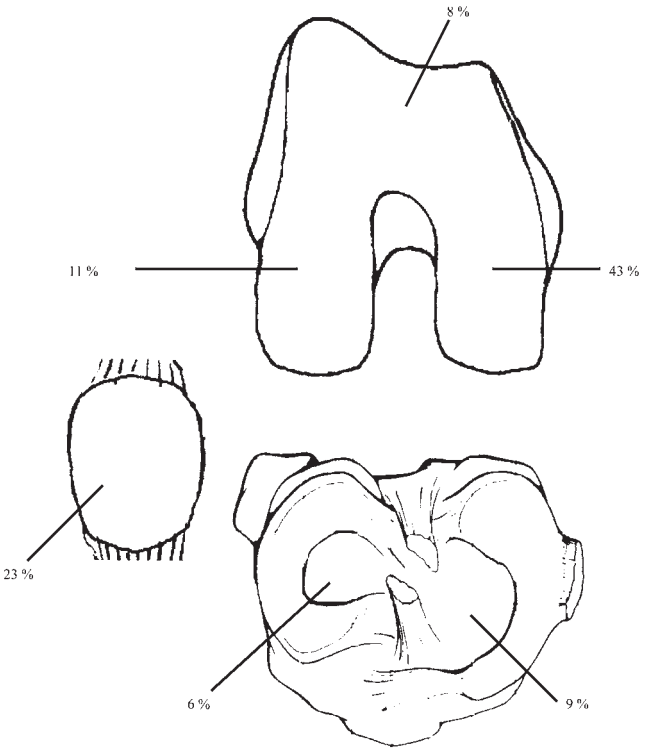

Figure 3. Anatomical distribution of the localized full-thickness cartilage defects of the knees (n = 203).

Chicago, Illinois). All percentages are given without any decimals.

RESULTS

Articular cartilage changes were noted in 66% of the knees. A localized cartilage lesion in combination with degenerative changes was diagnosed in 5% (n = 47) of knees. Localized cartilage lesions without degenerative lesions were observed in 20% (n = 203) of all knees. Localized cartilage lesions on opposing articular surfaces, so-called "kissing lesions," were diagnosed in 5 of these 203 knees. Figure 2 illustrates the different types of lesions of the localized knee cartilage injuries (n = 203 knees). Full-thickness cartilage lesions were found in 11% (n = 113) of the knees. The most serious cartilage injuries, grade 3 and 4, were most commonly located at the medial femoral condyle followed by patella, as illustrated in Figure 3.

A full-thickness cartilage defect with a square area of more than 2 cm^2 was observed in 6% (n = 62) of all the knees. Thirty-one of these 62 patients had a cartilage lesion as their only pathology. Fifty percent of these larger lesions (grade 3 to 4 and > 2 cm^2) were localized at the medial femoral condyle, and 13% were localized in femoral trochlea. Ten cartilage lesions were classified as osteochondritis dissecans.

Of all patients (N = 993), an acute traumatic onset of the knee symptoms was reported in 59% and a more gradual nontraumatic onset in 41%. Sports participation was the most commonly associated activity (49%), with team sports such as soccer and European team handball as the most frequent (Fig. 4). An x-ray examination was performed in 93% of the knees, and radiographic degenerative changes were noted in 13% of all the knees.

Previous arthroscopic procedures had been performed in 28% of the knees, most commonly a meniscal resection or an ACL reconstruction. Median time period from injury to the current arthroscopic procedure was 296 days. The performed arthroscopic procedures are shown in Figure 5.

Pain was reported with a median value of 40 on a Visual Analog Scale in which 0 was *no pain at all* and 100 represented the *worst pain the patient could imagine*. Seventy-three percent of all the patients reported to be preoperatively very restricted by activity pain. Compared to their healthy contralateral knee, half of the patients assessed the function to be more than 60% reduced. Still, 82% of the patients were preoperatively regularly doing exercise once or twice weekly (Table 1).

Table 2 shows the different diagnosis groups and the number of cases with concomitant localized cartilage lesion. Patellar dislocation had the highest frequency of associated cartilage lesion (57%) followed by older anterior cruciate ligament ruptures (29%) and partial anterior cruciate ruptures (27%).

Most of the patients with localized cartilage lesions were in younger age groups (median age 30 years), as illustrated in Figure 6. In the patients younger than 45 years of age, the finding of articular cartilage changes as a total was 54%, but the percentage of knees with localized (partial and full thickness) cartilage defects was 27%.

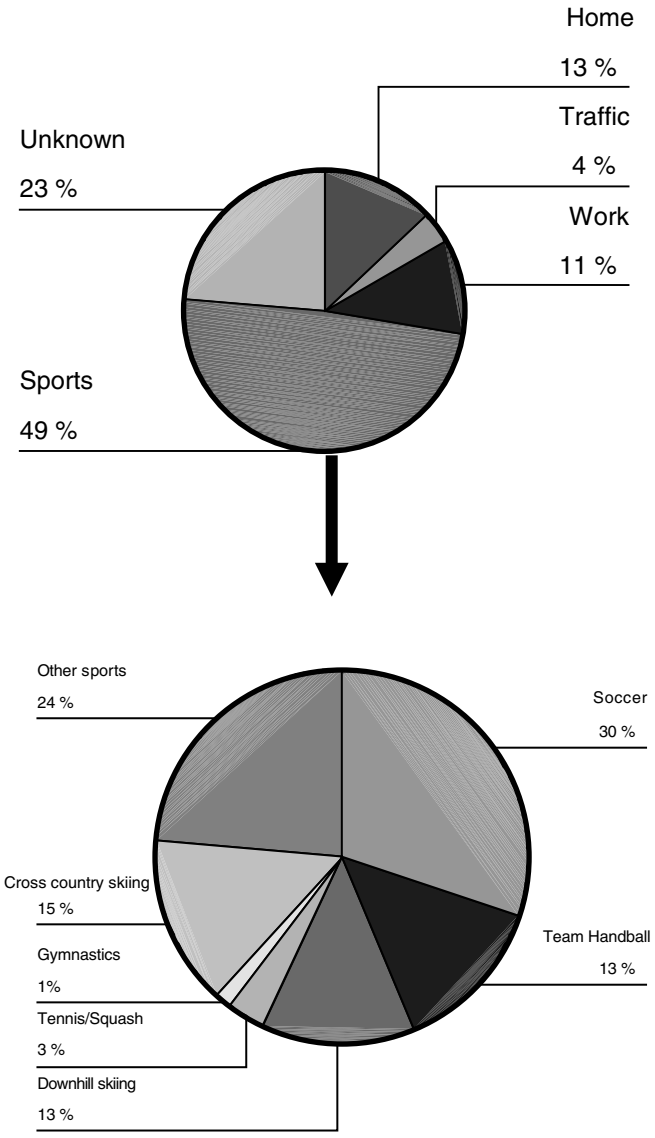

Figure 4. Cause of injury and a distribution of the different sports according to the knee injuries in this material caused by athletic activity (49%). *N* = 993.

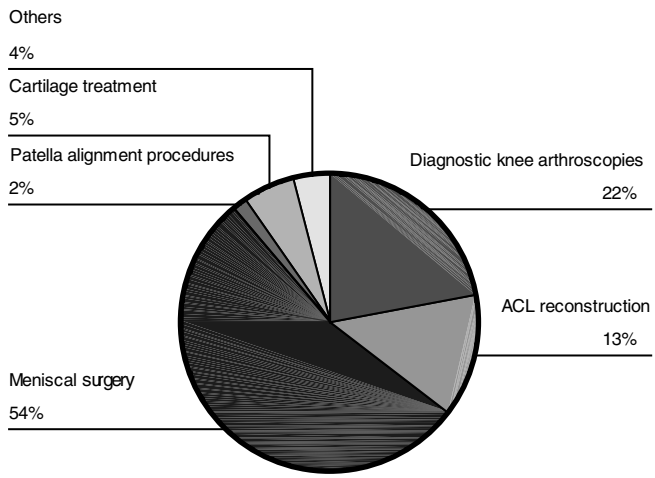

Figure 5. Performed knee arthroscopic procedures (*N* =993).

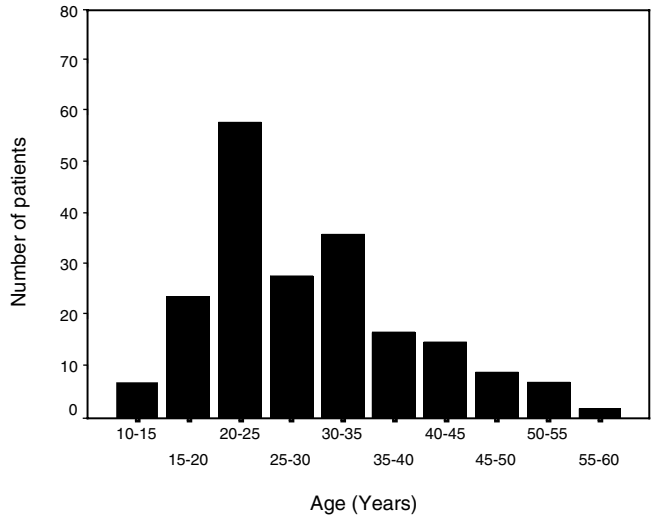

Figure 6. Number of localized cartilage lesions including the osteochondritis dissecans lesions (*n* = 203) in the different age groups. Median age of this group is 30 years.

DISCUSSION

The widespread clinical use of many relatively new cartilage repair methods may increase the risk of negative results for an initially successful technique. Inappropriate application or overuse of a new technique in an uncontrolled environment was shown by Mont and coworkers in 1999.[13] Obviously, the selection of the patients is an important factor for the results in cartilage repair studies. As shown in this study, the patients with cartilage defects are not a uniform group, and this should be taken into consideration in studies on cartilage repair. The defects are commonly associated with other pathological conditions of the joint such as ACL ruptures and meniscal injuries.[8,14] Our data reinforce previous studies of focal cartilage lesions in patients with anterior cruciate ligament injury, although meniscal injuries are less frequently associated with focal cartilage lesions than previous studies indicate.[18]

Another similar study presented at the 2000 ICRS conference in Gothenburg demonstrated similar results with medial femoral condyle as the most common location of a focal cartilage lesion and with a single full-thickness lesion with square area more than 2 cm^2 accounting for 7% of all knee arthroscopies.[7] This is comparable with our findings. These findings are also in accordance with the results published by Curl and coworkers,[5] who, in a retrospective study made by analyzing the database of 136 orthopaedic surgeons in the United States, showed a full-thickness lesion in 5% of 31,516 arthroscopies in patients younger than 40 years of age.[5]

To date, only nonrandomized clinical series have been published on cartilage repair, in which patients often have struggled with their knee problems for a long period of time, often several years. A prospective study on adult

TABLE 1
Activity Level Among the Patients (N = 993)

Activity level	Frequency (N = 993)	Percentage
National team	56	6
Competitive athlete	160	16
Training 2–4 times a week	301	30
Training 1–2 times a week	299	30
Nonsporting	142	14
No answer	35	4

TABLE 2
An Overview of the Association of the Localized Cartilage Damage to the Specific Diagnosis in This Material[a]

Knee pathology	N_o	N_C	N_C / N_o
ACL rupture	89	16	0.18
Old ACL injury	63	18	0.29
ACL and meniscal injury	44	3	0.07
Partial ACL injury	64	17	0.27
Meniscal injury	528	68	0.13
Patella luxation	14	8	0.57
Isolated cartilage defect	70	70	1.0
PCL injury	8	1	0.13
Combined ACL and PCL injury	7	2	0.29

[a] N_o, number of patients with the different knee pathology in this material; N_C, number of patients with current diagnosis with associated localized full-thickness cartilage lesion.

osteochondritis dissecans lesions has demonstrated that failed surgical treatment will result in degenerative changes and problems, although initial results were quite promising.[3] Whether this end result also will be observed in traumatic full-thickness cartilage lesions is unclear. Further follow-up on our study group could give some indications on the natural history of the localized cartilage lesions of the knee.

CONCLUSION

This study shows that 6% of the patients admitted for arthroscopic procedures have a cartilage injury of ICRS grade 3 or 4 injury and size more than 2 cm^2. In total, about 11% of all knee arthroscopies show cartilage defects that may be suitable for cartilage repair procedures. However, the natural history of these lesions and the number of patients that will benefit from a cartilage repair procedure are so far unknown.

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