The long-term prognosis for severe damage to weight-bearing cartilage in the knee

A 14-year clinical and radiographic follow-up in 28 young athletes

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We examined 28 young athletes with isolated severe chondral damage in the weight-bearing area of the knee joint clinically and radiographically 14 years after arthroscopic diagnosis. Except for Pridie drilling in 3 cases and occasional cartilage shaving or removal of free bodies, no special treatment was given initially. 21 patients were able to return to pre-injury team sport activity levels. During the follow-up period, only 3 patients needed repeat surgery with removal of free bodies, and another 2 underwent diagnostic arthroscopy because of persistent pain. At the latest follow-up evaluation, 22 patients had excellent or good knee function. At this time, the patients were mainly involved in individual sports on a physical fitness level. 12 cases had radiographic joint space reduction (< 50%) which was limited to the compartment concerned.

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In young athletes, isolated traumatic chondral injuries or osteochondritis dissecans are sometimes encountered in the weight-bearing area of the knee. Several surgical repair methods have been tried, with no convincing results (Engkvist and Johansson 1980, Niedermann et al. 1985, Homminga et al. 1990, Jensen and Bach 1992, Brittberg et al. 1994a,b). Little is known about the natural course of these lesions.

We investigated 28 young patients with isolated chondral defects in the weight-bearing area of the femoral or tibial condyles clinically and radiographically 12–15 years after the initial arthroscopic diagnosis.

Patients and methods

Since 1976, we have used a standardized protocol to document arthroscopic findings. Localization and size of cartilage changes are documented by a schematic drawing; further, the degree of cartilage damage, as seen and palpated during arthroscopy, is graded according to a modified Outerbridge-classification (Lysholm et al. 1987) (grade 1: soft, discolored or superficial fibrillation, grade 2: fragmentation of cartilage, grade 3: defect to subchondral bone). The protocol was introduced to create a detailed database of arthroscopic findings for the purpose of research. For this study, we chose the time interval between 1978 and 1981. During this period we did about 1000 knee arthroscopies each year. We included all patients aged < 40 years who had isolated grade 2 or 3 chondral damage with a minimum diameter of 1 cm. Patients with meniscal ruptures, ligament injuries, a history of patellar dislocation, chondromalacia patellae, systemic joint disease, and patients with previous surgery on either knee were excluded. 7 women and 21 men fulfilled these criteria. Their median age at arthroscopy was 25 (14–38) years. At the time of arthroscopy, radiographs of the injured knee were taken in all patients. 23 patients had lesions in the medial femoral condyle, 2 in the lateral femoral condyle, and 3 in the lateral tibial plateau. 19 patients had chondral damage due to a trauma, and 6 had localized chondral lesions with radiographic abnormalities of the underlying bone (osteochondritis dissecans). In the remaining 3 patients, no history of trauma was described (Table 1). The median duration of preoperative symptoms was 12 months (1 day–120 months) (Table 1). Except for occasional removal of free or pedunculated fragments with a shaver at arthroscopy, and Pridie drilling in 3 cases, the area with chondral damage was not treated (Table 1). After the arthroscopy, the patients followed a standard rehabilitation program without supervision.

All patients were reexamined after a mean of 14 (12–15) years after the arthroscopy by means of a questionnaire and physical and radiographic exami-

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nations. The questionnaire included the Lysholm knee-score (Lysholm and Gillquist 1984) and an evaluation of the patients' activity-levels before injury, postoperatively, and at the follow-up evaluation according to the Tegner activity scale (Tegner and Lysholm 1985).

The physical examination included assessment of range of motion, swelling, tenderness, meniscal, ligamental, and patellar disorders. Anterior and posterior drawer, Lachmann and pivot-shift, and varus and valgus stress tests with extended and slightly flexed knee were also performed. Further, sagittal laxity of both knees was determined by the OSI laxity tester (Orthopaedic Systems Inc. Hayward, CA, USA) at 20° of flexion. The thigh circumference was measured 10 cm proximal to the superior pole of the patella and was compared with that of the uninjured thigh. A difference of more than 2 cm was regarded as significant.

Finally, all patients underwent a radiographic examination of both knee joints, including weight bearing, anteroposterior and lateral roentgenograms at 30° flexion. A combined scale, based on Fairbank's signs (1948) and Ahlbäck's (1968) classification of arthrosis, was used: grade 0, no changes; grade 1, sharpening of the edges, beginning formation of osteophytes, sclerosis and flattening of the condyles, but no joint space reduction (Fairbank); grade 2, grade 1 plus joint space reduction up to 50% (Ahlbäck, grade 1); grade 3, joint space reduction more than 50% up to joint space obliteration (Ahlbäck, grade 2). The clinical and radiographic evaluations were performed by a physician not involved in the primary arthroscopy.

Except for 2 cases with persistent postoperative joint effusion, requiring a knee puncture within the first weeks after arthroscopy, no postoperative complications occurred. During the follow-up period, surgery was performed in 5 of the patients; 2 patients underwent a diagnostic arthroscopy because of persistent pain and, in another 3, loose bodies were removed arthroscopically. 1 patient underwent the latter procedure twice. Most patients required 2–3 check-ups (range 1–7) after the initial arthroscopy.

Statistics

Parametric data, such as values from instrumental stability testing, were calculated with ANOVA/MANOVA and post-hoc t-tests. For non-parametric data such as the Lysholm score, Tegner activity scale and OA-grading, the Mann-Whitney U-test and the Fischer's exact test were used. A significance level of $p < 0.05$ was chosen.

Results

At the follow-up, the patients had a median knee function score of 92 (70–100) points. 10 patients had an excellent and 12 patients a good knee function. The remaining 6 patients had knee problems during daily activities (Table 1). Over all, 6 patients had no symptoms at all, 16 patients reported occasional pain and 5 had minor knee swelling during or after vigorous activities; only 1 patient had occasional locking.

21 patients were able to perform on preinjury activity levels after injury and arthroscopy, the other 7 patients did not regain their preinjury activity level. Thus, the activity level had declined after injury ($p < 0.01$). Furthermore, a reduction in activities was noted during the follow-up period ($p < 0.001$), and at the time of the follow-up only 7 patients still performed on their preinjury activity level. The change in activities corresponded initially to a decline from competitive team sports before injury to recreational team sports after arthroscopy; at the follow-up evaluation, the patients were mainly engaged in individual sports on a physical fitness level. 22 patients were satisfied with their activity level, 6 patients had reduced activities because of the knee problems, but no patient had to change occupation.

Except for 1 patient with clearly increased sagittal laxity (Lachmann 2+, pivot shift 1+) after having suffered an anterior cruciate ligament rupture during the follow-up period, all knees were stable at the follow-up evaluation, nor were there any signs of meniscal or patellofemoral disorders. We found no cases of a significant reduction in the thigh muscle circumference.

12 patients had no radiographic signs of arthrosis in the injured knee, 4 patients had grade 1 arthrosis, 11 had grade 2, and 1 grade 3 arthrosis (Table 1). Patients more than 30 years of age at arthroscopy had a higher incidence of arthrotic changes than younger patients ($p < 0.05$). The other uninjured knee had in 18 cases no arthrosis, in 1 grade 1, and in 9 cases grade 2 arthrosis. The difference between injured and uninjured knees was not significant.

Patients with osteochondritis dissecans had about the same knee function, activities, and radiographic arthrosis as the other patients.

Discussion

The most striking result of our study is the good outcome 14 years after diagnosis of severe chondral damage of the knee. Disabling symptoms such as catching, locking, and swelling, which were in most cases present before initial arthroscopy, resolved in

Table 1. Patient characteristics, treatment, results

Case no.	Sex	Age follow-up	Preop symptoms	Duration symptoms (mo)	Type/grade of damage	Site of damage	Treatment	Lysholm score	OA
1	M	33	S, L	48	OD, 3	MF	PD	92	2
2	M	18	S, L	24	T, 2	MF	SH	75	2
3	M	23	S, L	2 days	T, 3	LF	FB	95	0
4	M	23	S, P	12	T, 2	LF	NT	100	0
5	M	26	L, P	12	T, 2	MF	FB, SH	86	2
6	F	38	L, P	7	T, 2	MF	NT	73	2
7	F	23	L, P	6	T, 2	MF	SH	94	2
8	M	23	S, L	4	OD, 3	MF	SH	70	2
9	M	23	S, P	6	TIB, 2	LT	FB	85	0
10	M	19	S, L	12	T, 2	MF	FB	90	0
11	M	38	P	6	T, 2	LT	NT	94	0
12	M	27	S, P	6	T, 2	MF	SH	89	1
13	M	33	S, L	24	OD, 2	MF	FB	90	3
14	M	26	S, P	1 day	T, 2	LT	NT	95	2
15	M	32	S, P	24	DEG, 2	MF	NT	91	2
16	M	35	L, P	60	T, 2	MF	NT	100	2
17	M	33	L, P	120	DEG, 2	MF	FB	81	2
18	M	38	L, P	6	DEG, 2	MF	NT	74	2
19	F	36	S, P	12	T, 2	MF	NT	99	1
20	F	21	S, P	60	T, 2	MF	NT	81	0
21	F	18	L, P	24	T, 2	MF	FB	86	0
22	F	23	S, L	7	OD, 2	MF	SH	100	1
23	M	21	S, L	2	OD, 2	MF	SH	95	0
24	F	17	S, L	36	T, 2	MF	FB, PD	95	1
25	M	14	S, L	12	T, 2	MF	NT	92	0
26	M	34	L, P	7	T, 2	MF	SH	100	0
27	M	18	L, P	12	OD, 2	MF	PD	100	0
28	M	21	S, L	2	T, 2	MF	SH	90	0

S swelling, L locking, P pain, OD osteochondritis disseccans,T trauma, TIB tibial plateau fracture, DEG degeneration, MF medial femoral condyle, LF lateral femoral condyle, LT lateral tibial plateau, PD Pridie drilling, SH shaving, FB extirpation of a free body, NT no treatment.
The Lysholm score consists of 8 items related to the function of the knee. A total score of 95–100 points indicates excellent function, 84–94 points good function with symptoms only in association with vigorous activities, less than 84 points signifies symptoms in association with daily activities.

the long term. The good and excellent outcomes in three quarters of patients with large chondral defects in the weight-bearing area of the knee joint that we found are well in the range of results reported from studies using advanced cartilage repair techniques with implantation of periosteum (Homminga et al. 1990), periosteum combined with autologous chondrocytes (Brittberg et al. 1994b), or most recently, carbon fiber implants (Brittberg et al. 1994a).

Knee function seemed to decrease with increasing follow-up time; 14 years after the initial diagnosis, most of our patients complained of occasional pain with strenuous activities. Moreover, the radiographic findings implied permanent knee deterioration caused by the cartilage injury. The incidence of joint space reduction in our patients is twice as high as in patients with partial meniscectomy with initially intact cartilage and similar follow-up time (Rockborn and Gillquist 1995). On the other hand, knee function and activity levels are similar in both series. It is known from previous studies that radiographic arthrosis at stages 1–2, as in our patients, does not adversely influence knee function (Lawrence at al. 1966, Sommerlath 1989). If these arthrotic changes advance and eventually become symptomatic can only be answered by longer follow-up.

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