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Early results of one-stage knee extensor realignment and autologous osteochondral grafting

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Abstract We treated 49 patients with recurrent patellar dislocations or persistent patellar subluxations. Chondral defects were graded according to the International Cartilage Repair Society (ICRS). Thirty patients (group I) had chondral defects grade I or II, and 19 patients (group II) had chondral defects grade III or IV. All patients were treated with proximal and distal realignment of the knee extensor mechanism, but group II also had a simultaneous autologous osteochondral grafting of the chondral defect. Patients were followed for 2 years and clinically assessed using the Marshall score comparing the two groups. Apart from a slower recovery in group II, the clinical and functional results were almost the same at the final follow-up.

Résumé Nous avons traité 49 malades avec des luxations rotuliennes périodiques ou des subluxations permanentes. Les altérations cartilagineuses ont été notés d'après l'ICRS (Société Internationale de la Réparation du Cartilage). 30 malades (Groupe I) avait une atteinte chondrale de niveau I ou II et 19 malades (Groupe II) avait une atteinte de niveau III ou IV. Tous les malades ont été traités par alignement de l'appareil extenseur du genou avec, en plus, dans le groupe II, une greffe ostéochondrale autologue simultanée du défaut chondral. Les malades ont été suivis pendant deux années et étudiés en utilisant le score de Marshall qui compare les deux groupes. À part une récupération plus lente dans le groupe II, les résultats clinique et fonctionnels étaient presque les mêmes au dernier recul.

Introduction

Recurrent patellar dislocations are best managed with surgical procedures [3, 12, 15, 18]. Regardless of the selected procedure, correct realignment and function of the patellofemoral joint must be achieved. Once this aim is met and adequate patellar tracking is established, the risk for patellar dislocation and subluxation will be reduced [3, 10, 15]. Despite a satisfactory radiological result, the patient will not always gain a painless knee [9, 12, 15]. This is particularly true for patients treated for frequent dislocations and with a long history with coexisting chondral or osteochondral lesions of the femoral groove or the patellar facets. This may suggest that persistent anterior knee pain after surgical realignment may be triggered by irritated chondral defects or exposed subchondral bone despite achievement of a correct patellar tracking [1, 7, 8]. This of raises the question of whether something should be done to restore the cartilaginous surface of the patella. Many procedures, including drilling, microfractures, denervation, and shaving, have been suggested but achieve only limited success [2, 4, 6, 10, 12, 14, 16]. In the literature, there is only little data on the outcome of a simultaneous, one-stage extensor realignment and resurfacing of patellar chondral defects using osteochondral grafts.

Material and methods

We prospectively studied 19 patients scheduled for extensor realignment between February 2001 and February 2003. All patients had severe and extensive (over 1 cm²) patellar chondral defects [grade III or IV according to the International Cartilage Repair Society (ICRS)[13]]. All patients were treated surgically with extensor realignment and simultaneous autologous osteochondral patellar grafting.

We used 30 patients treated surgically by realignment but without severe patellar chondral defects as controls. In the control group, there were no patients with chondral lesions above grade I or II according to the ICRS. The main indication for treatment was recurrent patellar dislocation or

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Table 1 Mean Marshall score in the control and study groups preoperatively and until 24 months postoperative

	Preoperative	6 weeks	3 months	6 months	12 months	24 months
Patellar realignment	40.7±3.7	30.1±2.5	35.8±3.4	41.6±3.8	45.7±2.5	47.1±1.6
Patellar realignment and osteochondral grafting	36.3±2.1	28.6±2.4	32.7±1.8	39.7±1.8	45.1±1.5	46.2±1.8

Results are shown as mean±standard deviation

persistent patellar subluxation after a failed three- to six-month course of intensive medication, physical exercises programme, and life-style modification. In both groups, extensor realignment was performed both proximally and distally. In the study group, the mean age of patients was 25.5 years; in the control group, 21.7 years; the majority of patients were women. The mean number of dislocations in the study group was 11 and in the control group six.

A functional knee evaluation using the Marshall [11] score was conducted just prior to surgical treatment and again at six weeks and three, six, 12, and 24 months after surgery. Statistical analysis was performed using SPSS Statistical 6.0 PL software. We used nonparametric Mann-Whitney *U* test and nonparametric Wilcoxon test. A *p* value <0.05 was considered significant.

Surgical technique

A lateral parapatellar approach was used. The proximal part of the realignment consisted of a lateral release and reattachment of the vastus medialis muscle. In addition, the medial retinaculum was reefed. Transfer of the tibial tubercle was performed in the distal part. The tubercle was osteotomized only proximally, and this part was displaced medially by force leaving its thin, distal cortical attachment intact as the hinge. It was fixed in the newly prepared position with two cancellous screws [18]. The joint surfaces were examined. For osteochondral grafting, SDS (by Sulzer) and Mosaicplasty (by Smith and Nephew)

grafting tools were used. The mean number of grafts was three. The grafts were harvested from the lateral margin of the lateral femoral condyle.

The postoperative regime did not differ between the groups. For the first one to two weeks, patients were immobilized using a long-leg cast or orthosis. Walking was allowed after two to three days using crutches and partial weight bearing. Patients were instructed about quadriceps isometric and straight-leg-raising exercises. Passive and active range of motion exercises were started after five weeks.

Results

Preoperatively, joint function as evaluated by the Marshall score differed significantly between the two groups of patients (Table 1). Postoperatively, the progress as evaluated by the Marshall score was delayed in the study group. During this period, patients regained their preoperative level of activity and function; however, in the study group, the mean score improved faster than in the control group. In the study group, a persisting joint effusion was seen in nine knees. One year postoperatively, the functional assessment was very similar and generally much higher than preoperatively, and 24 months postoperatively, there was no significant difference in the Marshall score between the groups (Fig. 1).

Furthermore, when the range of knee motion was compared, there was a significant difference between the two

Fig. 1 Mean Marshall score in both groups before operative treatment (*left graph*) and 24 months postoperatively (*right graph*). The results are presented as mean value (MV), standard error (SE), and standard deviation (SD)

Table 2 Mean range of motion in the control and study groups preoperatively and until 24 months postoperatively

	Preoperative	6 weeks	3 months	6 months	12 months	24 months
Patellar realignment	122.3°±23.2	40.5°±19.9	91.4°±26.8	117.3°±16.5	126.3°±13.2	128.0°±8.9
Patellar realignment and osteochondral grafting	102.6°±25.1	31.0°±12.4	60.5°±15.4	100.0°±13.7	115.2°±14.2	124.7°±8.4

Results are shown as mean±standard deviation

Fig. 2 Improvement in Marshall score in study and control groups. The results are presented as mean value (MV), standard error (SE), and standard deviation (SD)

groups (Table 2). Recovery of the range of motion was much slower in the study group than in the control group at any time from six weeks up to 12 months postoperatively, and 12 months after surgery, some patients still had restriction in their range of motion compared with their preoperative status. In the study group, most patients had an improved range of motion after 24 months although this was not statistically significant (Fig. 2).

It was necessary to perform manipulation under general anesthesia in one patient in the study group four months after surgery, and at the final follow-up, the patient had a 15° flexion deficit compared with the opposite knee. In the control group, two manipulations were performed six and eight months postoperatively; both patients regained a full range of motion. In the study group, one patient had a repeat arthroscopy due to loosening of an osteochondral pin from the patellae two months postoperatively. Patients in the study group suffered more often from crepitus and “clicks” during knee movement and had a tendency for joint effusion more frequently than the control group. There were no infections in either group.

Discussion

Treatment for patellar instability is only rarely reported in the literature. This makes it difficult to compare our study with others. Various techniques have been applied, different scoring systems have been used, and the initial cartilage status of the knees have varied. Malalignment of the knee

extensor mechanism in combination with clinical symptoms that fail to be relieved by conservative treatment for three to six months is an indication for surgical treatment [12]. Patellar dislocation, persistent patellar subluxation, or maltracking may lead to early, degenerative changes in the patellofemoral joint, which are difficult to treat successfully [2, 5, 7, 8]. Realignment procedures independent of the chosen surgical technique will change the load transmission on the joint surfaces. The role of the realignment procedure is, however, limited to prevention further dislocations and correction of the patellar tracking and in turn, prevention of further cartilage deterioration. Once correct patellar tracking has been established, there should be no anterior knee pain. If, however, the deep cartilage lesions of the patellofemoral surfaces remain untreated, patients will still complain. When diagnosed early, problems might be managed with a high success rate, but the diagnosis is often delayed. Grades III and IV cartilage lesions are common findings on the patella as well as the femoral condyle and the femoral groove.

For many years, various techniques have been claimed to be efficient for the repair of cartilage lesions. However, the extent, depth, and location of the cartilage defect may limit the efficacy of the various treatment options. Part of these disadvantages may be overcome using osteochondral grafting as a supporting procedure [6].

From the clinical point of view the final outcome in the two groups in our study showed only slight differences. Two years after surgery, the clinical and functional results were similar despite the initial functional differences and

despite variation in the severity of the cartilage defects. As a consequence, some patients in the study group may well be scheduled for patellectomy [16]. This course still creates controversy. Osteochondral grafting might partially restore the cartilage surface on the patella, thereby slowing the development of osteoarthritis. However, even this technique carries some restrictions and involves certain morbidity.

Extensor realignment, proven to be efficient in restoring improved tracking—supported by osteochondral grafting techniques to restore the hyaline cartilage surface—raises the possibility of a “true biomechanical restoration” of the patellofemoral joint. Although the rehabilitation progress is slower, this difference might be outweighed if the final outcome is promising. In both groups, there was a significant improvement in the Marshall score as well as range of motion from preoperative to final status. Despite significantly poorer preoperative knee function in patients subjected to the combined treatment, this difference was eliminated two years after surgery.

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