Pain reduction after anteromedial displacement of the tibial tuberosity

5-year follow-up in 21 knees with patellofemoral arthrosis

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We performed anteromedial displacement of the tibial tuberosity in 21 knees of 16 patients having patellofemoral arthrosis with lateral subluxation. The mean age of the patients was 53 (47–65) years and they were followed for 5 (2–13) years. Preoperatively, all knees were painful on descending or ascending stairs; pain was relieved after operation in 20. Retropatellar crepitations disappeared in 2 of 20 knees, but retropatellar pain when squeezing the patella against the femur disappeared in 16 of 17 knees. Patellar subluxation diminished in all knees.

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Anterior displacement of the tibial tuberosity is performed in many cases of patellofemoral arthrosis to reduce the compressive force between the patella and the femoral condyles. Patellofemoral arthrosis often includes lateral subluxation of the patella, which may require patellar realignment in addition to decompression. There are a few reports about patellar realignment in adult patients (Groeneveld 1973).

We examined the clinical and radiographic outcome of anteromedial displacement of the tibial tuberosity for patellofemoral arthrosis with lateral subluxation.

Patients and methods

We performed anteromedial displacement of the tibial tuberosity in 21 knees—5 right, 6 left and 5 bilateral—in 16 patients, 1 and 15 women with patellofemoral arthrosis and lateral subluxation of the patella. The mean age at operation was 50 (47–65) years. The mean follow-up time was 5 (2–13) years.

The procedure was carried out in patients who had no varus deformity or significant narrowing of the medial tibiofemoral joint space in a standing anteroposterior view of the knee, but who fulfilled one or more of the following 4 criteria: A) patellar pain on walking or descending or ascending stairs, B) narrowing of the patellar joint space to less than 3 mm in a standing sky-line view of the patella (Ahlbäck 1968), C) lateral deviation of more than 5 mm in a sky-line view of the patella with 30 degrees of knee flexion or D) more than 15 degrees of lateral tilt in the same sky-line view (Figure 1).

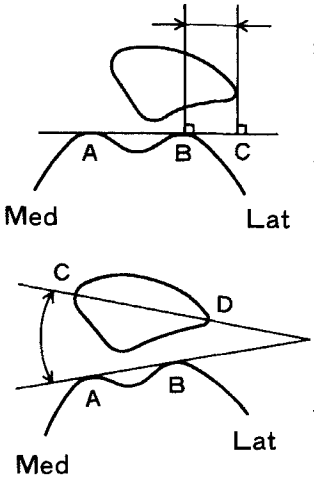
A longitudinal incision was made on the anterior aspect of the knee. After medial and lateral release of the patellar retinaculum, a longitudinal osteotomy was performed from the tibial tuberosity parallel to the tibial edge forming a 4–6 cm long, 2 cm wide and 0.8 cm thick fragment. Medial displacement of the tibial tuberosity was performed by rotating the tip of this fragment medially, so that the center of the tuberosity reached the extension of the femoral axis and anterior displacement was carried out to elevate the tuberosity about 1 cm anteriorly, with an iliac bone graft behind it (Figure 2). After these displacements, the fragment was fixed with two screws. The patellar joint was inspected.

Active motion exercises were begun 1 week after the operation, partial weight bearing after 4 weeks and full weight bearing after 8 weeks. The screws were removed after radiographic union. At this time, the patellar joint surface was exposed in order to check cartilage regeneration.

Clinical findings were recorded before and after operation by one of the authors. Alleviation of the pain was evaluated by the all-or-none rating system, as used by Ferguson (1982): if pain relief was sufficient to regain the ability to descend or ascend stairs in a normal manner, the result was considered to be satisfactory, but otherwise it was unsatisfactory.

The width of the patellar joint space was measured on a standing sky-line view. The lateral deviation and the lateral tilt of the patella were measured in the sky-

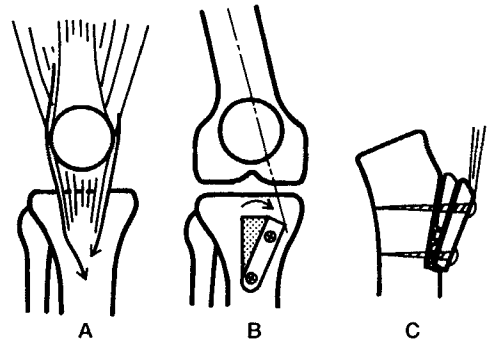
Figure 1. Lateral deviation and degree of lateral tilt of the patella.



Lateral deviation of the patella. In the sky-line view with the knee flexed 30°, a normal is drawn from the lateral edge of the patella to a line through the top of the femoral condyles (AB), and the intersection is named C. Lateral deviation is the distance between B and C.

Degree of lateral tilt. Lateral tilt is the angle formed by AB and CD, a line through the medial and lateral edges of the patella.

Figure 2. Anteromedial displacement of the tibial tuberosity.



A. Medial and lateral release of the patellar retinaculum.
B. After osteotomy, the tip of the fragment is rotated medially so that the center of tuberosity reaches the extension of the femoral axis.
C. The anterior displacement (0.5–1.0 cm) is carried out by elevating the tibial tuberosity with an iliac bone graft.

line view of the patella with 30 degrees of knee flexion. The patellar height (ligament/patella (l/p) ratio) was measured according to Insall and Salvati (1974). These radiographic data were obtained pre- and postoperatively and were compared using Student's t-test.

Results

Pain on descending or ascending stairs was noted in all 21 knees before operation, and it improved in 20 knees after operation. Retropatellar crepitation, found in 20 knees before operation, improved in only 2. Retropatellar pain when squeezing the patella against the femur, noted in 17 knees before surgery, was relieved in 16 knees.

The smallest width of the patellar joint space line increased after operation (p 0.001) from 0.7 *SD 1.3* mm to 3.5 *1.2* mm. Lateral deviation of the patella diminished from 7.6 *3.5* mm to 4.4 *2.7* mm (p 0.002). The degree of lateral tilt improved from 13.7 *5.8* degrees to 7.8 *3.9* degrees (p 0.005). The l/p ratio decreased from 1.13 *0.12* to 0.94 *0.26* (p 0.01).

After the operation, the patellar joint surfaces showed an ulcerative lesion in the patellar and/or femoral cartilage in all cases. On removal of the screws, performed an average of 1.6 years after surgery, regenerated cartilage was found at the site of the previous ulcer in all 21 knees.

Discussion

Isolated patellar joint arthrosis occurs in only 2% of arthrotic knees (Koshino 1987). Maquet (1974, 1976) advocated anterior displacement of the tibial tuberosity to decompress the patellar joint. Groeneveld (1973) suggested anteromedial displacement of the tibial tuberosity, if the patella was laterally subluxed. Maquet calculated that 2 cm of anterior displacement would reduce the compressive forces on the patella by one half during walking. This can be expected only if the quadriceps power is the same before and after operation. However, Koshino (1991) reported that quadriceps power almost doubled after anterior or anteromedial displacement of the tibial tuberosity because of relief of knee pain and muscle exercise. This would cause higher pressure in the patellar joint, in spite of advancement of the tibial tuberosity (Koshino 1986, 1991). Nakamura et al. (1985) showed that a 1 cm elevation of the tibial tuberosity was optimal in reducing high patellar joint forces occurring at 90 degrees and 110 degrees of flexion, which caused the least reduction in contact area. In addition, excessive advancement of the tibial tuberosity may cause painful kneeling or sitting in the squatting position.

Few authors mention the amount of medial displacement of the tibial tuberosity required for realignment of the patella (Hauser 1938, Trillat et al. 1964, Groeneveld 1973, Ficat and Arlet 1975, Cox 1976, Maquet 1976, Zimbler et al. 1980). We performed the medial displacement of the tibial tuberosity, so that the center of the tuberosity reached the extension of the femoral axis. We measured the distance of medial displacement in the anteroposterior radiographs before operation, and we believe it to be a simple method to obtain satisfactory patellar realignment.

We found improvement in the patellar deviation and tilt after operation, and a satisfactory improvement in radiographic findings, while there was one postoperative patella baja, probably caused by fibrosis of the patellar ligament (Koshino et al. 1990, Okamoto et al. 1993, Sakai et al. 1993).

Clinical findings in our patients were specific, notably anterior knee pain on descending or ascending stairs, rather than pain on walking. The pain was relieved satisfactorily, although retropatellar crepitation was relieved in only 2 of 20 knees.

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