ORIGINAL ARTICLE

Medial facet patelloplasty in patellar instability associated with patellofemoral dysplasia: A report of 26 cases

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Summary
Introduction: Numerous procedures may be used in the surgical treatment of patellar instability. We have noticed that certain types of patellar instability result in a bulge (or protrusion) of the distal medial facet of the patella which can hinder recentering in the trochlear groove. Hypothesis: In certain patellofemoral dysplasias, trimming down of this bulge (patelloplasty) as long as it is associated with a "à la carte surgery" program, can improve stability, centering and lateral patellar tilt.
Patients and methods: This retrospective series included 23 patients (26 knees), 13 women and 10 men, mean age 25.9 ± 9.01 years old (15–52) operated between 1997–2008. Patellar dislocation had occurred at least once in all knees, and at least twice in 16 knees. The mean preoperative Kujala score was 79.1 ± 6.1 points (68–91). There was a bulge on the medial facet of the patella in all cases, in particular on skyline views associated with the usual criteria for patellofemoral dysplasia. Patelloplasty was associated in all cases with resection of the lateral patellar retinaculum and anteromedialization of the tibial tubercle (7 were lowered) and four Albee trochleoplasties.
Results: Recurrent dislocation occurred in one case (4.7%). Nineteen patients (22 knees) were followed up for a mean 7.53 ± 3.27 years (2–13 years). The mean postoperative Kujala score was 91.8 ± 7.9 points (70–100) and the subjective results in 19/22 (86.5%) knees were satisfactory or very satisfactory. On skyline views, 21 patellae (95.5%) were well centered and one (4.5%) still presented with lateral tilt. There was no osteoarthritis in 15 knees (68%).
Conclusion: In selected cases, patelloplasty of the medial facet of the patella has no particular morbidity at intermediate follow-up. Associated with other surgical procedures, the rate of satisfaction of patients is very high and especially encouraging.
Level of evidence: Level IV, retrospective cohort study.
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Introduction

Objective patellar instability is a frequent entity. Four main anatomical factors have been reported to favor these dislocations [1,2]: trochlear dysplasia, patella alta (high riding patella), excessive lateralization of the anterior tibial tubercle (ATT) in relation to the trochlear groove (TT-TG) and excessive patellar tilt. Among these criteria, patellofemoral incongruence is found in 85% of recurrent patellar dislocations [1]. In most cases, dysplasia of the femoral trochlea is associated with a patella with a long lateral facet and a short, or very short medial facet (Wiberg type 3) [3]. The Dejour school in Lyon [1—3] has not paid special attention to the appearance of the patella which often has an abnormal shape due to trochlear dysplasia and lateral patellar tilt. In certain cases, the patella also has a convex medial facet (or is bulged) especially distally, which is the obvious cause of incongruence during recentering whether this is from the soft tissues, or osteotomies (ATT transposition or trochleoplasty). Moreover, if patellar tilt is corrected without treating the bulge of the medial facet, this raises the lateral facet, which has no contact with the lateral side of the trochlea during surgery. The patella will inevitably return to its initial position from the action of soft tissues (during closing of the wound, for example) with medial hyperpressure caused by the tightening of the medial soft tissues or reconstruction of medial patellofemoral ligament (MPFL). This bulge (or bump) of the distal medial facet is especially visible on axial views of the patella at 30° of flexion where a double outline of the medial side can be seen, one oblique (proximal part), the other with a more or less pronounced bulge, at a nearly 90° angle to the lateral side of the patella (Figs. 1—3).

In 1997, we hypothesized that patelloplasty of the medial facet of the patella would prevent these two disadvantages. Within the framework of providing “à la carte surgery”, we decided to perform a patelloplasty of the medial facet in case of excessive convexity of this facet. The aim of this study was to evaluate the intermediate term results of 26 medial patelloplasties performed between 1997 and 2008.

Patients and methods

The series

There were 23 patients (three bilateral interventions), 13 women and 10 men, mean age 25.9 ± 9.01 years (15—52). At least one dislocation had occurred in all knees and two dislocations in 16. All patients presented with pain, which increased with physical activity and was associated with a feeling of instability. Four patients had chronic swelling. The mean preoperative Kujala score (Table 1) was 79.04 ± 6.07 points (68—91).

Radiologically and in particular on skyline views of the knee at between 30—45° of flexion, all had a more or less pronounced bulge (or a bump) of the medial facet of the patella (Figs. 2, 3) of between 4—8 mm, convex with a small radius or an actual bone spicule (Fig. 3). This facet created an angle of nearly 90° with the lateral side of the patella. When this anomaly was suspected on X-ray, it was always confirmed during peroperative evasion of the patella (Fig. 4). According to D. Dejour’s classification [5,6], there were four type A trochleas, 12 type B, six type C and four type D. Patellar morphology was evaluated according to Wiberg’s classification [7]. There were four Wiberg type 1 patellae, 12 type 2, and 10 type 3. The mean Caton and

Table 1 Summary of clinical results.

<table>
<thead>
<tr>
<th></th>
<th>Preoperative (26 knees)</th>
<th>Revision (22 knees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patellofemoral pain</td>
<td>21</td>
<td>8</td>
</tr>
<tr>
<td>Worse</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Same</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Improved</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>No pain</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Instability (dislocation)</td>
<td>26</td>
<td>1</td>
</tr>
<tr>
<td>Hydarthrosis</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Mean Kujala score</td>
<td>79</td>
<td>91</td>
</tr>
</tbody>
</table>
Deschamps index [8] was $1.22 \pm 0.24$ (0.9–1.74) and the trochlear patellar index [9] was $0.64 \pm 0.10$ (0.5–0.9) (normal from 0.35–0.84).

On CT scan, the mean TT-TG was $17.7 \pm 5.82$ mm (6.1–29), the trochlear angle was $156^\circ \pm 19.46^\circ$ (124–180°) and mean patellar tilt was $23^\circ \pm 9.37^\circ$ (10–50°).

**Surgical technique**

The patient was installed in supine position, with the knee flexed at 45°, and a pneumatic tourniquet at the top of the thigh. A lateral parapatellar approach was used and a 7–8 cm arthrotomy was performed after resection of approximately 5 mm of lateral retinaculum. The vastus lateralis tendon was also resected (2 cm) where it attached to the superolateral angle of the patella. The patella was then turned so that the bulge of the distal medial facet could be seen (Fig. 4). The patelloplasty included resection of the distal 2/3 of this medial facet with an oscillating saw until the patella had a shape similar to the normal anatomy (Wiberg 1), in particular a flat facet and a medial side “identical” to the lateral side (Fig. 5). The size of the resection depended upon the bulge and could be up to 5–8 mm thick, cartilage included, and extend to the entire depth of the facet if necessary. Four trochleoplasties were performed using the Albee technique [10] when the proximal trochlea was convex with no groove separating the medial and lateral sides. A 10–12 mm Emslie-Trillat ATT transposition [11] was systematically performed with, in seven cases, additional lowering of 6–10 mm when the Caton and Deschamps index was above 1.2 or when the patellotrochlear index [9] was above 0.84. In case of simple transposition, the ATT was attached with a 6.5 mm cancellous screw with shorter threads and when it was associated with lowering, two screws were used. The arthrotomy was left open and the wound was closed after coagulation of the proximolateral articular artery. Two drains were left without aspiration for 8–12 h, then aspiration was begun.

**Postoperative course**

The patelloplasty did not change postoperative rehabilitation and the course was the same whatever the “à la carte surgery” techniques performed. Partial weight bearing without immobilization was immediately allowed. Mobilization of the knee began on the 10th day. Full weight bearing was allowed on the 45th day, when progressive exercise of the quadriceps muscle was allowed.

**Methods of evaluation**

All patients underwent a clinical and radiological follow-up by an examiner who was not the primary surgeon. The Kujala [4] score was used to evaluate the objective
functional results and radiological evaluation was performed with AP and lateral views at 30–45° of flexion and skyline views at 30–45° of flexion. We evaluated centering of the patella, the appearance of the joint space and patellofemoral osteoarthritis based on the criteria of Iwano et al. [12]. Patellar tilt was measured by the angle formed between the line joining the medial and lateral angles of the end of the ventral convexity of the patella and the posterior bicondylar axis, which we considered to be horizontal when both knees were touching in flexion at between 30–45°. Patellar centering was considered satisfactory when the crest of the patella was in front of the trochlear groove.

Subjective evaluation included asking the patient if s/he was satisfied with the intervention and if s/he would be ready to undergo the same intervention if necessary.

The differences between pre- and postoperative values of the Kujala scores were analyzed by the paired Student test. A P-value of .05 or less was considered to be statistically significant.

Results

The postoperative outcome was simple except for one postoperative hematoma which resolved spontaneously and one case of Sudeck’s atrophy which regressed at 1 year.

Four patients (four knees) out of 23 patients (26 knees) were lost to follow-up. The mean follow-up was 7.5 ± 5.66 years (2–13).

Poor results included one case of traumatic patellofemoral dislocation (4.7%), one grade 2 patellofemoral osteoarthritis at 10 years of follow-up and one patient presenting with chronic anterior knee pain with patella alta, but no instability. The mean preoperative Kujala score went from 79.1 ± 6.1 points (68–91) to 91.8 ± 7.9 points (70–100) postoperatively (P < 0.001). Preoperative anterior knee pain, which was present in 80% of cases (21/26 knees), persisted in 31% (8 cases) after surgery. This pain was worse in one case, the same in two cases and improved in five cases. Knees without pain did not change after surgery (Table 1).

In 21/22 cases (95.5%), the patella was centered on the trochlea on axial views at 30° flexion (Fig. 6). Medial patellectomy corrected patellar tilt in seven cases (70%), and knees without preoperative tilt were not modified by surgery. At the final follow-up, 15 knees (68%) had no patellofemoral osteoarthritis according to Iwano, five (22%), had grade one patellofemoral osteoarthritis, and two (9%), had grade 2. Three patients developed osteoarthritis on the unoperated controlateral side (Fig. 6). We identified two cases of medial tibiofemoral osteoarthritis grade 1 according to the modified Ahlbäck criteria [13] and one case of grade 2 (Table 2). One patella was still high after surgery with a Caton and Deschamps index of 1.28 but a patellotrochlear index [9] of 0.74.

Sixteen out of 19 patients who were followed-up (or 19/22 knees) were satisfied or very satisfied (84%) with the results, and three were disappointed and included in the poor results mentioned above. No lesions of the medial
side of the trochlea were found during the seven follow-up arthroscopies performed to remove ATT screws. ‘Fibrous cartilage’ of the patella was found in five cases at the site of the patelloplasty. There was no impingement with the trochlea, despite removal of the cartilage of the medial facet of the patella.

**Discussion**

After performing vastus medialis plasty according to Insall technique for 15 years [14], we abandoned this technique because it complicated surgery without having a significant effect on patellar tilt. In an unpublished retrospective study performed in 1994, we reported that patellar tilt was persistent in 40% of cases on 30° axial views despite ATT transfer, resection of the lateral retinaculum and vastus medialis plasty. In the present series of patelloplasty of the medial facet of the patella, we successfully corrected this tilt in 70% of cases, without touching the medial soft tissues, which suggests that this surgical technique helps correct patellar tilt. Nevertheless, a randomized prospective study is needed to confirm this hypothesis.

We performed the patelloplasty in 20% of cases and only in the presence of a bulge or protrusion of the medial facet which could be visualized on patellofemoral skyline views at 30–45° of flexion. The double outline of this facet, one oblique corresponding to the proximal part, and the other convex or protruding, corresponding to the distal part of this facet (Figs. 2 and 3) is the fundamental feature. Wiberg [7] did not mention this anomaly in his description of the different features of the patella. The description of this protrusion therefore represents a new approach to the morphology of the patella in patellofemoral instabilities. Since the end of this study, we have systematically obtained 3D scans to more precisely analyze the convexity of this facet.

Our intermediate term results (7.5 ± 3.27 years) are satisfying because there was a significant improvement in the Kujala score (79.1 ± 6.1 points versus 91.8 ± 7.9 points), satisfaction of 84% (86.5% if “operated knees”, rather than patients, are counted) and an absence of the development of postoperative pain in patients without preoperative pain. Radiological results show that the patella was perfectly centered in 95.3% of cases at the final follow-up and 15 knees (68%) had no patellofemoral osteoarthritis.

Although it is difficult to compare published series, progression to osteoarthritis is frequent and seems inevitable for several reasons. First, because of the different episodes of dislocation which result in cartilage damage to the posterior side of the patella, and then because whatever the trochleoplasty, patelloplasty or patella centering technique, patellofemoral congruence will never be perfect and this incongruence is the source of osteoarthritis. Nakagawa et al. [15] reported the presence of osteoarthritis in 74% of knees following the Roux-Emslie-Trillat technique and which initially had no osteoarthritis, after a mean follow-up of 13 years. Von Knoch et al. [16] reported a 30% rate of osteoarthritis after a mean 8.3 years of follow-up of deepening trochleoplasties. In patients presenting with bilateral patellofemoral dislocation, Arnbjörnsson et al. [17] showed that surgery was effective for instability, but not for the progression to or the prevention of patellofemoral osteoarthritis. They also showed that operated knees had more osteoarthritis than unoperated knees. Nomura et al. [18] reported the development of osteoarthritis in 28% of knees a mean 11.9 years after MPFL reconstruction.

**Conclusion**

For specific indications, patelloplasty of the medial facet of the patella provides excellent intermediate term results for patellofemoral stability and the development of osteoarthritis. However, we never used the procedure alone. It was always combined with another procedure in a surgical program, which was decided upon according to different factors of instability. A prospective study with 3D CT-scan of the patellofemoral should provide several modifications to the Wiberg classification.

**Disclosure of interest**

The authors declare that they have no conflicts of interest concerning this article.

**References**