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THE EFFECT OF ANTERIOR DISPLACEMENT OF THE TIBIAL TUBEROSITY IN IDIOPATHIC CHONDROMALACIA PATELLAE

A Prospective Randomized Study

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In 42 patients with idiopathic chondromalacia patellae, the effect of anterior displacement of the tibial tuberosity was evaluated in a prospective and randomized study. The operation performed was a modified Bandi procedure, and it resulted in significant relief of the patellofemoral pains, compared with the effect of a standard shaving procedure. Shaving alone was done in 22 patients of whom 6 (27 per cent) were classified as good, a result which may have been due to the placebo effect. In another 20 patients shaving was combined with anterior displacement of the tibial tuberosity resulting in pain relief in 18 (9° per cent). The lack of unambiguously good results may be due to the fact that, although an anterior displacement reduces the retropatellar pressure, it cannot by itself compensate for an abnormal, dynamic tracking pattern of the patella.

Key words: biomechanics; chondromalacia; patella; tendon transfer

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In the last few years several authors have shown that chondromalacia patellae (c.p.) may be caused by patello-femoral instability, and thus a correction of the mechanical incongruity may remove the inconvenience of c.p. (Despontin & Thomas 1978, Hejgaard et al. 1980, Insall et al. 1976, Mariani & Caruso 1979). In most patients with c.p., however, a morphologically normal patello-femoral joint is revealed by clinical and radiographic examinations. These patients have an idiopathic c.p. and, as the treatment is not causal, the general management is quite a problem. Shaving – partial chondrectomy of the patella – has been proposed as a valuable procedure with up to 80 per cent satisfactory results (Goodfellow et al. 1976, Wiles et al. 1960, Wilppula & Vahvanen 1971). The usefulness of the shaving procedure has also been questioned (Bentley 1978, Insall et al. 1976, Janssen 1974). This discrepancy may be due to the fact that changes in the cartilage alone rarely result in the well-known patello-femoral pains. Thus Leslie & Bentley (1978) by means of arthroscopy found that 38 out of 78 patients (49 per cent) all with clinically evident c.p. had completely normal cartilage, and Abernethy et al. (1978) found coincidental chondromalacia in 85 per cent of post-mortem knees. A more rational treatment was introduced by Maquet (1963) and Bandi (1977), who advocated elongation of the extensor lever arm of the knee by an anterior displacement of the tibial tuberosity. Thus, at a given degree of flexion, the compression pressure in the patello-femoral joint is reduced. Using this procedure up to 90 per cent good results were attained. Because of its anatomical suspension the patella is subjected to strong and potentially deforming tensile stress, as shown by Minns et al. (1979). These forces are not diminished by anterior displacement of the tibial tubercle. The etiology of pain in idiopathic c.p. is obscure, but is thought to be due to abnormal shearing stress on the sub-

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chondral tissue (Abernethy et al. 1978), and, in an entirely new study, to be due to increased intraosseous patellar pressure (Björkström et al. 1980).

Any kind of surgery, in particular "one's own method", has a prominent placebo effect (Beecher 1961). The results of surgical treatment of c.p. are characterized by a lack of randomized studies. Thus, the aim of the present prospective randomized study was to investigate to what extent anterior displacement of the tibial tuberosity adds to or deducts from the results of a standard shaving procedure.

PATIENTS AND METHODS

Forty-two out of 172 patients (24 per cent) with c.p. admitted to our department from November 1977 to November 1979 participated in this study. Requirements for inclusion were: 1) Patello-femoral pains, lowering the patients' level of activity, which had persisted for at least 6 months and had not responded to conservative management. 2) Absence of pathologic morphology detectable by clinical and radiographic examination of the patello-femoral joint. (The following conditions were precluded: patella alta, subluxation of the patella, lateral hyperpression syndrome, dysplasia of the patella and/or femoral condyles, Q-angle >20 degrees, coxa antetortae, plica syndrome). 3) Peroperative diagnosis of c.p., Outerbridge grade 1–3, as the only single detectable lesion in an otherwise quite normal knee joint.

A medial, parapatellar incision was used in all patients. The altered cartilage was scraped smooth with a scalpel, removing all the soft and fibrillated tissue as far down as necessary. The patients were then divided into two groups according to random numbers. In one group, A, the incision was now closed. In the other group, B, however, an anterior displacement of the tibial tuberosity was performed. Instead of using crista chips, no problems were encountered in stamping a triangular bone block from the upper part of the tibia in the area beneath the pes anserinus in order to support the displaced tuberosity. To prevent rotation, the tuberosity was fixed with a 40 mm AO-screw, which was removed 3 months later. No anticoagulants were used.

The postoperative management of both groups was similar. Full weight-bearing was permitted as early as the first postoperative day, and most of the patients could be discharged with instructions about isometric quadriceps exercises. After removal of the sutures on the 12th day, the patients started flexion exercises of the knee against slight resistance and after 3 months full activity, including sports, was permitted. The costs and complications of the operations were evaluated, and the final results 12 months postoperatively were classified according to Table 1.

All the patients were both operated on and examined by the authors. Statistical calculations are based on non-parametric tests (Fisher's exact test and Mann-Whitney U-test) with 5 per cent as the level of significance. The cure rate with 95 per cent confidence limits is calculated according to Wulff (1973).

RESULTS

Table 2 shows the preoperative variables in the two groups. No significant differences were found between the comparable data.

Table 3 shows the final results of operation. Shaving alone gave such poor results that 73 per cent (16/22) of the patients had unchanged or intensified pains. The inverse proportion was present when shaving was combined with anterior displacement of the tibial tubercle. The difference is significant ($P = 0.02$), and the confidence interval of the cure rate difference was calculated to be 43 ± 33 per cent. The poor results (6 cases) were only due to persistent pains in 2 cases; the remaining 4 were bothered in particular by periarticular tenderness especially of the tuberosity area. The efficiency of Bandi's method for eliminating patello-femoral pains thus reaches 90 per cent (18/20).

Table 4 shows costs and complications of

Table 1. The criteria used for assessing the results of operation

Evaluation	Symptoms	Activity level	Patient's evaluation
Excellent	totally absent	high	completely satisfied
Good	partly absent	high (no sports)	satisfied
Fair	equal	equal	not satisfied
Poor	intensified	lowered	not satisfied

Table 2. Preoperative variables in the two groups

Data		Group A (shaving)	Group B (shaving + displacement)
Number of patients		22	20
Male – female		9–13	10–10
Age (years)		32 (range 19–50)	28 (range 18–38)
Occupation	heavy	10	8
	sedentary	12	12
Athletics		12	10
Duration of symptoms (months)		18 (range 7–25)	19 (range 6–27)
Grade of chondromalacia	1	11	12
	2	8	7
	3	3	1

Table 3. Assessement of results

Result	Group A	(per cent)	Group B	(per cent)	*P*
Excellent	1		5		
Good	5	6	9	14*	0.02
		(27)		(70)	
Fair	13		2		
Poor	3	16	4	6	
		(73)		(30)	

* see text.

Table 4. Costs and complications of operations

Data	Group A	Group B	*P*
Hospitalization time (days)	2.8 (range 2.0–4.3)	4.1 (range 2.1–10.8)	0.02
Off-work > 8 weeks	12 (55 per cent)	4 (20 per cent)	0.05
Physiotherapy	5 (23 per cent)	7 (35 per cent)	N.S.
Effusion	5 (23 per cent)	2 (10 per cent)	N.S.
Thromboembolism	0 (0 per cent)	2 (10 per cent)	N.S.

N.S. = not significant.

operations in both groups. There were no complications in group A apart from a longer period of effusion in 5 cases. There was, however, a significantly increased number of patients in this group with a period off-work of more than 8 weeks ($P = 0.05$).

In group B two non-fatal cases of phlebothrombosis with pulmonary embolism occurred, but there were no complications associated with the wounds and no fractures of the tuberosity or the medial tibial condyle. The total duration of hospitalization in this group was significantly prolonged compared with group A ($P = 0.02$). The degree of anterior displacement evaluated on lateral radiographs varied from 8 to 14 mm (mean 10 mm). Eighteen patients in group B were bothered by severe tenderness of the tuberosity, so that a kneeling position could only be achieved with difficulty. Removing the AO-screw only improved the condition slightly.

DISCUSSION

Combining shaving with anterior displacement of the tibial tubercle gave a marked therapeutic advantage as the cure rate with a true difference between the two groups lies within the interval from 10 to 76 per cent.

As all patients only suffered from moderate alteration of the cartilage and, apart from this, had quite normal knee joints, relief of pain by shaving can only be a purely placebo effect, as no changes were made in the knee biomechanics in this group. A considerably more efficient procedure was lowering of the patello-femoral pressure obtained by elongation of the extensor lever arm. Only 10 mm of anterior displacement sufficed to obtain 90 per cent good results in this group, which equals the results of other authors (Bandi 1977, Lund & Nilsson 1980, Sudmann & Salkowitsch 1980).

Displacement exceeding 20 mm only moderately relieves the femoro-patellar pressure as shown experimentally by Ferguson et al. (1979). This extreme displacement does not give results which exceed ours (Hirsh & Reddy 1980, Maquet 1963). That an operation failure in Sudmann's study still cured the patient in spite of 0 mm displacement is a curiosity.

The pains of the patello-femoral pain syndrome are thought to be due to pathological changes of pressure in the subchondral tissue in transitional areas of stress (Abernethy et al. 1978). This shearing stress can be completely eliminated if the cartilage and the subchondral tissue are replaced by a rigid resurfacing patellar prosthesis. But this type of operation gives such poor results and does not relieve the pains (Insall et al. 1980) that other co-factors causing pain must exist.

The patella, being the largest sesamoid bone of the body, is subjected to massive forces (Minns et al. 1979), which may deform it and perhaps even increase its intraosseous pressure. This could cause pain with activity due to the vast number of pain sensitive nerve fibres which are present in the subchondral tissue (Reimann & Christensen 1977). Then again it is odd that not all people have patello-femoral pains, as the patella is stressed to a theoretically intolerable extent. The explanation is probably due to the fact that patients with painful c.p. suffer from a primary patello-femoral instability, undetectable with radiographic and clinical examination. New methods of evaluation, which may contribute to a more rational management of idiopathic c.p., are the detection and measurement of increased intrapatellar pressure (Björkström et al. 1980) and malfunction of the medial vastus muscle (Mariani & Caruso 1979).

The conclusion of the study is that anterior displacement of the tibial tuberosity has an excellent beneficial effect on patients with idiopathic c.p. compared with a standard shaving procedure.

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