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REPLACEMENT OF THE ANTERIOR CRUCIATE LIGAMENT WITH A POLYETHYLENE PROSTHETIC LIGAMENT

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The results of insertion of the Richards Polyflex® ligament in 9 patients to replace the anterior cruciate ligament are reported. In 3 of these 9 patients it had been necessary to remove the prosthetic ligament and in another patient the operation had not stabilized the knee. Half of the patients who still have a Polyflex ligament complained of pain. It is concluded that from the material-technical point of view the Polyflex ligament has not yet been satisfactorily developed, and the operation poses a great many technical problems. Technically and functionally this system must still be considered to be in the experimental stages and not yet properly developed for general use.

Key words: alloplasty; cruciate ligament

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In the course of time injuries to the cruciate ligament in the knee have increased in frequency, presumably because of an increasing number of active athletes (Jacobsen 1973). During a 12-month period (1971–1972) 82 ligament injuries of the knee were referred to the Orthopaedic Department of Gentofte University Hospital. Twenty-six of these were ruptures of the anterior cruciate ligament (ACL) in a partially selected material of athletes. Concomitant lesion of the medial collateral ligament was present in some cases. Some, but not all patients with rupture of a cruciate ligament develop symptoms, in particular a sensation of instability in the knee. In addition, the threat of early osteoarthrosis of the knee (Jacobsen 1977) is sufficient indication for stabilizing surgery on patients with insufficiency of the ACL.

In acute cases, i.e. within 1 or 2 weeks after the trauma, the ligament should be sutured (Jacobsen 1975, Marshall et al. 1979), especially in cases where the ligament is avulsed from its attachments. Later, the ligament undergoes atrophy. This necessitates the use of another structure inserted as a cruciate ligament. Among the many autoplastic methods available for repair of the cruciate ligament, we have chosen that of Jones (Jones 1970). During a period of 31 months (1971–1973) Jones' operation was performed on 25 patients. At follow-up 18 patients were classified as completely satisfactory (Jacobsen & Rosenkilde 1977). This also corresponds to the results of others (Gillquist et al. 1971). The remaining 7 patients suffered from instability with a persistent drawer sign. In some but not all of these cases the instability was so disabling that treatment was definitely required.

METHODS

After having tried various types of artificial substances, Richards, in 1974, constructed a cruciate ligament of ultra-high-polymerized polyethylene. In weight-bearing experiments, the ligament had a strength cor-

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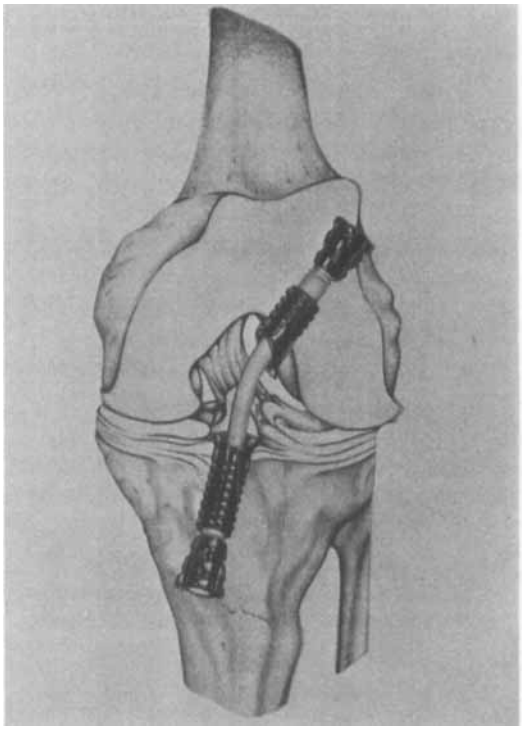

Figure 1. Anterior aspect of the left knee with a Polyflex system inserted.

Figure 2. X-ray of the right knee with a Polyflex system inserted.

responding to only one-quarter of the tensile strength of the ACL in young adults. With advancing age, the strength of the normal ACL decreases (Kennedy et al. 1976) approaching the strength of the polyethylene ligament. Beauchamp et al. (1979) found the elastic resistance of a polyethylene prosthetic ligament to be about one-third of that of the human ligament, but its elasticity was considerably less.

The Polyflex system (Figure 1) consists of: 1) A metal tube with three different angles: 90°, 75° and 60°. 2) The ligament itself, whose central, thinner part is available in three lengths, corresponding to the intraarticular distance between tibia and femur, viz. 30 mm, 35 mm and 40 mm. 3) Screws for fixation and polymethyl methacrylate cement.

Through a long medial arthrotomy, the patella is dislocated laterally, and guide wires are drilled obliquely through the tibial tuberosity and the lateral femoral condyle. Above these wires a tunnel is drilled through which the ligament is pulled. The artificial ligament is fixed and tightened by bolts screwed on the ligament into the outermost, conical part of the bony tunnel with which the bolt interlocks and is also fixed with some polymethacrylate cement. Where the artificial ligament passes from the bony tunnel into the joint, it is protected by a metal tube with a suitable angle. This tube is also fixed with cement (Figure 1).

Postoperatively the patients are immediately allowed weight-bearing and flexion, but only to about 60° because of the fairly large scar.

In the Department of Orthopaedic Surgery T 3 reconstructions of the ACL using the Richards Polyflex ligament were performed in 9 cases in the period 1977–1979. The minimum follow-up time is 2 years for 8 patients, and 1 year for the remaining one. All the patients were males aged 24–47 years. In 6 the primary injury was an athletic trauma, 5 of which were sustained at football, while 3 were due to traffic accidents. The primary trauma had taken place 6 months to 22 years previously. In 3 cases an injured medial collateral ligament had been treated primarily. In another 4 cases meniscectomy had been performed. There was no case of the "unhappy triad".

Four patients had previously had an autoplastic reconstruction of the ACL which had failed. The indications for insertion of an artificial ligament were in all cases a pronounced drawer sign and a feeling of instability. Three patients were often falling and five complained of pain. Two patients had mild to moderate

Table 9. Objective findings in the ankle at follow-up: Talocrural mobility

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
Talocrural mobility:						
Increased by 10°	0 (0)	4 (5)	1 (2)	1 (2)	0 (0)	0 (0)
Equal on both sides	33 (94)	72 (86)	35 (83)	38 (79)	17 (85)	23 (85)
Reduced by 10°	2 (6)	4 (5)	5 (12)	8 (17)	3 (15)	4 (15)
Reduced by 20°	0 (0)	4 (5)	1 (2)	1 (2)	0 (0)	0 (0)
( ) per cent	Not significant		Not significant		Not significant	

Table 10. Objective findings in the ankel at follow-up: Muscular atrophy (calf) – muscular strength (ankle)

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
No atrophy (calf)	28 (80)	64 (76)	36 (86)	41 (85)	9 (45)	19 (70)
Equal muscular strength (ankle joint)	35 (100)	82 (98)	40 (95)	46 (96)	19 (95)	22 (82)
( ) per cent	Not significant		Not significant		Not significant	

Table 11. Assessment of the overall clinical result in the various treatment groups 1 year after ankle injury

	No clinical signs of ligament rupt.	No arthrographic signs of lig. rupt.	Rupture of ant. talofibular ligament		Rupture of ant. talofibular ligament and calcaneofibular ligament	
	Strapping		Plaster cast	Operation	Plaster cast	Operation
Total number of patients	35	84	42	48	20	27
Good	30 (86)	64 (76)	33 (79)	41 (85)	14 (70)	20 (74)
Fairly satisfactory	2 (6)	18 (21)	9 (21)	5 (10)	5 (25)	7 (26)
Not satisfactory	3 (9)	1 (1)	0 (0)	2 (4)	1 (5)	0 (0)
Poor	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)
( ) per cent	Not significant		Not significant		Not significant	

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