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Femoral press-fit fixation versus interference screw fixation in anterior cruciate ligament reconstruction with bone-patellar tendon-bone autograft: 20-year follow-up

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ABSTRACT

Introduction: The aim of this paper is to present our experience with femoral press-fit fixation in anterior cruciate ligament reconstruction using bone-patellar tendon-bone autograft.
Methods: The patient population was randomly placed in two groups: group A (58 patients), who underwent femoral screw fixation; group B (62 patients), who underwent femoral press-fit fixation.
Results: At last follow-up 9.2% of patients were lost; 28% of patients in group A and 64% of patients in group B had excellent International Knee Documentation Committee score (grade A); 66% of patients in group A and 32% of patients in group B had good International Knee Documentation Committee scores (grade B). The difference was statistically significant ($p < 0.05$).
Conclusions: Femoral press-fit fixation of bone- patellar tendon- bone autograft provides stable fixation at low cost, it ensures unlimited bone-to-bone healing and high primary stability, avoiding the disadvantages of hardware and the need for removal in case of revision.

1. Introduction

The anterior cruciate ligament (ACL) is one of the most frequently injured ligaments in the human body. So, ACL reconstruction has become a common surgical procedure in orthopaedic surgery. Many different grafts have been used but the bone –patellar tendon-bone (B-PT-B) autograft is considered the gold standard.[1,2,9,19,22,29] The main advantage of B-PT-B autograft include high load to failure, adequate stiffness and rapid bone healing.[8] Various techniques have been used for femoral fixation of the graft, among which interference screws have been the most widely used, although various complications have been reported, including divergent screw placement, possible impingement and abrasion.[8] Metal interference screws are difficult to remove in case of revision surgery and they may also produce disturbance in postoperative magnetic resonance imaging. To avoid difficulties related to fixation devices, in 1987 Hertel developed a femoral press-fit fixation and in 1989 a tibial press-fit fixation.[10] Then several authors like Boszotta,[4] Paessler[20] and others[3,24] developed similar techniques. Several biomechanical studies have been performed in order to compare the press-fit fixation with commonly used implant fixations. The press-fit fixation has been shown to have similar pull-out strength and stiffness compared to fixation with interference screws in animal models[13,18,23,25,26,28].

The aim of this paper is to present our 20-year follow-up with femoral press-fit fixation in ACL reconstruction using B-PT-B autograft, comparing the results with a homogeneous group of patients who underwent the same procedure with femoral interference screw fixation.

2. Materials and methods

Between September 1994 and September 1997, the authors performed 120 ACL reconstructions using BPTB autograft.

Inclusion criterion was: documented ACL lesion associated with subjective knee instability. Exclusion criteria were: concurrent fracture of the knee, posterior cruciate ligament injury, poor bone quality and patellar problems. The study design was approved by the local ethics committee and all patients gave informed consent prior to inclusion in this trial.

This patient population was randomly placed in two groups, regarding the treatment. In the first group (Group A; n = 58), femoral interference screw fixation technique was used; while in

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the second group (Group B; n = 62), femoral press-fit fixation was used. In both groups was used the tibial interference fixation.

Group A: 58 patients randomly assigned to femoral and tibial interference screw fixation with screw (Kurosaka screw, Depuy, Warsaw, IN).[14] We had 37 males and 21 females. Mean age was 28 years (range 15–41); the left knee was affected in 32 patients, the right knee in 26. Eleven were professional athletes. The time between injury and surgery ranged from 1 month to 25 months (median 6 months). Twelve patients had undergone previous knee arthroscopies for meniscus tears. During ACL reconstruction, we performed 18 meniscectomies, 13 medial and 5 lateral.

Group B: 62 patients randomly assigned to femoral press-fit fixation. We had 44 males and 18 females. Mean age was 23 years (range 18–39); the left knee was affected in 26 patients, the right knee in 36. Fifteen were professional athletes. The time between injury and surgery ranged from 20 days to 18 months (median 5 months). Seven patients had undergone previous knee arthroscopies. During ACL reconstruction, we performed 13 meniscectomies, 5 medial and 8 lateral.

Clinical evaluation was assessed with International Knee Documentation Committee score (IKDC)[12] and with arthrometer KT-1000. The IKDC was formed in 1987 to develop a standardized international documentation system for knee conditions. Then several minor revisions were performed until its publication in 1998. The test can be used to evaluate different knee injuries, such as ACL lesions, posterior cruciate ligament lesions, meniscal tears, knee cartilage lesions and traumatic knee dislocation. Patients are divided in 4 grades, according clinical and radiological findings: grade A (normal), grade B (nearly normal), grade C (abnormal) and grade D (severely abnormal). All patients underwent pre-operative radiological examination in order to evaluate poor bone quality, such as osteoporosis or patello-femoral problems and computer-tomography at 2 and 6 months to evaluate graft integration. Patients were followed-up at different time intervals: 1, 6 and 12 months. Then were recalled at last follow-up for clinical evaluation. The data was stored on a Microsoft Excel database. Statistical analysis was performed using t-student test. Significance was set <0.05.

3. Surgical technique and rehabilitation

All operations were carried out under general or spinal anesthesia and tourniquet. A diagnostic arthroscopy was performed to verify the rupture of the ACL and to address associated injuries as mentioned above. After removing the ACL remnants, the femoral notch was prepared. The medial wall of the lateral femoral condyle was debrided until the posterior arch of the notch was clearly visible. Then a midline incision over the medial edge of the ipsilateral patellar tendon was made. The B-PT-B autograft was 10 mm wide and harvested with 20–25 mm of bone from the patellar and tibial tubercle. The bone blocks were formed to a trapezoid shape by using an oscillating saw. The tibial and femoral tunnels were reamed to an appropriate size depending on the width of the autograft bone blocks (in group B, 1 mm undersized to the bone graft). Then the graft was pulled through the tunnels with out-in technique for the tibial autograft and in-out technique for the femoral autograft, using a pull-through suture, so that the patella bone block was within the femoral tunnel and the tibial bone block was within the tibial tunnel. The graft was positioned so that no bone protruded into the joint. In group A an interference screw of Kurosaka (average dimension 7×25 mm) was used both in the femoral and in the tibial tunnel to fix the bone block. In group B, an interference screw of Kurosaka (average dimension 7×25 mm) was used to fix the tibial bone block, while the fixation of the femoral autograft was a press-fit fixation.

Rehabilitation differs in group A and B.

Group A. Standard protocol with brace adjusted to allow 0–90° of flexion during the first 2 weeks, then full range of motion was allowed. Full weight-bearing was permitted.

Group B. A fixed splint in full extension was worn during the first 2 weeks. The patient walked with toe touch weight-bearing using crutches. The immediate active quadriceps isometric exercises were started. On the fifteenth postoperative day, the brace was adjusted to allow motion between 0 and 60° of flexion. The patient continued walking with toe touch weight-bearing using crutches. Four weeks after surgery, the brace was adjusted to allow between 0 and 90° of flexion and the patient was permitted to bear 50% of his weight. At five weeks, the brace was adjusted to allow 0–120° of flexion and full weight-bearing was permitted. Six weeks after surgery full flexion was allowed. Swimming and bicycle without resistance were allowed.

4. Results

Eleven patients (9.2%) could not be contacted because they had changed address or were unable to participate because of geographic constraints, allowing a clinical assessment of 109 (90.8%) patients. The average follow-up was 19.5 years (range 18–21 years). Except for these patients, results were similar at different time intervals of follow-up. Therefore, the group A consisted of 53 patients, 34 men and 19 women. The group B consisted of 56 patients, 41 men and 15 women. All patients returned to normal activities such as moderate physical work, running or jogging.

At 6 and 12-month follow-up results were identical; in particular, 30% of patients in group A and 66% of patients in group B had excellent IKDC score (grade A); 68% of patients in group A and 30% of patients in group B had good IKDC score (grade B); 2% of patients in group A and 4% in group B had fair IKDC score (grade C). At the last follow-up, 28% of patients in group A and 64% of patients in group B had excellent IKDC score (grade A); 66% of patients in group A and 32% of patients in group B had good IKDC score (grade B); 6% of patients in group A and 4% in group B had fair IKDC score (grade C) (Table 1). The difference between the two groups was statistically significant ($p < 0.05$).

Using the KT-1000 arthrometer, at the 6 and 12-month follow-up the side-to-side difference was 1–2 mm in 38% and 69% of patients respectively in group A and B. The side-to-side difference was 3–5 mm in 62% and 31% of patients respectively in group A and B. At the last follow-up, the side-to-side difference was 1–2 mm in 35% and 68% of patients respectively in group A and B. The side-to-side difference was 3–5 mm in 65% and 32% of patients respectively in group A and B (Table 2). The difference was statistically significant ($p < 0.05$).

The most frequent complication was muscle atrophy (21% in group A and 25% in group B), followed by anterior algodystrophy (17% in group A and 13% in group B). Arthrofibrosis occurred in 6% of patients in group A and 11% in group B, all recorded at 12-month follow-up and treated with arthroscopical arthrolysis. Two patients in group A had to be revised because of Cyclops syndromes

Table 1
IKDC results between the two groups ($p < 0.05$) at last follow-up.

IKDC	Kurosaka screw	Press-fit
Grade A (Normal)	28%	64%
Grade B (Nearly normal)	66%	32%
Grade C (Abnormal)	6%	4%
Grade D (Severly abnormal)	0%	0%

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