Anterior cruciate ligament reconstruction with a multistrand hamstring graft fixed with a Ligament Tension Screw: a new device that can be used to readjust graft tension after fixation

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Abstract We developed a new fixation device for reconstruction of the anterior cruciate ligament with a multistrand hamstring graft. This device allows the graft tension to be readjusted after fixation. This device, called a Ligament Tension Screw, consists of three parts, a screw, a washer, and a post. To create the graft, the tendons were formed into a loop. The device was hung from one end of the loop of the graft and a Kennedy-ligament augmentation device (LAD) artificial ligament was hung at the other end. The Kennedy-LAD artificial ligament was used extraarticularly for fixation at the tibia with double staples. Graft tension was increased by turning the screw, which pulls on the post suspending the graft. Fifty-two patients were evaluated after a minimum 2-year follow-up. The evaluation included physical examination, stability measurement with a KT2000 arthrometer, a Cybex muscle strength measurement, a functional test, and scoring of the knee according to the International Knee Documentation Committee (IKDC). Pivot test was negative in 47 patients (91%), but glide occurred in 5 patients (9%). No patient had a “clunk” or markedly poor result on the pivot test. All patients recovered full extension. Seven patients lost full flexion, but the loss of flexion was less than 5° in all seven. The KT 2000 arthrometer measurement with 133 N anterior drawer force indicated that 46 patients (88%) had less than 3-mm side-to-side difference. The mean muscle strength of the quadriceps and hamstring was 91% and 94%, respectively, compared with the findings in the contralateral limb. The functional test showed a one-leg hop distance equal to 94% of that the opposite side. According to the final IKDC evaluation, 48 patients were graded as normal or nearly normal, and 4 patients as abnormal; none was severely abnormal. This study demonstrated satisfactory results for the reconstruction with a multistrand hamstring graft fixed with the new Ligament Tension Screw.

Key words Anterior cruciate ligament · Reconstruction · Fixation device · Ligament Tension Screw

Introduction

Arthroscopically assisted surgical techniques have now become a standard method for reconstruction of the anterior cruciate ligament (ACL). However, several important problems remain. These include graft selection, tensioning, fixation, the position of the drill hole, and whether to use a single bundle or two bundles. Commonly used autogenous grafts are the patellar tendon and the hamstring tendons. Patellar tendon reconstruction is considered to be the gold standard, but there is a high rate of such complications as patellofemoral pain, patellar tendinitis, muscle weakness, and loss of extension. Therefore, in recent years, the number of hamstring graft reconstructions has increased. In reconstruction with the hamstring graft, the rate of complications is relatively low, but it is difficult to achieve rigid initial fixation by means of conventional devices such as buttons or screws. To address this problem, we developed a new fixation device for a multistrand hamstring graft, the Ligament Tension Screw; this device provides high initial strength and allows graft tension to be readjusted after fixation. We describe this fixation device, outline the surgical techniques employed for its use, and report the results of ACL reconstructions with an average 34-month follow-up.

Patients and methods

Fifty-three patients underwent ACL reconstruction with a multistrand hamstring graft, in which the Ligament Tension Screw fixation device was used, between May 1994 and August 1997. In all patients, the reconstructions were done more than 4 weeks after injury. One patient incurred reinjury 11 months after the operation during participation in sport; he was excluded from this study. The study group, consisted of the re-
maining 52 patients (26 males and 26 females), who were followed-up for a minimum of 2 years. The average duration of follow-up was 34 months (range, 24 to 52 months). The mean age of the patients was 26 years (range, 15 to 44 years). Two revisions were included in this study. One patient had had a previous reconstruction with an artificial ligament, and the second patient had had a hamstring graft (in the second patient, the revision reconstruction was done with a hamstring graft harvested from the opposite limb). Seventeen concomitant operations were performed in 16 patients. These included one medial collateral ligament reconstruction, 14 partial menisectomies, and two meniscal repairs.

Description of the Ligament Tension Screw

The Ligament Tension Screw fixation device (Nakashima Propeller, Okayama, Japan), which is made of pure titanium, is available in two sizes; the size employed depends on the diameter of the bone tunnel (Fig. 1). The smaller device is used for an 8-mm- or a 9-mm-diameter bone tunnel, and the larger one for a bone tunnel with a diameter of 10 mm or an 11 mm. The device consists of three parts: a post for suspending the tendon, a screw, and a washer. A pin to prevent rotation and extrusion of the screw is used if the device is loose in the bone tunnel (Fig. 2). To allow for the possibility of reoperation, a removal device is prepared (Fig. 3). The removal device is inserted after removal of the screw of the Ligament Tension Screw device. This removal device has the same size and pitch as the screw and a cruciate-shaped single blade at the top for twisting off the graft. It is easy to remove the Ligament Tension Screw with this removal device.

Surgical procedure

Arthroscopically assisted reconstruction was performed in all patients. A 3-cm longitudinal skin incision was made 1 cm medial to the tibial tuberosity. The gracilis and semitendinosus tendons were harvested from this incision, using a tendon harvester. To make a graft that was at least greater than 8 mm in diameter, four to six strands of tendons were used. The tendons were shaped into a loop. The hook of the post of the device was hung from one end of the loop and a Kennedy-LAD artificial