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Original article

## Lack of stability at more than 12 months of follow-up after anterior cruciate ligament reconstruction using all-inside quadruple-stranded semitendinosus graft with adjustable cortical button fixation in both femoral and tibial sides

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### ABSTRACT

**Introduction:** The use of the semitendinosus tendon alone for anterior cruciate ligament reconstruction keeps the gracilis muscle intact and decreases anterior pain in comparison with the use of the patellar tendon. Recently, Lubowitz described a new all-inside technique with an ST4 tendon fixed with a cortical button in both femoral and tibial sides. We hypothesized that this type of graft with cortical button fixation provides well-controlled residual anterior tibial translation (<3 mm).

The aim of this study was to assess the results obtained with this technique in terms of laxity and IKDC score at more than 1 year of follow-up.

**Material and methods:** We performed a prospective single-center study to evaluate the results with this procedure with at least 1 year of follow-up. The primary endpoint was the objective IKDC score and side-to-side anterior tibial translation difference. The secondary endpoint was the subjective assessment using the subjective IKDC and Lysholm scores. Tunnel positioning was assessed using the Aglietti criteria. **Results:** Thirty-five patients were included and reviewed with a mean follow-up of 19.7 months. Sixty-three percent of the patients were male and the mean age at the procedure was 28 years. The IKDC score was A or B in 43% of the patients and C or D in 57%; 54% of the patients had a residual side-to-side anterior tibial translation difference less than 3 mm and 29% presented significant pivot shift (grade C or D). Five patients underwent revision surgery, including one for rupture of the ACL reconstruction. The meniscal status did not influence postoperative laxity and the IKDC grade.

**Discussion:** Our hypothesis was not verified and the postoperative stability of the knee was insufficient. Postoperative side-to-side anterior tibial translation difference remained greater than 3 mm for 16 patients and the analysis seems to indicate that the distal cortical fixation of the graft with an adjusted loop is insufficient.

**Level of evidence:** Prospective study – Level IV.

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### 1. Introduction

Many anterior cruciate ligament (ACL) reconstruction techniques exist today. The patellar tendon and the STG (semitendinosus/gracilis) tendons are the most frequently used transplants. STG reconstructions can reduce anterior knee pain and limit extension deficits [1,2]. Recently, several authors have suggested using

the semitendinosus tendon alone (four strands, or ST4) for single-bundle reconstructions. These short grafts reduce the loss in strength of the knee flexors [3,4].

For the fixation of these short grafts, many authors use distal cortical fixation for the femoral fixation with good clinical and biomechanical results [5–7], but the tibial fixation is most often provided by an interference screw. In 2011, Lubowitz et al. suggested an all-inside ACL reconstruction technique, using an ST4 graft associated with a distal cortical fixation at the femur and the tibia [8]. This attractive technique makes it possible to perform a retrograde tibial tunnel that limits bone substance loss and

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stabilizes the graft with an adjustable fixation system (TightRope™, Arthrex, Naples, FL, USA).

The objective of this study was to assess the results of this technique with a minimum 1-year postoperative follow-up period. The primary endpoint was residual laxity at a minimum follow-up of 12 months, evaluated using the IKDC score associated with side-to-side anterior tibial translation difference measured using the KT-1000 (MedMetric, San Diego, CA, USA). The secondary endpoint was the subjective assessment using the IKDC subjective score and the Lysholm score. We hypothesized that this less invasive technique would provide postoperative residual laxity similar to that found in the literature despite distal tibial fixation of the graft.

## 2. Material and methods

### 2.1. Population

In this prospective single-center study conducted between April 2011 and October 2013 in the Reims University Hospital Orthopaedics Center (France), the inclusion criteria were age over 18 years, participation in a pivot sport (with or without contact), ACL tear confirmed by MRI, presence of side-to-side anterior tibial translation difference measured with the KT 1000™ (MedMetric) greater than 3 mm, and no history of knee surgery. Existence of a meniscus tear was not a factor of exclusion. ACL reconstructions were performed with an all-inside technique performed using the GraftLink All-Inside™ (Arthrex) ancillary instrumentation [8,9]. All patients presenting a collateral ligament lesion, a severe cartilage lesion, a partial ACL lesion, an associated fracture, or a contralateral ACL injury were excluded.

During the inclusion period, 208 ACL reconstructions were performed arthroscopically in our department.

Forty-four patients were initially included after having provided their agreement to participate in the study. Nine of them were lost to follow-up before 1 year. In this group of patients lost to follow-up, no complication was found at the last follow-up. Therefore, 35 patients (22 males and 13 females) underwent clinical and radiological review with a minimum follow-up of 12 months. The mean follow-up was 19.7 months (range, 12–39 months). The mean age at the time of surgery was 28 years ( $\pm 7.8$  years), and the mean body mass index was  $24.4 \text{ kg/m}^2$  ( $\pm 3.5 \text{ kg/m}^2$ ). The mean time to surgery was 9.9 months ( $\pm 17.4$  months). Preoperatively, all the patients presented positive pivot shift: six (17%) subnormal pivot shift (grade B), 17 (49%) abnormal pivot shift (grade C), and 12 (34%) very abnormal pivot shift (grade D).

### 2.2. Operative technique

- The semitendinosus was first harvested. No complication was observed during this stage.
- The short graft was prepared according to the company's guidelines: the length of the transplant adjusted to have four strands, with 1 min of pretension performed, providing one ST4 mounted with two TightRope™ implants (Arthrex) [10].
- The second phase was arthroscopic: evaluation of the ligament, meniscus, and chondral lesions. In case of meniscus tear, it was treated first: as far as possible the tear was repaired using anchors (Meniscal Cinch™, Arthrex); if not, a partial meniscectomy was performed: seven partial lateral meniscectomies, five partial medial meniscectomies, and four medial meniscal repairs were performed in 14 patients (two patients had a lesion in both menisci). The femoral tunnel was drilled via the anteromedial approach (differing from the out-in technique described by Lubowitz) with an alignment guide 5 mm away, at 11 o'clock for the right knees and 1 o'clock for the left knees, and then a blind



Fig. 1. AP and lateral postoperative X-rays. Note the application of cortical buttons on the bone.

tunnel was carried out. The tibial tunnel was performed using an alignment device adjusted to  $55^\circ$ , then a blind tunnel was carried out using the FlipCutter™ (Arthrex). The drilling diameters and depths were defined when the graft was prepared with the calibrator.

- In the last phase, the graft was introduced in the joint, with the femoral fixation first, then after ten cycles of flexion/extension, the tibial fixation was performed at  $15^\circ$  flexion, avoiding any tibial anterior drawer (Fig. 1).

No lateral tenodesis was performed.

After surgery, the knee was immobilized with a brace articulated at  $0\text{--}90^\circ$ , worn for 1 month until the first follow-up visit, and immediate weightbearing was authorized. Physical therapy was initiated on D1 postoperative with the same protocol for all patients.

### 2.3. Evaluation

The preoperative workup comprised X-rays, MRI, and comparative side-to-side anterior tibial translation difference using the KT-1000™ (MedMetric) as recommended by the manufacturer and performed by the same experienced operator.

Postoperatively, the patients were seen at M1 (1 month), M2, M4, M7, and M12. The assessment at 12 months included X-rays, comparative side-to-side anterior tibial translation difference measured using the KT-1000™ (MedMetric), a questionnaire, and clinical examination to determine the objective IKDC (International Knee Documentation Committee) score. The subjective IKDC score and the Lysholm score [11] were completed by the patient during consultation. A Lysholm score between 84 and 100 points was considered good, between 65 and 83 points fair, and if less than 64 points poor [12].

Tunnel placement was evaluated on X-rays according to the Aglietti criteria [13] (Fig. 2).

### 2.4. Statistical analysis

The statistical analysis was performed by the Reims University Hospital's Public Health Department. The descriptive analysis of the quantitative variables was based on the mean and standard deviation (SD), and for the qualitative variables percentages were used. The objective IKDC grade was compared for before and after the intervention (using the McNemar chi-square test, with the IKDC grade reduced to two categories: A/B and C/D), and the

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