The Knee xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

The Knee

Clinical and arthrometric outcomes of an anatomic outside-in single-bundle anterior cruciate ligament reconstruction using a retrodrill

David Figueroa *, Rafael Calvo, Francisco Figueroa, Daniel Paccot, Guillermo Izquierdo, Nelson Morales

The Knee Surgery Unit, Orthopaedics and Traumatology Department, Clínica Alemana – Universidad del Desarrollo, Santiago, Chile

ARTICLE INFO

Article history:
Received 1 November 2015
Received in revised form 28 May 2016
Accepted 26 July 2016
Available online xxxx

Keywords:
ACL
Outside-in
Retroconstruction
Anatomic femoral tunnel

ABSTRACT

Background: The main option to perform an anatomic anterior cruciate ligament (ACL) reconstruction is the anteromedial portal (AMP) technique. It has several reported complications (iatrogenic chondral injury, posterior-wall blowout, short sockets, increased risk of injury to common peroneal nerve). In an attempt to avoid these complications the outside-in (OI) technique was revived with the addition of a retrodrill. The aim of this study is to evaluate the clinical and arthrometric outcomes of a series of anatomical OI single bundle ACL reconstruction using a retrodrill.
Methods: Prospective case series. KT-1000 and Pivot Shift Test were done at 24 months follow-up. International Knee Documentation Committee (IKDC), Lysholm and Tegner activity scores preoperatively and at final follow-up. Complications were reported. Statistical analysis was done with t-test.
Results: 275 knees of 200 (73%) males and 75 (27%) females were enrolled in the study. Mean age 29.1 years (15–54). Mean follow-up 34.5 months (24–49). Mean preoperatively Lysholm Score 62 (25–95) versus 95 (76–100) at final follow-up ($p < 0.001$) Mean preoperatively IKDC score 60 (26.4–90.8) versus 92 (59.8–100) at final follow-up ($p < 0.001$) Mean Tegner activity Score pre injury 5 versus 5 at final follow-up. ($p = 0.59$) Mean KT-1000 side-to-side difference 2 mm (1–6). Pivot Shift test negative in 243 patients (90%); positive in 32 (10%) patients. 13 (5%) ACL re-ruptures. 2 (0.7%) infections. No other complications were reported.
Conclusion: OI single bundle anatomic ACL reconstruction using a retrodrill is a valid and safe option that avoids the complications reported with the AMP technique.

1. Introduction

Better positioning of the tunnels is a strategy for reducing rotational instability and future osteoarthritis (OA) in anterior cruciate ligament (ACL) surgery [1–4]. From this perspective, improvements in the understanding of the anatomy and biomechanics of the knee have resulted in a conceptual shift from femoral tunnels located at the isometric point of the ACL to anatomic points located in the footprint [5].

The transtibial drilling technique has been the standard surgical method for femoral tunnel placement in ACL reconstruction over the past 20 years [6,7]. However, current interest in the anatomic ACL technique has led to a reconsideration of the proper femoral tunnel positioning, and to an understanding that independent drilling of the tibial and femoral tunnels in ACL

* Corresponding author at: Chief of Knee Surgery, Clínica Alemana, Vitacura 5951, Santiago, Chile.
E-mail address: franciscofigueroab@gmail.com (D. Figueroa).

http://dx.doi.org/10.1016/j.knee.2016.07.007
0968-0160/

reconstruction might be more anatomic than the transtibial technique for femoral ACL tunnel creation because the transtibial technique is associated with a risk of a compromised tunnel position due to the transtibial constraint [8,9].

In attempts to provide more anatomical femoral tunnels, other techniques have been developed, including the anteromedial portal (AMP) technique. This technique can produce more anatomical positioning of the femoral tunnel, but it is associated with several risks including: difficulty visualizing in hyperflexion, possibly leading to iatrogenic chondral injury to the medial femoral condyle; posterior-wall blowout; short or bicortical sockets, which may limit fixation options; and increased risk of injury to the common peroneal nerve [8,10,11]. The shorter tunneling is of special relevance because short tunnels can result in reduced tendon graft lengths within the femoral bone tunnel, and may be more prone to mechanical failure [12,13].

In an effort to provide an anatomical femoral tunnel without the complications attributed to the AMP technique, the outside-in (OI) technique was revived with the addition of a retrodrill to simplify the procedure and to be able to create a femoral socket that can improve the available femoral fixation options (contrary to a complete femoral tunnel). The OI technique provides consistent femoral tunnel placement, no posterior wall blowout, a clear visual field, no screw divergence, easy revision of ACL reconstruction, and longer tunnel lengths. However, this technique has disadvantages that include lateral femoral dissection from an additional incision, and inconsistent femoral reaming due to variability in the starting position [14]. However, because this technique uses retractable retrograde cutting bits, it requires only a portal-sized stab wound rather than a lateral incision and dissection [14]. There are few reports of this technique in the literature, and most of these reports are related to anatomical parameters rather than clinical results.

The aim of this study was to evaluate the clinical and arthrometric results of a clinical series of patients with acute ACL ruptures who were treated with the single-bundle anatomical OI technique for femoral tunneling using a retrodrill. It was hypothesized that using the OI technique for femoral tunneling would have comparable outcomes to those reported for the other techniques, with the advantage of avoiding the complications attributed to the AMP technique.

2. Methods

This study was a prospective, consecutive case series of patients who underwent anatomic ACL single-bundle OI reconstruction using the Flipcutter system (Arthrex, Naples, FL) with autologous hamstring grafts between January 2012 and May 2014. Two experienced knee surgeons (28-year experience each) performed the surgeries and started using this technique in September 2011; they had experience with more than 50 patients each before starting this study.

The institutional ethics committee approved the study, and all patients provided written, informed consent to participate in this study.

2.1. Surgical technique

The patient is positioned in the supine position on an orthopedic table with lateral knee support. An ischemia tourniquet is inflated. The knee is positioned in 90° of flexion. The procedure begins by harvesting the hamstring (semitendinosus and gracilis) grafts with an anteromedial approach five centimeter distal to the joint line. The graft is prepared with high-strength sutures to obtain a quadruple graft. Following the findings of Magnussen et al. [15], it is preferable to use a minimum diameter of eight millimeters. In cases in which the graft is smaller, a triple graft is prepared or the diameter is increased using an allograft (hybrid technique).

The classic anterolateral and anteromedial portals are used. Diagnostic arthroscopy is performed, and the associated injuries (meniscal or chondral lesions) are addressed. The anatomical footprint of the ACL is located in the femur, based on the description of Piefer et al. [16] (43% of the proximal-distal distance of the lateral wall of the intercondylar notch and the radius of the tunnel +2.5 mm anterior to the posterior articular margin), and in the tibia, based on the description of Bhatia et al. [17] (2 ± 0.49 mm anterior to the posterior border of the anterior horn of the lateral meniscus). The injured ACL is debrided, while all attempts are made to preserve all remaining functional bundles. To finish the first step, both of the footprints are marked as described above.

2.2. Femoral tunnel

To place the femoral tunnel, the demarcation of the footprint is guided with the AR-1510H grip (Arthrex Inc., Naples, FL) fixed at 100° (70 to 110°) through the anterolateral portal (Figure 1). The guide is located with arthroscopic viewing in the previously mentioned femoral footprint. A lateral incision approximately the size of an arthroscopic portal is made at the distal femur, where a sleeve is placed. Through the sleeve, an anterograde perforation is made from outside to inside in the direction of the femoral footprint using the Flipcutter™ (Arthrex, Naples, FL) drill (Figure 2). The tip of the Flipcutter is then flipped into a horizontal reamer. Using this reamer, retrograde drilling (Figure 3) is performed with a diameter equal to that of the graft and a previously defined length (tunnels between 30 and 35 mm are preferred). Finally, when the tunnel has been made, the Flipcutter drill is flipped again into the initial longitudinal position and retired. A Fiberstick™ (Arthrex Inc., Naples, FL) is introduced through the tunnel into the joint and is used to pull the graft later on (Figure 4).

2.3. Tibial tunnel

A tibial guide that is fixed between 55° and 60° is used through the medial portal to locate the tibial footprint of the ACL. A sleeve is placed in the anteromedial tibia using the incision that was previously used to harvest the hamstring graft. Next, a

Please cite this article as: Figueroa D, et al, Clinical and arthrometric outcomes of an anatomic outside-in single-bundle anterior cruciate ligament reconstruction using a retrodrill, Knee (2016), http://dx.doi.org/10.1016/j.knee.2016.07.007