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Prospective study of the anterior cruciate ligament reconstruction associated with high tibial opening wedge osteotomy in knee arthritis associated with instability

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ABSTRACT

Introduction: Chronic ACL insufficiency with associated varus malalignment due to knee osteoarthritis (OA) is challenging to treat surgically. A combined ACL reconstruction (ACLR) with medial open wedge high tibial osteotomy (HTO) without using any metallic implant for HTO is an effective technique.
Materials and method: All the patients attending the outpatient department ACL injury and with associated medial compartment OA (Kellegren's grade 2 and grade 3) were considered for inclusion in the study. Forty patients who met inclusion criteria were included in the study. Simultaneous ACLR (single bundle of quadrupled hamstring graft fixed with Endobutton on femoral side and biointerference screw on the tibial side) along with medial opening wedge osteotomy (with tricalcium phosphate wedge) was done. The patients were assessed with IKDC, KOOS scores and any change in anterior tibial translation was also checked.
Results: The combined procedure showed mean varus angle correction of 9° (10.5–1.5°), and the mechanical axis of the knee was restored from an average of 172–181.5°. There was a significant improvement in knee score (KOOS and IKDC) after the surgery ($p < 0.05$). The average time for the radiological union of the osteotomy was 3.56 months. The anterior tibial translation was improved. No intraoperative complications and slippage of the synthetic graft were noted in any case.
Conclusions: Combined ACLR with HTO (using TCP wedge, without any hardware) is a reliable method that prevents rapid progression of OA. It reliably corrects varus deformity and obviates the use of any hardware.

1. Introduction

The chronic anterior cruciate ligament (ACL) deficient knee has high chances of progression to osteoarthritis (OA), mainly of the medial compartment and later progressing to be global osteoarthritis.[1–9] Hence, it is not uncommon to find medial compartment OA in combination with chronic ACL ruptures. The reconstruction of ACL can help stall the progression of OA, but the medial compartment OA with varus deformity needs realignment osteotomy.

The results of combined ACL reconstruction (ACLR) with a medial open wedge high tibial osteotomy (HTO) have been described in the literature to provide satisfactory long-term results.[10–12] We describe our experience of doing simultaneous arthroscopic ACLR with medial open wedge HTO. An arthroscopic ACLR using a single bundle (quadrupled) of hamstring tendon graft with simultaneous medial open wedge HTO (using a tricalcium phosphate wedge), without any plate fixation, was used.

The present study hypothesized that the simultaneously performed arthroscopic ACLR with medial open wedge HTO (using TCP wedges, with no internal fixation) can provide a satisfactory outcome. It is also hypothesized that it could provide adequate pain relief and restoration of knee stability and alignment.

2. Materials and methods

All the patients in the age group of 30–55 years presenting to the outpatient department with a history suggestive of instability and knee pain were assessed clinically. A detailed examination of the knee was performed, and the knee was also examined for the presence of any medial joint line tenderness. Varus and valgus stress tests were performed and documented. The pre-operative

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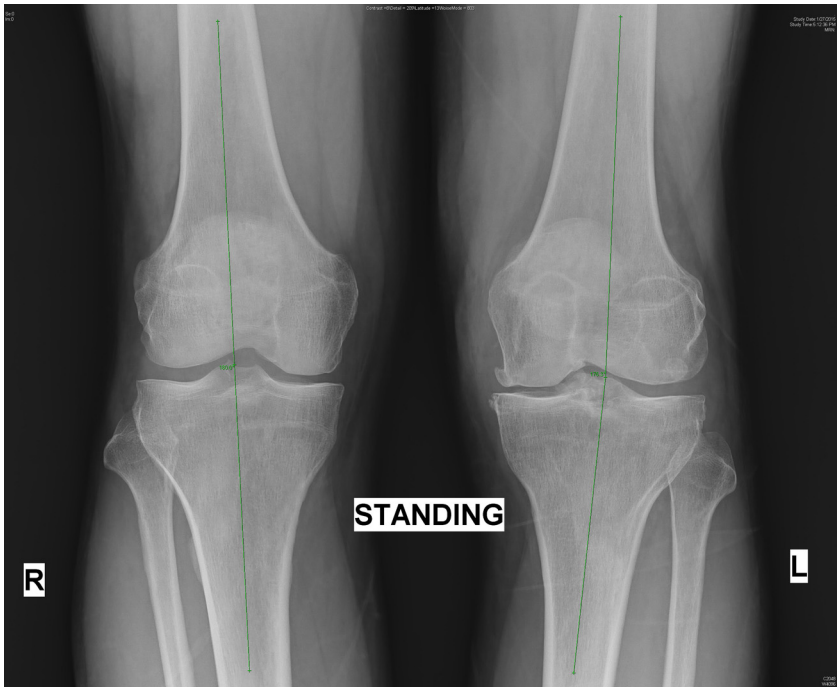

Fig. 1. Pre-operative standing radiograph with grade II osteoarthritis and varus deformity on the left knee.

range of motion (ROM), IKDC score, and KOOS scores were documented.

The patients who had pain and instability underwent weight bearing antero-posterior radiograph and magnetic resonance imaging (MRI) of the knee to look for the cause of instability and knee pain (Fig. 1). The patients with radiologic and clinical evidence of OA (Kellegren Lawrence grade II/III) and MRI proven ACL tear were considered for inclusion in this study. The amount of varus deformity was calculated on the preoperative weight-bearing radiograph. The exclusion criteria included a history of previous ACL or any other ligament reconstruction, Grade IV OA, the presence of peri-articular implant, severe varus deformity ($>20^{\circ}$), and lateral joint line opening.

Forty-six patients met the inclusion criteria and underwent the surgery between 2009 and 2014. Of these, six patients were lost to follow-up. Forty patients were available for final follow-up. The patients were re-assessed for a union at osteotomy site, post-op ROM, KOOS score, and IKDC score.

2.1. Surgery

The pre-operative planning included calculation of the distance of the site of osteotomy from the medial joint line and its relationship from the tibial tuberosity. After taking informed consent from the patient, the surgery was performed. All the surgeries were performed under spinal anesthesia, under tourniquet, and by the senior author.

An examination under anesthesia (EUA) was done to test the ligamentous laxity, and an arthroscopy was performed through standard anteromedial and anterolateral portal. After documentation of the lesions in the knee, the lesions were addressed. Any unstable cartilage lesions were debrided to stable margins. Small cartilage ($<1\ cm^2$) lesions, in the weight-bearing region, were further treated with microfracture after stabilization the edges, if needed. Larger lesions were treated with debridement alone. We did a conservative resection of meniscus trying to retain as much meniscal tissue as possible. The intercondylar notch and any remaining femoral stump of ACL were cleared, and the footprint and resident's ridge were identified.

The second phase of surgery included identifying the tibial tubercle and making a skin incision on the anteromedial aspect of the proximal tibia. We did ACLR first, followed by medial open wedge HTO. The key to performing a simultaneous ACL reconstruction and HTO is the correct positioning of the tibial tunnel for ACL graft. An 8 cm oblique incision in the proximal anteromedial tibia, starting three finger breadths below the joint line, was given. The Sartorius fascia was identified and cut, and the Gracilis and Semitendinosus tendons were harvested using an open-ended tendon stripper.

The transportal technique was used for making femoral tunnel at the postero-lateral part of the femoral condyle to remain close to the isometric point of insertion of ACL. The tibial tunnel was made 1–1.5 cm proximal to the pes anserine tendon insertion. The guide is fixed at 40–45° angle (acuter than the usual 50–55°). Hence, adequate bone is left distal to the starting point of the tibial tunnel (approximately 1 cm bone) for the starting point of the osteotomy. The rest of the ACLR is performed in the usual trans-portal manner. An Endobutton fixation was used to fix the graft in the femoral tunnel, and a biodegradable screw was used to fix the graft at the tibial tunnel.

After completing the ACLR, medial open wedge HTO was performed through the same exposure used for hamstring graft harvesting. The medial upper tibia adjoining the tibial tubercle was exposed and cleared off periosteum and soft tissue. A 4.5 mm drill bit was passed from the exposed medial tibial cortex directed obliquely distal to proximal toward the head of the fibula (under image intensifier guidance). The entry point is made distal to the tibial tunnel of ACLR and proximal to the tibial tubercle (leaving a safe gap of about 10 mm) (Fig. 2).

After confirming the orientation, an oscillating saw is passed just proximal and parallel to the drill bit. The saw is advanced till two-thirds of the diameter of the tibia, thus avoiding breaching the lateral tibial cortex. A completion of the osteotomy was achieved by osteoclasis by giving valgus stress. The opening on the medial