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Management of combined knee medial compartmental and patellofemoral osteoarthritis with lateral closing wedge osteotomy with anterior translation of the distal tibial fragment: Does the degree of anteriorization affect the functional outcome and posterior tibial slope?

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ABSTRACT

Background: The aim of this study was to assess the effect of degree of anterior translation of the distal tibial fragment after lateral closing wedge high tibial osteotomy in patients having combined knee medial compartmental and patellofemoral osteoarthritis.
Methods: A retrospective study was conducted on 64 patients who were operated on for combined knee medial compartmental and patellofemoral osteoarthritis, by lateral closing wedge high tibial osteotomy with anterior translation of the distal tibial fragment. They were divided into two groups; Group I comprising 32 patients (34 knees, mean age of 51.4 ± 7 years) whose degree of anterior translation was <1 cm and Group II comprising 32 patients (33 knees, mean age of 52.2 ± 8.3 years) whose degree of anterior translation was >1.5 cm. The final assessment was performed via: visual analog scale, postoperative Knee Society clinical rating system function score, active range of motion, time to union, degree of correction of mechanical axis, posterior tibial slope, and Insall–Salvati ratio.
Results: Group II patients exhibited statistically superior mean postoperative score and better return to their work than Group I ($P = 0.013$, 0.076, respectively). Both groups showed statistically significant differences between the preoperative and postoperative evaluation parameters ($P < 0.001$). The posterior tibial slope was decreased in both groups but with no significant difference ($P = 0.527$).
Conclusions: Lateral closing wedge high tibial osteotomy combined with anterior translation of the distal tibial fragment more than 1.5 cm achieved significantly better postoperative functional knee score. Both groups exhibited comparatively decreased posterior tibial slope.

1. Introduction

Knee osteoarthritis (OA) is one of the leading musculoskeletal disorders resulting in high patient morbidity and economic compromise. Mechanical knee malalignment, whether primary or secondary, eventually results in altered load distribution with subsequent progression of OA [1]. Based on the fact that varus knee is the most common mechanical knee malalignment encountered in OA patients, medial compartment is the most common affected knee partition. However, patellofemoral osteoarthritis (PF-OA) occurs less frequently in an isolated fashion (3.8%) despite being a common association with medial compartmental osteoarthritis (MC-OA) [2].

High tibial osteotomy (HTO) has become an accepted technique, especially in high-demand patients with isolated MC-OA. HTO can be performed by different techniques varying from lateral closing wedge osteotomy (LCW-HTO) [3], dome osteotomy [4], medial opening wedge osteotomy (MOW-HTO) [5], to combined open and closed wedge osteotomy [6]. However, surgical management for PF-OA has also shown a great progression and variability ranging from arthroscopic debridement, lateral facetectomy, anteriorization of the tibial tuberosity (ATT) introduced by Maquet [7] up to patellar resurfacing arthroplasty. However, there is a tremendous debate about the optimum solution for such a dual problem of combined MC-OA and PF-OA.

ATT offered unloading of the overloaded patellar articular surfaces [8]. The combination of HTO and ATT represents a rational theoretical answer to this problem. This is why a few studies have been conducted combining such procedures, including LCW-HTO with anterior translation of the distal tibial fragment [9], LCW-HTO and Maquet procedure [10] or combined MOW-HTO with Maquet-like osteotomy [11].

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This retrospective study assessed the effect of different degrees of anterior translation of the distal tibial fragment after LCW-HTO in two groups of patients who were diagnosed as having combined MC-OA and PF-OA. The assessment comprised functional evaluation through Knee Society clinical rating system function score and radiological evaluation including the degree of knee mechanical axis correction, Insall–Salvati (I/S) ratio, and the posterior tibial slope.

2. Materials and methods

A retrospective analysis of 64 patients, diagnosed with combined knee MC-OA and PF-OA and operated on in the period from January 2008 to December 2013, was performed. All patients recruited to this analysis were operated on by performing LCW-HTO with anterior translation of the distal tibial fragment. All surgical procedures were performed by the same surgeon (A.F.S.).

All patients enrolled in this study fulfilled the following inclusion criteria at the time of surgery: (1) older than 35 years of age with high demands and no systemic disorders; (2) body mass index (BMI) <40; (3) combined MC-OA and PF-OA with no clinical or radiological evidence of lateral compartmental OA; (4) associated knee varus deformity of ≤10°; and (5) active knee range of motion (ROM) of ≥90° with no fixed flexion contracture.

Exclusion criteria were as follows: (1) clinical or radiological evidence of lateral compartmental OA; (2) lateral tibial subluxation of more than 1 cm; (3) fixed flexion contracture; (4) more than 10° required for correction; (5) rheumatoid arthritis; and (6) evidence of patellofemoral maltracking.

The subjects were divided into two groups, according to the degree of anterior translation achieved. Group I included 32 patients (34 knees) with a mean age (at the time of surgery) of 51.4 years (SD: seven; range: 40 to 64). Group II included 32 patients (33 knees) with a mean age of 52.2 years (SD: 8.3; range: 36 to 74). The patients in Group I had anterior translation of the distal tibial fragment by <1 cm and those in Group II had anterior translation of the distal tibial fragment by >1.5 cm. Group I patients comprised 26 females and six males, while Group II patients comprised 21 females and 11 males (Table 1). The study design and protocol were approved by Minia University Hospital human ethical committee in December 2013. All patients enrolled in this study signed a full informed consent stating their approval of participation in this study via personal interviews, radiological evaluation and clinical assessment. All postoperative evaluations were performed by a blinded surgeon (M.K.O.).

The data of all patients were collected from the patients' medical files, pre and postoperative X-ray files, personal interviews, and subsequent clinical and radiological assessment.

2.1. Preoperative radiological evaluation

Preoperative radiological evaluation included weight-bearing anteroposterior and lateral views of both knees, scanogram of both lower limbs to define the mechanical axis of the knee (which is the line extending from the centre of the femoral head to the centre of the talar dome) and Merchant view to exclude the presence of lateral patellar compression syndrome or patellofemoral maltracking.

Table 1
Demographic data of both groups.

Parameter	Group I	Group II
Age (years)	51.4 ± 7 (40–66)	52.2 ± 8.3 (36–74)
BMI	27.7 ± 4.6 (20.8–38.3)	25.3 ± 3.9 (18–33.8)
Varus (degrees)	7 ± 1.9 (3–10)	7.6 ± 1.5 (5–10)
Sex	M (6), F (26)	M (11), F (21)
Side	R (16), L (18)	R (15), L (18)

BMI, body mass index; L, left; R, right.

2.2. Preoperative planning

From the preoperative scanogram, the mechanical axis of the involved knee was determined. This was followed by determining the mechanical axis deviation (MAD) and allocating the centre of rotation and angulation (CORA) by measuring the angle formed by the intersection of the mechanical axes of isolated femoral and tibial segments as described by Paley [12].

The degree of correction was performed as described by Coventry [3], by carrying out a laterally based wedge osteotomy at the proximal tibia with the length of the base of that wedge matching the degree of correction.

3. Surgical technique

Under spinal or epidural anesthesia, the patients lay in the supine position. A non-sterile pneumatic tourniquet was applied to the midthigh and elevated to 100 mm HG above systolic blood pressure. After standard scrubbing and draping, an inverted hockey-stick-shaped incision was performed at the proximal lateral leg starting from the Gerdy's tubercle aiming to the shin of the tibia and continuing distally for about eight centimeters. After subperiosteal elevation of the extensor muscle group, a transverse osteotomy cut was performed approximately two to 2.5 cm distal and parallel to the joint line, starting laterally and aiming medially until reaching the medial cortex. Another oblique osteotomy was performed starting distal to the first osteotomy by 0.3 to 1 cm (considering that every one millimeter represents one degree of correction) and aiming at the final medial point of the first cut forming a wedge of bone that was subsequently removed. Through a lateral leg incision, a fibular osteotomy was performed. The proximal tibial osteotomy was then closed by applying valgus stress to the distal leg. The distal tibial segment was then anteriorly translated approximately one centimeter (Figure 1)

Figure 1. Lateral X-ray of the knee of patient number 32 in Group II, showing the degree of anteriorization of the distal tibial fragment (red arrow) and the resultant patellar offloading (white arrow) if the PFJ.