RESEARCH ARTICLE

The Results of Biplanar Distal Femoral Osteotomy; A Case Series Study

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Abstract

Background: Distal femur wedge osteotomies for varus or valgus alignment of the lower extremity could be done in either uniplanar or biplanar fashion.Union time and stability of the osteotomy site has been considered important in this anatomic region. In this study, clinical and radiographic findings of biplane distal femur osteotomy were reported.

Methods: Clinical, functional, and radiological findings of eight patients (10 knees) underwent biplane distal femur osteotomy were evaluated. Visual analogue score (VAS) and Lysholm-Tegner knee score were used for the assessment of pain and function before and three months after surgery.

Results: In this study, eight patients were included. All patients were female. The mean age was 28±6.3. The mean pre-operative mechanical angle was 8.7±2.2˚ and the post-operative angle was 1.4±0.53˚ in patients with valgus alignment whileit was 7.0±1.0˚preoperatively and 0.66±1.2˚ postoperatively in patients with varus alignment. The mean lateral distal femoral angle (LDFA) was 85±8.0˚ before surgery and was 88±1.3˚ after surgery. According to Lysholm-Tegner knee score, in the post-operative visit, six knees were good and four were excellent. The mean union time was 9.2±2.3 weeks.

Conclusions: Biplane distal femur osteotomy is a reliable technique that creates larger surfaces and more stability at the osteotomy site with further rapid union.

Key words: Biplane Osteotomy, Lysholm-Tegner Knee Score, Visual Analogue Scale

Introduction

One of the most common anatomical areas for osteoarthritis is the knee (1). The most frequent lower extremity deformities are in the coronal plane in the form of varus-valgus deformities. Malalignment is the manifestation of weight-bearing axis deviation (2). The valgus deformity results in a load increase on the lateral compartment of the knee and may lead to arthritis (1).

Distal femoral osteotomies are performed in three ways; opening and closing wedge osteotomies as well as dome osteotomy (3). Wedge osteotomies are undertaken through uniplanar or biplanar method. Apart from the fixation device,the type of osteotomy,its orientation, and itslocation play an important role in the stability (4-6). Optimal cortical contact at the site of osteotomy is essential to avoid overcorrection because of the subsidence of distal fragment into the proximal segment (2, 7-8).

A new technique of biplane osteotomy has been developed for the lateral knee compartment osteoarthritis because the standard medial closing-wedge distal femur osteotomy had the immediate effects on the extensor mechanism function,which was the most important disadvantage of this technique (9). Biplane distal femur osteotomy creates wider and larger surfaces at the site of osteotomy compared to the other techniques by which the increase incancellous bone contact surface can help faster healing (10).

The present case-series is undertaken to analyze the clinical and radiographic results and average time to union of biplane distal femur osteotomies using visual

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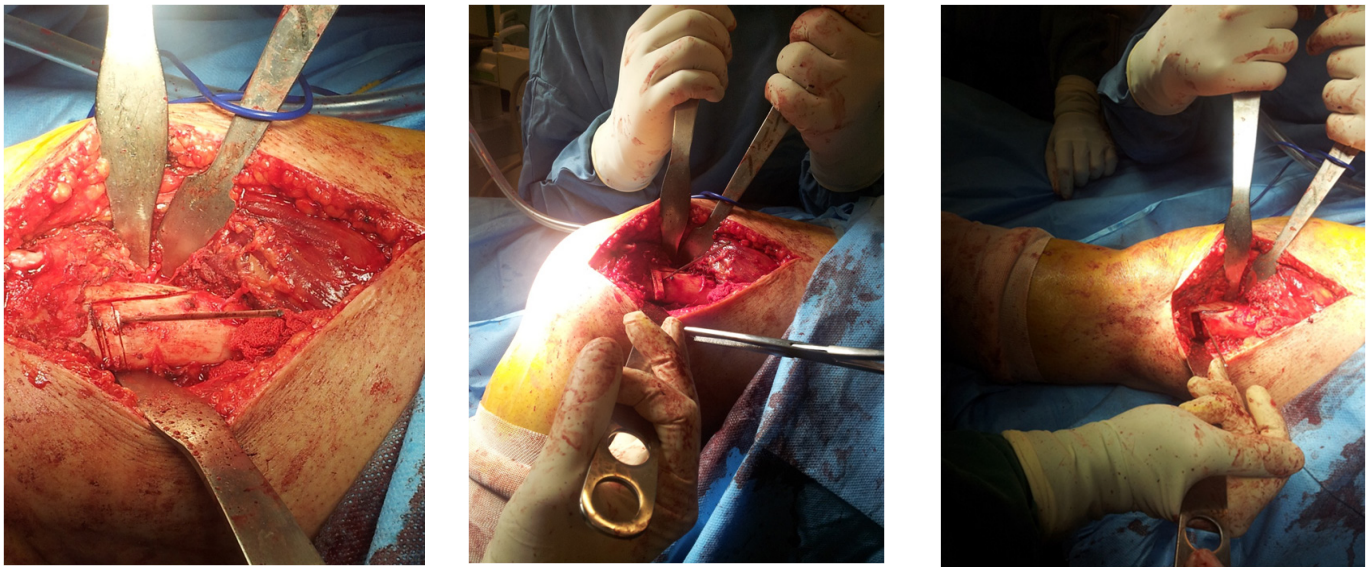

Figure 1. Surgical Procedure; bi-plane osteotomy was made; no bone was resected in the vertical limb of the osteotomy. After opening the site of osteotomy, it is inherently stable rotationally.

analogue scale (VAS) and Lysholm-Tegner knee score.

Methods

Patients

We performed ten biplane distal femur osteotomies on eight patients. All patients were referred to our center because of angular deformity in addition of pain. Radiographs including standing alignment view, anteroposterior (AP), lateral, and patellar views of both knees were taken. The indication for distal femoral osteotomy was determined according to changes in the mechanical medial proximal tibial angle (mMPTA) and mechanical lateral distal femoral angle (mLDFA).

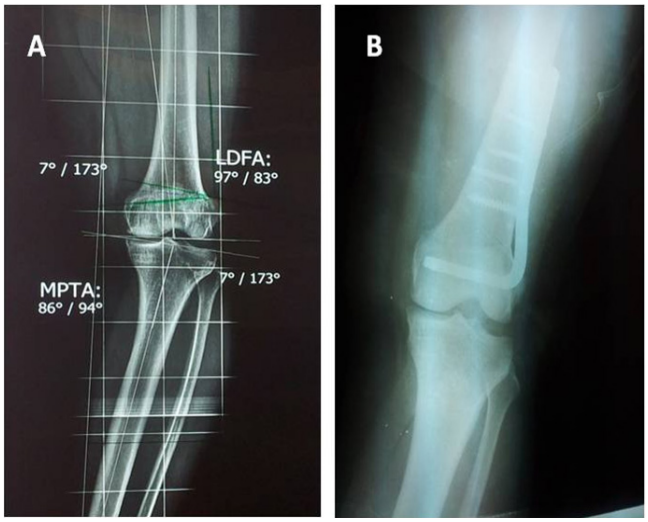

Figure 2. A) pre-op and B) post-op radiographic carachteristics of a patient before and after biplane distal femur osteotomy.

Presence of unicompartment painful knee osteoarthritis being compatible with radiographies was an inclusion criterion. We assessed the patients using visual analogue scale (VAS) and Lysholm-Tegner knee score before surgery and at three month after surgery.

Surgical Procedures

The technique is similar to uniplanar method, but in this type of osteotomy, an ascending bone cut is added parallel to the posterior femoral cortex starting at the lower cut of the osteotomy site. The ascending limb is made 100-110 degrees in the sagittal plane. Because of the anterior femoral bowing, this cut terminates a few centimeters (2-5 cm) proximally and exits through the anterior cortex. By this mean, biplane osteotomy is made in which opening or closing biplanar wedge can be accomplished (2). At last, the osteotomy site was stabilized using fixed angle devices such as 95 degrees angled blade plate. We did not use autograft or allograft for patients with biplanar lateral opening wedge osteotomy [Figure 1].

Evaluation

All patients had a standing alignment view to determine the amount of deformity and correction angles. We considered normal mLDFA equal to 87±3 degrees. Angles smaller or larger than this range indicate valgus or varus deformity of the distal femur, respectively (2).

Visual analogue scale (VAS) is a self-completed measure by patients and comprises a horizontal or vertical 10-centimeter line. Zero means no pain while the worst imaginable pain s scored 10 (9). Lysholm-Tegner knee scale is a 100-point measure and consists of instability, pain, independent walking, swelling, ability of squatting, and stair climbing. Total sore is further subdivided into

Table 1. Factors evaluated in eight patients with bi-plane osteotomy

No	Sex	Age	Side	Follow up (month)	Alignment in Valgus patients (pre-op)	Alignment in varus patients (pre-op)	Alignment in Valgus patients (post-op)	Alignment in varus patients (post-op)	LDFA (pre-op)	LDFA (post -op)	Union (week)	Lysholm-Tegner knee (pre-op)	Lysholm-Tegner knee (post -op)	VAS (pre-op)	VAS (post -op)	Wedge size
1	F	24	R	6	10	-	2		77	89	11	67	85	8	4	8
2	F	26	L	5	8		1		79	88	9	65	82	7	4	6
3	F	21	R	24	12		2		75	89	13	64	92	9	3	12
4	F	21	R	7	6		1		81	88	7	72	90	8	3	6
5	F	35	R	2.5	6		1		81	88	6	77	91	8	4	9
6	F	25	L	2.5	9		1		78	88	10	75	84	9	4	7
7	F	37	R	19	-	8		2	95	85	8	75	90	9	5	8
			L	7	-	6		0	93	87	9	69	92	7	3	10
8	F	33	R	3	-	7		0	94	87	7	72	90	8	4	7
			L	5	10	-	2	-	92	86	12	66	86	9	3	9
Mean		27.75		8.1	8.71	7	1.42	0.66	84.5	87.5	9.2	70.2	88.2	8.2	3.7	8.2
SD		6.34		7.35	2.21	1	0.53	1.15	7.97	1.26	2.29	4.63	3.61	0.78	0.67	1.87

F: Female/R: Right/ L: Left/op: operation/ /VAS: visual analogue score/SD: St. Deviation

four groups of poor (<65), fair (65-83), good (84-90), and excellent (>90) (10).

Results

In this study, eight patients were evaluated. All patients were female. The mean age was 28±6.3. Two patients underwent bilateral osteotomy, four patients on the right and two patients on the left side.

The mean follow up time was 8.1±7.4 months. The mean preoperative mechanical alignment for patients with valgus knee was 8.7±2.2 and the post-operative angle was 1.4±0.53. The mean pre-operative mechanical alignment for patients with varus knee was 7.0±1.0 and the post-operative angle was 0.66±1.2. Pre-operativemean LDFA was 85±8.0˚ and post-operativemean LDFA was 88±1.3˚.

Pre-operativemean Lysholm-Tegner kneescore was 70±4.6 and post-operative mean scorewas 88±3.6. According to preoperative Lysholm-Tegner knee score, nine knees were fair and one was good while six knees were good and four were excellent after surgery.

Mean pre-operative VAS was 8.2±3.6 while it was 3.7±0.67 after surgery. Mean wedge size used during osteotomy was 8.2±1.9 mm.Mean union time was 9.2±2.3 weeks [Table 1].

Discussion

For more than a century, proximal tibia and distal femur osteotomies have been used to correct different types of angular deformities about the knee (11). Bi-plane distal femur osteotomy is a new technique that was developed for lateral compartment osteoarthritis (9).

In this study eight patients with biplanar osteotomy were assessed. Three knees had varus deformity and seven had valgus deformity. Mechanical angles, LDFA, and Lysholm-Tegner knee score were improved in these patients.

Brinkman et al compared the axial and torsional stability of an improved single-plane and a new bi-plane osteotomy technique for supracondylar femur osteotomies. According to their results, both stability and stiffness of the bi-plane technique were higher than single-plane under an axial loads, but they were lower under torsional loading compared to the single-plane technique. Axial stability and stiffness were improved by

the screw configuration modification, but had no effect on torsional stability (9).

The mean wedge size used for bi-plane osteotomy was 8.2±1.9. According to vanHeerwaarden study, bi-plane distal femoral osteotomy creates wider and larger surfaces at the osteotomy site compared to the other techniques (10).

In the available studies we did not find any reported healing problem after bi-plane osteotomy (10, 12). Also, Brinkman et al reported faster recovery of knee performance after type of osteotomy. They encouraged patients to start and increase weight bearing. Moreover, after 6-8 weeks signs of bone healing were observed (9).

According to the post operative results of patients with valgus and varus, it can be concluded that bi-plane distal femur osteotomy is a reliable technique that creates larger surfaces with more stability at the site of osteotomy along with rapid union. Moreover in this technique, suprapatellar fat pad is not damaged which may result inless postoperative pain and better range of knee motion. In addition, the inferiorarm of the osteotomy in the metaphysial region results in faster union.

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