

## RESEARCH ARTICLE

# Distal Femoral Osteotomy in Genuvalgum: Internal Fixation with Blade Plate Versus Casting

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## Abstract

**Background:** To compare the results of two different ways of distal femoral osteotomy stabilization in patients suffering from genuvalgum: internal fixation with plate, and casting.

**Methods:** In a non-randomized prospective study, after distal femoral osteotomy with the zigzag method, patients were divided into two groups: long leg casting, and internal fixation with blade plate. For all patients, questionnaires were filled to obtain data. Information such as range of motion, tibiofemoral anatomical angle and complications were recorded.

**Results:** 38 knees with valgus deformity underwent distal femoral supracondylar osteotomy. (8 with plaster cast and 30 with internal fixation using a blade plate). Preoperative range of motion was  $129\pm 6^\circ$  and six months later it was  $120\pm 14^\circ$ . The preoperative tibiofemoral angle was  $32\pm 6^\circ$ ; postoperative tibiofemoral angles were  $3\pm 3^\circ$ ,  $6\pm 2^\circ$ , and  $7\pm 3^\circ$  just after operation, six months, and two years later, respectively. Although this angle was greater among the group stabilized with a cast, this difference was not statistically significant. In postoperative complications, over-correction was found in five, recurvatum deformity in one, knee stiffness in three and superficial wound infection was recorded in three knees.

**Conclusions:** There is no prominent difference in final range of motion and alignment whether fixation is done with casting or internal fixation. However, the complication rate seems higher in the casting method.

**Key words:** Casting, Distal femoral osteotomy, Genuvalgum, Internal fixation

## Introduction

Proximal tibial and distal femoral osteotomies have been used for several years to correct knee deformities (1-6). These methods for the first time were used by Jackson et al. to treat knee osteoarthritis (3).

The normal anatomical knee alignment is around  $5^\circ$  to  $7^\circ$  of valgus; subsequently, the medial compartment of a normal knee tolerates 60% of the body weight (7). Any changes in the knee mechanical axis can lead to knee articular damage. In varus deformity or medial knee osteoarthritis, the excess pressure is on the medial compartment; thus, proximal tibial wedge osteotomy (medial opening or lateral closing), dome osteotomy or a combination of both could be used for treatment (1, 3, 6, 7). In valgus deformity or lateral knee osteoarthritis, the procedure could be done in a reverse manner (1, 3, 6-10). The purpose of these operations is to transfer the

mechanical axis to the medial side in order to reduce the lateral component pressure; however, it is necessary to stabilize the osteotomy site. Stabilization could be achieved with either internal fixation or casting. Each method has its probable advantages (1). While internal fixation provides stable fixation for early range of motion, casting has the probability of recorection.

In this study, we compared the results of these two different ways of stabilization—internal fixation and casting—after distal femoral osteotomy in patients suffering from genuvalgum.

## Materials and Methods

### Population

In a non-randomized prospective study, 31 patients (38 knees) suffering from genuvalgum were referred to Ghaem Hospital, Mashhad, Iran for distal femoral

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**Table 1. Comparing of femorotibial angle preoperatively and postoperatively in two groups of internal fixation and casting**

Time	Tibiofemoral angle (degree)			P value
	Total	Internal fixation group	Casting group	
preoperative	31.6±5.4	31.7±5.8	30.9±3.8	0.696
Postoperative (after two weeks)	2.6±2.8	2.4±2.7	3.3±3.5	0.482
6 months postoperative	5.5±2.4	5.3±2.2	6.1±3.3	0.422
2 years postoperative	7.2±3.3	6.7±2.9	9.0±4.6	0.088

osteotomy. All the patients were adults and had a femoral-tibial anatomical angle of more than 20°. Patients with more than one compartment involvement, severe degenerative arthritis, restrictions in knee range of motion, inflammatory knee arthritis, and previous history of surgery on affected knee were excluded from our study. All the patients filled out an informed consent, and the Ethical Committee of Mashhad Medical University approved our study. After providing information, patients chose between casting or plating.

#### Data collection

Information such as sex, age, weight, chief complaints, fixation method, degenerative signs, range of motion, tibiofemoral angle, and operation side was gathered before operation. During the follow-up period, data such as alignment, range of motion and complications were recorded three times at two weeks, six months, and two years after operation.

#### Surgical techniques

Knees were divided into two groups: casting and plating. In the casting group, fixation was done after zigzag osteotomy with a long leg cast, and in the other group, fixation was done by a blade plate. In zigzag osteotomy the distal medial femoral cortex was osteotomized in a zigzag line and then the two side of the osteotomy were compacted to gether. We believed that in this manner we would provide more cortical contact for stability and union achievement.

#### Statistical evaluation

SPSS version 16 (SPSS Inc., Chicago IL) was used for descriptive and statistical analysis. To compare two independent means of variables, we used an independent t-test. Non-parametric variables were assessed with the Fisher Exact test and Chi-squared tests. A p-value of less than 0.05 was deemed to be significant.

#### Results

Fixation was achieved in 30 knees (79%) with plating and in 8 knees (21%) with casting. 25 cases were women (81%) and 6 were men (19%) ( $P=0.003$ ). The average age of the patients was  $23\pm 21$  (Ranged, 16 to 55). The mean weight of the patients was  $57\pm 8$  kilograms. The two groups had no statistically relevant difference in age and weight. Operations on the left side were done on 21 knees and on the right side on 17 knees.

Among the patients, the most common chief complaint

was deformity of the limb (29 cases, 76.3%), followed by pain and deformity (five cases in each complaint, 13.2%). Pure pain was expressed as chief complaint in only 4 cases (10.5%). There was no difference between the two groups in regards to their chief complaints ( $P=0.85$ ). Preoperative degeneration changes were detected in 3 knees (7.9%). The average range of motion in all the patients was  $128.7\pm 5.7^\circ$ , while the postoperative range of motion after 6 months was  $119.5\pm 13.6^\circ$ . There was no statistical difference in pre- and post-operation ranges of motion ( $P=0.13$ ).

The preoperative tibiofemoral angle was  $31.6\pm 5.4^\circ$  (ranged, 22 to 37); however, in images taken two weeks after surgery, the angle changed to  $2.6\pm 2.9^\circ$  (ranged, 0 to 8), six months after the operation, it became  $5.5\pm 2.4^\circ$  (ranged, 2 to 16), and two years postoperatively the angle became  $7.2\pm 3.4^\circ$  (ranged, 2 to 17). Although the tibiofemoral angle in the casting fixation group was higher, there was no statistically relevant difference [Table 1].

The average duration of union-time amongst all patients was  $7.7\pm 2.3$  weeks. There was no statistically relevant difference between the two groups ( $P=0.32$ ).

In postoperative complications, overcorrection occurred in 5 knees (13%); among them 3 cases were in the casting group (38%) and 2 in the internal fixation group (7%). The fifteen-degree recurvatom deformity after operation was seen only in one knee (13%) stabilized with a cast. Fixation failure happened only in one case, and a fracture of femoral bone postoperatively happened in just one patient. Knee joint stiffness after the surgery occurred in 3 cases (8%) two were in internal fixation group and one in casting group. Deep infection occurred in 3 patients (8%) in which, two happened in internal fixation group and one in casting group. Neuromuscular complications, deep venous thrombosis, and lung embolism were not reported in our patients.

#### Discussion

Final alignment was favorable in both casting and internal fixation with plate. Casting did not affect the final range of motion. The complication rate, especially for over-correction and recurvatom, was higher in the casting group.

In the total of 31 studied patients, most of the patients were women (81%), with a male to female ratio of 1 to 4.4, which is comparable to other studies (4, 5). May be it is related to more concerns of women to cosmetic appearance. In other studies similar to ours,

the operation was performed on young patients after the closure of the distal femoral physis (4, 5, 10). In the review article of Amendola, it was debated that the patients' most common complication was the limb deformity (1).

In our study the postoperative complications were deformity of the limb in one case and overcorrection in 5, which is the same as other studies (8).

Joint stiffness occurred in only three knees; however, the complication rate was much higher in a similar study done on 21 patients with a 5 year follow-up. They reported 57% joint stiffness, among which 48% of patients suffered from severe stiffness, lead to further manipulation under general anesthesia (2). In addition, the deep infection rate in this study was 25%, whereas in our study the infection rate was just 7.9% (2).

Many studies have evaluated the outcome of femoral supracondylar osteotomy (4, 8-12). In the Puddu et al. study, they compared the different kinds of osteotomies to find out which is more efficient for the valgus deformity, and they suggest that in moderate to severe tibiofemoral angles, distal femoral osteotomy alone is preferable (6). In our study we used this method, and it yielded good results in both groups (no change in range of motion, acceptable alignment and low rate of complications). In the Omidi-Kashani et al. study done in 2005, they evaluated the results of supracondylar osteotomy in genuvalgum with blade plate fixation and they concluded that this method is effective in tibiofemoral correction, which is compatible with our results (5). In the same study done by Wang et al., the result of supracondylar osteotomy on patellofemoral arthritis was evaluated and at the end, they expressed that this method of osteotomy has no effect on severe patellofemoral arthritis (10).

Pach et al. studied the long term influences of supracondylar osteotomy, and their success rate was 95%

in 18-year-old patients(11). In the same study done by Saithna, the success rate of this method was 64% to 82% in 10-year-old patients, and 45% in 15-year-old patients that is compatible with our study in the follow-up period of two years and failure rate of less than 10% (8).

Thein and his partners studied the result of this procedure with fixation by the Puddu plate and they noted that this method is competent and has no significant side effects (9).

Similar to our study, that of Mathew et al. stated that the method of internal fixation with plating was more efficient in the reduction of postoperative complications (4).

There are limitations in our study. Due to ethical concerns, our study set-up was non-randomized. The case distribution in the two groups was unequal and the number of cases was limited to 38 knees. Another limitation was that we did not measure medial proximal tibial angle and lateral distal femoral angle in our patients. We did not use a standard functional test such as Lysholm score as well.

Supracondylar osteotomy is an effective method with few complications used for the correction of knee deformities, especially genuvalgum. There is no prominent difference in final range of motion and alignment whether fixation is done with casting or plating. However, complication rates seem higher with the casting method.

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