

ORIGINAL PAPER

Efficacy of Tibial Proximal Osteotomy in Correction of Lower Limb Alignment Indexes in Patients with Osteoarthritis in Medial Compartment of Knee

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Introduction: Tibial proximal osteotomy is one of the treatments for patients with knee compartment osteoarthritis. Studies showed 80 % good prognosis in five years follow up after osteotomy. Almost always this method is used for pure medial knee compartment osteoarthritis that has a varus deformity. **The aim** of all methods is reforming varus deformity and lower limb alignment to gain 3 to 5 degree extra reformation and take knee in 10 degree valgus. One of the main etiologies for patients inconvenience and no decreasing in their pain is overcorrection or undercorrection, but unfortunately these can't be noticed. Therefore we must make sure that additional stress on the medial joint line was eliminated and regeneration of cartilage was facilitated or at least occurrence of osteochondritis was decreased. So we aimed to determine the efficacy of tibial proximal osteotomy in lower limb alignment indexes in patients with osteoarthritis in medial compartment of knee. **Material and methods:** This study is a clinical trial study that has done in Alzahra University Hospital of Isfahan Medical Science University in Iran since June 2010 till February in 2011. Patients had pain, pure medial knee compartment osteoarthritis and varus deformities were determined for study. Patients who wouldn't come for control, those who had no convenience for giving their data or osteoarthritis of all three compartments were excluded from study. Number of patients has determined 40 persons according to previous studies. Sampling occurred convenient. Before any surgical processes, the AP x-ray radiography was applied for alignment view. The demographic and radiographic data was registered. Six months later we applied AP x-ray radiography again and obtained data and analysis them with SPSS software and T-Paired statistical method. **Results:** The mean of anatomical limb angle before and after surgical process were 5.1 ± 3.4 varus and 11.9 ± 3.4 degree valgus, respectively, so with T-test there was a significant difference between them ($P < 0.001$). The mean of mechanical limb angle before and after surgical process were 12.6 ± 3.4 varus and 4.75 ± 3.5 degree valgus, respectively. Therefor with T-test, there was significant difference between them ($P < 0.001$). **Conclusion:** Results were achieved from this study showed that Tibial proximal osteotomy is appropriate treatment for young and middle age patients with progressive deformity, symptomatic varus knee. **Key words:** Tibial proximal osteotomy, Knee, Osteoarthritis, Varus deformity.

1. INTRODUCTION

The most common deformity in patients with knee osteoarthritis is varus deformity (1, 2, 3, 4, 5). The proximal tibial valgus osteotomy is choice of treatment for young and middle-aged patients with progressive deformity, symptomatic knee varus and mild to moderate osteoarthritis that lead to eliminate pressure on the affected medial knee compartment (3, 6, 7, 8, 9). Some authors have been reported evidence of arthroscopic repair of Fibrocartilage in patients was done proximal tibial osteotomy (3, 10, 11).

Although the natural history of knee varus deformity not well determined, it is widely accepted that patients with severe deformity of knee varus are at risk of progression to severe medial compartment osteoarthritis unless, the normal knee mechanics be modified (1, 3, 9, 12, 13, 14). Most reports have shown about 80% satisfactory results are existed within 5 years follow up (3).

The main complication of this surgery, according to Coventry is return of deformity that leads to revert pain (3, 5, 7, 15, 16). Coventry's findings showed that the risk of failure of surgery increases, if limb alignment is not corrected at least 8 degree of valgus and if the patient is overweight (30% or more over ideal body weight (3, 5, 7,

13). Therefore, accurate measurement of the indicators along the limb before the operation, with performance of standard standing radiographs of the entire limb (alignment view) have a large impact on the detailed plan of action before surgery and increase the success rate of surgery (3, 17). Indicators considerable in this standard radiography are include: The central point of the hip joint, knee joint center point, tibiotalar joint central point, lower limb anatomical axis, lower limb mechanical axis, the femoral anatomical axis, mechanical axis of femur, tibial mechanical axis, anatomical axis of tibia, weight bearing line, medial proximal tibial angle, lateral distal femoral angle and joint line angle (3, 17, 18). In the normal knee, joint surface of tibia's proximal is about 3 degree varus toward mechanical axis and about 9 degree valgus into joint surface of femur's distal (3, 17). In most cases, proximal tibial osteotomy surgery is performed on people who have pure medial knee compartment osteoarthritis and varus deformity (2, 3, 5, 6, 7, 13, 19). There are several surgical procedures for this condition, four basic methods that are commonly used include: 1-medial opening wedge, 2-lateral closing wedge, 3-dome, 4-medial opening hemicallotaxis (1, 2, 3, 13, 20, 21, 22, 23). Anyway, the aims of all these methods of surgery are deformity correction, modification of indicators of lower limb alignment and obtain correction of the excessive valgus (10 degrees) (3, 5, 7, 9, 17). The correction of the deformity should be investigated in the standing long leg radiographs (alignment view) after surgery and mentioned indicators should be compared to each other's to assess deformity correction (3, 17). Alignment view has a large impact on the detailed plan of action before surgery and determining the amount of correction needed (3, 17, 20).

After tibial proximal osteotomy, some of the main etiologies for patients inconvenience and no decreasing in their pain are overcorrection or under correction, but unfortunately these complications don't be noticed. In this study, we aimed to more survey these complications and determine how many suggested alignment gained

in patients who had osteotomy. So we could sure that additional stress on the medial joint line was eliminated and re-generation of cartilage was facilitated or at least occurrence of osteochondritis was decreased. Therefore we aimed to determine the efficacy of tibial proximal osteotomy in lower limb alignment indexes in patients with osteoarthritis in medial compartment of knee.

2. MATERIAL AND METHODS

This study is one clinical trial study that has done in Alzahra University Hospital of Isfahan Medical Science University in Iran since June 2010 till February in 2011. Patients had pain during the weight-bearing activities and sometimes even at rest, pure medial knee compartment osteoarthritis and varus deformities were determined for study. Patients who wouldn't come for control, those who didn't have convenience for giving their data or had osteoarthritis of all three compartments were excluded from study. Number of patients was determined 40 persons according to previous studies, considering the confidence level 95%, test potency 80% and standard deviation of correction of lower extremities mechanical axis angle that was reported in the literature 2.7 degree (20). Sampling occurred convenient. Before any surgical processes, the AP x-ray radiography was applied for alignment view. The indices were calculated from the alignment view, and were recorded in the form. The demographic and radiographic data was registered. Plan of surgery and calculation the amount of correction required were done. Methods of calculation the amount of correction required are including: Minci's method, Dugdale's method and Coventry's method (3,17). In this study the method of Dugdale was used. During surgeries, after tibial osteotomy and at the time of deformity correction with using the alignment rod, weight bearing line was determined. With performance of fluoroscopic C-Arm, desired amount of correction (62.5% from medial side of knee) was done. After that the osteotomy site was fixed with two crossed pins and after closing wound, long leg cast was plastered. Five or six weeks after surgeries, cast was opened

and two pins were removed on an out-patient basis. Then partially weight bearing and joint movement were started, physiotherapy was administered for patients and patients gradually progressed to full weight bearing and range of motion. Six months later, we applied AP x-ray radiography (alignment view) again and obtained data. After completing the information and sample size calculation, data analysis was performed and analysis them with SPSS software and T-Paired statistical method.

3. RESULTS

The study involved 40 patients with medial compartment osteoarthritis of knee that were admitted for tibial proximal osteotomy in Alzahra University hospital in Isfahan in Iran since June 2010 till February 2011. Mean age was 43 ± 13.9 years, with range of 18 to 70 years old and 65% were females. Mean average of men and female were 35.4 ± 17.3 and 47.3 ± 10.3 , respectively. The results did not show significant difference between mean age of men and women ($p=0.07$).

The mean of anatomical limb angle before surgical process was 5.1 ± 3.4 varus and after surgery was 11.9 ± 3.4 valgus, so with T-test, there was significant difference between them ($P<0.001$). Average angle difference before and after surgery was 16.9 ± 0.89 . The mean of mechanical limb angle before and after surgical process were 12.6 ± 3.4 varus and 4.75 ± 3.5 degree valgus, respectively. Therefor according to the T-test, there was significant difference between them ($P<0.001$). Average angle difference before and after surgery was 17.3 ± 4.6 . The mean of medial proximal tibial angle before and after surgical process were 83.8 ± 1.7 and 89.65 ± 2.3 degree, respectively. Therefor with T-test, there was significant difference between them ($P<0.001$). Average angle difference before and after surgery was 5.85 ± 2.9 . The mean of joint line angle before and after surgical process were 5.95 ± 1.8 and 1.7 ± 0.2 degree, respectively. So according to the test, there was significant difference between them ($P<0.001$). Mean angle difference before and after surgery was 5.75 ± 0.43 . The mean of lateral distal

angel	Before surgery		After surgery		P value
	Mean	SD	mean	SD	
Anatomical axis	1/5	4/3	9/11 -	4/3	<0.001
Mechanical axis	6/12	4/3	75/4 -	5/3	<0.001
MPTA	8/83	7/1	65/89	3/2	<0.001
Joint line	95/5	8/1	2-	7/1	<0.001
LDFA	45/96	54/1	5/96	43/1	0.66
WBL	6/29 -	58/8	1/59	67/7	<0.001

TABEL-1: MEAN and standard deviation of the knee joint angles before and after surgery MPTA: medial proximal tibial angle, LDFA: lateral distal femoral angle, WBL: weight bearing line

femoral angle before and after surgery were 96.45 ± 1.54 and 96.5 ± 1.43 degree, respectively. Therefore with T-test, there was no significant difference between them ($P=0.66$). Average angle difference before and after surgery was 0.51 ± 0.05 . Location of weight bearing line toward the central point of the tibial plateau before and after surgical process were 29.6 ± 8.58 and 59.1 ± 7.67 , respectively. So with T-test, there was significant difference between them ($P < 0.001$). Mean angle difference before and after surgery was 88.65 ± 2.58 percentile. All of mean differences are shown in Table 1.

4. DISCUSSION

The goal of study was survey efficacy of tibial proximal osteotomy in correction of lower limb alignment indexes in patients with osteoarthritis in medial compartment of knee. Considering that osteoarthritis of the knee is common problem between forty and sixty years old, especially in our country, because of some of the reasons including issues of nutrition, lifestyle, obesity and lack of knee hygiene, progression of this complication can lead to different deformities and deviation in knee's axis and double patient's problem. Actually, progress of these complications can lead to several difficulties for routine activities and patients walking that they can lead to problems associated with middle aged and old age that will produce. Therefore, correction of these deformities needs considerable assistance and prevents progress of varus knee deformity (1, 3, 9, 12, 13, 14). Also we have to make sure that additional stress on the medial joint line was eliminated and regeneration of cartilage was facilitated or at least occurrence of osteochondritis was decreased and consequently modification of caused deviation and deformities improve life style of patients (10, 11, 20). Most reports have shown

about 80% satisfactory results existing within 5 years follow up (3). Similar to finding of previous studies, there were significant improvements in malalignment after surgery including: anatomical and mechanical limb angles, medial proximal tibial angle, joint line angle and location of weight bearing line toward the central point of the tibial plateau (24, 25). We could obtain similar result because with accomplishment of surgery, knee was preserved; pain decreased, prevented early osteoarthritis and consequently life style improved. However this procedure, like other surgical and orthopedic procedures has complications. The most important complication of tibial osteotomy is recurrence of disease. The disease might return, if angles are not corrected completely. Negative effect of time is seen mostly in knee that surgeon couldn't achieve arbitrary alignment during surgery. In addition, other causes like overweight, foot placement in poor condition and surgeon's skill and techniques are completely efficient in recurrence of disease and recovery after surgery. Result obtained showed tibial proximal osteotomy due to improvement in lower limb alignment indexes especially lower limb anatomical and mechanical axis. Overall; it seems that after selection of patients, the most important affecting factor in long-term results of this operation is alignment obtained during surgery. At the end, results achieved from this study showed that Tibial proximal osteotomy is appropriate treatment for young and middle age patients with progressive deformity, symptomatic varus knee and mild to moderate osteoarthritis of knee that can lead to eliminate pressure on the medial compartment of knee joint and finally improve their life style.

Conflict of interest: none declared.

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