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Correction of Genu Varum Deformity by Proximal Tibial Osteotomy and Gradual Distraction with Dynamic Axial Fixator

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Abstract
Background*: High tibia osteotomy is a common procedure in correcting genu varum deformity. The proximal tibial osteotomy is an accepted and commonly used treatment for younger and active patients with medial unicompartmental osteoarthritis of the knee and varus deformity. The aim is to achieve 2-8 degree of valgus over correction and to achieve good long-term outcomes.****Materials and Methods:*** *A prospective analysis was performed on patients treated with high tibial osteotomy using dynamic axial fixator for tibiavarum deformity in our hospital from August 2015 to October 2017. There were 6 cases [7 knees] including 4 males and 2 females.Unilateral external fixator (dyanamic axial fixator) was placed on the medial side. In all cases incomplete percutaneous oblique infratubercle osteotomy was done. The osteotomy was gradually distracted using the fixator to achieve correction of deformity.****Results:*** *Correction of deformity was achieved in all patients without any major complications.****Conclusion:****Distraction of infra-tubercle osteotomy using dyanamic axial fixator for correction of genu varum by high tibial osteotomy gave good results in all the knees with the advantage of modifying the degree of correction.*

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I. Introduction

High tibia osteotomy (HTO) is intended to transfer the mechanical axis from medial to slightly lateral to the midline of the knee to decrease the load and subsequently delay osteoarthritis (OA) [(1-3)]. Some studies showed that regenerative process began after realignment [(3-5)].

HTO was considered as an option to treat an isolated medial compartment OA in varus knees, which was reported by Jackson in 1958[(6)].This surgery was not popular until Coventry reported good results in 1973[(2)]. HTO became more popular in young active patients after improvement in surgical technique, fixation devices.

External fixators can be used to treat varus deformity of the knee. If the changes are isolated to the medial compartment, high tibial osteotomy (HTO) can provide symptom relief, mechanical realignment and is associated with a survivorship of approximately 80% at 5 years and 60% at 10 years[(7–14)].

High tibial osteotomy is an accepted treatment for unicompartmental osteoarthritis of the knee. Conventional laterally based closing wedge osteotomy can be a demanding procedure with potiential for complication such as peroneal nerve palsy, over or under correction of the deformity, compartment syndrome, infection and intra articular fracture. Opening wedge high tibial osteotomy using external fixator is an alternative that may have advantages in comparison with classic methods. The aim of the current study was to assess the effectiveness of opening wedge osteotomy using hemicallotasis technique with the dynamic axial fixator.

II. Materials And Methods

Inclusion criteria includes young patients with isolated, symptomatic, medial compartment osteoarthritis of the knee with varus alignment. Only 1 patient in our series was a young girl aged 16 years who had severe tibia varum. She was having unexplained medial sided bilateral leg pain inspite of her young age and also wanted the deformity to be corrected for cosmetic purposes. Metabolic causes of tibia varum was excluded by investigations. The other patients were all active patients in the age group of 40-50 years who did not wish to have an arthroplasty, had good range of motion of the knee and were ligamentously stable. Exclusion criteria includes lateral compartment osteoarthritis, symptomatic patellofemoral compartment osteoarthritis, neutral or valgus knee alignment, femoral deformities and inability of the patient to manage an external fixator.

A prospective analysis was performed on patients treated with proximaltibial osteotomy for genu varum deformity in our hospital performed by authors from August 2015 to October 2017. There were 6 cases [7 knees] including - 4 males and 2 females and -4 right and 3 leftknees . They were reviewed clinically and

radiographically. The primary diagnosis was medial compartment degenerative osteoarthritis of the knee in all patients except for the one patient mentioned previously. All patients required angularcorrections in the coronal plane to shift the weight-bearing line into the lateral compartment of the knee. None of them had a significant deformity in the sagittal and transverse plane.

Preoperative planning was done on all patients. Long-leg standing anteroposterior radiographs with patella facing forward were obtained, and the mechanical axis of the lower limb was drawn on the radiograph. Dror Paley malalignment test was done on the xrays to ensure that the deformity was only in the tibia. The fixator was applied in the operating room with the patients under regionalanesthesia. In all cases Pitkar dynamic axial fixator for high tibial osteotomy was used. This fixator (Fig.2) has a transverse clamp connected by a ball and socket joint to the longitudinal clamp. 2 conical Schantz screws (pins) were inserted into the anteromedial surface of proximal tibia through the proximal transverse clamp of the fixator. It is important to ensure that the first Schantz screw is placed as posterior as possible close to the posteromedial border of tibia so that there is place for a second parallel Schantz screw. The proximal two pins must be parallel to the knee joint. 2 conical Schantz screws are applied through the longitudinal clamp on the anteromedial surface. These pins must be perpendicular to the mechanical axis of the tibia. Fibular osteotomy was not done. Incomplete infratubercle osteotomy through a 1 cm longitudinal incision was done directed obliquely from below the tibial tubercle towards the head of fibula (Fig.2). The lateral cortex of tibia is kept intact. The fixator is applied and distraction of the osteotomy is done to check whether the osteotomy is distracting and whether desired correction could be achieved . The osteotomy is recompressed and the fixator is locked. After 1 week distraction of the osteotomy was begun at the rate of 1 mm day divided into 4 times / day. The patient was asked to review every week when xrays were done. Distraction was stopped once the mechanical axis of the limb passed through the Fujisawa point (lateral edge of the lateral tibia spine) or a tibiofemoral angle of 7 degrees of valgus was achieved . Usually 25 to 30 mm (25 to 30 days) of distraction was required to correct the mechanical axis. The fixator was retained for 2 months after distraction was complete usually by which time adequate healing of regenerate occurs. Patients were subsequently followed up after removal for loss of correction and functional outcome.

Fig-1 Pre-op

Fig-2 Intra-op

Fig-3 immediate post-op

Fig-4 6weeks follow-up

Fig-5 2Months follow-up

Fig-6 3Months follow-up

Fig-7 post-op removal

III. Results

6 knees underwent correction for medial compartment osteoarthritis. The mean age of these 6 patients were 47 years. In one young girl aged 16 years, deformity was corrected mainly for cosmetic purposes and the same patient had unexplained medial sided leg pain. The mean tibialvarus was 13 degrees (range : 12-15 degrees). The mean degree of correction achieved using dynamic axial fixator was 22 degrees. The mean duration of distraction was 26 days and mean duration to removal of fixator was 94 days. None of the patients

had any major complications. 2 patients had a superficial pin tract infection of the distal pins which subsided with antibiotics. In all cases good regenerate formed. There were no cases of non-union or loss of correction due to collapse of regenerate.

IV. Conclusion

Correction of tibialvarus deformity can be effectively achieved by an incomplete oblique infra-tubercle proximal tibial osteotomy and distraction of the osteotomy by using the dyanamic axial fixator. This method allows fine-tuning and adjustments of correction so that perfect mechanical axis can be restored.

V. Discussion

Two techniques are available to correct tibial deformities: corrective osteotomy and internal fixation (COIF) or gradual correction by corticotomy and use of an external fixator. Although COIF is usually better tolerated by patients and requires less frequent follow-up and radiographic evaluation, the deformity correction cannot be changed postoperatively. In contrast, **external fixator allow dynamic postoperative corrections.**These are useful because slow correction allow soft tissues to adapt, angular and translational corrections are possible, and adjustments can be made to achieve a more mechanically favourable alignment postoperatively. In 2 of our patients valgys overcorrection was done by distraction. The distraction was reduced to restore desired correction. This is not possible with corrective osteotomy - either medial opening wedge or lateral closing wedge and internal fixation. One final potential advantage of using an external fixator is that since osteotomy is made distal to the tibial tubercle the **patellofemoral mechanics remain unaltered**. Since the distraction of the osteotomy resembles aopening wedge fibula osteotomy is not required.

The time from fixator application to the start of correction on average was 8 days. This is similar to the findings in other studies that describe osseous correction techniques using an external fixator(15-19,20–22) The time to correction ranged from 7 to 25 days. The amount of deformity did not always correlate with the time to correction. The time in the fixator ranged from 12 to 15 weeks (average 13 wk). Again, there was no specific correlation between the size of the deformity and the total time in the fixator

The major effect of hightibial osteotomy is mechanical[(26)]. Studies show a relationship between outcome and alignment, but there is no agreement concerning optimum alignment[(27)] Calculation of the tibiofemoral angle was used in this study because of its simplicity and widespread use as a method of expressing alignment[(23,24)]. According to Kettelkamp et al[(25)]the normal tibiofemoral angle is 175° or 5° valgus on weightbearing films. Bauer recommended a postoperative tibiofemoral angle of 177° to 164° (3°–16° valgus)[(23)]. Coventry et al[(28)] consider the normal tibiofemoral angle to be a valgus deviation of 5° to 8° (175°–172°) and recommend overcorrection of 5°, with the objective of osteotomy a valgus deviation of 10° to 13° (170°–167°). Kettelkamp et al[(25)] recommended 5° valgus (175°) correction. In our study we aimed to achieve postoperative alignment of 170° ± 5°. In some of our patients especially in the younger girl where exact alignment was required, standing lower limb xrays were taken to ensure that the mechanical axis passed through the Fujisawa point. In other patients the tibiofemoral angle was used to assess correction

Complications included those that are common to any external fixation device. Pin-tract infections were seen in 2 of the 7 patients. This rate is comparable to those in other studies using Ilizarovfixators(21,22,29,30) both the patients were treated with antibiotics and appropriate pin care.

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