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Medial open wedge osteotomy using puddu plate for unicompartmental osteoarthritis of knee

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Abstract

Introduction: Osteotomies around the knee have had a significant complication rate in the past and many surgeons abandoned these procedures although the favourable long term results were well known. The main problems were the intraoperative choice of the correction angle and the risk of a postoperative loss of correction. After many years of closed-wedge osteotomy, open wedge valgization osteotomy has become popular.

Methodology: This is a prospective study of patients who attended the orthopaedic out patient clinic in our hospital between September 2010 to October 2012. The patients were evaluated by clinical examination and weight bearing radiographs.

Results: Of the 13 knees operated, 4 had excellent outcome, 5 had good outcome, 2 had fair and 2 had poor outcome.

Conclusion: Future Total knee replacement will not be a problem as the bone stock is preserved.

Keywords: Osteoarthritis, Knee Joint, Open wedge osteotomy

Introduction

Worldwide one out of four human beings had already developed or will develop osteoarthritis in the future. In 2020, osteoarthritis will rank number four for reasons for permanent invalidity worldwide. About one third of the patients scheduled for total joint replacement of the knee are potential candidates for an osteotomy.

The fundamental principles of osseous deformity correction were defined by Friedrich Pauwels in 1964 ^[1] and Paul Maquet in 1976 ^[2]. Since then, many techniques have been developed for osteotomies around the knee. Mark Coventry published his technique for closed wedge osteotomy in 1965 ^[3], which became the gold standard for many years. The success of an osteotomy around the knee depends on the biomechanics of the lower extremity, Wolff's law of continuous transformation of bone under stress, load distribution in knee and also on the mechanical property of the implants used for osteotomy fixation.

Osteotomies around the knee have had a significant complication rate in the past and many surgeons abandoned these procedures although the favourable long term results were well known. The main problems were the intraoperative choice of the correction angle and the risk of a postoperative loss of correction. After many years of closed-wedge osteotomy, open wedge valgization osteotomy has become popular.

The experience and the development of new techniques for axis correction around the knee have led to its revival. 90% of all osteotomies around the knee are for valgization of tibia (high-tibial osteotomy = HTO). Whereas in the past closed-wedge osteotomy from the lateral side with fibula osteotomy was the gold standard in many countries; and in 1990s fixation plate by Puddu came to vogue. This procedure looked very attractive to many surgeons because of the small incision and the simple surgical steps. Open-wedge osteotomy of the tibia can be performed without bone grafting or bone substitution in most cases.

In this study we analyse the outcome of open wedge osteotomy in patients having uni compartmental osteoarthritis with genu varum using the puddu plate.

Methodology

This is a prospective study of patients who attended the orthopaedic out patient clinic in our hospital between September 2010 to October 2012. The patients were evaluated by clinical examination and weight bearing radiographs. The patients who were found to have

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unicompartmental osteoarthritis with knee pain not relieved by conservative management and who satisfy the inclusion criteria were selected.

The patients were explained about osteotomy and its advantages and disadvantages were discussed. Those patients who were willing for the procedure were selected and their consent obtained.

Pre-operative planning is done by Miniaci method and pre-operative evaluation by Visual Analogue pain scale, Knee society knee scale and Japanese Orthopaedic Association Knee rating scale (See Appendix).

High tibial opening wedge osteotomy is done using Puddu plate (10 mm or 12 mm) according to the desired wedge to be created. The surgical steps are as described before. Bone grafting was done in one patient and in all other eleven patients, bone grafting was not done.

Results

Opening wedge osteotomy using puddu plate was performed in thirteen knees of twelve patients with minimum age of 35 and maximum age of 54 and the average age is 41.8 years. All the patients were followed up between 6 months and 28 months and the mean followup is 18.6 months.

Patients were analysed for any complications and their functional outcome was compared with their previous status.

Relation between BMI and outcome

The minimum BMI (Body Mass Index) was 21.5 and the maximum 36.5. One patient was severely obese, two patients were moderately obese, five patients were overweight and four patients had normal weight. The average BMI was 27.8.

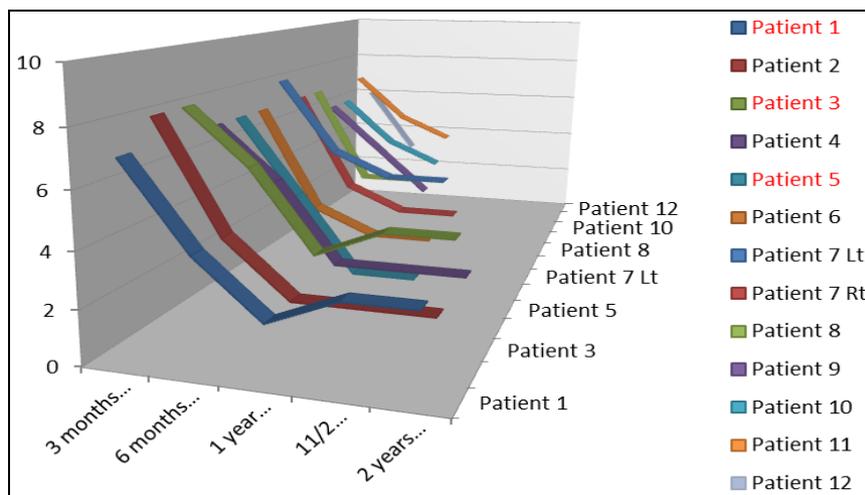
The three patients in the obese category were marked in red in the above figure of the three patients, one severely obese had poor outcome, other one had fair and the third person had excellent outcomes.

Complications

Two patients had superficial infection and one patient had hardware prominence causing pain and one patient had under correction of varus.

The patients with infection were treated with appropriate antibiotics and regular dressings. They were followed up closely and their implants were removed after 6 months. Subsequently they were followed up. One patient had hardware prominence causing anterior leg pain and the implant was removed in her after 6 months. One patient had under correction of varus but he is followed up closely as he was not willing for another correction.

Visual Analogue Pain Scale



The names of the patients with complications are marked in red colour. These patients had fair pain relief and all other patients had good relief. It is to be noted that the patients had maximum pain relief only after 1 year which could be correlated to the time for cartilage regeneration.

Japanese Orthopaedic Association Knee rating Scale

Of the 13 knees operated, 4 had excellent outcome, 5 had good outcome, 2 had fair and 2 had poor outcome.

The poor result of one patient is correlated to superficial infection and the other patient due to inadequate correction. Also to be noted is the scoring improved upto 1 year and thereafter it remained a plateau.

The knee scores were excellent in 2 knees (15%), good in 7 knees (62%), fair in 2 knees (15%) and poor in 1 knee (8%).

The function scores were excellent in 4 knees (31%), good in 5 knees (38%), fair in 4 knees (31%) and no poor outcome.

Bone grafting

Bone grafting was done in one patient only. All other 12 knees were not grafted.

Patient in whom grafting was done



Patient in whom bone grafting was not done



Immediate post op



6 months



12 months



20 months

In all the knees the early signs of bone consolidation starts by 3 months and by 1 year they cover most of the wedge and consolidation was evident.

Discussion

In medial compartment osteoarthritis due to shifting of the weight bearing on the medial side of the knee will result in more cartilage destruction and subsequently varus deformity. Therefore, a unicompartmental knee replacement will not correct the alignment. A corrective osteotomy to alter the weight bearing axis will be ideal to slow down the degenerative process^[4, 5]. Many studies including one by Khan *et al.* have stressed the effect of local alignment on osteoarthritis occurring in respective compartments after analysing 306 patients and 608 knees^[6]. They have found that one degree increase in varus angle was associated with increased risk of having medial compartment disease^[7]. Raymond H.Kim has stated osteotomy as a reasonable option to treat active, physiologically young patients^[8]. Although age is not a definitive criteria, the patients must be active enough to undergo rehabilitation and have good bone quality. Body weight is definitely an independent risk factor for complications.

Song *et al.* have analysed the complications of 104 lateral closing wedge and 90 medial opening wedge osteotomies and stated that the latter had slightly lesser complication^[9]. Luites *et al.* stated that both types of osteotomies had equal fixation stability, pain relief and certainly improved knee function, although the intended correction was achieved more likely with medial opening wedge technique^[10].

Initially, a number of plates were used and later locked plates came into being. Kolb *et al.* have analysed good results with locked low-profile plates. They have analysed 51 medial open wedge osteotomies and found that 50 osteotomies healed in an average period of 3 months without bone grafts and had excellent grading in 57%, good in 24% patients by one rating system and 18% excellent, 63% good by another rating system^[11]. Brouwer *et al.* have used the puddu plate for opening wedge osteotomy and compared it with staples for closed-wedge osteotomy in overall 92 patients and have found that pain caused removal of puddu plate in 60% patients and removal of staples in 23% patients which is a significant difference. They have stated that closed wedge osteotomies have more accurate correction but both types have equal functional outcome at the end of 1 year^[12].

Sen *et al.* and Esenkaya *et al.* have used puddu plate and plates

with wedges respectively and showed that these plates provided better stabilisation to maintain the wedge and early mobilisation. Sen *et al.* assessed 65 knees with osteotomies and found that it resolves pain and improves knee function significantly. But he has stressed that long term studies are required in elderly patients to know whether the results are satisfactory^[13].

Koshino *et al.* have studied the effectiveness of high tibial osteotomy by the use of porous hydroxyapatite as a wedge and have stated to have good results and prevents collapse, but this study is not a comparative study. Bone grafts and substitutes are usually not necessary and we have observed that, all the patients in our study without bone grafting had good consolidation^[14].

Conclusion

- The results are evident and maximal at 1 year.
- Bone grafting is not necessary for this procedure.
- No hazardous complications occur in these patients.

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