

# Autologous Bone Grafting and Revision Plating in a Case of Persistent High Tibial Osteotomy Non-Union

Tan Shi Ming<sup>1</sup>, Wong Merng Koon<sup>1</sup>

## What to Learn from this Article?

HTO non-union can be successfully treated with revision plating and autologous bone grafting with the main objectives of restoring alignment, preserving bone stock and effecting bone healing.

## Abstract

**Introduction:** Uni-compartmental knee arthritis may be treated with several surgical options including uni-compartmental knee arthroplasty, total knee arthroplasty and high tibial osteotomy. Non-union is a well-established and common complication that may arise from the latter option and few reports have shown successful treatment of persistent non-union of high tibial osteotomy.

**Case Presentation:** We present a case of persistent non-union after high tibial osteotomy treated with autologous iliac crest bone grafting and revision plating. At 1 year post-operative interval, successful union was achieved after revision internal fixation. In addition, a good functional outcome was achieved.

**Conclusion:** In this patient with persistent non-union following high tibial osteotomy, the aim of revision was to restore alignment and effect bone healing while preserving adequate tibial bone stock. Revision plating with autologous bone grafting is a good surgical strategy in the treatment of persistent non-union with hardware failure.

**Key Words:** High Tibial Osteotomy, Non-union, Bone Graft, Revision

## Introduction

Uni-compartmental varus osteoarthritis in young and active patients has always proven to be a surgical challenge. High tibial osteotomy has become a widely accepted extra-articular, biological option with high survival rates at 5 year and good functional outcomes [1]. The theoretical advantages of opening wedge high tibial osteotomy include greater precision in intraoperative angular correction, obviation of need for lateral dissection and fibular osteotomy with reduced risk of common peroneal nerve palsy, a less invasive surgical approach and absence of lateral knee instability. Despite these advantages, several authors have reported complications associated with opening wedge high tibial osteotomies [2-8], including infection, deep vein thrombosis, lateral tibial plateau fracture, common peroneal nerve palsy, non-union, delayed union, loss of correction and vascular injuries. The incidence of non-union after HTO has been reported to be as high as 5.7% [9, 10]. In this report, we highlight the treatment of persistent non-union in a high tibial osteotomy case

with the use of autologous bone grafting and revision plating.

## Case Presentation

A 53-year-old Chinese lady, with a history of hypertension, diabetes mellitus and chronic depression, presented with an 8 month duration of severe medial right knee pain associated with varus knee deformity. Pain was exacerbated on walking and standing. She was initially treated conservatively with a course of non-steroidal inflammatory drugs, intra-articular visco-supplementation, physiotherapy and weight loss regime. Despite a two-year trial of non-surgical therapy, she continued to experience a deterioration in her symptoms with limitation of her functional status requiring a quadstick as a walking aid. Clinical examination revealed bilateral genu varum. Range of motion was limited to 0 to 110° with no fixed flexion deformity found bilaterally. Significantly, there was medial joint line tenderness and absence of lateral joint line and patellofemoral tenderness. Minimal effusion was found in the right

## Author's Photo Gallery



Dr. Tan Shi Ming



Dr. Wong Merng Koon

<sup>1</sup>Department of Orthopaedic Surgery, Singapore General Hospital, Singapore.

### Address of Correspondence

Dr. Tan Shi Ming,  
Blk 310A Ang Mo Kio Ave 1 #04-387 Singapore 561310.  
E-mail: tshiming@hotmail.com

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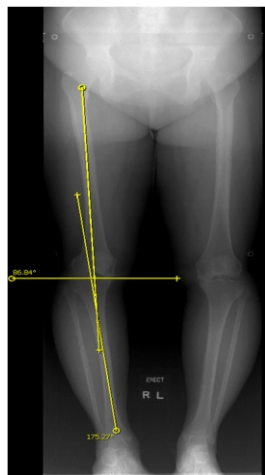
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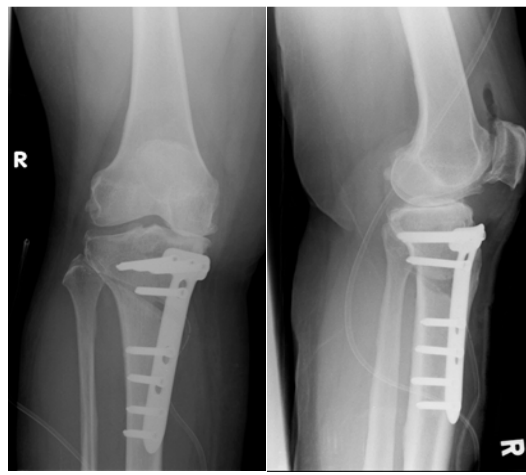
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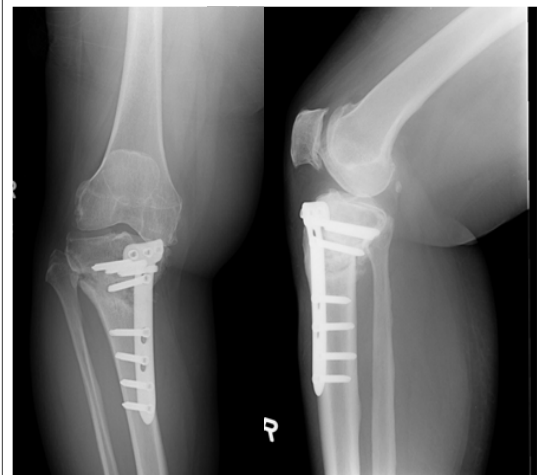
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**Figure 1:** Weight-bearing long limb films. Femoral-tibial angle measured was 175° and anatomical distal femoral angle was 86°.



**Figure 2:** Post-operative radiographs. Tomofix plate used for fixation.



**Figure 3:** Radiographs at 8 month post-operation showing non-union.

knee. No limb length discrepancy or varus knee thrust was found. Bilateral weight-bearing knee and long limb radiographs were performed (Fig. 1). Significant medial compartment radiographic osteoarthritic changes were noted in the right knee, corresponding to Kellgren-Lawrence grade 3 osteoarthritis. These changes included loss of medial joint space, varus knee deformity and the presence of marginal osteophytes. The femoral-tibial angle measured was 175° and the anatomical lateral distal femoral angle was 86°.

We performed a diagnostic knee arthroscopy and then proceeded to an opening wedge high tibial osteotomy using the Tomofix plate after a failed two year trial of conservative therapy (Fig. 2). Arthroscopic findings include medial compartment Outer bridge grade 4 lesion with degenerate radial tear of the posterior horn of the medial meniscus. The lateral compartment had no cartilage or meniscal tear. Intra-operative correction with the opening wedge osteotomy was guided with the use of radiographic imaging. Post-operatively, she was started on a rehabilitation programme, progressing to partial weight bearing at about 6 weeks.

However, she continued to experience pain over the osteotomy site up till 6 months post operatively. Pain was exacerbated on standing and ambulation. Repeat radiographs showed minimal callus formation over previous osteotomy site (Fig. 3). She was treated conservatively with continued protected weight bearing. However, her symptoms deteriorated and she

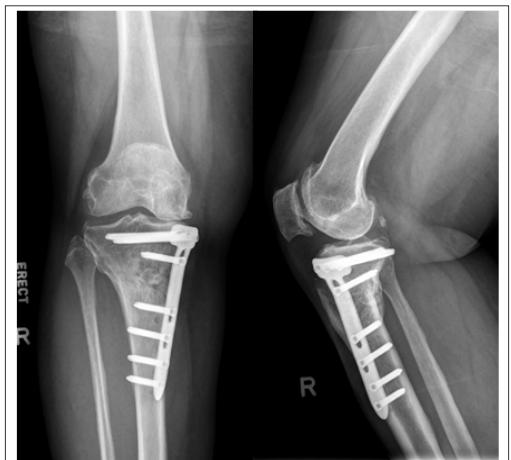
developed a fix flexion deformity of her right knee. A computed tomogram performed 8 month postoperatively revealed non-union of the osteotomy site with hardware failure and loss of correction (Fig. 4). Three proximal screws were broken and 1 screw had back-out. The proximal tibia was angulated laterally in varus and anteriorly increasing the tibial plateau slope. Inflammatory markers were not elevated.

The patient subsequently underwent revision plating with autologous bone graft. The surgical approach was similar to the index surgery. Intra-operatively, findings were consistent with CT scan results. The screws were completely removed together with the Tomofix plate. Bone edges were freshened and the alignment was corrected under radiographic imaging guidance. Autologous cancellous iliac crest bone grafts were harvested and compacted into the osteotomy site. A proximal tibial locking plate was placed on the posteromedial aspect and locking screws were used to secure the fixation. The previous plate was medial. Intraoperative cultures sent were negative for infection.

Post-operatively, the patient progressed from non-weight bearing to partial weight bearing at 3 months and full weight-bearing at 6 months post-operatively. She no longer experienced pain at the osteotomy site and repeat radiographs performed at 1 year post-operatively showed union (Fig. 5). She was able to ambulate without any walking aids and no longer has any limitations in her daily activities.



**Figure 4:** Radiographs at 8 month post-operation showing non-union



**Figure 5:** Radiographs at 1 year post-operative interval show radiographic union.

### Discussion

Non-union is an uncommon complication associated with opening wedge high tibial osteotomy [5,7,9,10]. Some authors have advocated non-operative treatment with a regimen of protected weight bearing to achieve union. In a study by Martin et al [11] looking at the adverse events following high tibial osteotomy, 3.2% (10/317) of cases were complicated by non-union (defined as absence of radiographic non-union at 6 months) and 1% of cases had hardware failure and loss of correction. In this retrospective review, non-operative treatment with continued protected weight bearing regimen was able to achieve union in 7 out of 10 patients. Three patients underwent revision surgery for aseptic non-union with the use of either autologous iliac crest bone grafting or allograft. All 3 patients had further supplementation either with BMP-2, BMP-7 or platelet-rich plasma. Active smokers were found to have a higher rate of non-union (4.8%) as compared to ex-smokers (4.3%) and non-smokers (2.4%) while diabetic patients were also found to have a higher rate of non-union (16.6%) than non-diabetic patients (2.6%).

Various surgical options have been utilized in the treatment non-union after high tibial osteotomy including internal fixation with bone grafting [10,12], external fixation with grafting including the use of Ilizarov external fixator [13-15] and staged total knee arthroplasty [16].

In a high tibial osteotomy, the metaphyseal location of the non-union site makes the achievement of stable fixation difficult because of the transverse plane of the non-union and a small proximal fragment. A major disadvantage of utilizing external fixation is the inability to provide adequate rotational stability as the small proximal fragment has little room for multiple Steinman

pin fixation. Furthermore, external fixation may introduce pin site infections, potentially converting an aseptic non-union to a septic non-union. A 3rd disadvantage would be the loss of correction with pin-site loosening.

Wolff et al in his series of 6 cases reported successful outcomes with the use of internal fixation and bone grafting. Internal fixation obviates the need for pin sites and reduces the risk of infection and chronic osteomyelitis. With the primary goal of effecting bone healing over the non-union site and preserving tibial bone stock for a subsequent total knee arthroplasty, internal fixation with bone grafting provides a very good option in achieving these aims.

### Conclusion

Our patient experienced persistent non-union despite conservative measures, thus, in our case the aim of the revision with internal fixation using a proximal locking plate was to restore alignment and effect bone healing. Tibial bone stock had also been preserved. Additionally, she was able to achieve a good functional outcome. Revision plating with autologous bone grafting is a good surgical strategy in the treatment of persistent non-union with hardware failure.

### Clinical Message

Persistent non-union following a high tibial osteotomy presents a unique surgical challenge. With wide ranging considerations including achieving union and restoring alignment while preserving bone stock, revision plating with autologous bone grafting remains a key strategy in treating such cases.

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