Case 32: Acute Correction of Tibial Deformity and Plate Fixation, with Subsequent Lengthening Over Plate

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Contents

Abstract

The use of circular external fixator for gradual correction of distal tibial deformity associated with hypertrophic nonunion has been a successful technique (Saleh M, Royston S, J Bone Joint Surg Br 78(1):105–109, 1996). Due to inconvenience of the external fixator, a more convenient fixation method could be used in carefully selected cases (McKee MD, Yoo D, Schemitsch EH, J Bone Joint Surg Br 80:360–364, 1998). Provided that the resultant leg length discrepancy after treatment is less than one inch and is acceptable by the patient, then acute correction of the deformity and fixation by a locked compression plate has been successful with gratifying results to both the patient and surgeon (Helfet DL, Jupiter JB, Gasser S, J Bone Joint Surg Am 74(9):1286–1297, 1992; El-Rosasy MA, El-Sallakh SA, Strateg Trauma Limb Reconstr 8(1):31–35, 2013). In this case fixator-assisted correction of a hypertrophic nonunion with deformity was done followed by plate insertion. Staged lengthening over the plate was performed with a monolateral frame. Two examples of integrated fixation techniques (fixator-assisted plating and lengthening over a plate) were combined in the treatment of this patient.

1 Brief Clinical History

The case of a 29 year old male patient is being presented. He had previous surgery, limb lengthening to increase stature; however, premature removal of the external fixator led to distal tibia regenerate fracture and valgus deformity of the distal tibia. Due to lack of proper fixation, a stiff and hypertrophic nonunion resulted, and this was how the patient presented to us.

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Fig. 1 (**a**, **b**) Preoperative clinical photos show angular deformity of the lower leg due to fracture of a lengthening regenerate. (**c**, **d**) Preoperative X-rays show hypertrophic nonunion of the lower third of the tibia with medial angulation

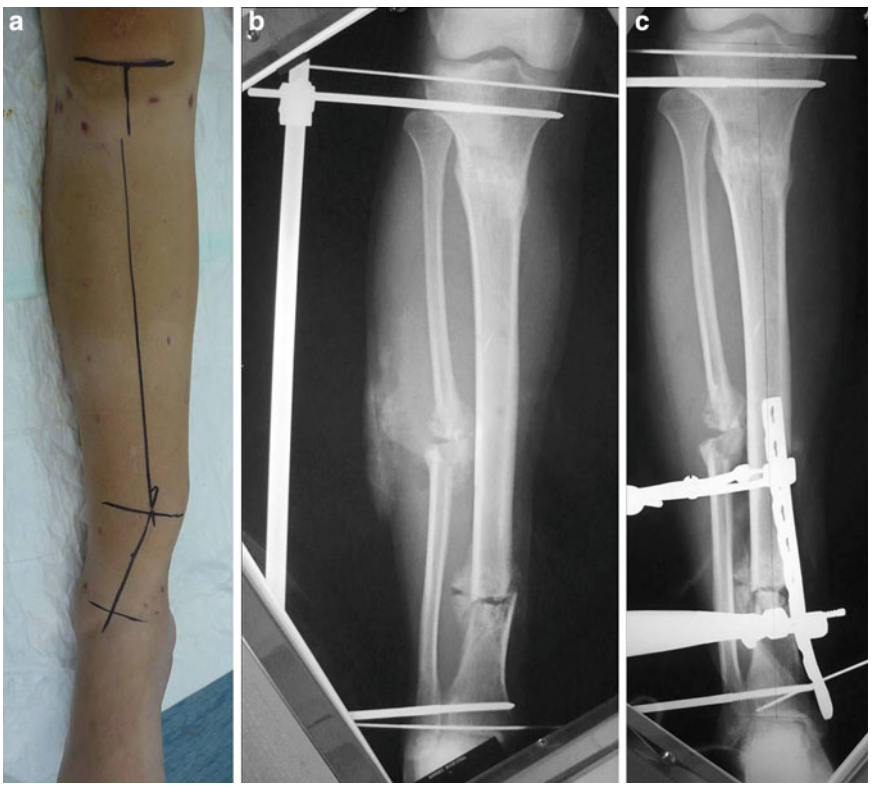

Fig. 2 (**a**) Intraoperative photo shows the planning of deformity correction. (**b**) Intraoperative radiograph after application of the temporary monolateral external fixator to hold the correction after osteotomy through the apex of the deformity. (**c**) Radiograph after deformity correction and preliminary application of a pre-contoured locked compression plate (*LCP*)

Fig. 3 (**a**, **b**) Immediate postoperative radiographs show the restoration of the mechanical axis and fixation with an LCP

2 Preoperative Clinical Photos and Radiographs

See Fig. 1.

3 Preoperative Problem List

1. Stiff nonunion of the tibia with deformity.
2. The patient cannot accept another treatment using circular external fixator due to his previous experience with the device.
3. Expected leg length discrepancy of about 2 cm after deformity correction.

4 Treatment Strategy

The treatment strategy was to acutely correct the deformity using a temporarily applied external fixator to hold the correction during plate application. The external fixator is removed at the end of the procedure. A neutral wedge osteotomy is adopted to have good bone contact and minimize soft tissue stretching. In the follow-up, the patient

Fig. 4 (**a**–**d**) Follow-up radiographs and clinical photographs after consolidation of the nonunion and restoration of limb alignment

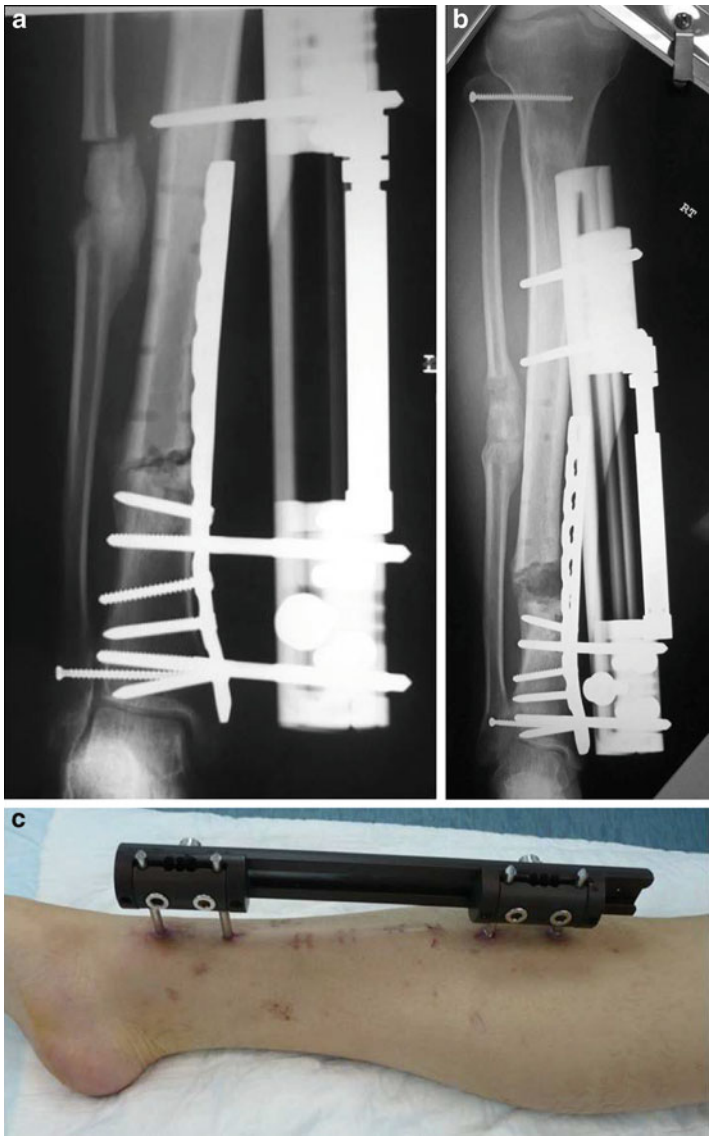

Fig. 5 (**a**, **b**) Radiographs show the application of a monolateral external fixator for tibial lengthening over plate after unlocking of the proximal screws and temporary fixation of the proximal and distal tibiofibular joints by percutaneously inserted cannulated screws to avoid tibiofibular dissociation. (**c**) Clinical photo shows the application of a monolateral external fixator (Orthofix LRS system) for distraction of the osteotomy

requested to correct a residual LLD of 2 cm, and then the plan was to do tibial lengthening over plate after application of a monolateral external fixator, unlocking of the proximal screws through stab incision over the head of each screw, and tibial lengthening osteotomy. After equalization of leg length, the screws were relocked at the end of distraction phase and the fixator was removed.

5 Basic Principles

1. Preservation of the soft tissue envelope and limitation of bone resection to minimum.
2. Careful application of a pre-contoured plate to avoid loss of reduction.
3. Avoid contact between internal and external fixation.
4. External fixator placement in a manner that does not interfere with insertion of subsequent internal fixation.

6 Images During Treatment

See Figs. 2, 3, 4, and 5.

7 Technical Pearls

The half-pins of the external fixator have to be inserted parallel to the joint line on the side opposite to plate insertion. The excess bone is shaved off the medial surface of the tibia and used as a local autograft to fill any resultant

Fig. 6 (**a**, **b**) After achievement of the desired leg length, the proximal screws were relocked, the fixator was removed, and the tibiofibular transfixion screws were extracted. The tibial and fibular osteotomies are consolidated

bone gap. An intraoperative hard-copy radiograph is obtained for evaluation of the correction (mechanical axis restoration) and conformity of the plate to the bone surface.

8 Outcome Clinical Photos and Radiographs

See Fig. 6.

9 Avoiding and Managing Problems

The magnitude of the deformity and direction of correction should be considered to avoid sudden stretch of the neurovascular bundle. The direction of deformity correction should be considered to avoid sudden stretch of the neurovascular bundle, e.g., in case of distal tibial varus deformity, the posterior tibial neurovascular structures are at risk in which case a prophylactic decompression of the tarsal tunnel should be performed (Paley and Herzenberg 2002). The expected leg length discrepancy is explained to the patient. In case the patient was not happy with the residual leg length discrepancy, then, leg lengthening over the plate could be performed. Another consideration is the soft tissue condition and history of deep infection which would preclude the use of internal fixation.

During the lengthening over a plate, care must be taken to avoid contact between internal and external fixation to minimize the risk of infection.

10 Cross-References

- Adult Deformity: An Introduction
- Case 20: Acute Correction of Combined Deformity of the Tibia by Double Level Osteotomy and Fixator Assisted Plating Technique

11 See Also in Vol. 2

Case 26: Plating After Lengthening

References and Suggested Reading

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