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## Ilizarov bone transport after massive tibial trauma: Case report



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## ABSTRACT

**INTRODUCTION:** This is a case report of extreme lengthening of the tibia of about 14.5 cm using bone transport technique following road traffic accident trauma to the lower limbs. The management of the subsequent massive skeletal defects was challenging to orthopedic surgeons. Based on reported cases, the highest tibial lengthening was 22 cm using bifocal transport, while the highest unifocal tibial lengthening reached 14.5 cm.

**CASE PRESENTATION:** A 20-year-old male driver was brought to the emergency department after a road traffic accident. The patient had a right Gustilo IIIA segmental open tibia fracture with bone loss and other severe injuries. The tibial defect was 14.5 cm and the patient was then admitted for Ilizarov application six months after the accident. Although this case was particularly complicated, full limb length was restored. **DISCUSSION:** The management of this case was directed to correct the deformities and achieve equal length of both limbs to restore the normal function. Several new techniques have been developed recently to fill large bone defects. Limb lengthening using bone transport technique by application of Ilizarov ring fixator has been suggested as the leading option in filling massive bone gaps.

**CONCLUSION:** The use of bone transport technique using Ilizarov external rings has proved to be a minimally invasive and reliable method in managing massive bone defects. Accurate application of the Ilizarov frame and proper transport of the middle segment are important factors alleviating the risk for deviation of the transported segment. However, due to the need for regular follow-ups and monitoring, it demands high compliance from the patient to achieve optimal results.

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## 1. Introduction

Lower limbs are highly vulnerable to trauma as well as to road traffic accidents (RTAs). RTAs are very common in Saudi Arabia as it occupies 20% of all its hospital beds [1–3]. The management of the subsequent massive skeletal defects is becoming a challenge to orthopedic surgeons. Multiple techniques have been considered for limb lengthening and reconstruction including autographs, free vascularized bone grafts, and bone transport with distraction osteogenesis [4–6]. Amputation is also a valid option if the previous techniques were not able to achieve the desired functional outcome [6].

Ilizarov technique uses the effect of gradual distraction to allow for new bone and soft tissue regeneration to fill the defect site [7,8]. It offers the advantage of lengthening a bone at one site (unifocal lengthening) for cases of minimum bone defects with good regeneration potential, or at two sites (bifocal lengthening) for cases of substantial bone defects [9]. Based on reported cases, the highest bifocal tibial lengthening was 22 cm whereas the highest unifocal tibial lengthening was 14.5 cm [5,10]. This case demonstrates the management of restoring the original length of the tibia after massive bone loss using bone transport technique.

## 2. Case presentation

A 20-year-old Saudi unrestrained male driver was brought to our emergency department after involvement in an RTA. He had a right Gustilo IIIA segmental open tibial fracture with bone loss (Fig. 1), bilateral knee dislocation with right patellar tendon rupture, left anterior cruciate ligament (ACL) and medial cruciate ligament (MCL) rupture, bilateral distal femoral condyle fracture, grade II liver injury and grade III splenic injury. The patient received fluid resuscitation with no improvement and was moved to the

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Fig. 1. Preoperative X-ray on the admission day demonstrating the bone defect.

operating room for a diagnostic laparotomy. The soft tissue injury over the fractured tibia was minimum; it was removed completely with many resultant scars in front of the tibia. Irrigation and debridement were performed for the open wounds of the lower limbs, followed by internal fixation of the bilateral distal femoral condyle fractures, and external fixation of the right tibia and left knee. Both dorsalis pedis pulses were palpable and the limbs were well perfused. The patient was discharged 41 days later in stable condition and normal operative fields.

Six months later, the patient was admitted for Ilizarov application after a thorough discussion that involved his family. The measured tibial defect was 14.5 cm using X-rays and the distal neurovascular function was intact on the right side. Corticotomy was performed to the distal segment to transport it proximally (Fig. 2). The patient was recommended to have an extension of the tibial external fixator to support the ankle joint to prevent joint contrac-



Fig. 2. Corticotomy was performed and Ilizarov apparatus was applied.

Table 1

Chronological events of the case.

Day	Event
–	Irrigation and debridement followed by external fixation on right tibia.
0	Ilizarov application. The transported segment is the middle segment. The defect is about 14.5 cm.
15	Distraction started at rate 0.25 mm three times per day (proximal–unifocal).
27	Beginning of appearance of the regenerate.
189	Incision and drainage of pin site infection. Adjustment of the two proximal pins with traction of the healthy bone that was transported. Fixation of both using two wrenches.
216	Distraction stopped.
540	Ilizarov frame application for right planter flexion deformity (hindfoot).
631	Acute correction for severe right planter flexion deformity (midfoot).
764	Ilizarov removal, cast applied, x-ray showed good bone healing.
Follow-ups:	Patient walks with crutches.
903	Fracture due to fall. ORIF of right tibia and bone graft with MIPO. MIPO was fixed and bone graft was placed on the docking site infection.
946	Infection. Plate was removed and IV antibiotic started. Re-application of Ilizarov with two rings for the proximal segment only.
976	Patient discharged.
Follow-ups:	Patient still walks with crutches mainly due to the effect of the other limb (drop foot, foot deformity and ACL).

tures and further deformity. However, the patient preferred not to go through it. Table 1 demonstrates chronological events in the case.

Physiotherapy and partial weight-bearing were initiated one week after the procedure. The bone was gradually distracted at a rate of 0.25 mm three times a day. The appearance of the regen-

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