

# Composite Bone and Soft Tissue Transport for Treatment of Bone Defects

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To treat bone defects is one of the difficult and demanding challenges of orthopaedics. Limb length deficiency and bone defects produced by tumor excision, osteomyelitis and traumatic bone loss are treated successfully by distraction osteogenesis or calotasis. This study examines 10 cases of bone defects produced by tumor excision or traumatic bone loss managed by distraction osteogenesis using monolateral Naseer Awais external fixator. All the bony defects healed during the process of bone transport. Distraction osteogenesis is a reliable method for composite bone and soft tissue transport for treatment of bone defects.

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## Introduction

For distraction osteogenesis, the external fixator is applied and osteotomy is performed for gradual distraction.<sup>1</sup> Segmental skeletal defects may result from high energy trauma, debridement of osteomyelitis, or tumor resection. During distraction osteogenesis not only the bone but also soft tissues are also lengthened and this may help in spontaneous closure of the soft tissue defects without the need for major plastic surgery.<sup>2</sup> The biological advantage of the distraction osteogenesis is the regeneration of the living bone with the regenerated tissue eventually having the same quality as native bone. Recently, distraction osteogenesis has also shown to provide durable reconstruction for skeletal defects after bone tumor excision for the restoration of natural limbs.<sup>3</sup>

## Patients and Methods

During the year 2009, ten cases of bone defects produced by tumor excision of bone loss were managed by composite bone and soft tissue defects were managed by distraction osteogenesis in the Department of Orthopaedic Surgery and Traumatology DOST unit-I. The ages of patients ranged from ---- to ----. ---- were males and ---- were females. The causes of bone defects were trauma in --- cases and tumor resection in - cases. The bony defects ranged from ---- cm to ----cm with an average of ---- cm. In --- cases unifocal segment transport was performed and in ---- cases bifocal segment transport was performed in ---- cases. In --- case retrograde transport was performed. The procedure involved application of Naseer Awais fixator after excision of the tumor or traumatic bone defect. An appropriate osteotomy was performed in order to transport a bone segment. Compression during surgery was performed across the osteotomy site. After a period of ten days, distraction was started at a rate of 1 mm/day in two increments. After achieving the desired gap distraction was stopped and the bone regenerate was allowed to consolidate. Once the consolidation was achieved, osteosynthesis between the bone ends was achieved by compression and cancellous bone grafting.

## Results

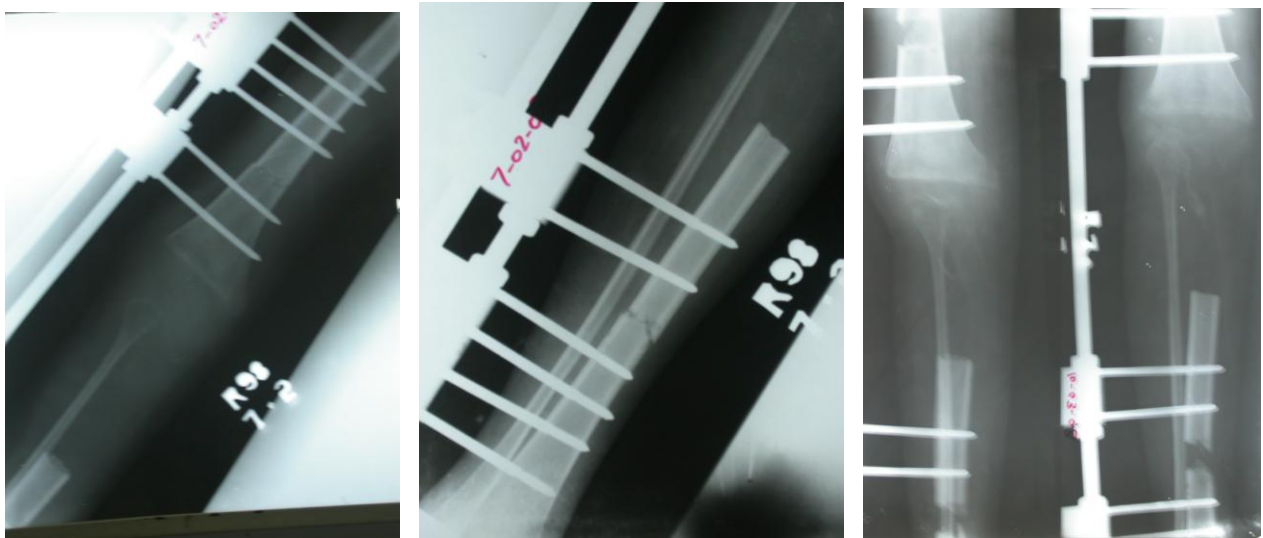
This study included 10 cases of bone defects produced by tumor excision or traumatic bone loss managed by distraction osteogenesis using monolateral Naseer Awais external fixator. All the bony defects healed during the process of bone transport. The causes of bone defects included trauma in four cases and tumor resection in six cases. The average age of patients was 19.6 years with range from 10 years to 48 years. 8 were males and 2 were females. The bony defects ranged from 4 cm to 15cm with an average of 8.7cm. In 4 cases unifocal segment transport was performed and in 6 cases bifocal segment transport was performed. In one case retrograde transport was performed. The average healing index (dividing external fixation time by length gain) was 5 days/cm in bifocal transport while it was 10 days/cm in unifocal transport. In one case reosteotomy had to perform because of consolidation due to delay in the start of transport. The bone defects were overcome in all the cases. Bone graft was added at the docking site in all cases. In one patient there was protrusion of the bone which was managed by adjustment of the direction of fixator pins. Other complications that were noted were pin tract infection, premature consolidation of osteotomy site, skin invagination into the docking site, cavus and equines deformities of feet. Pin tract infections were treated with local care of pintract like washing with soap and application of antiseptic solution and administration of systemic antibiotics. Premature consolidation of osteotomy site was treated by reosteotomy under anesthesia. Skin invagination was treated by excision of skin in between the docking site.

## Discussion

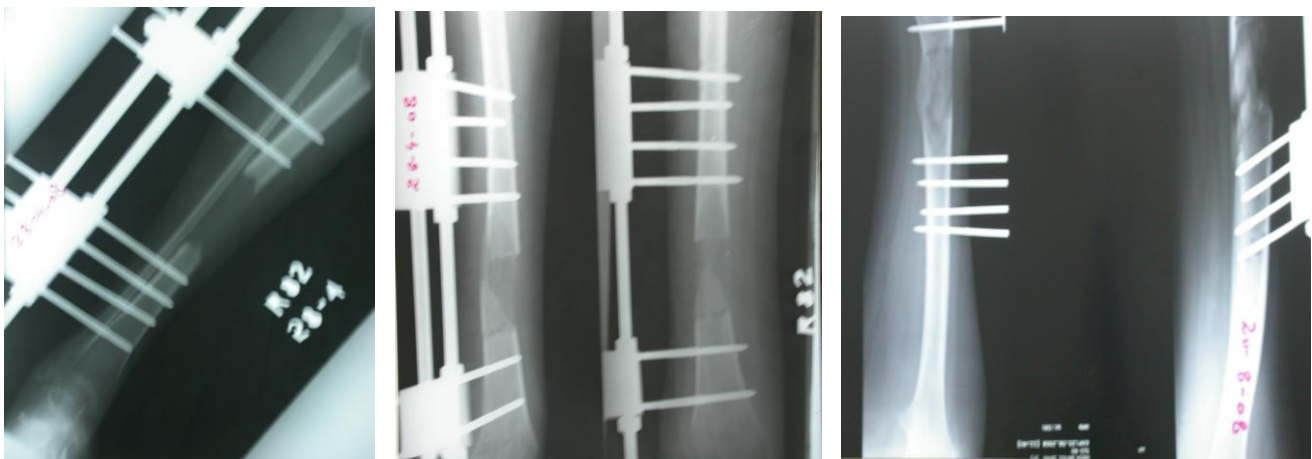
Managing a skeletal defect is one of the most demanding and difficult task for an orthopaedic surgeon. The bone transport technique defined by Ilizarov has been used in the treatment of bone defects produced by various causes<sup>4</sup>. The advantages of Ilizarov technique are that it is biological with low complication rate than any other technique, it can be applied to defect of any size, and it does not require long term immobilization and intensive autogenous bone grafts.



**Fig. 1:** A 13-year-old girl with osteosarcoma of proximal tibia.



**Fig. 2:** Treated with excision of bone tumor and application of Naseer Awais fixator using bifocal segment transport technique.



**Fig. 3:** Transport in progress and later completed.

In recent years this has been used in defects caused by bone tumors<sup>5</sup>. During distraction osteogenesis the bone ends carry the surrounding soft tissues, which help in spontaneous closure of the soft tissue defect without the need for major plastic surgery<sup>2</sup>.

In this study, the composite bone and soft tissue transport was used to fill the bony gap produced by either traumatic bone loss or by tumor resection. All the defects were successfully treated by this technique. The complications noted were pin tract infection managed by local cleansing and systemic antibiotics, premature consolidation by reosteotomy, and interposed invaginated skin was excised before docking.

Although some of the surgeons<sup>6,7</sup> use acute shortening to produce rapid closure of both the bone and soft tissue defects then relengthening from a distant corticotomy to restore the limb length, this technique was not used in any of the cases of this study. Sometimes, acute shortening is not feasible and may produce vascular compromise especially in patients with large defects<sup>2</sup>. In most of the cases especially in tumor resection the defect was closed by soft tissue envelop but most of the defects were left open to drain while bone transport was carried out in a study by Barakat El Alafy. The soft tissues spread gradually during distraction until they completely healed<sup>2</sup>. Larger defects were treated by using bifocal segment transport using Naseer Awais external fixator in this study. One case was managed using retrograde segment transport using the same fixator.

### Conclusion

Distraction osteogenesis is a reliable method for composite bone and soft tissue transport for treatment of bone defects. In this study locally developed Naseer Awais fixator was used. This fixator can be used for antegrade, retrograde, uni-focal or bifocal segment transport.

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**Fig. 4:** After the removal of fixator.