

## The T-Bar External Fixator for Definitive Management of Tibia Fractures with Soft-Tissue Compromise

*Samuel Mease, MD; Hallie Bradley, MD; Dharani Rohit Thota, BA; Adam Jennings Starr, MD; Drew T. Sanders, MD*

*Parkland Memorial Hospital, Dallas, TX, United States*

**Purpose:** Tibia fractures with associated soft-tissue compromise are challenging to manage. For fractures with significant swelling or open injury not amenable to internal stabilization, external fixators can provide sufficient stability for bony healing. Ring fixators and hybrid constructs provide adequate stability for healing but are costly and challenging to apply and maintain. We present the “T-bar” external fixator, a novel construct that can be maintained until bony union, allowing for range of motion of adjacent joints.

**Methods:** The T-bar external fixator uses standard pins and bars in a novel arrangement. It can be applied for OTA type 41/42/43 injuries, with or without supplemental fixation for intra-articular patterns. Two divergent pins are placed in the short articular segment and connected with a bar parallel to the joint. A third pin is placed in this segment, bisecting the first two. Two to three additional pins are placed anterior to posterior in the tibial diaphysis. The bisecting and diaphyseal pins are connected with a bar parallel to the tibial shaft and the two bars are connected with a clamp, forming a T-shape. We report the demographics, as well as clinical and radiographic outcomes, of 34 patients treated definitively with this construct.

**Results:** Between 2008 and 2015, 34 patients were treated for tibia fracture with T-bar external fixation, with intention to treat in a definitive manner. 29 were male, and average age was 44.3 years. 31 sustained high-energy mechanisms of injury. 20 were Gustilo type 2 or 3 fractures. Of 14 closed fractures, 12 were Tscherne type 2 or 3. 12 of 15 OTA41 fractures were followed to radiographic union. All achieved bony union, with 2 having staged bone grafting prior to external fixator removal. Radiographic knee arthritis was noted in 9 patients followed to union. 6 achieved coronal alignment within 5° of neutral, and 8 had posterior slope angle within 5° of 10°. 10 of 13 OTA42 fractures were followed to radiographic union. 9 of 10 achieved bony union, with 3 having staged bone grafting prior to external fixator removal. 7 achieved coronal and sagittal alignment within 5° of neutral. There was one case of osteomyelitis, and another transient pin site infection. 5 of 6 OTA43 fractures were followed to radiographic union. 3 of 5 resulted in nonunion, addressed with internal fixation. Radiographic ankle arthritis was noted in 4 patients followed to union. 4 and 5 achieved coronal and sagittal alignment within 5° of neutral, respectively.

**Conclusion:** The T-bar external fixator offers an alternative to ring and hybrid external fixator constructs in the treatment of tibia fractures with significant soft-tissue compromise. Of 28 patients with complete follow-up, only one case of osteomyelitis was reported. All patients were managed without amputation. 3 required revision for nonunion, all OTA-type 43.