

Abstract: Correction of Tibial Deformity using the Ilizarov/ Taylor Spatial Frame

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What was the question?

The Taylor Spatial Frame (TSF) is an evolution of the classic Ilizarov frame. It utilizes a computer program, which helps calculate a schedule for gradual strut and frame adjustment to simultaneously correct multiple aspects of deformity around a "virtual hinge" without the need for complicated frame modification. There are few reports in the literature regarding deformity correction using TSF. This computer program has two modes. The chronic mode requires inputting deformity parameters and pre-building a frame prior to surgery. The total residual mode is a newer program, which allows application of the rings first followed by easy connection of struts and the use of the program following surgery. There are no reports to our knowledge regarding clinical effectiveness of this mode. The purpose of this study is to review and evaluate the results of the gradual deformity correction using TSF.

Methods: Forty-two patients (50 tibiae) underwent osteotomy surgery for deformity correction using the Taylor Spatial Frame between 2000 and 2003. There were 25 males and 17 females with an average age of 38 (range: 11-64). Malunion was the most common etiology (23 limbs). Other causes included developmental deformity such as genu varum (19 limbs) or genu valgum (4 limbs) with pain and/or osteoarthritis, congenital deformity (2) and neurologic disorders (2). The osteotomy was performed near the apex of the deformity, which was at the proximal tibia in 33, middle tibia in 9 and distal tibia in 8. Varus angulation was the most common deformity. Mechanical axis deviation (MAD) and joint orientation angles were used to evaluate the deformity. Rotational deformity was assessed clinically. Twenty-five patients had leg length discrepancy with 3.1cm average (range: 0.4-22 cm). Tibia and fibula osteotomies were performed for deformity correction. Bilateral deformity was corrected in 8 patients (3 of them had one stage procedure). Simultaneous ankle arthrodesis was done in 2 patients and gradual correction of ankle equinus in one. Double level osteotomy was performed on one tibia. One patient underwent simultaneous correction of the femur deformity. Chronic correction mode was used on 14 tibiae with prebuilt frame. Total residual mode was utilized on 36 limbs with the rings first method. Clinical, radiographic parameters, SF-36 and AAOS lower limb module scores were assessed.

What are the results?

The average follow up was 19 months (range: 2-47). Planned deformity correction in different planes was achieved in all cases using TSF with chronic or residual mode. The average medial MAD improved from 28 mm (range: 9-100) to 4 mm medial (range: 0-9) or to 7 mm lateral (range: 1-13) in cases with hypercorrection. The average lateral MAD improved from 42 mm (range: 9-80) to 0 and in cases of osteoarthritis was overcorrected to 9 mm medial to midline (range: 4-18) to unload affected compartment of the knee. Simultaneous lengthening of 2.1 cm (range: 0.4-6) was done in 14 patients (16 limbs). Average time in a frame was 131 days (range: 77-355) and there were no nonunions. SF-36 improved in 4 categories. ALOS lower limb module scores increased from 76 to 89. Complications included cellulitis in one patient who was successfully treated with IV antibiotics, neuropraxia in 3 patients, which resolved after nerve release surgeries (all of these patients had previous lengthening procedures on the same limb in other institutions). One patient sustained a contralateral femur fracture after a fall during treatment and underwent open reduction and internal fixation.

What are your conclusions?

Osteotomy of the tibia and fibula and the use of the Ilizarov/ Taylor Spatial Frame can be used effectively to correct leg deformities. All aspects of deformity are addressed including length. This technique uses a minimally invasive approach and gradual deformity correction. While both chronic and total residual programs were accurately used, the rings first total residual method is more user friendly.

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