CHAPTER **33**

TAYLOR SPATIAL FRAME: Butt Frame Configuration and Application

Gary J. LaBianco, Jr., DPM

INTRODUCTION

The Ilizarov fixator was first introduced in 1951. Since that time, it has undergone many advancements and material changes. Most of the reconstructive foot and ankle surgeons throughout the world are familiar with the concepts and earliest configurations. All of these early configurations have been adapted by necessity to solve the problem fixation cases of the day. Through this process, distraction and compression have been at the center of the developmental focus. There has been no greater advancement in bone surgery than the use of both distraction and compression.

Until the last 10 years, distraction of the foot, although possible, was difficult to set up with an Ilizarov fixator. The development of the standard Taylor spatial frame (TSF) consisting of 2 proximal rings and a foot plate, made this easier but only for the rearfoot and it was limited by the planes of distraction available for the long bones of the arm and the leg (Figure 1). Following the integration of the TSF into standard practice, it became possible to use the fixator to distract the forefoot and the midfoot with the same ease of use demonstrated in the rearfoot and the leg. The use of the TSP in the butt frame configuration affords the reconstructive surgeon with a simplified application for both distraction and compression in 3 dimentions.

SURGICAL TECHNIQUE

The butt frame configuration derives its name from a carpenters end to side abutment joint. This is constructed using either a long or short foot plate and a ring or short foot plate on the tibia (Figure 2).

The application of the fixator begins with the planning stages preoperatively. Attention must be paid to the shape of the patient's leg and the amount of torque that will be necessary in the distraction phase of the deformity. Patients with a large posterior leg may benefit from using three-quarter rings or a short foot plate at tibial positions. This will allow for the posterior leg soft tissue to move freely without being caught on the posterior portion of the ring. Most often 2 tibial rings are used with 4 total half pins. The use of trans-osseous wires is appropriate here as well. If the patient is in a fixed varus or valgus and a large amount of torque will be necessary multiple tibial fixation points and rings will be necessary.

The fixator may be applied in a rings-first manner or with the foot plate that the distracters will be attached to off of the tibial construction. The alignment of the tibial rings with the foot plate attached often proves to be easier especially for someone using the butt frame configuration for the first time. In either case the tibial

Figure 1. Taylor spatial frame standard construction.

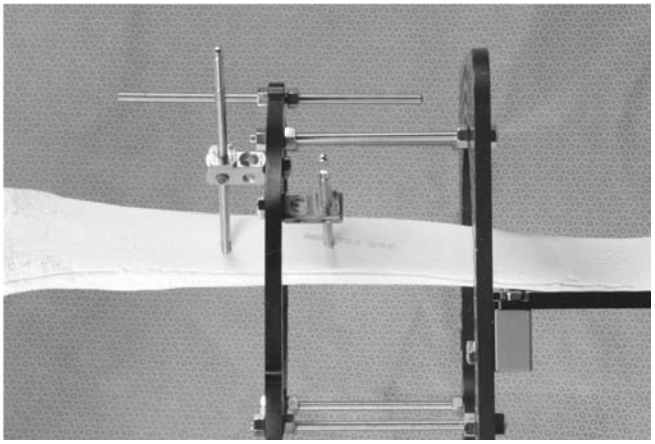

Figure 2. Application of Taylor spatial butt frame and alignment of the tibal rings and foot.

rings are applied to the tibia allowing for enough space for the posterior leg and the ability to potentially convert the butt frame configuration to a standard TSF is desired later during the postoperative process. Care must be taken to allow enough room for the placement of the foot plate and the distal distraction ring with the distracters in place on the foot. Once the foot plate is in place and attached to the tibial rings, the distal distraction plate is fixated though the distal foot area using trans-osseous wires. In some cases it may be possible to use half pins depending on the size of the bones to be distracted or compressed.

However, trans-osseous wires allow better control of the foot during three dimensional distractions although they lack the stiffness characteristics of half pins.

Following the application of the distal ring the distracters are attached. The surgeon may now manually distract the foot in the desired direction and set the clamps on the distracters. The application process is shown in Figures 3-8. At this time the numbers on the distracters are recorded and the data entered into the computer program. The computer program will provide a printout for the patient and the surgeon for the daily distraction process. It is important that the surgeon understand the rotation and the length of distraction that will be necessary for the numbers to take the deformity in the direction it is supposed to go. When placing the trans-osseous wires through the forefoot, the surgeon must be cautious that the attachment sites for the distracters are not used for the wires. There is a limited amount of connection holes between the distracter connection holes. Good understanding of the spatial relationship of the wires and the distracters will help avoid impingement of the two during the distraction or compression phase of treatment.

Figure 3. Dorsal alignment view with the foot centered on the tibial rings.

INTRAOPERATIVE CARE

The patient and the surgeon will distract or compress the deformity on a daily basis in most cases. Soft tissue deformities can be distracted at a rate of 1 mm per day at a minimum. It may be possible to distract larger amounts depending on the patient's tolerance to pain. Caution should be taken to keep from fracturing bone due to excessive or quick distraction. If an osteotomy has been made and the distraction is performed to grow bone while correcting the deformity, then the usual rate of 1 mm per day is recommended beginning at approximately 7 days postoperative. Soft tissue distraction does not require a postoperative waiting period. Daily pin care is required as is normal with all external fixators. Drainage should be expected from the distal foot wires as there is a significant amount of tension on the skin during distraction.

Distraction will often cause the skin to cut as the wires move distally. This area can become irritated and needs to be addressed with daily wound care. Radiographs taken throughout the postoperative process will allow the surgeon to check the progress and assess any needed corrections in distraction planes.

Following the adequate distraction of the deformity multiple options become available. In some cases an osteotomy may be used with or without bone grafting. There are instances when the deformity can be pinned in the new position and then compressed with the same fixation intact. The fixator may be reconfigured with the replacement of the distracters with threaded rods or to a standard TSF configuration.

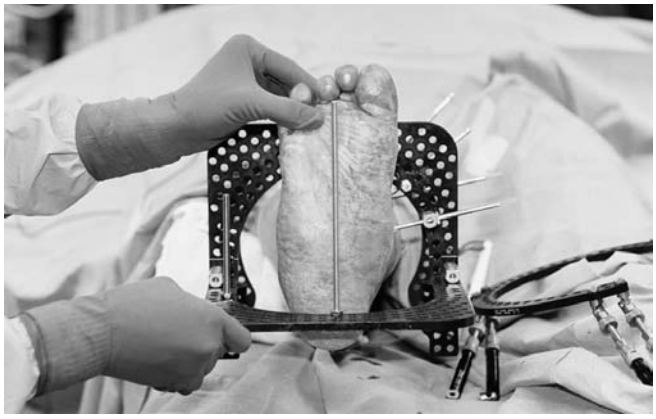

Figure 4. Plantar view showing alignment of the leg and foot with the Taylor spatial butt frame.

Figure 5. Lateral alignment with the foot centered for distraction.

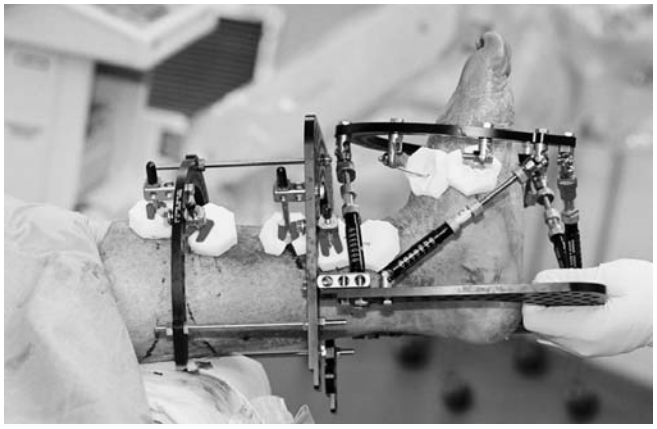

Figure 6. Final lateral view with distracters and distal foot ring in place.

Figure 7. Final plantar view with distracters and foot ring.

Figure 8. Final dorsal view of Taylor spatial butt frame.

DISCUSSION

Since the early 1990s there has been debate about the use of external fixation in foot and ankle surgery. Often, this debate is centered between those staunchly in favor of internal fixation versus external fixation. To add to this debate are those practitioners who consider themselves too old to learn about this at this point in their careers and those who were not taught the proper technique during their residencies. This has been debated in the literature for many years and extreme statements have been made on the part of both sides. So what is the truth in this old debate?

There is a middle ground. In the hands of a properly trained surgeon there is no more powerful tool for deformity reduction than external fixation. However, patient deformity characteristics and selection are the key to good postoperative results. The TSF and the butt frame configuration are excellent tools to be used in the correction and fixation of deformities. Contrary to popular belief by both sides of the debate there is most definitely room for strategies involving both internal and external fixation.

The strategy for the use of the TSF butt frame must be centered on the deformity, the patient, and the possibility of gaining a satisfactory result. Distraction may not always lead to the complete reduction of the deformity. In many cases the distraction of the deformity allows for reduction of the overall deformity followed by bone grafting and further stabilization. Multiple revisions may be necessary during the postoperative process. However, distraction does allow for the correction of deformities not possible without excessive soft tissue dissection and risk. It is always important for the physician and the patient to understand that not all deformities are “exfixable” and not all deformities are fixable.