Zimmer® Trabecular Metal™ Total Ankle System
Anterior/Posterior Translation Deformities

Introduction

Sagittal malalignment may involve either anterior or posterior translation of the talus or tibia relative to the other, and can be caused by bone deformities, soft tissue deficiencies, or both. It is common and must be corrected in patients undergoing ankle arthroplasty. However, even in a case that does not involve translation caused by traumatic or pathologic conditions, the surgeon should be aware that the tibia can slide posteriorly on the talus when the patient is placed in the supine position and the foot is elevated or secured in an alignment apparatus.

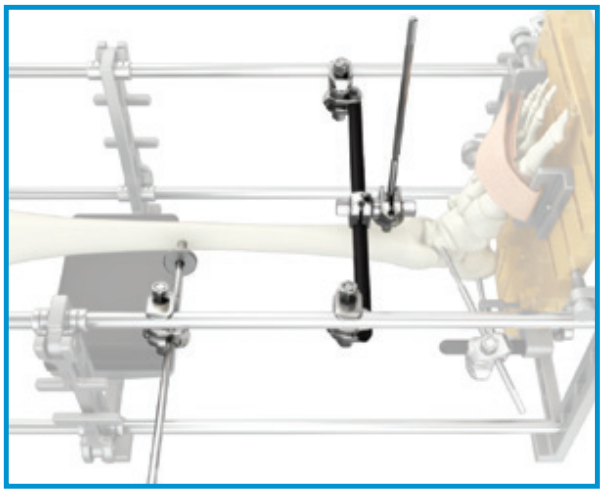
While much of the focus of ankle arthroplasty is on the ultimate correction of deformities and restoration of joint alignment, the potential effect of malignment on bone resection must also be carefully considered. It is very important that the bone resections allow the implants to be placed in positions that will result in optimal joint alignment and kinematics. This can be especially challenging unless the tibia and talus are brought into alignment before the bone resections are made. If the bone is milled without the tibia and talus in proper alignment, bone removal on one or both articulating surfaces may be unequal from anterior to posterior. Ultimately, this will lead to a misaligned arthroplasty.

Lateral x-ray of an ankle with anterior subluxation of the talus.

Addressing the Deformity

To the extent possible, it is recommended that the cause of the sagittal malalignment be addressed before placing the foot in the Alignment Stand. This will allow the joint to be locked in a corrected position when placed in the frame.

A joint with anterior translation requires that an anteriorly directed force be applied to the tibia before milling the articulating surfaces. The *Zimmer® Trabecular Metal™* Total Ankle provides an alternate alignment system configuration that allows the surgeon to adjust the sagittal position of the tibia, and then lock it securely while the arced bone resections are performed. In the standard configuration, the distal tibial fixation pin is inserted into the tibia anterior-medial to posterior-lateral. In the alternate configuration, the distal pin is inserted anterior to posterior, and then securely attached to a Carbon Fiber Rod placed across the top of the Alignment Stand.



The *Zimmer Trabecular Metal* Total Ankle alignment frame alternate configuration.

In most cases, placement of the anterior-to-posterior distal tibial pin can be achieved using fluoroscopic guidance without moving the C-arm from its lateral view after inserting the talar neck pin. Then, after inserting the distal tibial pin, the fluoroscope can be repositioned proximally so that an A/P image can be acquired to guide the placement of the proximal tibial pin. Note also that the proximal tibial pin can still be used to adjust tibial rotation by loosening the Pin-to-rod Clamp both where it connects to the distal tibial pin and to the Carbon Fiber Rod.

Specifics of the Technique

The alternate configuration is initiated after the foot, calcaneus, and talus have been securely fixed to the foot plate, but before the tibia is fixed to the Alignment Stand frame. Pin-to-rod Clamps are used to attach a Carbon Fiber Rod across the upper medial and lateral longitudinal

frame rods of the Alignment Stand. The Carbon Fiber Rod should be perpendicular to the long axis of the leg. Before attaching the rod, the Cutting Guide assembly should be moved as far distally as possible to ensure that the assembly remains distal to the rod. If the Cutting Guide assembly is proximal to the rod, it cannot be moved distally after the rod is attached. The Carbon Fiber Rod is fixed securely to the clamps at both ends, but the clamps are only loosely attached to the longitudinal frame rods of the Alignment Stand. A third Pin-to-rod Clamp is then attached to the rod between the two longitudinal rods.

With the Carbon Fiber Rod positioned directly over the desired pin insertion site, the distal tibial pin is inserted through the clamp and advanced to the anterior surface of the tibia. Fluoroscopy can be used to confirm the position. The pin should be placed at least 3cm-5cm above the tibial plafond. To ensure accurate placement, the anterior tibial crest is palpated, and the pin is inserted just lateral to the crest. It is important to avoid placing the pin too far laterally in the anterior compartment, as this could injure the anterior neurovascular bundle. The pin should be oriented as straight anterior-to-posterior as possible to allow for an optimal correction. When the desired pin position is confirmed, the medial and lateral Pin-to-rod Clamps can be tightened to the longitudinal frame rods of the Alignment Stand.

Under fluoroscopic guidance, an anteriorly directed force is applied to the back of the tibia to shift the tibia anteriorly on the talus until the appropriate sagittal alignment is achieved. The distal tibial pin will slide within the Pin-to-rod Clamp at the junction of the pin and the Carbon Fiber Rod. When the desired alignment is achieved, the clamp is securely tightened to maintain the position. Using the opposite force with this Alignment Stand configuration, the same principle can be applied to correct the alignment of a tibia that is translated anteriorly, or a talus that is translated posteriorly.

Additional Circumstances

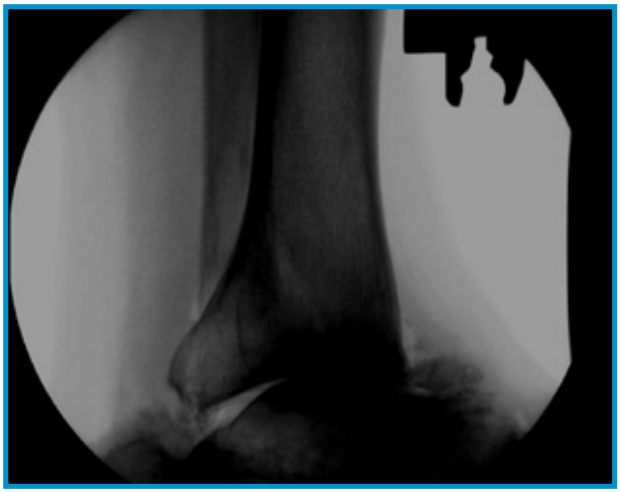
In some situations, it may be necessary to distract the joint before or after applying an anteriordirected force. This pin configuration also allows distraction. With the distal tibial pin securely fixed to the Carbon Fiber Rod, the medial and lateral clamps can be loosened where they attach to the upper longitudinal frame rods of the Alignment Stand. The joint can then be distracted by sliding the Carbon Fiber Rod proximally along the longitudinal frame rods while an assistant holds the distal aspect of the Alignment Stand. The medial and lateral clamps can then be tightened to maintain the distraction.

Typically, distracting the joint will help correct some of the sagittal malalignment before additional force is applied in the sagittal plane. When the desired sagittal position is achieved, the distraction can be released, and the Pin-to-rod Clamps can be tightened to maintain the position.

In most cases, the goal is to align the joint so that the axis of the tibia bisects the talar dome in the sagittal plane. However, the surgeon may choose to lock the foot into the frame with some degree of plantar flexion to facilitate access to the posterior aspect of the talus.

In a case where translation cannot be achieved with an anterior-directed force, and distraction is not possible, it may be necessary to remove some posterior bone from the distal tibia, or to correct soft tissue or bone deformities that may be preventing the necessary manipulation.

If any concern remains that the alignment is not securely locked, further stability can be achieved by attaching a second Carbon Fiber Rod from the talar neck pin to the distal tibial pin. It is important, however, to perform any varus/valgus manipulation before attaching this rod.



Inter-operative fluoroscopic image of an ankle joint with anterior subluxation of the talus.

Inter-operative fluoroscopic image of an ankle joint replaced with the *Zimmer Trabecular Metal* Total ankle prosthesis.

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