Bi-Planar Alignment

A Technical Overview of Arthrex's iBalance HTO Approach to Alignment of the Osteotomy-to-Patient Anatomy

What Is Bi-Planar Alignment?

Bi-Planar alignment is Arthrex's technique developed to orient the location of the osteotomy to the patient's anatomy. Bi-Planar alignment aligns the osteotomy to the A-P slope plane as in Figure 1a and the sagittal plane of the tibia as shown in Figure 1b. The sagittal plane of the tibia is defined as the plane that is orthogonal (90°) to the plane formed by aligning the posterior aspects of the medial and lateral tibial plateaus as shown in Figure 1c. The unique iBalance HTO instrumentation is aligned to these anatomic landmarks with the aid of fluoroscopy and then rigidly fixed to the tibia (Figure 2). Bi-Planar Alignment with the iBalance HTO System is designed with the intent of maintaining the patient's native A-P slope.

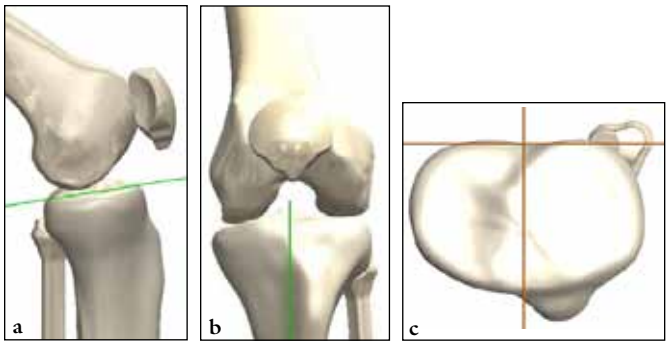

Figure 1: (a) Lateral view of the knee joint with the A-P slope plane overlaid in green. (b) Frontal view of the knee joint with the sagittal plane overlaid in green. (c) Superior view of the proximal tibia with the sagittal plane (*vertical*) and posterior aspect plane (*horizontal*) overlaid in orange.

The iBalance Solution

The iBalance HTO Biplanar Alignment Guide is an integral part of the iBalance HTO instrument system and is shown in Figure 2. Bi-planar alignment refers to the use of the iBalance HTO Biplanar Alignment Guide in conjunction with fluoroscopy to align the instrumentation to the patient's tibia. When used according to the surgical technique (LT0122), the Biplanar Alignment Guide is aligned to both the A-P slope plane and the sagittal plane of the tibia.

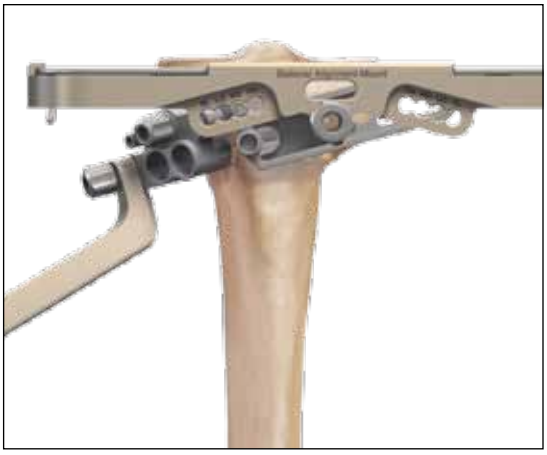

Figure 2. Bi-Planar Alignment Instrumentation

Theory of Operation

Firstly, maintaining A-P slope is accomplished in part by opening the osteotomy such that A-P slope plane maintains its anatomic orientation to the axis of the tibia[1]. Secondly, the implant construct must be stable enough to fix the proximal fragment of the tibia into a stable position during the healing period. Bi-Planar alignment addresses the alignment of the osteotomy plane with the tibial anatomy.

It is helpful to define the osteotomy in terms of the end of the osteotomy cut, or the hinge pin axis. With the iBalance HTO System, a 4.5 mm hole is drilled at the end of the osteotomy cut. The axis of this hole is shown in Figure 3 at Sections B-B, D-D, and F-F. Figure 3 illustrates how maintaining A-P slope and maintaining parallelism with the sagittal plane affects the final A-P slope angle. Case 1 illustrates ideal alignment where the axis of the drilled hole is parallel to both A-P slope and the sagittal plane. Deviations from the ideal case are illustrated in Cases 2 and 3 along with the resulting theoretical change in A-P slope.

In Case 2 the hinge pin axis is shown misaligned 10° lower than the native A-P tibial slope. Assuming that the osteotomy is opened parallel to the hinge pin axis, Figure 3 Case 2 images a, c & d show how the A-P tibial slope is changed. The malalignment results in a change in A-P slope from 9° - 8.7°. If malalignment occurred in the opposite direction, the A-P slope would be misaligned in the direction opposite to that which is shown.

Case 3 illustrates the effect of misalignment rotationally in the transverse plane *(see Section View F-F in Case 3 image b)*. This type of misalignment also results in a theoretical change in slope. A rotational misalignment of 10° results in a decrease of A-P slope from the original 9° to 6.5°.

The importance of alignment to the tibial A-P slope during the conduct of high tibial osteotomy is shown. The numbers presented are examples and will, of course, vary with individual A-P slope and the degree of malalignment to the A-P slope and the sagittal planes.

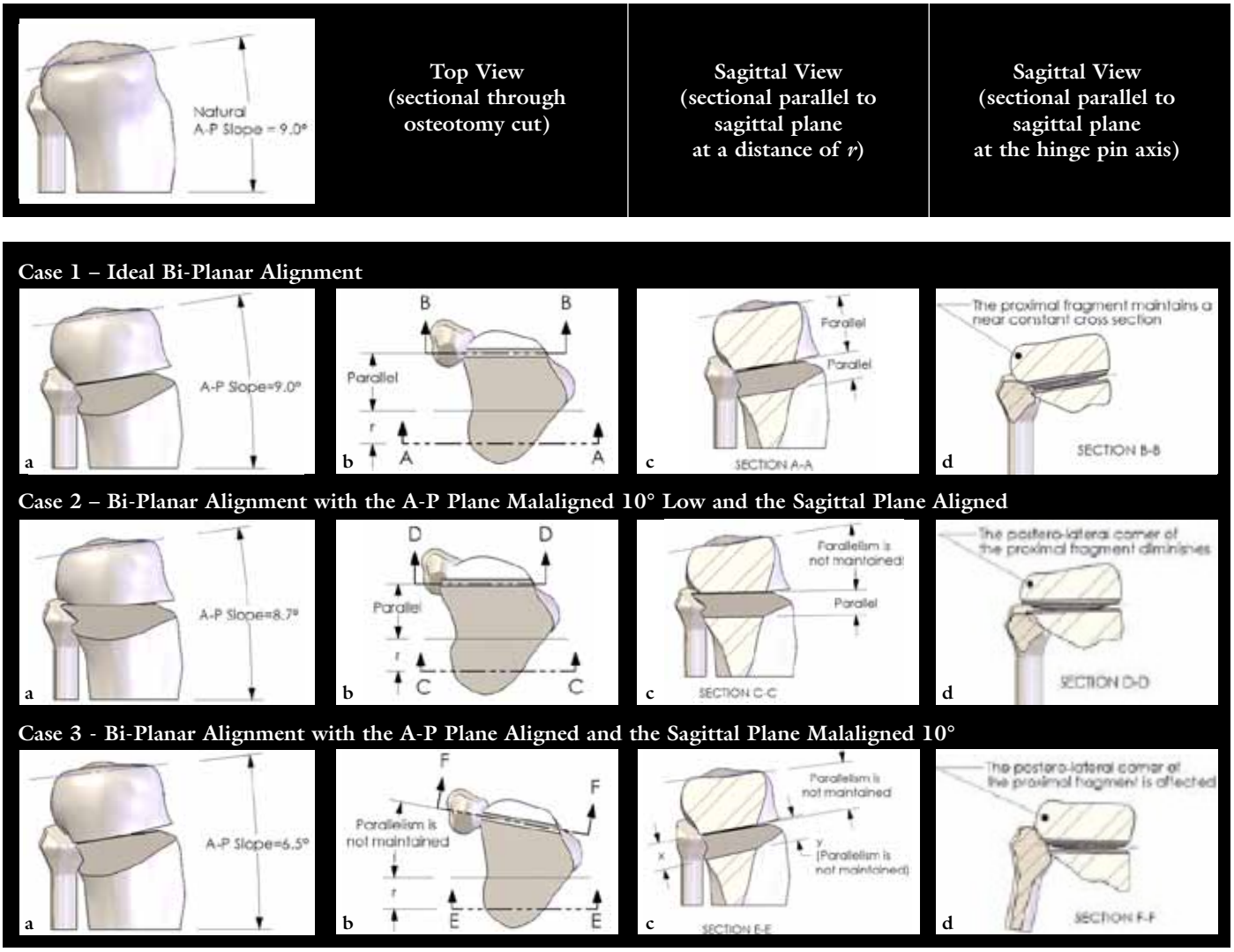

Figure 3. Simulated osteotomy alignment. Case 1 illustrates the effect of ideal Bi-Planar Alignment. Case 2 illustrates the effect of malalignment with the A-P slope plane. Case 3 illustrates the effect of malalignment with the sagittal plane.

REFERENCE

1. Noyes FR, Goebel SX, West J, *The 3-Triangle Method to Correct Axial Alignment and Tibial Slope,* Am J Sports Med. 2005:33-3. 378-387.