The Buechel-Pappas™ Total Ankle Replacement System

Developed by F.F. Buechel M.D., FACS and M.J. Pappas Ph.D.,P.E.

ARE ANKLE REPLACEMENTS VIABLE? NO AND YES

Fixed bearing prosthesis do not work well and are plagued with failure due to numerous problems exacerbated by high load and small bone volume for fixation. In a survey of ankle replacements Buechel[1] found that fixed bearing prostheses displayed high contact stress, stability problems, and lack of adequate prosthesis motion particularly due to constrained axial rotation. He also found that the most common mechanical complication was loosening followed by talar subsidence where talar resection was necessary.

Other publications on fixed bearing ankles show similar results. In a study by Demottaz et al.[2], 21 implants of various types (Mayo, TPR, Smith, Oregon) showed only 2 of the 21 having good results with the majority showing signs of loosening and pain. Unger et al.[3], reported the results of 22 Mayo implants showed an 83% satisfactory result after 2 years; however, deterioration of the results with time was noted.

For a prosthesis to be successful, it must be able to accommodate joint loading and motion. During a standard gait cycle, tibiotalar forces have been estimated to exceed 4 times body weight. Also, a prosthesis should allow normal ankle motion which is approximately 30° dorsi and plantar flexion, coupled with internal and external rotation.

Mobile bearing prosthesis have been successful due to their ability to provide for complex ankle motion while maintaining low contact stress by constant congruent contact throughout any and all phases of motion. In a study by Keblish et al.[4], 237 cementless ankle replacements of the original Buechel-Pappas Meniscal Bearing design were examined. They show the device worked well with an implant survivorship of 90.7% and less than 4% showing radiolucencies at 18-72 month follow-up period.

Several clinical studies outside the United States have shown that mobile bearing prostheses provide the best results for ankle replacements[5-8]. Doets[7], displayed good results with both the original and current meniscal bearing design. Tillman[5], compared the current meniscal bearing design to fixed bearing designs and showed the best mobility and pain relief came from the mobile bearing design. Also, the original and current design have shown near normal gait pattern duplication[8-9,14].

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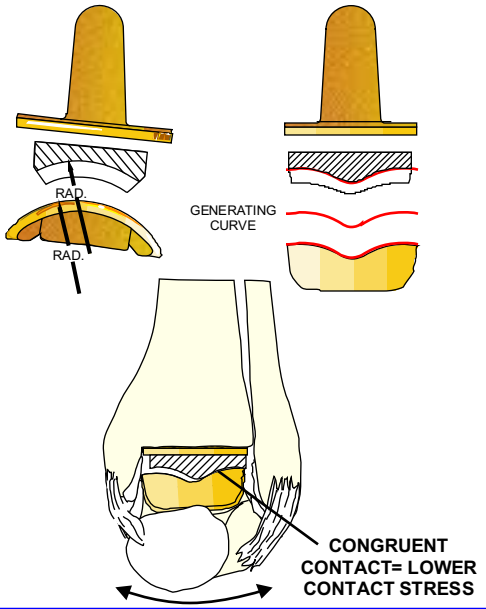
Improving Clinical Performance Through Advanced Technology

Buechel-Pappas™ Total Ankle System

Description and Design Rationale

The Buechel-Pappas™ Total Ankle Replacement is a time-tested System which is the result of more than twenty years of development, clinical investigation, and use. The components have been available in their current form since 1989.

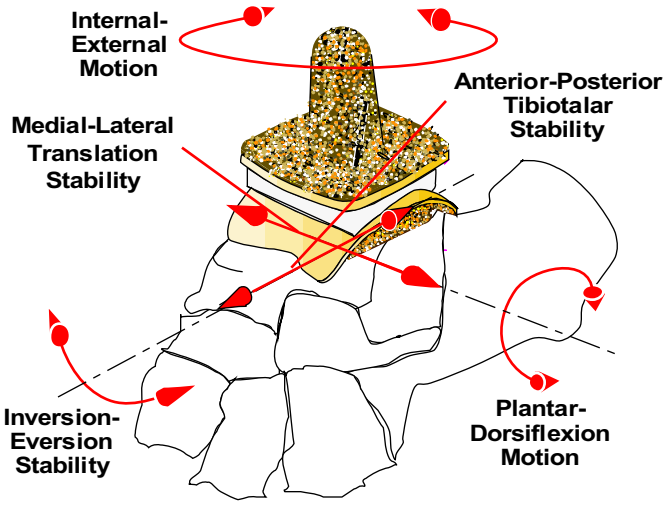


Mobile Bearing and Articular Surface Design

A mobile bearing is the key to a successful ankle replacement[1,15-16]. Loads in the ankle are similar to those in the knee. Yet the ankle is much smaller. Thus the problem of excessive stress in UHMWPe bearings that is common in fixed bearing knees is even more difficult to deal with in the ankle. To date only a mobile bearing has provided acceptable levels of contact stress with needed ankle mobility.

In the B-P Total Ankle this is achieved by a primary articulation that is generated by the use of a compound curve. This curve is identical for the talar and inferior bearing articular surfaces. This provides congruent contact throughout the entire range of flexion. These articulation surfaces not only allow for full congruence in flexion/extension, but also in inversion/eversion (I/E).

A secondary articular surface is flat-on-flat. This articulation provides the needed axial rotation and translations needed to avoid unnecessary constraint without preventing congruent flexion.



Mobility and Stability

The B-P ankle provides natural mobility and stability[14]. Normal flexion/extension is provided. Medial-lateral stability is provided by the mortise. Resistance to posterior shear present during walking is provided by the 7° posterior tibial inclination angle.

Normal inversion/eversion stability is provided with the B-P ankle as opposed to abnormal stability present in some designs as illustrated below[17].

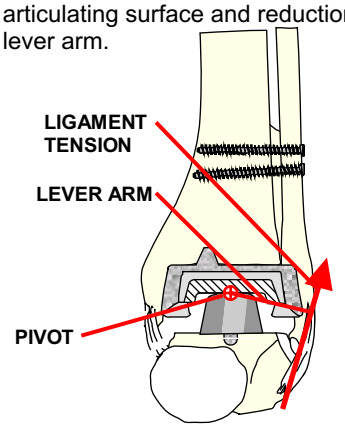
Materials Used

Ceramic UltraCoat® coating reduces joint friction and both plastic and metallic wear debris[10-12].

BioCoat® porous coating provides enhanced ingrowth fixation.

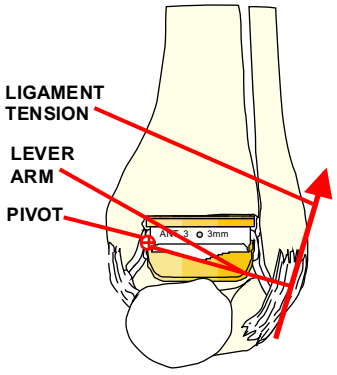
Titanium alloy provides superior compatibility[13].

Abnormal Inversion-Eversion Stability is due to the decreased tibiotalar articulating surface and reduction in lever arm.



ABNORMAL I/E STABILITY

Normal Inversion-Eversion Stability is restored with the maximum tibiotalar articulating surface and the identical lever arm as in the natural ankle.



NORMAL I/E STABILITY

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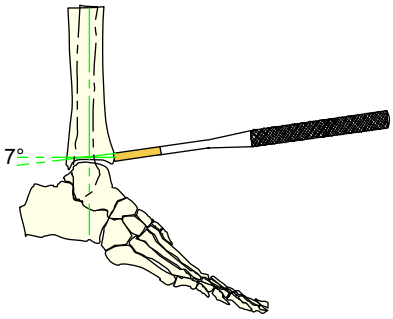
Buechel-Pappas™ Total Ankle System

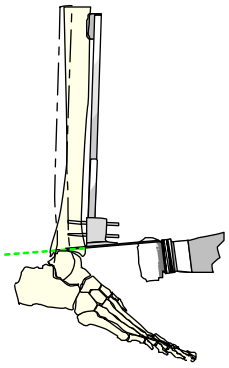
Surgical Procedure

A comprehensive instrumentation system provides simple, accurate, reproducible implant positioning and fit.

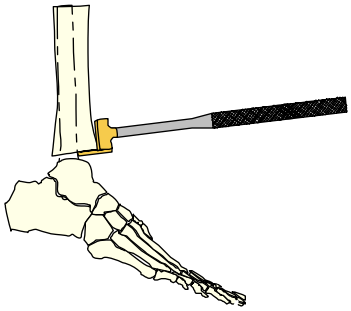
1 Mark the tibial cut by placing the Tibial Marking Osteotome at a 7° incline.



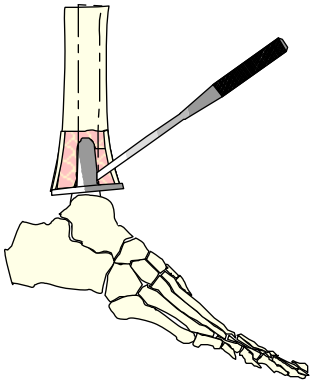
2 Resect the distal tibial at the 7° incline



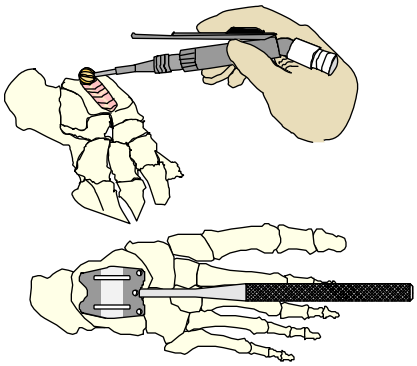
3 Fashion an anterior cortical window to allow introduction of the Tibial Component Fixturing Stem.



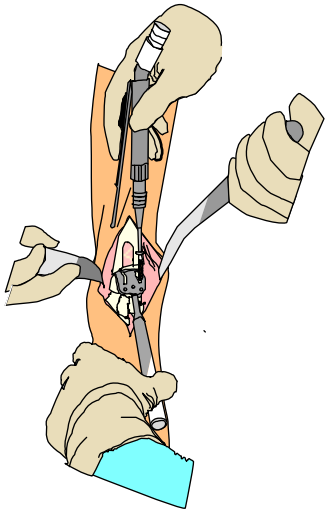
4 Select the proper size Tibial Trial and place it through the anterior cortical window of the tibia.



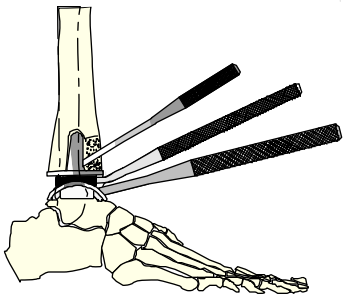
5 Use the 10mm Spherical Burr to roughly shape the upper surface of the talus to match the undersurface of the Talar Template.



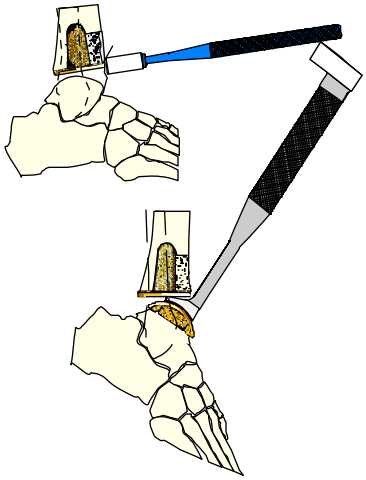
6 Use the Talar Slot Burr through the Talar Template to prepare the two fixation channels to allow seating of the Talar Component Fixation Fins.



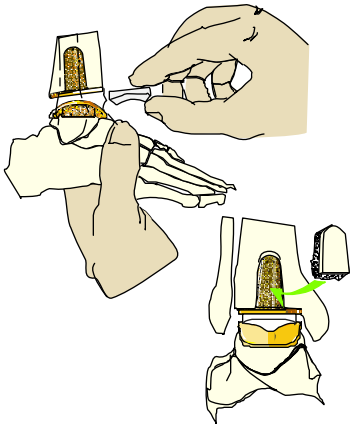
7 Insert the Tibial Trial and then the Talar Trial into position. Finally insert a Bearing Trial, of appropriate thickness, between the Tibial and Talar Trials to determine the correct ligament tension.



8 Implant the Tibial Component, and provide final seating with the Tibial Impactor. Then insert the Talar Component and seat with the Talar Impactor.

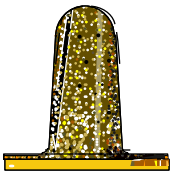


9 Insert the appropriate Bearing between the Talar and Tibial Components and then replace the anterior window.



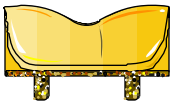
Buechel-Pappas™ Total Ankle System

Implants

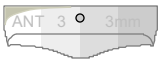


Tibial Component, Six Sizes

Talar Component, Size Sizes



Thick Talar Component, Six Sizes



Sliding Cylindrical Bearing, Six sizes, 5 thicknesses

Instrumentation

10mm Spherical Burr

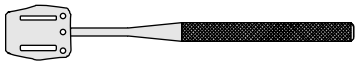
Tibial Window Impactor

Talar Shaping Rasp

Talar Channel Depth Template

Talar Template Pin

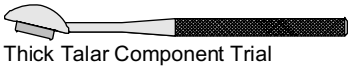
Talar Template



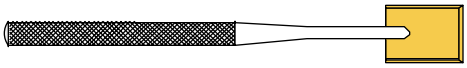
Thick Talar Template

Talar Slot Burr

Talar Component Trial



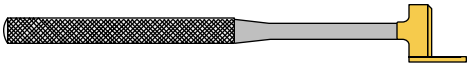
Thick Talar Component Trial



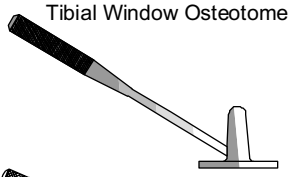
Tibial Marking Osteotome

Tibial Resection Guide

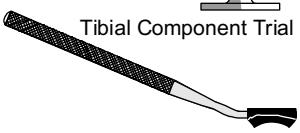
Guide Pins (2 Req'd)



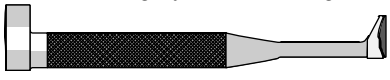
Tibial Window Osteotome



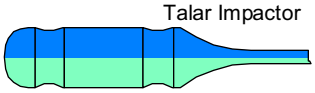
Tibial Component Trial



Sliding Cylindrical Bearing Trial



Talar Impactor



Bearing Pusher

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