# UNLOADING VS OFF-LOADING ANKLE BRACES

TayCo External Ankle Brace
Fred Ferlic, MD

There have been a number of questions about "unloading vs. off-loading" ankle braces. To be a true unloader brace, there has to be 2 components:

1. The bottom of the foot can have no contact with shoe or brace- "plantar suspension."
2. The GRF (ground reactive forces have to be transmitted to the calf cuff/shell/corset)

The only true unloader braces (>90%) are Zero G, Tag or TOAD - see below.

A PTB cast or brace only off-loads 30%-see below.

A CROW walker only off-loads 35%-see below.

A TayCo External Ankle Brace (with orthotic), CAM walker or walking boot, Ritchie, Arizona, Breg, Don Joy, etc. do not unload. They provide no free space below sole of foot and shoe/brace - see below. They only minimally < 30% off-load.

Many physicians have used the Acute TayCo External Ankle Brace successfully for acute fractures (non-op or operative) and significant sprains/tendonitis treatment (ICD-10's < 6 mo.). The patient is placed in a splint/cast until the swelling has subsided enough to fit in a jogging/walking/diabetic shoe-work boot for the Acute TayCo External. Subsequently the patient can transition from a fixed to a ROM TayCo External per physician protocol, thus providing a continuum of care with one single brace.

The Custom TayCo External is indicated for ICD-10's with greater than 6 mo. use-OA, RA, chronic PTTD, Charcot, etc.

The addition of other products (crutches, walkers, sscooter, wheelchairs) allow the patient to completely unload the lower extremity also.

"The effect of the patellar tendon-bearing cast on loading." JBJS
Tanaka H1, Nagata K, Goto T, Hoshiko H, Inoue A.

**Abstract**
We assessed the unloading effect of the patellar tendon-bearing (PTB) cast in five healthy volunteers using a new system for analysis of dynamic plantar pressure. We devised a method to improve the unloading effect of the PTB cast, and tested this using the same system. Our findings showed that the conventional PTB cast only achieved unloading of 30% of the body-weight and that the part of the cast on the leg had a more important role in the unloading than that which was in contact with the patellar tendon. When the depth of the free space under the foot inside the PTB cast was 1, 2 and 3 cm, the unloading effect was 60%, 80% and 98%, respectively. The unloading effect of the conventional PTB cast was disappointing at only 30% of body-weight. It was improved by producing a space between the sole of the foot and the cast, and was adjustable by altering the depth of this space.

## Available & State of the Art Solutions

To treat patients with fractures (non-op or operative) or Charcot ankle/foot, orthotists will recommend various orthoses that immobilize and unload/off-load the ankle/foot. The main goal of unloading/off loading the ankle/foot is to redistribute plantar pressures to the limb while minimizing the GRF, shear, and normal stresses on the limb.
The following orthoses show the various types of unloading possibilities and how they meet this goal.

### 1.8.1 Patellar Tendon Bearing Braces-30%

One bracing mechanism for unloading the foot is the PTB brace that utilizes the patellar tendon to bear the weight of the user. The current orthosis being used at the Dr. Soetomo Hospital is a PTB orthosis, which is shown in figure 1.3:

This orthosis is made of two interlocking thermoplastic shells that come together to compress the leg. Two unloading bars (one medial and one lateral) redistribute the force from the ground to the shells. A protrusion on the anterior shell (located at the patellar tendon) allows the brace to press the tendon and bear weight. This design also utilizes the conical shape of the leg and applies hydrostatic compression on the leg to further bear weight. Other PTB braces on the market utilize the same concepts as this brace to unload the foot.

### 1.8.2 Total Contact Bracing-35%

Total contact braces differ from other solutions in that they allow loading on the foot. They aim to redistribute the pressure evenly over the foot and leg so that the pressure in not built in one area. These braces focus more on foot immobilization to prevent the joints from further subluxation or dislocation, which would progress the deformity. A common recommendation by orthotists in this category is the Charcot restraint orthotic walker (CROW), which is a custom bi-valved total contact ankle foot orthosis.

The aim of the CROW brace is to distribute the pressures evenly over the foot so that the joints and skin will be protected.[5] The foam liner and thermoplastic shells reduce the shock and allow pressure to be distributed both in the foot and on the leg. Bivalve shells lock
together so that the limb is compressed and bears about 30-40% of the weight, which can be adjusted by the patient.[6] The rest of the weight is distributed along the plantar surface.
Other total contact solutions include total contact casting (TCC) and aircast pneumatic walkers. Both of these solutions distribute pressure in a similar way, but vary in material selection, volume control, and donning and doffing capability.

### 1.8.3 Hydrostatic Compression Bracing

Hydrostatic compression bracing, or what many market solutions are referring to as ‘anti gravity bracing,’ utilizes the compressive force over the contact area between the brace and the leg to distribute pressure. The key is to maximize the contact area between the brace and the leg to keep pressure low while efficiently utilizing the conical shape of the leg to additionally bear weight.

Figure 1.5 below shows two of these braces.

Figure 1.5: hydrostatic compression bracing (left: Zero G AFO; right:TAG brace

These braces all feature anterior and posterior shells that have an inner foam liner and close together with adjustable Velcro straps. Each of the braces claim to completely unload the foot, which has been verified in video of users ambulating in the brace. However, supporting literature of the braces is required.