Pathologic hindfoot motion is one of the most common deformities seen in the foot and ankle profession. In a flexible condition, the talus partially dislocates on one or more of its articular facets with the calcaneus and/or navicular, depending on the planar dominance of the deformity. This mal-alignment of the talus on the tarsal mechanism has been shown to lead to a multitude of secondary pathologic conditions, not only in the foot, but also up the musculoskeletal chain. Common secondary conditions in the foot include plantar fasciopathy, Achilles tendonitis, progressive posterior tibial tendon dysfunction, tarsal tunnel syndrome, hallux abducto valgus, sinus tarsi syndrome, metatarsalgia, hammertoe syndrome, neuromas and degenerative joint diseases of the foot and ankle. Knee, hip, spine, shoulder and neck pain are also prevalent. However, for many years there were few options for stabilizing the talus on the tarsal mechanism in a manner that would not only eliminate excessive motion but would allow the normal amount of pronation and supination at the subtalar joint.

Conservative treatment options include observation and orthoses. Orthoses have been used as the first line in the treatment of flexible talotarsal dislocation (partial). There is subjective clinical experience from individual patient encounters that show improvement in the reduction of some symptoms using orthoses. Properly fitted orthoses can make standing, walking and running more comfortable and efficient by altering the angles at which the foot strikes the ground and they can absorb shock, improve balance and reduce pressure. However, no research has shown that externally applied orthoses are effective in realigning the osseous structures to restore the foot to normal position, nor have any studies demonstrated that the correction achieved with the use of orthoses is adequate to alleviate the associated symptoms or prevent the development of new pathologies. When these conservative methods fail, surgical intervention may be necessary.

Traditional surgical options for this condition include subtalar arthroereisis, or in severe cases, osseous rearfoot reconstructive surgery. Subtalar arthroereisis is often the preferred method, as it is less invasive. Early attempts to use various biomaterials in the early 1970s lead to an evolution of designs. While a few of these devices were intra-osseous, the majority are extra-osseous. Subtalar arthroereisis has been shown to have some favorable patient outcomes but also to have nearly a 40% removal rate. The devices are placed within the sinus tarsi, in a lateral to medial direction. This placement goes against the natural orientation of the sinus tarsi, which is anterior-lateral-distal to posterior-medial-proximal. The major mechanism of action of arthroereisis devices is that they act as an anterior extension of the lateral process of the talus. Arthroereisis devices act to “lift up” and or “block/limit” subtalar joint range of motion. Eventually, limitations of the material(s) or design(s) have led to the need for further improvement.

Every once in a while a new technique presents that truly creates a paradigm shift in the treatment of a disease or deformity. One great example is the placement of a stent within a coronary artery to keep it open so that blood can flow through. A similar concept has been applied to the treatment of the mal-alignment of the talus on the tarsal mechanism. In 2004, the HyProCure extra-osseous talotarsal stabilization device achieved clearance from the Food & Drug Administration (FDA) in
the United States. HyProCure, invented by Dr. Michael E. Graham, a surgically trained podiatrist in Michigan, USA, is a product of GraMedica (Macomb, Michigan USA), which was founded in 2004 to distribute this product. Since its release, over 17,000 HyProCure's have been inserted by both orthopedic and podiatric foot surgeons globally.

The design of HyProCure overcomes many of the limitations of earlier devices. HyProCure® is an extra-osseous talotarsal stabilization (EOTTS) device intended to restore the normal alignment of the articular facets of the talotarsal joint, thus eliminating abnormal excessive motion within the talotarsal joint while preserving the normal range of hindfoot motion. It is composed of medical-grade titanium alloy and is intended to remain in situ permanently. HyProCure's unique design, with a lateral conical shape portion coupled with medial cylindrical geometry, allows for a better anatomical fit. It aligns perfectly with both the sinus and canalis portions of the sinus tarsi. The device is cannulated for ease of insertion. It is also threaded to allow tissue on-growth within the canalis tarsi, making it a medially anchored device. HyProCure is positioned from anterior-lateral-distal to posterior-medial-proximal, that is, in the orientation of the sinus tarsi which allows for uniform distribution of forces to the anterior and posterior aspects of the foot. The medial threaded cylindrical portion of HyProCure is placed within the canalis portion of the sinus tarsi; before placement, the tissues within the canalis portion are transected, which will heal back together, incorporating around the threads to anchor the device in place. The middle tapered portion of the device abuts the medial sulcus of the sinus portion of the sinus tarsi to ensure proper placement and prevent overinsertion, and functions to stabilize the cruciate pivot point. The lateral conical portion of the device prevents the anterior deviation of the lateral process of the talus and thus stabilizes the sinus portion of the sinus tarsi. This internal fixation device re-establishes the normal tri-plane alignment of the talotarsal mechanism. Radiographically, the weightbearing talar second metatarsal angle and talar declination angle are normalized following insertion of the device.

Many scientific manuscripts have been recently published, including cadaveric-based research studies and a retrospective analysis, which establish the effectiveness of the HyProCure device. The first of these was a biomechanical investigation on adult human cadaver specimens in which the distribution of forces on the anterior and posterior aspects of the talocalcaneal joint was studied. The results of this paper, "Stabilization of Joint Forces of the Subtalar Complex via HyProCure Sinus Tarsi Stent," (Journal of the American Podiatric Medical Association, Volume 101, No. 5, 390-399, Sept/Oct 2011), show that with partial talotarsal dislocation, the forces that should be transferred to the posterior facet are instead being transferred to the middle and anterior facets. It is these abnormal forces that would place an increased strain to the support structures on the spring ligament, plantar fascia and posterior tibial tendon. The study designers then inserted the HyProCure device and re-tested the specimens. The insertion of the stent resulted in a significant decrease of forces acting on the middle and anterior facets and increased forces acting on the posterior facet. The next three studies focused on demonstrating the effect on strain to the posterior tibial tendon, plantar fascia and tibial posterior nerve with internal stabilization of the talotarsal mechanism using the HyProCure stent. In the published studies, "Effect of Extra-osseous Talotarsal Stabilization on Posterior Tibial Tendon Strain in

The papers cited above establish the positive benefits of stabilizing the talus on the tarsal mechanism. Perhaps more importantly, the device has been shown to have a significantly lower removal rate than predicate devices. Several months ago, the largest retrospective study of any extra-osseous talotarsal stabilization device, "Extra-Osseous TaloTarsal Stabilization using HyProCure" in Adults: A 5-Year Retrospective Follow-up," (Journal of Foot and Ankle Surgery, Volume 51, Issue 1, Pages 23-29, January 2012) was published. This blinded study, which included 83 patients (117 feet) at an average follow-up of 51 months post-operative, showed an average Maryland Foot Score of 88/100, a less than six percent removal rate and no significant, long-lasting complications.

EOTTS with HyProCure can be performed on both pediatric and adult patients with a flexible/reducible talotarsal joint partial dislocation. This soft tissue procedure can be performed under twilight sedation with local anesthesia. The procedure is fully reversible, should removal be necessary. This procedure has been performed in patients from age 4 years to 80 plus years of age and at all levels of activity including patients involved in various sports. There are potential complications as with any surgical procedure but these are relatively minor when compared to potential complications of traditional hindfoot rearfoot reconstructive surgery. EOTTS with HyProCure is an incredibly powerful technique which should be in the armamentarium of any foot and ankle surgeon which deals with the life changing complications associated with chronic talotarsal dislocation.