

# Effect of Extra-Osseous Talotarsal Stabilization on **Posterior Tibial Nerve Strain** in Hyperpronating Feet: A Cadaveric Evaluation

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## Purpose

The primary goal of this study was to quantify strain on the posterior tibial nerve in cadaveric feet exhibiting talotarsal dislocation (partial), before and after an extra-osseous talotarsal stabilization (EOTTS) procedure. It was hypothesized that excessive strain placed on the posterior tibial nerve in hyperpronating cadaveric feet would be reduced significantly after intervention using the *HyProCure*<sup>®</sup> device.

## Background

Peripheral neuropathy is a very serious concern, especially in the plantar aspect of the foot. An unstable hindfoot/midfoot joint complex has been shown to lead to excessive posterior tibial nerve tension and strain. Stabilization of the talotarsal joint complex can minimize the abnormal forces placed on the posterior tibial nerve, which should in turn alleviate strain and minimize over-stretching. EOTTS with *HyProCure*<sup>®</sup> rebalances the talotarsal mechanism and offers an internal but minimally invasive option without the patient compliance issues of external modalities.

## Methods

- In this study, strain on the posterior tibial nerve in 9 fresh frozen cadaver specimens exhibiting talotarsal dislocation (partial) was quantified before and after an extra-osseous talotarsal stabilization procedure with *HyProCure*<sup>®</sup>.
- A miniature differential variable reluctance transducer was used to measure nerve elongation as the foot was moved from its neutral to a maximally pronated position, before and after intervention.
- The blinded sub-investigator was instructed to maximally pronate the talotarsal mechanism by applying maximum force to the 4<sup>th</sup> & 5<sup>th</sup> metatarsal heads. A pressure sensor was placed under the 4<sup>th</sup> & 5<sup>th</sup> metatarsal heads ensuring that the same maximum pressure was applied for each reading.

## Results

- The posterior tibial nerve stretched on average  $5.91 \pm 0.91$  mm (N = 27) as the hindfoot was maximally pronated without intervention.
- Following placement of *HyProCure*<sup>®</sup>, the posterior tibial nerve only stretched  $3.38 \pm 1.20$  mm (N = 27).
- The reduction was statistically significant at  $p < .001$ .

**Talotarsal joint stabilization with *HyProCure*<sup>®</sup> decreased strain to the posterior tibial nerve by an average of 43%.**

## Clinical Significance & Conclusions

- The effects of over-stretching of the posterior tibial nerve will lead to occlusion of both venular and arterial blood flow within the nerve. Additionally, there will be a reduction in amplitude of the action potential up until a point where there is a complete block of nerve transmissions.
- This excessive over-stretching/strain occurs during all weightbearing activities – standing, walking and running. The repetitive cumulative trauma will eventually lead to symptoms.
- The extra-osseous talotarsal stabilization procedure with *HyProCure*<sup>®</sup> was effective in stabilizing the talotarsal joint complex, thus restoring the normal range of pronatory motion and significantly reducing the excessive strain placed on the posterior tibial nerve.
- Clinical implications of this study suggest the use of EOTTS devices in the treatment of posterior tibial neuropathy in which the underlying etiology is abnormal talotarsal biomechanics.

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