

## Role of fasciae in Civinini-Morton's neuroma

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Civinini-Morton's metatarsalgia is characterized by a swelling, known as "neuroma", of the common digital plantar nerve (CDPN), which may cause extreme pain and disability. Microscopically, the affected nerve presents extensive concentric perineural fibrosis. It is considered an entrapment syndrome, due to the impingement of CDNP against the stiff deep transverse metatarsal ligament (DMTL). According to this hypothesis, some surgeons suggest neurolysis, by cutting the DMTL<sup>1</sup>, as a treatment, instead of generally performed neurectomy. Also some rehabilitation techniques affirm that modifying perineural connective tissue improves patients' symptoms<sup>2</sup>.

To better study the relationships of the nerve with DTML and deep fasciae of the foot we dissected 15 feet and analyzed 30 MRI.

Data from dissections confirm that CDPN's bifurcation in the second and third webspace is always distal to DTML. Proximal to the metatarsal heads, the nerve is encased by a sheath made by concentric sleeves of fibrous and loose connective tissue continuous with vascular sheaths and deep fasciae of the foot: this arrangement, similar to a "telescope", may provide a channel to allow the nerve to move independently from surrounding structures, being protected against traction during walking. In the intermetatarsal space, fascial septa connect DMTL, tendon sheaths and plantar fascia, and bound lobules of adipose tissue, more abundant on plantar aspect of the neurovascular bundle: these, along with adipocytes contained between concentric layers of neural sheath, could cushion compressive stresses. Distally to DMTL this protective system is less represented.

MRI shows marked inter-individual morphologic variation of the intermetatarsal channel: its size varies from 16.22 mm<sup>2</sup> to 64.43 mm<sup>2</sup>, with a mean value of 37.34 mm<sup>2</sup>. Its shape ranges from oval or rounded (with a big distance between DMTL and plantar fascia) to roughly rectangular (with a narrow distance); in some people the channel is filled with adipose tissue, while in others fibrous tissue prevails. Fascial septa also vary among people, ranging from barely discernible to 1.2 mm thick, while DMTL is relatively constant (from 0.5 mm to 1.0 mm thick). Plantar fascia varies from 0.6 to 1.1 mm.

People who lack an efficient "sliding and cushioning system" could tolerate less mechanical stresses during walking and thus be at increased risk of Civinini-Morton's syndrome. Perineural scarring (which forms the neuroma) consequent to nerve impingement could, by destroying neural sheath's structure, further impair nerve protection and worsen symptoms.

### References

- [1] De Prado M, Golanó P, Ripoll PL (2003) Cirugía percutánea del pie. Barcelona: Masson.  
 [2] Stecco C. et al (2013) Plantar fascia anatomy and its relationship with Achilles tendon and paratenon. *J Anat.* 223:665-76.

### Keywords

Perineural tissue, plantar fascia, compression syndrome, imaging, neuroma, Morton diseases.