The relationship between fetlock joint dorsiflexion and flexor tendon moment arms variations

Prisca Noble¹, Bernard Collin¹, Jean-Marie Denoix² and Didier Serteyn³

¹ Anatomy Sector, Morphology and Pathology Department, Veterinary Medicine Faculty, Liège University, Belgium.
² CIRALE-ENVA, France.
³ Equine Clinic, Clinical Sciences Department, Veterinary Medicine Faculty, Liège University, Belgium.

Introduction: To calculate flexor tendon forces on the basis of inverse dynamic analysis, flexor tendon moment arms need to be determined in the equine distal forelimb. Moment arm of deep digital flexor tendon (dDDF) and of superficial digital flexor tendon (dSDF) have been recognized to vary during the fetlock joint dorsiflexion, however little distal forelimb model has taken into account dSDF and dDDF variations. This study describes a method to determine the relationship between the fetlock joint dorsiflexion and the flexor moment arms variations.

Methods: Eleven forelimbs of eleven horses (~500 Kg) were collected, transversally cut below the shoulder joint, frozen and cut into a sagittal plane until above the fetlock joint. Considering the forelimb pulley model (Meershoek et al. AJVR 2001; 62 1585-1593), in the segment based coordinate system, for the fetlock joint the pulley centers of the DDF and SDF tendons were determined directly from the section. For the fetlock radius-pulley experiments, forelimbs were thawed overnight, fixed to an immobilizing support and attached to a hoist that dorsiflexed the fetlock joint. For the fetlock dorsal angle (θ) 180° to 150°, the dDDF and the dSDF were measured directly from the section. For each tendon all of these data were fitted using a polynomial regression model (OriginPro8) and the relationships between θ and the radius pulley variation (Δd) was described assuming that Δd was zero at θ equal to 180°.

Results: When the fetlock dorsiflexion increased, dDDF and dSDF decreased (ΔdDDF(150)= -6.1 mm; ΔdSDF(150)= -5.2 mm) according to the following equations: ΔdDDF(θ)= -0.24923 x θ¹ + 0.00139 x θ² (R²=0.89867) ; ΔdSDF(θ)= -0.21494 x θ¹ + 0.0012 x θ² (R²=0.91504).

Conclusions: A distal forelimb pulley model with variable dDDF and dSDF has been performed. It could become an important tool for use in inverse dynamic procedures.