

A Biomechanical Analysis of the Crural Fascia in the Feline Hindlimb during Locomotion and Intra-Muscular Stimulation

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PURPOSE It has been shown that by carefully removing the crural fascias attachment to the calcaneus approximately half the torque produced by the posterior Biceps Femoris (pBF) was lost [1, 2, 3]. Therefore, our objective is to quantify and characterize the role of the crural fascia in transmitting forces from muscles across joints thereby exploring its role in intra-limb coordination and stability. We hypothesize that the crural fascia redirects some of the force produced by the hip extensors and knee flexors to the ankle joint.

APPROACH The crural fascia in the feline hindlimb initiates from the hip flexor/knee extensor muscles, surrounds the triceps surae muscles as a sheath and inserts into the medial side of the calcaneus as two thickened bands. We investigated this anatomical connection in the decerebrate cat by systematically disrupting the crural fascia. In all experiments we recorded four conditions: 1, intact; 2, longitudinal split through the sheath; 3, randomized cut of the medial or lateral band; and 4, cutting of the remaining band. This was conducted in locomotion studies involving electromyography (EMG) and kinematic recordings, as well as intramuscular stimulation (IM Stim) experiments recording ground reaction forces in the x, y and z directions.

RESULTS In the locomotion preparation we observed a decrease in EMG in the peroneus brevis muscle; and an increase in rotation of the tibia resulting in an eversion of the foot during swing phase. During IM Stim, the largest change in the force direction in the xy plane was seen when one band was disrupted in the gracilis, semimembranosis and posterior biceps femoris muscles. Upon disruption of both bands the end point force direction returned closer to the original direction.

CONCLUSIONS The crural fascia contributes to the stability and constraining of the degrees of freedom at the ankle joint, as well as the transmission of force from hip extensors/knee flexors to the ankle joint.

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