Major Effects of Epimuscular Myofascial Force Transmission on Muscular Mechanics in Experimental Conditions Similar to Those in vivo

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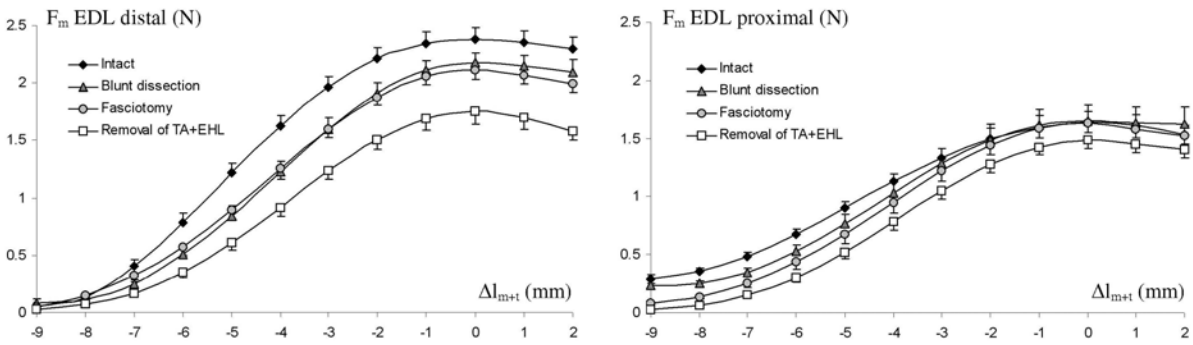
PURPOSE The goals of this study are (1) to test the effectiveness of epimuscular myofascial force transmission (MFT) [e.g. 1] in experiments performed with reference to joint positions attainable in vivo and (2) to asses the effects of experimental surgery performed to manipulate the myofascial connectivity of muscle to its surrounding tissues. METHODS In male Wistar rats (n=7) isometric forces of extensor digitorum longus (EDL) muscle exerted proximally and distally were measured after distal lengthening. The positions of proximal EDL tendon and the tied distal tendons of the synergistic tibialis anterior (TA) and extensor hallucis longus (EHL) muscles were kept fixed at a reference position corresponding to knee angle = 120°and ankle angle = 100°, representing in vivo initiation of stance phase in gait [2]. Muscles were activated maximally, in several conditions: (1) With all myofascial connectivity between the muscles intact, (2) after disruption of the direct (i.e. intermuscular) connections between EDL and TA+EHL (blunt dissection), (3) after compartmental fascia is cut longitudinally (fasciotomy) and (4) after TA+EHL muscles are removed. RESULTS In the intact condition, epimuscular MFT was evident from substantial proximo-distal force differences: at low muscle lengths (below Δl_{m+t} = -6.5 mm) the proximal force was higher (by maximally 0.23 N). This is in contrast to the dominance of the distal force (by maximally 0.74 N) at moderate and higher muscle lengths. After surgical manipulation, muscle length-force characteristics were altered significantly (see Fig.). Changes include: decreased optimal force, shifts in muscle optimum length to higher lengths and reductions in proximo-distal force differences (e.g. largely diminished dominance of proximal force at low lengths).



EDL muscle lenght-proximal and distal active force characteristics. 0 mm indicates muscle optimum lenght

CONCLUSIONS Effects of epimuscular MFT on muscular mechanics at lengths similar to those in vivo are substantial, and show major dependence on fascial connectivity of muscle to its surroundings. Important implications on pathological muscle function and surgery are expected. REFERENCES

[1] Yucesoy CA, et al. J Biomech Eng. 127, 819-828, 2005.
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