

ELONGATION OF ACHILLES TENDON REPRESENTS JUMP HEIGHT DURING HOPPING

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INTRODUCTION: It is well known that ultrasonography gives directly, but non-invasively, an image of tendon and/or aponeurosis during joint motion (Fukunaga et al.,1996). And the compliant aponeurosis is known to make it possible to jump higher (Kubo et al.,2000). Therefore the purpose of present study is to investigate the relationship between elongation length in the Achilles' tendon during ankle joint motion and jumping height during foot jump.

METHOD: Ten healthy males voluntarily served as subjects in this study. They lay prone on the originally made ankle joint dynamometer. Their ankle joint was passively and slowly extended at about 10deg/sec from 70 to 105degree. During passive plantar flexion, two real-time B-mode ultrasound apparatuses were used to measure the tendon displacement at 30% from proximal of the lower leg (P1), and myotendinous junction of medial head of gastrocnemius muscle (P2). The difference between P1 and P2 was defined as the elongation of Achilles' tendon (Δd). The foot jump was filmed using a high-speed video camera at 250fps, 1/500sec. The height of ankle was measured by digitizing the film. Ground reaction forces were measured by a force platform during foot jump.

RESULTS: The tendon displacement at P1 was significantly different from that at P2 ($p < 0.01$, Fig1). The elongation of the Achilles' tendon was significantly correlated with the jump height ($n=10$, $r=0.69$, $p < 0.05$, Fig2).

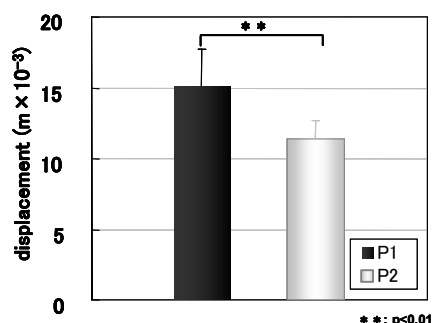


Fig.1 Comparison between P1 and P2 displacement.

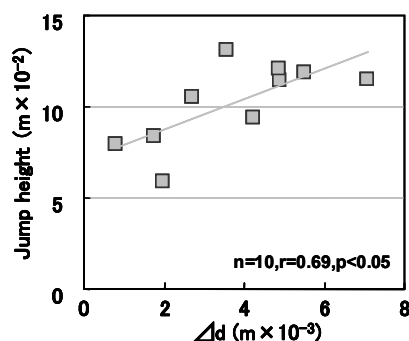


Fig.2 Relationship between jump height and Δd .

DISCUSSION: Kubo et al. (2000) reported the more compliant muscle tendon complex of vastus lateralis muscle, the higher vertical jump height. Furthermore they measured tendon elongation during maximal contraction. However, the results of this study indicated that the Achilles' Tendon elongated regardless of no voluntary contraction, and its elongation length had a positive correlation with some jump performance. The elongation of the Achilles' tendon during passive ankle joint motion was significantly correlated with jump performance.

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