

A Study on Human Musculoskeletal Model for Cycle Fitting: Comparison with EMG

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Abstract : It is difficult to study the effect of various variables on cycle fitting through actual experiment. To overcome such difficulty, the forward dynamics of a musculoskeletal model was applied to cycle fitting in this study. The measured EMG data were compared with the muscle activities of the musculoskeletal model through forward dynamics. EMG data were measured from five cyclists who do not have musculoskeletal diseases during three minutes pedaling with a constant load (150 W) and cadence (90 RPM). The muscles used for the analysis were the Vastus Lateralis (VL), Tibialis Anterior (TA), Bicep Femoris (BF), and Gastrocnemius Medial (GM). Person's correlation coefficients of the muscle activity patterns, the peak timing of the maximum muscle activities, and the total muscle activities were calculated and compared. BIKE3D model of AnyBody (Anybodytech, Denmark) was used for the musculoskeletal model simulation. The comparisons of the actual experiments with the simulation results showed significant correlations in the muscle activity patterns (VL: 0.789, TA: 0.503, BF: 0.468, GM: 0.670). The peak timings of the maximum muscle activities were distributed at particular phases. The total muscle activities were compared with the normalized muscle activities, and the comparison showed about 10% difference in the VL (+10%), TA (+9.7%), and BF (+10%), excluding the GM (+29.4%). Thus, it can be concluded that muscle activities of model & experiment showed similar results. The results of this study indicated that it was possible to apply the simulation of further improved musculoskeletal model to cycle fitting.

Keywords : musculoskeletal modeling, EMG, cycle fitting, simulation

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