Muscle Activity of Cycling Movements at Different Pedal Shaft Widths

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I. Introduction

The bicycle was the first machine to be mass-produced for personal transportation and was a prominent figure in the early development of the automobile. A remarkably efficient machine both structurally and mechanically, the bicycle continues to offer distinct advantages as a means of personal transportation. In the sport of cycling, both recreational enthusiasts and competitors desire to maximize their performance. In order to provide for better performance, the bicycle must transmit power efficiently, must minimize rolling resistance, and must be the minimum weight in order to reduce the effort of pedalling uphill.

Cycling has received much attention from biomechanics researchers in recent years. Previous observations in the research literature have focused on EMG activities while cycling against varying degrees of resistance at constant pedalling rate (Houtz and Fisher, 1959), saddle heights and loads (Despres, 1974), loads and pedalling frequencies (Goto et al., 1976), speeds (Miller and Seireg, 1977; Suzuki et al., 1982), RPMs, work loads, RPMs, saddle heights, foot positions, and toe-clips (Erickson et al., 1985), gear ratios, shoes, and seat heights (Jorge and Hull, 1986). However, no attempts have been
made to study muscle activity during cycling at different pedal shaft widths. Because the general objective of cycling is to reach an end point as effectively as possible, understanding interfaces between the rider and bicycle is critical. Propulsion of a bicycle via pedalling action of the legs is caused by contraction of the leg muscles. Understanding which muscles are active while pedalling and the forces being developed by the muscles is very important. A thorough understanding of the muscle activity process could very well lead to improvements in efficiency. In this study, EMG activities during cycling were investigated under conditions of different pedal shaft widths. It is clear that the lower limb muscle stresses may be determined with good accuracy directly from EMG activity. The results of this study will provide useful information to design and build bicycles for optimum performance and comfort. This understanding could lead to either elimination or amelioration of overuse injuries in the knee incurred from the pedalling activity.

II. Procedures

1. Subjects

Five female subjects were asked to participate in this study. All of the subjects were experienced recreational cyclists. Each subject was familiarized with the experimental protocol and signed an informed consent statement, as required by the University Guidelines for the Protection of Human Subjects. The men physical characteristics of the subjects sample were: age, 25±2.35 yr; height, 165±7.16 cm; weight, 61.8±12.01 kg; trochanteric leg length, 85.3±4.60 cm.

2. EMG Recordings

To obtain information of muscular activity of each subject, the silver chloride surface electrodes were placed over the muscle bellies of vastus medialis (VM), rectus femoris