

RESEARCH

Strength Changes in the Normal Quadriceps Femoris Muscle as a Result of Electrical Stimulation

R Keith Laughman, James W Youdas, Tom R Garrett and Edmund Y S Chao

Mr. Laughman is Associate in Biomechanical Research, Department of Orthopedics, Mayo Clinic and Mayo Foundation, Rochester, MN 55905.

Mr. Youdas is Instructor in Physical Therapy, Mayo Medical School, Rochester, MN 55905.

Mr. Garrett is Associate Program Director, Mayo School of Physical Therapy, and Instructor in Physical Therapy, Mayo Medical School, Rochester, MN.

Dr. Chao is Consultant in Biomechanical Research, Department of Orthopedics, Mayo Clinic and Mayo Foundation, and Biomechanical Engineering, Mayo Medical School, Rochester, MN.

The purpose of this study was to examine the effectiveness of an electronic muscle stimulator in strengthening normal quadriceps femoris muscle without the assistance of simultaneous isometric muscle contraction. The sample consisted of 58 subjects who were randomly divided into three independent groups. One group ($n = 19$) served as controls; one group ($n = 20$) underwent daily stimulation of the right quadriceps femoris muscle using a specified protocol; and one group ($n = 19$) underwent isometric strengthening of the quadriceps femoris muscle using a specified protocol. The mechanical force of isometric quadriceps femoris muscle contraction was recorded weekly for the three groups, and the initial and final values were subjected to an analysis of covariance. The electrical-stimulation and isometric-exercise groups had statistically significant increases in quadriceps femoris muscle torque when compared with the nonexercised controls ($p < .001$). The data supported the use of this electronic stimulator as an appropriate device for strengthening skeletal muscle without voluntary effort.