Medicine & Science in Sports & Exercise:
May 2001 - Volume 33 - Issue 5 - p S264
F19u Free Communication/Poster Skeletal Muscle II

Internal Vs External Velocity: Effects of Strength Training Protocols on Velocity-Specific Adaptations and Human Skeletal Muscle Variables

Tricoli, V A.1; Ricard, M D.1; Parcell, A C.1; Sawyer, R D.1

Author Information

[1]Brigham Young University, Provo, UT

This study investigated the effects of 8 wk high velocity isokinetic and isometric ballistic strength training on velocity-specific adaptations. In addition, modifications in muscle fiber characteristics, myosin heavy chain (MHC) isoforms, and neuromuscular adaptations were also studied. Twenty male subjects were randomly divided into two training groups: isokinetic concentric at 300°.sec^{-1} (IC, n = 9) and isometric ballistic at 60° knee angle (IB, n = 11). All subjects were pre- and posttested for peak torque and power at 60, 120, 180, 240, and 300°.sec^{-1} and for maximum isometric peak torque. Electromyographic signals (EMG) were recorded from the vastus lateralis (VL) and vastus medialis (VM). Rate of force development (RFD), time to peak torque (TPT), and electromechanical delay (EMD) were calculated. Muscle biopsies from the VL were analyzed for cross sectional area (CSA), fiber type, and MHC isoforms. Results showed no changes in fiber type, CSA, EMD, TPT, and EMG in either the IC or IB group. MHC type I and IIa percentage changed from 32.8% to 41.9% and from 52.4% to 42.5%, respectively, in the IB group ($P < 0.05$). Maximum isometric peak torque and RFD peak improved significantly in both groups. Significant increases ($P < 0.05$) in isokinetic peak torque and peak power were observed only in the IC group. The greatest change in torque occurred at 60°.sec^{-1} (21.7%) with a 12% change at 300°.sec^{-1}. Power increased 12% to 18% at all velocities with exception of 60°.sec^{-1}. We concluded that training involving external velocity (concentric contractions) increased both isokinetic concentric and isometric torque whereas training with internal velocity (isometric contractions) improved only isometric torque production.