Letters to the Editor

■ Reporting Angular Isokinetic Performance

To the Editor:

I applaud the attempt by Tis et al ("Isokinetic Strength of the Trunk and Hip in Female Runners" IES 1:22–25, 1991) to provide normative data for concentric and eccentric flexion and extension of the hip and trunk for a specific population. It is important to note, however, that their results were presented in terms of force rather than torque.

It is imperative that research measuring angular isokinetic performance be reported as torque rather than force. Force is a linear measure and cannot be used to express angular motion. While it can be argued that at any given angle a linear force is being applied tangent to the arc of motion, reporting force for angular isokinetic performance provides incomplete information. For example, suppose concentric hip flexion is being assessed isokinetically with the machine axis appropriately aligned with the biological axis of rotation. If the resistance pad were placed 6 inches distal to the axis, the same muscular force would produce twice the measured force as a 12 inch lever arm. This is true provided that the machine axis remains aligned with the biological axis (a basic assumption of most isokinetic research). Put simply, torque equals force multiplied by the distance from the axis of rotation. The use of specific resistance pad placement protocols fails to resolve the problem of reporting force as a measurement of angular isokinetic performance. For example, using the mid-sternum for measuring isokinetic trunk flexion performance would yield entirely different force measurements for two individuals who produced equal torques, yet were of dissimilar heights. Human muscular force produces torque about a joint axis. Angular isokinetic performance should be reported as such.

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■ Reply:

The Kinetic Communicator (Kin Com, Chattecx Corporation, Chattanooga, TN) was used to measure isokinetic strength of the trunk and hip in our investigation. The Kin Com is somewhat different than other instruments in that the load cell is attached to the distal pad on the lever arm rather than to the axis of rotation of the dynamometer. As such, the load cell of the Kin Com indicates the amount of *force* that is produced by the subject at the distal resistance pad. Kin Com protocol allows for notation of the length of the lever arm from the axis of rotation of the joint being tested, and data can thus be converted to torque (torque = force × lever arm length). However, since torque is a function of force, we feel justified expressing our data as force, or torque with this instrument.

Patterson states that it is imperative that isokinetic performance be reported as torque because it is an angular motion. Interestingly, isokinetic muscular performance is frequently reported as work and power, neither of which express angular motion. However, as with torque, both are functions of force, i.e., work = force × distance traveled and power = work/time.

We have recently reported a strong relationship between isokinetic average force, peak force, average torque, and peak torque (Tis et al., *Athletic Training,* 26: 164, 1991). The strong relationship among these variables suggests data may be reported as either force or torque. We contend that valid and reliable assessment is contingent upon optimal subject stabilization and joint alignment, proper warmup, and consistent test protocols, and that isokinetic muscular performance may be appropriately expressed as either force, torque, work or power.

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