The Role of Isokinetics in Rehabilitation

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Isokinetics refers to the force that a muscle applies during the movement of a limb at a constant angular velocity with specific reference to the involved joint. Isokinetics apparatus allow for the angular velocity to be preset. During isokinetic exercise, the dynamometer (apparatus designed to measure power) provides accommodating resistance throughout the specified range of motion. Maximum muscle tension can be generated throughout the range of motion because the resistance changes to match the muscle tension produced at different points in the range of motion.

Various isokinetic dynamometers are commercially available. The different systems offer variable types of resistance and velocities. The only system currently being manufactured is the Boidex System 4 dynamometer. The Cybex and Kim-Com dynamometers are still in use but no longer produced.

The major advantages associated with isokinetic exercise are the ability to work maximally throughout the range of motion and the ability to work at various velocities to simulate functional activity. However, the majority of the isokinetic testing is done in a non weight bearing (Open-Kinetic-Chain) position that is not representative of functional activities (Closed-Kinetic-Chain). Many variables contribute to the overall athletic performance and isokinetic testing evaluates just one of these many variables.

The reliability of isokinetic evaluation is dependent on many different variables.

1. Speed of testing – coactivation of the antagonist musculature occurs with high velocity testing. The antagonist musculature produces force to slow downthe lever arm in preparation for the end point of range of motion (ROM) with open kinetic chain testing.

2. Subject position – subject position during testing varies depending on the specific literature reviewed and the different manufactures. Historically, joint position should account for the gravity affect and the healing phase of the injured structures. The clinician may need to modify the testing position to protect healing structures. Positioning the joint being tested such that it produces functional activity may be beneficial for rehabilitation purposes.

3. Lever arm – the length of the lever arm of the dynamometer affects the ability to produce force. Torque production can be limited early in the healing phase of injury by decreasing the length of the lever arm.

4. Pain inhibition – pain inhibition is a protective neuromuscular response of an injured muscle to limit maximal recruitment of muscle fibers secondary to pain and swelling. Testing should not be performed when the injured body part is painful or swollen, this may lead to variations in torque production from one testing session to another.

Isokinetic dynamometers often provide other types of resistance, such as isotonic, isometric and passive motion. The additional resistance modes allow for more versatility in the use of dynamometers for rehabilitation. Progression through the rehabilitation programme should be based on the healing phase after injury. In the acute phase of injury, the goal should be to regain motion and maintain strength. Isokinetic apparatus can be used in this phase to provide isometric resistance, submaximal isotonic resistance and passive motion. As healing progresses and the injury enters the scar proliferation stage, graded resistive stresses can be applied to initiate the strengthening phase of the rehabilitation process. As the injury progresses into the scar remodelling phase, more aggressive strengthening can be added to the rehabilitation programme.
The use of isokinetics apparatus in rehabilitation should not be in isolation. Statements regarding the strength and functional ability of the tested musculature should be limited as isokinetic evaluation may not be correlated with the ability to perform functional activity. The clinician needs to evaluate functional ability in a functional setting using functional activities. However, retesting of the involved musculature enables the clinician to evaluate the progress made with the rehabilitation programme

References:

1. William E. Prentice (2004) Rehabilitation Techniques for Sports Medicine and Athletic Training, Fourth Edition.
2. http://www.biodex.com/rehab/system4/system4_feat.htm
3. http://www.isokinetic.info/