The language of plyometrics

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Editor's Note: Due to the increasing popularity of plyometric training for athletic performance, the NSCA Journal *is pleased to announce "Jumping into Plyometrics," a new feature edited by Donald A. Chu, Ph.D. "The Language of Plyometrics" opens the series, which will continue with discussions of various facets of plyometrics, individual drills with illustrated techniques and the role of plyometric drills in speed/strength development for specific sports.*

Plyometrics—a term which has generated great interest among all practitioners of conditioning and exercise. Now considered to be a revolutionary phenomenon in training, plyometrics does indeed bridge the gap between speed and strength. The system is what is most important in applying plyometrics. The key to implementing a successful plyometric regimen is understanding the system of utilizing each sub-group of plyometrics in moving from less difficult to more difficult exercises. Each exercise consists of skilled movement patterns which are generally learned rapidly and easily.

The following is a list of definitions pertaining to plyometrics. The purpose of this mini-glossary is to help the coach better understand the terminology involved when describing plyometrics.

Plyometrics

Plyometrics are drills or exercises aimed at linking sheer strength and speed of movement to produce an explosive-reactive type of movement. The term is often used to refer to jumping drills and in-depth jumping, but plyometrics can include any drill or exercise utilizing the stretch reflex to produce an explosive reaction.

Stretch or myotatic reflex

A stretch or myotatic reflex is a reflex which responds to the rate of muscle stretch. This reflex has the fastest known response to a stimulus (in this case the rate of muscle stretch). The myotatic/stretch reflex elicits *contraction* of the homonymous muscle (the same muscle that was stretched) and synergist muscles (those surrounding the stretched muscle which produce the same movement), and *inhibition* of the antagonist muscles (those which produce an opposing movement). (**Figure 1**)

Mono-synaptic or one synaptic junction

A mono-synaptic reflex is a direct connection from the sensory neuron to the moto-neuron. Most reflexes involve several synaptic connections before eliciting a response. A mono-synaptic reflex has the fastest response to a stimulus. The only true mono-synaptic reflex known is the stretch reflex.

Proprioceptor

Any mechanism which monitors change in the body is a proprioceptor. Proprioceptors conduct sensory reports to the central nervous system (CNS) from muscles, tendons, ligaments, and joints. These sensory reports are about orientation, angle of joints, degree of muscle shortening/lengthening, and velocity of stretch.

Muscle receptors

Muscle receptors are proprioceptors which monitor systems related specifically to skeletal muscles. These receptors include the Golgi tendon organ and muscle spindle, which send information to higher brain centers about muscle tension, static length, velocity of stretch, and pressure.

Muscle spindle

One of the most elaborately structured intrinsic receptors of the body is the muscle spindle. It conveys information about the muscle to the CNS. It is located within the muscle in-parallel to the extrafusal fibers. This feature allows the muscle spindle to be sensitive to muscle length. The muscle spindle monitors the muscle's static length, change in length, and pressure.

Intrafusal fibers

Located within the muscle spindle, the intrafusal fibers have a contractile component which maintains the sensitivity of the muscle spindle at various lengths. Intrafusal fibers do not participate in developing external tension, but instead serve as a sensory organ.

Extrafusal fibers

Commonly referred to simply as a muscle fiber, they are called extrafusal fibers only to differentiate them from intrafusal fibers. These fibers develop external tension.

In-depth jumping

Exercises utilizing the body weight of the athlete and the force of gravity to exert force against the ground are known as in-depth jumping. In-depth jumps are done by stepping off a box from heights of .75–1.10 meters. Upon making contact with the ground, the body is moved directly upward as rapidly as possible. The key to

successful development of explosive-reactive type movement is a "touch and go" type action off the ground when performing an in-depth jump. The in-depth jump demonstrates the use of the stretch reflex. (**Figure 2**). When the athlete lands on the ground, the hip extensors (gluteal muscles) and the leg extensors (quadriceps) are lengthening rapidly in an eccentric type of contraction (**Figure 2b**). This part of the jump is known as the *amortization phase*. The stretch on the muscle elicits a stretch reflex which results in a supramaximal contraction of the extensor muscles (**Figure 2a-b**). Thus, although only a moderate amount of stretching occurs, the rate of stretching is great.

Because the contraction resulting from the stretch reflex is greater than a voluntary contraction, another method of utilizing the overload principle becomes available to the athlete.

Concentric/isotonic/dynamic contraction

A concentric/isotonic/dynamic contraction is a contraction in which the muscle develops tension while shortening.

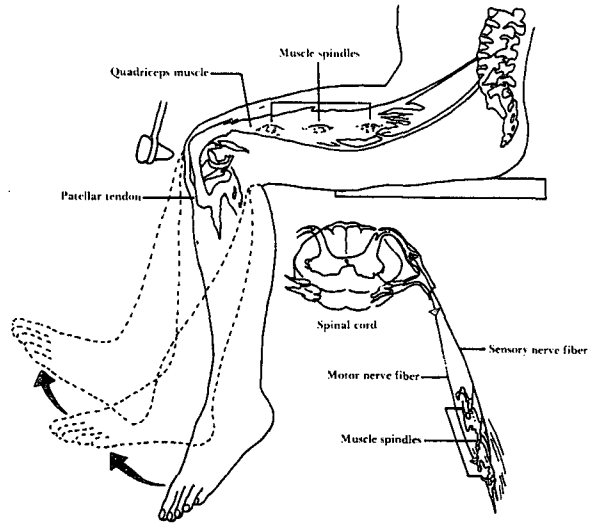

Figure 1: Following a rapid stretch of the quadricep muscle group by a tap on the patellar tendon, the muscle spindle sends information to the spinal cord where it connects directly to a motoneuron leading back to the same muscle, causing it to contract. An impulse is also sent to the antagonist muscle group which inhibits their contraction.

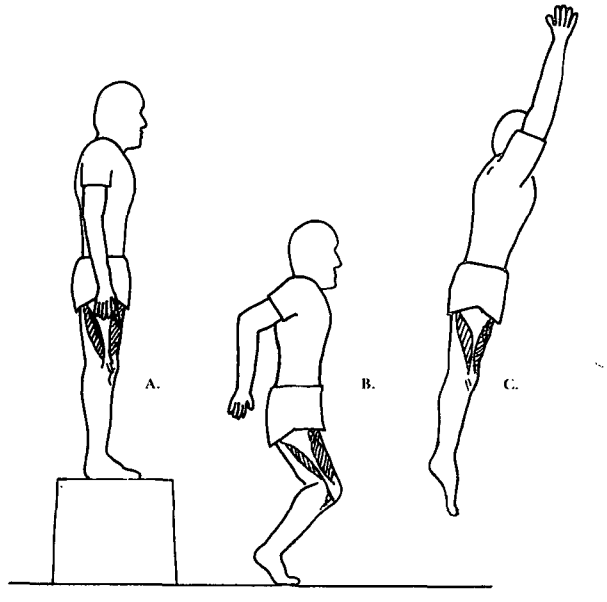

Figure 2.

Eccentric contraction

An eccentric contraction is a contraction in which the muscle develops tension while lengthening. An example of an eccentric contraction is seen during the down phase of a squat. The quadriceps are still producing tension, but the muscle is lengthening, i.e., the muscles are in a yielding phase.

Amortization phase

The amortization phase is the eccentric or yielding phase of an activity. Amortization occurs just prior to the active or push-off phase of an activity, and includes the time from ground contact to reversal of movement.

Jumps in place

Jumps in place are exercises requiring limited space and equipment, yet which serve to develop the neuromuscular reactivity to the ground. The stimulation of ground contact followed by immediate take-off is essential to reduction of the amortization or "time spent on the ground" phase.

Standing jumps

Standing jumps are exercises employed to stress maximal effort with both vertical and linear components. These are one repetition, maximal efforts. The drill itself may be repeated several times. Examples: standing long jump, standing triple jump, and jumps over cones.

Multiple jumps and hops

Multiple jumps and hops utilize the skills developed in the jumps in place and standing jumps. The exercises include double and single leg hops, hurdle or cone hops, and box jumps.

Bounding

Bounding exercises are employed to improve both running stride length and frequency. They are exaggerations of the normal running stride in order to accomplish or stress a specific aspect of the run cycle. These exercises are performed at distances of 10–100 meters.o