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Plyometrics Training

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PLYOMETRICS

Introduction

Plyometrics is a conditioning technique used to increase performance in sports that require explosive speed and power along with quick change-of-pace, stop-and-go movements. Although plyometrics has only recently caught on in American-training programs, it was developed years ago in the Soviet Union and Eastern Block countries. Also called bounce loading or rebound jumping, plyometrics implements a "cocking" action via a rapid stretching of a muscle group from an eccentric (lengthening) contraction to a concentric (shortening) contraction. This muscular "cocking" is necessary to gain maximal vertical jump when playing basketball or maximum arm speed when throwing a baseball, etc.

Physiology

This quick stretch-shortening cycle is a major factor in many sporting events and its importance in training has long been underestimated. The physiology behind plyometric training is that a muscle, which is contracted immediately after being stretched, will produce greater force than a muscle that has not been pre-stretched. The faster a muscle is allowed to shorten during pre-stretch position, the greater the acceleration. Receptors within the muscles called muscle spindles react to a sudden pre-stretch by sending nerve signals to the spinal cord. Milliseconds later this results in a reflex contraction of the same muscle fibers that were stretched. This serves to resist the stretch and protect against possible injury. Plyometrics thus "fools" this defense mechanism know as the "myotatic stretch reflex" to enhance muscular force generation.

Plyometric training also utilizes the natural stored elastic recoil energy within the muscle to increase strength. An intricate elastic structure within and surrounding the muscles provided stability and integrity within each muscle fiber. During plyometric training these elastic elements act like a rubber band that has been stretched and suddenly released. The force generated during the eccentric muscle contraction is converted into an equal and opposite force during the concentric contraction. Gains in joint range of motion and flexibility are also seen as these elasticity properties develop.

Another advantage to Plyometrics is that the central and peripheral nervous systems are training to react with maximum speed, thus stimulation the muscles to shorten rapidly and produce maximum force. A skeletal muscle fiber must be enervated by a motor neuron in order to contract (even if you beat a muscle fiber with a hammer it will not contract. A nerve must stimulate it). Nautilus, stair climber, etc. provide great muscular workouts but only provide minimal neural training because of their slow contraction speed. The level of neuromuscular training needed to improve coordination in most sports can only occur when the muscle is stretched rapidly and with large amounts of force.

Muscle Fibers

Athletes who have a high percentage of fast-twitch muscle fibers will benefit more from plyometrics than athletes with more slow-twitch fibers. Fast-twitch muscle fibers are fast contracting, require anaerobic (without oxygen) energy metabolism of carbohydrate and are activated during speed and power movements. Slow-twitch fibers generate energy aerobically (with oxygen), can utilize both

carbohydrate and fat, and are used to sustain continuous, endurance activities. Plyometrics will only train fast-twitch muscle fibers and thus are only advantageous when training for fast-twitch activities.

Training

Probably the most popular form of plyometrics is depth jumping. This involves having an athlete jump from an elevated surface, land simultaneously with both feet and immediately perform a maximal vertical jump to the top of the platform, repeating for several repetitions. Load can be varied by jumping off platforms of different height (as high as 10 feet have been reported in Soviet training regimes) and attaching weight belts to the body.

Training can also be manipulated by varying the number of sets per session, number of repetitions per set, and the frequency of workouts (although no more than two plyometric workouts per week are advised). Other variations of lower-body plyometrics include lateral jumping over boxes, double and single leg tucks, hopping/skipping takeoffs on one or both feet, and bounding in long, loping strides.

Depth jumps should be performed on soft surfaces (mats or grass) to minimize shock and should be conducted within the mechanical action of the sport-specified range of motion you are training for. A 10 to 12 pound, basketball-sized medicine ball is commonly used in upper-body plyometrics simulation throwing, catching, and rotational exercises for the trunk and abdomen.

Plyometrics are usually only conducted during the peaking phase of periodization training (immediately prior to the competitive season). Depth jumping (considered the most dangerous and advanced exercise) should not be used throughout the entire year because of the potential for injury, and especially not when athletes are just beginning a strength training program. Coaches should monitor athletes on an individual basis for overuse injuries, such as tendonitis, during plyometric training.

Plyometrics should not be used in place of training, but as a supplement for overall sport-specific conditioning involving periodization weight training and interval sprint training. A few coaches have recommended that an athlete build up enough strength to squat double their body weight before starting lower-body plyometric training. Athletes should start with elementary drills such as skipping and hopping before they advance to depth jumps and more advanced exercises.

Conclusion

In conclusion, all sport movements depend on an athlete's ability to overcome the inertia of his/her own body weight or an external object. Plyometric training utilizes body weight and the force of gravity during jumping and the external weight of an object during medicine ball drills to train the stretch/shortening cycle and increase muscular speed and strength. Plyometric training has shown increased in explosive power and vertical jumping through the mitotic stretch reflex and the inherent elastic recoil properties of the muscles. The importance of neural conditioning though Plyometrics along with evaluation of different neural training methods is currently under investigation in several exercise physiology laboratories.

Personal Experience

An Olympic gymnast first introduced me to Plyometrics from Ireland's national team. Most of the history and advanced plyometric theories and drills that I incorporate into my training I learned from Olympic Gold Medallist, Herb Perez, of the United States Tae Kwon Do Team.

In my search for knowledge of how to increase my height and explosiveness when jumping, I looked to ballet dancers and gymnasts because of their perfect form, tight body positioning, control in the air and tremendous hang time. After learning about Plyometrics the first time around, I realized I was already implementing some of the plyometric theories in my training through the repetition of jumps, jump kicks, and forms sections.

Training Routine

2 Times Per Week: Sprints and Plyometric Drills

Starting with stretching and 1/4 - 1/2 mile warm-up, I do 8 - 10, 50 yard sprints. Sprinting the straight aways and walking or jogging the curves at UCLA's track. I stretch again, more intensely, all the leg, groin, hip and stomach muscles to prevent injury during training. I ease into the plyometric drills by doing light skipping and hopping exercises.

Choosing 4 -5 different exercises, I do 3 - 4 sets per exercise, at approximately 12 - 15 reps. Starting with basic drills and moving on to advanced ones.

Basic Plyometric Drills

1. Hopping/Skipping - W/ hands in guard position, hop off single leg, alternating legs in a forward direction bringing the knee to meet the chest. 2 variations - knee comes straight up, or out to the side.

2. Light Bouncing - stiff-legged jumps pushing primarily off of the ball of the foot. Important to keep the back straight, chest out and head forward. Can be done with feet together, apart, alternating, criss-crossing, or up and down stairs.

Intermediate Plyometric Drills

1. Single and Double Leg Tucks - These are your knees up to chest jumps. Can be done in place for height, moving forward for height and forward acceleration, a side to side.

2. Bounding in Long, Loping Strides - similar to the take off in the triple jump.

Advanced Plyometric Drills

1. Depth Jumping/Box Jumping - Jumping from elevated surfaces, landing with both feet immediately jumping up onto another platform and repeat for several repetitions. This can be done forwards, laterally (side to side) or back and forth on a single box.