# *Plyometrics Principles for Enhanced Speed—Part I*

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Plyometrics is a sometimes misunderstood concept of training. But like anything else, just because it is misunderstood by some, that does not mean it should be avoided. An athlete can drastically enhance his/her explosive power on the field or court with plyometric training. This tool for improvement is a crucial element of any performance enhancement program in which augmenting rate of force production (RFD) is a desired goal, which is generally a part of any sporting event which uses anaerobic energy systems (short-duration bursts with adequate rest time).

The concept of plyometrics includes use of the stretch-shortening cycle, an elastic component of muscles and tendons which allows for power production. Think of a muscle and its tendon attachment as a rubber band. When the rubber band is stretched, or loaded, properly, it can produce great recoil force, launching itself or an object (paper birdie) a considerable distance. The same general concept applies to plyometric use of the series elastic component, a major element of the stretch-shortening cycle.

Training with plyometrics can enhance the rate of force production an athlete's body can produce. Rate of force production means the time it takes for an athlete to reach a certain force output, ideally maximal force. The shorter this time, the better. Just like the term "zero to sixty" with a car, we want our bodies to go from zero to max force as quickly as possible. The rate of force production is synonymous with the term "twitched." If an athlete is described as "twitched up," he likely has an abundance of Type-II (fast-twitch, anaerobic) muscle fibers. However, not to be forgotten, training plays a major role in rate of force production as well. As with any aspect of athletic performance, genetics play a big role in this characteristic of movement; but the ability within an athlete can be tapped into and enhanced with proper training. The popular phrase, "Great athletes are not made, they're born" can be somewhat true, but mediocre athletes can become good, and good athletes can become great. If you do not train, you do not have a chance. So train hard!

Plyometric movements consist of three components: an eccentric phase, a transition piece, and a concentric phase. In the eccentric phase, the muscle is lengthened (stretched) and potential energy for a movement is stored. Liken this phase to a rubber band being pulled. As the band is stretched, you can feel the energy inside waiting to explode. Next, during the amortization (transition) phase, the switch from lengthening to shortening is kick-started. This is the period when you have the rubber band stretched and ready to fire at your unsuspecting friend's arm. However, the transition phase for the human body during plyometric movement is a bit different than a rubber band. With the rubber band, really no matter how long you hold it in the stretched position (short of a year), the band will propel with the same force as it would if you held it stretched for one second. A human muscle needs to be fired as quickly as possible after being stretched. With that being said, do you notice how pulling the rubber band back and immediately letting it go causes it to launch a further distance? The same general concept is true with the human body – the shorter the amount of time you spend in this transition phase, the more force you will be able to produce. The longer you stay in the transition, the more of your potential energy is dissipated as heat and is thus useless for force production. If you have ever heard the phrase "limit your ground contact time," this is the concept that phrase refers to. Finally, the part of the movement plyometrics are used for, concentric action, comes into play. During this phase, the muscle quickly shortens (contracts), causing the launching of the object against resistive force(s)—in this case, the human body against the ground and gravity. The muscle and tendon are more elastic, or concentrically powerful, (again, like a rubber band) when the transition phase is limited.

Similar to the need for an athlete to learn to decelerate properly before he begins a sprint training program, the initial focus for any athlete who is beginning jump training is to learn to land properly. You must teach your body to absorb the forces produced by its own explosive components and opposing objects/forces. This is important for one of the primary reasons we train in the first place – to prevent injuries. An athlete cannot put himself/herself in positions with increased likelihood of injury during training. That would defeat the purpose of training.

So, you must land correctly if you are going to jump. To land in the proper position, think about a quarter squat, often referred to as the "football position" or "athletic position." The forces of gravity pulling you back toward the earth should be absorbed mostly with the hips. The glute muscles are the largest in the human body, so absorb the shock with them rather than the much smaller patellar tendon on the front of the knee, as many people do. Your future self will thank you immensely for it. Now, I am not saying land with a completely vertical shin angle. This is not realistic to athletics, and you must train for what your body will be required to do in practice and competition. But, do not over-exaggerate your anterior shin angle. Also, you want your back flat with your chest up and over your knees, your head in a neutral position (not facing up or down), and your feet firmly on the ground armpit width with the toes forward and the force driving down through the mid-foot back to the heel. If you can avoid it, try not to land only on the front of your foot – again, this puts tremendous stress on the front of the knee. Ensure your knees are in-line with your toes when you land. Do not allow your knees to dip inside. If your knees are dipping in, your hips are not as strong as they need to be; so stop jumping, and start squatting. As with any training exercise, keep the core (mid-thigh to lower chest) engaged and tight to improve core strength and to protect the spine. When landing, do not slam your feet on the surface upon which you are landing, as you may see some inexperienced athletes do when they begin utilizing Olympic lifting. Remember, absorb the forces. Again, your ankles, knees, hips, and back will thank you in the future.

To practice landing, stand on a flat surface and explosively drop into the landing position – again, a solid quarter squat position. Be sure you are absorbing the forces evenly with both legs (i.e. do not allow your hips to pivot left or right). Practice this repeatedly until you feel comfortable landing. Once you have mastered this landing drill, step up onto a six- to eight-inch box, step off backward and employ the same landing principles. As you progress, you can continue to move onto progressively higher boxes, but I would not recommend exceeding 12 inches or so for beginners. Again, it's about absorbing forces, and if you are a beginner you are likely not yet strong enough to absorb forces from higher elevations. Don't worry, you'll get there. Just keep lifting!

As with any aspect of training, resistance (weight) training is the foundation of all performance enhancement. It is critical that an athlete is consistently utilizing weight training (preferably free weights) to develop the strength necessary to jump and to land.

In the next article, we will look at different plyometrics exercises, how to perform them properly, and when to do them.

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