

# Plyometrics

## What are they?

Plyometrics are explosive movements that harness the body's elastic abilities to produce force quickly. They are ideal for athletes who require powerful movements in their sports (a boxer's punch, a golfer's swing, a basketball player's jump, etc.).

## The Specificity Principle

In order to improve at a sport related task (improving your batting power for baseball, increasing your vertical jump, etc.) you have to train your body the way it would act while performing these movements. Ask yourself, is your training program:

- Moving at the same speed of the movement you want to get better at (a baseball swing is a very fast movement so training with slow rotational movements will not help you)?
- A similar movement pattern (if you are standing during a baseball swing, then training your obliques on the MedEx Rotary Torso where you are sitting down will not translate into a better swing)?
- Training stabilizing muscles (athletic movements require a lot of neuromuscular coordination, something that machines provide very little of)?

This is where plyometrics become key. If you are performing some sort of explosive movement, as most athletes do in their sports, then training explosively with plyometrics is the way to go.

## How do they work?

Plyometrics use the *stretch shortening cycle* (SSC) to produce power. Simply put, the SSC occurs when a muscle lengthens, storing elastic energy that can be used for a powerful contraction. Think of it like a rubber band- when you stretch out a rubber band, it stores elastic energy so that when you release it the rubber band can be shot really far. A practical example of this is a golf swing. How far do you think a golf ball could be driven back if golfers did not use a backswing?

So what is the gist of all of this? In order for plyometrics to be done properly, you need to lengthen a muscle before you contract it.

To ensure this, we divide plyometric movements into three phases:

1. *An eccentric contraction.* This occurs when a muscle is lengthened while still under tension. Examples of this are lowering the bar during a bench press or lowering your body during a squat. Elastic energy is stored in this phase.
2. *Amortization phase.* This phase is characterized as the point between phases one and three in which no movement occurs. Shorter amortization phases translate into more powerful movements.
3. *Concentric contraction.* This is the actual explosive portion in which you release the stored elastic energy. Examples would be exploding the bar up on the bench press or explosively jumping up during a squat.

There is also the belief that *muscle spindles* are activated while doing plyometrics. These are detectors found in muscle that alert the muscle that it is being stretched

too much thereby forcing the muscle to contract. It is thought that during the eccentric phase the body thinks that the muscle is being pulled on too much which signals the muscle spindle, creating a more powerful concentric contraction.

### **Benefits**

- A wide variety of training studies show that plyometrics can improve performance in vertical jumping, throwing, long jumping, sprinting and sprint cycling.
- As little as 2-3 sets 2-3x/week has been shown to drastically improve motor performance in both trained and untrained individuals.
- Good supplementation to current strength training routine.

### **Safety Considerations**

Since plyometrics can potentially be high impact, the National Strength and Conditioning Association (NSCA) recommends the following before engaging in plyometrics:

- Males be able to squat 1.5x their bodyweight and bench 1 times their bodyweight.
- Females be able to squat 0.5 to 0.75 times their bodyweight.
- Stable joints, especially the ankle, knee, hip, elbow, and shoulder.

## **Exercises**

### **Low Intensity (beginners)**



### **Jump rope**

Jump roping is great for developing elasticity (fast response) in your calf muscles. Good for: boxing, soccer, general conditioning.

### **Split Squat jumps**

Get in a lunge position. Jump up powerfully, bringing your legs together in the air and then land either in the starting position or with the feet switched. Good for: basketball.





### **Clap Pushup**

Perform a pushup but push powerfully enough up so that you can lift your hands off the ground and clap in midair. Good for: boxers, football linemen, shot-putters.

### **Lateral Jumps**

Hop side to side over a line (either imaginary or place something flat on the ground) in a controlled fashion. To increase difficulty, perform on one foot. Good for: running backs, wide receivers, tennis players.



### **Ice Skaters**

Stand in an athletic stance and hop powerfully side to side over a line, landing on your right foot to the right of the line and left foot to the left of the line. Cross the leg that is not touching the ground behind the leg in contact with the ground. This should resemble someone ice skating. Good for: running backs, wide receivers, tennis players.

### **Bounding**

Skip powerfully, trying to get as high in the air each time as possible.

## Medium Intensity



### Tuck Jump

Jump as high as you can and tuck your knees into your chest at the highest point. Good for: basketball players, wide receivers, cornerbacks.

### Hopping

Hop forward, and land into your jump by bending at the knees and then immediately hop forward again.



### Medicine Ball Rotational Toss

In an athletic position and with your side facing a wall or a partner, toss a medicine ball to the wall/partner by rotation at the hips and waist. Catch the ball as the wall/partner returns it to you by rotating away from it/them and try to return the ball as fast and powerfully as possible. Good for: golfers, tennis players, baseball players.

## Depth Pushup

Get in a pushup position with your hands supported on two blocks (or medicine balls for an extra challenge) spaced shoulder width apart. Drop your hands inside the blocks and land your hands inside of the blocks, absorbing your fall by bending your elbows and shoulders, and push off immediately to land your hands back on the blocks. Good for: football linemen, boxers, shot-putters.



## Medicine Ball Crunch Toss

Perform a crunch with a medicine ball. Toss the ball to a partner at the top of the crunch then have them pass it back as you descend. Aim to possess the ball for as little time as possible.



## Single Leg Box Jumps

Standing on one foot, jump up on a platform. Return to the ground, absorbing shock by bending at the knee, and jump back on the platform as soon as possible.



## High Intensity

### Depth Jumps

Stand on a plyometrics box. Drop down off of it, land firmly on both feet and absorb shock by bending at your knees and hips, then immediately jump up. Good for: wide receivers, basketball players.



### Box Jumps

Jump from the ground onto a box. Hop back down, bending your knees into the landing, and return to the top of the box as quickly as possible.

### Plyometrics and Program Design

- Lower intensity can be added anywhere and can help you in terms of cardio and for power production
- Higher intensity plyometrics should be reserved for developing power only.
  - Sets with low repetitions (<6) recommended
  - Ample rest between sets also suggested
- Plyometrics should be performed at the beginning of workouts after ample warm-up to prevent injury

## EXERCISES/THINGS YOU SHOULD NEVER DO IN THE GYM:

### Lat pull-downs behind then neck

- **Why?** Lat pull-downs done behind the neck are not a normal movement pattern (can you think of anything where you pull something down behind your neck??) and they force your rotator cuff tendons (your rotator cuff is a group of muscles that stabilize the shoulder) to fit into a very narrow space. This can cause inflammation of those



tendons if they rub against bones which can lead to a condition called *shoulder impingement*. Impingement is characterized by pain when moving the shoulder, especially during abduction, and it can really kill your training routine by severely limiting the amount of exercises you can do.

- **Alternative.** Lat pull-downs to the front.

### Military press/pull-ups behind the neck

- **Why?** Same reason as lat pull-downs- it causes shoulder problems.
- **Alternative.** Presses to the front, dumbbell presses, Arnold presses.

### Round your back

- **Why?** Your vertebrae have an optimal alignment with respect to one another and rounding your back disrupts this alignment. Think of it like a tree branch- if you have a straight branch and push down on it, it should be able to support a good amount of weight, but if you take a branch that is bent and push down on it, it will have more of a tendency to bend and break.



- **Reasons this may occur.** There are a number of reasons people round their back. The first may be that they just do not know better. Another more common one is that people have tight hip flexors, hamstrings and/or glutes which pull down on the lower back and cause it to round prematurely. Core weakness could also be a problem- a weak transverse abdominus or erector spinae can cause people to round.

- **Alternative.** Keep your back aligned. In many cases this requires fixing the problems mentioned above: stretching your hip flexors and hamstrings, while concurrently strengthening your core musculature.



### **Train one movement while ignoring its antagonistic movement**

- **Why?** There are a multitude of reasons why you should avoid doing this. On the simplest level, it does not look good to have one muscle trained while another neglected. On a more complex level, training one movement while avoiding its antagonist will lead to muscle imbalances. This will affect your posture (ex: training chest while avoiding back exercises will pull your shoulders forward and give you a slouched posture) which can lead to injury (upper back and neck pain can result from the previously mentioned example).
- **Alternative.** Make sure your training routine is balanced. Cite January's FS education which discussed anatomical movements and make sure that you include each one in your training. Furthermore, make sure that you are including an even amount of each one. For example, if you do 4 different exercises for chest and only one for back, your routine is still unbalanced.

### **Crunches while neglecting transverse abdominus training**

- **Why?** While everyone wants to have "6 pack abs," overtraining the rectus abdominus (the muscle responsible for the spinal flexion done during crunches) can lead to a condition called *rectus dominance*. This means that your rectus will try to perform the job of the transverse abdominus (stabilize the spine). This means that your core muscles are not activating properly which can lead to a multitude of problems. A simple way to see if you are already suffering from rectus dominance: perform a plank and see if your natural tendency is to push your stomach out or pull it in. If your stomach juts out, you are probably rectus dominant.
- **Alternative.** Add transverse abdominus specific exercises to your training. These include 4-point draw ins, sky reaches, etc. A fun alternative to help activate your transverse is jumping on a trampoline. If you are already rectus dominant, stop doing crunches. Also make sure that your stomach does not protrude will doing crunches and that the belly button remains drawn in towards the spine for the duration of the movement.





### **Machines only**

- **Why?** Machines lock you into one range of motion with little to no assistance from stabilizing muscles. This means that you will be utilizing less muscle than with free weights and therefore burning less calories and obtaining less functional strength. Training solely on machines will neither increase your sport performance nor lower your injury risk when playing sports or partaking in real life activities. This is because muscles that stabilize certain joints do not get worked, such as the rotator cuff in the shoulder or the gluteus medius in the hip.
- **Alternative.** Train with freeweights. An even better alternative is training functionally which will increase sports performance and lower injury risk.

### **Not take time off now and then**

- **Why?** While strength and cardio training are some of the stimuli to help you reach your fitness goals, so is rest. Without adequate rest your body is not allowed to repair itself and it is very easy to be pushed into a state of overtraining. While getting sufficient sleep every night will help, working out 6 or 7 days a week may still be too much to keep you from getting the recovery you need. A week off every now and then is not a bad idea (in fact, many athletes will take as much as a month off from training once their season has ended).
- **Symptoms of overtraining.** If you are exhibiting many of the following symptoms, you may be overtraining (or at least overreaching which is overtraining's precursor).
  - Constantly tired and "out of it"
  - Irritability and loss of enthusiasm
  - Stagnation in your workout
  - Insomnia
  - Muscle and joint pain
  - Increased sickness
  - Decreased appetite
  - Elevated resting heart rate and blood pressure
  - Lowered libido
- **Alternative.** Have at least a day or two off a week and take a week off every couple months. If you are trying an Arnold Schwarzenegger training protocol where you are working out two times a day six days a week, remember that Arnold was a genetic freak who probably was getting chemical help, so while he may not have overtrained, you will. Also, try incorporating an "active rest" day every week into your training. This just means staying active but at a lower intensity, and is usually comprised of something physical that you enjoy doing that does not involve picking up a weight or running on a treadmill (such as basketball, hiking, etc.).