Plyometric Training for Track and Field  
Indiana High School Clinic 2008  
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What is Plyometric Training?
- Exercises like hopping, skipping, jumping, bounding, depth jumps and medicine ball throws are common plyometrics that should be blended into the training plan.
- Hurdles, stairs, benches and boxes of various heights also are used throughout the training program to build a base for later high intensity speed-strength work.
- Concentric Jumps and depth jumps are very effective medium and high intensity plyometrics used during the in-season training phase.

Explosive vs. Plyometric Training: Is there a difference?
- **Explosive**: “Exercises or movements where rapid initiation of force production and ability to accelerate are of primary importance”
- **Plyometric**: “Exercises that train the muscles, connective tissue, and nervous system to effectively carry out the stretch shortening cycle.”
- Involve the use of maximum or near maximum rates of force development (RFD)
  - Ability to achieve high RFD is associated with the ability to achieve high accelerations
- Almost any exercise can be performed explosively depending on the resistance used
  - Light weight = High acceleration
  - Heavier weight = High RFD

Plyometrics
- **Plyometric Training**
  - One of the objectives in training for power is to involve as many motor units (muscle fibers) as possible in a quick explosive contraction
  - Peaking for Track and Field
  - Plyometrics are also shown to improve force production at high velocities
  - Plyometrics have long been considered to provide event-specific training, both in the mechanics of performance as well as in addressing the need to improve RFD

Are Plyometrics Necessary
- Verkhoshansky suggests that traditional weight programs which incorporate plyometrics are superior to those that do not include plyometrics

Utilizing Plyometrics with Throwers
- There are some pre-requisites that must be developed in order to make this mix of plyometrics and weight training work at maximum efficiency.
- If F=ma, then particular care should be taken with heavy athletes.
  - It is up to the discretion of the coach to assess strength in relation to bodyweight and use safe methods with all athletes

Plyometric Training
- Perform a thorough warm up before a plyometric session
- Introduce and master less demanding drills prior to attempting more complex drills
- “Reduction of athletic injury risks associated with participation in sports involving high RFD and high accelerations requires some training with exercises involving high RFD or high accelerations.”
Plyometric Training

- A simple rule of thumb to determine if an athlete is ready for plyometrics: the athlete must be able to squat approximately 1.5x body weight.
- It has been suggested that athletes over 100kg should not perform depth jumps higher than 18 inches.
- In addition, plyometrics should not be used by athletes with orthopedic injuries.

Body Weight Squat

Guidelines

- Although authorities have placed many qualifications upon the use of plyometric training ultimately, the wisdom of the coach and close training state observation are pre-requisites to the use of this type of training.
- Throwers should not do very much single leg jumping, excepting javelinists.
- Written guidelines can never replace visual control by the coach.

The Basic Jumping Skills

- Hop: one foot to the same foot
- Step: one foot to the other foot with ground contact
- Bound: one foot to the other with flight phase
- Jump: one foot to both feet or both feet to both feet

Basic Jumping Skills

Different Categories of Plyometrics

- Low Intensity
  - Ground Level Plyo’s

- Medium Intensity
  - Concentric Jumps

- High Intensity
  - Depth Jumps
  - Hurdle Hops

Plyometric Exercises can be Grouped According to the Strength Qualities

- Elastic strength (low hurdle jumps; low drop jumps)
- Concentric strength (standing long jump; high hurdle jumps)
- Eccentric strength (higher drop jumps, depth jumps)
- Plyometric exercises should be sequenced to reflect the period in the annual plan

Progression of Activities

- Soft surfaces to hard surfaces
- Harder surfaces encourage high rates of energy return

The Exercise Progression is as Follows:

- Double leg to single leg jumps
- In place to moving jumps
- Un-weighted to weighted jumps
- Jumps with a pause to jumps to continuous jumps
Low amplitude to high amplitude jumps

**For Most Throwers**
- The beginning box or hurdle height should be relatively low and increased gradually
- Proper form and body mechanics should be taught and be constantly monitored

**Proper Plyometric Landing Position**
- Postural integrity

**Technical Guidelines**
- When performing a box jump, the athlete should step off the box in a relaxed state, not jump
- The optimal height of the box should not result in a landing where the heel is forced to the ground by momentum
- Biomechanical data supports the idea that high force production corresponds to a “bridging” action of the foot on ballistic action
- Contact is made on the outside edge of the mid-foot then rolling onto the inside edge of forefoot (5th metatarsal to the big toe)

**Coupling Times**
- The transitional time between eccentric and concentric action
- The time it takes to reverse action must be very short in order to take advantage of the increased force production
- Two very effective cues for coaching plyometric exercises are: “quick off the ground” or “jump off the frying pan.”
- Shoes should be suited to the foot, and provide good support for beginners and good energy return for advanced athletes

**Proper Technique**

**Stretch Reflex & Training Background**

**Eccentric-Concentric Force Profiles**

**Designing Plyometric Training**
- Ground level plyometrics should be introduced initially and used in the high volume preparation phase to build the foundation for more intense plyometrics.
- When in doubt about volume, intensity, or frequency, it is best to be conservative in program design.

**How Many Reps?**
- It is wise not to perform too many repetitions in any one session and since it is a quality session, with the emphasis on speed and power rather than endurance, split the work into sets with ample recovery in between.
- An experienced athlete conducting lower body plyometrics may conduct up to 150-200 contacts in a session –
- Athletes new to plyometric work should start with around 40 contacts per session e.g. 3 sets of 10 bunny hops is 30 contacts. Similar approach should be taken with upper body plyometrics

**Young Athletes**
- Some authors suggest that moderate jumps can be included in the athletic training of very young children (Lohman, 1989).
- However, great care needs to be exerted when prescribing any training procedures for preadolescent children.
- Because of the relatively immature bone structure in preadolescent and adolescent children the very great forces exerted during intensive depth jumps should be avoided (Smith, 1975).
Conditioning for Plyometrics
Higher than normal forces are put on the musculoskeletal system during plyometric exercises so it is important for the athlete to have a good sound base of general strength and endurance. Most experts state that a thorough grounding in weight-training is essential before you start plyometrics.

It has been suggested that an athlete be able to squat twice his body weight before attempting depth jumps. However, less intensive plyometric exercises can be incorporated into general circuit and weight training during the early stages of training so as to progressively condition the athlete.

Simple plyometric drills such as skipping hopping and bounding should be introduced first. More demanding exercises such as flying start single-leg hops and depth jumps should be limited to thoroughly conditioned athletes.

Planning a Plyometric Session
The choice of exercises within a session and their order should be planned. A session could:
- Begin with exercises that are fast, explosive and designed for developing elastic strength (low hurdle jumps; low drop jumps)
- Work through exercises that develop concentric strength (standing long jump; high hurdle jumps)
- Finish with training for eccentric strength (higher drop jumps).

Planning a Plyometric Session
An alternative session could be:
- Begin with low hurdle jumps
- Progress to bounding and hopping,
- Continue with steps or box work
- Finish with medicine ball work out for abdominals and upper body.

Warm up
A thorough warm up is essential prior to plyometric training. Attention should be given to jogging, stretching (static and ballistic), striding and general mobility especially about the joints involved in the planned plyometric session. A cool down should follow each session.

Multiple Jump Exercises (Preparation Phase)
Beginners
Power Skip for Height
Prepartion Phase Plyometrics Ground Level)
- Bounding, skip for height, skip for distance, frog jumps
- Standing broad jumps, vertical jumps, rocket jumps

Preparation Phase Multiple Jump Exercises
Tuck Jumps
How to perform the drill
- Begin in a standing position
- Jump up, grabbing both knees as they come up your chest
- Return to the starting position landing on the balls of the feet
- Try to anticipate the landing and spring up as quickly as you can
- Keep the feet touch down time on the ground to the shortest time possible

How much
- 1 to 3 sets
Allow a full recovery between each set
5 to 10 repetitions/set
Quality of Tuck Jumps is far more important than quantity

**Bounds**

**How to perform the drill**
- Jog into the start of the exercise
- Push off with your left foot and bring the leg forward, with the knee bent and the thigh parallel to the ground
- At the same time, reach forward with your right arm. As the left leg comes through, the right leg extends back and remains extended for the duration of the push-off
- Hold this extended stride for a brief time, then land on your left foot
- The right leg then drives through to a forward bent position, the left arm reaches forward, and the left leg extends backward
- Make each stride long, and try to cover as much distance as possible
- You should land on the sole of the foot (flat footed), allowing energy to be stored by the elastic components of the leg muscles, and immediately take off again
- Keep the foot touch down time to the shortest time possible

**Bounds**

- How much
- One to three sets over 30 to 40 meters
- Allow a full recovery between each set
- Quality of bounding is far more important than quantity.

**Bounds**

Single Leg Hopping
- How to perform the drill
- Stand on one leg
- Push off with the leg you are standing on and jump forward, landing on the same leg
- Use a forceful swing of the opposite leg to increase the length of the jump but aim primarily for height off each jump
- You should land on the ball of the foot, allowing energy to be stored by the elastic components of the leg muscles, and immediately take off again
- Keep the foot touch down time to the shortest time possible
- Try to keep your body vertical and straight
- Perform this drill on both legs
- Beginners will use a straighter leg action where as advanced athletes should try to pull the heel toward the buttocks during the jump

**Single leg hopping**

- How much
- One to three sets over 30 to 40 metres
- Allow a full recovery between each set
- Quality of bounding is far more important than quantity
  - One Leg and Two leg Bound
  - Straight Leg Hops
  - Frog Jump and Vertical Jump

*Medium/High Intensity Plyometrics*
Fast leg, concentric jumps, Depth jumps, Depth jumps w/rocket jump, box jumps, one leg box jumps
Rotational boxes
Sides, 180s, 360s
Concentric Jumps

**Hurdle Hopping**
- How to perform the drill
  - Jump forward over the barriers with your feet together
  - The movement should come from your hips and knees
  - Keep your body vertical and straight, and do not let your knees move apart or to either side
  - Tuck both knees to your chest
  - Use a double arm swing to maintain balance and gain height
  - You should land on the balls of the feet, allowing energy to be stored by the elastic components of the leg muscles, and immediately take off again
  - Keep the feet touch down time between hurdles to the shortest time possible

**Hurdle Hops**
- How much
  - One to three sets using 6 to 8 hurdles
  - Allow a full recovery between each set
  - Hurdles should set up in a row, spaced according to ability
  - The height of the hurdles should be in the region of 12 and 36 inches high
  - Quality of hurdle hopping is far more important than quantity

**Hurdle Hops**
Low Hurdle Hops
Box Jumps
- How much
  - One to three sets using 6 to 8 boxes
  - Allow a full recovery between each set
  - The height of the box should be in the region of 30-80 cm
  - Quality of box jumping is far more important than quantity

Depth Jumps and Rocket Jump
Box Jumps

**Upper body Plyometrics**
- A variety of drills can be used to make the upper body more explosive:
  - **Press ups & hand clap:** Press-ups with a hand clap in between is a particularly vigorous way to condition the arms and chest. The pre-stretch takes place as the hands arrive back on the ground and the chest sinks, and this is followed quickly by the explosive upwards action. Once again, to get the best training effect keep the time in contact with the ground to a minimum.
  - **Medicine Ball:** Another means of increasing upper body strength popular with throwers is to lie on the ground face up. A partner then drops a medicine ball down towards the chest of the athlete, who catches the ball (pre-stretch) and immediately throws it back. This is another high-intensity exercise and should only be used after some basic conditioning.

**Medicine Ball Push**
- Take a medicine ball (2 or 3 kg.) and hold it with the elbows up and the thumbs down.
Instruct the athlete to throw the medicine ball to a partner.
The hands follow through outward with the thumb down.
This drill will teach the proper follow through in the arm strike.

**Chest Pass**
- How to perform the drill
- This drill requires a partner
- Stand facing each other with your feet shoulder width apart and your knees slightly bent
- Begin by holding the medicine ball with both hands at chest level, elbows pointing out
- Pass the ball to your partner, pushing it off your chest and ending with your arms straight
- Your partner catches the ball, allows the ball to come to the chest before passing it back to you
- Try to anticipate the catch and return the ball as quickly as you can
- Keep the catch time to the shortest time possible
- How much? 1 to 3 sets
- Allow a full recovery between each set
- 10 to 20 repetitions/set
- Quality of Chest Passes is far more important than quantity

**Chest Pass**
- Plyometric Push up
- How to perform the drill
- Two mats, three to four inches high, placed shoulder width apart
- A box high enough to elevate your feet above your shoulders when in a push-up position
- Face the floor as if you were going to do a push-up, with your feet on the box and your hands between the mats
- Push off from the ground with your hands and land with one hand on each mat
- Push off the mats with both hands and catch yourself in the starting position
- Keep the catch time to the shortest time possible
- How much? 1 to 3 sets
- Allow a full recovery between each set
- 10 to 20 repetitions/set
- Quality of Push Ups is far more important than quantity

**Shot Put Push-ups**
- Position hands in shot put release position
- Develops specific strength

**Ball Drop**
- How to perform the drill
- This drill requires a partner
- Lie supine on the ground with your arms outstretched
- Your partner stands on the box holding the medicine ball at arm’s length
- Your partner drops the medicine ball into your hands.
- Catch the ball with elbows bent
- Allow the ball to come towards your chest
- Extend the arms to propel the ball back to the partner on the box
- Keep the catch time to the shortest time possible

- How much
- 1 to 3 sets
- Allow a full recovery between each set
10 to 20 repetitions/set
Quality of the vertical toss is far more important than quantity

**Ball Drop**

**One Arm Ball Drop**

**Vertical Toss**

How to perform the drill
- This drill requires a partner
- Sit in front of the box with your back to it, legs spread apart and straight
- The other person stands on the box holding the medicine ball over you
- Your partner drops the medicine ball into your hands
- Catch the ball with elbows bent and toss it back over your head to the partner on the box
- Keep the catch time to the shortest time possible

How much
- 1 to 3 sets
- Allow a full recovery between each set
- 10 to 20 repetitions/set
- Quality of the vertical toss is far more important than quantity

**Seated Side Throw**

**Plyometric Exercises**
- Jump Squats
- Box Jumps
- Forward Bounds
- Stride Jumps
- Single Leg Hops/jumps/bounds
- Vertical Jumps
- Depth Jumps

Box Jumps
Concentric Jumps

Plyometric training
- Plyometrics should not be performed on consecutive days
- Plyometrics should not be performed when fatigued
- Do not perform plyos during phases of high volume weight training
- Do not perform plyos to failure
- Complete recovery should be allowed between plyometric exercise sets
- Utilize good footwear and landing surfaces to avoid injury
- Depth jumps should only be used by a small percentage of athletes
- Heavier athletes (>220 lbs) should not use higher than an 18 inch platform