Introduction to Plyometrics

Section 1 Background

Some Background

Origin: Eastern Europe
Plyo – (prefix): More
Metric – (suffix): measure
Plyometric – (Latin): measurable increases

Some Background

The interest increased for this form of training during the 1970s. Soviet Bloc athletes began to produce powerful and superior athletes in track & field, gymnastics, and weight lifting. Other countries became interested in this training method after seeing the success of these athletes. The term *Plyometrics* was coined in 1975 by Fred Witt (track & field coach). Plyometrics then became known to coaches and athletes as exercises or drills. This was aimed to link both strength and speed together to produce power in real life situations. In the 1980s, coaches began using Plyometric exercises in sports like volleyball, football, and weightlifting.

The term Plyometric is erroneously called 'Jump Training'. It is important to remember that not all plyos are based on jumps, and not all jumps are Plyometric. The problem that developed was that most American coaches didn't understand the science and application behind this method; they thought more was better. The result was unrealistic expectations turning into over training & higher risk of injuries.

Exercise is Medicine and Plyometrics is a Powerful Medicine

First, understand that Plyometrics and related forms of ballistic training are very powerful types of "medicine". These 'medicines' can have serious potential for harmful side effects. Applying Plyometric 'medicine' to the wrong client is the same as a doctor prescribing a powerful drug or an invasive medical procedure inappropriately. They have the same consequences and liabilities.

Dangers & Pitfalls of Plyometrics

Plyometrics play a very powerful role when training and improving an athlete's ability to perform explosively. It also helps individuals who need to develop their power or rate of force production (e.g. certain military & law enforcement personnel). Some fitness activities, such as sprinting or jumping rope, have Plyometric components that are appropriate for the general public. Plyometrics specifically trains and improves myostatic capabilities of the body. This is the type of training that is the subject to this course. Plyometrics have no place in general fitness applications, Unfortunately, amongst the general population, jump training, Olympic style weight lifting, and Plyometrics have become very popular.

Dangers & Pitfalls of Plyometrics

Many certified fitness professionals have taken to Plyometric training inappropriately with little to no relevant education; some trendy, popular programs & uncertified sports coaches, and even some average health clubs tend to fall into this category. This course was created as a correction to this growing, industry-wide problem. After taking this course, as a better practitioner, you will know how to train using Plyometrics, and more importantly, who to train with Plyometrics. We don't want to discourage you from using Plyometric training; we just want you to do it the right way with the right clients. This will make you a more effective trainer or coach & protect your clients and athletes. It will also help protect you from the legal ramifications to which so many of your peers are being exposed by utilizing Plyometrics inappropriately.

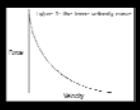
Dangers & Pitfalls of Plyometrics

The first section of this course will teach you how to assess physical readiness for training, guidelines for choosing appropriate Plyometric exercises, and progressions. It is important to know that Plyometrics are contraindicated for most individuals. Even individuals with the physical capability and desire to do Plyometrics can be ill-served by this type of training. This is because very few people (e.g. speed/power athletes) have training objectives that substantially benefit from this type of training.

When one of your general fitness clients ask you to duplicate the 'plyo workout' that they saw you conduct with an athlete, or that they saw on YouTube, you need to be able to explain the risk vs. reward as it relates to Plyometrics. Yes, high risk does equal high reward, but the high risk of injury produces high rewards that are specific only to those who need to train for speed/power events. Remind overzealous clients that an increased vertical jump or a faster 40-yard dash may seem like good objectives, but they are capabilities that can be more appropriately and safely improved through other types of training. Plyometrics has an unavoidable higher risk of injury.

Section 2
Exercise Physiology of Plyometric Training

Mechanism Behind Plyometrics



Plyometrics = the movements that achieve maximal force in the shortest possible time.

This definition is correct but leaves much to the imagination. To better help new trainers understand the true meaning, we explain it as "a loop consisting of forceful ground contact followed by a coordinated forceful movement in the opposite direction." The more the force increases, the more the velocity decreases and vice versa. For example, if you do a heavy 1 rep max squat your force output is very high, while the speed of the rep is fairly slow. When you jump, the speed you travel upwards will be relatively fast but you produce less force than a 1 rep max squat.

Muscle Spindles are the main stretch receptors in the muscle. When a muscle is forcefully and rapidly stretched, the muscle spindles initiate a stretch reflex response. This response produces power output that greatly exceeds that of a simple voluntary muscular contractions.

Types of Muscle Contraction

Eccentric: The tension developed in the cross-bridges are less than the external resistance. The lengthening of a muscle (group) resulting in an increase in the angle between two (or more) segments across an articulation (extension).

Isometric: The tension in the cross-bridges equals the resistance in shortening, and the muscle length remains relatively constant.

Concentric: The total tension developed in all the cross-bridges of a muscle is sufficient to overcome any resistance to shortening. The shortening of a muscle (group) resulting in a decreased angle between two (or more) segments across an articulation (flexion).

***Note**: A quasi-isometric contraction is our way of describing the moment right before the change of direction. During this extremely short period of time, it is almost like an isometric contraction as opposing muscles change roles.

Types of Muscle Contraction

If the anticipatory eccentric/quasi-isometric contraction is not immediately followed by an involuntary concentric muscle/tendon response, then the energy stored can be lost and dissipate as heat. This diminishes the Plyometric value.

The Rate of Force Development, RFD is crucial for optimal performance. This measures the rate at which force is developed. The time is takes to achieve peak force is usually greater than the contact time.

Types of Plyometric Strength

Starting strength is the muscles' ability to overcome inertia by creating enough force to initiate movement. This applies to the initial force a sprinter uses off the line or a weightlifter picking a barbell off the floor. This is considered to be concentric.

Stopping strength is the body's ability to absorb force via the muscle-tendon system; think of a running back planting the foot and 'cutting' to change direction. This is considered an eccentric contraction.

Elastic strength is the ability of the muscle-tendon system to absorb force within the stretch-shortening cycle, to overcome the force in a relatively short amortization time and to explosively move the body in the opposite direction.

Stretch-Shortening Cycle

Stretch Shortening Cycle (SSC): Utilizes the energy storage capabilities of the Series Elastic Component (SEC) and stimulates the stretch reflex. This cycle facilitates a maximum increase in muscle recruitment over a minimal amount of time.

SSC involves three distinct phases:
1. Eccentric Phase
2. Amortization Phase
3. Concentric Phase

Stretch-Shortening Cycle

Eccentric Phase: involves preloading the agonist (prime mover) muscle group(s). This is also known as the deceleration phase. The eccentric phase will tap into the stored elastic energy when done properly.

Amortization Phase: The time from the end of the eccentric phase to the initiation of the concentric phase (ground contact).

Concentric Phase: The PNF/CNS reflexive response to the eccentric and amortization phases where energy stored in the Series Elastic Component (SEC) is used for muscle contraction. *Inefficient movement will result in the loss of this elastic energy, which will dissipate with heat.*

Series Elastic Component

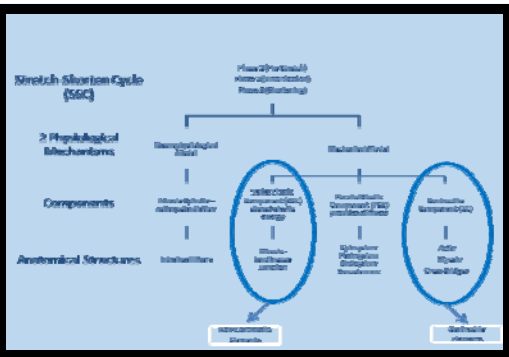
A non-contractile component of muscle that lies in series with muscle fibers. Series elastic components store energy when stretched and make a major contribution to the elasticity of the human skeleton. Tendons are the major representatives of the series elastic component, but the cross bridges between actin and myosin may also contribute.

Parallel Elastic Component

A non-contractile component that consists of the muscle membranes, which lie parallel to the muscle fibers. This component is what provides the tension you feel during a passive stretch.

Contractile Component

This refers to the actual muscle fibers we voluntarily use when we move or exercise. The Contractile Component (CC) is what initiates the movement to get the process started.



Importance of the Amortization Phase

This phase is crucial in allowing greater power production; therefore, its duration must be kept short.

*Remember: If the amortization phase lasts too long, the energy stored during the eccentric phase dissipates as heat and the benefit is lost. The stretch reflex will not increase muscle force capabilities during the concentric phase if ground contact time is too long. i.e. Great high jumpers are on the ground for approximately 0.12 seconds.

Importance of the Landing Phase

The landing phase starts as soon as the muscles start to experience an eccentric contraction. The rapid eccentric contraction serves to stretch the elastic components of the muscle/tendon complex (MTC) and activate the stretch reflex. A high level of eccentric strength is needed during the landing phase. Inadequate strength will result in a slow rate of MTC stretch and less activation of the stretch reflex.

Proper Landing Technique

Developing 'Proper Landing Technique' is a key aspect of injury prevention and safe execution of Plyometrics.

As a general rule, an athlete should not be jumping if they do not know how to land. A good landing involves the knees remaining aligned over the toes, hips back, trunk inclined forward slightly, the head neutral, and the back flat. This establishes a good center of gravity.

If the center of gravity is offset from the support base, the loss of balance will result in a loss of energy; directionally lost energy will hinder performance and may cause injury.

Proper Landing Technique, demonstrated

Proper Landing Technique

When an athlete is learning to do Plyometrics for the first time, they should focus on the box jump and depth drop landing. Focus on being able to move out of a landing before moving on to more intense drills. Depending on the athlete, this could take between 2 days and 3 weeks.

Micro-hurdle Plyometrics progression (linear or lateral) athletes land in the athletic position driving the heels into the ground (dorsi flexion). Doing this correctly increases the speed of eccentric loading and decreases time in the amortization phase. Initiate the jump by driving the heels into the ground. This will force the glutes to activate and begin the positive direction of force application by hip extension.

Proper Landing Technique

In bounding Plyometrics, athletes land on the ball of the foot (plantar flexion) making ground contact underneath or slightly behind their center of mass. As ground contact is made through the extending leg, the leg continues to drive down and back decreasing time in the amortization phase. The athlete should feel as if they are driving the heels into the ground in the opposite direction of the of the movement. This will take full advantage of fascial reflexes that protect the anatomy and increase force and speed.

Use the athletic position, with emphasis on the heels for landing to help absorb shock to joints. Athletes should progressively learn eccentric loading as opposed to landing forcefully too soon. Proper landing also avoids any twisting or sideways motion to joints.

Landing Surface

Plyometrics can be performed indoors or outdoors. The landing surface should be able to absorb some of the shock of landing.

Field turf or thick enough rubber flooring/track lanes are good indoor surfaces as well as the sprung wood floors found in basketball courts and many aerobics studios. Plyometrics are done on the grass and turf, if performed outdoors.

Jumping on concrete or asphalt can lead to knee, ankle, hip and back problems. Therefore, these surfaces should be avoided.

Minimum Strength Requirements

Lower Body Plyometrics:
Movement technique should be adequate and athlete's 1RM squat should be at least 1.5 times his or her body weight before bounding type Plyometrics are applied. First and foremost, the athlete needs to be coordinated. Poor motor patterns and mechanics will cause injury even if the athlete is strong enough to perform plyometrics.

Upper Body Plyometrics:
Athletes should be able to maintain neutral alignments throughout their body during high-speed Plyometric movements.

The athlete must be coordinated to perform Plyometrics safely. It is not just about being strong. The key is great motor control. If an athlete can't pass the basic tests, do not move forward to a Plyometric program.

Importance of Strength and Flexibility

1) Poor coordination and poor strength can result in loss of stability when landing.
2) Poor flexibility and mobility will inhibit a full range of motion and will disrupt eccentric loading.
3) Lack of flexibility will result in a higher risk of injury.
4) Early fatigue can also become a problem.

*Lack of these two elements will result in a decrease in performance and an increased chance of injury.

Minimum Speed Requirements

Speed is an important component when performing any Plyometric exercise because of the amortization phase of the SSC. Assuming the athlete is transferring all the downward force vertical, the less contact time the better.

An athlete must be able to perform five squats (lower body plyo's) and five repetitions of the bench press (upper body plyo's). This must be done with 60% of their body weight in less than 5 seconds, or a display of a high level of coordination during low level plyo's in order to move on.

Note: Participation in Plyometrics should be delayed until minimum requirements are met.

Minimum Balance Requirements

Assessing balance is important because many lower body Plyometric drills require the athletes to move in nontraditional movement patterns (backward, skipping, single leg drills).

Beginner: Stand on one leg for 30 seconds.
Advanced: Perform a single leg RDL while holding all joints in proper alignment. Do this without falling for 30 seconds.

Importance of Joint Stability and Mobility

Many professionals overlook this part of the equation. If a joint is unstable or lacks mobility, the athlete will have improper form during movements. Poor form creates compensation patterns and greatly increases chance of injury. A good example is your ankle; it needs to be neutral during Plyometric training. The same is true while playing sports. Look for joint instability and tightness during the balance tests and simple movement screenings.

Importance of Recovery

Plyometric training is strictly anaerobic and utilizes the ATP-CP energy system, allowing maximum energy to be stored in the muscle before an explosive movement is performed.

In order to stay in the ATP-CP energy system, the duration of effort should be 6 seconds or less.

Recovery is paramount between each set. Depending on the athlete, recovery should be approximately 2-5 minutes. You can measure the athletes' recovery by monitoring his/her recovery heart rate.

*If sufficient recovery is not allowed, then the activity will be more aerobic, the quality and explosiveness of the movement will suffer. (CHU)

Section 3
Fundamental Plyometric Warm-Ups and Drills

The following section breaks the warm-ups down into very general categories and are arranged in order of difficulty. Subsequent to the general dynamic warm-up breakdown, there are some general warm-ups for sports. We offer videos for many of the general movements, but not all of the advanced exercises are explained or demonstrated because this is a foundation level course. The majority of exercises contained in this course are best learned in a live environment after completing this course. Our goal is to introduce you to the truth about Plyometrics and provide a learning base. This course is not intended to create experts in Plyometrics. The next step, after completing this fundamental course, is to practice the simple moves learned here and supplement your education through additional reading and live course work.

Dynamic Warm-Up for Movement Preparation

1) Used to develop fundamental movement skills.
2) Used to increase circulation, elasticity and CNS activation.
3) Helpful in establishing motor patterns that will carry over to the development of speed and jumping ability. (CHU)
4) Performed as a skill enhancement drill, aimed at reinforcing motor patterns, and not as conditioning drills.
5) Performed over distances of 10 to 20 meters.

Why No Static Stretching?

Do not do any static stretching as a warm-up for Plyometrics. Through experience in the industry, our team of professionals have found that most fitness enthusiasts, and even trainers, insist that 3-5 minutes on the stationary bicycle and static stretching are a proper warm-up. What these individuals fail to realize is that increasing body temperature alone may have some benefit, but it is not enough. Despite popular belief, improvement and optimization are not one and the same. Although the body may be warm, the muscle groups need to be specifically warmed up through active and dynamic movements, not by static stretching. Once your warm-up is completed properly, you move into the event or routine.

- Scientific evidence demonstrates that static stretching of muscle decreases isometric and dynamic muscle strengths at different velocities.
- Isometric strength is important for stability during complex movements.
- Dynamic strength has obvious importance when it comes to actual movement.
  - This means you will be slower and weaker on tasks that are fundamental to high-level performance.

Static Stretching Acutely Impairs

- The muscle and nervous systems ability to perform slow-speed, high force movements such as power lifting.
- The muscles and nervous systems ability to perform high-speed, lower force movements such as jumping & sprinting.
- Research also demonstrates that balance, reaction time and overall movement time are negatively affected.
- Static stretching also reduces muscular endurance. This is important for endurance athletes.

Classification & General Progression of Plyometric Exercises

Jumps-In-Place
Footwork Drills
Standing Jump
Multiple Hops and Jumps
Skipping Drills
Lunging Drills
Bounding
Box Drills
Box Drills w/Multiple Ground Contacts
Depth Jumps

Classification & General Progression of Plyometric Exercises

Jumps-In-Place:
- Done with relatively low intensity.
- Provides stimulus for developing a shorter amortization phase by requiring the athlete to rebound quickly from each jump using the proper mechanics.
- Performed one after another, with a short amortization phase.

Footwork Drills:
- Start with simple drills at slow speed and build up.
- Require hip movement and quick changes in direction such as shuttle drills, multidirectional side shuffle drills, and "drop" step drills.
- Reinforces proximal to distal muscle firing sequences.
- Simple drills are great warm ups.

Classification & General Progression of Plyometric Exercises

Standing Jumps:
- Stresses single maximal effort.
- May be repeated several times, but full recovery should be allowed between each effort.

Multiple Hops and Jumps:
- Combine skills developed by jumps-in-place and standing jumps.
- Requires maximal effort but are done one after another.

Skipping Drills:
- Practices reciprocal movements that are required during efficient running.
- Will warm-up the athlete and prepare them for more complex drills.

Classification & General Progression of Plyometric Exercises

Lunging Drills:
- Dynamic movements where the athlete must explode off the ground as soon as contact is made.
- The force generated by the leading leg must be so great that the athlete returns to starting position.
- The back-planted leg is mainly for stabilizing and balance and really shouldn't help.
- Jumping split squats or explosive multi directional lunges are great choices.

Bounding:
- Exaggerates (under the proper mechanics) the normal running stride to stress the direction of force application and recovery of the running stride cycle.
- Used to improve stride length and frequency (without over-stride).
- Typically performed for distances greater than 20 yards.

Classification & General Progression of Plyometric Exercises

Box Drills:
- Combine multiple hops and jumps with depth jumps and incorporate both horizontal and vertical components.

Depth Jumps:
- Use the athlete's body weight and gravity to exert force against the ground.
- Perform by stepping off of the box, dropping to the ground, then jumping back up to the height of the box.
- The key to performing this exercise and decreasing the amortization phase is to stress the speed in the action of the arm, just before ground-contact.
- Then begin driving down into the ground with your heels.

Considerations for Determining Maximum Depth Jump Height

If the height of the box is too great for the intramuscular coordination in the sequence of lower body and core activation, then the legs spend too much time absorbing the impact of the landing. This inhibits the ability to reverse the eccentric loading quickly enough to take advantage of the SEC and the stretch reflex. Thus, it has no training benefit and increases the risk of injury.

Determining Maximum Depth Jump Height

In order to determine the depth jump height, you must measure an athlete for a standing jump-and-reach (vertical jump test). The athlete then performs a depth jump from an 18 inch box while trying to attain the same standing jump-and reach score.

If the athlete reaches this height with proper mechanics, the athlete may proceed to a higher box. If the athlete fails to reach their jump score, then that box becomes their jump height. If an athlete cannot rebound from an 18-inch height but he/she displays good mechanics, then they could have a low level of intramuscular training adaptation or a weak core.

Warm-Ups

Principles of Warming Up

The warm-up is meant to mirror the proper recruitment/firing order of the lower body muscles during sprinting and jumping.

Part 1: Hip Flexors, Quadriceps and Glutes
Part 2: Hamstrings
Part 3: Abductors
Part 4: Adductors

Within each part or muscle group, the muscles are:
A) Activated
B) Dynamically Stretched

Order of Standard Plyometric Warm-Up

1. Hip Flexors, Quadriceps and Glutes
A) Activation:

Forward jog / backward jog (w/ or w/out arm circles)	2x 20 yards
Forward jog backward snap skip (with arm action)	2x 20 yards
Forward jog / backward reach run	2x 20 yards

B) Dynamic stretch:

Heel-to-butt raise	5x each leg
Angled lunge-twist-reach	5x each leg

Order of Standard Plyometric Warm-Up

2. Hamstrings
A) Activation:

Butt kickers	2x 5 yards
Linear strait leg bound (mini-bounds)	2x 20 yards

B) Dynamic Stretch:

Straight leg march	2x 5 each leg
Inverted toe touch	2x 5 each leg
2 point starts 75%	2x 20 yards
Linear leg swings	10x each leg
Lateral leg swings	10x each leg

Order of Standard Plyometric Warm-Up

3. Abductors

A) Activation:	
Skip (in-place)	5x each leg
Carioca quick-step	2x 20 yards
B) Dynamic stretch:	
Leg cradle	5x each leg

4. Adductors

A) Activation:	
Groin Skip	5x each leg
Lateral Gallop	1x 20 yards each direction
B) Dynamic Stretch:	
Sumo Squat	5x
Forearm to instep	5x each leg
Iron cross	5x each leg
Prone scorpions	5x each leg
2 point starts 50%	2x 20 yards

Section 4
Program Design

Basics for Designing a Plyometric Program

This section is meant to introduce you to some basic principles. Plyometrics are extremely detailed oriented and can be dangerous. Students need a live class to execute almost all of these exercises. Our goal here is an introduction, so please do not start adding bounding exercises to your 50 year old clients routines!

Begin: Create a plan that breaks the program into cycles with specific goals, i.e. 6 week cycle beginning with pretest.

Goal: Increase distance in the standing broad jump.

Cycle Ends: Post test to see if goal was obtained.

Basics for Designing a Plyometric Program

An effective program accomplishes specific goals through the manipulation of **5 variables:**

1. MECHANICS
2. INTENSITY
3. VOLUME
4. FREQUENCY
5. RECOVERY

1. MECHANICS
For beginners, take it slow. Introduce simple movements that will progress into true Plyometrics. For example, try a single jump onto and off of a box. Have them master the landing before attempting to explode into repetitive jumps.

Basics for Designing a Plyometric Program

2. INTENSITY
The type of Plyometric exercise performed determines intensity. The exercises range from simple technique work to highly complex and stressful exercises.

Intensity can be increased by:
Progressing from technique work to athletic movement application drills: increasing the height of the platform, or covering greater distances for longitudinal jumps.

Intensity order from low to high:
Jump-in-place, standing jumps, multiple hops and jumps, box drills and depth jumps, linear and lateral bounding.

It is important to account for time of year when training athletes because intensity may need to be lower in season.

Basics for Designing a Plyometric Program

3. VOLUME
This is the total work performed in a single workout session or cycle.

Volume Measured by: Counting foot contacts. The warm-ups are generally not included in the number of foot contacts.

4. FREQUENCY
We broke the plyometrics into three categories below. We suggest doing each category one time per week for a total of three plyometric workouts each week.

Basics for Designing a Plyometric Program

5. RECOVERY
This is the most overlooked aspect of most training programs. Recovery is the key variable for determining whether Plyometrics will develop power or muscular endurance.

Foam rolling and static stretching should be done at the end of each workout. *A Lymphatic drain is a good idea to do at the end of each week.

Plyometrics are extremely fatiguing to the CNS. They train two anaerobic energy systems, ATP-CP and the lactic acid cycles. Plyometrics that last 4 -15 seconds depletes the energy stores in the creatine phosphate system. Therefore, sufficient rest or recovery is needed (e.g. 2-5 min) between sets. Beginners should rest 48hrs between plyometric sessions.

*A simple Lymphatic drain protocol is to ride the bike at 90 rpm for 90 seconds and then immediately lye on the floor with your legs up on the wall for 90 seconds, repeat four times for a total of 12 minutes.

Drills

In an effort to keep it simple, we broke the drills into three categories; Lateral Acceleration, Linear Acceleration, and Max Velocity. Many of these exercises are for more advanced athletes and should not be prescribed without taking live courses on proper technique. In addition to the three categories, we have included some generic programs to help you understand how athletes train.

Linear Acceleration

Mini Hurdle Series
- *Stick and Hold the Landing*, 2x5.
- *Double Tap*- 2 Ground contacts before jumping into next hurdle, 2x5.
- *Bound*- Little ground contact as possible and done extremely quick, 2x5.

Single Leg Series
- *Stick and hold Landing (Single Leg)*- Shift your weight into the heel upon landing to activate glutes. Hold landing for a second, 2x8.

Wall Drills (Linear)
- Arms are extended on the wall with shoulders retracted, Gluteus Maximus and core are held tight.
- The working leg comes up to thigh block and then drives back down to the ground.
- Leg does not cross mid line of the body (refer to the belly button as reference).
- Single is when you only do one side at a time.
- Double means both feet come up to thigh block as quickly as possible.
- Triple, you begin on one side while making three ground contacts as quickly possible. This should end on the opposite leg.

Linear Acceleration (continued)

Linear Acceleration with Resistance
- Belt goes around athletes' waist.
- Athlete must mimic linear wall drill.
- Coach will apply tension to the belt as the athlete drives forward.

Lateral Acceleration

Mini Hurdle Series (Lateral)
- *Stick and Hold the Landing,* 2x5.
- *Double Tap* - 2 ground contacts before jumping into next hurdle, 2x5.
- *Bound* – As little ground contact as possible, this is done extremely quick, 2x5.

Single Leg Series (Lateral)
- *Stick and Hold Landing (Single Leg)* – Shift your weight into the heel upon landing to activate gluteus maximus. Hold landing for a second, 2x8.

Wedge Step (Rings or Ladder)
- Athlete stays low in athletic position (squat or defense position).
- Athlete laterally moves forward, each leg crossing over the other into each step of the rings or ladder.
- Weight should be on the leg closest to the rings; this is so the opposite leg can cross over into thigh block and back into the rings.

Lateral Acceleration (continued)

Wall Drill (lateral)
- Lean on a wall with one arm extended on the wall.
- Shoulders are retracted, Gluteus Maximus and core are held tight.
- Outside leg comes up to thigh block and then drives back down to the ground.
- Leg does not cross mid line of the body (refer to the belly button as reference).
- Single equals one ground contact.
- Double equals two ground contacts.
- Triple equals three ground contacts and landing on the opposite leg.

Lateral Acceleration with Resistance
- Athlete mimics the wall drill while moving laterally.
- Coach applies resistance as athlete propels laterally with as many ground contacts as possible. Face both directions.

Max Velocity

Front Side Mechanic - Athlete starts in thigh block, foot extends slightly passed the knee and drives downward with a pulling motion. The middle of the foot to the front of the foot is the only part to make ground contract. Gluteus Maximus is squeezed tight on planted leg that is closest to the wall, 2x10.

Back Side Mechanic - Athlete must start with foot on the ground. The heel travels up the planted leg. Heel comes up to the butt and makes a circle around the knee into thigh block. Athlete must hold this position, 2x10.

Full Mechanic - Athlete combines both front and back side mechanic into one, 2x10.

Ankling

- Athlete must make tiny circles around their ankles and will maintain dorsi flexion. The toes come up to the shins.
- Athlete must make as many ground contacts as possible with very small steps.

Max Velocity con't

"Peg Leg"

- Athlete must perform the ankling movement.
- Athlete must then incorporate the full mechanic and then into the ankling movement.
- *Single Leg* - One full mechanic and change legs after ten yards.
- *Double* - Two full mechanic strides.
- *Continuous* - Nonstop full mechanic with one leg and then alternate to other leg.
- *Alternate* - Full mechanic right leg and then immediately follow with the full mechanic left leg.

TRAINING SCENARIOS

	Beginner	Intermediate	Advanced	Intensity
Off-season	80-100 Depends on phase	100-120 Depends on phase	120-140 Depends on phase	Low-High Depends on Ability of athlete
Pre-season	60-80 This does not include sprints	80-100 This does not include sprints	100-120 This does not include sprints	Moderate-High
In-season	Volume for power is half that of off season	Volume for power is half that of off season	Volume for power is half that of off season	Moderate-High
Championship Season	Super compensation workouts 48 – 72hrs before competition	Super compensation workouts 48 – 72hrs before competition	Super compensation workouts 48 – 72hrs before competition	High

	Example 1	Example 2	Example 3
Monday	Weight training	Plyo's (LE*)	Plyo's (LE)
Tuesday	Plyo's (LE)	Weight training	Plyo's (UE**)
Wednesday	Weight training	Plyo's (UE)	Running Program
Thursday	Plyo's (UE)	Weight Training	Plyo's (LE)
Friday	Weight training	Plyo's (LE)	Rest

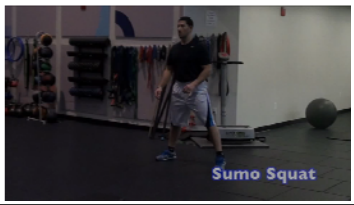
*Lower Extremity
**Upper Extremity

Section 5
Drills and Warm-Up Videos

WARM-UPS

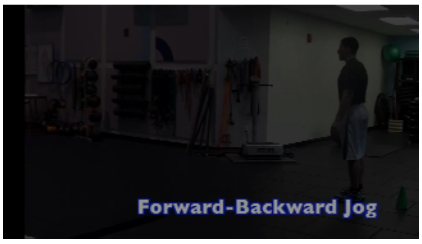
Sumo Squat

Stand with your feet slightly wider than shoulder width. Point your toes forward and make sure that your feet stay flat on the ground and your hips and knees are rotated outward. Avoid shifting forward on your toes and think about keeping more weight in the heels. First engage the hips as you hip hinge and then bend the knees to squat. Squat depth is based on the individual client but the goal is just past parallel. Drive through the heels keeping the feet flat to the floor and engage the glutes to stand back up.



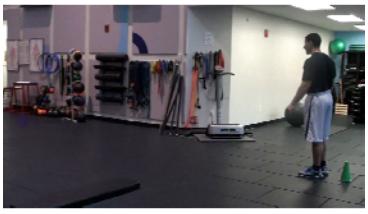
Forward/Backward Jog

Run forward and then back peddle. Make sure as your back peddle, that your feet stay underneath your hips and you are pushing yourself back and "not" just leaning backward as you casually back peddle.



Straight Leg March

Reach one hand out in front of you and kick the opposite leg to that hand. Make sure the planted leg is straight and the leg swinging up to your hand is straight as well. Be sure to drive the heel into the ground on each contact. Take strides in-between each kick and repeat.



Ankling

Athlete must make tiny circles around their ankles while maintaining dorsi flexion. The foot should not come too far off the ground, this is a small movement. Athlete must make as many ground contacts as possible with very small steps. This a prerequisite for peg leg drill which teaches people how to properly run in the max velocity phase.

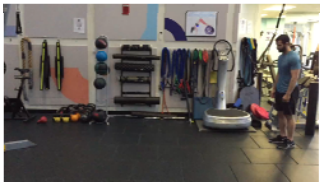
Peg Leg

Single Leg - One full mechanic and change legs after ten yards.

Double - Two full mechanic strides.

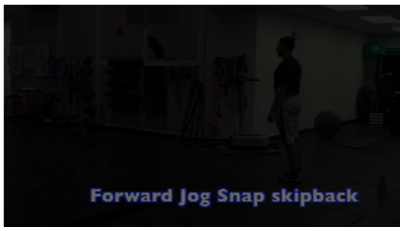
Continuous - Nonstop full mechanic with one leg and then alternate to other leg.

Alternate - Full mechanic right leg and then immediately follow with the full mechanic left leg.



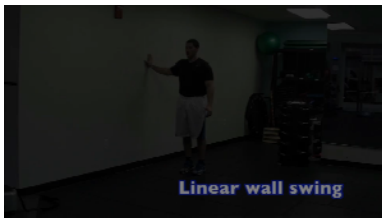
Forward Jog-Snap Skip back

Jog forward and then bring the knee into a high thigh block position while skipping backward on the way back. Push through the toe as you are skipping backwards driving your foot into the ground and keep your feet under your hips.



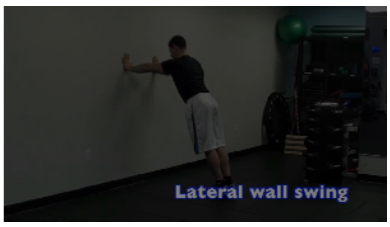
Linear Wall Swing

Stand with one hand on a wall while facing perpendicular to the wall. Make sure you are up on your toes. Kick the leg closest to the wall forward to feel a stretch in the hamstring and repeat.



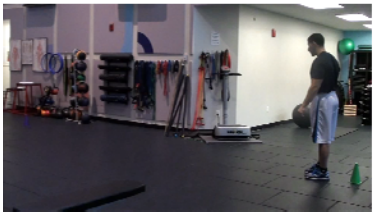
Lateral Wall Swing

Lean against a wall with both hands on the wall. Then swing one leg out to your side (abduction) while swinging it across your body and then out to the side again. Make sure you avoid tipping or dropping the torso too far to the left or right as the leg swings across the body.



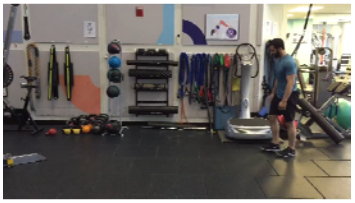
Leg Cradle

Perform this dynamic stretch while walking. Pull one knee up to your chest and then grab just above the ankle to externally rotate the hip. Try to avoid pulling on your foot.



Active Quad Stretch

While walking pull the heel up to the butt with the opposite arm and alternate as you walk 10-20 yards.

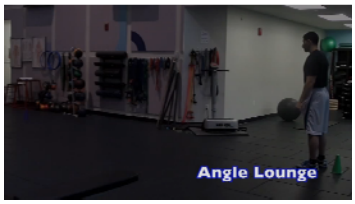


Butt Kickers

While jogging, kick your heels up to your butt.

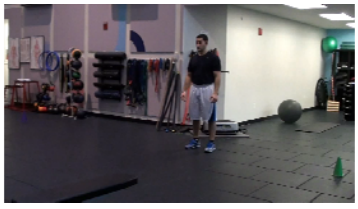
Angled Walking Lunge

This is exactly like a walking lunge except you step slightly to the lateral side instead of straight ahead. Weight should be placed mostly on the heel of the front leg. The force should come from the front leg, do not push off the back foot to return to starting position. Reach the opposite hand overhead to stretch the hip further.



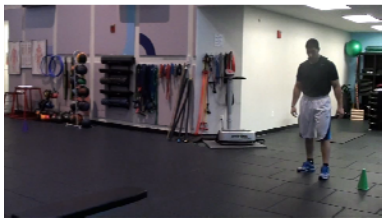
Forearm Instep

Start in a push up position. Bring one foot forward and line it up on the outside of your hand on the same side. Then drop the same side elbow/forearm to the instep of your foot. Then rotate your hand outward and reach toward the sky, making sure your spine and head rotate in unison.



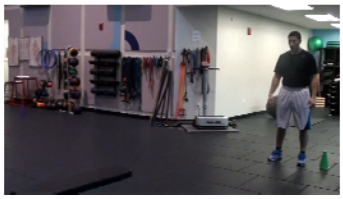
Carioca

Initiate with the leg furthest away from the direction of travel. Once the foot makes contact push laterally to propel the body sideways. The opposite leg should cross behind the leg you initiated with. Keep the torso facing forward as you swing the arms in the opposite direction of the legs.



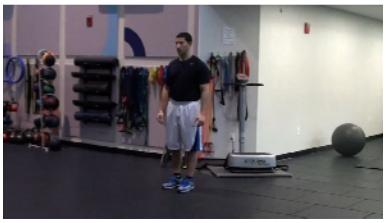
Carioca with Thigh Block

Initiate with the leg furthest away from the direction of travel. Once the foot makes contact push laterally to propel the body sideways. The opposite leg should cross behind the leg you initiated with. Keep the torso facing forward as you swing the arms in the opposite direction of the legs. However, when the foot you initiated with crosses in front; drive that knee up to your chest into a thigh block position.



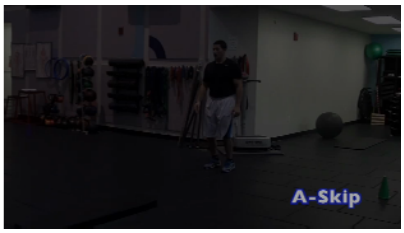
Inverted Toe Touch

Balance on one foot and reach one hand above your head and the same leg in a thigh block position. Then reach down towards the opposite foot while trying to maintain a neutral spine. Keep your foot flat on the floor and weight in the heel of the foot.



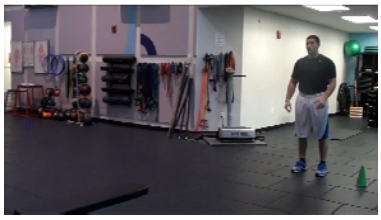
A Skip

Start by jumping up and down on your toes in place. Quickly accelerate into a thigh block position by driving one knee towards your chest while the opposite arm swings upward as if you're running.



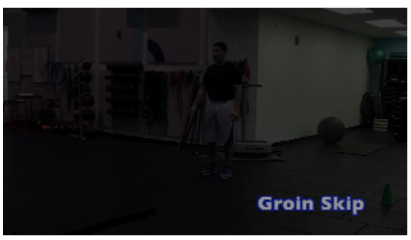
Lateral Gallop

Swing the lead leg laterally. This leg will be the leg you "pull" with to travel laterally. Then kick off of the ground with the trail leg in a galloping motion.



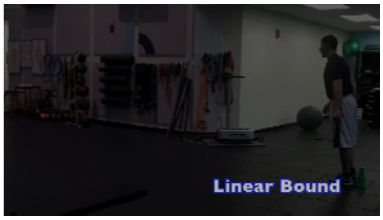
Groin Skip

Jump up and down on the toes, then drive one hip up and into external rotation (towards the groin). Swing your arms just like a running motion.



Linear Bound

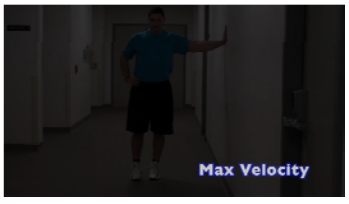
Kick one leg forward like a straight leg march and quickly accelerate your foot back to the floor making sure the weight is in the toe. Then push off and transition to the opposite foot bounding forward.



DRILLS

Max Velocity – Front Side Mechanics

Athlete starts in thigh block, foot extends slightly passed the knee and drives downward with a pulling motion. The middle of the foot to the front of the foot is the only part to make ground contact. Gluteus Maximus is squeezed tight on planted leg that is closest to the wall, 2x10.



Max Velocity – Back Side Mechanics

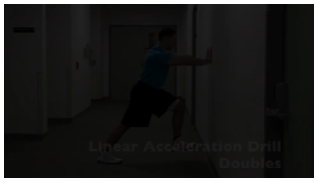
Drive one leg into a thigh block position (knee-to-chest) keeping the foot underneath the hip in the first motion. Then the second motion is to extend the knee to a 90 degree angle.

Max Velocity – Full Mechanics

Athlete combines both front side and back side mechanics into one drill, 2x10.

Linear Wall Drill

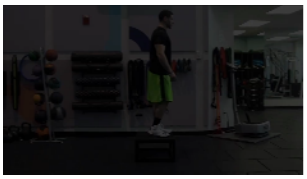
Single- 45 degree angle on the wall. Athletes' heels should be slightly off the wall while the gluteus maximus is squeezed for hip extension and shoulders in retraction. Then bring the single leg up to thigh block.
Double - both feet come up to thigh block as quickly as possible.
Triple - you begin on one side while making three ground contacts as quickly possible. This should end on the opposite leg.

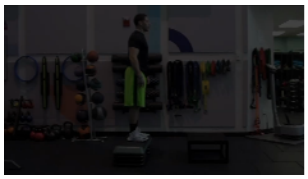


Lateral Wall Drill

Arms are extended on the wall. Shoulders are retracted and core held tight. Gluteus maximus are squeezed tight. Outside leg comes up to thigh block and then drives back down to the ground. Leg does not cross mid line of the body (refer to the belly button as reference). Single equals one ground contact. Double equals two ground contacts. Triple equals three ground contacts and landing on the opposite leg

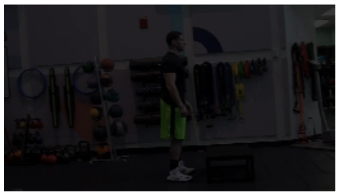
Box Jump – Landing





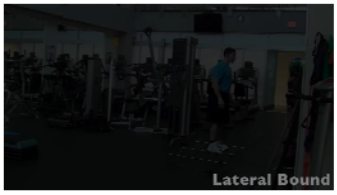
Standing Box Jump

Start with your hands up by your head and elbows bent to 90 degrees. Accelerate down into an athletic position to feel your hamstrings and glutes engage. Jump up by driving your force through your heal. To achieve triple extension at the ankle, knee and hip make sure your toes are pointed downward as you travel upwards. As you are jumping throw your hands towards the sky like an uppercut. Landing must be toes then heels so weight is distributed in the center of your foot. Bring your hands back down to your hips as you land on the box. As you progress increase the height of the box.



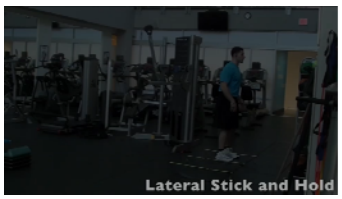
Lateral Bound

Jump up over the hurdle in succession by extending the ankle, knee and hip. As you launch, your arms are swinging upward and then quickly accelerating back down as you come down. While going over the hurdles the weight in the lead foot should be distributed towards the outside and the weight on the trail foot should be towards the inside as you bound over the hurdles. As you come back down to the floor, drive your toes into the ground to launch back up quickly. The heels should not hit the floor during a bound and knees should not tuck to the chest. When jumping over the hurdles avoid clicking the feet together.



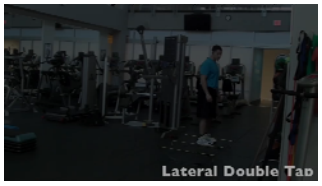
Lateral Stick and Hold

Start with your hands up by your head and elbows bent to 90 degrees. Accelerate down into an athletic position to feel your hamstrings and glutes engage. Laterally jump over the hurdles by extending the ankles, knees and hips while making sure your toes are pointed downward as you are in the air. As you are jumping throw your hands towards the sky like an uppercut. Land toes first then on your heels so weight is distributed in the center of your foot. Bring your hands back down to your hips as you land in a half squat position. Then reset and repeat.



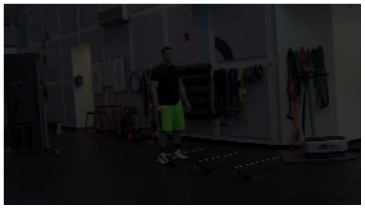
Lateral Double Tap

Start in front of the hurdles with your elbows bent to 90 degrees and hands by your face. Lower your body into an athletic position while bringing your hands down by your hips. Make sure the feet are flat in this position. While going over the hurdles the weight in the lead foot should be distributed towards the outside and the weight in the trail foot should be towards the inside as you bound over the hurdles. Then bound over the hurdle making sure that the toes are pointed to the floor while in the air. As you return to the floor accelerate the hands down and take a small hop and then drive your feet into the ground for a second launch. At this moment drive the hands back up to the sky and repeat. Avoid clicking the feet together as you go over the hurdles.



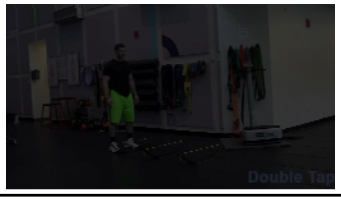
Mini Hurdle Bound

Jump up over the hurdle in succession by extending the ankle knee and hip. As you launch, your arms are swinging upward and then quickly accelerating back down as you come down. As you come back down to the floor, drive your toes into the ground to launch back up quickly. The heels should not hit the floor during a bound and knees should not tuck to the chest.



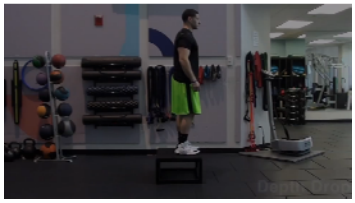
Plyometric Double Tap

Start in front of the hurdles with your elbows bent to 90 degrees and hands by your face. Lower your body into an athletic position while bringing your hands down by your hips. Make sure the feet are flat in this position. Then bound over the hurdle making sure that the toes are pointed to the floor while in the air. As you return to the ground accelerate the hands down and take a small hop and then drive your feet into the ground for a second launch. At this moment drive the hands back up to the sky and repeat.



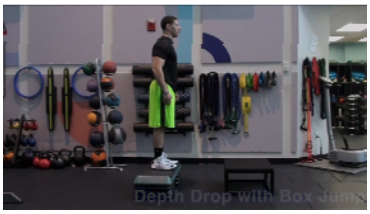
Depth Drop

Start by placing your dominant leg forward like you are taking a step forward. Step off of the platform landing in a good athletic position with your spine neutral and hands down by your pockets. The heels should be down and your weight balanced in the center of the foot. The purpose is to perform this movement quickly and efficiently making sure that the body is stable when landing or ready for another triple extension movement.



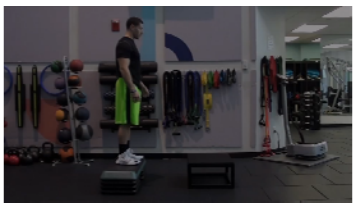
Depth Drop with Box Jump

Step off of a platform and land in an athletic position. Your hands should be down as you make ground contact. Throw your arms up as you quickly bound up onto the box. You will be triple extending the ankles, knees and hips. Make sure when you land, your weight is in the center of the foot and your feet are flat on the ground.



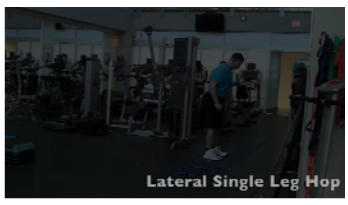
Depth Drop with Double Tap Box Jump

Step off the platform and land in an athletic position. Then quickly take a small hop preparing for a more powerful second jump landing on the box. The hands should be down by your pockets while taking the small hop. On the second jump throw the arms upward quickly to explode onto the box. Make sure the heels are down when landing and the weight is in the center of the foot.



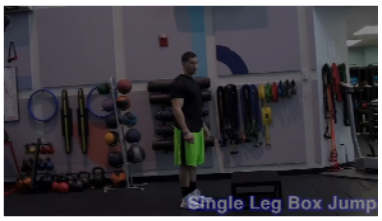
Lateral Single Leg Hop

Balance on one leg in a thigh block position while raising the opposite hand over your head. As the planted knee extends, the arm goes down and the opposite hand goes up. As you land on your toes drive the force through your heel into the ground. Make sure that you land with the foot flat on the floor with more weight towards the heel.



Single Leg Box Jump

Stand on one leg by bending at the waist reaching one leg back to load the glutes and hamstrings. Drive the back leg up into a thigh block position as your opposite arm swings upward. As you land on the box switch your hands back to your starting position.



Wedge Step

Wedge Step (Rings or Ladder)

Athlete stays low in athletic position (squat or defense position). Athlete laterally moves forward, each leg crossing over the other. Weight should be on the leg closest to the direction of travel.

Wedge Step with Rings

Wedge Step (Rings)

Athlete stays low in athletic position (squat or defense position). Athlete laterally moves forward, each leg crossing over the other into each step of the rings. Weight should be on the leg closest to the rings; this is so the opposite leg can cross over into thigh block and back into the rings.

Section 6 General Programs

Sport Specific Plyometric Exercise*

BASKETBALL

Jumps-in-Place	Standing Jumps	Multiple Hops	Box Drills
DL and SL jumps, hops, bounds (L - M)	Standing Long Jump (L) and Standing Jump & Reach (M)	Linear Micro-hurdle (L) Lateral Micro-hurdle (L)	Eccentric Landing (L)
Squat Jump, w/ or w/out Resist (H)	Micro or macro-hurdle Jumps (L-M)	Inside edge ladder (M) Outside edge ladder (M) Lateral Cone Hops (M-H)	SL Push Off, Lat Push Off, Box Blast (M)
5-5-5 Squat Jump (VH)	Lateral long Jump With Two leg or single leg application inside edge / outside edge (M)	Rim Jumps (M-H)	Box jumps DL or SL (M)
Jump Rope Progressions (L)		Standing Long Jump w/ Hrdl Hop (VH)	Box jump bound DL or SL (M-H)
		Zig-Zag Drill (VH)	
Depth Jumps	Bounding	Medicine Ball Exercises	
Drop from box to vertical jump, or Jump to Box (L-M)	Acceleration bounding No arm action (M-H)	Over-Under (L)	
Depth Jump w/ Rotation (H-VH)	Acceleration bounding With Arm Action (M-H)	Low Post Drill (H)	
Depth Jump to Rim Jump (VH)	Inside / outside edge line bounding Inside / outside edge ladder bounding	Depth Drop w/ Pass and Shoot (VH)	

*Charts Key:
DL = Double Leg
SL = Single Leg
Intensity Levels:
L = Low
M = Moderate
H = High
VH = Very High

Sport Specific Plyometric Exercise*

FOOTBALL

Jumps-in-Place	Standing Jumps	Multiple Hops	Box Drills
5-5-5 Squat Jump stick landing, hops, bounds (M-H)	Micro-hurdle jumps (L-M)	Linear Micro-hurdle Hops (M) Lateral Micro-hurdle hops (M)	30 (L)-60 (L-M)
	Standing Long Jump With linear / Lateral Sprint (M)	Inside edge ladder hops (M) Outside Edge ladder hops (M)	
		Wedge step ladder drills Inside edge ladder cont. Outside edge ladder cont.	
		Zigzag Drill (H)	
Depth Jumps	Bounding	Medicine Ball Exercises	
Drop From Box (L)	Micro-hurdle bounds DL and SL (M-H)	Quarter-Eagle Chest Pass (M-H)	
Depth Jump With Blocking Bag (H)	Acceleration bounding No arm action / arm action (M-H)	Medicine Ball Grab (M-H)	
Depth Jump With Pass Catching (H)	Inside / outside edge line bounding Inside / outside edge ladder bounding	Power Drop (H)	
	Lateral Acceleration bounding (position Dependent)	Catch and Pass With Jump-and-Reach (H)	

*Charts Key:
DL = Double Leg
SL = Single Leg
Intensity Levels:
L = Low
M = Moderate
H = High
VH = Very High

Sport Specific Plyometric Exercise*

WRESTLING

Jumps-in-Place	Standing Jumps	Multiple Hops	Box Drills
	Micro-hurdle jumps DL or SL	Linear Micro-hurdle Hops DL or SL (M)	
5-5-5 Squat Jump (M-H)	Linear and Lateral (L-M)	Lateral Micro-hurdle hops DL or SL (M)	Lateral Step-Up (L)
Split squat jumps (M)		Three-Point Stance With Single Leg Hurdle Hop (H)	Multiple Box-to-Box Jumps (M-H)
		Hexagon Drill With Barriers (M-H)	Multiple Box-to-Box Squat Jumps (H)
		Single Leg Hops (H)	
Depth Jumps	Bounding	Medicine Ball Exercises	
N/A	Moving Split Squat With Cycle (M)	Kneeling Side Throw (M)	
	Micro-hurdle bounds DL and SL (M-H)	Medicine Ball Grab (M-H)	

*Charts Key:
DL = Double Leg
SL = Single Leg
Intensity Levels:
L = Low
M = Moderate
H = High
VH = Very High

Sport Specific Plyometric Exercise*

BASEBALL AND SOFTBALL

Jumps-in-Place	Standing Jumps	Multiple Hops	Box Drills
DL and SL jumps, hops, bounds (L - M)	Standing Long Jump (L)	Linear Micro-hurdle (L)	Lateral Step-Up (L)
	Micro or macro-hurdle Jumps (L-M)	Lateral Micro-hurdle (L)	Box jumps DL or SL
	Lateral long Jump With Two leg or single leg application inside edge / outside edge (M)	Inside edge ladder Outside edge ladder	Box jump bound DL or SL
Depth Jumps	Bounding	Medicine Ball Exercises	
Drop from box to vertical jump, or Jump to Box (L)	Acceleration bounding No arm action (M-H)	Over-Under (L)	
	Acceleration bounding With Arm Action (M-H)	Overhead Throw (L-M)	
	Inside / outside edge line bounding		
	Inside / outside edge ladder bounding	Side Throw (L-M)	
		Kneeling Side Throw (M)	

*Charts Key:
DL = Double Leg
SL = Single Leg
Intensity Levels:
L = Low
M = Moderate
H = High
VH = Very High

Sport Specific Plyometric Exercise*

DOWNHILL SKIING

Jumps-in-Place	Standing Jumps	Multiple Hops	Box Drills
	Linear micro-hurdle stick landings (L)	Linear Micro-hurdle Hops (M)	30 (L)-60 (L-M)-or 90 (H)-Second Box
Hip-Twist Ankle Hop (L)	Lateral micro-hurdle stick landings (L)	Lateral Micro-hurdle hops (M)	Drills
	Inside / outside edge sticking landings	Inside edge ladder hops (M)	Multiple Box-to-Box Jumps with Single
Tuck Jump With Heel Kick (M)	(L-M)	Outside Edge ladder hops (M)	leg Landing (H)
		Wedge step ladder drills	
		Inside edge ladder cont.	
5-5-5 Squat Jump (M-H)		Outside edge ladder cont.	SL Box jump to DL bound
Depth Jumps	Bounding	Medicine Ball Exercises	
Depth drop bound (M-H)	Micro-hurdle bounds DL	Vertical toss (L-M)	
Depth drop double bound	and SL (M-H)	In-line lunge lateral wall slams (L-M)	

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Sport Specific Plyometric Exercise*

GYMNASTICS

Jumps-in-Place	Standing Jumps	Multiple Hops	Box Drills
Tuck Jump With Heel Kick (M)	Micro-hurdle jumps (L-M)	Hexagon Drill With Barriers (M-H)	Pyramiding Box Hops (M-H)
		Linear Micro-hurdle Hops (M)	
Split Pike Jump (H)		Lateral Micro-hurdle hops (M)	
Depth Jumps	Bounding	Medicine Ball Exercises	
	Acceleration bounding no arm action /		
Jump From Box (L)	arm action (H)	Over-Under (L)	
Depth Jump (L-M)	Micro-hurdle bounds DL and SL (M-H)	Underhand Throw (L)	
Single Leg Depth Jump (H)		Power Drop (H)	
Incline Push-up Depth Jump (M)			
Handstand Depth Jump (H)			

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Sport Specific Plyometric Exercise*

TRACK & FIELD: JUMPING EVENTS

Jumps-in-Place	Standing Jumps	Multiple Hops	Box Drills
			Multiple Box-to-Box Jumps
Single Foot-Side Ankle Hop (L)	1-2-3 Drill (M)	Standing Long Jump With Hurdle Hop (M-H)	with Single leg Landing (H)
		Three-Point Stance With Single Leg Hurdle Hop	
5-5-5 Squat Jump (M-H)	Standing Long Jump With Sprint (H)	(H)	
DL and SL jumps, hops, bounds (L -		Linear Micro-hurdle Hops (M)	
M)	Micro-hurdle jumps (L-M)	Lateral Micro-hurdle hops (M)	
Depth Jumps	Bounding	Medicine Ball Exercises	
Depth Jump to Prescribed Height (L-	Alternate Bounding With Single Arm		
M)	Action (M-H)	N/A	
	Alternate Bounding With Double Arm		
Jump From Box (L)	Action (M-H)		
	Combination Bounding With Single Arm		
Depth Jump (L-M)	Action M-H)		
	Combination Bounding With Double Arm		
Depth drop bounds (H)	Action (H)		
	Combination Bounding With Vertical Jump		
	(H)		
	Single Leg Bounding (H)		

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Sport Specific Plyometric Exercise*

TRACK & FIELDS: SPRINTS

Jumps-in-Place	Standing Jumps	Multiple Hops	Box Drills
Single Foot-Side Ankle Hop (L)	Standing Long Jump (L)	Double Leg Hops (M)	Lateral Box Jump (L-M)
			Multiple Box-to-Box Jumps with
	Standing Long Jump With Sprint (H)	Barrier Hops (Hurdle Hops) (M-H)	Single leg Landing (H)
	Standing Triple Jump (H)	Single Leg Hops (H)	
	Standing Triple Jump With Barrier Jump		
	(H)	Wave Squat (H)	
	Micro or macro-hurdle Jumps (L-M)	Zigzag Drill (H)	
		Linear Micro-hurdle Hops (M)	
		Lateral Micro-hurdle hops (M)	
Depth Jumps	Bounding	Medicine Ball Exercises	
	Alternate Bounding With Single Arm		
Depth Jump to Prescribed Height (L-M)	Action (M-H)	N/A	
	Alternate Bounding With Double Arm		
Jump From Box (L)	Action (M-H)		
Depth Jump (L-M)	Single Leg Bounding (H)		
Depth drop bounds (H)			

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Sport Specific Plyometric Exercise*

TRACK & FIELD: THROWING EVENTS

Jumps-in-Place	Standing Jumps	Multiple Hops	Box Drills
Single Foot-Side Ankle Hop (L)	Micro-hurdle jumps Lateral DL or SL (L-M)	Lateral Micro-hurdle hops DL or SL (M)	Linear and Lateral box jumps DL or SL
Depth Jumps	Bounding	Medicine Ball Exercises	
Jump From Box (L)	Lateral Ladder bounding series (M-H)	Trunk Rotation (L)	
Depth Jump With 180-Degree Turn (M-H)	Micro-hurdle bounds DL and SL (M-H)	Backward Throw With Jump to Box (M)	
Depth Jump With 360-Degree Turn (H)		Kneeling Side Throw (M)	
Depth Jump With Backward Glide (H)		Power Drop (H)	

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Thank you for choosing this *NFPT Introduction to Plyometrics* course for your continuing education and professional development needs. We hope that you have enjoyed learning and expanding your training knowledge, and that these techniques can be applied to your personal training field.

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