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Integrating Low-Intensity Plyometrics into Strength and Conditioning Programs

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Summary

This article will define plyometrics and provide a basis of understanding for functional progressions leading up to plyometric exercises. Readiness for plyometrics is presented as a method of defining an adequate strength base. Sample exercises and progressions are provided, including an example of the integration of low-intensity plyometrics into a speed development program.

Introduction

Plyometric exercises are often included in rehabilitation programs to prepare athletes for the demands of their sport and for a safe return to play. In a clinical setting, care plans are often developed based on sound principles, such as functional progression, specific adaptations to imposed demands, and manipulating routine variables (frequency, intensity, time/duration, type/mode, and rate of progression). Performance conditioning for the well athlete should not be different. The effectiveness of a plyometric workout should not be measured by how tired an athlete feels. This approach may lead to overtraining, exercise-related pain, and even overuse injuries. There is a need for structure and accountability when including plyometric exercises in strength and conditioning programs, including progression in work volume and intensity.

Functional Progression In Review

Functional progression is a series of basic movement patterns graduated according to the difficulty of the skill and an athlete's tolerance (5). The primary objective of functional progression in rehabilitation is an athlete's timely and safe return to competition. From a prevention standpoint, it is the optimal preparation for the specific demands of a sport. At the heart of functional progression is the specific adaptations to imposed demands principle, which simply means that physical activities should be appropriate and strategic in preparing an athlete for the demands of his or her sport (5), including such components as acceleration/deceleration of movement, specific velocities of movement, planes and ranges of motion, varied degrees of dynamic trunk stabilization, and coordinated whole-body patterns of movement.

Tippett and Voight (5) provided guidelines governing the advancement of a functional progression program:

- Begin with static positions and progress to movement.
- Initiate skills at a slow speed and progress to faster speeds.
- Initiate skills that are simple and progress to more difficult skills.
- Initiate skills unloaded (bodyweight only) and progress to loaded (resisted) skills.

In this article, emphasis will be placed on cardinal plane maneuvers performed in one place and/or covering a shorter distance, including 2- and 1-leg squatting, step ups, and varied jumping exercises, such as the 4-square and staggered-ladder patterns. In these exercises, the athlete remains within the cardinal plane(s), such as forward/back (FW/BK) in a sagittal plane and left-to-right jumps over a barrier, which includes frontal plane hip movements. For the purposes of this article, these exercises are examples of simple skills that are building blocks in preparing an athlete for more difficult skills, such as running with quick start and stops, cuts, and pivots within varied sport specific distances.

Below is an example of how to apply functional progression guidelines and graduate an athlete from one basic skill to the next. There are 2 important points to note on the exercise progressions below:

1. The athlete learns to attain alignment and postural control prior to advancing to the next phase (i.e., static control in a squat position followed by adding movement).
2. The athlete develops strength to maintain proper alignment that builds a stronger base for dynamic actions, (i.e., landing strategies prior to jump patterns).

The below exercises progress in the order listed:

1. **Strength phase**: Static squat to adding movement, 2-leg squat to 1-leg squat on bench, and FW/BK step-ups to lateral step-ups.
2. **Plyo-support phase**: Landing strategies with simulated jump patterns.
3. **Performance phase**: Jump patterns as follows:
   - FW/BK jumps and left/right jumps.
   - Add diagonals in 4-square formations.
   - Staggered-ladder formation—progressive locomotive patterns.
   - 2-leg to 1-leg jumps in above patterns.

The plyo-support phase is the period between 1 and 3.

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**Figure 1.** (a) Rounded shoulder and bowing spine during landing. (b) Squat using a dowel to assist in aligning proper position of head/spine and pelvis during landing.
during which the athlete develops neurological control and dynamic stabilization of his or her body during the amortization phase, or during ground-contact time (transition between jumps and/or change of direction). If there is a breakdown in postural control and alignment (Figure 1a, i.e., protracted and flexed cervical vertebrae or “forward head,” protracted scapulae or “rounded shoulders,” flexed thoracic spine or “bowing spine,” and a posterior tilt of the pelvis, or loss of lordosis), ground contact time will be delayed and the amortization phase will be less than optimal. In this case, ground contact is most likely increased because of the time needed to extend the spine before changing directions. The flexed spine position will also adversely effect correct joint positions and actions of the lower extremities.

Figure 1b shows an effective training method for postural control during landing. In this figure, a dowel is used as a cue for proper alignment from the head/neck, trunk, and low back/pelvis. In a squatting posture, the spinal curves should change and adjust to the anterior tilt of the pelvis. As the pelvis tilts forward, the lumbar vertebrae are forced anteriorly, thereby increasing lumbar convexity (lordotic curve). The line of gravity therefore is at a greater distance from the joint axes of the spinal segments, and the extension moment is increased at both the cervical and lumbar regions. The posterior convexity of the thoracic curve increases slightly and becomes kyphotic in order to balance the greater-than-normal lordotic lumbar curve. Referring back to the dowel, the contact points of the body along the dowel are at the head, mid-thoracic spine, and the base of the lumbar spine-pelvis, which assists the athlete in maintaining the 3 adjusted spinal positions—the increased cervical, thoracic and lumbar curves that accompany an increased anterior pelvic tilt. Note that Figure 1b shows the body’s posture in the “freeze” positions under Landing Strategies. As an athlete jumps forward/back and freezes, he or she needs to land while maintaining the posture noted in Figure 1b, by maintaining the anterior pelvic tilt and proper curves of the spine, and not flexing at the head/neck and trunk or losing lumbar lordosis. This is an example of dynamic postural control training, which is part of the plyo-support phase following the development of an adequate strength base.

### Plyometric in Nature

The practical definition of plyometrics is a quick powerful movement involving prestretching or countermovement that activates the stretch shortening cycle (6). Within this powerful movement is an eccentric or force reduction phase; an amortization phase, or transition moment involving dynamic stabilization, and a concentric phase, or force production phase (3). Although
it is common to view plyometrics by the muscular activity involved, the nervous system must be considered as well. Ultimately, the purpose of plyometric conditioning is to heighten the excitability of the nervous system for improved reactive ability of the neuromuscular system (6). If one considers the parameters that go into describing a plyometric exercise, including the use of the stretch reflex and taking advantage of the elastic rebound tendency of muscle tissue, then the definition can be broadened to include many exercises that are plyometric in nature (2).

Chu (2) notes that plyometrics have been broadened to mean many different activities, from depth jumps using a 48-inch box to aerobic dance exercises. Some aquatic programs will term certain exercises as being plyometric. Plyometrics, in its purist form, are meant to be maximal, all-out, quality efforts in each repetition of an exercise. There are certain populations that will benefit from low-intensity exercises that are plyometric in nature, performed with submaximal effort, including young athletes and collegiate/professional athletes who are in-season. This is especially true for young athletes, who may lack the strength base or physical maturity to undergo the rigors of a maximal-effort plyometric workout and would benefit by performing lower-intensity exercises designed to improve movement (kinesthetic awareness and body control). The nature of these exercises can definitely qualify under the heading of “plyometric in nature” (2).

**Intensity and Work Volume: Strategic and Appropriate—More is Not Better**

The actual term *plyometric* is based on Latin origins—plyo + metrics—and is interpreted to mean measurable increases. Inappropriate applications of plyometric exercises can happen if the exercises are not monitored correctly. Part of proper practice using plyometrics is to simply measure performance and have a plan. In other words, if a scheduled workout has assigned 80 total foot contacts (2 exercises, 2 sets × 20 repetitions each exercise), the athlete is finished with the plyometrics portion of the session once that work is completed. There is an increased risk of overtraining and exercise-related injuries when plyometric work is not measured and progressed appropriately, especially if a coach or athlete uses a feel the burn approach and measures success by how tired the athlete feels following the workout.
Table 1

Foot contacts based on season and skill level

<table>
<thead>
<tr>
<th></th>
<th>Beginner</th>
<th>Intermediate</th>
<th>Advanced</th>
<th>Intensity</th>
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<tr>
<td>Off-season</td>
<td>60–100</td>
<td>100–150</td>
<td>120–200</td>
<td>low–moderate</td>
</tr>
<tr>
<td>Preseason</td>
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<td>150–300</td>
<td>150–450</td>
<td>low–high</td>
</tr>
<tr>
<td>In-season</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>low–moderate</td>
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Table 2

4-square plyo-formation and work volume

<table>
<thead>
<tr>
<th>Exercise Description</th>
<th>Work Volume</th>
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<tr>
<td>1, 2 × 10 reps (2 foot contacts each rep, or 20 foot contacts per set)</td>
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<tr>
<td>2, 3 × 10 reps (20 foot contacts per set)</td>
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<tr>
<td>1, 2, 3 × 10 reps (1 rep = 3 foot contacts, or 30 foot contacts per set)</td>
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</tr>
<tr>
<td>4, 3, 2 × 10 reps (1 rep = 3 foot contacts, or 30 foot contacts per set)</td>
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</tr>
<tr>
<td>2, 1, 3, 4 × 10 reps (1 rep = 4 foot contacts, or 40 foot contacts per set)</td>
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Note: 1 set of each exercise above = 140 foot contacts, 2 sets = 280 foot contacts.

Table 1 adjusts work volume (total foot contacts) and intensity based on seasonal periods and an individual’s readiness for plyometrics.

The recommended volume of specific jumps in any one session will vary with intensity and each workout’s objectives. Table 1 shows how work volume should vary for beginning, intermediate, and advanced workouts (2). For example, a beginner in a workout during the off-season could complete 60–100 foot contacts of low-intensity exercises, while the intermediate exerciser might be able to do 120–200 foot contacts in an off-season workout. With low-intensity jump training, the work volume accumulates quickly. Note that an athlete performing 2 sets of each of the exercises in Table 2 will complete 280 foot contacts in 1 workout using the 4-square formation (please refer to Figure 4 for an illustration of the exercise).

It is important to consider the cumulative effect on work volume when combining low- and high-intensity exercises during preseason workouts for both intermediate and advanced level athletes. If an athlete at either level has a scheduled plyometric workout that includes 300 total foot contacts, the above example of 280 foot contacts of low-intensity jumps using a 4-square formation would only allow room for 2 sets of 10 repetitions of a high-intensity exercise, such as depth jumps. The proportions of low-intensity, moderate, and high-intensity work would depend on the objectives of the program and on the objectives of each session within a periodized model. Once again, reiterating the importance of measurement and accountability, a strength and conditioning coach who carefully monitors work volume within athletes’ programs will be able to make more objective decisions with regard to progression, or even with regard to tapering work when necessary. In addition to work volume, the frequency of plyometric work and recovery between sets are factors to measure and monitor as part of an objective-based strategic plan.

Frequency and Recovery

Allowing 48–72 hours between low-intensity plyometric sessions will ensure that adequate rest takes place and that the athlete is ready for the next plyometric workout. For example, a common weekly schedule could include the submaximal jump patterns on lower body strength days, such as Tuesday and Fridays, with upper body sessions on Monday and Thursdays.

Adequate recovery between sets in a workout is equally important as adequate rest between workouts. A common work-to-rest ratio is 1:5. For example an exercise that takes 10 seconds to perform would have 50 seconds of rest between sets. An important point to consider with low-intensity plyometrics, particularly with the footwork patterns presented in this article, is that they are submaximal in nature. With this in mind, fatigue should not be a factor with this type of work. As stated earlier, proprioception, postural control, and dynamic stabilization are points of emphasis with this mode of exercise. Again, fatigue should not be an issue if an athlete follows a course of progression, including development of an adequate strength base (i.e., squats and step-ups), and practices landing strategies with adequate body control prior to performing actual working sets of low-intensity jump training. An athlete will not reach a fatigue state given submaximal intensity, short duration of activities, and appropriate work: rest ratios. Note that submaximal footwork patterns/jumps are often used as part of a warm-up in preparation for moderate and high-intensity plyometrics (2). Otherwise, they can be placed toward the end of a workout, following the primary work of the day (weight training, sprinting, and agilities).

Safety Considerations

Low-intensity plyometrics should be performed in areas that allow both adequate space and a yielding training surface. Multipurpose rooms (group fitness classrooms), gymnasium floors, and outdoor fields are common places for performing footwork patterns. As in moderate and high-intensity plyomet-
rics, submaximal jump patterns should not be performed on cement or slippery surfaces.

Although it is common to use tape to set up the 4-square and staggered ladder patterns, this article shows the use of agility ladders for these exercises. Ladders are portable, easy to set up, and allow for consistency in the dimensions of the patterns. Also, note that the ladders shown in this article are foam ladders, which adds to performance safety should an athlete not clear the lines and land on the ladder. Another safety point to note is to use foam barriers, which are also less likely to cause injury if landed on. Note that 2-inch, 4-inch, and 6-inch foam blocks are the barriers used in the 4-square and staggered ladder patterns presented in this article.

Allowing time for an adequate warm up is another important safety consideration in preparing for low-intensity jump training. Jump rope is one simple way to prepare for the low-intensity jump patterns. For example:

1. Jump rope for 2 minutes. Perform 2–3 bouts with 60 seconds of dynamic stretching between bouts.
2. Dynamic stretching can include multidirectional lunging and standing quad/hip, hamstring, and lower-leg stretches.

**Readiness for Plyometrics: Medical and Orthopedic Considerations**

There are important considerations that need to be entertained prior to beginning a plyometric program. In some circumstances, preexisting medical conditions need to be considered. These concerns would generally apply to elderly or pediatric populations. Certain conditions, such as diabetes or a current viral illness, can have a significant detrimental effect on even our most fit collegiate and professional athletes. It is important to ascertain the athlete’s relevant past medical history and especially the athlete’s current medical status, because it may be necessary in some cases to obtain formal medical clearance prior to starting the program.

There are also important orthopedic considerations, as well as factors such as age, gender, physical maturity and experience level, which are crucial to the design of the specific program. What is appropriate for one 15 year old may not be for another. Structural and physiologic factors may predispose adolescent females to exercise-related pain or injury.

Any preexisting injury would have a very important influence on the appropriateness of a specific program. For example, deep squats and resisted knee extension may be contraindicated in patients with significant patellofemoral symptoms. A greater emphasis on hamstring and soleus strengthening and cocontraction...
strategies is appropriate in patients with a history of anterior cruciate ligament insufficiency. Likewise, athletes who have undergone previous surgery may have specific contraindications or require special areas of emphasis.

Bodyweight and strength ratios are important factors to consider. For instance, it is suggested that an athlete to be able to barbell squat 1.5 times his or her bodyweight (1 repetition maximum) before beginning high-intensity plyometrics such as depth jumps (2). This can be a dilemma for a high school athlete who could otherwise benefit from a plyometric program, but lacks this type of strength. When an athlete is running, he or she is already imposing up to 3 times his or her bodyweight in forces through the knees. Therefore, as stated earlier, low-intensity plyometrics, such as submaximal footwork patterns, are a healthy alternative for young athletes who lack an adequate strength base for performing high-intensity plyometrics (2). Continuing with the high school athlete as an example, the submaximal footwork patterns will teach a young athlete to control his or her center of gravity, land softly, change direction quickly, and spend as little time on the ground as possible. Low-intensity plyometrics can then be viewed as support work for healthier running in young athletes when combined with bodyweight resistance strength work and landing strategies.

Low-intensity plyometrics are also a safer choice for larger athletes, such as athletes weighing more than 220 pounds. For a tall, 260-pound basketball player, the 4-square drill can be viewed as a dynamic ankle stabilization exercise and combined in a lower-leg circuit, including wobble-board exercises and resisted dorsiflexion with a resistance band. In this case, submaximal footwork patterns that are plyometric in nature are a healthy alternative for a heavier athlete, whereas high-intensity plyometrics may be contraindicated because of bodyweight and sport demands (e.g., basketball, a sport that inherently includes high-volume/high-frequency jumping throughout a long season).

And, of course, an adequate strength base is necessary prior to beginning any plyometric program. Strength progressions should begin before plyometric progressions. The athlete needs to demonstrate appropriate body control and exercise tolerance before progressing to the next level. The following strength movements are examples of the type of progressive sequence that an athlete should be able to complete before beginning a plyometric program using submaximal footwork patterns.

**Squatting and Step-Ups**

*Squat* is a body position and posture; *squatting* is a movement. The squat position is part of most functional activities and a prominent part of most sports movements. The functional progression for squatting is as follows:

- **Squat position:** An athlete should practice the squat position as a prerequisite to performing the squatting movement. This is an example of static to dynamic progression. Controlling posture in a static squat position involves (a) head/neck alignment (chin slightly in), (b) shoulder blades slightly back (slight scapula retraction), and (c) maintaining lordosis in the low back in both 2-leg and 1-leg squat positions.

- **Squatting:** The actual squatting action should begin as a slow movement and progress to a faster movement. This is a continuation of functional progression, from (a) static to dynamic, then (b) slow to fast movement(s). The manner in which an athlete performs a squat will depend on the objectives of the exercise. Variations of a squatting action can include less or more ankle dorsiflexion with the tibia in a less or more vertical position, and knee- or hip-dominant motion depending what the movement is meant to accentuate. These actions will influence the body’s position (whether it will be more upright or angled forward) naturally through a kinetic link system. Additional progressions include changing the body’s base of support to condition the hip muscles globally, including the wide “sumo” squat, squat with a staggered leg stance (asymmetrical), and 1-leg squat, as in Figure 2 (to name a few). Adding lateral and/or across the body reaches while 1-leg squatting is a way to challenge frontal and transverse planes (1).

- **Step-ups:** Perform FW/BK and then progress to lateral step-ups. Step-ups are a healthy alternative to barbell-resisted squats, particularly for prepubescent and adolescent athletes and for athletes for whom loading the spine directly is generally contraindicated. In a step-up, the height of the bench is set according to the objectives of the exercise and the degree of desired hip action involved. For example, if an athlete’s goal is to emphasize hip action and optimally engage the gluteal muscles, he or she can use a bench that allows the stepping leg to begin the step-up in a 90° hip-flexed position once the foot steps onto the bench. Like a squatting movement, varying degrees of ankle motion, lower leg positions, and knee/hip flexion relationships will be based on the objectives for performing the exercise.

**Landing Strategies**

Landing strategies are the next progression from squats and step-ups. In essence, the landing position(s) of the body in low-intensity plyometrics is a partial squat. A partial squat is a position with feet shoulder-width apart and the bodyweight centered over a stable base of support (BOS). Bearing weight symmetrically, a stable BOS includes the trunk being upright over the legs with slight flexion of the hips and knees, or a partial squat position. The partial-squat
position may involve slightly more hip flexion (60–70°) than knee flexion (30–45°), keeping the knees posterior to the toes. By maintaining a more perpendicular position of the tibia to the ground, patellofemoral reaction forces are minimized and anterior translation of the tibia is minimized as well, particularly because of the normally occurring 7° posterior tilt of the tibial plateau (6). In short, the partial-squat position is an important quality point in landing strategies, which will, in turn, have a carryover effect to low-intensity jump training by:

1. Minimizing risk of exercise-related knee injuries (minimizing patellofemoral reaction forces and anterior tibial translation), and
2. Teaching an athlete to control the body’s center of gravity within its base of support.

Landing strategies bridge the gap between squats/step ups and the actual low-intensity jump patterns by training an athlete to develop dynamic postural control in the partial-squat position and enhancing dynamic trunk stabilization at ground contact when the feet hit the ground. This type of training will have a direct transfer effect that carries over to jump training, particularly during the amortization phase(s) of each repetition in a jump training set. The objective is to enhance proprioception and kinesthetic awareness during ground contact time. It is also important to note that when an athlete is able to control posture at ground contact, he or she will be able to change direction quickly and easily, with minimal wasted movement(s).

Examples of landing strategies could include the following jumps:

- R/L/R and freeze.
- L/R/L and freeze.
- Add 6-inch box to the above patterns.

Practicing landing strategies is one example of controlled, proactive exercises. When an athlete demonstrates body control in the above exercises and has concurrently developed an adequate ground base, he or she will then progress to:

- Advanced controlled proactive type exercises: Repetitions of preset jump patterns (without freeze moments) that advance from FW/BK and L/R movement to adding diagonal patterns and foam barriers (see Instructions for Jump Patterns and Figure 4), and
- Uncontrolled, reactive type of exercises (4). In this case, the athlete progresses to situations in which he or she must control activity reactively. The above landing strategies and below jump patterns are examples of controlled movement patterns simply because the athlete initiates movement. In uncontrolled reactive exercises, the athlete reacts to a stimulus during eccentric, deceleration moments. Using the 4-square jump pattern as an example, the athlete would progress from preset jump patterns to random jump patterns on command by the coach. In this case, the coach can combine both a visual and auditory stimulus to direct the athlete by calling out and pointing directions. Other examples of controlled proactive versus uncontrolled reactive exercises would be balancing on a wobble board or mini-trampoline, then progressing to catching and throwing while 2- and 1-leg standing on the same apparatus, or progressing from lateral movement on a slide board to catching and throwing with lateral movement on the slide board.

Instructions for Jump Patterns

The following jump patterns are low-intensity plyometrics that follow a natural progression to the exercises noted in Landing Strategies. Figure 3 shows an athlete in position to begin a jump pattern in the 4-square formation. The body position in Figure 3 is an example of the partial-squat position described earlier. Even though the athlete’s feet will be traveling in and out of the boxes in prescribed patterns, the body’s COG should remain constant. The

Objectives for Jump Patterns

Objectives for submaximal jump patterns include:

- Improve body control and movement in youth populations. These exercises are appropriate for young athletes who may lack the strength base or physical maturity to undergo the rigors of a maximal effort plyometric workout.
- In-season maintenance conditioning. These exercises are appropriate for collegiate and professional athletes in season who otherwise may lack adequate recovery time if performing maximal effort plyometrics.
- Improve dynamic stabilization strength in feet/ankles. These exercises are prerequisites to agilities that require start and stops, cuts, pivots, and change of direction.

Footwork patterns with low-intensity plyometrics are common and found in special speed development programs. Chu (2) notes that some footwork patterns are based on the inverted funnel principle. The inverted funnel principle is based on the fact that athletic movements require an individual to often move the feet out from under the body’s center of gravity (COG) and then recover the position for a brief period of time so as to regain balance and stability (2). The essence of footwork drills is that they teach an athlete to maintain their body’s COG in a relatively constant position while the feet rapidly work out from under it in multiple directions. The result is improved kinesthetic awareness, or that sense of where the body is in relation to the environment.


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partial squat position depicted in Figure 3 will allow an athlete to control the body’s COG effectively during submaximal footwork drills. Please refer to Figure 4 for an illustration of both the staggered-ladder and 4-square patterns using 2 foam agility ladders, and the varied jump patterns in these formations. Note how the boxes are numbered (1–6 in the staggered-ladder and 1–4 in the 4-square). The general rule for all patterns is to count “1” each time the athlete returns to the starting point. For example, when performing the staggered ladder pattern and going from box 1 to box 2, the scorer will count each time the athlete’s foot or feet return to box 1. For a box 1-2-3 pattern, again, count 1 each time the athlete’s foot or feet return(s) to box 1. In 1–6 for max-time (1, 2, 3, 4, 5, 6 formation), the athlete’s center of gravity should stay centered between the ladders as his or her feet jump from 1 to 6 and return from 6 to 1 for max time (2).

Adding Foam Barriers: When jumping foam barriers, the method of counting changes. Each foot contact is counted. Using the staggered ladders and box 1-2 jumps with a foam barrier, count 1 when the athlete contacts box 2 on the initial jump, count 2 when the athlete touches box 1 on the return trip, and continue in this manner for the remainder of the drill time (10–20 seconds). Please note Figure 5, which shows an athlete ready to begin performing jump patterns using the staggered ladders.

Different sizes of foam blocks can be used to increase the intensity of a staggered footwork pattern. This is particularly helpful in teaching an athlete to simply pick his or her feet up in an off-time rhythm, or syncopated pattern. Using the staggered ladder pattern and 1, 2, 3, 4 as an example, an athlete develops a natural rhythm and pattern of movement while his or her feet move from box to box. After the athlete becomes familiar with the 1, 2, 3, 4 pattern under normal conditions (consistent spacing and jump heights between boxes), a 4-inch foam block can be placed between boxes 3 and 4, which will augment the athlete’s previously learned pattern of movement and rhythm. Picture the athlete jumping a similar height and angular distance from 1 to 2 to 3, then having to quickly pick up his or her feet to clear a different height (of the foam block) from 3 to 4, and upon landing in box 4, picking up the feet again to change direction, landing in box 3, then continuing the return to box 1 under the normal dimensions of the jump pattern. Using the same pattern (1, 2, 3, 4), a 2-inch block can be placed between 1 and 2 and a 6-inch block between 3 and 4, which is another example of staggering jumps/footwork patterns and training in a syncopated rhythm. In either case, an athlete can improve body control by learning to maintain a rhythm during normal jump
patterns, then progress to varied syncopated patterns using the foam blocks.

**Integrating Footwork Patterns into Speed Development Programs**

Table 3 is an example of how to integrate low-intensity plyometrics into a strength and conditioning program designed for speed development. Simply stated, lower-body strength training and plyometrics are performed on Monday and Thursday, and upper-body weight training and plyometrics are performed on Tuesday and Friday.

Note the order and sequence of exercises on Monday and Thursday workouts in Table 3. This sample program has lower-body strength training preceding lower-body plyometrics, followed by sprinting and/or multidirectional speed drills for 3 workouts (Monday, Thursday, and the following Monday). In this schedule, every other Thursday is a measurement day. On that day, the workout will begin with maximal effort speed drills, including sprinting, following a proper warm-up, of course. In other words, every other Thursday is the day to measure progress and note improvements in speed, including straight-ahead sprinting or lateral movement. There are many ways to test speed in linear, lateral change of direction, and various multidirectional speed drills. This sample program provides 4 testing days to formally track data within an 8-week training period.

Regarding the lower-body plyometrics and the emphasis of this article, it is important to follow proper progression and a strategic plan based on an athlete’s functional capacity, manipulating variables such as intensity and work volume (refer to section on work volume and intensity). Note also that this is a sample off-season schedule in a cycled conditioning program. In the off-season, an athlete is not competing and recovery between sessions is not a critical concern. In the off-season, performance enhancement can become a primary objective because of the extra time an athlete has to recover between workouts. When an athlete is in-season, injury prevention becomes the primary objective of a strength and conditioning program.

**Conclusion**

While most strength and conditioning coaches have at some point prescribed plyometric exercises, proper progressions may not always be followed. Progressions can be based upon the functional ability of an athlete and the seasonal demands of a sport. Low-level plyometrics, particularly submaximal footwork patterns, are effective for less-skilled athletes, those who are physically immature, and in some cases athletes who are in-season. With this modality, it is important to progress carefully only after a strength base is first developed and good body control is demonstrated.

A general strength base can be developed through exercises such as step-ups and different types of squats, whereas practicing landing strategies and dynamic postural control exercises can develop greater body control. Furthermore, it is important to focus on quality performance and ensure that plyometric exercises are not used simply for conditioning. This is where the balance between qualitative and quantitative measures of performance is important. Using the staggered ladder formation as an example, maintaining a relatively constant COG as the feet move quickly from box to box is a qualitative measure in low-level plyometrics (i.e., inverted funnel principle). Quantitative measures with low-level plyometrics include monitoring work volume per session and following a logical and strategic progression throughout a training period. Work volume can be measured through actual foot contacts, and the number of foot

### Table 3

<table>
<thead>
<tr>
<th>Table 3</th>
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</tr>
<tr>
<td>Core 1</td>
<td>Core 2</td>
</tr>
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</table>

Core 1 = Phys-ball trunk exercises  
Core 2 = Med-ball trunk exercises on the floor  
Core 3 = Standing med-ball exercises, i.e., chops, throws, etc.  
* Thursday = weeks 2 and 4 are testing days. LB = lower body; UB = upper body; PLYOS = plyometrics
contacts prescribed can be based on the athlete’s skill level, the intensities of combined plyometrics in 1 workout (low-moderate-high), and seasonal period (in-season versus off season).

Repeatability of jump quality is equally important. Special tools such as ladders and different-sized foam blocks can be used to create a controlled environment that teaches spatial awareness and body control. Foam ladders and blocks also contribute to a safe environment, should an athlete land on the blocks or ladders. Adequate space and a yielding surface are additional safety points to consider when performing jump patterns.

The effectiveness of a plyometric workout should not be measured by how tired an athlete feels. This approach may lead to overtraining, exercise-related pain, and overuse injuries. There is a need for structure and accountability when including plyometric exercises in strength and conditioning programs, including progression in functional ability, work volume, and intensity.

References