Practical Guidelines for Plyometric Intensity

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Strength and conditioning professionals have long relied on plyometrics as one of the primary tools for developing athletic power and speed. It is not surprising that training exercises such as plyometrics, which are performed with high movement speeds would improve the performance of activities requiring speed, such as jumping, running, and agility. The technical term for this idea is "specificity." In other words, training that is "specific" or similar to the activity to be performed is believed to be optimal. As a result, recreational athletes, as well as those who desire to increase their overall fitness and add variety to their training, often incorporate plyometric training into their programs.

Plyometrics can be thought of as exercises that train the fast muscle fibers and the nerves that activate them, as well as reflexes, and include a variety of hopping, jumping, and bounding movements, which ideally are organized into a cohesive program. The main difficulty with creating a plyometric program may be the choosing the correct exercises and progression of intensity (1). The focus of this article is to help the reader understand the basic types of plyometric exercises and to provide some guidelines regarding the progression of plyometric exercises through increasing intensity over the course of a program.

Categorizing Plyometric Intensity

Classic text books describe typical categories of plyometric exercises and intensities (2). These categories are a useful starting point for understanding plyometric exercise options, their intensity, and program design. Common categories and examples of plyometric exercises are briefly described in table 1, which represent increasing exercise intensity from jumps in place to depth jumps. Intensity has been defined as the amount of stress the plyometric drill places on the muscle, connective tissue, and joints (2). As such, for plyometrics, intensity depends on the specific exercises performed. However, recent research has advanced the understanding of the intensity of plyometric exercises based on the muscle activation, connective tissue, and joint stress associated with various plyometrics (1,3). The following guidelines have been gleaned from these studies. Assuming all plyometric exercises are performed maximally:

- Any single leg plyometric exercise is more intense than the same exercise performed on both legs.
- Despite being considered a low intensity category, "jumps in place" such as the pike and tuck jump have the highest knee joint reaction forces.
- The height that the athletes jumps up to or down from (as in depth jumps) is one of the most potent predictors of plyometric intensity. For example, a person who performs a "jump in place" with a 30 inch vertical jump will experience greater ground reaction force and thus stress, than if they performed a "depth jump" from an 18 inch box. Thus, "jumps in place" may be of higher intensity than "depth jumps."

- Jumps performed with added weight, such as a weighted vest or dumbbells held at the side are typically only moderate in intensity as a result of the ground reaction forces. For this type of plyometric intensity is determined more by the jump height than the added weight. Since the added weight limits jump height, these plyometrics are only moderately intense.

- Jumps performed while reaching the arms overhead, particularly when trying to reach to a challenging goal (e.g. basketball rim) result in higher jump height and as a result are of higher intensity.

Plyometric Program Design Guidelines

Table 2 presents a ranking of plyometric exercise intensity based on the research (1,3). With the knowledge of exercise intensity one can begin to create a program. A number of design variables for creating plyometric programs have been described (2). Plyometrics, like other forms of training are usually only performed two or three times a week. Training should occur in a non-fatigued state. Therefore, these exercises should not be performed after resistance training or aerobic conditioning. Ample rest between sets should be used in order to avoid turning these speed and power enhancing exercises into endurance training. As a general rule, rest five to ten times more than it takes you to perform the set of plyometrics. Thus, if you do a set of multiple hops that takes four seconds, you should rest 20 to 40 seconds prior to the next set or exercise. Another good rule to follow is to limit your sets to no more than 10 repetitions. In fact, it is probably good to use a range of repetitions such as sets of one, three, five, and ten repetitions in order to train explosiveness as well as power endurance across a continuum.

Table 1. Exercise categories for a number of plyometric drills

- Jumps in place. These are drills where involving repeated jumps and landing in the same place. Some examples include multiple vertical jumps while reaching an overhead object, squat jump (figure 1), pike jump (figure 2), or tuck jump.
- Standing jumps. These plyometrics can be performed with either a horizontal or vertical emphasis, but typically are performed for one maximal effort. Examples include the single leg jump (figure 3), maximal vertical jump (figure 4), standing long jump (figure 5), or lateral long jump.
- Multiple hops and jumps. These drills involve the performance of multiple hops or jumps. Examples would include multiple long jumps (figure 6) or cone hops performed in succession, such as 5 hops in a row (figure 7).
- Box drills. This type of plyometric is performed using special boxes or other stable elevated surfaces that the exerciser attempts to jump up to. Examples of these drills include box jumps (figure 8), repeated box jumps, and single leg box jumps.
- Depth jumps. These drills are also referred to drop jumps and are performed by jumping down from a plyometric box or other elevated surface such as the first row of bleachers. Examples include stepping off the box and landing, stepping off the box and jumping vertically immediately after landing (figure 9), or stepping off the box, landing, and sprinting.

The amount of plyometric training, or volume, which is performed in any given training session is measured by the number of foot contacts. Beginners often perform approximately 80 to 100 foot contacts per session (2). However, half of that amount may be appropriate, particularly for children, older adults, or those who are untrained. Obviously, exercise intensity is an important consideration as well. Eighty foot contacts of a variety of line hopes, cones, and ankle hopes is dramatically less intense than 80 foot contacts of high box depth jumps, single leg jumps, pike jumps, and maximal overhead jumps and reaches.

Plyometric programs should start with low intensity exercises such as those described in table 2. Over time, moderate and eventually higher intensity exercises can be incorporated for those who are healthy and fit. A sample program for a fit and moderately trained exerciser is described in table 3. You will notice that this program increases the volume (foot contacts) to a point and then volume eventually decreases as exercise intensity increases, in order to reduce exerciser fatigue and increase adaptation to the program.

Summary

Plyometrics can be thought of as one of the important tools in the tool box for those who wish to add another dimension to their training programs. If improving variables such as speed, jumping ability, and agility is a goal, plyometrics may be the most important of these tools. Maximizing plyometric program effectiveness and preventing injuries depends on the logical progression of exercise intensity. Therefore the goal of this article was to provide information about the intensity of plyometric exercises, as well as to offer some general guidelines for plyometric program design.

References

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About the Author

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Table 2. The Approximate Highest to Lowest Intensity Plyometric Exercises

- Single leg jumps
- Depth jumps from heights that are similar to the exercisers actual vertica jump height
- Tuck and pike jumps
- Maximum jump and reach to overhead goals
- Maximum jump and reach without overhead goals
- Low box and depth jumps
- Weighted jumps
- Squat jumps
- Sub-maximal jumps in place (tall cone hops)
- Sub-maximal jumps in place (short cone hops, ankle hops, split squat jumps)

Figure 1. Squat Jump

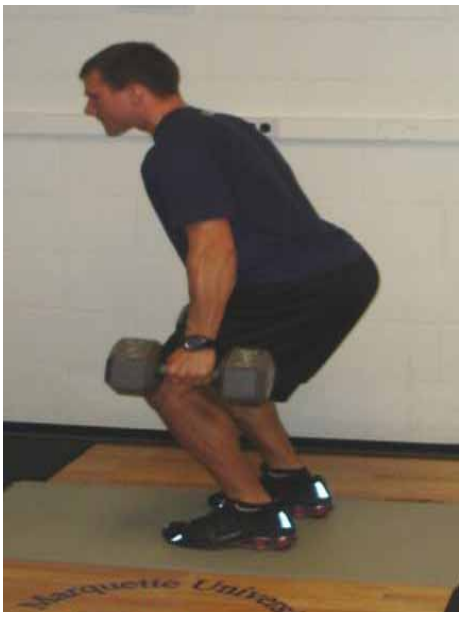

Figure 2. Pike Jump

Figure 3. Single Leg Jump

Figure 4. Maximal Vertical Jump

Figure 5. Standing Long Jump

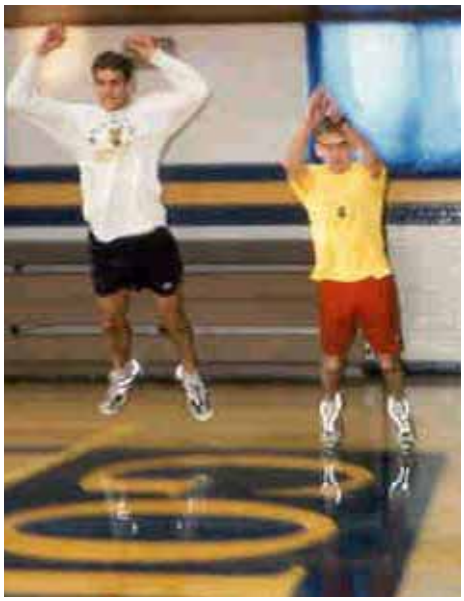

Figure 6. Multiple Long Jumps

Figure 7. Multiple Cone Hops

Figure 8. Box Jump

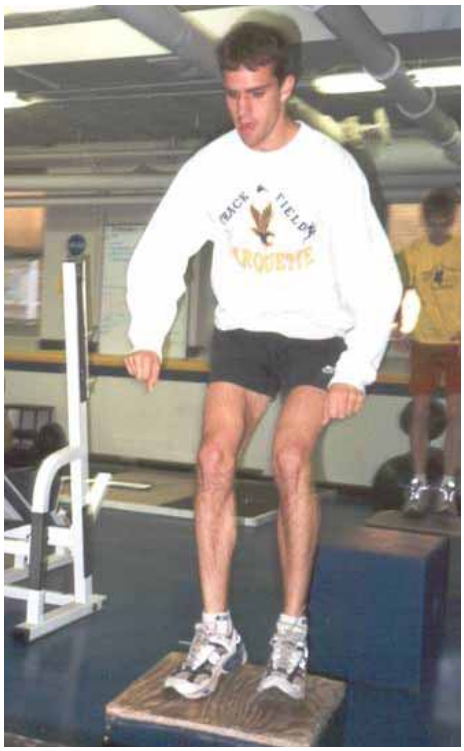

Figure 9. Depth Jump

Table 3. Sample 5 week program to be performed twice a week.

	Week 1	Week 2	Week 3	Week 4	Week 5
Volume	60 FC	80 FC	70 FC	60 FC	50 FC
Exercises	line hops 3x10	line hops 3x10	squat jumps 1 x 10	squat jumps 1 x 10	squat jumps 1 x 10
	ankle hops 1x10	ankle hops 2x5	split squat jump 3 x 5	split squat jump 2 x 5	multiple long jump 5 x 3
	cone hops 2x5	cone hops 3x5	multiple cone hops 5 x 3	tuck jump 5 x 1	lateral long jump 5 x 1
	squat jumps 2x5	squat jumps 2x5	lateral long jump 5 x 1	lateral long jump 5 x 1	pike jump 5 x 1
		split squat jump 2x5	weighted squat jump 10 x 1	weighted squat jump 10 x 1	two leg jump/reach 5 x 1
		long jump 5 x 1	box jump 2 x 5	box jump 2 x 5	single leg jump/reach 5 x 1
				12 inch depth jumps 10x1	18 inch depth jumps 5 x 1

FC = Total foot contacts per training session as determined by the total sets and repetitions for that session