Plyometric Training

What are plyometrics?

Movement that involves:
1. Rapid stretch of an activated muscle (lengthening contraction, eccentric contraction)
2. Pause (Amortization phase)
3. Shortening contraction (concentric contraction) to produce the functional force outcome

Readings:
- NSCA text: Chapter 17 pp 414 – 428

Force (and therefore speed) that results is significantly greater than shortening contraction alone can produce

Mechanism to enhance force production is:
- Neural – discussed in KIN 410 Motor Control & Learning
- Mechanical – discussed in KIN 312 Functional Anatomy
What are plyometrics?

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The NSCA text makes it sound like there is an actual “PAUSE” between lengthening and shortening.

There is NO PAUSE, you shorten as soon as you can stop the lengthening.

What are plyometrics?

Term PLYOMETRICS – common in exercise world
Synonymous with STRETCH SHORTENTING CYCLE (SSC) – common in biomechanics and motor control research world

Who should do plyometric training?

Athletes:
- Excellent way to develop quick, powerful movements & change of direction essential for sport success

Non-Athletes:
- Benefits of plyometric training for non-athletes has yet to be determined.
  - As people age the decrease in power exceeds the decrease in strength observed, but powerful shortening contractions can be developed without a SSC, although power may not be maximized
Who should **NOT** do plyometric training?

- Kids < 14 yrs, Adults > 60 yrs
  - Due to high stress on immature or weakened bones
- People who have not have a basic level of resistance training achieved
  - Due to muscle strength needed for plyometrics
- Clients > 220 pounds should avoid excess plyometric intensity or quantity

Plyometric program design

Plyometric exercise design is not well developed and established as for aerobic and resistance training

Guidelines suggested are based on experience of people who have used this training modality

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Plyometric program design

What are client’s goals related to power and speed?

- Jump higher?
- Change direction faster?
- Hit harder (bat, club, fist, racket)?
- Throw faster?

What are client’s goals related to power and speed?

- Jump higher?
- Change direction faster?
- Different forms of **lower body** plyometrics for jumping versus change of direction
Plyometric program design
What are client’s goals related to power and speed?
- Hit harder (bat, club, fist, racket)?
- Throw faster?
- Different forms of upper body plyometrics for hitting and throwing (but trunk and lower body plyometrics also critical for ground based arm force production)

Plyometric program design variables
1. Intensity
2. Frequency
3. Recovery
4. Volume
5. Progression

Plyometric Intensity
Intensity = amount of stress placed on tissues
All plyometric work is not high intensity and high intensity work is applicable to only highly trained athletes

<table>
<thead>
<tr>
<th>Low intensity</th>
<th>High intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low skips &amp; hops</td>
<td>Single leg jumps with weighted vest</td>
</tr>
<tr>
<td>Catch &amp; toss a light ball</td>
<td>Catch &amp; toss a medicine ball</td>
</tr>
</tbody>
</table>

Factors Affecting the Intensity of Lower Body Plyometric Drills

<table>
<thead>
<tr>
<th>Factor</th>
<th>Methods to Increase Plyometric Drill Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points of contact</td>
<td>Progress from double- to single-leg support.</td>
</tr>
<tr>
<td>Speed</td>
<td>Increase the drill’s speed of movement.</td>
</tr>
<tr>
<td>Height of the drill</td>
<td>Raise the body’s center of gravity by increasing the height of a drill (e.g., depth jump).</td>
</tr>
<tr>
<td>Participant’s weight</td>
<td>Add weight (in the form of weight vests, ankle weights, and wrist weights).</td>
</tr>
</tbody>
</table>
Plyometric Frequency

# of sessions per week
- 1-3 times/wk
- To allow required 48 – 72 hour recovery between sessions

Plyometric Recovery – within the workout

Complete recovery between sets is required, you must have excellent coordination and technique when doing plyometrics. e.g., 2-3 min between sets (1:5 to 1:10 work:rest ratio)

Recovery between reps is required for some very high intensity exercises

Plyometric Volume

Quantified in:
- Reps & sets
  - Throws
  - Foot contacts (for jumps)
  - Distance (for skipping & bounding)

Plyometric Volume

Sample Plyometric Volumes (but intensity is not factored into this table)
Plyometric Progression
Systematic increase in frequency, volume, &/or intensity

use 2 for 2 rule as in resistance training?

Plyometric Safety
Proper technique is critical (as in resistance training) e.g. landing technique for lower body plyo

Plyometric Safety
Proper technique is critical (as in resistance training)
For lower body plyometrics

Very stiff torso needed to transmit the hip extensor torque though body linkages without energy loss

Motion is about the hips & knees, NOT the low back

(McGill text, 3rd ed, pg 280)

Plyometric Safety
Adequate strength is needed

Lower body plyo:
- Client’s 1RM squat should be at least 1.5x body weight
  - But this may not be needed for very low intensity plyometric exercises

Upper body plyo:
- Client should be able to do 5 clap push-ups in a row
  - WHAT!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! This text, and this chapter is not supposed to be for high level athletes!!!!
  - OR use low volume of low intensity exercises
**Plyometric Safety**

Adequate **speed** is needed

Speed requirements for athletes and high intensity drills suggested in text

Non-athletes
- use low volume of low intensity exercises

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**Plyometric Equipment**

**Landing Surface**
- Adequate shock absorbing properties
  - Grass, suspended floor, rubber mats etc.
  - Not: hardwood or tile floors

**Training Area**
- Lots of open space to move, throw (and possibly fall) safely
- Don’t do it right next to equipment

**Equipment**
- Non-slip box tops
- **Footwear**
  - Good support (NOT narrow, light running shoes)

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**Plyometric Safety**

Adequate **balance** is needed

Tests of balance that must be passed (30 sec) to do lower body plyometrics of that level, and that # leg contacts e.g. to be able to do beginner unilateral leg drills, you must be able to stand on one leg for 30 secs

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**Plyometric Training**

Viewpoints from experts

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**Plyometric Training**

Viewpoints from experts
Plyometric Training

Viewpoints from experts

Like many current issues in functional training, plyometric training can be controversial. Many experts caution against the initiation of a plyometric program for athletes who do not have the proper leg strength. Articles on plyometric training often suggest that an athlete needs to squat a weight equal to two times his or her body weight prior to even commencing a plyometric program. This is a ridiculous guideline that eliminates nearly 90 percent of the athletes who have ever trained at our facility. The two-times-body-weight guideline was actually suggested years ago as a guideline to begin higher-level plyometrics but somewhere along the line was incorrectly applied to all plyometric training. Other authors suggest an eight-week strength phase before commencing a plyometric program. Although this suggestion is slightly more rational, it is still not practical because most athletes train for only 10 to 12 weeks in the off-season. An eight-week strength phase leaves only four weeks of plyometric training at most, a period far too short in which to implement a periodized program.

The keys to a plyometric program are that the exercises are taught in a progressive manner and that progress is based on competence, not a predetermined timeline. If an athlete cannot move beyond phase 1 skills, that athlete should stay in phase 1 for an additional two or three weeks before attempting to progress. Don’t try to force adaptation.


“Having a good strength base is essential for performing plyometrics safely and effectively. Without good lower body and core strength, the amortization phase becomes too long and much of the benefit of the plyometric is lost. Over the years, the need to squat one to two times body weight has been suggested as a requirement for plyometrics. While this is a good guideline for some of the higher intensity drills, simple jumps in place and hops over very low barriers can be used with most athletes as long as they have demonstrated the ability to land properly.”

Plyometric Training

Viewpoints from experts

Plyometric participation standards (7 min) (Source: Strength and Power Hour, 09-08-02)

Plyometric volume and power (4 min) (Source: Strength and Power Hour, 09-08-02)