



The Power of Plyometrics

Plyometric training has been regularly prescribed to strength and power athletes for the last 30 years. This form of training originated in Russia during the 1960's and was known as "The Shock Method". It is designed to do exactly as the name suggests, shock the muscles and tendons by inflicting high eccentric loads by dropping from a height of 0.4-0.8m and instantly rebounding off the ground. As such, Russian athlete's ability to produce jump force was significantly improved as a result of this high pre-loading and focus on eccentric contraction. During this period in the Olympics, the Russians performed exceptionally well in the strength and power dominated events (sprinting and jumping events). As such the Western world began to take notice and looked at Eastern Block methods of training. The main guy behind it all was Yuri Verkhoshansky.

During the 1970's an American Track and Field Coach called Fred Wilt began using the same training methods as used by the Russians and coined the jump training as "plyometrics". The contemporary use of plyometrics now includes a whole host of different jumping exercises which under the Russian original definition of the training technique would not constitute shock training or plyometrics.

Plyometric exercises constitute a natural part of most sporting movements because they involve jumping and hopping. Typical plyometric exercises we see include the countermovement jump (CMJ), the depth jump, hopping exercises and derivatives of these. Before we randomly prescribe these exercises, it is vitally important the strength and conditioning coach has:

- A strong rationale for their inclusion within the fitness programme
- Has a clear and precise technical model for coaching them

- Understands various prescription issues from a player and programme standpoint
- How to progress them from an intensity/demands perspective

Plyometrics involve a lengthening followed by a shortening muscle action. This is called the stretch-shortening cycle (SSC). This stretch-shortening cycle can then be broken into slow and fast SSC depending on how long it takes for the lengthening and shortening action to occur. Here is a simple example: Paul O'Connell regularly performs slow SSC movements when jumping in the line-out. It may take him 0.3 or 0.4 of a second in some cases to perform the jumping motion. Luke Fitzgerald running down the wing at top speed, however, performs his SSC (ie ground contact time) between 0.12-0.15 of a second. Because his SSC is performed in under 0.25 of a second, it is classified as fast SSC, whilst O'Connell's jump takes longer than 0.25 of a second, so it is classified as slow SSC. The implications of this for the strength and conditioning coach are that they need to understand the biomechanical considerations of specific motor skills before they can go prescribing auxiliary exercises to improve these sport specific skills. In this instance, to facilitate in improving Luke's straight line max speed with plyometric exercises, it is evident that he would benefit from fast SSC exercises such as depth jumps, hopping drills and reactive hurdle jumps. These fast SSC exercises would facilitate his development better than the slow SSC exercises such as squat jumps and box jumps (which would work better for O'Connell's line-out jumping).

Once the needs analysis is clearly identified and correct exercises are chosen, the "coaching" aspect takes over. If you call yourself a strength and conditioning "coach", then you must be able to do just that, "coach". Having a clear and precise "technical model" will help facilitate this coaching process. See below for a basic sample model for coaching a depth jump exercise.

Technical Model:

Start Position:



Landing Position – Key Points:



Minimal ankle-knee-hip flexion upon landing (stiffness)

Minimize ground contact time

Shoulders over centre of mass (COM)

Landing Position – Key Points:



Good ankle-knee-hip alignment

Ball of foot landing time
(slight touch of heel)

Jump Position:



Rapid triple extension of ankle-knee-hip complex

Exercise Classification – Vertical & Depth Jumping

- Box Jump/CMJ
 - Concentric dominance
 - Low eccentric loading
 - Lower intensity plyo exercise
 - Novices perform jump with larger kinematic changes around ankle-knee-hip joints
 - Classified as a slow stretch-shortening cycle exercise
 - Eccentric-Concentric phase lasting longer than 0.25sec

- Stop Jump
 - Same as box jump but involves a walk-in/run in approach to box before jumping
 - Larger eccentric loading from stepping pattern prior to jump
 - Increased forces as a result of deceleration component
 - Elastic energy derived from eccentric phase can be used to enhance concentric phase
 - Approach steps – sequence/pattern? Manipulate for line-out jumpers, ie backward into forward movement before jump
 - Classified as a slow stretch-shortening cycle exercise
 - Eccentric-Concentric phase lasting longer than 0.25sec

- Depth Jump
 - Original ‘shock’ method used by Russian’s in 1960’s
 - Larger the box height from the step-off, larger eccentric demands placed upon the athlete
 - Pre-activation of lower limb musculature prior to ground contact
 - Progress from 15cm, 30cm, 45cm, etc to max of 1m box height
 - Classified as a fast stretch-shortening cycle exercise
 - Eccentric-Concentric phase lasting shorter than 0.25sec
 - Depth jumps used as a rebound depth jump (off box onto a box)
 - Depth jumps used for reactive strength index scores (RSI’s) on a VJ mat

Exercise Prescription Issues – The Athlete

Biological Age	All ages can benefit (Saez-Saez Ce Villareal et al., 2009) Careful prescription of exercises – intensity of exercises
Training Experience	Tissue conditioning More experience athletes seem to gain more rewards (Saez-Saez Ce Villareal et al., 2009)
Strength	Squat x2 bodyweight? Squat 5reps of 60% body mass in 5 seconds? More practical approach maybe to look at training experience where first month or two are spent on low level plyos to allow safe and positive adaptations. The next 6-12 months spent on moderate intensity drills with high intensity drills to be introduced after 12 months
Gender	Q-Angle Joint laxity Eccentric control Men seem to get more benefit (Saez-Saez Ce Villareal et al., 2009)
Body Mass	Larger the body mass, the larger the loading demands especially on depth jumps, hurdle rebounds and hopping
Athlete Considerations	Footwear Clothing

Exercise Prescription Issues – Programming

Environmental Considerations	Surface (stiff vs soft, ie track vs wet pitch) Hazards
Recovery	Work:Rest is 1:5 2-3 mins typically
Volume (foot contacts)	Beginner: 80-100 Intermediate: 100-120 Advanced: 120-140 (Baechle & Earle, 2008, p.421)
Frequency	Beginner: x1 per week Intermediate: x2 per week Advanced: x3+ per week

To consult with Karl on any speed related topics, visit:

www.kg-elite-performance.ie

www.belarmine-clinic.ie