

Training for Power II – Elastic Strength

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Dynamic strength may be expressed as concentric strength eccentric strength or elastic strength. Concentric strength is defined as that involved in overcoming a resistance, e.g. lift a weight. As we have argued before¹, it is best developed in the weights room. Eccentric strength is expressed in resisting an external force, e.g. in lowering a weight or resisting collapse during landing while bounding or running. Elastic strength is the most complex to define, since it includes a mixture of (a) explosive, voluntary concentric contraction, (b) a reflex concentric contraction triggered by the stretch reflex, and (c) elastic recoil of the series elastic component (s.e.c). The s.e.c. consists of the tendons and connective tissue of muscle which store potential energy during resistance to stretching. This potential energy can be explosively released and appropriate training facilitates this. The relative contribution of these three components depends on the nature and speed of the movement concerned, the more rapid and explosive the movement (e.g. the take-off in the long jump or during each stride of a sprint), the less the voluntary concentric component involved and the greater the reflex and elastic components. The latter two, while positively related to the gross and concentric strength the athlete can express, are best trained by recoil-type exercises plyometric exercises². Since the term 'plyometric' seems to encompass such a variety of different exercises and effects, the remainder of this article attempts to illustrate some of them.

Hurdle Jumping

Two-footed jumps over 6-8 very low hurdles spaced about 1.25m apart. The athlete concentrates on elastic recoil off the ground (with a mental target time of 1/10th of a second). The coach looks for upright body posture, minimal flexion of the knees during the amortization phase, and good use of the hip flexion and arms. The emphasis must be on quality, not quantity. Some transfer of effect might be attempted by a short, explosive sprint of 20m after the last hurdle in each set.

Hurdle heights may be progressively increased, with a concomitant increase in the landing and take-off stresses. There comes a point when the dwelling time on the ground increases to where the nature of the exercise changes. With the hurdles at 3'3" to 3'6", the athlete might be asked to exaggerate the effects by concentrating on resisting collapse during landing - developing eccentric strength in the legs, while subsequently flexing the knees and employing concentric strength to clear the hurdles.

Variations on the above theme include setting the hurdles so that they are progressively higher, or alternating

high and low hurdles. In each case the coach needs to consider the desired effect and whether the hurdle heights, quality of execution, age, and standard of the athlete are appropriate.

Yet another variation includes the interjection of a very low, very fast very firm-priming jump between hurdles.

To alter the exercise markedly, the hurdles may be arranged in a dry and raked sand pit. The concentric element and the demands on the calves, Achilles tendon and lower foot are amplified.

An arrangement of low hurdles in some form of grid can be used for hurdle jumps sideways.

The well-conditioned senior athlete may include hopping over hurdles in his routine. This is both stressful and dangerous and should not be undertaken lightly. Any progression in hurdle height must be very gradual and carefully monitored. More or higher are not necessarily better, and at every stage the coach needs to question the specificity and value of the exercises attempted. Hurdles may be replaced by any other suitable obstacles.

Steps

A short flight of 20-30 wooden stadium steps permits a variety of hopping and bounding exercises that, depending upon the height and width of the steps can be demanding, challenging and competitive. Bounding up the steps 1 or 2 at a time can be employed for concentration on elastic recoil - 3, 4 or 5 steps at a time for increasing demands on concentric strength.

Hopping up increasing numbers of steps at a time makes for similar changes in emphasis and stress. Variations such as hopping '2 steps up and 1 step down' can make demands on mental concentration co-ordination and strength.

Variations such as hopping sideways up the steps, using either the near foot or the far foot, also change the demands on muscle groups, balance, co-ordination and strength but should be attempted with care. Where a short run-up of 2 or 3 strides is possible, triple jumping up steps might be attempted.

If longer flights of steps are available, bounding up them 1,2 or 3 at a time might be timed, introducing a further challenge to power and strength endurance. Concrete steps should be avoided.

the track, and complete the combination set with some short approach jumps into the pit. The sprinter may complete the same set with some short, explosive sprints. Similarly, one might use combinations of squat, squat jumps with weighted jacket, and bounding, jumping or sprinting. The thrower may combine the inclined bench press with putting heavy and light shots. The objective, of course, is to choose a combination of exercises that are as specific to the event as possible and that contribute a combined training effect on concentric, eccentric and elastic strength requirements of the event. Performing the combination in rapid sequence is thought to promote a carry-over effect from one form of training to the next. The necessary proximity of weights room to track is a luxury few of us enjoy.

Choice of Plyometric Exercises

The choice of exercises within a session and their order should be planned. One might choose a sequence that begins the session with exercises that are fast, explosive and designed for developing elastic strength (low hurdle jumps; low drop jumps), work through exercises that develop concentric strength (standing long jump; high hurdle jumps) and finish the unit with training for eccentric strength (higher drop jumps). Alternatively, one might organise such a progression within a set of exercises. The coach must be armed with a battery of exercises to ensure variety. In our own group, we tend to begin with low hurdle jumps, progress to bounding and hopping on the track, continue

with either steps or box work and finish with an enjoyable medicine ball work out for abdominals and upper body. When it snows, we are content with a very hard session on the stadium steps!!

Progress with beginner or developing athletes must be slow. Chu¹ suggests that (a) if an athlete cannot lift 1.5 times his body weight in a single repetition squat to parallel or (b) execute in 5 seconds 5 squats to parallel with 60% of his body weight, than further resistance training is a prerequisite to starting regular plyometric training. For the first 4-8 weeks of training, it may be advisable to hop or bound on grass. Depth jumping provides the highest intensity of training effect and should be reserved for strong and well conditioned athletes.

A judicious mixture of 1 or 2 plyometric units of training, 2-3 weight training units, and 1-3 units of speed training per week, during winter preparation is adequate power work for most explosive athletes.

¹Sabnis D and Vince A (1995) training for Power. Athletics Coach 29: 20-24.

²Chu D A (1993). Jumping into Plyometrics, Leisure Press, Champaign, Illinois.

³Jones M (1995). Medicine Ball Training. BAF Instructional Books, 1995.

⁴Tenke Z and Higgins A (1992). Medicine Ball Training