

Main muscles involved - quadriceps (thigh), hamstrings, glutes (buttocks), calf muscles

Joint motion - ankle extension, knee extension, hip extension

Sports applicability - Running (sprinting, middle and long distances), all running and jumping based sports such as tennis, football, basketball and high jump etc.

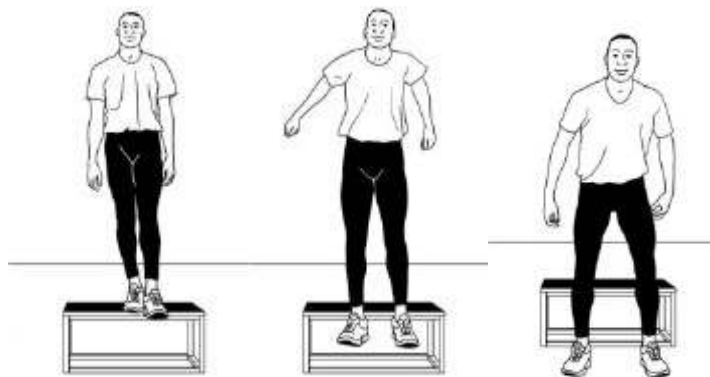
MUSCULAR ACTION

The depth jump is a 'plyometric exercise'. Plyometric exercises work on the principle that a concentric muscular contraction is much stronger if it immediately follows an eccentric contraction of the same muscle. (Eccentric muscular action occurs when a muscle lengthens under load – *eg.* the lowering phase of a biceps curl. Concentric muscular contraction occurs when a muscle shortens under load.)

The effect of a plyometric exercise is a bit like stretching out a coiled spring to its fullest extent (the eccentric contraction), then letting it go (the concentric contraction); large amounts of energy are released in a split second as the spring recoils.

CONDITIONING BENEFITS

- **General** - The depth jump provides a great base of dynamic power for the majority of sports. This is because it closely matches the sport specific speeds of movement and muscular action. Most standard weight training lifts, even when performed as quickly as possible, take 0.5 - 0.7 seconds to complete, whereas during a depth jump your feet may only be in contact with the ground between 0.2 and 0.3 seconds.
- **Sport specific** - Although the basic depth jump is very sports specific in itself, it can be made even more so by adaptation and variation (more later).



Start position

Stand on top of a strong platform 0.5m to 0.8m high (the greater the height, the greater the strength component, the lower the greater the speed component).

Action

- Step slightly forward off of the platform. Land toward your forefeet;
- React as quickly as possible to the ground and spring immediately back up into the air;
- Use your arms to add to your speed by drawing them back prior to stepping off the platform and swinging them vigorously upward, as your feet hit the ground;
- Keep your back in neutral alignment, *ie.* not arched or rounded;
- Focus your gaze straight ahead of you.

Training Tips

- Maintain neutral posture and a balanced elevated chest position throughout the exercise. Do not attempt to absorb the landing on impact, rather react as quickly and as fast as you can, even if this sacrifices height gained;
- The faster a muscle is forced to perform an eccentric contraction, the greater the concentric force it can generate. To ease your understanding: think of a rubber ball being thrown against a wall. What happens when the ball is thrown harder? It springs back even faster and further. This is the effect you are after when performing plyometric exercises, like the depth jump;
- Always warm up thoroughly before performing depth jumps;
- Don't perform more than two workouts a week and allow at least 5 days before important competitions;
- Monitor the number of jumps performed. Depth jump volume is measured in ground contacts; avoid more than 60 in a session. Start with 3 x 6 repetitions;
- To allow your power producing fast twitch muscle fibres to be at their most effective, take 30 seconds recovery between exercises and two minutes between sets;
- Perform depth jumps on a non-slip flat surface - a sprung gymnasium floor or an all-weather athletics track are ideal surfaces;
- You need to be in 'the right frame of mind' to get the most out of depth jumping. Going through the motions will not turn on a sufficient neuromuscular input to optimise their performance.

SPORTS SPECIFIC EXERCISE PROGRESSION

1 – 'Single leg' depth jump (hop) for distance

This variation will up your leg muscles' power and is a great exercise for field and racquet sports players, sprinters and jumpers (where all movements are performed with an independent leg action). Note the single leg depth jump places greater potential strain on the legs and back, as such this exercise should only be performed by those with a high degree of prior plyometric training experience.

Assume the same starting position as for the first exercise, but this time drive forward, to land about 1m in front of the platform, on the same leg. React as quickly as possible to the ground and hop forward as far as you can. Maintain an upright posture and cycle your hopping leg under your body whilst in the air. Co-ordinate your arms with your legs *i.e.* in a running, 'opposite arm to leg' style. Try: 3 x 5 repetitions, alternating left and right leg sets

2 – 'Double footed feet apart landing' depth jump with 10m sprint

The exercise is designed to assist the development of explosive acceleration in non-linear directions and is especially beneficial for field and racket sport players. To perform the exercise step off the platform with two feet then 'rotate' in the air so as to land at an angle – *eg.* 45 degrees to the left. On landing, drive (push back) with one leg, while pulling the other quickly through from the hip, to begin accelerating forward. Sprint for 10m. Pump your arms backwards and forwards as vigorously as possible to aid acceleration. Try: 3 x 8 repetitions, varying the angle of landing and sprint.

Plyometric Exercise and Power Training

Add power to your punch with plyometric exercise. Do you ever look in awe at top sprinters and realise just how fast they are running? Dwain Chambers would get a speeding ticket in built-up areas! And what about the slam-dunk in basketball? How on earth do players like Kobe Bryant leave planet earth and attain such height? And what of Matthew Pinsent and James Cracknell? Unbridled, these rowers would seem to be able to tear their boat apart!

Wherever you look in the world of top-class sport, power counts; and one of the best ways of developing this most precious commodity is through **plyometric training**.

Plyometrics exercises are based on the understanding that a concentric (shortening) muscular contraction is much stronger if it immediately follows an eccentric (lengthening) contraction of the same muscle. It's a bit like stretching out a coiled spring to its fullest extent and then letting it go: immense levels of energy are released in a split second as the spring recoils. Plyometric exercises develop this recoil or, more technically, the stretch/reflex capacity in a muscle. With regular exposure to this training stimulus, muscle fibres should be able to store more elastic energy and transfer more quickly and powerfully from the eccentric to the concentric phase.

Unlike traditional weight training, plyometric drills can closely mimic both the movement pattern and the speed of execution of actual sports performance. While a sprinter's foot may be in contact with the ground for just 0.084 seconds, and even running at a moderate pace can result in a foot strike time of 0.2 seconds, most standard weight-training lifts, performed at their quickest, take 0.5-0.7 seconds to complete.

A plyometric drill will match runners' ground contact times, while at the same time generating a significant amount of force. One piece of Soviet research showed that under certain conditions athletes could display brief (in the range of 0.037-0.067 seconds) plyometrically-induced muscular tensions equivalent to 1,500-3,500kg, although it should be noted that this example was probably based on eccentric (drop and hold depth jumps from a great height) rather than the more familiar types of plyometric drills, of which more later. So you can see why weight training for sport can be limiting when it comes to specific training transference and why plyometrics are a great way to address power needs.

To get the best out of plyometrics you should ensure adequate pre-conditioning. Some authorities recommend that an athlete should be able to half squat at least 1.5 times their body weight before embarking on a plyometric programme, but this may be an excessive requirement, particularly if an athlete is planning to embark on a progressive plyometric-conditioning programme, beginning with low-intensity drills before progressing to the more intense. As with all 'new' training experiences, progress should be incremental.

Despite my seemingly dismissive comments about weight training, it should not be discounted as means of generating specific sports-related power. Weight training still has a vital role to play in terms of laying the foundations for greater power and pre-conditioning an athlete for plyometrics. A larger and stronger muscle (built up by weight training) will be able to generate greater force plyometrically, and strengthened tendons and muscles will be less prone to strains and pulls. It is also possible to combine weight training with plyometrics for a heightened fast twitch muscle fibre response.

When it comes to selecting the right plyometric moves, the coach or athlete needs to consider the specifics of their sport, the athlete's maturity, his level of pre-conditioning and his ability to pick up what can be a complex skill.

Single leg moves are often more complex and more stressful than double leg moves. Compare squat jumps to alternate leg bounding over 20m, with either a single or double arm shift and a 15m run-on. The complexity and speed component of the latter is significantly greater than the former. And it is likely that a beginner – or even a moderately conditioned individual – would not be able to perform even the first bound without collapsing, let alone a series over 20m, whereas he or she would probably be able to perform five consecutive squat jumps. **Always err on the side of caution when selecting your moves.**

When introducing plyometrics into their training program, you should wear well-cushioned trainers and perform the drills on a yielding surface, such as a running track or sprung floor.

Eccentric drop and hold jumps

Eccentric drills focus on the plant and absorption phase of a dynamic movement and forsake the concentric phase in the stretch/reflex sequence. They are advocated because of their huge force absorption potential and as a further conditioner of the stretch/reflex.

Poor interpretation of the work done by Yuri Verhoshansky (the former Soviet sports scientist, known as the 'father' of plyometric research) sometimes resulted in subjects being asked to perform depth jumps (i.e. rebound on landing) from very considerable heights (e.g. in excess of 3m) with obvious potential for injury. (I myself was once asked to perform this form of eccentric training from a similar height but refused on the grounds of sanity!) The height itself is a major fear factor, let alone the landing! However, if implemented sensibly and from **lower** heights, or in the form of **'bound/hop and hold' drills**, eccentric power training can be an effective way of further developing power.

It's yet another way to overload muscles and thus avoid stagnation and maintain training progression in seasoned athletes. Both coach and athlete need to be aware that eccentric training is likely to cause muscular soreness even in the well-conditioned; but, as with other forms of eccentric training, such as downhill running, one session may be all that is needed to 'inoculate' the body against further soreness. As with weight or endurance training, you can periodise your plyometric training. Obviously the specific requirements of your sport and your competitive aims for the forthcoming season need to be considered, but there are some general guidelines for progression. The following recommendations are based on the requirements of a power athlete with a single main competition period, but occasional reference is made to the needs of endurance athletes.

Pre-season/early conditioning phase

Plyometric moves such as split squats, jump squats and straight leg jumps can all be incorporated into a circuit. Normal circuit training protocols should be used – i.e. high reps, short recoveries. At this stage of general conditioning they will develop low-level power and general sports-specific movement pattern conditioning, as well as specific endurance. If you are an endurance athlete you could continue this type of training beyond your pre-conditioning phase and integrate it into your non-track/rowing/cycling sessions. Runners could also incorporate plyometric drills into fartlek-type workouts.

Main power conditioning phase

Athletes who are sufficiently skilled should use drills from the medium-intensity categories in the table on page five during this phase of training. Runners should progress to single leg variants as these will have the greatest relevance to their sport. Do not neglect lower leg drills such as straight leg jumps – where the athlete literally 'pogo' up and down on the spot. These will improve specific calf and Achilles tendon power, leading to optimum foot-strike and force return when running. Middle – and long-distance runners could incorporate bounding and hopping into the warm-up stages of their track sessions; they could also carry out hill training to develop running-specific power as well as maintaining plyometric drills within their circuit training.

Pre-competition phase

During this period athletes should concentrate on quality plyometric drills that replicate the speed and movement patterns of their chosen sport. Select drills from the high-intensity examples in the table, but ensure quality and do not allow fatigue to impair performance.

Competition phase

In power sports the activity itself will act as the prime conditioner: nothing beats a competitive situation for optimum power expression. But in training athletes should perform high-quality plyometric drills in low numbers, well away (7-10 days) from important competitions. Endurance athletes could continue with medium/high-quality drills as part of their warm ups or as part of their low-intensity workouts.

Volume and intensity guidelines

The recommended volume of specific jumps in any one session will vary with intensity and progression goals. For jumps on the spot or from standing, measure the volume in terms of foot contacts. As a guide, **a beginner** in a single pre-season workout could perform **60-100 foot contacts** of **low-intensity exercises**.

The **intermediate plyometrics** exponent might be able to do 100-150 foot contacts of low-intensity exercises in one workout and 100 of moderate-intensity exercises in another, while an **advanced exerciser** might be capable of 150-200 foot contacts of low-to-moderate intensity exercises in a single session.

Intensity is the key: the more dynamic the move and the greater the power generated, the fewer foot contacts are required. As training phases progress, maintaining quality is crucial and the number of foot contacts should be reduced, as optimum power and speed need to govern performance.

Bounding and hops are best measured in terms of sets and reps, distance covered and whether they are performed from a standing start or with a run-on.

Verhoshansky recommended incorporating a maximum of 5-10 bounds per set into a session, with no more than 50-75 ground contacts. If a run-on is used, the number of reps should be reduced.

For optimum sports-specific training effect performers should not allow themselves to become fatigued. Rest between sets should be in the region of 1-2 minutes; successive depth jumps or drop jumps should be separated by intervals of at least 15-30 seconds – or even longer if very intense multiple hops and jumps routines are being performed.

Such recovery intervals will allow the stretch reflex mechanism to return to optimum capability. In terms of number of sessions, 2-3 per week should suffice – but they should not be performed on consecutive days or 7-10 days before important competitions. Those new to this form of training may experience an initial decline in their performance until they become accustomed to the training method.