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To New Heights

Improving an athlete's jumping ability means taking into consideration speed-to-intensity ratios, inhibitory deceleration, eccentric stretch, and the use of plyometrics. But it starts with the proper foundation of strength.

By Jeff Connors

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In almost every sport, athletes are eager to increase their vertical jump. Whether they want to soar above the rim in basketball, leap to deflect a pass in football, go up for a powerful spike in volleyball, or gain the advantage on a header in soccer, athletes who can jump high gain a competitive edge.

But athletes who have developed vertical power can actually do much more. The feet-way-above-the-ground leaps that wow fans and make the covers of magazines are awesome, but they are just the icing on the cake. Developing vertical jump means an athlete has a powerful single- and double-leg triple extension, which is a vital component of many high-level athletic activities.

Effectively training this area will result in increased force application into the ground. The athlete develops the ability to overcome inertia out of a static position, improve the acceleration and maximum velocity phases of a sprint, and increase leg driving power against resistance. Improvement in tests such as the broad jump, vertical jump, and linear acceleration will happen, but they are just the byproduct of a comprehensive explosive strength-training program.

FOUNDATIONAL STRENGTH

The starting point for developing these attributes is foundational strength. Traditional slow velocity multi-joint exercises are employed in most programs to meet this objective. They might include the back squat, single-leg squat, step up, lunge, front squat, split squat, RDL, and overhead squat.

In our program, we emphasize the back squat and back squat variations, barbell step ups, tri-planar lunges, and a number of exercises that target the hamstrings and glutes. We also focus on strengthening the hip flexors and the remaining areas of the core.

Why is foundational strength so important? A reasonable number of studies have concluded that this particular type of strength development improves hip rotary power

as measured by vertical jump. Through years of experience, we have found that the back squat and back squat variations are key to foundational strength.

For most of our athletes, even though they were heavily recruited high school stars, it will take at least a couple years to develop the foundational strength needed to affect vertical jump. Many college athletes played multiple sports in high school and were not involved in a consistent strength program that was intense or frequent enough. Their lower-body strength usually has a significant gap remaining in the window of adaptation.

Our goal is for each athlete to get to the point where foundational strength is highly developed so we can work on more specific, intense plyometrics. But we never progress until the athlete is ready. For example, we have a linebacker who could not significantly improve his lower-body strength due to a number of injuries. But when he was able to complete a full year of training, he improved his back squat weight by 100 pounds. He also established a new team record in vertical jump for linebackers at 40 inches. The measurable improvement he demonstrated was due in part to being able to finally establish a foundation of strength.

OUR RECIPE

The recipe for foundational strength in our program includes the back squat as the primary movement. The back squat has obvious specificity to rotary hip movement, and it works the major muscle groups that originate athletic movement. In addition, subtle changes in stance can conveniently target different muscle groups—for example, the high bar squat is specifically executed out of a vertical jump stance. Finally, the squat is a great exercise for hypertrophy.

We use six-week training cycles in the off-season and three-week mini cycles in-season. Athletes perform five reps or fewer to target fast-twitch muscle recruitment, straining through heavy weight and striving toward a new max effort triple once a week. Our second day is a maximum velocity training day using 55 to 76 percent of single-rep max with no more than three reps and only short rest intervals. We also use band tension with accommodating resistance off a box, with the speed of the bar ranging from .7 to .8 on a tendo unit. Monitoring foundational strength by straining through heavy weight and then moving to lighter weight for maximum bar speed with accommodating resistance has been another key to our program.

Athletes with few training years under their belts might spend the first year alternating their workouts on the second day between high velocity and hypertrophy. Many young athletes will need to continue training in a developmental fashion aimed at basic strength before shifting to more high velocity training.

In addition, the importance of training the posterior leg cannot be overemphasized. Our favorite exercises for the hamstrings and glutes include RDLs, glute-ham raises, reverse hyperextensions, negative accentuated leg curls, and resisted movement drills such as a low pedal in a sand pit or straight-leg bounds with a sled.

One of our favorite choices for developing the total leg is the plate-loaded Power Runner. Our athletes perform anywhere from 20 to 40 reps in a set with heavy weight. This exercise is also used explosively to reiterate force application during the acceleration phase of sprinting. We also use this exercise, together with barbell step ups, to train each leg independently. And we'll combine it with a back squat in a superset when working on hypertrophy.

This combination of exercises and schedule has given us the best results. Several all-time vertical jump and broad jump records were set this past year, and sprint times were also favorable under this routine.

LOTS TO CONSIDER

When moving our athletes to more high velocity training, there are some additional issues to consider. A major one is how to counteract inhibitory deceleration—that is, how to limit or account for the slowdown at the peak of the lift. The use of accommodating resistance in our program has been a trial-and-error process.

We have found that exercises such as the resisted squat jump have value because full extension is expressed without the inhibitory factor. Using the Vertimax, a weighted vest, or medicine ball routines also work well, as they require acceleration and facilitate maximal effort hip extension. The Smith Machine, with a braking device to enable safe return to the starting position, is most productive when used with 30 percent of single-rep max. This is notable because it would be quite difficult to wear a 150- to 200-pound weighted vest or perform jumps with a 150- to 200-pound medicine ball.

Olympic lifts are also key to enabling athletes to accelerate the bar to its highest point with maximum force and full extension at the ankle, knee, and hip joints. We have experimented with every primary and component Olympic lift over a 25-year period and have found that the block clean with the use of a tendo unit is most effective. It especially helps develop the second pull and eventually an improved single-rep max power clean.

We have also established a specific speed-to-intensity ratio for this lift so that our athletes get the most out of it. We block clean with 70 percent of single-rep max at 2.0 meters per second, and decrease the velocity by .2 meters per second for every three-percent increase in training weight. For example, if we are using 82 percent of single-rep max, our speed expectation would be 1.2 meters per second. Obviously, to develop a higher level of power output, we want to increase the speed of the bar with the same weight, increase the weight with the same speed, or do a combination of both.

It is important to note that these exercises require coaching every single repetition to facilitate maximal vertical force production. When it comes to training with the intent to be as fast as possible, specific feedback is critical.

Since one of our goals with this exercise is for the athlete to increase acceleration of the lift, we also need to consider how to limit the eccentric stretch. We want to force the

athlete to work harder to initiate acceleration of the bar. That's why we prefer moving weight from a static position in some of our component exercises both in the rack and on the platform. When our athletes squat off a box, they relax very briefly and then accelerate with maximum speed, intending to "rattle the plates" at the top.

I prefer the block clean to the hang clean for the same reasons. It challenges the stretch reflex of the athletes by forcing them to move from a paused position. This also helps the athlete to become more explosive out of a normal stretch reflex.

The final part of our program includes some speed and plyometric work. We greatly emphasize single-leg bounding, power bounding, and speed bounding. We use these exercises with mini-hurdles to increase stride length, and we also use a weighted vest to enhance the stimulus. In addition, we blend the speed bounds into turnover drills to increase stride frequency.

In the weightroom, we use vertical/lateral plyometric drills. Our favorite drills include a single-leg thrust off of a box, box jumps, side lateral jumps, skis with a medicine ball twist, continuous Bear machine jumps, and various combinations on the Vertimax.

INTO A SCHEDULE

Another important consideration is the volume and scheduling of training. The choice and frequency of exercises is very important to avoiding overtraining and ensuring proper recovery. Neural fatigue is a primary reason that athletes stop making gains.

One training program that facilitates recovery but allows for an adequate level of training is a three-day lift and four-day run schedule (see "Weekly Schedule" below). With this schedule, Tuesday and Thursday are absolute speed training days and include an extensive dynamic warmup, neural drills, bounding, full-speed resistance running, and sand training. Athletes also run on Monday and Wednesday before lifting, but they are tempo runs (75 to 90 percent of max effort). Friday is a lift day with high-volume plyometrics and no running.

We measure our total volume of bounding and plyometric training to ensure we do not overtrain. Total volume includes the reps performed as part of the speed training on Tuesday and Thursday and the heavy plyometrics in the weightroom on Friday. These concepts are also adaptable to a four-day split routine.

Helping athletes reach new heights, both literally and figuratively, starts with an emphasis on the foundation. From there, the considerations of inhibitory deceleration, eccentric strength, and recovery must all be balanced in order to develop an effective jump training program.

Sidebar: **Weekly Schedule**

The following weekly schedule is used to facilitate power:

Monday
Submaximal tempo runs
Lower-body foundational strength training (maximum effort) using Dartfish
Foundational upper-body training
Olympic lift teaching day with medium resistance using Dartfish
Tendo unit used for bench press and block clean

Tuesday (Absolute Speed)
Dynamic warmup
Neural drills
Resistance modalities
Full-speed maximal effort sprints or drills

Wednesday
Submaximal tempo runs
Component upper-body lifts
High velocity lower-body lifts
Component Olympic movements
Tendo unit used for box squat

Thursday (Absolute Speed)
Dynamic warmup
Neural drills
Bounding
Resistance or assistance modalities
Sand pit strength training

Friday
No run
Heavy Olympic lifts
High velocity upper-body lifts
Component lower-body lifts
High volume plyometrics
Tendo unit used for bench press