

## GROUND-BASED TRAINING FOR IMPROVED ATHLETIC SPEED

Following are some FAQ's regarding the numerous "speed, power and agility training" devices on the market today and their advantages and disadvantages from a biomechanics perspective. Hopefully, this information will help you better understand these options and assist you in making choices related to ground-based training activities.

### **GUIDING PRINCIPLES OF HIGH-VELOCITY RESISTANCE TRAINING**

If there is one thing that everyone must learn about Athletic Republic's resistance cord technology, it is that proper mechanics must be executed during high-velocity resistance training in order to have a positive training benefit. If proper mechanics are not used during high-velocity resistance training, it is likely the training will be counterproductive.

Using this principle, consider that almost all of the current "speed training" devices on the market attach at the waist. Resistance or assistance at the waist will almost always result in a change in the position of the pelvis and lower extremities during the movement. In many cases, the adjustments in body position that the athlete makes (especially the pelvis) will not be consistent with the biomechanics associated with good movement skills. Reinforcing the wrong mechanics can be very detrimental to the training process. A large part of improving athleticism is moving better.

### **WEIGHTED SLEDS**

Any athlete that has to accelerate explosively from a fixed position (sprint starts, football stance, etc.) has to be able to maximize the force they produce in the horizontal direction. The best way to do this is to stay low—keeping the trunk and pelvis tilted forward. For this purpose, weighted sleds that use a well-designed harness can be an effective training method for improving explosiveness in the first 3-5 steps. It is likely counterproductive to have athletes pull weighted sleds for a distance any longer than 10 yards because they keep the athlete leaning forward as they accelerate to higher speeds. This is incorrect when you visualize the movement a sprinter makes: beginning from a crouched, fixed position and moving to a full running stride at which point the athlete's body is upright. In addition, the weighted sled offers no resistance during the swing phase (recovery) of each stride. Using the SprintCords® for training provides "more bang for the buck," in that you can provide effective resistance to the athlete during both stance and swing. Swing-phase resistance loads the hip flexors, abdominals, and upper body to improve the power output capacity of these key muscles. World-class sprinters like Derrick Atkins use SprintCords to optimize their start training.

### **PARACHUTES**

Parachutes apply a slight resistance (15-35 lbs of force) at the waist during sprinting. This resistance requires the athlete to produce more

propulsive force during sprinting. However, the parachute is only able to apply resistance once the athlete has sprinted 5-10 yards, which means that athlete doesn't meet any resistance for the initial jump start. Like weighted sleds, parachutes apply resistance which will usually cause the athlete to tilt their pelvis forward. This pelvic position is not safe or effective, as an athlete accelerates to higher speeds. The load the parachute provides kicks in at the wrong time.

### **TOWING DEVICES, RAMPS AND OTHER "OVER-SPEED" TRAINING METHODS**

There are a number of manufacturers of "bungee cords" that allow trainers to pull athletes along faster than they can run on their own. Almost all devices attach at the waist—creating a situation where the pelvis will rotate forward—causing it to move out of proper alignment. More importantly, the athletes must adopt a "braking strategy" (tendency to over-stride and plantar-flex the ankle) to deal with the extra speed/force. While the athlete is able to run at supra-maximal velocities, the benefit is lost in that proper sprinting mechanics are not being executed during the training. Gottschall and Kram (J. of Biomechanics, 2005) provided clear evidence that running at a slight downhill grade results in a relative increase in the braking force and a decrease in propulsive force—which is essentially what "braking strategy" means. Other "over-speed" methods such as sprinting on a treadmill with a means to unload the athlete (harness or a pneumatic system like Alter-G) in order to allow them to run faster than they can normally, also have the same effect—the athlete will tend to over-stride as to assist against gravity extends the time they spend in the air between footfalls.

Along the same lines, sprinting on the level on our treadmills at zero percent grade can change running mechanics enough to cause athletes to over-stride—particularly at speeds greater than 20 mph. Since there is no air resistance, the athletes are required to exert slightly less propulsive force than running the same speed over ground. This is why it is important to do speed work with the treadmill locked-out at inclines between 2.5 and 5%. A slight grade requires the athletes to produce more propulsive force than braking force and maintain mechanics that are more conducive to proper sprint mechanics—dorsi-flexed ankle, higher knee drive, etc.

The take home message is that when training high-velocity movements, it is essential that proper movement mechanics are maintained during "overload" situations. Also, effective training always includes an opportunity for the athlete to execute the skill again without the load (contrast training)—so their body learns to execute the skill properly at higher velocities.