Acceleration - Deceleration

Think of a sport – any sport. How often do you see an athlete sprinting at top speed for 40 yards? How about 400 yards?

The answer is…*almost never.* A high school basketball court is 28 yards long. To first base in baseball, 30 yards; softball, 20 yards; volleyball to the net, 10 yards. How often does a football player actually run most of the field? Only when occasionally something really good…or really bad is happening!

What you do see in sports' competition is the majority of athletes accelerating and decelerating over and over, and over again. Unfortunately, as that isn't what all training sessions for those sports look like. Let me share some interesting information about the ability to accelerate.

Training mythology has often boasted that the some of the fastest 10m to 30m sprints in history have been performed by Olympic weight lifters and throwers. How can they be as fast or faster than a world-class sprinter? The solution becomes apparent when we examine what makes great acceleration take place. Acceleration requires huge force production over a longer ground contact than at top speed. Because of this, maximal strength for bodyweight is important. The shot putter or lifter may have the edge here. We also know that, during acceleration, stride frequency and stride length are slower and shorter than at top speed. Because of this, the world-class sprinter cannot take advantage yet of their superiorly firing nervous system and subsequent greater turnover. Upper body strength is also critical to great acceleration. Improved arm strength and mechanics are more important to driving the athlete forward than at top speed. This could also give the thrower or lifter the edge. Now as the race goes on, acceleration becomes less and less as the athletes approach their top speed. At the 30m mark, most athletes should be at 95% or more of their top speed. Here's where the sprinter starts passing the shot putter.

The moral of the story? Athletes have to run the best 10 yards at the beginning of the race. They have to be fast at "getting going" – that's where the game is played. This is why I've defended the 40 yard dash (and the 10 yard portion especially) as a predictive test that tells me a lot about an athlete.

Because of tests like my cherished 40 (21 4.3's at the NFL combine over the last 9 years), however, many athletes only think of acceleration in terms of running straight ahead for a short distance. In reality, acceleration can take place in any direction. In actual play, athletes accelerate forward, backward, sideways, and diagonally. Many think acceleration occurs only from a static start. On the contrary, acceleration can also take place from a moving start at any number of speeds. For instance, a receiver in motion may have to accelerate quickly or decelerate quickly on the football field. Both of these are forms of acceleration, and both can be improved with proper training.

As I describe acceleration, I'll use the classic training situation of forward acceleration from a static start as a common way to describe muscles and biomechanics. Remember that this isn't always what happens on the sport's field and that we have to prepare our athletes accordingly.

There are a number of physical and technical characteristics that can lead to poor acceleration. The first and most important characteristic is relative body strength. How strong an athlete is for how much they weigh is directly proportional to how well they can accelerate. Since acceleration is an athlete overcoming their own inertia with the force they produce, the leaner (less body fat) and the stronger they are at that weight are predictors of how well they will accelerate.

To look at the situation generally, the major muscle difference between acceleration and top speed, is that the quads are used more in acceleration, and the hamstrings and hip flexors are utilized more during top speed. The most important areas to strengthen for acceleration are the gluteal and quadriceps muscles, the calves and muscles of the upper body, especially the anterior deltoid. Maximal strength is important here because ground contact times are much longer during acceleration than at top speed. Since there's a greater amount of time to produce force, the more absolutely strong a muscle coupled with great relative body strength, the better the acceleration. For acceleration training, more maximal weights can be used in exercises such as the squat, hip thrusts, lunge walks, chin ups, calf raises, incline bench and step ups.

We know that acceleration has a longer ground contact, smaller stride length, less stride frequency, different technique and teaching cues and relies differently on the muscles of the body when compared to top speed. Since there are different muscle actions during acceleration and top speed, it is logical that there will be different cues used when teaching technique. For instance, for force production at foot contact, acceleration should be taught as a "pushing" motion.

For good acceleration, keep the center of gravity low and forward while trying to push out as long strides as possible. It's difficult for any athlete to learn to "lean forward," genetically we're programmed to keep our bodies from leaning forward and falling. Driving arm action is also critical to proper acceleration. The athlete should draw in breath right before the acceleration and hold it for the first few steps. This will allow for a Valsavla maneuver and a subsequent better opportunity for the nervous system to produce force. This is all part of what makes it necessary to teach the skill of acceleration .

Acceleration training is an opportunity to make your athletes faster, but this information alone could also make them more prone to injury!

We have more training information available than ever. We have more trainers training athletes than ever. Kids are starting training younger than ever. We have better equipment and scientific tools than ever. We have fitness screens, performance tests, and better supplements than ever. Why then, if everything was working according to plan, do we have more injuries than ever?

Deceleration

Deceleration Training is like getting 8 hours of sleep and eating right. We all know it's important to the point of being potentially life threatening, but we still don't do it as often as we should.

Not sure exactly what Deceleration Training is?

Let's take a car, an athletically-challenged friend's sturdy, dull kind of car. We're going to remove the engine and replace it with a high performance engine built by the best racing engine designers in the business. The car is now going to look pretty much the same, but be phenomenally fast. Oh, with the addition of that monster Hemi engine, we're also removing the brakes. Get in, buckle your seat belt, and enjoy the power and speed – until we need those brakes and crash.

Our athletes are crashing. And the injuries that are happening at an all-time rate just might be our fault! We have more information at our disposal than ever. We train athletes to be faster. We train athletes to be stronger. We "train in" incredible acceleration, powerful speed, heightened jumps. As we put those metaphorical high performance racing engines into their bodies, the forces that can cause injury increase. So, we need to train them to decelerate, to stop, to land jumps; we need to install high performance braking systems because, unlike or natural tendencies to run and jump, we weren't programmed for stopping, cutting and landing. The unchecked increase in non-contact ACL injuries confirms the escalating accident rate. Practice and training have to mimic the actual demands of the sport on the athlete – the kids have to stop, they have to land in an actual game. While it seems counter-intuitive, improving stopping speed and technique not only prevents injuries, but improves speed on the field.

The human body is not designed for modern sports. Stopping, cutting quickly while moving, landing from heights – these abilities are not built into our biomechanical systems. So we either stop playing sports (and we're all out of jobs we like), or we start teaching our athletes how to control the tremendous forces that are teaching them to generate in these movements.

Studies show the techniques to slow down, stop and land, when taught and practiced are as high as **80%-90% effective** in reducing the chance of injuries. Across genders, injury prevention and increased performance are built on proper deceleration and landing techniques. The techniques of deceleration are designed to reduce force, obviously, if you reduce force, you put less strain on the body. Remember, tremendous force, subsequently strain, is present every time an athlete incorrectly decelerates or incorrectly lands from a jump. The scary part is that can be thousands of times a season.

Every sport movement uses all three of these muscle functions:

1. Concentric contractions to create acceleration (or force production).
2. Isometric contractions to create stability.
3. Eccentric contractions to create deceleration (or force reduction).

Training and practices tend to focus on concentric functions, but eccentric contractions set up the concentric. To increase athletic performance and decrease injuries, we need to make eccentric training part of every practice. Deceleration techniques improve neuromuscular control, augment the structural integrity of connective tissue, and reduce forces the body was not built to handle. We can work the eccentric contraction in the weight room and on the field. The key is to pay attention to another critically important, yet often abused training variable, tempo.

The coaching profession generally doesn't teach and practice deceleration or landing because we assume that athletes know how to slow down, know how to stop, know how to land a jump. They don't. In order to deal with the demands of modern sports on athletes' bodies, we incorporate three elements into our training regimes.

1. **Every drill has a start and a finish**. Just watching the start of a sprint is the equivalent of just watching the start of the game. A coach needs to watch technique at the end of sprints as closely as at the beginning. Watch the landing of a jump. Watch the lowering process of a lift. Be there and be on them to finish and lower just as well as they start and press.
2. **Teach force reduction, or deceleration, techniques and then continually correct technique**. It takes more effort to change a learned bad technique than it does to insist on proper technique to begin with. Unfortunately, by high school most athletes have acquired some really bad deceleration techniques; demonstrate correct technique and insist on its practice.
3. **Add tempo to your lifts**. Not many athletes care about how much they can lower or how well they can land from a vertical or box jump. Start to value this as a coach and your athletes will start to value it too. Their knees, ankles, hips and wrists will thank you for it.

Estimates are that there are 200,000 ACL injuries alone in the United States each year. Estimated cost for treatment exceeds a billion dollars annually. If good deceleration techniques can prevent a significant percentage of those injuries, how many of our athletes would be on the playing field, increasing their abilities and self-confidence, instead of in rehab?

We know that an athlete who can decelerate actually is faster and performs better on the playing field. Deceleration is a skill. It can be learned. For this learning to occur, it must be continually practiced. It's time to start paying as much attention to the brakes as we do the engine.

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