Evolution Running: Letting Off the Brakes

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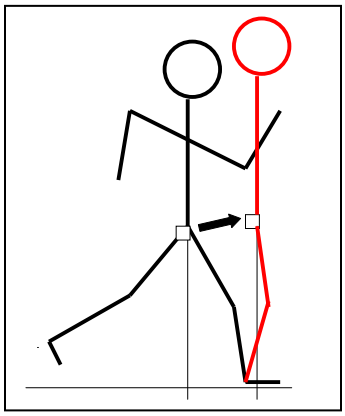
The easiest way to run faster is to stop slowing down so much on every stride. Most runners brake every time their foot hits the ground and then must push off powerfully just to accelerate back up to running speed. Obviously this is inefficient, but few runners realize the degree of their braking until they learn how to let the brakes off and let their momentum flow efficiently.

Correct Foot-strike Location

The most devastating error most runners make in their technique is reaching forward with the foot before foot-strike. Almost every runner swings the foot forward at the completion of leg recovery in an effort to extend stride length. This one simple error leads to enormous wasted energy and increased risk for injuries for a number of different reasons.

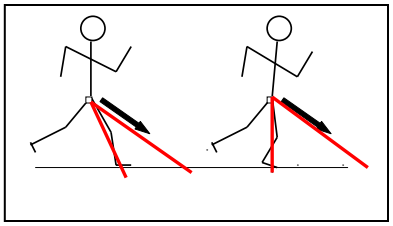


When the foot hits the ground out in front, the runner's leg is not in position to provide propulsion. He has no leverage to pull himself forward, but must wait until his body coasts up over the position of the foot. Only when his body is directly over his foot, can he push off. This wastes a tremendous amount of energy.

Notice in the diagram that the runner's center of mass, represented by the square, moves upward as it moves forward. The runner's mass does not move horizontally, but rotates on an upward arc around the position of the foot-strike. This upward movement of the center of mass causes wasted energy and muscular fatigue.

This foot-strike location also contributes to braking, the slowing of a runner's speed at the moment of foot-strike. From the time the foot first hits the ground to the moment of

push-off, the runner's center of mass rises without significant input from the muscles. Raising mass against gravity requires energy. The source of this energy is a runner's momentum. Unfortunately, the energy required to do this must be paid back. Using momentum to raise a runner's mass comes at a cost of slowed forward speed. Energy must then be used to accelerate back to running speed. This energy is wasted on acceleration instead of providing propulsion for fast steady-speed running.

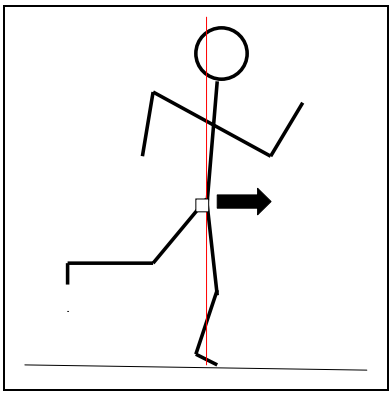


Efficient runners carry almost all the momentum from the previous stride forward into the next stride. The requirement for energy expenditure, then, is only to maintain running speed with almost no energy required for reacceleration every stride.

Reaching forward with the foot places the leg almost in line with the direction of the runner's mass, which maximizes impact stress. At the moment the foot hits the ground, a runner's mass is moving forward and down. As shown in the illustration, an out-front foot-strike minimizes the angle of deflection. With this small angle of displacement, the impact of landing provides the foot and leg with a relatively direct blow. Moving the foot-strike back underneath the hips provides a much greater angle of displacement, meaning that the impact of landing is a glancing blow, with less impact delivered to the foot and leg of the runner and more energy directed forward to maintaining momentum and running speed.

The single most critical aspect of running technique is the location of the foot-strike, where the runner puts his foot down. Placing the foot in the proper position relative to the body minimizes vertical displacement, enables effective use of elastic recoil, prevents braking at impact, optimizes body balance, increases turnover, and decreases the force required at push-off for fast running.

Many other critical aspects of correct technique build on this cornerstone. Placing the foot-strike in the proper location is necessary before many other parts of good technique can be accomplished. While this technique is not at all complicated, it may be more difficult to correct than you would imagine. Correct foot-strike placement is natural for very few adult runners. While this adjustment may seem rudimentary and easy to change, almost every runner automatically reaches forward with the foot in an attempt to artificially lengthen the stride. When learning to run with shoes that have a thick slab of rubber under the heel, this incorrect technique seems natural, automatic, and relaxed.

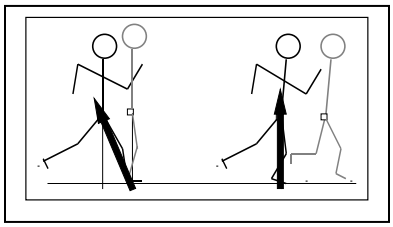


Correcting the placement of your foot-strike will change your body position, balance and the basic rhythm of your running. These changes are improvements that will eventually help you run further, faster, and more injury free than ever before, but they will not feel natural initially. Don't expect to alter your technique to run quickly and efficiently right away. You have

probably run thousands to millions of steps improperly and correct technique will feel unnatural and it will take time to adapt.

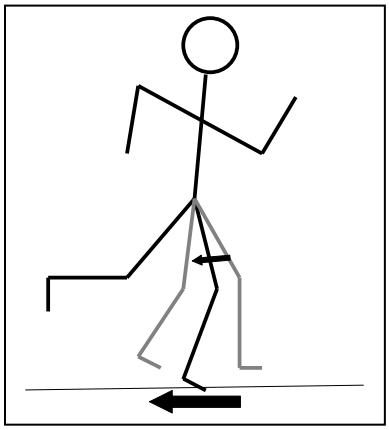
Efficient runners increase stride length by increasing the power of push-off, not by elongating range of motion. Watch a professional runner, even at four-minute pace, and notice how narrow the angle between the legs stays. Even at very high speeds, the foot never reaches forward and his legs do not open very wide. Efficient runners legs never open wider than about 100 degrees, even when running very fast.

Placing the foot down directly beneath the hips maintains momentum, minimizing any braking effect caused at foot-strike. The large black arrow in the illustration shows the direction of the initial force transmitted by the ground at foot-strike. Clearly the out-in-front foot-strike sets the runner up for significant braking forces, while the foot-strike under the hips allows momentum to be carried cleanly through to the next stride. Accelerating back to running speed after braking increases both the energy cost of sustained fast running and local muscular fatigue in both the quadriceps and the hamstring muscles.



The key to learning correct foot-strike placement is simply putting your foot down earlier during leg recovery. The knee will drive forward and then the foot will swing forward to catch up. Most runners allow the foot to swing forward past the knee. Instead, just as the foot catches up with the knee, pull back with the entire leg and put your foot down much earlier than you think you need to. In my research on efficient running technique, I have seen thousands of runners swing the foot too far forward before foot-strike. I have never seen a single runner put the foot down too early on a single stride.

Movement of Foot at Impact



Most runners' feet are motionless, relative to the body, when they strike the ground. The average runner holds his foot out in front of his body during the flight phase, waiting for gravity to pull him down into the ground. Very few runners even think about this aspect of running technique, but this is one critical error which prevents efficient, injury-free running and dramatically increases braking.

When the foot is held out motionless relative to the body until foot-strike, it is actually moving forward relative to the ground at running speed. Runners create force for propulsion against the ground, using the foot, in a backward direction. A runner using this technique and running eight miles per hour asks his foot, which is moving forward at eight miles per hour relative to the ground to make an instantaneous sixteen miles per hour change of direction - to accelerate from eight miles per hour in one direction to eight miles per hour in the opposite direction – all of this immediately and while the runner's weight is on the foot. Of course, that can't happen. This style of running causes excessive braking as the leg muscles contract to change the direction of force the foot applies to the ground. This slows the runner's momentum and requires reaccelerating every step.

When an efficient runner's foot strikes the ground, it is already moving backward relative to the runner's body, by a magnitude at least equal to running speed. In order to have the foot drop straight down to the ground, a runner moving 8 mph must have the foot moving backward at 8 mph relative to his body at foot-strike.

Efficient runners swing their legs only slightly in front of the hips and then forcefully pull the leg backward into the ground before the weight comes down on the foot. This prevents braking, conserves a runner's momentum, and eliminates the need to reaccelerate every stride.

The most effective way I have found to learn to land with the foot underneath the hips begins with running in place and then very, very gradually accelerates to walking speed and then to running speed. Moving at extremely slow speeds, a runner has no momentum to waste, so he has to keep his feet underneath him. Over a period of several minutes, gradually speed up. I often have athletes, even very fast ones, begin running on a treadmill at 1 mph (60 min/mile), increasing speed by 1 mph each minute. This may seem silly, but it is very effective.

Another way to work on this aspect of technique takes advantage of the plastic shield on a treadmill. Most treadmills have a plastic shield covering the motor at the front of the treadmill and a bar about hip height just slightly behind the shield. Running with the hips almost touching the bar uses the position of the plastic shield to prevent the out-in-front foot-strike placement.

Learning to pull the foot backward before foot-strike presents a different challenge. This is difficult to learn at slow speeds, so practice this aspect of technique at moderately fast speeds at first. The key is tuning in to the degree of braking so that you can feel the difference when you get it right and when you don't. Then the ground becomes your teacher and will automatically focus your concentration when required.

Video analysis is an amazing tool for improving running technique. Few runners have ever thought about the techniques they use, and many are surprised when they first see how they actually run.

Improving this aspect of your running technique will improve your speed and efficiency. It also reduces impact stress, minimizing the risk of injury and post-workout soreness. The next time you head out on a run, work on letting off the brakes and see how you can run faster without expending more energy.

Ken Mierke is head coach of Fitness Concepts (www.Fitness-Concepts.com), developer of Evolution Running (www.EvolutionRunning.com), and author of the Triathletes' Guide to Run Training and has produced a DVD called Evolution Running: Run Faster with Fewer Injuries. Ken is a two-time world champion triathlete and has coached 6 world champions. Evolution Running clinics are held regularly in Fairfav, Virginia, Annapolis, Maryland, and across the country.