

Why do runners get stress fractures?

According to a 1996 review in Sports Medicine, stress fractures “result from repetitive, cyclic loading of bone which overwhelms the reparative ability of the skeletal system.” Stress fractures can occur from either increasing the load on the bone (e.g. adding speedwork, switching from trail running to sidewalks, or wearing less supportive shoes), or from increasing the number of times the bone is stressed (i.e. increasing your mileage). Running causes more stress fractures than any other sport because we tend to run on hard surfaces and land with forces of 4 to 6 times bodyweight.

The impact forces of running make our bones stronger, however, our bones can only adapt at a gradual rate. That is why you may get a stress fracture from increasing your mileage too quickly from 20 to 40 miles per week, but a few years later may handle 60 miles per week with no problems

Retuning to running after stress fracture or other major injury

In another Lab Report, we looked at how to stay fit and sane when a stress fracture or other serious injury prevents you from running. Over the past few months, several readers have asked about the next step. How should you start back when your doctor (finally) gives you the green light to begin running after a major injury?

The answer to that question depends on the site and severity of the injury, how long you were off running, and your overall health status. On average, it takes 90 days for a stress fracture to heal completely. So, while you may be able to resume running 6 to 8 weeks after the initial diagnosis, it is critical to start back slowly and increase your mileage gradually to allow the final healing to take place. Let's investigate how to get back into training after an injury.

Reducing Shock to Prevent Running Injuries

To control injuries, you need to understand their root causes. The root cause is usually predictable - the system is pushed too hard and the weakest link gives out. Running injuries can usually be prevented, therefore, by increasing the ability of your tissues to tolerate a force repeatedly, or by decreasing the cumulative amount of impact shock your tissues must withstand. In the last Pfitzinger Lab Report, we looked at how to prevent injuries by correcting muscle imbalances. This month we look at the other side of the injury equation- minimizing the amount of shock your body must absorb.

You can reduce the cumulative amount of shock imposed on your body in several ways. One solution, of course, is simply to stop running, and this advice is frequently doled out to injured runners. Fortunately, there are other less drastic solutions, such as adjusting your running surface and terrain, shoes, and mileage. In a 1993 review in Sports Medicine, Dr. Michael Gross of Orthopaedic and Sports Medicine Associates of Emerson, New Jersey explained, "Most overuse syndromes will respond to rest, training modification, and a change in the running surface or shoe."

Running surface and terrain

The total force absorbed by your body during running can be calculated as the amount of force per step times the number of steps you take. Adjusting either of these factors will reduce your risk of injury. Let's look at the amount of force per step first. The surface that you run on can make a substantial difference in the amount of pounding absorbed by your body. This difference may determine whether or not you cross your threshold for injury.

Concrete is the least forgiving surface for running. Unfortunately, many runners are forced to do a portion of their mileage on concrete, particularly the lunchtime running crowd. Shin splints and stress fractures incurred on concrete may be prevented by running on a softer surface. Blacktop or asphalt, while slightly softer than concrete, is far from an ideal running surface. Our bodies did not evolve while

running on a uniform hard surface. Your joints, muscles, tendons, ligaments and bones are not designed to withstand hundreds of miles of running on roads. Search for natural surfaces-dirt paths, grass fields, golf courses, trails-anywhere that will allow you to run with less shock and less chance of injury. The higher the percentage of your training that you do off-road, the lower your likelihood of developing overuse injuries.

A 1997 study by Dr. Carmelo Bosco and colleagues at the University of Rome, published in *Ergonomics* investigated the effect of the hardness of the surface on the efficiency of jumping. The investigators concluded that "soft surfaces may favor a very low rate of running injuries."

If you feel as though you are on the verge of an injury, avoid downhill running. The impact forces of downhill running are significantly greater than for level running, so by avoiding downhills you may prevent an injury from occurring.

Are your shoes dead?

Keeping your shoes in good condition can make a big difference in the amount of shock that your body absorbs. As of this writing, the cushioning properties of all running shoes on the market break down substantially after less than 800 miles of running. For those training 20 miles per week, this represents 40 weeks of use. For the 100 mile a week crowd, 800 miles are reached in only 8 weeks. Depending on your size, running mechanics, and what model shoe you wear, you may need to replace your running shoes after as little as 400 miles.

It is also a good idea to use different pairs of running shoes on different days. The forces your body must deal with are altered somewhat by different pairs of shoes. By switching shoes, you make the shock that your feet, legs and back receive somewhat less repetitive. This reduction in the repetitiveness of the forces may thwart the development of an injury. And, although you have to buy an extra pair of shoes now, each pair will last longer. In addition, research has shown that it takes time for the resiliency of your shoes to completely return after running. For this reason, if you train twice a day (committed), rotating shoes is even more important for injury prevention.

Replacement Mileage

The total amount of shock your body must deal with is also determined by how far you run. A 1992 study published in *Sports Medicine* observed that although running experience was associated with a decreased injury rate, that weekly mileage was the strongest predictor of a future running injury. The challenge is to maintain an outstanding fitness level by replacing some of your running mileage. Replacement mileage doesn't mean cutting back on training. After all, this is the magazine for the serious runner. Those miles just get replaced with other forms of aerobic training. Cross-training allows you to maintain your cardiovascular fitness without adding to the number of times that your feet strike the ground. Cross-training is a particularly good option for recovery training. You improve the recovery process by pumping blood to the muscles, and do not add to the cumulative pounding on tissues.

Cycling, rowing, swimming, running in water, in-line skating, cross country skiing, stair climbing, slideboarding, elliptical training, arm cranking, and other options are available for working out without the impact of running. Unfortunately, there is no foolproof way to equate cross-training to running mileage. Running is running, cycling is cycling, etc. Because your muscles adapt specifically to the type of training you do, the closest substitute to running is running in water with a flotation vest. Because there is no contact with the ground, however, even water running does not replicate the muscular demands of running on land.

Finally, if you feel an injury coming on, take a day or two off now to allow your muscles and connective tissue to recover, and resiliency to improve. In this way, you will miss a couple of days now and then rather than several weeks with a serious injury. Many injuries can be prevented. By developing a strategy to prevent injuries, you can take more control over your running.

Running and its Impact!

Running is a weight bearing exercise that is effective for maintaining our bone mass. The stress placed on our bones every time we land generates a force that is 5-6 times our body weight. Running of course is a moderate to intense aerobic exercise, which can increase and maintain our cardio respiratory fitness. As running enthusiasts call "the runner's high", our brain releases feel good (opiate like chemicals) neurotransmitters which is why so many of us become almost addicted to it. So, what are the disadvantages?

Unfortunately, running places great stress on our joints and soft tissues such as muscles and tendons. This stress is greater if our posture and running form is incorrect. Running is also more stressful to our joints if we do not weight- train and strengthen the muscles which support our joints and absorb the impact. Running like most things, requires some thought and planning. Also, the very feel good neurotransmitters that give us the high mood, also block pain signals temporarily, which is why we might continue running through an injury when we shouldn't!

So, here are a few tips whether you are a runner, or would like to try running:

- **Cross-Train:** Let's add some cross training to our routine such as cycling, swimming, and fast walking. Many of our injuries are a result of repetitive stress. Let's give our body a rest from impact, and train our muscles to work in different ways. Training for a race? Try race-walking. A study done on Olympic athletes showed race-walking (6 mph) to be an effective training method that enhanced running ability. And let's not forget about strengthening exercises for our upper and lower body!
- **Start slowly:** This tip includes beginners and current runners when changing any variable, such as surface, shoes, geography (uphill vs. flat). Why? One client who had been used to running on a flat surface, ran 5 miles mostly uphill and created a chronic tendonitis in her shins!
- **Vary our routine:** Let's challenge ourselves by doing interval training (changing speed for instance). Our bodies adapt to the same training methods so if we want to increase fitness, let's add some variety to our routine. This can also be good for someone like myself who cannot run for more than a few minutes since I had knee surgery years ago. Now during my fast walk, once per week I add in a few fast 20 second sprints, and I've increased my fitness level, and renewed my interest with a new challenge. I also have added a little more impact on my bones!
- **Let's wear the right shoes:** This is important for all our activities. An example: fast walking is more difficult in running shoes, walking shoes do not have enough support for the impact of running and running shoes do not offer enough lateral support for weight training. Some of us need more support due to body biomechanics, so let's buy shoes for function, not style.
- **Let's heed the signals.** Let's heed the signals of our body. Are we tired, in pain or coming down with a cold? Let's remember that rest is part of a training program!

So, let's make our running and exercise program as safe as possible and keep it enjoyable. Let's seek the advice of a doctor before starting anything new or if in pain.

Posture Perfect

You run how you run...It works for you... You've always run this way...You're an old dog, and it's too late to change your running style...You do just fine, thank you

I've heard all of these justifications before, and they do make a certain amount of sense. But what if I told you there was one adjustment you could make to your running form that would really make a difference? Perhaps then you'd be ready to listen.

The adjustment: straightening your posture. In my opinion, a strong, upright carriage is one of the most important aspects of running. Maybe *the* most important, because so many things follow from it. Whether you're running 50 meters or 50 miles, here's what upright running will do for you.

You'll move as one. When your body is upright à la Michael Johnson, you'll move forward as one unit, with all your muscles working in synch. Your muscles won't be wasting energy maintaining balance, correcting for forward lean and so on.

You'll run more easily. Upright posture helps keep the whole body in proper alignment. That's right, it's the ol' "the hipbone's connected to the thighbone, the thighbone's connected to the knee bone" routine. When you're in proper alignment, you'll generate maximum power, which reduces the effort required to run at any pace.

You'll increase speed more easily. An upright body allows your legs to extend maximally with no extra effort. With this kind of extension, you'll be able to "shift gears" more easily because you're already in the proper biomechanical position to do so.

You'll get injured less. When you reduce inefficient leanings and extraneous motions, your muscles and tendons will spend less time correcting these problems. Therefore, they'll be less likely to succumb to overuse injury.

You'll breathe easier. When you're upright, you'll get maximum breathing capacity from your lungs. A forward lean makes it tougher for you to fill your lungs and use your diaphragm properly. Stronger, deeper breathing allows you to get more oxygen in and out of the lungs.

You'll cut down on side stitches. By encouraging better breathing, good posture makes it less likely that you'll develop stitches.

Have I got you convinced that upright posture is important? Good. Before I tell you some ways to improve posture, you might want to get a better idea of how you're doing in this department. Have a friend or family member videotape your running from the side. If you don't have access to a video recorder, have someone stand and watch you closely as you run. Are you leaning too far forward? Too far backward? Are your shoulders hunched? Is your head slung forward? Once you have something to work with (and on), it's time to start perfecting your posture.

Be a puppet

When I occasionally have trouble straightening up on a run (such as when I'm tired), I envision myself being suspended by a string attached to the top of my head. As I hang there, gravity efficiently aligns my head (which should be facing forward, not down), torso and pelvis. I complete the vision by imagining my feet lightly touching down as the legs go through their smooth running circuit.

Try this "puppet" visualization the next time you're out on a relaxed run. It will help you stay upright and light on your feet, both of which will allow you to conserve energy and run more efficiently.

Another visualization technique you might try, courtesy of the great New Zealand coach Arthur Lydiard: Imagine that you have a pulley attached to the center of your breastbone. The other end of the pulley is attached by a rope to the top of a low building one block away. As you run, imagine that the rope is pulling you toward the top of the building. This will help lift your chest. Remember, don't lean forward. You want your whole chest leading the way

Get stronger

Strengthening your postural muscles will help you run upright from the beginning of your run. Plus, once you're stronger, it becomes less likely that you'll slip out of position when fatigue sets in. A quick aside: If you think bad posture is a serious problem for you, talk to your doctor about it. He or she can refer you to a physical therapist or strength trainer who will help you get back into shape with a specific plan tailored to your needs.

Most of us probably just need a little tinkering. When I realized I needed help in this area about 10 years ago, I did some research and eventually came up with a program of eight to 10 strength exercises. As I combined or eliminated certain ones over the years in my search for efficiency, I worked my program down to two basic exercises. Call it Jeff Galloway's Posture Program, and you don't have to go to a gym to do it.

Bent-knee crunches. To do these, lie on your back with knees bent at about a 90-degree angle. (Doing crunches with legs straight puts too much stress on the lower back.) With each crunch, lift your shoulder blades off the floor without "dropping" your head forward. (Bringing your head forward puts too much strain on the neck and shoulders.) Go up till your shoulder blades are just a couple of inches off the floor. Come down slowly each time, but not all the way down. Keeping your stomach tight throughout the exercise will really work those abdominal muscles. Try to do crunches every other day, working up to 40 or so per session.

Arm running. To balance abdominal strength, you need to build up your back and sides, too. A great way to do this is by "arm running" with hand-held weights. (If you don't have dumbbells for this, you can always use water-filled plastic jugs or anything else of appropriate weight that can be grasped.) To do the exercise, stand erect, hold onto the weights and begin moving your arms as you do during running, while keeping your feet firmly planted. You might want to glance at a mirror while you do this, so you'll be sure to stay in the proper posture. As with running, keep your elbows bent at roughly 90 degrees as you pump your arms. Continue until fatigue sets in. Try to do this exercise every other day.

You'll find that you don't need to do all that much work to improve postural muscle strength. And once you get these muscles in shape, it takes very little maintenance to keep them that way. After a few weeks of diligent visualization and strengthening, you'll be more efficient, and your running will feel easier.

Straighten Up and Fly Right

Having videotaped hundreds of runners over the years, I've seen that those who lean too far forward (this is very common, by the way) normally cut about an inch from each stride. In essence, they do this in order to maintain balance. An inch per stride might not sound like much, but it works out to almost 1,000 feet in a 10-K, and about 4,000 feet over the course of a marathon. In other words, your upright self would out marathon your hunched-over self by more than 3/4 of a mile. At 10-minute mile pace, this means the upright you would finish the marathon more than 7 minutes faster-with no extra effort.