Starting Strength

Why Getting Sore Doesn't Mean You're Getting Stronger

by

Mark Rippetoe

Training with weights produces muscle soreness. Many people don't like to be sore, and that's why they won't train for strength. Running also makes you sore, but not as bad and not all over the body, like weights, so running is more popular. Other people have noticed that riding a bike doesn't produce sore muscles, so they ride a bike for exercise instead of lifting weights or running. But to some people – and this may come as a surprise to most of you – getting sore becomes the whole point of exercise. They wear their soreness like a badge of honor, and regard sore muscles as the price they must pay for continued self-improvement.

Here are some facts.

Delayed-Onset Muscle Soreness (DOMS) is a phenomenon associated with certain types of muscular work. It can occur as the result of exercise or manual labor, and is a perfectly natural consequence of unaccustomed physical exertion. There are a couple of different theories about its actual cause at the cellular level, which are beyond the scope of this article. Suffice it to say that DOMS has nothing to do with lactic acid production during exercise, and that it is an inflammatory response to certain types of muscular work which therefore responds to NSAIDs like naproxen, ibuprofen, and aspirin.

Muscles are the contractile motors that operate the system of levers we call the skeleton. Muscles work by generating "tension," or pulling force between their attachment points on the bones they operate; they pull on these two points of attachment with varying degrees of force. They generate this pull under three modes of operation:

1. Concentric muscle contraction occurs when the muscle generates tension as it gets shorter. This action is familiar when you see a dumbbell being curled in the hand; as the elbow bends and the weight approaches the shoulder, the biceps muscle gets shorter. When you stand up from sitting in a chair, the muscles that operate your knees and hips got shorter, and worked concentrically.

2. Eccentric muscle contraction occurs when your muscles generate tension as they lengthen. When you lower the dumbbell or sit back down in the chair, the same muscles controlled the descent eccentrically

by generating tension as they get longer, thus letting your elbow straighten or your knees and hips re-bend under control. Bodybuilders call this the "negative" part of an exercise.

3. Isometric muscle contraction occurs when you control your position by keeping the muscle the same length. As the knees and hips lower you into the chair, your back muscles function isometrically by holding the bones of your spine in a constant position during the movement. Even though the angle of your back with respect to the floor may change, the vertebral segments that make up your spine are held motionless in correct alignment by your back and abdominal muscles during the motion.

Adaptation to muscular work is the basis of exercise, and each type of muscular contraction must be adapted to when it is experienced. Important exercises like the squat have both eccentric, concentric, and isometric phases. Some exercises, like riding a bicycle, only work the legs and hips concentrically; the muscles that shorten to straighten the left knee and hip do not tense and then resist the muscles that straighten the right knee and hip as you pedal the bike, because that would be a stupid way to pedal a bike. Each alternating knee/hip extension is concentric-only work.

As it turns out, eccentric muscular work is the source of muscular soreness. Concentric contractions don't make you sore, and only poorly controlled isometric contractions (where some lengthening has in fact occurred) produce soreness. This is due to the things that happen to the contractile components of the muscle cells at the cellular level, again outside the scope of this essay.

This means that exercises with a significant eccentric component produce soreness, and that by emphasizing the "negative" part of a rep you can get really, really sore. Bench presses can be done this way: when the lifter has finished the last possible rep of a heavy set, the spotter helps pull the bar back up after the lifter lowers it to his chest under as much control as possible. Only a couple of reps are possible this way before the lifter tires so much that he cannot help the spotter get the bar back to the top, and would not be able to control the descent of another rep. The net result is a tired spotter and very sore pecs for the lifter.

It also means that exercises without a significant eccentric component, like riding a bike or pushing a weighted sled, don't make you sore. Cyclists very seldom experience sore quads even as their legs get stronger from the work of riding up hills. But this same cyclist with strong legs will experience horrible debilitating soreness if you have him squat, because he is not adapted to the eccentric component of the work. He hasn't lowered any weight as he climbed his hills, so the squat will murder him the first time he does it.

Soreness is produced by any exercise with an eccentric component, and the muscles that work eccentrically will get sore in a predictable way until they adapt to the work. All types of squats use the quads eccentrically, and sore quads are par for the course until you adapt to the eccentric work. If you squat three days per week, you'll stop getting really *really* sore, even as the weight on the bar continues to increase, because adaptation to the eccentric component is taking place. An experienced lifter working through a program of increasing weight will not experience acute soreness unless some aspect of the squat program changes, i.e. he goes from sets of five reps to sets of 10, thus increasing the eccentric volume.

It doesn't matter how heavy or light the weight is – if there is enough eccentric volume in the workout to which you are not adapted, you will get sore. This is why 100 bodyweight-only squats ("air" squats) will make you exquisitely sore, and if you do them infrequently enough that you do not adapt to the work, they will make you exquisitely sore *every time* you do them. In fact, since they weigh essentially nothing, they're not heavy enough to make you stronger, but the 100 negatives will make you sore enough that you can't walk correctly for several days. Done twice a week, you'll stop getting sore, thank God, but you will not get any stronger because you're not lifting progressively heavier weight.

Here's the problem: the soreness doesn't make you stronger. Soreness just makes you hurt. Lifting heavier weights makes you stronger, because that is what stronger means: the ability to produce more force. Soreness is merely a side effect of the process of using exercises that have an eccentric component. And if those exercises do not involve progressively increasing force production – lifting increasingly heavier weights – then they cannot make you stronger, even if they make you so sore you can't walk.

Many people who have become involved in the recent extreme fitness movement's popularity have grown accustomed to being sore all the time. The workouts are often done in a random fashion, which prevents the adaptation that is necessary to prevent the soreness. But the workouts are perceived as "fun" and productive, because they are done in a group of (usually) friends, and since the workouts make you sore, the soreness comes to be perceived as a positive thing, too – proof of your commitment, your courage, your membership in The Community, and your willingness to do what it takes to get the job done. Soreness therefore becomes the point itself, the Good at the end of the effort.

It's not. Not at all. Soreness is muscular inflammation, and inflammation has effects beyond just the inflamed tissue itself. Like having the flu, DOMS across a large muscle mass is systemic inflammation. Like rheumatoid arthritis, it is a maladaptive stress on all the regulatory mechanisms of the body. It can cause cardiac symptoms, sleep apnea, hypertension, vascular disease, respiratory inflammation and bronchitis, and all kinds of unpleasantness.

Occasional soreness is a normal part of training, but chronic systemic inflammation for weeks, months, or years on end is a very bad thing for your health, essentially the same thing as a disease. Our physiology is not designed to function under these circumstances, and it cannot adapt to chronic soreness any more than it can adapt to starvation. You may get away with it for a while, especially if you're younger, but it takes a toll.

If you have been operating under the assumption that soreness means progress, re-evaluate your assumptions. Improved performance means progress, and while soreness is an occasional necessary evil, it should never be the objective.

A version of this article appeared on PJ Media June 19, 2014