

Even My Eyebrows Hurt!

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Just about everyone who strives to be the best they can develops sore muscles at some time, so it is amazing that this condition is still mostly a mystery. Consider this: we don't really understand the main source of pain, we don't understand why it takes so long to show up, most of the treatments suggested don't work consistently, and there is no absolutely reliable way to prevent the problem except taking it easy.

If we overdo any kind of physical effort...working out longer than usual or harder than usual...about 12 to 48 hours later we stand a good chance of developing very stiff, sore muscles. In the medical field everything needs a name and category; in the sports medicine community, then, this is called DELAYED ONSET OF MUSCLE SORENESS, or DOMS for short. Those of us who taper for the big meets, swimming or running faster than usual, can attest to the fact that everything hurts...even the eyebrows! This can bring on disconcerting feelings of "I'm in trouble; I don't feel good even in the taper. How can I ever do well at the meet?!" Fortunately for most athletes most times, if they hit their taper appropriately, this discomforting feeling morphs into a solid perception of strength and power by the time they have to present their best. But not always...this sensation of DOMS seems to be the price we pay for having our muscles help us move quickly and forcefully. Keep in mind that pain is still a signal that something is wrong, so let's see what we can do to minimize the problem.

MUSCLE DAMAGE

Hard exercise causes muscle damage; that is nature's way. In fact, this is the principle we have to follow to increase muscle size, strength, and power. "Muscle damage must precede size increases. The repair process leads to increased muscle size," says William Evans, PhD, at Penn State University. If we looked under a microscope at our sore muscles after a hard or fast workout, we would see ruptured individual muscle cells and breakdown of the membranes between them. There are some components of cells that are too large to escape from normal intact cells; but when the cells are "beaten up" and have broken membranes, the large molecules escape into the bloodstream. This brings about a useful physiologic tool for researchers with which to analyze muscle damage. Blood samples are much easier to perform than muscle biopsies and much less painful for the recipient of the procedure. An enzyme called CREATININE KINASE (CK) is an example which is

often used as an index of muscle damage. Another enzyme called LACTATE DEHYDROGENASE (LD) is a prime example of a molecule that comes from the breakdown of the lipid cell membranes around muscle cells themselves, and it also leaves its “footprints” in the blood.

Muscle cell damage not only leaves us stiff and sore, we also lose some muscle strength; we usually are not able to move as well as normal, and we may even have swelling in the musculature due to broken blood vessels leaking fluid into the surrounding area. Another factor to consider is the kind of exercise we perform affects how we feel. Sometimes our muscles elongate and return to their original size; this is called ECCENTRIC movement. Other times the muscles contract and return to their original size; this is called CONCENTRIC movement. Since muscle fiber tissue is made to contract to produce force, this last type of movement is natural and is not as likely to produce tissue damage and pain as the elongation after the contraction. Though elongation is necessary to bring the contracted muscle back to neutral or normal position, if it is forced into this position repeatedly, that is what usually brings about the discomfort; the eccentric movement is much more the cause of DOMS. When we curl our upper arms, for example, to contract the biceps muscle, that is concentric movement; when we relax and let the arm straighten out, that is eccentric movement.

High-intensity speed workouts can also affect how we feel. Muscles become sore after faster movement, even if the force and work levels were higher at slower speeds according to studies from East Carolina University and the University of Wyoming. It has been stated that protein loss is a factor in sore muscles, but this is really not the case. It is true that exercise increases protein turnover because some is broken down and then replaced during repair...a natural process. But the amount is much less than most would believe.

Most Americans get around 15% of their total calories from protein which, for the average non-athlete, is more than they need for muscle repair. Athletes or people who enjoy a vigorous lifestyle, on the other hand, need that daily 15% caloric intake from a good protein source. In fact quality, muscle-friendly protein (whey, casein, and soy) is the smart choice for those who rely on their musculature to be nourished and repaired to carry them through intense prolonged training and/or competition.

PREVENTING DOMS IS TOUGH

Researchers have diligently tried to prevent muscle soreness, but their ideas usually haven't worked. For example, when we push a workout, our bodies respond naturally by breathing faster and more deeply because more oxygen is needed to help burn muscle fuel faster and to blow off (rid the body of) the concomitant build up of carbon dioxide (CO₂). Some of the extra oxygen causes an increase in the number of reactions that produce free radicals which can damage cells and genetic material. Several studies have shown that we can reduce this kind of damage with antioxidant vitamins and minerals, yet they don't reduce muscle soreness. Vitamins C and E and beta-carotene made no difference to the aftereffects of intense training of rowers at the University of California, Berkeley. They suffered the same amount of DOMS whether they took the antioxidants or not.

Physiologic studies have shown a similarity between sore muscles and inflammation which causes its own characteristic cascade of events to occur: pain, redness, heat, stiffness, and swelling. It would be a logical extension of thought to use anti-inflammatory medication in this situation to prevent or at least lessen muscle damage. The results have been inconsistent. Some times they seem to help, but often they do not. Topical products that contain counter-irritants, such as menthol, seem to stimulate blood flow which can present as soothing. Other topicals contain anti-inflammatories such as trolamine salicylate, a relative of aspirin. Both kinds of products may help a little by making you temporarily "feel" better, but there is no hard physiologic evidence that they promote muscle healing. Cold applications also provide no healing though they do have a place with immediate trauma by delaying swelling and slowing the attendant damaging cascade of events that usually follows moderate to severe injury. Also, cold can bring about muscle spasm and contraction which is counterproductive for recovery.

On the other hand, adding warmth such as with a heating pad (moist heat being better than dry heat due to better tissue penetration) does provide for muscle-relaxation and increased blood flow, allowing for accelerated muscle repair in many instances.

MINIMIZING DOMS

Good training habits help. First, start with a slow warm-up. Cold muscles suddenly put to work are more likely to become damaged than warmed-up muscles. In addition, the fast-twitch fibers (what I call the "Hustle Muscle") are more easily pulled (torn) than the slow-twitch fibers. Warm-ups help us

to relax and put us in the right frame of mind to tackle a challenging workout or competition.

Warm-ups gradually increase our heart and breathing rates and increase the flow of oxygen and nutrients to our muscles before we begin to work them hard. They also allow for a gradual increase in the speed and strength of muscle contractions and a decrease in joint stiffness. At least 15 minutes should be allotted to each workout session for this most important of “rituals.” But keep in mind that on some days more time may be needed to loosen up the body. Taking the time to prepare for intense muscular contraction is extremely important especially as the athlete gets older and develops more muscle. Short change this part of the exercise bout, and the athlete will usually pay the price later on with discomfort he or she didn’t bargain for.

Wise athletes also take the time to cool down after workouts or races. Though absolutely not recommended for sound training principles, suddenly stopping from intense activity does allow the body to slow down the heart rate and breathing but the muscles will still retain by-products of strong physical activity such as lactate (which is the salt of dissociated lactic acid that is produced when not enough oxygen is available to keep up with muscle contraction over time). If not properly warmed down, the muscles will most likely begin to feel tight and lose some range of motion (ROM) within a few hours. For the older, or masters, athlete, this is just asking for physiologic trouble since blood pressure and cardiac stress need to be lessened in a logically-decreasing amount. Any athlete of any age not warming down is a mistake because the muscles need bathing by the blood to draw away the resultants of intense muscular contraction. Exercising at low intensity does two things: (1) it keeps the heart pumping at slightly higher than resting levels which keeps the supply of nutrients coming to help clean out the muscles, and (2) it causes the muscles to contract moderately to help squeeze out the by-products of intense contraction.

Since the main causes of DOMS are sudden increases in intensity or duration of muscular work, building a good training program dictates that any increase in the above parameters are kept to no more than 10% each week. It is also highly recommended to NOT increase both intensity and duration during the same week. These guidelines will allow the body to recover properly and adapt slowly to improved performance levels. I cannot over-emphasize the importance of adequate recovery from one workout to

the next. Following hard workouts with easier ones is one way in implement this. Hydrating adequately and eating a moderately high complex carbohydrate low fat diet so the muscles will have enough fluid to bathe the fibers and lessen the attendant friction between them and have plenty of quality fuel to burn is the correct way to eat to compete. In fact, there are now products that are specifically designed to help in this reparative process; they have a 4:1 ratio of quality carbohydrate to muscle-friendly protein which not only fuels the muscles but lessens their damage.

HANDLING SORE MUSCLES

If you follow the ground rules but end up sore anyway, what then? Conventional injury treatments don't seem to work well for DOMS, and there is now some evidence that, though the anti-inflammatories (Motrin, Advil, Aleve, etc) do keep inflammation under control and often act in consort to help the body deal with injury, they may actually retard healing due to their prostaglandin inhibition (prostaglandins allow the body to trigger natural responses to infection and injury). Relief provided by these medicines seems to come mainly from their analgesic (pain-relieving) properties.

Active sports massage has become an important accepted protocol for helping intense athletes recover between workouts or races. Whether it is the soothing psychological benefit of "hands-on" sore tissue or the potential of actual reparative processes, massage in the hands of qualified practioners seems to provide at least perceived moderate benefit.

Even though massage hasn't proven to be absolutely cause-and-effect for the healing process or the lessening of DOMS, a series of tests have shown that when athletes worked out hard and followed up two hours later with 30 minutes of massage, their blood CK levels were lower (less damaged cell membranes); also, a type of white blood cell called a neutrophil, which helps fight inflammation, increased in number, and the athletes reported lower levels of perceived DOMS compared to a placebo treatment with "medication." Best results are usually seen in the hands of certified massage therapists, but self-massage and the use of hand-held massagers provide some benefit.

Small amounts of moderate exercise (active recovery) are much better than inactivity (passive recovery). The idea is to give the body a prod to stimulate natural healing processes, but not enough to cause more damage. Usually,

one recovers in a few days from intense activity and is the better for it. Hard races need more caution, but in a multi-day championship, recovery must be timed to allow for repeat competitions. A prescribed warm-down after each intense effort would be the first procedure of benefit, followed by massage at the end of the day's events.

Ask anyone who has weathered the multi-event battles at a national competition...they are usually so beat-up at the end that EVEN THEIR EYEBROWS HURT!