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Muscle Strains

by Thomas Kurz

Muscle strains are the most severe form of muscle damage. As the articles on muscle fatigue and muscle soreness (see *Stadion News* Summer 2001 and Fall 2001) explained, all physical exercise damages muscles to some degree. Depending on the severity of this damage, you may not feel anything particular at all, or you may feel fatigue, or soreness, or ultimately a tear or a pop of the strained muscle.

Muscle strains occur when the mechanical and chemical damage exceeds the muscle's pace of rebuilding or when a muscle is too weak for the forces acting on it. The muscle can be too weak for these forces because an athlete simply makes a foolish attempt at a task beyond his or her strength, because of poor conditioning, because the muscle is put in a mechanically disadvantaged position, or because of a previous injury.

A previous injury is a reliable predictor of further injuries (Best and Garrett Jr 1996; Macera 1992; Neely 1998). For example, Ekstrand and Gillquist (1983) found that minor injuries doubled the risk of having a more severe injury within two months.

Sometimes, after an injury on one side of the body, a similar injury occurs on the other side. Such injuries result from overloading the other side, due to altered muscle recruitment, because the athlete is consciously or subconsciously sparing the previously injured muscles (Bilik 1966).

When a muscle is torn, the gap between torn fibers fills with blood. If healing goes badly, the blood clot calcifies (*myositis ossificans*)—turns into a sharp bone-like body that continues to reinjure the surrounding muscle. If healing goes well, the blood clot is replaced with a scar.

The scar that replaced the torn muscle fibers does not contract, so the scarred muscle will never regain its full strength. In addition, the scar tissue, being less pliable than the muscle fibers, causes more stress to fall on the remaining muscle fibers. This predisposes the muscle to repeat injuries.

Inflammation from overuse or from a minor injury that was not allowed to heal well also makes a muscle likely to tear.

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The Wall Street Journal discovers the secret of peak performance—the Gold Medal Mental Workout

Below is an excerpt from the article in the Wall Street Journal:

"... With many an athlete, a few Eastern sports psychologists have moved West. One is Artur Poczwardowski, 36, a Polish judo master...

"We can condition an athlete to respond with a specific mental state to a specific signal," says Prof. Poczwardowski. "Self-hypnosis makes a person much more susceptible to this type of learning."

"The Soviets were toying with such ideas going back to Ivan Pavlov, who in-

duced dogs to drool without the benefit of dog food. When Swedish psychologist Lars-Eric Unestahl mingled sports and hypnosis in the '80s, the [Eastern] bloc lapped it up. Only in the '90s, though, did its methods of entrancement appear in the West. Credit goes to Stadion... Stadion has brought out an English translation of the Polish athlete's favorite hypnotic handbook: *Gold Medal Mental Workout*.

"Its author, Dariusz Nowicki, is the psychologist who coordinates mind games for all of Poland's Olympians ...

"His program fills 10 weeks with readings and tapes that sink the subject into an 'alternative state of consciousness,' implant 'triggers' that activate the trance in seconds, and then soothingly build a cool disposition for the heat of competition."

—Barry Newman, "The Key to Ski Jumping? Never Think about It: Mr. Malysz Was in a Funk Till He Tried Hypnosis; Entranced with a Bronze," the *Wall Street Journal*, February 11, 2002.

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Another reason injuries recur may be that the original cause or causes of the first injury are still there. These are poor form of movement, poor strength or strength imbalance, and imbalance of muscle activation. (Imbalances of muscle activity are more likely to cause an injury than a imbalances in strength [Murphy 1991].) Imbalances of muscle activation and perhaps even poor form of movement can be corrected with the techniques of Applied Kinesiology.

If treated properly, previous injuries may not cause reinjury (Taimela et al. 1990). But rushing treatment and rehabilitation is asking for repeat injury—"therapeutic regimens designed to achieve an early return to competition may further increase the risk for additional injury by eliminating protective pain mechanisms" (Taylor et al. 1993).

How strains happen

Most muscle strains occur when the muscle tenses overcoming excessive resistance, when the muscle tenses during a movement in the opposite direction, or when a tensed muscle encounters sudden resistance (Järvinen 1977). In all these situations eccentric muscle action is the common denominator.

Muscle strains are divided into four categories of severity (Järvinen 1977):

1. A few muscle fibers are torn but not the fascia (the connective tissue sheath that covers the whole muscle). Blood pools in the torn spot, and often there is a muscle spasm. Touching and stretching cause pain.

2. More muscle fibers are torn, the fascia is still intact, but the blood pool (hematoma) spreads into undamaged muscle tissue.

3. Many more muscle fibers are torn and often their ends no longer touch each other. The fascia is damaged and bleeding is profuse. Blood pools outside the muscle and a bruise may show up below the injured spot. Touch produces sharp pain and there is considerable swelling. It may be possible to feel the partial gap in the muscle. Movements involving the strained muscle are usually impossible.

4. The whole muscle is torn apart and the limb can't work. Swelling immediately covers a large area of the limb. There is

either a gap between both ends of a muscle or one of the ends is not where it should normally be. Fourth category strains require surgery as soon as possible.

A pop may be felt or heard in third and fourth degree strains.

One of the ways to guarantee yourself a serious muscle strain is to keep exercising as a muscle heals. Just because the muscle stops hurting after an injury does not mean that it is ready to work. The injured muscle tissue must first heal completely and then the healed tissue must have enough time to mature. Exercising while a muscle is healing continues damage at the site of the injury, may increase that damage, and causes inflammation that involves more and more tissue and so weakens the muscle.

Tissue maturation involves lining up its structural elements to absorb energy without breaking. If the healing tissue is not allowed to mature, that is, to attain the same elasticity, pliability, and strength as the healthy tissue, then it will likely get injured again. Maturation requires just the right activity. Too much and you will reinjure yourself right then. Not enough and the tissue will become too stiff and you will reinjure yourself later—as soon as you increase the level of activity.

The other way to reinjure yourself is to rush back to the preinjury level of exercise before recovering full strength and endurance in the strained muscle under the guidance of a sports medicine specialist.

Warning signs

Except for muscle strains caused by overwhelming forces, such as in risky stunts or accidents, there will be warning signs. This is because it is very difficult to strain a healthy muscle. Usually the strain is preceded by an accumulation of damage that has weakened the muscle and made it less elastic.

The warning signs of excessive muscle damage are persistent muscle soreness and muscle aches, sometimes unlocalized, limited range of motion, or increased muscle tonus.

A minor strain may feel as if a thread snapped in a muscle. This is a sign to immediately stop the exercise. If you continue to use the muscle you will increase the damage.

Accumulation of scar tissue from minor muscle tears may occlude small blood vessels when pressure inside the muscle increases during exercise. This causes aches that increase during exercise and decrease during rest (Renström and Johnson 1986).

Disregarding the warnings because of an optimistic underestimation of their significance or because of being compulsive about working out leads to major injuries and permanent loss of athletic potential.

Treatment

The initial treatment for all degrees of muscle strain is the same: ice the strained area, compress it with elastic bandage, and elevate. All these are done together.

Icing lowers the temperature of the muscle, which causes local blood vessels to contract and so reduces the internal blood clot. The cold can penetrate to a depth of four inches into the muscle, which is why icing is done in all categories of strain.

Ice for up to half an hour, with breaks of similar duration. The ice bag should not be kept on the muscle for more than half an hour at a time because longer cooling causes the blood vessels to dilate and so increases blood flow (Järvinen 1977). Icing should continue for two days following the injury—even for first category strains if bruising still spreads.

Compression by bandaging the part of the limb with the strained muscles limits blood flow and protects the torn ends of a muscle from moving. The bandaging is done for at least a month in the case of second degree strain.

Elevating the limb helps venous blood and lymph return from the limb and so reduces pressure inside the torn muscle.

Up to the third category of strain the strained muscles should be immobilized for two days—unless a physician orders otherwise. Longer immobilization slows down healing and makes regenerated tissues weaker and less elastic (Järvinen 1977).

After a first category strain it may be okay to gently move the affected limb a few hours after the injury.

On the third day after a strain of the first or second category it may be possible to gently stretch the recovering muscle and massage it with a stream of warm water—

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up to 100°F (38°C). Be aware that hot water may restart bleeding. Hand massage is not to be done as it may cause calcification of the internal blood clot (Järvinen 1977). Stretching, if permitted by physician, must be very gentle as too strong a stretch can reinjure the strained muscle.

Third category strains should be x-rayed after three weeks to see if the blood clot has calcified in which case it has to be removed surgically (Järvinen 1977).

Fourth category strains are treated surgically right away so the surgeon will supervise all recovery.

Chronic muscle tears and chronic inflammation cause a buildup of scar tissue in the muscle. During increased activity the scar tissue may cause tearing of the muscle around the scar and inflammation. Upon deep probing in painful areas of the muscle the scarred and inflamed tissue feels hard and is tender to your touch. Such scar tissue may be made more pliable by deep transverse friction (cross-friction massage), which breaks adhesions and mobilizes connective tissue fibers (Benjamin 1984; Hertling, and Kessler 1996).

Surgical removal of scar and degenerated tissues often helps in cases of complicated and protracted healing (Renström and Johnson 1986). Rehabilitation after surgery may be long, however. If conser-

vative treatment is successful there is no need for surgery.

Prevention

Systematic conditioning and self-observation are the surest prevention of injuries.

Self-observation—being attuned to the earliest warning signs **and acting on these signs** can keep small problems from growing into injuries.

The stronger and less fatiguable the muscles the less likely they are to tear. Good coordination, sound technique, and unflinching concentration help too. All these attributes are developed in the course of rational training that follows the principles given in *Science of Sports Training*.

A well-conducted warm-up enables muscles to absorb greater forces and stretch to a greater length before tearing (Safran et al. 1988). You can learn how to warm up right for different workouts or for competition from *Science of Sports Training*.

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Inflammation

Inflammation is a necessary part of healing. In the case of a muscle strain, dead muscle fibers and other debris are removed in the process of inflammation. Without removal of debris, healing and rebuilding cannot take place. The pain, swelling, and raised temperature are inseparable parts of healing.

Taking nonsteroidal anti-inflammatory drugs (NSAIDs) relieves pain and improves muscle function in the short term but in the long term may interfere with muscle rebuilding and cause a loss of strength (Almekinders 1999; Almekinders et al. 1995; Almekinders and Gilbert 1986; Jones 1999; Mishra et al. 1995).

Recent research suggests the inflammation may exacerbate the pathological processes leading to Alzheimer's disease and that taking NSAIDs may help prevent AD

(in 't Veld et al. 2001).

Inflammation itself, however, is just a response to a problem—injury arising from poor technique, poor condition, or poor nutrition.

People who do not eat healthily, train systematically, or increase training loads gradually have frequent or chronic inflammations that may increase their chances of Alzheimer's disease. If they use NSAIDs, they may be weakening their muscles and setting themselves up for more injuries and more inflammation.

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Q and A on STRETCHING and TRAINING

(continued from previous issue)

Study these typical questions on stretching and training carefully. You may find information that relates to questions of yours. Questions are in *italic boldface*.

■ **After reading about your stretching technique in Black Belt I decided to get your book *Stretching Scientifically* and see if it would work for me. I started in and got to isometric splits. Things were going ok for a while and suddenly I felt my groin muscle give way and a lot of pain. I guessed that I tore a muscle and it took about two weeks before I stopped feeling pain in my groin. I put the book back on the shelf (after that experience who wouldn't) and decided to pick it back up tonight. Well, once again, I got to isometric splits. I started really high (almost in a wide leg stance with my legs straight) and pulled tension. Without warning I felt a pop and again the pain returned. Now my groin hurts standing normally and pulling tension to the inside. I'm 18 and I love weightlifting. What have I been doing wrong? Every time I've tried isometric splits I've torn something and it's taken me out of commission. There must be some way to correct what I'm doing wrong and achieve full (or even close to full) splits.**

What have you been doing wrong? I suspect that you have not gone through the exercise program of preparing for isometric stretches that is described in the book *Stretching Scientifically* at the beginning of the chapter "Isometric Stretches," on pages 61-62. The same program of exercises will help with the final stages of rehabilitating your muscle tears.

You write that you love weightlifting—perhaps you do most of your lifts explosively or with near maximal weights? If so, you may be capable of tensing your muscles very strongly and very quickly. If you do that with muscles of the inner thigh, which most people do not exercise, you can tense them harder than their structure can withstand and rip them. (If you tense a muscle or pull on it very quickly, its tendon—if healthy—stiffens and so the energy is absorbed mostly by the muscle's

belly, which stretches or tears—depending on the amount of the energy.)

Muscles that are tired or inflamed are easier to tear than well-rested and healthy muscles.

If you take steroids, or supplements that increase the force of your muscles' contractions, the structural strength of the muscles may lag behind their contractile strength and muscle belly or even tendon tears are likely.

It is bad to tear a muscle. It is much worse to tear it again. You can find out the nature of your injury and how to fully rehabilitate it by studying books on injuries that are listed at <http://stadium.com/bookshelf.html>. I especially recommend *Management of Common Musculoskeletal Disorders: Physical Therapy Principles and Methods* because this book explains how to rehabilitate after an injury as well as what the lifetime consequences are of not letting an injured muscle heal, not rehabilitating it fully, and reinjuring it. Another title I recommend is *Complementary Sports Medicine*.

In my opinion injuries, both chronic and sudden, as well as difficulties with healing, are most effectively treated by physicians specializing in Applied Kinesiology.

Either a good orthopedic surgeon or a physician specializing in Applied Kinesiology should be able to help you. In the United States you can find an AK specialist at <http://www.icakusa.com/directory/>. In Canada you can call Gilles Brisson, D.C. at 514-434-1162.

If you have a choice, go to those doctors who are Diplomates of the International College of Applied Kinesiology and have initials DIBAK after their names. The safest course of action is to also see an orthopedic surgeon specializing in sports injuries.

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