

When Joints Need Help: The Magic of Motion

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Rick is a 35 year old male with an aching, painful right knee. It hurts to walk, climb stairs and with nearly anything that involves weight bearing. For the last two years, Rick spent considerable time, energy and money trying to get his life back. He visited several physicians and therapists. He also worked with a personal trainer and a nutritionist. The results were less than optimal. He finally went to Dallas, Texas to see an orthopedist who said, "You are not a surgical candidate but the guy you need to see is in Austin." Thus, I met Rick in November 2001.

Rick's story is a very common one. He recalls feeling some discomfort in his knee in 1999 but cannot relate it to anything specifically. It just gradually worsened despite a year of physical therapy. He can tell when the weather will change. His knee aches a day or so before a cold front appears. He elected to undergo a lateral release in 2000 which was followed by another year of rehab. In describing the rehab, he told me, "I did a lot of exercise. All sorts of things but my leg never really felt very tired. But, if I tried to push it, my knee would hurt. Now, I think I may be headed to surgery. I am incredibly frustrated."

As Rick told me his story, I heard a consistent theme: stiffness. **The stiffness is of two different types.** One lasts for several days at a time and the other for 30 or 40 minutes. The second type of stiffness occurs with static positions like sitting in a movie theater or riding in a car or sleeping. The key to successfully solving his problem involves understanding why Rick has the stiffness in his knee and what to do about it.

Why Joints Get Stiff

Stiffness is one of the few ways your knee joint can communicate its state of health. With no blood or nerve supply, the protective lining over the ends of your bones, articular cartilage, has few options to let you know it is in trouble. If it could speak, the joint might say, "Hey, you know all that running you've been doing? Well, you're killing me down here!" Instead, it sends a slow, steady signal waiting for you to acknowledge it. Unfortunately, most of us do not know "jointese" (the foreign language of joints). **The stiffness of a joint lasting for days on end is primarily due to the shearing of cartilage cells creating**

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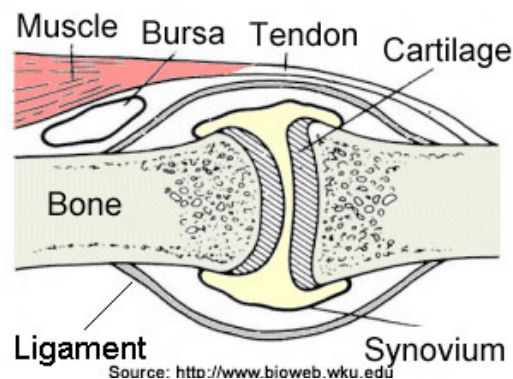
Sports Center is a physical therapy practice in Austin, Texas devoted to rebuilding active, athletic lifestyles following an injury or surgery.

"Your staff give a level of personal attention that I have not seen the three previous times I had physical therapy elsewhere. I am very impressed with the dedication that Christine and Ryan have for their clients and the creative efforts they make to address new problems as they arise. Every time I had difficulty with an exercise, they always had a quick (and good) alternative. Y'all Rock! I tell my friends that you're the best at what you do. I tell them that you have the most creative and effective PT program I've encountered."

Grant Gurley (Skiing, Rowing)

Doug Kelsey, PT, PhD
Ryan Smith, PT
Christine Springer, PT
Jenna Vincent, PT

very small fragments in the joint. These tiny fragments are absorbed by the synovium which in turn becomes inflamed. Synovium is a thin layer of cells that lines your joint and controls the environment of the joint. What happens inside your joint reminds me of the movie starring Jim Carrey, "The Truman Show". In the movie, Jim Carrey plays a man whose life is actually a TV show although he doesn't know it. His world is a huge, sophisticated TV studio set that con-



Source: <http://www.bioweb.wku.edu>

trols everything about his day: the weather, people, places, and events. Your synovium is like the studio set of the Truman Show. Inside the joint, everything that happens is controlled by the synovium. Healthy synovium secretes a thick, nutrient-rich fluid that

bathes the cartilage and helps maintain a firm, cushion-like capability. When the synovium is inflamed, the fluid will be thinner and the cartilage becomes softer. **The condition of a joint with soft, thinning cartilage is often referred to as Degenerative Joint Disease (DJD).**

The more inflamed or irritated the synovium becomes, the more it swells and since it has an abundance of nerves and blood vessels, the dull sense of aching and stiffness soon follow.

The short-term stiffness, however, is entirely different. On the surface of articular cartilage, secreted by the synovium, is a surface-active phospholipid (SAPL). This SAPL's job is to provide the lubrication you need in the joint and to prevent the layers of cartilage from melding themselves together or gelling. In the case of DJD, the synovium does not produce as much SAPL and therefore, you feel stiff; the layers begin to gel until you get up and move.

How Cartilage Heals

The good news is you can improve DJD. All tissues of the body respond to motion and force (or load) in either a positive or negative way. Too little motion or too little force and tissues weaken while too much motion or too much force, tissues may be injured. The key to eliminating stiffness and aching while restoring full functional use of the leg is in finding the precise combination of load and force that serves as a biologic booster helping cartilage heal and grow stronger. We refer to this range of motion and force as the *Magic Zone*.



Find the right load, the right number of repetitions, the right movement and things begin to improve. And, it really does feel like magic. It seems almost too simple but it is this combination of load

and motion that creates the magic of cartilage healing.

Articular cartilage is composed of a fibrous mesh that tightly binds water. Imagine a fishing net with a lot of small rocks in it. The rocks are like the water molecules and the net is like the fibrous mesh of cartilage. As long as the net is strong and the holes in the net are smaller than the rocks, the net can hold a lot of rocks. But, if the net is weak or has holes that are too large, the net will fail and some of the rocks will fall out. This is essentially what healthy cartilage is like. It's ability to hold the water creates a lot of cushioning. Soft, injured or diseased cartilage is like a weak fishing net with holes in it. When you place a load on this netting, the water leaks out and the cushioning effect diminishes.

Unlike other cells in the body, cartilage cells communicate with each other via pressure. For example, when you cut your skin, cells can determine what to do (who needs to clean up and who needs to produce new cells) by their close proximity and blood availability. Cartilage cells are not as close together and they do not have a blood "highway" to transport themselves to the injured area. Cartilage cells determine what to do based on the "volume" of the pressure signal. With high pressures, cells begin to disintegrate. If the pressure is very low, cells fail to produce the substance they need to bind the water. So, in one case, your cartilage begins to come apart (too much pressure and holes develop in the netting) or, in the other case, the cushioning is too low because of the inability to bind up enough water.

To strengthen cartilage, you have to first know how much pressure the joint can tolerate. This, in a sense, is a strength test of the joint. Just like you would determine the strength of your arm muscles when you begin muscle training, you also need to know the strength of your cartilage.

We accomplish this by using certain tools that reduce the effect of gravity. We need to know how much force you can comfortably place on your leg while performing a squatting motion. We use a Variable Incline Plane (VIP) in most cases to find this force. Each level of the VIP corresponds to a certain percentage of body weight. **By raising or lowering the VIP, we can increase or decrease the resulting force on the leg and identify a pain free load level we refer to as your Load Tolerance.** Identifying the Load Tolerance is a critical step. The matrix needs pressure but if you exceed your pain threshold the mechanical force on the matrix will be too great. The result will be a continued weakening of the cartilage.

For example, assume you are 6 feet tall and weigh 200 pounds and our Load Tolerance Test identifies your pain free threshold for squatting on your right knee at 120 pounds. This means that every time you go up a flight of stairs, you overload your knee by 80 pounds. (200 lbs. - 120 lbs. = 80 lbs.). If you jog, you overload your knee even more since jogging creates an increased load on the knee of 3-6 times your body weight. Since your Load Tolerance is 120 pounds, jogging over loads your knee anywhere from 240 to 480 pounds (80 lbs. x 3 = 240 lbs.!) No wonder you hurt.

Where to Start

To get started on reducing your stiffness and rebuilding your knee's weight bearing ability, we suggest the following:

1. **Control swelling:** Get off your feet at least three times per day with your foot above the level of your heart for at least ten minutes. A compression garment (either compression sock or a neoprene knee sleeve) may also help control and reduce swelling.

2. **Drink adequate amount of fluids:** You need at least 64 fluid ounces of fluid per day up to 50% of your body weight in ounces per day.

3. **Add glucosamine to your diet:** Glucosamine is a form of an amino sugar that has been shown to reduce symptoms and improve the architecture of cartilage. Dosage is based on body weight and should be divided into two doses per day.

Up to 150 pounds: 1500 mg

Over 150 pounds: 2000 mg

4. **Add omega three fatty acids (OTFA) to your diet:** OTFA are a natural anti-inflammatory and have been shown to be effective in combating joint disease symptoms.

5. **Move gently and often:** A gentle, assisted motion of the knee is better than an active motion of the knee in the early phases of your rebuilding program. Peddling a stationary bike performing most of the work with your opposite leg is a good example of a partially assisted movement. This type of exercise is very important and it is this step where many people make a mistake. They try too hard, and do too much. **Cartilage is nudged into health not pushed.** In fact, in 1999, a group of researchers reported that patients with a full thickness defect of the cartilage responded much better to the use of controlled motion than a control group who performed active motion. Just the weight of the leg is too great for the young cartilage cells to withstand. Imagine what happens when you add some resistance like lifting weights, using a leg press or knee extension machine.

The Timeline

We all would like to heal faster and with less effort but cartilage is one tissue you simply cannot rush. Because cartilage has no blood supply, it heals very slowly. **Research has proven that cartilage requires 1000's of repetitions of movement per session to change it's thickness and resistance to compression.** You can expect to spend several months restoring full weight bearing capacity (in some cases of very advanced joint disease, you may not be able to achieve full weight bearing ability. But, you can dramatically improve how you feel and what you can do.) and must exercise 2-3 days per week consistently to maintain your improvements.

Summary

Joint stiffness is often a sign of joint problems. The most common form of stiffness is from a deterioration of the joint surface. Cartilage heals best from the combination of controlled motion and force. Exercising in the "Magic Zone".

About Sports Center

Sports Center is a physical therapy practice located in Austin, TX devoted to rebuilding active, athletic lifestyles following an injury or surgery. Visit Sports Center on the web at www.sportscenteraustin.com to learn more and to visit our online store.

Be sure to sign up on our website for our weekly update, **The View**, delivered each Sunday evening to your email address where we share our secrets to rebuilding your body and your life for free and only from Sports Center.

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