

Acupuncture and Laser Therapy for Knee Damage

It's not the years, it's the mileage"....one of my favorite quotes from Indiana Jones in "Raiders of the Lost Ark"

Some of the most common medical conditions among active adults are knee problems. Reported knee injuries and knee degeneration just in the United States number in the millions per year. If we just look at reported ACL tears, for example, between 250,000 and 300,000 ACL injuries are reported each year. Most are attributed to athletes.(1) Keep in mind this is only one of the common knee injuries.

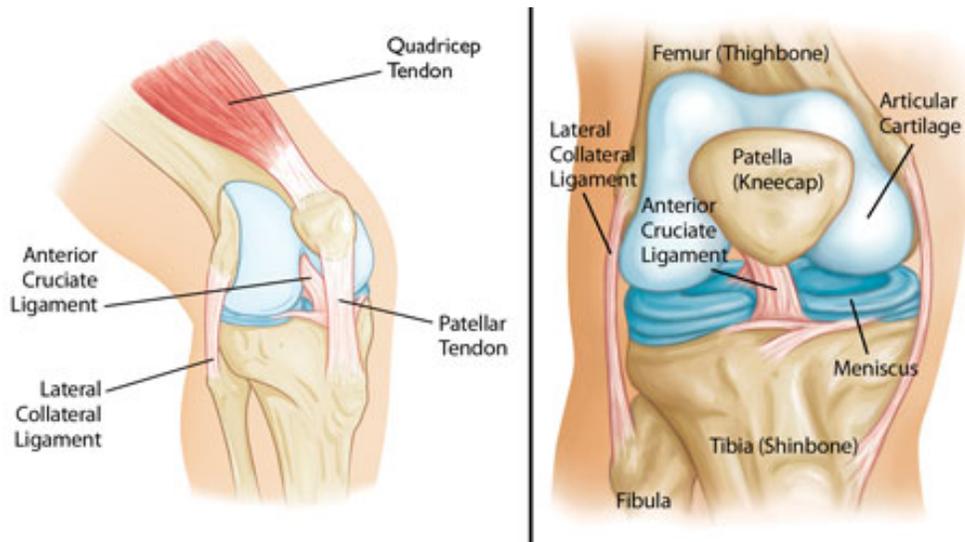
In this article we will briefly describe common knee problems including both ligament damage and cartilage degeneration and discuss the advantages of using **acupuncture** and **cold laser therapy** (low level laser therapy or LLLT) to not only decrease pain, but also accelerate the healing of these injuries.

A Quick Overview of the Knee Anatomy.

The joint is considered a "hinge" type of synovial joint that allows basically two directions of movement; flexion (bending) and extension (straightening). Yes, there is a small amount of flexibility allowing for some rotating and bending side-to-side, but only a little. The repeated load that the knees sustain during movement, and the relatively limited direction of the motion allowed by the knee leave it vulnerable to some unique risks and injuries. Shown below is a diagram showing the basic parts of the knee. Most knee injuries occur in either the ligaments (cruciate or collateral) or the meniscus (cartilage pads that help cushion the load of the knee joint when weight is applied). Degeneration of the knee is usually more attributed to a thinning and eventual loss of the cartilage (either the meniscus or the articular cartilage lining the femur) commonly referred to as "osteoarthritis".

Craig Amrine L.Ac. is the owner and operator of Hidden Rhythm Acupuncture located in the heart of Tempe, Arizona. These newsletters are designed to help educate the public on various afflictions that acupuncture as a part of Traditional Chinese Medicine is known to treat. Each month, Craig will address a new health challenge that commonly affects the general public and offer a brief explanation on the disease from both the Western perspective as well as from the Traditional Chinese Medical perspective. He will also offer his own thoughts on treatment based on personal clinical observation and treatment experience.





Let's discuss some of the more common injuries in a little bit more detail. In a normally functioning knee joint, flexion and extension (bending and straightening) occur without any drama... it sustains the weight of the body through standing, walking, running, sprinting, and side-to-side movements. It will sustain a small amount of side-to-side bending or rotation. It is essentially a hinge joint. Ask the knee to do much more than that, and injuries will result, most often in the form of ligament tears.

Most athletic injuries result from asking the knee to rotate or flex further than it is designed. They can result from impact of another person, or rotating the body while the foot is planted and cannot rotate.

ACL Tear

The anterior cruciate ligament (ACL) tear can result from rapid changes of direction, improper landing from a jump, or impact.**(2)** It is often accompanied by damage to other parts of the knee. There are of course varying degrees of damage to the ACL. Grade 1 and 2 sprains describe just over "stretching" or even partial tear of the ligament while a grade 3 sprain indicates a complete tear with full separation. Grade 1 and 2 sprains can indeed resolve themselves without surgery. Grade 3 complete tears, however, will require a surgical repair (usually a graft) to regain full function and stability of the knee.

PCL Tear

Posterior cruciate ligament (PCL) tears usually result from front impacts while the knee is bent. These are much less common than ACL tears and can often resolve without surgery.

MCL and LCL Tear

Damage to the collateral ligaments, either medial (MCL) or lateral (LCL) sides of the knee are often the result of side impacts to the knee. While it obviously depends on the degree of damage, collateral ligament damage can often be resolved without surgery.

Meniscal Tear

The meniscus are vulnerable to tearing during impact with sudden twisting and are more common in older patients. The need for treatment of meniscal tears depends on the type and severity. Flap tears occur where portion of the meniscus tears and can fold underneath itself. The knee will suddenly lock up with severe pain. In contrast, degenerative tears will result in gradually increasing pain, swelling, and stiffness.

Tendon Tears

Patellar tendon tears occur in the tendon connecting the kneecap (patella) to the tibia (shinbone) while quadriceps tendon tears occur between the quadricep (thigh) and the patella. These type of tears can occur from landing from a jump and are more common with increasing age. The need for surgery (like ligament tears) is largely dependent on the degree of tear.(2)

Bursitis of the Knee



Bursa are fluid filled sacs that help relieve pressure and reduce friction around the knee between tendons/ ligaments and the bone. 11 such bursa exist around the knee. Bursitis can be caused during repeated injury or overuse such as prolonged kneeling or pressure on the knees. It is characterized by pain, swelling, and warmth. Bursa can also become infected. X-ray, MRI, and ultrasound imaging is often used to differentiate bursitis from other common knee problems. Conventional therapy can include cortisone injections, aspiration (draining of the fluid) and even removal of the bursa.(3)

Keep in mind that these are not ALL of the injuries that can occur in the knee, just some of the more common ones.

Cartilage Degradation

Aside from traumatic injuries such as ligament and cartilage tears, knees are also prone to simply “wearing out”. The articular cartilage lining the head of the femur begins to thin over time, and the surface can become rough, uneven, and ultimately degrade to the point where it is no longer there. This condition can be collectively labelled Osteoarthritis or OA (6).



As a result of this thinning and irritation of the area, a full inflammatory process can take place including extra fluid in the joint capsule, thickening of the synovium also known as the lining of the joint capsule surrounding the knee, thickening of the surrounding bone into spurs called osteophytes, and extra swelling around the joint leading to contracting of the surrounding ligaments .

Sometimes this inflammatory process can indeed lead to tissue repair and decrease in pain. Other times, however, it can lead to further damage because of increased instability and other parts of the joint attempting to carry the load.

Prolonged pain and swelling can lead to weakening of the surrounding ligaments and muscles leading to further instability and increased risk of further degradation. Left unchecked, the downward spiral can continue until permanent damage will result.

Osteoarthritis can be caused by several factors(4):

Gender - Women are 50% more likely to experience OA (osteoarthritis) than men.

Age - As we get older, our internal repair processes slow down, and by our mid-to-late 40's, OA becomes more prevalent. The connection between "getting old" and OA isn't so clear cut, however. As we age, things do indeed tend to wear down a bit, but increasing evidence shows that OA is not simply caused by regular activity or exercise in our 40's. It is now suggested that **INACTIVITY** can contribute to osteoarthritis. To be specific, there is an optimum amount of "recovery time" suggested after noted cartilage damage. Intense exercise too soon after damage has been shown to increase injury. It was surprising to note, however, that prolonged immobility can also accelerate cartilage damage.(5) Research suggests that activity (especially low-impact movement like elliptical training) can stimulate cartilage growth resulting in increased cartilage health. By the time many people reach 40 or older, a shift to sedentary lifestyles is common...increasing chances of immobility, thus reinforcing the perception that getting older leads to OA.

Obesity - Being overweight can vastly increase the chance of OA in the knees. The extra load on the knees coupled with likely inactivity can accelerate cartilage damage.

Injuries - Other knee related injuries such as torn meniscus or ligament tears can lead to joint instability and cause uneven loading and uneven wear on the cartilage leading to damage.

Genetics - Yes, a genetic connection can increase your chance to developing OA if you have other family members suffering from OA.

Smoking - It is common knowledge how toxic cigarettes are for virtually every organ of the body. While some early research suggested that nicotine might even have a protective effect on OA, more recent and thorough studies confirmed that smoking does speed up cartilage loss and disorder cells that can rebuild cartilage.(7)

What to do?

Traditional treatments in treating OA target reducing inflammation of the joint and thus reduce pain. Cortisone injections target shutting down the inflammatory process by first retarding the immune response. The drawback with corticosteroids however are that they destroy the joint by weakening ligaments at the injection site and destroys cells that rebuild cartilage.(8)(9) Deterioration from repeated injections will inevitably lead to knee replacements. While there are times where partial or full replacements are the best option, several more conservative approaches are available and should be tried before surgery.

NSAIDS or Non-steroidal-anti-inflammatory drugs such as ibuprofen may seem like harmless alternatives to stronger pain killers, but studies show that in addition to damage to the the stomach, liver, and kidneys, prolonged use can speed up damage to articular cartilage of the knee and hips.(10)

More progressive alternatives to help relieve OA pain include injection of cushioning agents such as Euflexxa and Synvisc. They can provide a level of relief for a few months without any side-effects. Immuno-stimulatory approaches such as prolotherapy and PRP (platelet rich plasma) where inflammation is stimulated to induce tissue healing is becoming more popular and is showing promise to help knee damage.

Since this article is more on how acupuncture and cold laser therapy can help with knee health, we'll focus on these two modalities.

Acupuncture:

Acupuncture and Traditional Chinese Medicine (TCM) have been successfully shown to treat a wide variety of physical and emotional problems. TCM views most diseases in terms of the imbalance of Yin and Yang along with improper flow of Qi (energy) within the body. Restoring the proper flow of Qi and re-establishing Yin/Yang balance was done by inserting needles in very specific locations on the body.

While the success of treatment has been touted for thousands of years, the mechanisms explaining HOW it works has only begun to be investigated in the last few decades. In treatment of OA, acupuncture has been proven to reduce pain, increase range of motion, and increase function according to several studies. How? Acupuncture is well understood in how it can reduce both local and systemic inflammation by strongly

influencing specific pro and anti-inflammatory components of our immune system called interleukins.(12)(13) Research has discovered a strong correlation between these pro-inflammatory components (interleukin-1 beta (IL-1b) and tumor necrosis factor alpha (TNF-a) and prevention of cartilage repair. In contrast, anti-inflammatory cytokines like interleukin-10 have a cartilage protective effect.(11) Between its endorphin stimulating and anti-inflammatory effects, acupuncture is a great tool to increase knee function, reduce pain, and reverse effects of OA.(21) Has it been proven to actually restore cartilage? There is some evidence suggesting that electro-acupuncture can promote cartilage regrowth, but the mechanisms on how that works are not yet fully understood.(14)

Pain reduction and increased functionality leads an upward spiral in knee restoration. We've already discussed how activity is shown to stimulate knee cartilage growth. With higher activity levels, metabolism increases, weight loss may occur...leading to lighter loads on the knees thus leading to greater incentive for knee movement.

What is Cold Laser Therapy?

Cold Laser or Low Level Laser therapy is a method to help wound-healing by shining laser light of specific power and color (wavelength) at damaged tissue. Countless studies have been published proving that cold-laser therapy can accelerate healing of bone, ligament, tendon, skin, and even nerve tissue.(15) The mechanisms involved include a massive increase in mitochondrial ATP production, increase in protein synthesis, decrease in local inflammation, and a rise in angiogenesis (new vessel formation) at the laser exposed site. Several other changes occur as well, but these are the ones most commonly discussed.(16) What about knee injuries? Specifically, can laser therapy accelerate repair of ligaments? Is it possible to restore worn out cartilage that lead to osteoarthritis?

Cartilage Repair.

There are three main types of cartilage in our bodies including hyaline cartilage (found at joints), fibro-cartilage (found at vertebral discs and ligaments), and elastic cartilage (ear).

The cartilage found at the head of the femur (leg) is called articular cartilage and is a form of hyaline cartilage. It is a smooth glassy-like material that allows joints to move easily and to sustain compressive loads. It is composed of about 4 % chondrocytes and 96% extracellular matrix. This matrix includes several components that give cartilage its rubbery texture including water, collagen, proteoglycans, and glycosaminoglycan chains. These chondrocytes play a huge role in maintaining cartilage health and to fix damage. What happens if damage becomes too great? We rely on stem cells from the adjacent bone to migrate into damaged area where they transform into chondrocytes or collagen since chondrocytes don't replicate easily on their own.

If this process works properly, we have no problem. This repair process doesn't work however, if the cartilage damage doesn't extend down into the sub-chondral bone. In other words, if cartilage damage isn't deep enough, the stem-cell induced repair process doesn't occur. The role of mesenchymal (stem) cells of the bone marrow in the repair of cartilage has been reinforced by several studies (Cartilage repair arises from mesenchymal cells which differentiates into cartilaginous cells and matrix).(17)

Another wrinkle is that sometimes, the stem cells will transform into the wrong kind of cartilage (fibro-cartilage) rather than the desired hyaline cartilage. A fascinating study investigated this variation by using different types of lasers on damaged hyaline cartilage. The results showed that damaged areas irradiated with red laser light (632 nm) induced fibro-cartilage while areas exposed to Infra-red (904 nm) laser light formed hyaline cartilage.(18)

Several other studies show overwhelming evidence how repeated low-level treatments increase both cartilage content and quality compared to non-treated damage areas.

The mechanisms include an increase in chondrocyte (cells responsible for healthy growth of cartilage) formation and differentiation from stem cells produced in the adjacent bone marrow. We've also discovered that laser therapy also inhibits the activity of pro-inflammatory cytokines (interleukin-1 beta (IL-1b) as well as tumor necrosis factor alpha (TNF-a). These cytokines that are common with inflammatory reactions have been shown to inhibit cartilage formation.(19) In contrast, anti-inflammatory cytokines such as interleukin-10 appear to have a cartilage protective effect. So research suggests that laser therapy can help restore cartilage in several ways.

Ligament repair.

As we've already discussed, ligament tears can often happen in the cruciate or collateral ligaments of the knee. While complete tears with separation will most often require surgery, there are many instances where the ligaments can heal themselves. Due to lack of blood flow in ligament tissue, healing rates are often very slow. And since most people don't have the patience to allow proper healing time (especially athletes), the healing process is rarely allowed to complete.

Laser-enhanced healing for ligaments around the knee has been investigated in several animal studies. Both tensile strength and ligament fibril diameter was shown to be significantly higher after laser treatments in comparison to un-treated areas.(20)

The future of low level laser therapy?

We are just beginning to gain understanding in how cold laser therapy can help heal the body. With its wide-ranging benefits that seem to help heal almost all tissues of the body, its possibilities seem endless. At this time, however, there are no standard "protocols" that can tell us the "perfect" laser power, treatment time, and color to give us

the best results. Since different wavelengths and energy doses affect the body differently, there is still much work to be done. Research has given us some guidelines, however, to allow the use of low-level lasers in the successful treatment of wound healing.

Acupuncture

Acupuncture, on the other hand, has been around for at least 4,000 years. Like laser therapy, however, the mechanisms in how it works are just now being investigated. Fortunately, phenomena like pain reduction and inflammation are starting to be better understood.

Summary

Degradation and injuries to knees can have a profound impact on your career, your fun, and even simple day to day living. As we get older, our chance of knee injury increases even further. Both acupuncture and low-level-laser therapy (LLLT) provide a powerful combination of tools that can not only decrease pain, but actually speed up healing and reverse cartilage damage to the knees. Before you reach for the ibuprofen, allow the cortisone shot, resign yourself to surgery, or simply say you've got "old" knees, I urge you to investigate acupuncture/LLT combination therapy as a hugely powerful, safe, and effective treatment option.

Sources

- (1) <http://www.txsportsmed.com/acl.php>
- (2) <http://orthoinfo.aaos.org/topic.cfm?topic=a00325>
- (3) <http://www.mayoclinic.org/diseases-conditions/knee-bursitis/basics/definition/con-20030816>
- (4) <http://www.mayoclinic.org/diseases-conditions/osteoarthritis/basics/risk-factors/con-20014749>
- (5) <http://www.webmd.com/osteoarthritis/news/20020703/inactivity-worsens-knee-arthritis>
- (6) <http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=14&ved=0CE4QFjADOAo&url=http%3A%2F%2Fwww.arthritisresearchuk.org%2F~%2Fmedia%2FFiles%2FArthritis-information%2FConditions%2F2027-osteoarthritis-of-the-knee.ashx&ei=-GXSV03BBMHDggTZz4G4Dw&usg=AFQjCNE1X43F9ty0FHgrt6Ypp3l5Z-w0yg&bvm=bv.85076809,d.eXY>
- (7) http://osteoarthritis.about.com/od/osteoarthritisresearch/a/smoking_and_OA.htm

- (8) <http://www.journalofprolotherapy.com/index.php/the-deterioration-of-articular-cartilage-in-osteoarthritis-by-corticosteroid-injections/>.
- (9) <http://ptjournal.apta.org/content/62/6/835.full.pdf+html>
- (10) <http://www.journalofprolotherapy.com/index.php/the-acceleration-of-articular-cartilage-degeneration-in-osteoarthritis-by-nonsteroidal-anti-inflammatory-drugs/>
- (11) <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4021678/>
- (12) <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2810544/>
- (13) <http://www.hindawi.com/journals/mi/2003/807126/abs/>
- (14) <http://www.ncbi.nlm.nih.gov/pubmed/23713295>
- (15) <http://www.scielo.br/pdf/jvb/v6n3/v6n3a09>
- (16) <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3288797/>
- (17) <http://www.hindawi.com/journals/sci/2015/974864/>
- (18) <http://www.betterbraces.com/media/Effects%20of%20Light%20Therapy%20on%20Cartilage%20Repair%20and%20Osteoarthritis%20Healing.pdf>
- (19) <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4021678/>
- (20) <http://waltza.co.za/wp-content/uploads/2012/08/THE-BIOLOGICAL-EFFECTS-OF-LASER-THERAPY-AND-OTHER-PHYSICAL-MODALITIES-ON-CONNECTIVE-TISSUE-REPAIR-PROCESSES.pdf>
- (21) <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0023116/>