

COLLATERAL DAMAGE TO

KNEE LIGAMENTS

By Dr Ben Benjamin, PhD

INTRODUCTION

I worked as a therapist for 14 years before I truly got to understand the injury process. It was while obtaining my PhD in sports medicine that I came across the theories of Dr James Cyriax and Dr Milne Ongley and this revolutionised my thinking. After studying and testing Cyriax's theories on several hundred people, I had to put aside many of his assumptions and long-cherished beliefs. Muscles, muscle injuries and muscle tension were only one small part of understanding the pain and injury process.

The first important fact is that the formation of adhesive scar tissue in the tendons, ligaments and joints is often the primary culprit in long-term pain. Although muscles get injured most frequently, they also heal more easily on their own. Tendons, ligaments and joints, on the other hand, may take months or years to heal and often stay injured for a lifetime. There are hundreds of discrete injuries to muscles, tendons, ligaments, bursas, nerves and joints that could be precisely assessed, understood and successfully treated. I learned an effective hands-on technique called friction therapy, which can be used to break down adhesive scar tissue in muscles, tendons, ligaments and fascia.

Therapists who work with pain and injury problems must gain an understanding of what I term the 'essential principles' - the underlying principles that govern effective assessment and treatment. If this information is mastered then the most inscrutable symptoms, conditions and pain patterns presented by clients can be understood, including the most difficult pain cases. What follows are

There are many approaches to the treatment of pain and injury problems. It is best to have a full and clear understanding of what the problem is before a person is treated. In this article the author outlines some of the principles that are essential to a therapist's overall understanding of the injury process, and demonstrates how to apply these principles to two common knee injuries.

some of these important concepts that will help to provide an understanding of the body and its pain in a new way. I will use as an example, two common knee injuries - the lateral and medial collateral ligaments - to show how the application of these 'essential principles' can help you clearly assess and effectively treat your clients.

PRINCIPLE: THE NATURE OF INJURY

An injury, often called in medicine 'a lesion', is present when there is tissue damage. The damage could manifest as a swelling in a bursa or a joint; pinching of a nerve or a tendon; micro-tears in a muscle, tendon, ligament or fascia; or a major disruption of tissue like a broken bone or a ruptured tendon. When there is an injury, a part of the body has lost its structural integrity.

Application: Injuries to the collateral ligaments of the knee

The collateral ligaments of the knee link the leg by connecting the femur to the lower leg on the medial and lateral sides of the knee.

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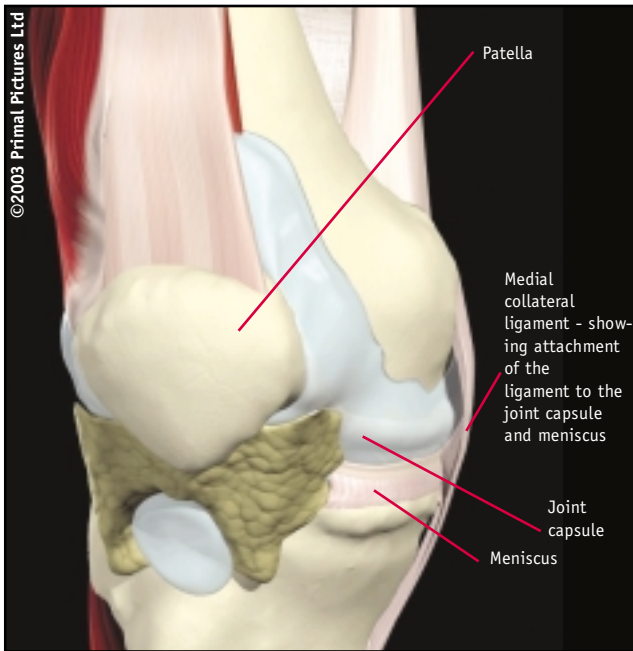


Figure 1a: Medial collateral ligament of the knee (anterior aspect)

These ligaments are very important because together they prevent the knee from buckling inwards and outwards and keep it on track for forward-back movement. A person can have a mild sprain of these ligaments, where only a few fibres are damaged; a moderately severe sprain, where many fibres are torn; or an extremely severe one, where the ligament tears more extensively or ruptures completely in half.

The medial collateral ligament of the knee is injured more frequently than the lateral collateral ligament. The medial ligament runs from the femur to the tibia while the lateral ligament attaches the femur to the fibula. With either of these ligament sprains, commonly the fibres may have torn either in the middle or near the ends of the ligament at the attachments.

The medial collateral ligament is actually attached to the inner aspect of the joint capsule of the knee and is connected to another important ligament in the knee, the medial coronary ligament. Medial collateral and coronary ligament tears therefore often accompany each other and are sometimes confused with one another. The lateral collateral ligament is not contiguous with the joint and therefore causes less or no swelling when injured.

PRINCIPLE: PAIN AS A SIGNAL

Pain is the signal that something has gone wrong in the body. When the body speaks it is good to listen. If the pain diminishes and disappears within a few days, there is usually nothing to worry about. If the pain persists for more than several days, becomes more frequent or hurts with less and less activity then the body is giving the person an important message: "Pay attention!"

The sooner appropriate healing begins, the better are the person's chances of full recovery. Early warning signals are too frequently ignored and often result in more severe injuries that may incapacitate the person for months or years. Curtailing activities or resting for a few days may be all that is needed. In other circumstances it may be necessary for the person to be treated by a

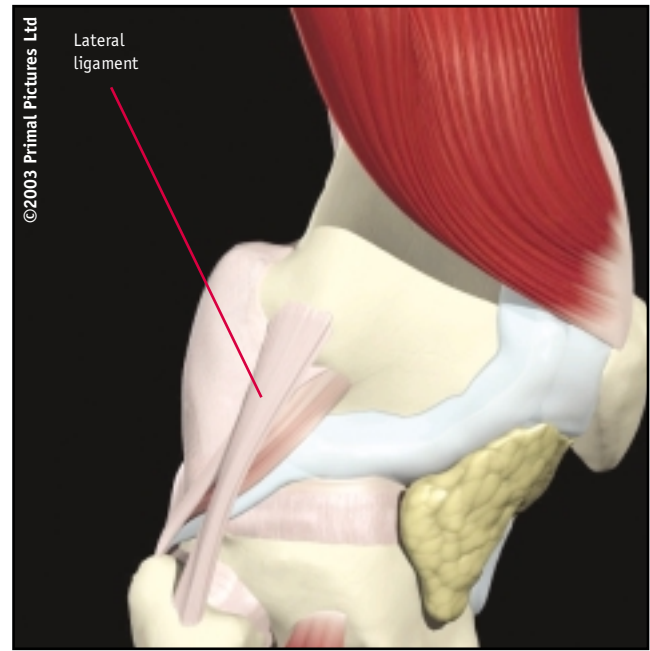


Figure 1b: Lateral collateral ligament of the knee

physician or hands-on healthcare practitioner.

It is essential to see a doctor if:

- The pain is very severe
- There is paralysis
- There is numbness or constant pins and needles in the arms, hands, legs or feet
- The area is swollen
- A snapping sound or tearing sensation accompanied the injury
- There is weakness of the injured body part
- There is extreme limitation of movement or inability to use the injured area
- There is malfunction of the bladder or bowel
- There is associated nausea, vomiting or blurred vision
- The person is disorientated, dizzy or cannot perform normal activities because of the injury.

Application: Pain signals at the medial and lateral aspects of the knee

In a medial or lateral collateral knee injury, regardless of where along the ligament the lesion is, pain is felt directly on the medial or lateral side of the knee.

A collateral ligament sprain generally arrives in one of two ways. Suddenly, as if hit by lightning, a person finds themselves on the ground. They fell or were tackled, and the knee buckled inwards (medial collateral) or outwards (lateral collateral). Perhaps the person heard a snapping sound, but more likely it was missed in the confusion of the fall. The person's knee hurts everywhere and often the patient hobbles off trying not to bend it. Over the next few hours the knee swells, feels hot to the touch, and continues to ache. With the passing hours, the knee stiffens, making bending and straightening difficult, and by the next day the pain begins to concentrate on the inner or outer side of the knee. Activity automatically becomes limited because walking is painful and anything more strenuous is impossible.

In the second case, a person might start feeling a twinge of pain

now and then while playing tennis, running or hiking. After a few weeks the pain settles on the inside of the knee and is more constant. There may be slight swelling or maybe not. The person begins to notice pain as he begins an activity, then the pain goes away and an hour or so, after finishing the activity it hurts again. The pain mysteriously disappears in the midst of activity because the ligament warms up (and this often relieves the pain). Eventually the person can no longer do certain strenuous activities without pain.

In both these cases the problem is the same - a torn medial or lateral collateral ligament. This mysterious injury has many personalities. It can come on quickly with mild, moderate or severe pain or it may develop more slowly and be either mild or moderately painful. No matter how it starts it often lingers for a long time, causing confusion by coming and going. The medial collateral ligament injury usually prompts the phrase "my dodgy knee", as the pain has a habit of appearing and disappearing mysteriously. When the injury results from trauma, it's easy to understand what caused it. When it appears slowly, the causes are subtle and often interlocking: poor leg alignment with knees turned-in or out; excess muscle tension, which leads to early fatigue; or loose or stretched ligaments caused by old sprains or poor stretching exercises.

PRINCIPLE: SCAR TISSUE AS THE SECRET OF CHRONIC PAIN

Sometimes the acute pain of an injury disappears completely and the patient is never bothered by it again. Sometimes pain becomes a chronic problem. Most people do not realise that the cause of most chronic pain from soft tissue injuries is the initial poor healing of the injury. Adhesive scar tissue forms, binding the originally damaged tissue to the adjacent soft tissues. Scar tissue formation is normal when soft tissue injuries are repairing. When scar tissue forms in the appropriate places, it is the biological glue that holds torn fibres together. However, if this healing process occurs in a random fashion, the scar tissues form a jumbled mass of adhesions that tear on normal movement.

Scar tissue within the musculo-skeletal system forms primarily in ligaments, tendons, muscles, fascia and joint capsules. When scar tissue forms in the fascial tissue, it often binds the skin to its underlying fascia, limiting the movement of the skin. If this abnormal scar tissue is placed under tension, the nerve endings in the skin and the underlying fascia are stimulated, producing pain. Fascia also lies deep in the body, where its purpose is to envelope and to provide a gliding surface for muscles, tendons, ligaments and other structures.

Putting tension on this scar tissue in the deeper fascia again stimulates local nerve endings and produces pain. Methods of fascial release can be employed with beneficial results. However, until all the abnormal adhesive scar tissue is removed from all of the affected structures, a pain-free state cannot be achieved.

Movements that excessively stress the damaged tissue result in re-injury. This re-injury results in the formation of more adhesive scar tissue. Understanding how to encourage the correct healing of tissues prevents these complications. Breaking the cycle of tearing and re-tearing of adhesive scar tissue is the key to effective treatment.



Application: Scar tissue and chronic pain at the medial and lateral knee

A complication of torn collateral ligaments is the "dodgy-knee" syndrome. In one way or another, the ligament has been sprained, and though there are brief reprieves and the person begins to think, "It's gone, I've beaten the problem", the pain then returns. It can recur with what was seemingly a simple activity such as helping a friend move some boxes up a flight of stairs, squatting for five minutes while weeding in the garden, running a mile every other day for two weeks, or making a dash to catch the bus. Troublesome adhesive scar tissue that keeps re-tearing is the key to understanding this mystery.

When the knee bends and straightens, the collateral ligaments normally move freely across the bone on the medial and lateral sides of the knee. If a collateral ligament is injured and heals properly, the scar tissue that's formed within the ligament does not interfere with its free movement. However, if the injury doesn't heal well, scar tissue may form a matted scar within the ligament or between the ligament and the bone where it is not supposed to be attached.

This scar tissue often acts like glue, adhering the ligament to the bone so that its free-sliding movement becomes more limited. If activities are strenuous and jarring, or involve twisting, the scar tissue does not hold and tears repeatedly. When a ligament warms up during activity, pain often diminishes or disappears temporarily. An hour or two later, when the ligament has cooled down, the pain intensifies or returns. This cycle of poor healing and scar tissue re-tearing can happen hundreds of times over many months or years. In its most extreme form the ligament completely ruptures and the knee becomes unstable. This event tends to only occur in very serious accidents or severe falls. If it does occur, the person should see a doctor immediately.

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PRINCIPLE: INJURY VERIFICATION THROUGH RESISTED AND PASSIVE TESTING

A therapist should begin the assessment of a client by obtaining a complete history of the injury, including a description of the location of the pain, any traumatic event that led to the injury and any factors that aggravate or relieve the pain. The therapist can further verify the injury through palpation and by applying a series of simple tests to the region. These tests will help the therapist pinpoint the location of injured structures, evaluate the severity of the injury and develop a rationale for a treatment plan.

A resisted test is an isometric contraction against resistance that does not involve movement of the limb. This type of test primarily tests for injury to muscles and tendons (ie. those structures which initiate movement). It also tests for weakness when there is disc pressure on the nerve.

A passive test is when the client behaves like a rag doll and does not assist during the movement that the therapist takes the client through. Passive tests primarily check for injury to ligaments, joints and bursas, structures that do not initiate movement.

Application: Verification of collateral ligament knee injuries

One of the clearest signs of a collateral ligament injury in the knee is the location of the pain. If you know how to palpate these ligaments, you can find the precise source of the pain. The lateral collateral ligament is easy to find. When a person crosses their legs, the lateral collateral becomes taut and sticks right out at the lateral knee. To find it place your finger on the head of the fibula just below the lateral knee while the legs are crossed and move superiorly until you come to the attachment on the femur.

The medial collateral ligament is a little trickier to find because the ligament is flattened against the bone. To locate it let the person lie supine and bend the knee so that the foot is on the table. Place your finger at the inferior pole of the patella - this puts you at the joint line. Slide your finger medially in the crevice of the joint line ninety degrees until you reach the ligament. It is relatively close to the skin surface. Injuries to this ligament often occur at the joint line in the middle of the ligament.

Resisted tests should not cause pain in cases of collateral ligament injuries, since the resistance tests active structures such as muscles rather than the ligaments. The following list offers one palpation test and four passive tests to help you assess whether the collateral ligaments of the knee are injured.

TESTS

Testing for heat

Place the back of your hand alternately on the inner side and then outer side of both knees and compare their relative heat. If there is active inflammation and swelling in one knee, there is usually a heat differential.

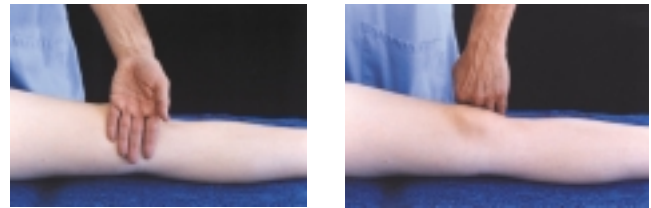


Figure 2a+b: Testing for heat differential on medial and lateral aspects of the knee



Passive knee flexion test

Lift the knee slightly toward the chest and gently flex the knee by bringing the heel toward the buttock. If you reach the buttock without pain or limitation, give the foot a slight push toward the buttock. If the knee is swollen you will not be able to bring the heel to the buttock, so do not force it. If the motion is limited, check the other knee to see that it is not just the person's natural structure.



Figure 3: Passive knee flexion test

Passive knee extension test

Place one hand under the Achilles tendon and the other hand above the knee. Now press down with the hand above the knee, while simultaneously pulling up with the hand under the Achilles. You are gently, passively trying to straighten the knee. If the knee is swollen, movement will be slightly limited and/or painful.



Figure 4: Passive knee extension test

Valgus stressing of the medial knee

Standing next to the knee facing the person's head, place your outer hand on the lateral aspect of the knee with your fingers just under the knee. Then, place the palm of your inner hand on the medial ankle as shown in the photograph. Now apply a shearing force in opposing directions to stress the medial knee. In other words push laterally with the hand on the medial ankle and medially with the hand on the lateral knee. If there is no pain when

the knee is taut, give it a slight extra push. If there is still no pain, slide the leg off the table laterally and repeat the test with the knee slightly bent (about one inch).



Figure 5: Valgus knee stress test

Varus stressing of the lateral knee

Facing the client's head, place your outer hand on the lateral ankle. Then place your inner hand on the medial knee with your fingers just under the knee. Now apply a shearing force in opposing directions to stress the lateral knee, that is, press laterally with the hand on the medial knee and push medially with the hand on the lateral ankle. If there is no pain when the knee is taut, give it a slight extra push. If there is still no pain, repeat the test with the knee bent only one inch by slipping the leg off the table. If the valgus test or the varus test causes pain, you have verified a strain of the medial collateral or lateral collateral ligament respectively. It should hurt where the person normally feels pain. If the injury is severe, you have to exert only a small amount of pressure during the test. If it is mild, you must exert more pressure. If passive flexion and/or passive extension are painful or limited in the ability to move through a full range of movement it means that there is some swelling accompanying the collateral ligament injury. Collateral ligament injuries are often accompanied by a tear of a ligament that attaches the meniscus to the tibia (the coronary ligament). These two ligaments are often injured simultaneously.



Figure 6: Varus knee stress test

PRINCIPLE: HEALING INJURED TISSUES

Most of the body's healing processes proceed without our conscious direction. When musculo-skeletal structures are damaged or torn, the body's wisdom ensures that the damage, whenever possible, will be repaired. However, to a large extent the degree and quality of this repair depends upon our own participation. The natural mechanisms of inflammation and wound healing are usually excessive for the job at hand. The body over-compensates when it responds to injury. More plasma, red and white cells, blood platelets and chemical mediators are released than are actually needed to allow full healing to occur. Therefore, additional scar tissue is likely to form. This scar tissue often binds together damaged and undamaged structures, resulting in adhesions that, as we have seen, can lead to re-injury and to chronic pain.

There are several methods by which we can help the body limit the formation of adhesive scar tissue and/or recover from adhesions that have already formed. The first of these methods is friction therapy. A therapist applies cross-fibre friction therapy in a controlled manner to break up specifically targeted areas of adhesive scar tissue. When friction therapy is accompanied by the second method, healing in the presence of a full range of motion, healthy tissue can grow without the re-formation of adhesions. This means that in order to heal properly, the body part must be regularly moved through its full range of movement during the healing process so that adhesions do not form. If the injured person is able to collaborate with the body's healing processes by adequate



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physical movement, complete healing is more likely. If the person is unable to perform the required exercises by him or herself, it is important to have a therapist assist the person in a full range of motion of the injured part.

Application: Treatment for injuries to the collateral ligaments of the knee

Friction therapy applied to injured collateral ligaments, along with full range of movement of the knee, can be a safe and effective treatment for these injuries. The therapist should also be aware of other treatment options and refer the client to other practitioners when necessary.

TREATMENTS

1. Deep massage and friction therapy

This is an effective treatment for medial and lateral collateral knee ligament injuries if done twice a week for three to four weeks. It speeds the healing of the ligament and prevents scar-tissue formation, especially if done soon after the initial injury. In long-standing cases, treatment may take longer and may need to be combined with manipulation by a physiotherapist, chiropractor or osteopath to free the ligament from the bone.

Friction therapy for the medial collateral ligament

Sit on a stool next to the injured knee and place your index finger at the lower pole of the patella. Now trace the joint line with a moderate pressure as you move around the knee toward the table in a straight line medially. Half way down toward the table you will feel the ligament under your finger. It feels about a quarter of an inch wide and a sixteenth of an inch thick. It isn't that easy to find until you know it. Place your middle or index finger over the ligament and apply a friction stroke upwards, then relax as you bring your hand back to your original position. Friction for five or six minutes, take a break and repeat again for five or six minutes. Most often the ligament is injured here at the joint line, but it may be injured as well at the tibial attachment or at the femoral attachment. In that case, those areas must be frictioned also.

Friction therapy for the lateral collateral ligament

Sit on a stool next to the injured knee and place your thumb on the head of the fibula just below the lateral knee. Now move superiorly toward the condyle of the femur with a moderate pressure. Halfway towards the femur you will feel the ligament under your finger. It feels like a tight band about a quarter of an inch wide. It is sometimes easier to find if the client crosses the leg, placing the ankle of the bad knee just above the opposite knee. This causes the lateral collateral ligament to protrude out from the knee. Once you have located the ligament, palpate for where the pain is felt. This is where the primary scar tissue is located. Using your middle or index finger over the ligament, apply a friction stroke upwards, then relax as you bring your hand back to your original position. Friction five or six minutes as described above, take a break and repeat again. Most often the ligament is injured here at the joint line, but it may be injured as well toward the fibula attachment or toward the femoral attachment. In that case, those areas must be frictioned also. After frictioning the ligament, deep massage should be applied to the front thigh and knee area. This will enhance the circulation and speed healing and the removal of waste products. Don't neglect working on the other leg as it is usually doing double work to compensate for the injured leg.

2. Exercise therapy

The knee must be moved under a little stress so that adhesive scar tissue does not reform. As a first exercise have the client sit and swing the leg for two or three minutes several times a day. After three or four treatments have the person lean against a door and do 10 to 20 mini knee squats where the knee bends no more than 45 degrees. As the knee improves the squats should deepen so that the thigh and lower leg are at a 90 degree angle. These exercises prevent the re-establishment of adhesive scar tissue while building strength in the muscles and ligaments.

3. Manipulation

This is only effective where there is an external adhesion to the femur. This occurs with medial collateral ligament tears only.

4. Anti-inflammatory injection

An anti-inflammatory injection is helpful in stopping inflamma-

RESOURCES

- Cyriax JH. Cyriax's Illustrated Manual of Orthopaedic Medicine. Butterworth Heinemann 1996. ISBN: 0750632747
- Dr Milne Ongley is a leading expert in the field of non-surgical reconstructive therapy. For more information www.ongleyonline.com

tion and pain and preventing internal adhesions when friction is not successful. It is also effective in the chronic stage when there are adhesions to the bone. The injection, when properly given, ruptures the adhesions and prevents additional adhesions from forming.

5. Proliferant injection

If the ligament has been excessively stretched and weakened, massage, exercise, oral medication, manipulation, or other methods of treatment cannot, to my knowledge, tighten the ligaments. Proliferant injections cause the ligaments to tighten and strengthen. A proliferant is usually composed of dextrose (a sugar), glycerine (which helps the blood congeal), xilocane (the stuff the dentist uses to numb your mouth) and phenol (which acts as a sterilising agent). The dextrose is the main active substance; it irritates the ligament or tendon tissues and tricks the brain into producing (proliferating) many like cells of tissue. There are three goals of the proliferant treatment procedure: first, to break up adhesive scar tissue, second, to tighten the stretched ligaments and third to strengthen the weakened ligament fibres.

6. Surgery

If the ligament has been completely ruptured, surgical repair is best performed as soon as possible. After the initial recovery period, rehabilitative exercise therapy and deep massage aid in the healing process.

CONCLUSION

The principles discussed here not only changed the way I view injury and the healing process, but also changed the ways in which I assess, verify and treat the people who come to me with acute and chronic pain. I hope you have gained a picture of the importance these principles can have in your day-to-day work with your own clients.

The techniques described here take time and practise to master. These who wish to gain proficiency in this very precise approach to pain and injury may wish to pursue further training. As you gain more experience with orthopaedic massage - performing assessment tests, locating injured structures and practising friction therapy - your treatments will be more effective and your clients will improve more quickly.

THE AUTHOR

Ben Benjamin holds a PhD in sports medicine and education and is the founder and president of the Muscular Therapy Institute in Cambridge Massachusetts. He studies with Dr James Cyriax the 'father of orthopaedic medicine' and has applied his insights to the healing of soft tissue injuries through skilled massage therapy. He has been in private practice for more than 40 years and teaches extensively.

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