

SCIENTIFIC

PHYSICAL THERAPY

Patient with recently released locked right knee

CASE STUDY

By Matt Hatscher P.T.

HISTORY:

The patient is a 48 year old male with mild discomfort in his R knee. He states his knee was “locked” until 4 days ago (he was unable to fully straighten his leg) when it was resolved following a “click” in his knee. Locking of the knee has reportedly occurred once in awhile over the last few years. It also occasionally swells up. The discomfort is described as a feeling of “tightness” across the front of the knee. Patient states it feels like there’s “gravel” in his knees and there has been audible grinding in both knees (R>L) for several years. Currently, he works with horses and has to squat and kneel frequently which increases the discomfort. There is no history of traumatic injury to his leg but he did play football growing up. He has not received any forms of treatment other than recently starting Vioxx.

Inspection: Mild swelling in R knee anteriorly. No significant atrophy, hypertrophy, or scarring.

Functional movements/AROM: During gait, patient exhibits decreased extension in R knee during heel strike. Squatting is painful and there is significantly audible grinding in both knees. AROM is WNL but end range pain medially is noted with knee flexion and also external rotation.

PROM: All motions WNL but end range pain is again noted with flexion.

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By Didrik J Soplér, PhD., L.Ac.

Resisted Tests: All motions WNL for strength. Pain provoked with knee flexion in the shortened position and knee extension in the lengthened position.

Palpation: Tenderness noted at medial joint line.

Neurology: Myotomes, sensation, and DTR's all WNL.

Special tests: All ligamentous tests WNL. Pain provoked medially with combined knee flexion and external rotation. Inconsistent clicking with extension and external rotation.

Mobility testing: Patellar mobility WNL. Grade 2 hypomobility with distraction and IR at the tibio-femoral joint.

Diagnostic testing: No X-rays or MRIs at this point. Dr. considering MRI if P.T. not successful.

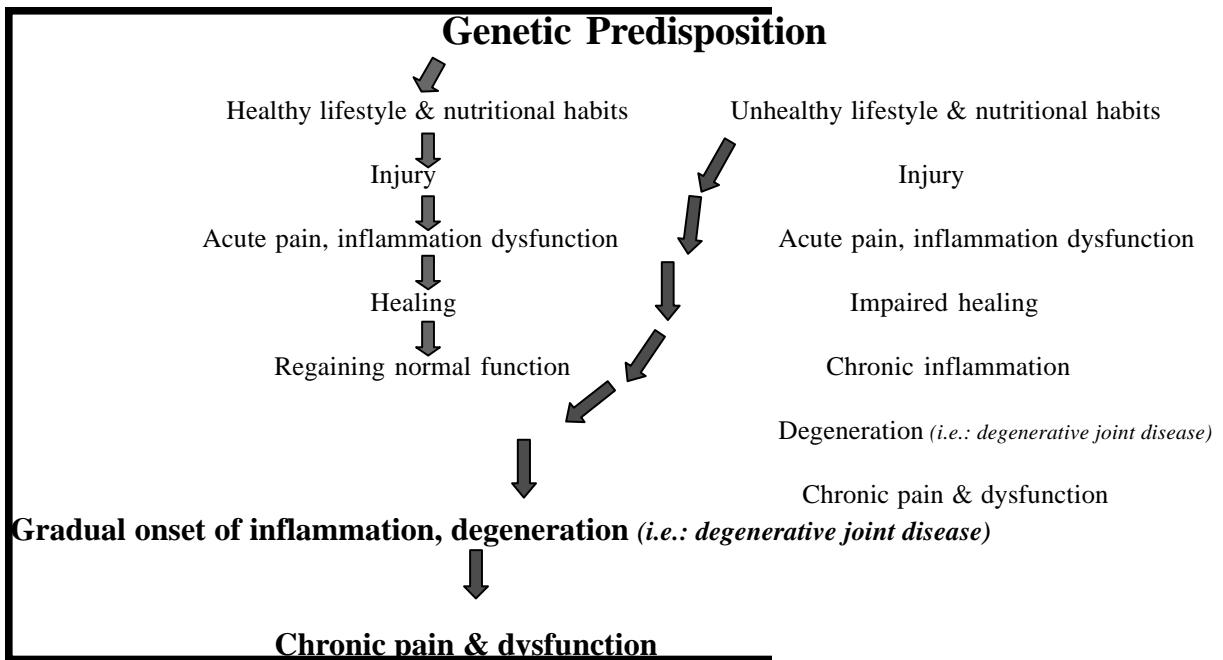
Treatment: Initial treatment included tibio-femoral distraction and tibial IR joint mobs. Exercise included seated knee flex-ext in 45- 90 degree ROM 3 x 25 and Vigor Gym squats at L5 for 3 x 50. Patient was instructed to try to avoid pain and deep squatting as much as possible. Home program included standing HS curls and dangling his leg while seated on a table.

After 3 treatments patient reported decreased tightness and improved function but swelling still returning following activity when not using meds. Patient and P.T. both agree he should not try meds for awhile to see if P.T. is truly beneficial for him. 2 weeks later, knee has swelled once and patient states he has been able to perform ADL's and complete work without pain. Current treatment includes the above mobs, Vigor gym L8 3x50, bike x 10 min, resisted HS curls and knee extension for coordination training.

The importance of nutritional tissue support in orthopedics and sports

By Didrik J Sopler, PhD., L.Ac.

Looking at physiological tissue requirements and scientific research there is an abundance of evidence supporting the importance of nutritional tissue support to enhance treatment outcomes. What brings patients in for treatment is usually injury, inflammation, and degeneration. This in turn leads to pain and dysfunction which is what the patient is concerned about.



The genetic predisposition for chronic disease varies greatly. An individual with good genetics will usually heal up within a normal amount of time when exposed to an injury; the individual with genetic impairment may instead develop a chronic condition. A genetic predisposition to inflammation and degenerative joint disease will usually gradually be expressed even without the incidence of an injury.

It is, however, more than the involvement of genetics when an individual develops a chronic condition. More and more research is now supporting the theory that lifestyle and nutritional habits have a large impact on genetic expression. Imperfect genes can be compensated for by a healthy lifestyle and specific nutritional support to important tissue. Metabolic pathways affected by the genetic predisposition can also be supported.

By supporting all connective tissue; bone, cartilage, ligament and tendons as well as neuromuscular function, the treatment outcome can be improved. This may seem complicated, but it can be easily implemented with formulas consisting of the key nutrients specifically made for this purpose. This type of nutritional support can significantly help to reduce symptoms and also increase tissue regeneration.

There is also well documented research to justify these recommendations. If the physiological effects of certain foods were briefly explained, patients could gain long term benefits. In chronic inflammatory conditions like bursitis, tendonitis and arthritis; arthritis also including degeneration, the goal would be to decrease inflammation and stop the degeneration. While there may be many nutrients that can be recommended for these types of conditions, what will be covered in this article are the most important issues based on scientific research. It is important that the daily diet is healthy. A major reason for this is that the diet affects inflammation and energy production. The glycemic index of food is a rating of how high a set amount of that food elevates the blood glucose levels, compared to glucose or white bread. It was first developed for the care of diabetic patients, however it can be a very useful tool for non-diabetics as well.¹ The reason is that high glycemic index foods (*food that elevate the blood sugar high*), if eaten often, leads to insulin resistance.² Insulin resistance in turn leads to increased inflammation and decreased energy production.

What is insulin resistance?

Insulin is released by the pancreas in response to blood sugar levels. The higher the blood sugar the more insulin is released. Insulin's role is to transfer the blood glucose into the cells to be used for energy. In insulin resistance the receptor sites on the cells become impaired and less glucose is able to be transferred into the cells. This in turn will lead to an increase production of insulin as the body attempts to compensate. As less glucose is transferred into to cells the blood sugar will increase and cellular energy production decreases.

How does this relate to inflammation?

Insulin resistant patients will accumulate glycosylated protein which is formed when glucose reacts with protein amino groups. This results in oxidative stress reactions and a shift towards inflammation.³ Increased insulin levels have been found to raise levels of the pro-inflammatory cytokines interleukin 1 and 6 activating the arachidonic acid cascade, which is a part of the inflammatory response.⁴ Arachidonic acid in turn converts to

prostaglandin E₂ producing inflammation and pain. Insulin resistance may also lead to adult onset diabetes if the pancreas is not able to compensate with increased production of insulin.

How can you recognize insulin resistance in patients?

There are laboratory test which will measure blood glucose and insulin levels both fasting and after glucose loading. Even if a patient does not get tested for this, there are certain signs and symptoms which usually can be observed. These are increased waist to hip ratio (accumulation of fat around the waist), tiredness and sleepiness after eating, tendency toward inflammatory conditions, elevated cholesterol and/or triglycerides and usually elevated fasting blood glucose levels.

A low glycemic index diet is not only important for patients with inflammatory conditions, but very important for athletes, to get access to optimal energy production. After a meal has been digested and absorbed, the glucose which is not used for energy at the time is stored as glycogen in the muscles and the liver to be used as energy later when needed.

If there is still glucose left over, it will be converted to fat and stored as fat.

For optimal performance both regarding immediate strength performance like weight lifting or an endurance event like running, the glycogen storage in both the muscles and the liver should be filled to full capacity. When a high glycemic index meal is eaten the blood glucose level will rise up very high, followed by a drop due to a large insulin release resulting in lower blood glucose and decreased energy. If this type of meal is eaten before an endurance event it will not be conducive to optimal performance. High glycemic index nutrients will be of benefit only **during** an endurance event when it can be used as immediate energy and have a glycogen sparing effect. Immediately after such an event it can also be used to help recover quicker by replenishing the glycogen stores.

In fact years ago an interesting Tour de France simulation study showed how effective the right type of carbohydrates can be when used at the right time for improving performance.⁵ When a carbohydrate structure consisting of 85% maltodextrin and 15% fructose was added to a nor-

mally high carbohydrate rich diet in one group, it improved performance by 126% when compared with a group eating only the normal carbohydrate rich diet. The most effective way to eat before an endurance race would be to eat a low glycemic index meal a couple of hours before the event, and then during the race drink a carbohydrate mixture as described in the study.

What is a low glycemic meal?

A low glycemic meal is a meal where different foods are combined so when the whole meal is eaten it will not result in a high blood glucose level.

Foods like bread, potatoes, rice and pasta, if eaten alone, elevate the blood sugar high. They can however be combined with high fibrous vegetables, lentils or beans and also protein to prevent raising the blood sugar high. The addition of vegetables, lentils or beans will help to slow down the absorption of the glucose, contained in these foods. A large baked potato, if eaten by itself, will raise the blood glucose very high, but if the potato or potatoes are smaller and combined with vegetables and protein like fish or

chicken, the overall glycemic index for the meal will not be as high. A lunch salad made with different kinds of vegetables adding either beans or lentils will produce prolonged energy without the feeling of tiredness after eating. Protein like fish, chicken or turkey can also be added to a meal like this for a higher protein content and half an avocado can also be added to increase the calories and the amount of Omega 6 fat to the meal.

By adapting these principles for eating, insulin resistance can be prevented and also reversed if present. The inclusion of the essential fatty acids Omega 3 and Omega 6 in the diet is also very important. These types of fats are important for many reasons. Especially Omega 3 fats, coldwater fish like salmon is a good source, has shown to help inhibit inflammation.⁷ Both essential fatty acids and a variety of plant derived supplements can be used effectively without side effects to inhibit inflammation. To cover that topic, which is quite extensive, is outside the scope of this article.

What are the most important nutrients for the support of the different connective tissues?

For bone support calcium, magnesium and vitamin D are the most important supplements. Other trace minerals like zinc, copper, and manganese are also needed.⁸ Boron, which may have a light estrogen effect, may also be helpful as well as vitamin K which also effects clotting.^{9, 10} Several studies have shown that supplementation with calcium is effective in reducing bone loss in post menopausal women.^{11, 12, 13, 14, 15, 16} It is, however, important not to wait to take calcium until menopause. To prevent osteoporosis, calcium supplementation should be started earlier in life. A two-year study compared perimenopausal women who took either 1000mg or 2000mg of calcium daily with a placebo group.¹⁷ The control group showed a 3.2% loss of bone density in the spine, while the calcium treated groups increased bone density by 1.6%. There was no difference between the groups taking 1000mg or 2000mg, so it is not necessary to take really high amounts. Bone magnesium levels have shown to be lower in women

with osteoporosis.^{18, 19} When bone density levels were measured of the femoral neck in older women for two years, a group taking 400 IU of vitamin D₃ showed a significant increase in bone density compared to the placebo group which instead showed decreased levels.²⁰ Another study showed that vitamin D₃ reduced the rate of hip fractures by almost 60%.²¹ Exercise, even if it is not discussed in this article is very important in the prevention of osteoporosis and the hormonal balance certainly also plays a role

What are the most important nutrients for support of the other connective tissues like cartilage, ligaments and tendons?

Glucosamine is required for the synthesis of glycosaminoglycans, which is a common building block for cartilage, ligaments and tendons. It helps to stimulate the metabolism of synoviocytes in tissue and chondrocytes in articular cartilage. Glucosamine sulfate has shown in many studies to decrease pain effectively in osteoarthritis when given a dosage of 1500mg per day.^{22, 23, 24, 25, 26} When glucosamine sulfate was compared to the drug

Ibuprofen, the study showed that for the first 4 weeks Ibuprofen provided better pain relief.²⁷ After four weeks however the glucosamine sulfate relieved pain more effectively. This is not the only effect of glucosamine sulfate; it has also shown to stop cartilage degeneration. A study published in "The Lancet," investigated the effects of glucosamine sulfate over 3 years.²⁸ The joint space of the knees in patients with osteoarthritis were measured in the beginning and at the end of the 3-year-study period. The investigation found that the group receiving glucosamine sulfate still had the same height of the joint space after 3 years as they had at the start of the study, while the control group had lost joint space. No side effects were detected from the use of glucosamine sulfate over the 3-year-study. The same type of study was later repeated by other investigators verifying similar results.²⁹

Other important nutrients are zinc, copper and manganese. Manganese is important for collagen formation.³⁰ Zinc and copper are needed to form collagen as well.³¹ Vitamin C is a cofactor in the synthesis of collagen and is therefore

important.³² Both vitamin C and vitamin E are important antioxidants and they have both shown to have cartilage protective properties.³³ The minerals zinc, copper and manganese in addition to being important for collagen formation, are also needed for the production of superoxide dismutase, which is the body's own antioxidant enzymes.

Vitamin B₆ is another vitamin which is important in the formation of collagen.^{34, 35} Neuro-muscular function is also affected by calcium and magnesium. Complaints of muscle cramps can usually be eliminated by increasing the intake of calcium and magnesium, unless there is an existing neurological condition causing the symptoms. Potassium and sodium loss can also cause muscle cramps. Some athletes, who perspire heavily, may need to increase salt intake if they compete in long endurance races.

Summary

A low glycemic index diet is important for proper control of the glucose, insulin metabolism which affects energy production and inflammatory regulation. Support the tissue treated which in orthopedic cases includes all the connective tissues with the most important nutrients: calcium, magnesium, glucosamine sulfate, zinc, copper, manganese, vitamin B6, vitamin D, and vitamin C.

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