

The Integrative TCM Treatment of Cruciate Ligament Injury

Abstract

This article describes the integrative TCM treatment of cruciate ligament injury. It includes diagnostic information and strategies for treatment according to three phases: acute (absorption), sub-acute (reconstruction) and chronic (rehabilitation). Internal and external herbal medicine prescriptions are utilised, as well as acupuncture, moxibustion and other adjunctive TCM methods. Two case studies are included to illustrate the theory presented.

By: Karl Zippelius

Keywords:

Chinese medicine, cruciate ligament, traumatology, external application, Chinese herbal medicine, acupuncture, moxibustion, knee injury, integrative, musculoskeletal, TCM

Introduction

More and more people are participating in regular athletic activities, and thus the incidence of knee-joint injuries is increasing. According to the American Academy of Orthopedic Surgeons, with over 200,000 incidents per year in the United States, anterior cruciate ligament tears are one of the most common knee injuries.ⁱ

The stability of the knee joint is governed by four main ligaments: the medial collateral ligament (MCL) on the medial aspect of the knee, the lateral collateral ligament (LCL) on the lateral knee, and two ligaments inside the knee joint itself - the anterior cruciate ligament (ACL) and the posterior cruciate ligament (PCL). Further stabilisation and guidance of the knee joint derives from the knee-cap (patella), its ligament and the functional muscles of the leg. Two cartilaginous structures between the femur and the tibia, the menisci, act as absorbers for biomechanical load during movement. The ACL connects the thigh bone to the shin bone and is particularly important as it keeps the knee stable during stop and go movements, as well as preventing abnormal rotation and the tibia from shifting forward relative to the femur.

Most injuries of the cruciate ligament (CL) occur through non-contact mechanisms, while around 30 per cent result from direct contact with another player or object.^{ii,iii} The typical pathomechanism of ACL injury is that the knee joint is twisted too forcefully, particularly when the foot is planted (sudden deceleration) and direction is suddenly changed. Because of this, high-risk sports for ACL tears include football, basketball, soccer and volleyball. In certain activities like soccer, basketball and military training, females athletes are statistically more likely to suffer from tear of the ACL.^{iv,v} Various aspects are thought to explain this, including differences in physical conditioning, muscular strength, neuromuscular

control, pelvic structure, leg alignment, increased ligamentous laxity and the effects of oestrogen on ligament properties. Furthermore females may change direction - an important co-factor for non-contact ACL tears - differently to males.

The first sign of a tear of the ACL is that the person hears or feels a 'snap' in the knee. The knee then subsequently loses function in terms of stability (the patient typically reports it easily gives way). In time, swelling and pain typically increase. Injury of the PCL is very similar: there may be popliteal pain that radiates to the calf, plus swelling and dysfunction, although the symptoms are often less severe than with ACL rupture. Injury of the PCL is less frequent than the ACL and has less consequences in terms of stability and treatment. It typically occurs after a direct blow to the anterior tibia with a flexed knee (such as during a car accident), or after severe hyperextension of the knee or deceleration during sports.

Athletes fear ACL injury because a non-treated rupture of ACL results in chronic instability. The immediate consequence of an unstable knee is reduced ability to perform one's specific sport and technical gestures in the correct way. In the long-term, the pathological biomechanical loads during movement increase the risk of degenerative joint changes (post-traumatic osteoarthritis). This is why rupture of the ACL (less than the PCL) - even when treated with TCM or other effective methods - often requires surgical repair if the patient intends to continue with intense sporting activity.

Diagnosis

Clinical aspects and signs

A 'popping' sound may be heard by the patient during the incident, or they may simply have the sense of the knee 'giving way'. Subsequently the knee typically becomes increasingly swollen and painful.

The resulting instability of the knee joint often gives a feeling of unsteadiness.

Physical tests and radiological examination

To confirm a diagnosis of a ruptured CL, a physical test plus radiological examinations are required. Two physical tests are common and easy to perform:

- **Lachman Test:** The patient lies supine and the injured leg is bent to 20 to 30 degrees. The thigh is fixed with one hand while the other hand pulls and pushes the tibia (see Figure 1). If the tibia moves significantly more when pulling compared to the uninjured side, it is most probably the result of a torn ACL; if the tibia moves more while pushing, then the cause is likely a torn PCL.
- **Anterior Drawer Test:** This involves the same procedure as the Lachmann Test, but in this case the knee joint is bent to 90 degrees. If the tibia moves excessively anteriorly when pulled, a torn ACL is suspected.



Figure 1: Lachman Test [from Lam, M.H., Fong, D.T.P., Yung, P.S.H. et al. (2009). "Knee stability assessment on anterior cruciate ligament injury: Clinical and biomechanical approaches", *BMC Sports Science, Medicine and Rehabilitation*, 1:20, DOI: 10.1186/1758-2555-1-20]

If these clinical examinations suggest a CL injury, an MRI (magnetic resonance imaging) scan may be performed to obtain a more detailed picture of the knee; MRI is very accurate in determining whether a CL has been torn and if other tissues of the knee joint (such as cartilage, menisci, bone and muscles) have also been injured. Unfortunately, it is not always possible on the basis of an MRI scan to decide whether a CL is partially or completely ruptured. If it is only partially ruptured it can be worth trying to recover joint function without surgery.

Traditional Chinese medicine diagnosis

A TCM diagnosis involves identifying whether the injury is limited to a local/channel pattern of qi and blood stagnation, and if there are underlying deficiency patterns and/or pathogenic factors involved. The typical patterns associated with musculo-skeletal injury are as follows:

- **Qi deficiency:** this leads to reduced muscular protection of the joint during movement, with higher risk of ligament injury;
- **Kidney and Liver deficiency:** manifests with weak and/or rigid, vulnerable ligaments;
- **Internal pathogenic factors (dampness and heat):** these pathogens, especially when affecting the Liver, cause inflammatory reactions in the soft tissues that in the long-term change the microstructure of tendons and ligaments;
- **External pathogenic factors (wind, cold and damp):** these pathogens lodge in the channels and block the flow of qi and blood, making the joints vulnerable and weak.

Treatment

With or without surgery?

The first decision to be made in case of CL injury is whether it should be treated with surgery. The most important therapeutic aim is to recover stability of knee joint and to prevent subsequent post-traumatic osteoarthritis and future damage of meniscus or cartilage tissue during sporting activity, which are likely if the knee joint remains unstable. As mentioned above, significant instability of the knee joint arises from complete ACL rupture, whereas PCL injury has a less significant impact on global knee stability. This is why PCL injury is normally treated non-surgically. Complete ACL rupture is more often treated by surgical reconstruction. Astonishingly, spontaneous healing of a completely ruptured ACL is possible, even if it is rare.^{vi,vii} Naturally an ACL is more likely to heal if it is only partially torn. Furthermore, it is possible to increase the likelihood of healing if the injury is treated with TCM from the beginning. In most cases after ACL rupture it is difficult to compensate for the instability by merely building up leg muscle strength. The treatment strategy must be discussed case by case with the patient and according to his/her lifestyle and age.

Professional athletes must undergo surgery to reconstruct a damaged CL within the first 24 hours following injury, otherwise due to the swelling and haemarthrosis increasing with time, surgical reconstruction may only be done four to six weeks later. Patients that receive surgery immediately should receive TCM treatment post-surgery. All other patients can be considered 'non surgical' patients and treated by TCM and manual techniques for six weeks. If stability improves after this time, the patient may not need surgery; even if they decide to undergo surgery, the local conditions (less swelling and haemarthrosis) would favour a better outcome with quicker rehabilitation.

Integrative TCM treatment

The principal aims of CL injury treatment with TCM can be summarised in three stages as follows:

- Absorption stage (acute):
 - Topical (and if necessary internal) application of herbal medicine to accelerate haematoma absorption and reduce swelling
 - Acupuncture and tuina-anmo massage to provide pain relief and increase qi and blood circulation
- Reconstruction stage (sub-acute)
 - acupuncture and herbal tinctures applied to trigger healing process
 - early mobilisation to regulate process of repair
- Rehabilitation and mobilisation stage (chronic)
 - Acupuncture for pain reduction
 - Tuina-anmo massage combined with external application of herbs to soften hardness and expel pathogenic factors
 - Moxibustion to eliminate cold and damp from the channels
 - Physiotherapy to regain range of motion and normal joint function

1. Absorption stage (acute)

Duration: until blood stasis is dispersed and the haematoma is absorbed. Depending on severity this can last up to seven days.

First aid measures in conventional therapy for CL injury are summarised in the acronym 'RICE' (rest, ice, compression and elevation), in which, besides applying ice and compression, the injured part is elevated, immobilised and rested in a knee brace. The severity of the injury usually determines the type and duration of the immobilisation. The therapeutic principles for first aid measures according to TCM, on the other hand, are to unblock the qi and blood stagnation caused by the trauma as soon as possible. The widespread practice in the West of using ice therapy for acute injuries seems superfluous or even counterproductive from a TCM point of view: in the short term it may help to soothe pain and reduce swelling, but the longer it is applied, the more it decelerates qi and blood flow, which is already stagnant due to the trauma. TCM instead offers effective options to handle acute injury conditions without using ice. Internal and external herbal formulas, acupuncture and tuina-anmo massage can be applied in the acute and reconstructive stages to provide pain relief, increase qi and blood circulation and facilitate the rapid absorption of oedema and haematoma. Thus the basic conditions for reconstructive processes and surgery, if necessary, are improved and healing time is shortened.

An integrated treatment protocol for the acute stage of a cruciate ligament injury should include the following measures:

- Ice is indicated only during the very first moments (i.e.

minutes) after injury to constrict and stop blood and liquids passing out of vessels.

- Before immobilisation, a herbal paste should be applied to the knee and kept in place for five to eight hours to accelerate absorption of the haematoma.
- From the second day post-injury, a herbal tincture should be applied every three to four hours (the patient can do this his or herself), combined with gentle and superficial tuina-anmo massage techniques above and below the knee to relax the muscles and tendons.
- Non-steroidal anti-inflammatory pain killers (NSAIDs), especially cyclooxygenase (COX) inhibitors, should be avoided as these may delay healing.^{viii} Normally they are not necessary, and if there is intense pain an internal trauma formula can be given to improve qi and blood circulation and relieve pain.

These are the basic keys for a short acute/absorption stage, which allow a faster transition to the reconstruction stage. If the patient is able to start earlier with the reconstruction stage, a significantly shorter healing time can be obtained, and the risk of post-traumatic syndromes such as persistent pain and chronic osteoarthritis are reduced. Once the haematoma has reduced the second stage treatment starts.

Main treatment principles: Break blood stasis, move qi and blood, reduce oedema and pain, and accelerate haematoma absorption.

External herbal treatment

Tincture to dispel acute blood stasis, disperse swelling and reduce pain:

Zi Jin Jiu (Precious Purple Wine)	Quantity
Draconis Resina (Xue Jie)	6g
Carthami Flos (Hong Hua)	6g
Camphora (Zhang Nao)	3g
Alpiniae Officinari Rhizoma (Gao Liang Jiang)	12g
Piperis Longi Fructus (Bi Bo)	9g
Asari Herba (Xi Xin)	6g
Sinapis Albae Semen (Bai Jie Zi)	6g
Borneolum (Bing Pian)	3g
Rehmanniae Radix (Sheng Di Huang)	6g
Centipedae Herba (E Bu Shi Cao)	9g
Olibani Resina (Ru Xiang)	4.5g
Myrrha (Mo Yao)	4.5g
Ethanol (40-50%)	400g

Functions: Dispel blood stasis, promote blood circulation, disperse swelling and reduce pain.

Indications: Acute stage of traumatic soft tissue injury with swelling, haematoma and pain.

Preparation: All the drugs are ground to a powder, put into 400 grams of ethanol or spirit (40-50 per cent) and the container sealed airtight. After 10 days the medicated spirit is ready for use.

Administration: Rub into the knee every two to three hours.

Qu Yu Xiao Zhong Gao (Paste for Dispelling Blood Stasis and Dispersing Swelling)	Quantity
Draconis Resina (Xue Jie)	9g
Catechu (Er Cha)	6g
Olibani Resina (Ru Xiang)	9g
Myrrha (Mo Yao)	9g
Corydalis Rhizoma (Yan Hu Suo)	12g
Zanthoxyli Pericarpium (Chuan Jiao)	6g
Moschus (She Xiang) *	1.5g
Borneolum (Bing Pian)	1.5g (2g)
Stageoli Semen (Chi Xiao Dou)	30g
Lumbricus (Di Long)	30g

* If not available increase Borneol to 2g

Functions: Dispel blood stasis, promote blood circulation, and reduce swelling and pain.

Indication: Acute stage of soft tissue injury and fracture.

Preparation: All the herbs are ground into fine powder and mixed with honey to make a paste.

Administration: Apply to the injured part for several hours. In case of severe injury repeat every day for two to three days.

Internal herbal treatment

The following decoction can be taken internally to relieve pain and reduce the need for pain-relieving drugs:

Huo Xue Zhi Tong Tang (Decoction for Promoting Blood Circulation to Relieve Pain)	Quantity for 1-2 days
Angelicae Sinensis Radix (Dang Gui)	12g
Ligustici Chuanxiong Rhizoma (Chuan Xiong)	6g
Olibani Resina (Ru Xiang)	6g
Myrrha Resina (Mo Yao)	6g
Sappan Lignum (Su Mu)	5g
Carthami Flos (Hong Hua)	6g
Eupolyphaga seu Steleophaga (Tu Bie Ching) *	3g
Notoginseng Radix (San Qi)	3g
Paeoniae Rubra Radix (Chi Shao)	9g
Citri Reticulatae Pericarpium (Chen Pi)	5g
Centellae Herba (Tou Gu Cao)	6g
Cercis Chinensis Cortex (Zi Jing Pi) *	9g

* If difficult to find, may be substituted by increasing quantity of Lignum Sappan (8g), Paeonia rubrae Radix (12g) and Notoginseng Radix (6g).

Modification for CL injury, add:

Cyathulae Radix (Chuan Niu Xi)	6g
Milletiae reticulatae Caulis (Ji Xue Teng)	6g
Angelica pubescens Radix (Du Huo)	6g

Function: Promote blood circulation to relieve pain.

Indication: Acute traumatic knee injury with swelling and pain.

Preparation: The drugs should be soaked in cold water for half an hour before they are decocted. The water should cover the herbs by about an inch and a half, then cooked for 30 minutes.

Administration: Oral decoction.

Tuina-anmo massage

Beside rubbing *Zi Jin Jiu* into the skin of the knee area with superficial circular movements, gentle tuina-anmo massage techniques can be applied above and below the knee to relax muscles and tendons.

Acupuncture treatment

Acupuncture can move qi and thus relieve acute pain and reduce the need for pain-killers. At the acute stage of CL injury, reducing needling method can be used at the following points:

- Taichong LIV-3 and Hegu L.I.-4 (Si Guan, the 'Four gates'), the yuan-source points of the Liver and Large Intestine channels: promote circulation of qi in the channels and relieve pain
- Yanglingquan GB-34: benefits sinews and joints; local point to relieve knee pain
- Xuehai SP-10: promotes circulation of blood; local point to relieve knee pain

Furthermore, the first and last point of the affected channel can be needled with even technique, along with dispersing technique of its xi-cleft point (i.e. Liangqiu ST-34, Diji SP-8, Jinmen BL-63, Shuiquan KID-5, Waiqiu GB-36 or Zhongdu LIV-6). The qi of the channel accumulates at xi-cleft points and thus they are ideal to disperse stagnant qi and stimulate the flow of qi in the channels in cases of acute pain. As the acute pain will frequently be felt deep inside the knee joint and radiating along the Bladder channel (if the rupture area is close to the insertion of ligament to femur), this mean it will often be the Bladder channel that requires treatment by needling Zanzhu BL-2, Zhiyin BL-67 and the xi-cleft point Jinmen BL-63. Local ashi points can also be included to regulate local qi and blood circulation to relieve knee pain.

2. Reconstruction (sub-acute) stage

Duration: As the subdivision of trauma healing into three stages is only a theoretical model and physiopathological processes are gradually passing from absorption to

reconstruction, the decision about the right moment to pass from first stage to second stage treatment is based on different clinical aspects: observation of the superficial haematoma, swelling of the knee joint and time passed since the injury. This means that the second stage may start from the third to the seventh day after the injury, and last until the ligament is resistant enough for pulling forces during athletic movements. Depending on whether it is a complete or partial rupture of the CL and whether reconstructed by surgery or not, this stage can last from 45 to 120 days. Unfortunately most patients are not aware of the efficacy of TCM treatment during the acute stage of trauma, and tend to ask for it only after several days. Therefore untreated acute blood stasis is common, and will typically gradually transform into a chronic condition. The longer the blood stays in the joint and surrounding soft tissue layers, the more the body will increase the inflammatory reaction to absorb and eliminate dead cells and blood. Long term qi and blood stasis thus leads to local heat with the risk of the drying of tissue. This causes adhesions and damage of healthy body tissue. In the worst case this may lead to arthrofibrosis and the mobility and function of the knee joint can be permanently impaired. On the other hand, scar tissue and adhesions will obstruct the free flow of qi and blood in the channels, and a vicious circle may result. To prevent this, immediate herbal treatment in the absorption stage is recommended. Meanwhile in the second stage a combination of herbal applications, tuina-anmo massage and acupuncture are recommended to reduce swelling, stimulate and accelerate the healing process and improve the cellular structures. Physiotherapy (careful active knee joint movement) and manual treatment (passive knee joint movement) in this stage can help to prevent adhesions and stiffness and reduce swelling of the knee joint.

Main treatment principles: Move qi and blood, reduce swelling and stimulate ligament healing.

External herbal treatment

Tincture to promote blood and qi circulation, eliminate dampness and relax tendons:

Hai Tong Pi Jiu (Erythrina Bark Tincture)	Quantity
Erythrina Cortex (Hai Tong Pi)	6g
Speranskiae Tuberculatae Herba (Tou Gu Cao)	6g
Olibani Resina (Ru Xiang)	6g
Myrrha (Mo Yao)	6g
Angelicae sinensis Radix (Dang Gui)	6g
Zanthoxyli Pericarpium (Chuan Jiao)	9g
Ligustici chuanxiong Rhizoma (Chuan Xiong)	6g
Cartami Flos (Hong Hua)	3g
Clematidis Radix (Wei Ling Xian)	9g
Glycyrrhizae Radix (Gan Cao)	3g
Ledebouriellae Radix (Fang Feng)	6g
Angelicae dahuricae Radix (Bai Zhi)	9g
Ethanol (40-50%)	400g

Functions: Promote blood and qi circulation, dispel wind, eliminate dampness and relax tendons.

Indication: Sub-acute stage of traumatic soft tissue injury with swelling and pain.

Preparation: All the herbs are ground into powder, put into 400g of ethanol or spirit (40-50%) and the container sealed airtight. After 10 days, the medicated spirit is ready for use.

Administration: Rub into the knee three times a day.

Concerning external application of Chinese herbs, an animal experiment study aimed to determine the effectiveness of a herbal paste (see Table 1) in the promotion of fracture healing and the formation of callus of an artificially induced standard midshaft fracture of the rabbit tibia.^{ix}

Ingredients	Quantity
Sambucus Williamsii Ramulus (Jie Gu Mu)	30g
Dipsaci Radix (Xu Duan)	15g
Notoginseng Radix et Rhizoma (San Qi)	9g
Carthami Flos (Hong Hua)	9g
Rhei Radix et Rhizoma (Da Huang)	30g
Gardeniae Fructus (Zhi Zi)	9g

Table 1: Herbal formula used topically for bone fracture treatment (aqueous and ethanolic extracts mixed up to a paste).

In vitro this TCM formulation (Table 1) was able to significantly increase the cell proliferation rate in osteoplastic UMR-106 and human endothelium HUVEC cells. In vivo the bone-healing effect was shown by radiological findings. This study shows that external application of Chinese herbs not only has benefits in the first (absorption) stage, but may have stimulating effect on tissue healing. Whilst this research concerns bone tissue proliferation, traditional theory and clinical experience suggests that Kidney-tonifying herbs like Dipsaci Radix (Xu Duan) or Drynaria Rhizoma (Gu Sui Bu) can strengthen both bones and ligaments. They should be used, always as part of a formula, during the second stage of treatment of joint or bone injuries.

Internal herbal treatment

Pills to promote healing of the CL:

Qiang Jin Wan (Sinew-Strengthening Pill)	Quantity
Cyperii Rhizoma (prepared) (Xiang Fu)	10g
Achyranthis Bidentatae Radix (Niu Xi)	10g
Dipsaci Radix (Xu Duan)	10g
Olibani Resina (Ru Xiang)	5g
Myrrha Resina (Mo Yao)	5g
Polygalae Radix (Yuan Zhi)	5g
Glycyrrhizae Radix (Gan Cao)	3g

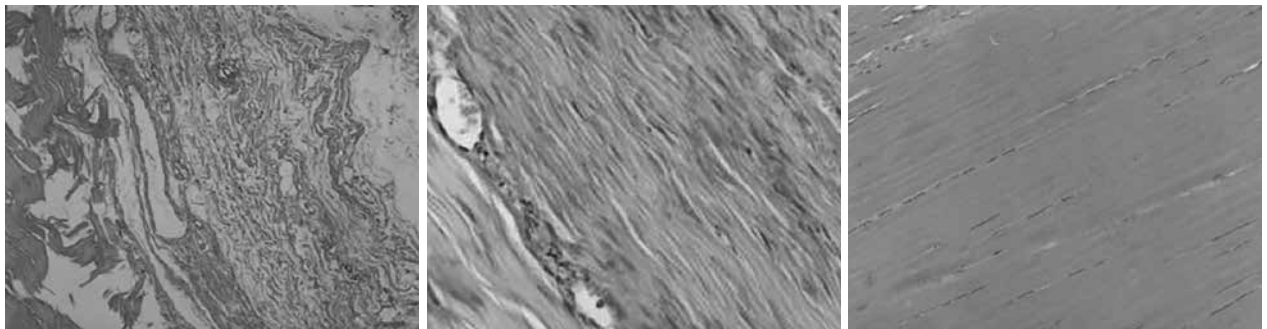


Figure 2: Longitudinal section of the Achilles tendon in the control group (left), of a treated dog 60 days after splitting (middle) and a normal section of the Achilles tendon on day 0 (right) (Sharifi et al., 2009)

Functions: Promote qi circulation to remove obstruction in the collaterals, promote blood circulation, strengthen muscles and ligaments, and tonify the Kidney.

Indication: Healing of ligaments and muscles in the subacute stage.

Preparation: The drugs are ground into powder, which is mixed with honey to prepare pills.

Administration: Take 3-6 grams each time, two to three times a day.

Tuina-anmo massage

As mentioned before, patients often do not start with TCM treatment immediately after injury but later on. Acute blood stasis has therefore often not been properly treated and blood and fluids have not been eliminated from the joint and surrounding soft tissues. As a consequence heat will have arisen from the stasis, manifesting as chronic inflammatory processes. The tissues lose their elasticity and scar tissue and adhesions increase. As far as manual treatment is concerned, passive movements of the knee joint can be used to reduce the likelihood of adhesions. Gentle rubbing, pressing and pushing of the knee should be done to move fluids out of the joint.

Acupuncture treatment

According to TCM theory, stable and strong knee function can be supported by strengthening the Kidney and Liver and stimulating and harmonising the flow of qi in the channels. The following treatment is recommended:

- Points such as Taixi KID-3 (the yuan-source point), Shuiquan KID-5 (the xi-cleft point) and Yingu KID-10 (a local knee point) can be used to stimulate qi flow in the Kidney channel, reinforce the Kidney and strengthen the ligaments and knees
- Liangqiu ST-34 (the xi-cleft point) and local ahshi points can be used to clear local obstructions in the channels and relieve knee pain.
- Xuehai SP-10 can be added to increase local blood flow
- If there is swelling of the knee joint, Yinlingquan SP-9 (water point of the Spleen channel) can be included to remove dampness, and direct moxibustion can be applied at Weizhong BL-40.

As far as acupuncture treatment to improve tissue healing is concerned, a study revealed the effect of acupuncture on the healing process of the Achilles tendon in dogs after tendon splitting.⁸ The dogs were randomly divided into two groups from the third day after surgery, and only one group received acupuncture at Huantiao GB-30, Weizhong BL-40 and Zusanli ST-36 for 10 minutes daily over two weeks. Macroscopic changes showed that the dogs that received acupuncture treatment had less peritendinous adhesions, fewer inflammatory cells and a more regular and parallel arrangement of collagenous fibre bundles (Figure 2). This animal experiment study postulated that acupuncture stimulates cells to differentiate, leads to better formation and organisation of collagen fibres, and prevents soft tissue bonding.

Physical movement

The kind of physical exercise programme depends on whether the ligament has been reconstructed with surgery or not. The aim is to keep the joint flexible and prevent adhesions developing in the soft tissues. Partial immobilisation with a knee brace may be necessary for a while, although passive movements can start early. Active movements should be carefully integrated to improve ligament healing through biomechanical stimulation of the ligament fibres.

3. Rehabilitation and mobilisation stage (chronic)

Duration: Until full range of mobility with proper stability, and free flow of qi and blood, are completely restored. No pain or discomfort should remain, nor sensitiveness to weather changes.

The aim of the rehabilitation stage is to restore stable mobility of the knee without pain. Specific physical exercises should be used to stimulate - via tensile forces - properly directed and resistant ligament fibres. Therefore physiotherapy is a fundamental part of the rehabilitation treatment protocol at this stage of CL injury. According to orthodox medical thinking, an injury is considered cured as soon as the damaged structure has regained stability and daily work is manageable, or a return to sporting

activities is possible. Minor complaints and restrictions of motion, pain caused by load or sensitiveness to climatic changes are typically accepted or seen as inevitable. Practitioners of TCM take a different view. Any remaining symptoms are seen as an expression of latent qi and blood stasis and blocked channels. If left untreated, this situation will result in movement-induced pain, and in the long term can lead to osteoarthritis of the knee joint. Therefore it is essential to continue TCM treatment during the rehabilitation stage. As well as moxibustion, there are a variety of specific herbal formulas and methods that can be used to warm and open the channels, and move qi and blood.

Main treatment principles: Open the channels, eliminate pathogenic factors (wind, cold, damp or heat) and establish functional integrity and stability of knee joint.

External herbal treatment

Tincture to relieve rigidity of muscles of lower limb during rehabilitation:

Xia Zhi Sun Shang Xi Fang (Formula for Injury of Lower Limbs)	Quantity
Lycopodium Herba (Shen Jin Cao)	8g
Herba Speranskiae Tuberculatae (Tou Gu Cao)	8g
Acanthopanax Cortex (Wu Jia Pi)	6g
Sparganii Rhizoma (San Leng)	6g
Curcuma zedoaria Rhizoma (E Zhu)	6g
Gentianae Macrophyllae Radix (Qin Jiao)	6g
Cortex Erythrinae (Hai Tong Pi)	6g
Achyranthis Bidentatae Radix (Niu Xi)	5g
Chaenomeles Fructus (Mu Gua)	5g
Carthami Flos (Hong Hua)	5g
Sappan Lignum (Su Mu)	5g

Function: Promote blood circulation to relieve rigidity of muscles.

Indication: Muscular spasms and aches of injured lower limb.

Preparation and administration: The herbs are decocted in water, which is then used to fumigate and then bathe the affected limb.

Karl Zippelius will be presenting a two-day JCM Mastery Seminar on the treatment of acute and chronic trauma and other musculoskeletal conditions, October 28-29 2017, Brighton, England (jcm.uk/news/seminars-events)

Internal herbal treatment

Decoction to strengthen CL ligament:

Die Da Yang Ying Tang (Nutrition Increasing Decoction for Traumatic Injuries)	Quantity for 1-2 days
Panaxis Quinquefolii Radix (Xi Yang Shen)	3g
Astragali seu Hedysari Radix (Huang Qi)	9g
Angelicae Sinensis Radix (Dang Gui)	6g
Ligustici Chuanxiong Rhizoma (Chuan Xiong)	4.5g
Rehmanniae Radix preparata (Shu Di Huang)	15g
Paeoniae Alba Radix (Bai Shao)	9g
Lycii Fructus (Gou Qi Zi)	15g
Dioscoreae hypoglaucae Rhizoma (Bi Xie)	15g
Dipsaci Radix (Xu Duan)	9g
Amomi Fructus (Sha Ren)	3g
Notoginseng Radix (San Qi)	4.5g
Psoraleae Fructus (Bu Gu Zhi)	9g
Drynariae Rhizoma (Gu Sui Bu)	9g
Chaenomeles Fructus (Mu Gua)	9g
Glycyrrhizae Radix (Gan Cao)	3g

Functions: Replenishes qi and blood, tonifies the Liver and Kidney and strengthens muscles and bones.

Indication: Late stages of bone and ligament injury.

Preparation: Decoct in water.

Administration: Oral decoction.

If knee pain persists during the rehabilitation programme, the classical formula *Du Huo Ji Sheng Tang* may also be used to disperse wind-dampness, stop pain in the lower limb, tonify Kidney and Liver, and nourish the blood.

Tuina-anmo Massage

More forceful techniques can be used at this stage - especially in the area of the patella - such as traction, pressing, pulling etc. These will help to recover mobility and elasticity of the tissues, soften hardness and move qi and blood to reduce pain. Massage can be combined with warming methods such as moxibustion, and application of herbal liniments to open the channels and soften the tissues to help overcome rigidity and pain syndromes in the later stages of rehabilitation.

Moxibustion

The treatment principles with moxibustion are to move qi by warming, tonify yang and eliminate dampness, cold and wind. Whilst moxibustion is not an important treatment method in acute and sub-acute stages, in the later stages of trauma - especially in areas or seasons of cold, damp weather - it becomes very helpful to eliminate cold and damp from the channels and treat persistent pain and stiffness. The following treatment is recommended:

- Warm up whole knee area with a moxa stick
- 'Warm needle' moxa at extra point Xiyan (MN-LE-16) and Dubi ST-35 (the 'Eyes of the Knee')
- In case of swelling use direct moxa at Weizhong BL-40
- Use a moxa box on Shenshu BL-23 to tonify Kidney yang and warm the Spleen to transform dampness

Acupuncture

The focus of acupuncture treatment during the rehabilitation phase is to open the channels (according to radiation of pain) and facilitate free flow of qi to prevent re-injury and/or pain syndromes. Any underlying constitutional patterns of deficiency or excess should be treated. The tendino-muscular channels should also be treated, as they are always affected in cases of physical trauma and tissue damage. There are no specific points along the tendino-muscular channels. They can be treated by needling ashi points around the knee and the jing-well points of the channel affected. Other techniques such as tuina-anmo massage, guasha, moxibustion, plum-blossom needling and cupping can also be applied around the knee and along the channels of the leg to stimulate the flow of qi and open the channel.

Besides providing pain relief, elimination of pathogenic factors and offering constitutional treatment, acupuncture may have further beneficial effects. The authors of a study titled 'Improvement in training quadriceps muscles after ACL-reconstruction (anterior crucial ligament) with acu-

puncture^{xi} suggest that an extended rehabilitation stage and chronic secondary injuries are the consequence of disordered proprioception and reduced capability to recruit neuromuscular structures. Tonifying needling technique at the points Futu ST-32 and Zusanli ST-36 was used with both manual and electrical stimulation in human subjects following ACL reconstruction. This caused a significant increase in electrical activity of the muscles vastus medialis, rectus femoris and vastus lateralis, and improved use of the neuromuscular potential of the quadriceps muscles. Higher levels of muscular strength were reported due to a better recruitment of neuromuscular structures. The study showed that acupuncture can increase motoric excitability and support the neuromuscular system. The authors conclude that acupuncture might shorten rehabilitation time and lower the risk of re-injury after ACL reconstruction.

Physical movement

The rehabilitation programme should aim to strengthen muscles and tendons and recover full function, range of motion and proprioceptive capacity. As there are almost no measurable parameters to verify resistance of the ligament, the experience of the physiotherapist/trainer and the subjective experience of the patient/athlete are required to decide the intensity of training and a timetable to gradually return to normal sport and daily activity.

Symptoms, diagnosis and examinations	Therapy	Chronology	Immobilisation and physical activity
Patient unable to bend or rotate right hip due to intense pain. Visible swelling in inguinal area.	Immediate action: rubbing in stage one herbal tincture NB: no ice therapy	Immediately following acute injury	Compression
Suspected muscle tear in the inguinal region	Further application of stage one herbal tincture	After a few hours	No further compression
Diminished pain while walking to school	Application of stage one herbal tincture three times a day for two days	1 day after injury	
MRI confirms complete tear of rectus femoris with tendon partially separated from the bone at its insertion point; the muscle bundle of iliatus is also ruptured and separated from the iliac bone. Large surrounding haematoma (see arrows on Figures 3 and 4)	Application of stage one herbal tincture once a day, and stage two herbal tincture twice a day for the next 16 days	3rd day after injury	
No pain during walking		4th day	Normal daily activity
		10th day	Careful running possible
After 20 days an MRI shows significant reduction of pathological processes at insertion point of rectus femoris, although tendon is still partially separated from the bone; iliatus no longer separated from bone. The haematoma has almost disappeared.		20th day	Normal running possible

Table 1: Summary of diagnosis and treatment in Case 1

Illustrative case histories

Case 1: Absorption of acute blood stasis

As mentioned above, breaking up blood stasis is the most important aspect of the acute stage of musculoskeletal trauma treatment. External blood-breaking formulas for acute stage do not differ according to injured tissue (muscle, tendon, ligament or bone) or localisation of the injury. Therefore the same acute stage formula can often be used for any kind of acute tissue injury and location. Although not an ACL injury, the following case of a 14 year-old soccer player is summarised to illustrate the impressive results that can be achieved with external application of herbal medicine in the first stage of trauma treatment, even when the blood stasis is located in deep tissue layers. The patient suffered a rupture of the tendon of the rectus femoris muscle at the insertion point, resulting in a partial bony avulsion, and the iliacus muscle had separated from the iliac bone causing a huge and deep haematoma (see Figures 3 and 4). As the patient could not afford medical treatment he treated himself by rubbing Chinese herbal tinctures into the injured area. See Table 1 for the salient aspects of diagnosis and treatment.



Figure 3: Anatomy of inguinal region showing iliacus and rectus femoris

Comment: Muscle or tendon injuries in children often leads also to bone injury as tendon and muscle is still more resistant than bone tissue.

After 10 days of self-treatment with a stage one herbal tincture, integrated with a stage two tincture from day four onwards, this young patient was able to run carefully (without changes of direction involving hip rotation). An MRI scan after 20 days showed the haematoma had been almost completely absorbed and the bone injury partially healed. The result was so impressive that the experienced radiologist remarked, 'I have never in my whole career seen such improvement in such short time'. This case confirms the author's 20 years of experience treating acute trauma with TCM - that herbal treatment to break up blood stasis during the acute stage is the most important and efficient method to accelerate the healing process and rapidly improve clinical symptoms.

Case 2: Integration of TCM and surgery

A 33 year-old amateur basketball player injured his knee during a game through a combination of twisting and bending, without direct contact with another player. He received no treatment or immobilisation for the first 10 days. As the resulting swelling, intense pain and sensation of instability persisted, he consulted a medical doctor who, based on an MRI scan, diagnosed a complete rupture of the ACL close to the femur (See Figure 5), plus a partial rupture of medial collateral ligament. Twelve days after the trauma he was treated with Chinese herbs for the first time. Treatment began with the application of a stage one herbal paste (see above) for five hours that day and another four hours the day after to remove blood stasis and reduce swelling. Otherwise the patient rubbed a stage two herbal tincture (see above) onto his knee, together with a stage one-type ointment to continue to treat blood stasis. Two days later a surgeon assessed his knee again and judged that its clinical condition was sufficient for surgery to

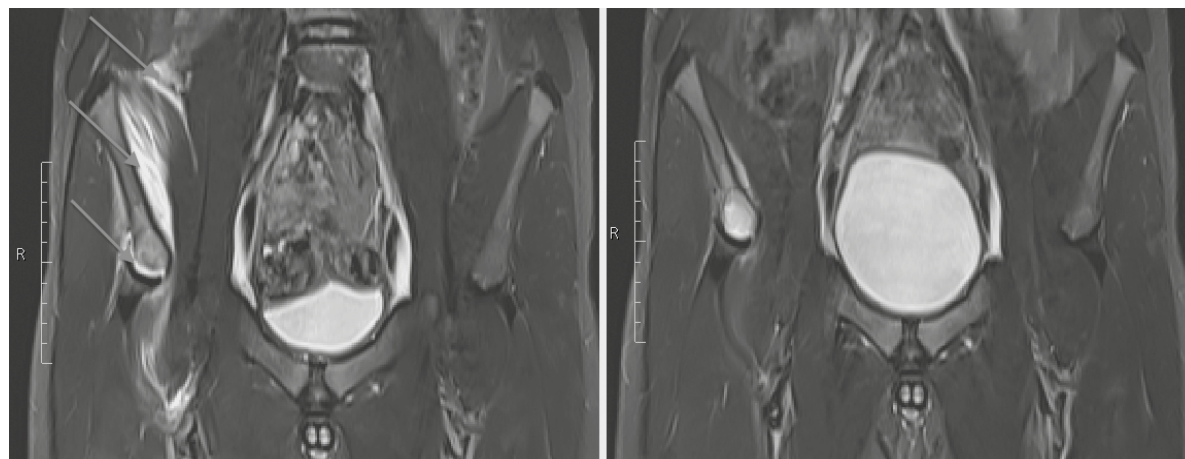


Figure 4: Large haematoma around iliacus and injury of tendon of musculus rectus femoris at insertion area three days after injury (left), and almost no haematoma anymore after 20 days (right)

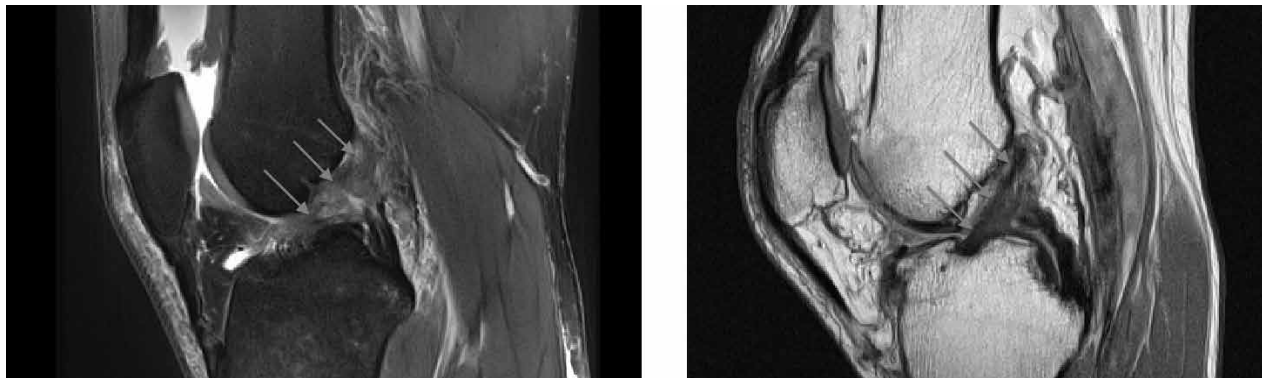


Figure 5: left side - MRI of the patient's injured knee - the lack of the continuous black line indicates a torn ACL; right side - continuous black line from tibia to femur indicates normal ACL in a healthy person.

reinsert the ACL. This was successfully performed two days later (16 days after the original injury). The patient wished to continue with external herbal treatment, and thus he was recommended to continue to use the stage two herbal tincture plus stage-one ointment for another four weeks, and to integrate this with a rehabilitation programme. After two months he was already able to bend the knee to 120 degrees and perform strengthening training of his leg in a fitness studio, all without pain or swelling.

This case shows how the integration of external Chinese herbal treatment and surgery can give optimal results. The TCM treatment was used to prepare the joint for surgery, to have the best conditions for the surgeon to reconstruct the ligament and lower the risk of subsequent arthrofibrosis. After surgery, healing processes can be accelerated and the risk of post-surgical complications - such as inflammatory pain syndromes and knee-joint stiffness - is lowered.

Conclusions

Traditional Chinese traumatology has existed since ancient times. It is based on the principles of Chinese medicine and includes not only acupuncture and tuina-anmo massage, but also external and internal use of Chinese herbs. The use of all TCM therapies is indicated during the three stages of CL healing to accelerate

absorption processes and reduce pain in the acute stage, stimulate healing of the ligament in the second stage (and after surgical CL reconstruction), and to prevent persistent qi stagnation and blood stasis in the late stage. Together with surgery, if indicated, complications like instability of the knee joint, arthrofibrosis, chronic pain syndromes and post-traumatic osteoarthritis can be avoided. Patients and athletes are typically very grateful for the considerable benefits of such treatment, which would also provide potential savings for the public healthcare system if TCM treatment was integrated into orthodox CL injury care.

Dr. med. Karl Zippelius specialises in sports medicine and is head of TCM at the Austrian Institute for Sports Medicine (Österreichisches Institut für Sportmedizin - ÖISM). He is part of the medical team of the Sportmed Clinic in Vienna, where he collaborates with Dr. Brandner, a staff member of the Austrian national ski team, to integrate surgery and TCM for optimal treatment of cruciate ligament injuries. He also operates a private practice in Florence, with a focus on TCM traumatology and orthopaedics. Dr. Zippelius specialised in Chinese orthopaedics and traumatology at the Orthopaedic Military Hospital of Sichuan Province, the Sichuan Tianxiang TCM Orthopaedic Hospital, the Dance Injury Research Institute in Chengdu, the Sichuan Tianpeng Academy of TCM Orthopaedics & Longevity and the Chengdu Sport University. Dr. Zippelius can be contacted at info@drzippelius.com, or see his website at www.tcm-sportsmedicine.info.

References

- i Miyasaka, K.C., Daniel, D.M. & Stone, M.L. (1991). "The incidence of knee ligament injuries in the general population", *Am J Knee Surg*, 4, pp.43-48
- ii Griffin, L.Y. (2000). "Noncontact Anterior Cruciate Ligament Injuries: Risk Factors and Prevention Strategies", *J Am Acad Orthop Surg*, 8, pp.141-150
- iii Kirkendall, D.T. & Garrett, W.E. (2000). "The anterior cruciate ligament enigma. Injury mechanisms and prevention", *Clin Orthop*, 372, pp.64-68
- iv Arendt, E.A., Agel, J & Dick, R. (1999). "Anterior cruciate ligament injury patterns among collegiate men and women", *J Athl Train*, 34 (2), pp.86-92
- v Wilckens, D.E., McDevitt, J.H., Ross, E.R. et al. (2000). "The relative incidence of anterior cruciate ligament injury in men and women at the United States Naval Academy", *Am J Sports Med*, Jan-Feb 28(1), pp.98-102
- vi Masahiro Kurosaka, Shinichi Yoshiya, Toshiyuki Mizuno & Kosaku Mizuno (1998). "Spontaneous Healing of a Tear of the Anterior Cruciate Ligament. A Report of Two Cases", *J Bone Joint Surg*, Aug 01, 80(8), pp.1200-3
- vii Costa-Paz, M., Ayerza, M.A., Tanoira, I., Astoul, J. & Muscolo, D.L. (2012). "Spontaneous Healing in Complete ACL Ruptures: A Clinical and MRI Study", *Clin Orthop Relat Res*, 470(4), pp.979-985
- viii Dimmen, S., Nordsletten, L. & Madsen, J.E. (2009). "Parecoxib and Indomethacin delay early fracture healing - A Study in Rats", *Clin Orthop Relat Res*, 467, pp.1992-1999
- ix Li Hua Peng et al. (2010). "In vitro & in vivo assessment of a herbal formula used topically for bone fracture treatment", *J Ethnopharmacol*, 131, pp.282-289
- x Sharifi, D., Sasani, F., Bakhtiari, J. et al. (2009). "The effect of acupuncture therapy on the repair of the calcaneal tendon (tendo calcaneus communis) in dogs", *Turk J Vet Anim Sci*, 33(3), pp.181-184
- xi Ludwig, M. (2001). "Verbesserung der Trainierbarkeit der Quadrizepsmuskulatur nach vorderer Kreuz-bandplastik durch Akupunktur", *Deutsche Zeitschrift für Sportmedizin*, 52 (3), pp.100-103