

# **Associate Professor Craig Waller**

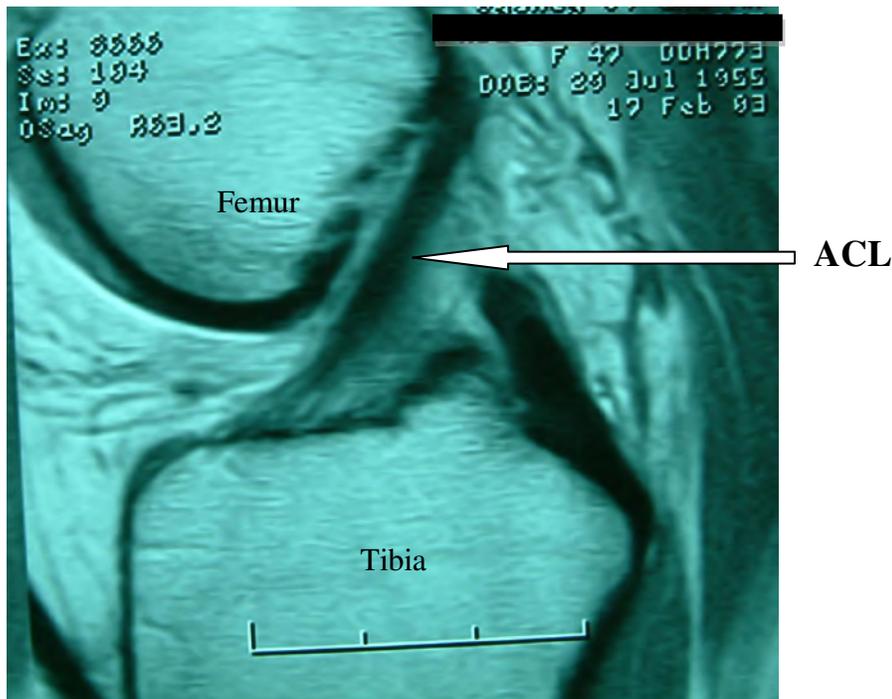
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## **ACL RECONSTRUCTION**

### **ANATOMY and FUNCTION**

The anterior cruciate ligament (ACL) is one of the major stabilising ligaments in the knee. It is a strong rope like structure located in the centre of the knee connecting the femur to the tibia.

The anterior cruciate ligament prevents the femur from moving forward and rotating abnormally on the tibia. The ACL is required for normal function of the knee. One of the main functions of the ACL is to provide stability during rotational movements such as turning, twisting, and sidestepping. ACL tears and ruptures do not heal satisfactorily so the knee remains unstable and likely to give way. ACL tears are often associated with damage to other structures in the knee such as bone, cartilage, other ligaments or menisci and these injuries may also need to be addressed at the time of surgery.



**MRI scan showing a normal ACL**

## **HISTORY OF INJURY**

There is usually a significant injury involving a twisting movement of the knee such as when changing directions whilst running. The ACL can tear after landing from a jump, stopping rapidly, or with direct contact such as a tackle during contact sport. This injury is particularly common in sports such as football, soccer, basketball and netball, but can also occur in many other activities. Skiing is a sport that is associated with a high rate of injuries to the ACL.

When the ACL ruptures the patient often feels something giving way in the knee and may hear a loud pop. The injury is usually very painful for 15 minutes or so. Most people cannot continue with their activity and the knee generally swells up within hours.

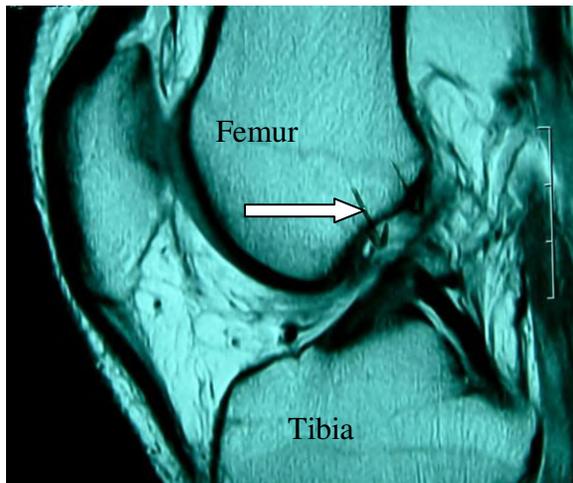
## **INITIAL MANAGEMENT**

The knee should be treated with ice, elevation and a compressive bandage. Crutches and analgesics usually are required. An X-ray is required to exclude an associated fracture. Physiotherapy is helpful to reduce swelling and regain motion. Most patients will be referred to an orthopaedic surgeon for diagnosis and assessment of the injury. Careful clinical examination is required to detect damage to the ACL and

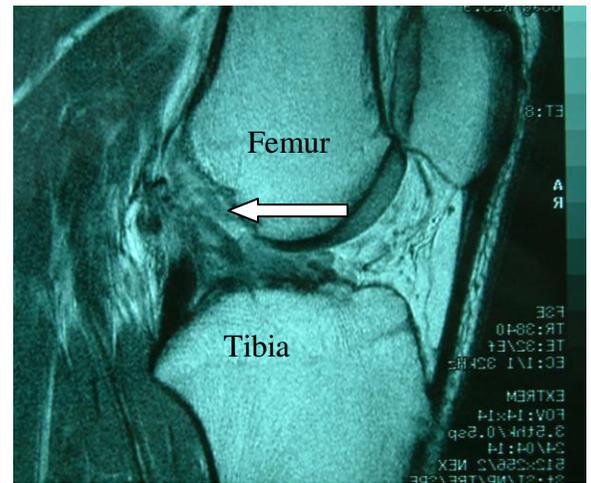
other ligaments and structures in the knee. It is common for ACL tears to be associated with damage to other ligaments, menisci, and articular cartilage.

## DIAGNOSIS

This can usually be made on history and clinical examination. An MRI scan may be done to confirm the diagnosis and to exclude damage to other structures such as the menisci or articular cartilage. The diagnosis can also be made with an arthroscopy.



MRI scan shows the ACL torn from its attachment to the femur



MRI scan shows the ACL has “blown out”

## TREATMENT RECOMMENDATIONS

Most patients who tear their ACL during sport will elect to have it surgically reconstructed, to enable them to return to full activities with a stable knee.

Other patients choose to modify their activities and give up sport to avoid further episodes of instability.

In general the younger and more active you are then the stronger the recommendation for reconstruction. I generally recommended surgery if you wish to get back to sports that involve twisting or pivoting.

Many patients who do not have surgery find that their knee becomes looser and looser over time, leading to gross instability and a knee that gives way during ordinary activities of daily living

These patients should strongly consider surgery to stabilise the knee.

I also usually recommend surgery in people with dangerous occupations eg; policemen, firemen, roof tilers and scaffolders. This is a safety issue to prevent instability in dangerous situations.

**If you do not elect to have surgery it is strongly advised that you give up sports that involve pivoting, sidestepping or rotation, as repeated episodes of instability are very likely to cause irreparable damage to the knee.** Damage to the cartilage following episodes of giving way of the knee can lead to **osteoarthritis**.

## **SURGERY**

There is no urgency in performing this operation and in fact it is sometimes better to allow the knee to settle down and regain a near full range of motion prior to surgery.

### **PRE-OP INSTRUCTIONS**

- Cease **aspirin** and anti-inflammatory medications (eg Voltaren, Feldene) 10 days prior to surgery as they can cause bleeding. If you are taking aspirin for a cardiac condition you should ask your cardiologist if it is safe to stop taking aspirin for 2 weeks
- Cease any naturopathic or herbal medications 10 days before surgery as these can also cause bleeding
- Continue with all other medications unless otherwise specified.
- Notify your surgeon if you have any abrasions or pimples around the knee.
- Please bring any X-rays, MRI scans or other investigations you have had done which may be relevant to your surgery.
- Bring a list of medications with you to give to the anaesthetist.

**You are advised to stop smoking for as long as possible prior to surgery.**

The operation involves replacing the torn cruciate ligament with either the hamstring tendons or patella tendon from the same leg. There is a lot of debate within orthopaedic literature as to which is the best method to reconstruct the ACL.

My definite preference is to use **hamstring tendons** to reconstruct the ACL. I began using hamstrings for this procedure in 1993 and have done over 4500 ACL reconstructions with this technique. I have been very happy with the results of hamstring ACL reconstruction after previously using patellar tendon grafts since 1988.

I believe that the hamstring technique offers the following advantages;

Stronger graft

Fewer complications and side effects

Faster recovery and easier rehabilitation

Less post-operative pain

Less muscle wasting after surgery

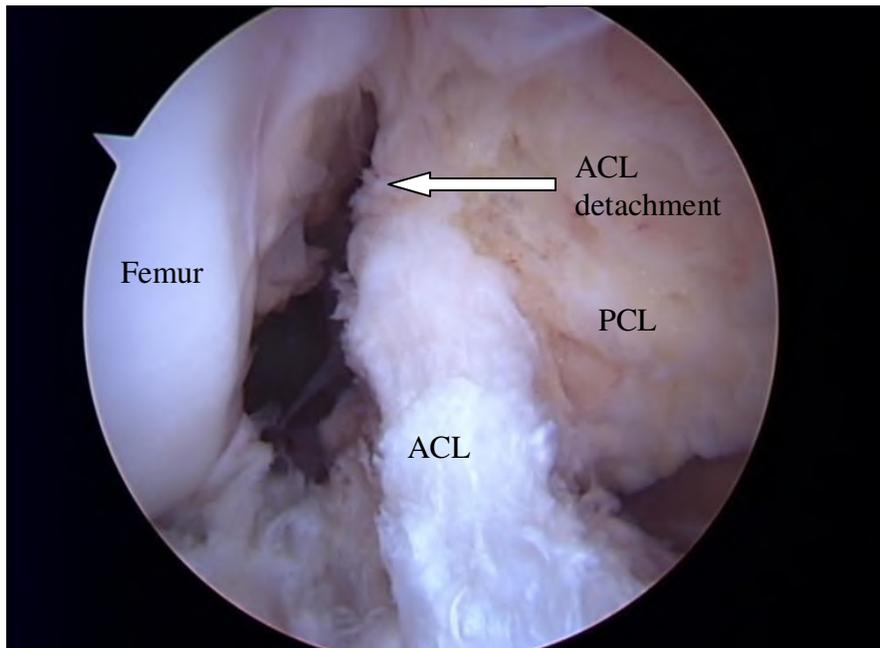
Less anterior knee pain

Easier to kneel comfortably after surgery

Minimal scarring

The operation involves taking the hamstring tendons through a small incision just below the knee and fashioning them into a four stranded graft which takes the place of the anterior cruciate ligament. Tunnels are then drilled in the tibia and femur (the two bones making up the knee joint) and the graft is passed through this tunnel. The graft is then fixed with various devices at each end to stabilise it and allow it to heal to the bone. My technique is to use the Arthrex Tightrope Endobutton in the femur and a **bio-absorbable screw** to anchor the graft in the tibia. The screw is made from polylactid acid and is very strong. It dissolves and is reabsorbed long after the graft has healed in the bony tunnel. These implants do not need to be removed and will not set off security alarms at airports.

This keyhole surgery is all done using the **arthroscope** which is inserted into the joint through one of two small incisions approximately 1cm in length. The inside of the knee is thoroughly visualised and any other problems such as meniscal tears are dealt with as part of the procedure.



Arthroscopic view of a torn ACL. Note that the ligament has detached from the femur

### **AFTER SURGERY**

Prior to the end of the operation the knee is injected with a large volume of long acting local anaesthetic (Naropin). For this reason patients usually wake from surgery with **some discomfort but rarely strong pain**. If you experience pain you will be given strong analgesics.

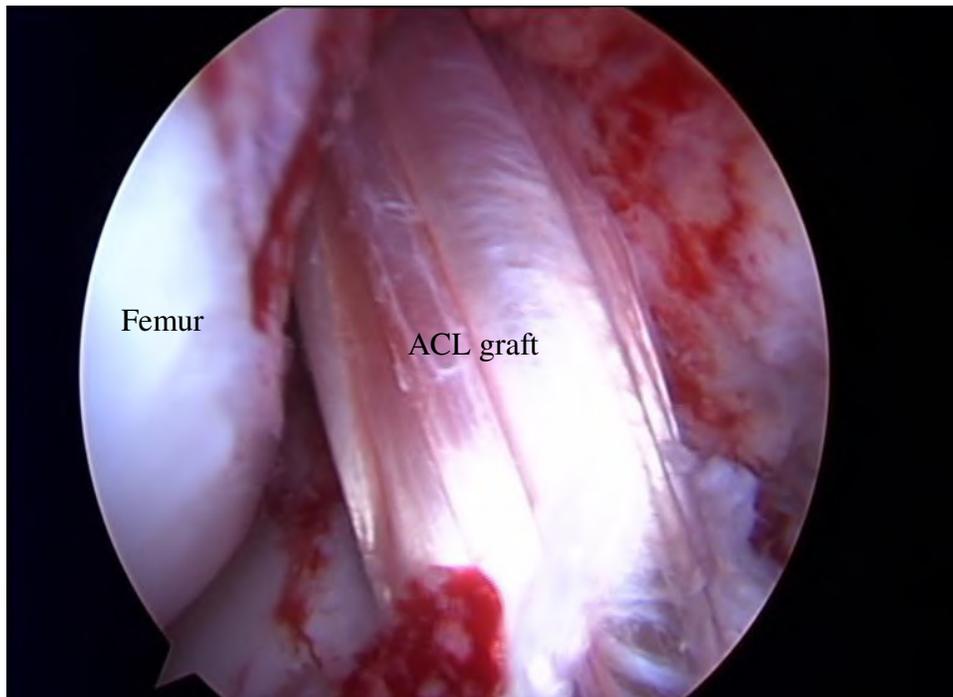
Most patients are able to leave hospital on the day of surgery. You will be seen by a physiotherapist prior to discharge who will teach you how to use crutches and show you some simple exercises to do at home.

For the first 3 days ice packs should be used to reduce swelling 20 minutes at a time as regularly as possible. The graft in the knee is very stable so full weight bearing through the leg is permitted and encouraged. You can walk around but rest as much as possible for the first week and elevate your leg when sitting. Most patients require crutches for a week or so. You can shower with the dressings on but avoid soaking baths and swimming pools for the first 2 weeks after surgery. If there is excessive ooze under the waterproof dressings they can be changed. Contact us prior to attempting to change the dressings.

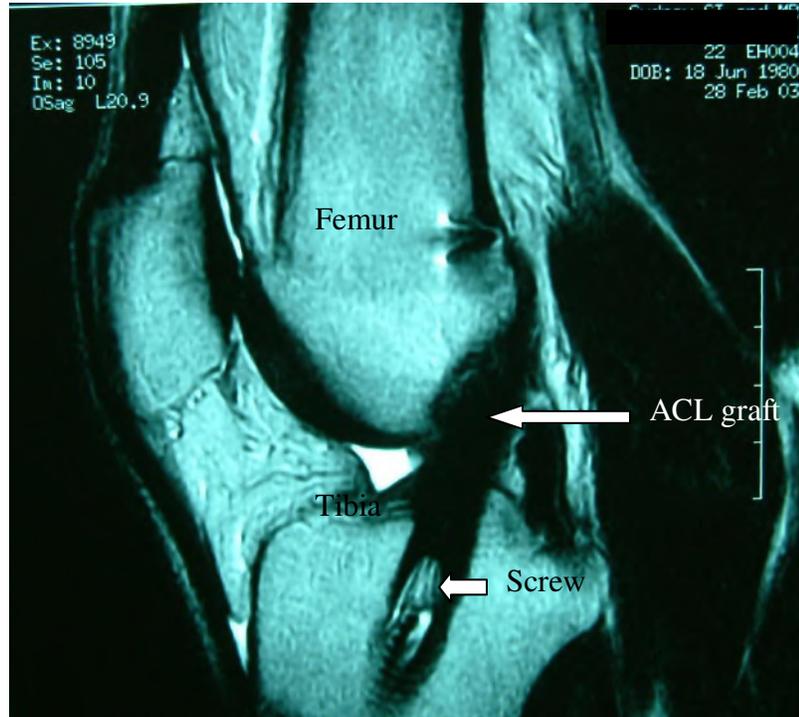
Pain is variable and prescription pain killers may be required for a week or two, especially at night.

You will be followed up in the office 5-6 days following surgery where the dressings will be removed and the wounds inspected. If there is any redness, increased swelling or if you have high temperatures you should contact the office or the hospital where the surgery was performed so they can contact me.

Time off work depends on your work requirements and is very variable .Office workers usually require 1-2 weeks off work and manual labourers 2 to 3 months.



### Arthroscopic view of an ACL graft using hamstring tendons



MRI scan shows a healthy ACL graft. Healthy grafts appear black on the MRI scan. The fixation screw can be seen in the tibia.

## REHABILITATION

Physiotherapy is an integral part of the treatment and is recommended to start as early as possible. Preoperative physiotherapy is helpful to better prepare the knee for surgery. The early aim is to regain range of motion, reduce swelling and achieve full weight bearing.

The remaining rehabilitation will be supervised by a physiotherapist and will involve activities such as exercise bike riding, swimming, proprioceptive exercises and muscle strengthening. Cycling can begin at 2 months, jogging can generally begin at around 3 months. The graft is strong enough to allow sport at around 6 months however other factors come into play such as confidence, fitness and sport specific training.

Professional sportsmen often return at 6 months but recreational athletes may take 10 -12 months depending on motivation and time put into rehabilitation.

The rehabilitation and overall success of the procedure can be affected by associated injuries to the knee such as damage to menisci, articular cartilage or other ligaments.

The following is a more detailed rehabilitation protocol useful for patients and physiotherapists, courtesy of Alan Davies, Diane Long and Mark Kenna at the Eastern Suburbs Sports Medicine Centre, Bondi Junction.

## **STAGE 1 ACUTE (0 – 2 WEEKS)**

### **GOALS**

1. Allow wound healing
2. Reduce swelling
3. Regain full extension
4. Achieve full weight bearing
5. Wean off crutches
6. Promote muscle control

### **TREATMENT GUIDELINES**

1. Pain and swelling reduction with ice, intermittent pressure pump, soft tissue massage and exercise
2. Patella mobilisation
3. Active range of motion knee exercises, calf and hamstring stretching, quadriceps and hamstring co-contraction, muscle control and full weight bearing. Aim for full extension by 2 weeks. Full flexion will take longer and generally will come with gradual stretching. Care needs to be taken with hamstring co-contraction as this may result in hamstring strains if too vigorous. Light hamstring loading continues into the next stage with progression of general rehabilitation. Resisted hamstring loading should be avoided for approximately 6 weeks.
4. Gait retraining encouraging extension at heel strike. Full weight bearing as soon as possible is desirable.

## **STAGE 2 QUADRICEPS CONTROL (2-6 WEEKS)**

### **GOALS**

1. Full active range of motion
2. Normal gait with reasonable weight tolerance

3. Minimal pain and effusion
4. Develop muscular control for controlled pain free single leg lunge
5. Avoid hamstring strain
6. Develop early proprioceptive awareness

#### TREATMENT GUIDELINES

1. Use active, passive and hands on techniques to promote full range of motion
2. Progress closed chain exercises (quarter squats and single leg lunge) as pain allows. The emphasis is on pain free loading, VMO and gluteal activation
3. Introduce gym based exercise equipment including leg press and stationary cycle
4. Water based exercises can begin once the wound has healed, including treading water, gentle swimming (avoiding breaststroke), and exercises using a kick board.
5. Begin proprioceptive exercises including single standing leg balance on the ground and mini-trampoline. This can progress by introducing body movement whilst standing on one leg.
6. Bilateral and single calf raises and stretching
7. Avoid isolated loading of the hamstrings due to ease of tear. Hamstrings will be progressively loaded through closed chain and gym based activity

#### **STAGE 3 HAMSTRING/QUADRICEPS STRENGTHENING (6-12 WEEKS)**

##### GOALS

1. Begin specific hamstring loading
2. Increase total leg strength
3. Promote good quadriceps control in lunge and hopping activity in preparation for running

##### TREATMENT GUIDELINES

- 1-Focal hamstring loading begins and is progressed steadily throughout the next stages of rehabilitation
  - a) Active prone knee flexion which can be quickly progressed to include a light weight and gradually increasing weights
  - b) Bilateral bridging off a chair. This can be progressed by moving onto a single leg bridge and then single leg bridge with weight held across the abdomen
  - c) Single straight leg dead lift initially active with increasing difficulty by adding dumbbells

With respect to hamstring loading, they should never be pushed into pain and should be carefully progressed. Any subtle strain or tightness following exercises should be managed with a reduction in hamstring based exercises

2-Gym based activity including leg presses, light squats and stationary bike which can be progressively increased in intensity as pain and control allows. It is important to monitor any effusions following exercise and if it is increasing then the exercise should be toned down

3-Once single leg lunge control is comparable to the other side hopping can be introduced. Hops can be made more difficult by including variations such as forward/back, side to side off a step and in a quadrant

4-Running may begin towards the latter part of this stage. Prior to running certain criteria must be met

- A) No anterior knee pain
- b) A pain free lunge and hop that is comparable to the other side
- c) The knee must have no effusion

Prior to jogging start having brisk walks, ideally on a treadmill to monitor landing action and any effusion. This should be done for several weeks before jogging properly.

5-Increased proprioceptive manoeuvres with standing leg balance and progressive hopping based activity

6) Expand calf routine to include eccentric loading

#### **STAGE 4 SPORT SPECIFIC (3-6 MONTHS)**

##### **GOALS**

- 1-improve leg strength
- 2-develop running endurance speed, change of direction
- 3-advanced proprioception
- 4-prepare for return to sport and recreational lifestyle

##### **TREATMENT GUIDELINES**

1-Controlled sport specific activities should be included in the progression of running and gym loads. Increasing effusion post running that isn't easily managed with ice should result in a reduction in running loads

2-Advanced proprioception to include controlled hopping and turning and balance correction

3-Monitor potential problems associated with increasing loads

4-No open chain resisted leg extension exercises unless authorised by your surgeon

## **STAGE 5 RETURN TO SPORT (6 MONTHS PLUS)**

### **GOALS**

A safe return to sporting activities

### **TREATMENT GUIDELINES**

1-Full training for 1 month prior to active return to competitive sport

2-Preparation for body contact sports. Begin with low intensity one on one contests and progress by increasing intensity and complexity in preparation for drills that one might be expected to do at training

3-To improve running endurance leading up to a normal training session

4-Full range, no effusion, good quadriceps control for lunge, hopping and hop and turn type activities. Circumference measures of thigh and calf to within 1 cm of other side.

At this stage you will be supplied with the PEP Safe Return to Sport Program. This program is designed to assist you to return to sport safely with a reduced risk of re-injury.

**Before returning to sport you should have achieved the following;**

**Full range of motion**

**No effusion**

**No pain**

**At least 90% quadriceps strength**

**Thigh and calf circumference within 1cm of the uninjured side**

**Good proprioception**

**Ability to complete 2 consecutive training sessions**

**Confidence**

A note on ACL reconstruction in older patients

Many surgeons believe that ACL reconstruction surgery should not be done in patients over 50, and that these patients should give up sport instead. I do not agree with them. My experience with hamstring ACL reconstruction in older patients has been very positive. I have reviewed my results from over 100 cases of ACL reconstruction in patients over 55 (age range 55-74 years). Most of these patients had been told that they were too old for this kind of surgery that is usually reserved for athletes. My research revealed that this group of patients did as well or better than younger patients following ACL reconstruction. There were no graft failures and over 95% returned to their sport of choice.

On the basis of my positive experience with ACL reconstruction in this group of patients I have no hesitation in recommending surgery to any patient with an unstable knee who wishes to return to their desired level of activity, regardless of their age.

## COMPLICATIONS

**Complications in arthroscopic anterior cruciate ligament reconstruction are not common**, especially in experienced hands. However, despite advances in surgical technique and great care being taken in surgery, complications can still occur. It is very important for patients undergoing this operation to understand the reasons for the procedure and to have a major role in making an informed choice to proceed with surgery rather than non operative treatment.

The following is a list of possible complications of ACL reconstruction. Most of the complications of ACL reconstruction are treatable and do not lead to long term problems, although on rare occasions graft failure can result.

**Excessive swelling and bruising of the leg:** This is due to bleeding in the joint and surrounding tissues. It can cause short term pain and make it difficult to bend the knee. To avoid this problem apply ice to the leg and elevate it as much as possible. If swelling in the leg remains a problem it can be effectively treated by our physiotherapists using the Masman soft tissue pump.

**Infection:** This occurs in approximately 1 in 400 cases. Every precaution is taken to avoid infection in the knee. The procedure is done via minimally invasive keyhole surgery in a sterile operating environment. Antibiotics are routinely given. If infection develops treatment involves either oral or intravenous antibiotics and may involve further operations to wash out the joint. If treated early, complete resolution can usually be expected.

**Joint stiffness:** Restriction of motion may result from scar tissue formation within the joint. Arthroscopic surgical technique using hamstring tendon grafts and accelerated rehabilitation makes this less likely than in the past. Treatment consists of physiotherapy

or occasionally further arthroscopic procedures to remove scar tissue. Full range of motion is usually achieved but cannot always be guaranteed.

**Bleeding:** Small amounts of bleeding in the joint following surgery are normal. Large amounts of bleeding can occur but are more common in patients with bleeding disorders or those taking anti-inflammatory medications or aspirin. These medications should be ceased 10 days prior to surgery. If you are taking aspirin for a cardiac condition you will need to contact your cardiologist for advice. Excessive bleeding can require aspiration of the knee or occasionally a repeat arthroscopy.

**Graft rupture or stretching:** This can occur with future injuries after returning to sport. Graft rupture is approximately 5% which is about the same risk as rupturing the good cruciate ligament. Graft rupture usually but not always requires a force equal to or greater than that required to rupture a normal cruciate ligament.

If the graft ruptures it can be revised using hamstring tendons from the other leg.

Alternative graft options include patellar tendon from the front of the knee, or Achilles' tendon allograft which can be obtained from the bone and tissue bank. The postoperative course for a revision is only slightly slower than normal and the potential complications are much the same.

In some cases the graft can stretch over time. This is more likely to occur in patients with ligamentous laxity or in patients with damage to secondary stabilisers of the knee (i.e. the other strong ligaments around the knee) and in patients with chronic ACL deficiency from an old, neglected injury. Patients who have their operation soon after their injury are more likely to have a more stable knee in the long term before other structures in the knee stretch out. If it does stretch in some cases a brace can assist with return to sport and in other cases it is in the best interest of your knee to give up sport.

**Damage to nerves or vessels:** There are small nerves under the skin which cannot be avoided and cutting them can lead to areas of numbness in the skin below the knee. There can also be areas of tingling or hypersensitivity around the scars. Any numb areas generally reduce in size with time and do not cause any problems with the normal function of the knee. Occasionally damage to more important structures can occur especially with meniscal suturing. This can lead to more significant areas of numbness and muscle weakness below the knee.

**Problems relating to the fixation devices :** The graft is fixed into place in the bone with strong screws and pins and, occasionally, staples. These devices can occasionally cause irritation to surrounding structures and require removal. They are only removed once the tendon is grown into the bone and they are no longer required to hold the graft in place. I have been very happy with the bio-absorbable implants and have not had a single problem with these implants in the last 600 cases.

**Donor site problems:** The choice of graft includes hamstrings and middle third patellar tendon. In my opinion problems after harvesting hamstrings are less than after harvesting middle third of the patellar tendon. Following hamstring harvest you can get some pain

and swelling in the region of the hamstrings at the back of the thigh but this is usually temporary. Weakness in the hamstrings if it occurs is usually minimal.

The biggest problem following middle third patella tendon harvest is anterior knee pain which can cause discomfort with every day activities but especially kneeling.

Anterior knee pain: Some patients develop pain around the kneecap. This is a result of muscle wasting and inactivity following surgery and usually resolves over time with appropriate physiotherapy.

Hamstring muscle tear: About 1 in 8 patients will experience a minor hamstring tear during their rehabilitation. If this occurs it will usually be around 3-6 weeks post-op. It causes some pain in the back of the thigh and interrupts the rehab programme for a week or two but rarely affects the long term function of the knee. Rarely, patients may suffer further hamstring tears/sprains that can affect function. Permanent hamstring weakness is unusual following ACL reconstruction but can occur.

Reflex sympathetic dystrophy: This is a rare condition, the mechanism of which is not fully understood. It involves an overactivity of the nerves in the leg causing unexplained and excessive pain.

Deep Venous Thrombosis: Blood clots in the leg which may require medical management in the form of injections or tablets to thin the blood. Very rarely these can travel to the lungs (pulmonary embolus) causing respiratory difficulties or even death.

Compartment syndrome: An extremely rare condition which is due to excessive swelling in the knee cutting off the circulation to the muscles. Treatment for this condition requires a fasciotomy operation to relieve this pressure. This is something described in the literature but I have not seen it in over 2500 cases.

Ongoing Pain: This can be unpredictable but is more common in knees with damage to other structures such as menisci or articular cartilage. Arthroscopy can not reverse arthritis but if the cartilage damage is localised then cartilage resurfacing is possible. If unexplained pain does occur then another arthroscopy may occasionally be recommended.

Limp: Persistent limp following ACL reconstruction is unusual and usually means that the knee has not regained full movement

Unsightly scar: Unusual but possible, especially in dark skinned patients.

Wound breakdown or suture reaction is rare but can occur.

Please note that other, rare complications may occur that may not be listed above. You should also read the handouts on anaesthetic complications and general complications of surgery.

If you have concerns or have any further questions please feel free to contact me or the practice registered nurse for further information. You may also make another appointment to see me to discuss the treatment options again if you are uncertain as to the best treatment in your circumstances.

Please note that my surgical practice is a subspecialty practice. I operate within my defined area of interest and expertise. I believe that this results in better outcomes for patients and a very low complication rate. Patients are only offered the option of surgery after non operative forms of treatment have been considered. Surgery is offered when I consider the potential advantage of this form of treatment outweighs the possible complications and side effects. Surgery is only offered when I feel that this form of treatment is likely to lead to a better outcome for the patient than non-operative forms of management. In the case of elective surgery, the patient is encouraged to consider the non-operative options of treatment and take time to make an informed choice about the preferred course of management. You are free to discuss this with me or your referring medical practitioner. If elective surgery is proposed, please feel free to take as much time as you need to come to an informed decision. If you are not completely comfortable with the decision to proceed with surgery, you are free to take up further discussion with me or seek an independent second opinion. This can be arranged through your referring medical practitioner.

## CONCLUSION

**ACL reconstruction performed arthroscopically by an experienced knee surgeon is a very safe and effective procedure. Most patients achieve excellent stability and return to the sport of their choice after completing the rehabilitation program. Please feel free to ask questions at any stage. You can be assured my best attention at all times.**

**Associate Professor Craig Waller**

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