

Bow Leg Correction (High Tibial Osteotomy)

High tibial osteotomies are performed to correct a deformity known as 'bow-legs'. The surgery is undertaken to treat osteoarthritis, and in some cases to try avoiding it all together.

Bow legs & knee pain

A 'bow leg' deformity at the knee has increased forces passing through the medial (inner) compartment that gradually destroys the joint surface. Early on it may can pain, wear of the joint surface, and contribute to tearing the cartilage. Later, it may develop obvious arthritis. Surprisingly, the amount of pain and disability is not exactly related to the amount of arthritis present. If the knee is not particularly stiff and the patient young, re-alignment may be best option.

What causes arthritis?

Arthritis is a general term for pain and stiffness of a joint. It can be caused by an old injury, inflammatory conditions like rheumatoid arthritis, but most commonly overloading the joint surfaces causes it.

Re-alignment surgery aims to slow the progression of arthritis. In a knee without wear, and with a perfect correction, the risk of arthritis can be dramatically reduced.

Re-alignment Osteotomy

If the pain originates from only one part of the knee, the leg can be re-aligned. Typically, this is the only option in people under 50, and would be considered in patients in their 50's. By the time people are in their 60's, joint replacement surgery is more seriously considered. The amount the alignment is corrected depends on the how much wear has occurred. In a patient with no wear but pain, the aim is to achieve a straight leg. The more wear that has occurred, the more the deformity is

over-corrected. For marked wear, we aim to make the leg somewhat "knock-knee". The common osteotomy is an opening wedge on the tibial side. The wedge is usually filled with "bone graft substitute", an artificial material that over a number of years, the body replaces with bone. A metal plate is used to hold the new position.

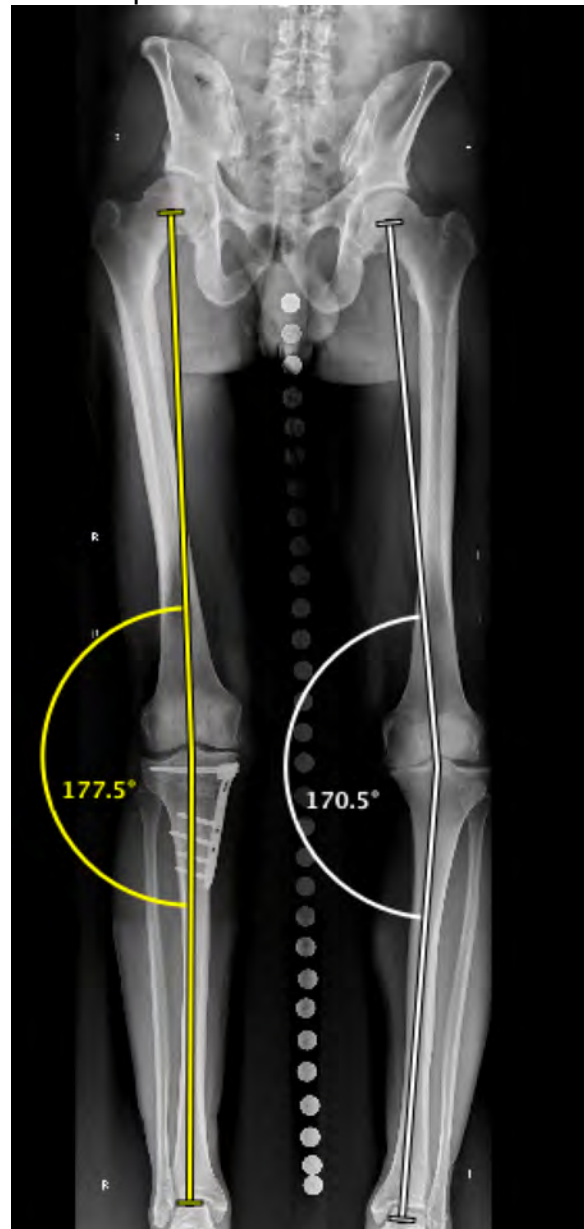


Figure 1. Normally a straight line should pass from the centre of the hip, through the centre of the knee, to the centre of the ankle. In this case, the right knee (left of image) the 177.5° indicates a small overcorrection (as is planned). The other side at 170° is 10 degrees out of alignment.

High Tibial Osteotomy

Most patients with 'bow legs' and a moderate deformity have the problem

predominantly on the tibial side. The re-alignment can be done from either side of the knee, either by inserting an opening wedge on the inner side, or removing a wedge of bone on the outer aspect of the leg.

Our preference to do medial opening wedge osteotomies is based on years of experience. Prior to 2000, lateral closing wedges were common but problems such as the lateral ligament becoming too loose, the tight medial ligament wasn't released, and if the patient ever required a knee replacement, it was difficult.

The advantages of medial opening wedge;

- Strong plate and able to full weight bear early.
- Two to six weeks of crutches
- Tight MCL corrected at same time
- Future options barely compromised

Down sides of re-alignment osteotomy

The list of complications is long. There is no operation that is completely safe. Complications can be severe enough that's both the patient and surgeon wish it hadn't been done! None the less, the vast majority of the re-alignment operations go well.

The biggest issue is that it probably means the knee probably can't have a subsequent partial knee replacement, although it can still have a total knee replacement. The theory is that partial knee replacements won't work if the other compartment is overloaded by the corrective osteotomy. Obviously that decision would be on a case-by-case basis.

Time off work is a serious consideration. Not everyone responds equally to the surgery – most patients are off crutches at two weeks, rarely, people take more than six weeks.

Driving is not possible until you are not taking strong painkillers and have normal leg performance. As a rule, automatic cars can be driven at two weeks if the surgery was to your left leg. Otherwise six to eight weeks may be necessary.

The plate is usually permanent. Removing the plate is not necessary but, if causing irritation, can be done. It will cost you time and money, as it is not part of the surgical fee for doing the re-alignment surgery.



Fig 2. The plate is on the surface of the bone, the screws buried in the bone. The void created by the opening wedge is filled with graft material, which is gradually replaced by your own bone. The plate stays in unless it bothers you, the majority of the patients still have their plate in place.

What other treatments are available for arthritis?

Weight loss

A significant number of Australians are overweight. Adults should have a body mass index (BMI) of 20-25. For an average height male, this would equate to 70-78kg. Being overweight will overload your joints. The knee for example carries 9 times your body weight when climbing stairs. Many patients blame their weight on their arthritic joint, but then don't lose weight after the joint is fixed. Your weight reflects both how much and what you eat, and how much you exercise – speak to your GP.

Impact reduction

Different sporting pursuits alter how much the joints are loaded. Sports like tennis place high impacts and twisting motions on your joints. Swimming and cycling on the other hand generally reduce arthritic pains. Walking can make arthritic pains worse if you have poor quality shoe wear.

Muscle strengthening

Strength is improved with activity such as walking, swimming and cycling. Some people could consider gymnasium training.

Improve suppleness

Stiff joints hurt. The natural response is to avoid activities that put pressure on the joints but the opposite approach is probably better. Western society avoids pushing joints to their full range of movement by sitting on chairs. A physiotherapist can demonstrate stretching exercises to you. Another option is taking up yoga classes.

Glucosamine tablets

50% of patients report these are useful. If they work for you, happily continue to use. It certainly seems a safe alternative to NSAIDs. If the cost exceeds the benefit, move on.

Paracetamol

Panadol® and Panamax® are quite safe in normal doses and do not cause stomach irritation. Some patients feel it is just as useful as NSAIDs without the side effects. It makes good sense to try this first! It can be used on an intermittent basis such as when pain is present, or even prior to predicted painful activities.

Anti-inflammatory tablets (NSAIDs)

There are hundreds of different anti-inflammatory tablets. Nurofen can be bought "over the counter" at a pharmacy without a prescription. Prescriptions from your GP could be for Voltaren or Naprosyn. Modern ones such as Celebrex and Mobic are felt to reduce the potential risk of stomach ulcers. These tablets can be used either before or after activity, or on a regular basis. This class of tablets has been associated with an increase risk of heart attacks, but the serious risks of these tablets is probably lower than the risk of surgery. It is usually advised the tablets are taken with you meal.

Physiotherapy

A physiotherapist is likely to be of help with strength and suppleness exercises. These can be useful at any stage of arthritis. Physiotherapists also have a specific value prior to and immediately after surgery as a constant source of information and coaching.

Shoe wedge

Bow-legs overload the inner part of the knee. Common foot orthoses with a large arch support exacerbate this deformity, so discarding the orthotic may help, or a wedge from physiotherapist under the outside of the heel.

Knee brace

A standard elastic knee brace from a chemist shop or sports store can help control swelling, and provide some additional comfort. A “Poly Farmer” brace has a metal hinge on each side, and can give further support. The ultimate brace is the “Unloader brace”. It has a hinge and a strap that somewhat holds the arthritic surfaces apart. It is useful if the arthritis is in a single area, in active people, and costs around \$1000. If you have “extras” insurance, your company might reimburse half the cost.

Cortisone injections

Cortisone is a naturally occurring substance that reduces inflammation. It can be injected into the knee joint quite easily in the consulting rooms. It is very useful to control an acute flare up of arthritic pain. Surgeons typically limit how many injections are given to an area to minimize the risk of joint deterioration, and infection either before or after joint replacements.

Hyaluronic Injections

Joints have a natural lubricating fluid (synovial fluid) that contains “hyaluronic acid”. Injecting the knee with a commercial version of this can provide relief (80% of patients claim a benefit for 6 months or more). We use Durolane, a synthetic equivalent, costing \$475, not covered by Medicare.

Walking stick

A walking stick is extremely useful to reduce arthritic pains. Particularly, they may be helpful with activity related pain.

Raised chairs / toilet seats / bed

Difficulty getting out of a low chair is a characteristic problem with knee arthritis. Some people find the use of higher chairs/seats to be beneficial.

Surgical Options

Knee arthroscopy

Knee arthroscopy involves placing a camera in the knee, allowing the surgeon to rectify a variety of problems such as torn cartilage and smoothing damaged joint surfaces. If the knee has arthritis, the arthroscopy may not make much difference. This is even more common in people who have an aching pain on the inside of the knee, and the knee has a “bowed” deformity. MRI may be useful to decide. If arthritis and meniscal symptoms, it may be reasonable to do both the arthroscopy and osteotomy at the same time.

Chondrocyte grafting & microfracturing

This technique aims to restore the damaged joint surface to normal. They may be used alone, or in combination with re-alignment osteotomies. Chondrocyte grafting involves molecular biology techniques, and a good number of cases have been done in Ballarat. It tends to be used only if the damaged joint area is very large, and the patient young. It works better for joints that have had a single serious injury than joints that are developing arthritis. Currently, chondrocyte grafting is not supported by your private health insurance. The out of pocket expense might be \$7,000-\$20,000.

Ligament reconstruction

Some knees have a ‘giving-way’ sensation caused by a previous ligament injury in the knee. Typically the knee gives way on twisting. It is possible to correct this problem at the same time as re-aligning the leg. It does not seem to add to the recovery time, although return to twisting / pivoting sports would be prevented until 12 months from the surgery. Anterior cruciate reconstruction does not relieve arthritic pain, only improves the knee stability. There are some other ligaments that could have previously been injured –the PCL or lateral ligament – the pain caused by these being injured sometimes requires reconstructive surgery.

Tibial & Femoral osteotomy



Figure 3. In this unusually severe case, the deformity was so severe the correction was undertaken on both the femoral & tibial side. Most patients only need the tibial correction. If a line is drawn from the middle of the hip to the middle of the ankle, it now passes through the middle of the knee, a little more so towards the outer side.

Alternate Plate Design & HTO

Without substantially changing our osteotomy operation, we have been using a new lower profile plate. It allows the plate to sit UNDER the hamstring tendons, closer to the bone. Previously our plate was over the top of the hamstrings to minimise irritation of these tendons.

There is a small 4 hole plate for where small corrections are required, and a 7 hole plate for where the correction is large or larger patients.



Figure 4. FlexIt osteotomy plate. This is a bit less bulky than the plate we have used in the past - see the image below..



Unicompartmental Knee Replacement

If the arthritis is limited to a single area, a partial replacement may be the best option. The Oxford & Unix each have good long term results, equivalent to a TKR.

Requirements for this surgery are that the range of movement is good, and preferably the cruciate ligament is intact. A disadvantage is the scar may cause more numbness, but this seems to be offset by the otherwise more normal function than after total replacement.

Partial knee replacement is generally not offered to young patients. The younger patient often overworks the knee replacement and needs further surgery. The Australian Joint Replacement registry demonstrates those patients having a revision operation still don't have a great knee replacement.



Fig 5. A Cemented Medial Uni-compartmental Replacement. Only the worn part of the joint is replaced.

Total Knee Replacement

Total knee replacement replaces all the joint surfaces and removes the anterior cruciate ligament. Designs keep improving, but the knee never feels normal and is suitable only for sedentary activity. As a rule, we don't do it for patients under fifty, and infrequently in patients under sixty years of age. The risk of failure in well selected (older patients) is approximately 1% per year through a variety of mechanisms. The failure rate in patients under 55 is more like 2% per year.



Figure 6. An x-ray taken from the side of a total knee replacement shows the three new surfaces. The top end of the tibia, bottom end of the femur, and the under surface of the patella have all been re-surfaced. The plastic part of the tibial component and the plastic of the patella can't be seen, as they don't show up on x-ray. There is bone cement on the back of the patella and a wire marker within the plastic of the patella component.

The Process of having a corrective osteotomy.

Pre-operative planning

The degree of deformity is measured usually with a long leg standing x-ray. The required amount of correction depends on the deformity, the amount of wear and, to a lesser degree, whether the other leg also has the same trouble. Previous arthroscopies done by other surgeons may provide useful information, including intra-operative photos and previous operation reports. An MRI scan can sometimes be helpful.

Admission to hospital

Typically patients are admitted on the day of surgery to the hospital through the Surgical Admission Unit. Pack a small bag only, you won't be in hospital long! You will be advised when to "fast" from prior to admission, but typically you may have clear fluids or Powerade up until one hour prior to admission.

Anaesthesia

Surgery can be done under general or regional anaesthetic, the anaesthetist decides, if given the choice of both – choose both! The anaesthetist will meet you before you go to the operating theatre to discuss any concerns. If you are a high-risk patient, it may be appropriate to meet the anaesthetist some weeks prior to surgery.

Recovery room

Typically you will wake up in the recovery room, adjacent to the operating theatre. When conscious they offer you an icy-pole. They may ask you how much pain you have (scored out of 10). Minor discomfort should be rated 1-2, if you are grimacing / clenching your teeth, with the pain it might be 6/10. If you report more than 4/10 they may inject you with morphine. This may cause nausea & vomiting instead.

Physiotherapy

The physiotherapist may help you get up walking the first time. If not available, the nurses will do this. Sometimes the first time is with a frame, subsequently crutches. Go quietly to start with - lay day when not actively walking

What will the knee be like?

The knee will be swollen, and swelling may increase for the first few days. The bruising will increase and change colour for the first weeks after the surgery. This can make bending the knee difficult and the thigh muscle feel weak. A knee brace may be used for the first few days, rarely a hinged brace for eight weeks. Swelling control is important – when not doing something – put your leg up (lay on lounge suite). Sitting for prolonged periods can increase the swelling.

Activities after Osteotomies

You need to put at least 50% of your weight through the operated leg for the first two weeks. Just hopping is not enough, your leg recovers faster if used.

As you will need crutches to walk, TAC regulations prevent you from driving except if the surgery is to your left leg and you drive an automatic. Even then, driving in the first two weeks would not be advisable, as you may be still using strong painkillers.

Crutches **MUST** be used until you can lift your leg straight & walk around the house with confidence. It may take 6 weeks from surgery to discard the crutches. This plan may be modified if a chondrocyte graft has also been done.

Exercise bike work can start once you have 90 degrees of knee flexion, typically 2-3 weeks. Light jogging may be possible at 4 months. Swimming could commence at 3 weeks. Kneeling exercises should commence at three-six weeks

Complications following corrective osteotomy

An osteotomy is a major surgical procedure with some risk. This list cannot be complete, but does deal with more common problems. Accepting and minimizing these risks is a responsibility of both the patient and the surgeon.

Numbness

The osteotomy involves cutting a number of layers to do the surgery. It is common for an area near the scar to be numb. The area may become smaller with time (years) but it is usually permanent.

Scar tenderness & kneeling

The scar will be tender for three months. A small number of patients have irritation by muscles or tendons rubbing over the plate. Removing the plate has successfully treated this. Rarely, the patient states they can't kneel. Removal of the plate is a separate operation that costs the patient time, and money.

Stiffness

A knee that was stiff before the surgery will still be stiff after the surgery, although the intention is that with time it improves. For knees with a good range of movement before the surgery, the surgery will have caused bruising and swelling which will gradually resolve.

Fracture & bracing requirement

The operation involves a controlled, incomplete break of the leg at the best location. Sometimes it "propagates" and cracks right through. Rarely it requires a brace for 8 weeks. Extremely rarely, it cracks up into the joint – this could require a larger plate, large incision and more numbness.

Neurovascular injury

Passing around the knee are nerves and arteries supplying the lower leg and they can be injured. Injury can result in permanent loss of function or viability of the limb.

Compartment syndrome

Excessive swelling of the leg after the surgery can permanently damage the muscles of the leg. If it does occur, urgent surgery to reduce the pressure would be undertaken. I have not had any cases of this complication after this surgery to date.

Thrombosis & pulmonary embolism

Clots can occur within the veins of the leg and pelvis before, during, or after surgery. They are associated with a risk of dislodging and moving up to the lung. It can be fatal. Even if they remain in the leg, it can leave permanent swelling of the leg and can cause ulcers to develop. Using Aspirin (100mg daily), Venosan stockings and early mobilization reduces the risk.

Infection.

Infections can occur directly after an operation. To minimize the risk of infection we prepare the operation site with antiseptics, use antiseptic impregnated drapes, and use intravenous antibiotics at the time of and after surgery.

Complex Regional Pain Syndrome

This rare diagnosis (previously known as Reflex Sympathetic Dystrophy) contributes to poor outcomes with pain and stiffness. If you have ever had this condition diagnosed in you, tell your surgeon so additional steps can be undertaken to minimize the risk.

Other

A small number of patients do not achieve the result required, and end up having a knee replacement.

It is not possible to provide a full list of complications. If you have a specific question, ask your surgeon, and he will answer it as well as possible.

What is included in the cost of Realignment Osteotomy?

Insurance generally pays for the “spare parts” and most of the hospital expense, but only covers a fraction of the doctors’ fees. This is because Medicare hasn’t adjusted their schedule to match CPI since 1983, or at all since 2014, Medicare is now worth less than one third of the real value of 1983. So there will be out of pocket expenses for doctors.

Doctors involved in the operation are: the surgeon, anaesthetist, surgical assistant, and if any medical problems occur, or are anticipated, a physician. The surgical assistant is a skilled nurse, doctor, or surgeon or a combination of these working alongside your main surgeon. The surgical assistant’s billing will occur through Ballarat OSM. Typically there will be an out of pocket expense, which contributes to paying the salaries of our nurses and our fellow. If a physician is required, please discuss his fees with him. The anaesthetist will arrange his/her own financial consent. Typical out of pocket expense after Medicare & private health insurance rebates (estimates) are \$500 for hospital, \$400 for anaesthetist, and \$400 for surgical assistant.

Included in the **surgeon’s fee** is performing the surgery, follow-up in the hospital and consulting rooms for twelve months is usually bulk billed - ie no additional charge to you. The surgeon takes responsibility for the whole process, and to solve whatever problems occur. The surgeon takes personal responsibility for the post-operative pain control –including extensive local anaesthetic infiltration around the wounds. For patients off track, the surgeon intervenes, or supervises interventions. The surgeon takes personal responsibility for achieving a low infection rate. If an infection does occur, aggressive surgical and antibiotic treatment is required.

The tem numbers are typically: 48421 (tibial osteotomy & internal fixation) bone grafting (48206), and typically some arthroscopic surgery such as meniscectomy, and debridement (49561). The AMA calculates annually the change in cost of medical practice, covering practice staff, insurance, rent etc, which roughly follows the CPI. Following the AMA fee suggestion, the surgeon’s fee for this combination of operations is \$3776. Insurers are only required by law to pay \$312 towards the surgeon, Medicare pays \$938, thus you’re \$2525 out of pocket, for the surgeon. Insurers require us to discount by 25-35% to allow "Gapcover" arrangements, even with moderate out of pocket expenses.

ESTIMATED COST	Insured patients	Medicare only insurance	No Medicare
Surgeon	\$ 2,850	\$ 2,525	\$ 3,780
Total	\$ 3,800	\$ 13,500	\$ 15,000

Included in the package of estimated fees are:

- Hospital, surgeon, assistants, anaesthetist, prosthetic implants
- post operative ward rounds, usual blood tests and XRs
- followup phone call(s) after discharge, access to Ballarat OSM nurses for advice
- 2 & 6 week appointment at rooms, and any other visits to the consulting rooms required.
- 12 months follow-up appointment related to the knee

Excluded:

- Physician involvement
- Other orthopaedic or surgical problems

If you are experiencing personal financial hardship, please discuss this well prior to the surgery so an amicable arrangement can be made. The out of pocket expenses will be required to be paid two weeks prior to surgery to avoid cancellation.

