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**Osteotomy:  
High Tibial Osteotomy (HTO)  
Distal Femoral Osteotomy (DFO)**

Patient Information

## Introduction

Osteoarthritis (“wear and tear”) often affects one side of the knee joint more than the other – unicompartmental arthritis – and frequently results in knee pain and deformity. When non-operative measures - weight loss, exercise programmes, painkillers, Chondroitin / Glucosamine - have not been successful in controlling the pain a major surgical procedure such as a joint replacement or an osteotomy is usually suggested.

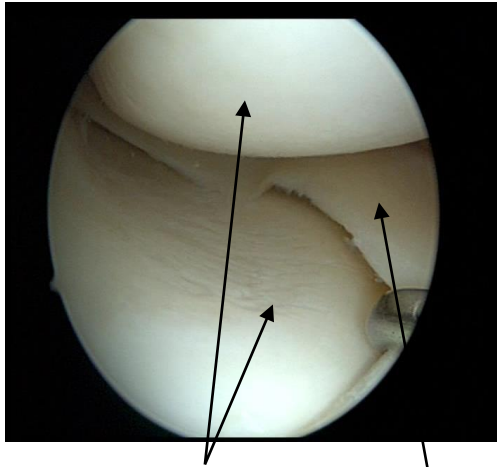
When there is unicompartmental arthritis, osteotomy (leg realignment) can ‘off load’ the affected side of the knee and move the body weight onto the healthier side of the knee. This will ‘preserve’ the joint surface, avoid the restrictions which accompany joint replacement and maintain the patient’s bone stock. It does not preclude any future surgical procedure such as partial or total joint replacement and is often thought of as ‘buying time’ for the knee.

Unicompartmental and total knee replacement (TKR) are frequently performed procedures with over 100,000 being performed in the UK annually. However, one common statistic that is frequently spoken about is that only 80% of patients are happy with their surgical outcome. A joint replacement will have post-operative constraints to activities such as running and heavy manual working which may not suit the more active patient and a ‘lifespan’ which will be reduced in younger, more active patients. Total joint replacement also involves the removal of some of the healthy bone stock and dividing at least one of the major knee ligaments. Revision joint surgery is possible for the ‘failed’ joint replacement but each time this takes place the outcome is less satisfactory both in terms of function and complications.

The information on the following pages covers the reasons for your current symptoms, the potential benefits of having an osteotomy, the risks involved and what to expect after the procedure.

## Knee anatomy & the problem

The knee joint is formed by the lower end of the thigh bone (the femoral condyles) and the upper surface of the shin bone (the tibial plateau). The joint is divided into two compartments – the medial (inner) and lateral (outer). A smooth substance - articular cartilage - normally covers the surface of these bones and minimises friction and weight transmission to the underlying bone.

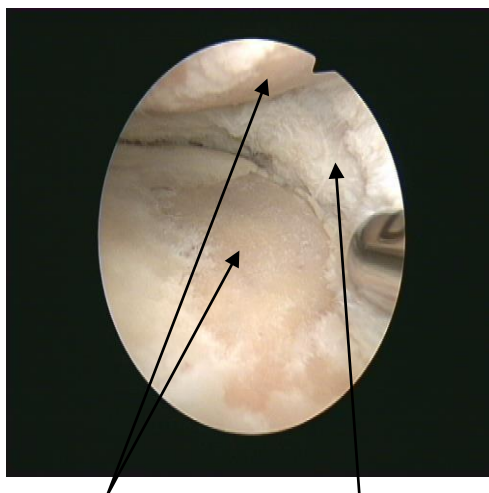


Normal articular cartilage and meniscus



Normal x-ray

Osteoarthritis (OA) describes the process of the articular cartilage thinning and eventually exposing the underlying bone. OA is strongly associated with age and genetic (hereditary) factors but could also be the result of previous injury (fracture or other), previous surgery (meniscectomy), previous infection or coexisting inflammatory joint conditions.



Exposed bone Torn, resected meniscus



'Healthy' joint space Bone on bone arthritis

When standing / walking your weight (force) passes from the centre of the ankle to the centre of the hip (femoral head). This 'weight bearing line' (mechanical axis / alignment) will pass through the knee – usually through the centre or just on the inner side of the midline. However not everyone is 'made the same', and there is great variability in what we may consider to be normal for each individual.

When the articular cartilage wears away from the medial or lateral compartment it causes bowleg (varus) or knock knee (valgus) deformities and this will result in a change of this mechanical axis. This in turn will lead to more of the body weight being transmitted through that compartment, overloading the underlying bone causing pain.



• •  
'Normal' alignment



•  
Varus  
alignment

This malalignment will (or should) be corrected when performing a joint replacement but 'joint preserving' procedures such as osteotomy are usually a preferable alternative in younger, more active patients.

## Osteotomy: General Information

There is no evidence that leaving an arthritic knee without surgery puts the patient at any particular risk, but it is likely the pain and deformity may worsen with time. Arthroscopy (keyhole surgery) is sometimes used to fully assess the extent of the arthritis in the knee joint but it will not 'treat' the arthritis. This information could help the surgeon decide which major procedure is the most appropriate.

The aim of an osteotomy is to reduce pain and improve function. It may not produce complete relief of pain but it should significantly improve the pains from that compartment of the knee. Some patients may find the mild 'knock knee' (valgus) appearance which results unacceptable. An osteotomy involves cutting and re-fixing the bone which implies that the 'fracture' will need to heal. This healing is significantly reduced in patients who smoke and this procedure is therefore not recommended for patients who are smokers.

Osteoarthritis is sometimes the long-term consequence of previous injury involving the major knee ligaments. The ligaments stabilise the knee and therefore arthritis can sometimes be associated with instability or giving way. Osteotomy can in some cases – by changing the shape of the upper surface of the shin bone (tibia) – improve the stability of the knee as well as offloading an arthritic compartment.

## Pre operative exercise(s) / weight loss

Besides the general health and wellbeing aspects of fitness, patients who already have good muscular strength and control will find the post-operative recovery easier. Exercises which are recommended are those 'lower impact' activities such as cycling, rowing and the cross-trainer.

Weight loss is obviously fundamental when talking about joint overload and would significantly reduce your risk of complications around the time of surgery.

## Anaesthesia / Pain management

Having an osteotomy will require a general anaesthetic i.e. 'completely asleep'. This will be discussed on the morning of your surgery by the anaesthetist as will appropriate measures to reduce any post-operative discomfort. At the time of your anaesthetic intravenous antibiotics will also be given to reduce the risk of infection.

## **Surgical wound**

Following anaesthesia a tight inflatable band (tourniquet) is applied to the upper thigh to restrict the bleeding during the procedure. A tibial osteotomy will involve one horizontal and one small longitudinal incision at the upper end of the shin bone (tibia). A femoral osteotomy involves a single longitudinal incision on the inner aspect of the thigh. The stitches will be removed 12 days after your operation and can be done at your local surgery. You will be able to shower whilst the stitches are still in situ.

## How is an osteotomy done?

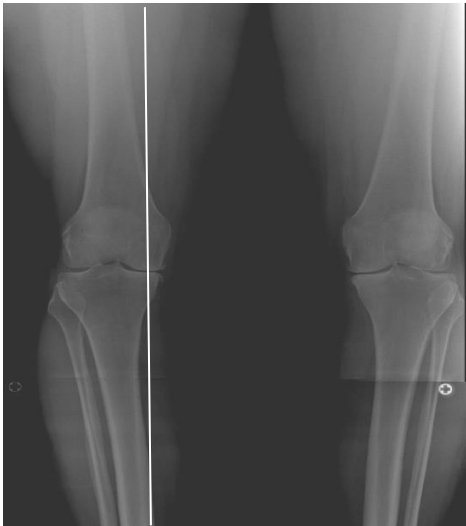
There are two main techniques of realigning the bone. Both (see below) involve cutting the bone with a saw using x-ray guidance. The 'fracture' is then stabilised with a plate and screws. The pre-operative planning of the osteotomy is the key to the success of this procedure. This is done with the aid of computer software and uses measurements taken from the 'long leg' x-ray you will have had done. This will help determine which type of osteotomy you will require and how large a correction will be necessary at the time of surgery.

- Closing wedge osteotomy

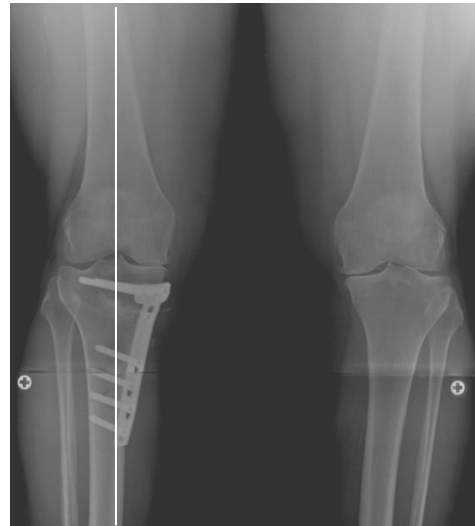
This involves two bone cuts to remove a wedge of bone either from the tibia (shin bone) for bowleg deformity or femur (thigh bone) for knock-knee deformity. Subsequently the 'fracture gap' is brought together and held in position with staples or a plate and screws.

- Opening wedge osteotomy

After the bone cut is made the two sides of the 'fracture' are separated by a pre-determined angle to form a wedge-shaped opening. The osteotomy is then stabilised with a plate and screws. The gap is then filled with sterilized bone chips to encourage healing of the osteotomy site.



•  
Varus  
deformity



•  
After  
osteotomy

### When should an osteotomy not be done?

- Smokers
- Signs of arthritis or previous excision of meniscus from other joint compartment
- Inflammatory joint disease
- Significant patello-femoral / anterior knee pains
- Stiff knees
- Knees with 'significant' deformity

### Risks and potential complications of an osteotomy

- Post-operative bruising

Due to the nature of the operation some bruising of the lower leg is inevitable. This can be made worse if blood thinning medication is given (see below).



- Altered wound healing / sensation

Most heal very well but the wound may become red, thickened and painful (keloid) – more common in the Afro-Caribbean race. Damage to the small skin nerves will result in some temporary or permanent alteration of sensation to a small area of skin on the front of the knee.

- Wound infection

Despite the routine use of antibiotics wound infections may occasionally occur. Another operation may be required to wash out the infected wound.

- Removal of the metalwork

The rigid plate is often palpable and sometimes is tender to the touch. It is generally removed after the bone has completely united (9-12 months).

Approx. 1-5 in 100 patients

- Blood clots (Deep Vein Thrombosis / Pulmonary Embolism)

Following all major lower limb surgery there is a risk of forming a blood clot in the calf (DVT) which can occasionally move through the blood stream to the lungs

(pulmonary embolus). Blood thinning treatment will significantly increase the risk of bruising and discomfort following this procedure and is avoided. However, you will be treated with a calf compression device during surgery and early movements and mobilisation are encouraged to reduce this risk.

- Delayed healing / 'non-union' of the bone

Sometimes the 'fracture' does not heal as quickly or completely as planned. This may require a further bone grafting operation.

- Intra articular fracture

A fracture into / around the knee joint may occur which may require additional fixation.

Approx. 1-5 in 1000 patients

- Compartment syndrome

Post operative bleeding into the calf muscles may cause an increase in pressure and significant pain. This requires an emergency procedure to release the muscle compartments under pressure.

- Damage to the major nerves around the knee

Very rarely, the larger nerves around the knee can be involved resulting in temporary or permanent weakness and/or altered sensation.

- Damage to the blood vessels behind the knee

This can lead to loss of circulation to the leg and foot. If this happens you will need immediate surgery to restore the blood flow and could result in amputation.

### After your operation

You will have no splints, braces or plaster on your leg after the surgery. The stability will be provided by the rigid fixation of the plate and screws. You will be encouraged to regain a full range of extension (straightening) and flexion (bending) as soon as possible after the operation and to begin some strengthening exercises when comfortable. Your physiotherapist will show you some general exercises to perform to aid your early recovery and mobility and may give you a booklet to take home with you.

Tibial opening wedge osteotomy.

You will be able to weight-bear as comfort allows on the day following surgery and your physiotherapist will also help you with this.

Femoral closing wedge osteotomy.

Because the distal femur is slower to heal than the tibia you will not be allowed to fully weight bear through the leg for the first 6 weeks. Only 'touch-toe' weight bearing will be allowed for balance when mobilising.

Most patients can go home on the day following surgery as long as:

- the pain is under control and a plan has been established for reducing pain killers
- you are able to get in and out of bed
- you can walk confidently using your crutches to access the bathroom

A full recovery from an osteotomy may take up to 12 months. As the osteotomy heals you will feel less pain and more confident when walking. You will have an x-ray at 6 weeks and 3 months to assess the bone healing. When you are confident to put full weight through the leg strengthening and balance exercises can help to further control and stabilise the knee.

#### Cold therapy (Cryocuff)

If you have been provided with this cooling device, it can be taken home and put into the fridge / freezer to help with pain control. If not ice packs will substitute.

#### Crutches / Mobilisation

Following a femoral osteotomy, you will need crutches for 6 weeks. After tibial osteotomy crutches will be required for 3-6 weeks according to your strength and confidence when walking.

#### Eating and drinking

Following your operation, you may feel nauseous - a common symptom following surgery and a frequent side effect of pain-relieving drugs. If severe, medication can be given to help improve this.

#### Driving

Usually not for 6 weeks following this major procedure but this will depend on which leg has been operated, comfort and confidence when walking / moving.

#### Sex

As able when comfortable although kneeling may be difficult for the first few weeks.

#### Sports

Only a few determined individuals are able to return to high levels of sports activity following an osteotomy. However, most are able to return to leisure sports activities such as walking, hiking, cycling, swimming, tennis. Contact sports and distance running are not recommended although the patient should ultimately be guided by how they feel about their own knee.

As long as the osteotomy heals and there are no other complications swimming and gentle cycling / rowing may be commenced at about 3 months. There are no restrictions but it may be 12 months or more before vigorous sporting activity can be resumed.

## What are the results?

Osteotomy has been performed for arthritis for centuries and many surgeons have reported their results. But the variety of techniques used, different methods of recording results and small numbers involved in each study have meant that there is still no consensus regarding certain aspects of this surgery. The question of 'what is success' has not been answered. Failure of osteotomy is commonly accepted as the time at which a joint replacement is undertaken.

Two factors are consistently recognised as being very important for success:

- Appropriate patient selection
- Quality surgical technique

Regarding patient selection. It is generally acknowledged that the best results are seen in:

- Patients under 60 years
- Smaller deformity i.e. relatively early in the arthritic process
- Unicompartmental disease
- Stable ligaments
- A good pre operative range of motion (greater than 90°)
- No inflammatory joint disease
- No significant patello-femoral (anterior knee) pain

The introduction of software to accurately plan the procedure has significantly improved the accuracy of the operative correction.

Poorer long term results are associated with:

- Under correction of the deformity
- Penetration of the joint / intra articular fracture

The success of the operation varies between reports but approximately 90% of patients will last 5 years and 75% 10 years. The survivorship depends directly on the accuracy of the post-operative correction and the approach of the patient. If a sufficient correction was achieved at osteotomy and symptoms (pain) increase with time then a joint replacement will be the only surgical solution.