

Knee Osteotomy

A joint preserving operation for unicompartmental arthritis in young and middle aged patients.



Mr Hugo Guthrie

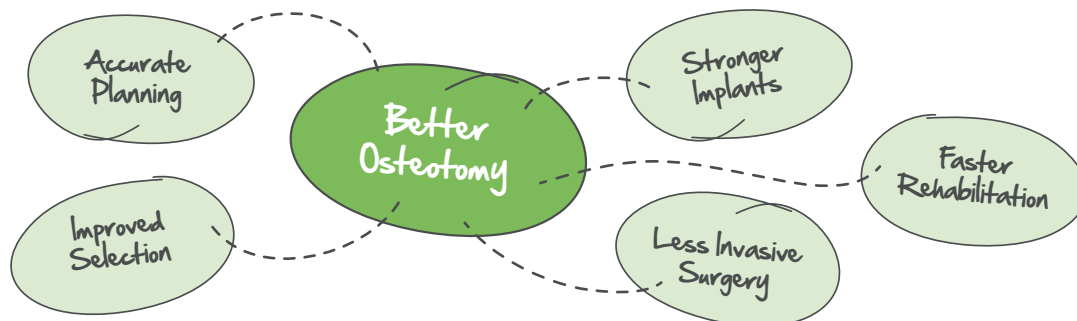
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Osteotomy is an effective biological treatment for arthritis in younger active patients who have degenerative disease limited to one side of the knee and unfavourable mechanical alignment. It can also be useful to pre-emptively offload a compartment of the knee that has had a significant meniscal or cartilage injury. Other indications include correcting deformity and enhancing knee stability.

Surgery involves either removing a wedge of bone (closing wedge) or opening a gap leaving an intact hinge on the opposite side (opening wedge). Around the knee these procedures can be performed in the distal femur or proximal tibia and can be applied on the lateral or medial side of the bone. This makes osteotomy an extremely versatile tool which can address varus or valgus malalignment. Changing the mechanical axis in this way offloads the damaged side of the knee in favour of the undamaged side.

The most common osteotomy procedure I undertake is a valgising (medial opening wedge) high tibial osteotomy (HTO) for patients with medial compartment degenerative change and varus alignment pre-operatively. Less commonly I perform a varising (medial closing wedge) distal femoral osteotomy (DFO) for patients with lateral compartment degenerative change and valgus alignment pre-operatively.

Osteotomy surgery can be planned using computer software to assess the current and desired mechanical axis and work out exactly how much of a wedge is required to obtain the desired effect. This precision planning is one of the areas that has led to renewed interest in osteotomy surgery and together with better patient selection, less invasive surgery and stronger implants is responsible for improved results.



Who is suitable for an osteotomy?

- Active patients under 60 years
- Degenerative joint disease or injury confined to one tibiofemoral compartment
- Corresponding/correctable leg alignment
- Varus/valgus deformity <15 degrees
- Fixed flexion deformity <15 degrees
- A good pre-operative range of motion
- No inflammatory joint disease
- No significant patellofemoral pain
- Non-smokers
- Non diabetics
- BMI <30

Factors predisposing to early unicompartamental arthritis:

- Previous injury to meniscus, cartilage or cruciate ligaments
- Post traumatic arthrosis after intra-articular fracture or malunion of femur/tibia fracture
- Physiological varus/valgus
- Obesity
- Genetics

Why not just replace the knee?

The concern is that a primary knee replacement in a young fit active patient is more likely to wear and eventually fail, requiring revision arthroplasty surgery with its associated risk of complications and reduced function. Even a partial knee replacement involves removing bone stock and revising a partial knee replacement to a total knee replacement has inferior results compared to a primary total knee replacement. Additionally, knee replacement is not universally successful with a significant number of patients reporting stiffness and residual pain following surgery. Therefore, arthroplasty should usually be avoided until patients reach later life.

There are a wide variety of non-operative measures which can be used to try to improve and manage symptoms until pain and function deteriorate to an unacceptable level. NICE guideline CG177 describes the optimal holistic approach to osteoarthritis assessment and management. In arthritis patients an osteotomy is a further albeit surgical method of delaying joint replacement and improving function.

In some patients who have sustained a significant injury to their articular cartilage or meniscus, it is possible to predict that premature degenerative disease will follow and an osteotomy to correct an unfavourable mechanical axis should be considered. This includes patients who have had a significant meniscal tear (or sub-total meniscectomy) or injury resulting in a large chondral or osteochondral defect. Where indicated osteotomy can be combined with cruciate ligament reconstruction to give a patient a stable well aligned knee and reduce progression to degenerative disease.

Non-operative measures for knee arthritis

Analgesia

Physical Therapy

Activity modification

Weight loss

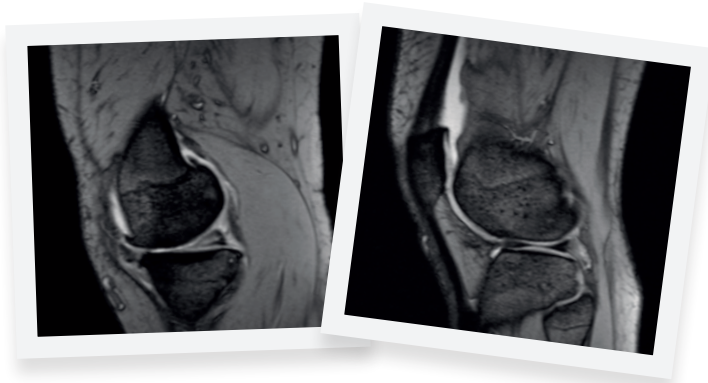
Low impact exercise

Off loader brace

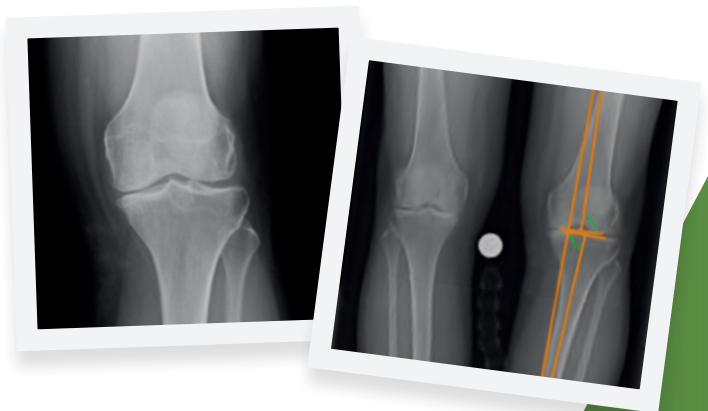
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Case 1. Diagnosis and Planning

- 42-year old nanny with progressive medial pain and stiffness
- GP organised MRI scan and referred to me asking whether she might benefit from arthroscopy for her meniscal tear. MRI also described medial arthritis
- History - As referred, active, non-smoker, not diabetic, otherwise well
- Examination - Varus on standing, correctable varus on couch, no scars, good RoM, intact collaterals and cruciates



Sagittal MRI scans showing (a) loss of articular cartilage medial compartment with degenerative medial meniscus tear and (b) preserved lateral compartment.



Weight bearing AP xray showing loss medial joint space and leg alignment view showing mechanical axis (centre of femoral head to centre of ankle) passing through medial compartment. These images confirm medial degenerate disease and corresponding varus alignment suitable for valgising (medial opening wedge) high tibial osteotomy. I would define this as a failing knee. In this case the degenerate meniscal tear is a consequence of this condition rather the cause.

Software planning tool showing that an 8° opening wedge corresponds to an 8mm medial gap correcting the mechanical axis to 60% of the way from medial to lateral. This results in a little valgus alignment post-operatively meaning that the failing medial compartment is off-loaded and the intact lateral compartment now takes the majority of the load.



These images confirm medial degenerate disease and corresponding varus alignment.

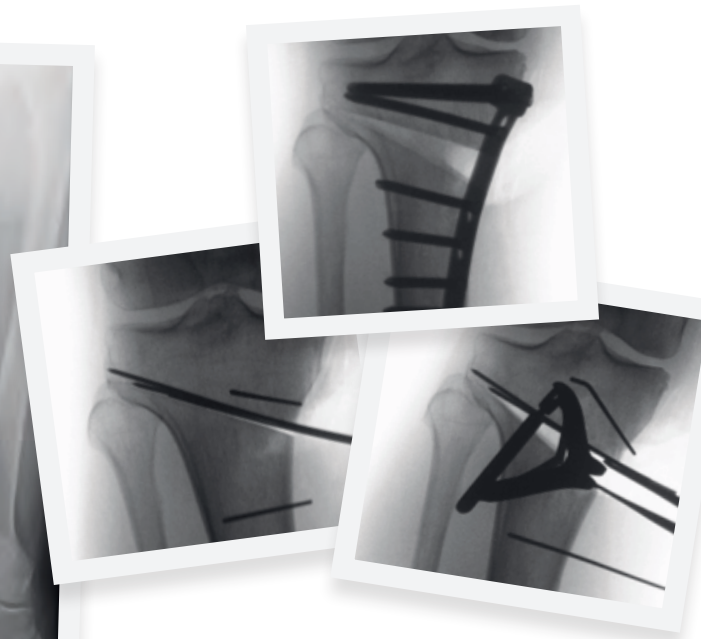
Case 2. Surgery and Recovery

- 56-year old caretaker
- Medial knee pain on activity
- Reduced walking distance
- Reliant on analgesia
- Planning to retire at age 65

Pre-operative leg alignment view shows mechanical axis very medial and passing through the edge of the medial compartment. It can be appreciated that most of the load will be passing through the degenerate compartment.

Surgery

The operation is performed under general anaesthetic. An arthroscopy of the knee is often performed to confirm imaging findings and suitability for the procedure and to resect unstable meniscal tears and debride unstable articular cartilage if required. The tibia is approached using 2 incisions. This is less invasive and the surgeon works through 2 windows to expose the proximal tibia, release the superficial MCL and create a stable biplanar osteotomy using a precision saw and preserving the insertion of the patella tendon. The osteotomy is wedged open to the planned amount and fixed with a locking plate. The new generation of plates are more stable and allow early weight bearing and immediate unrestricted range of movement.

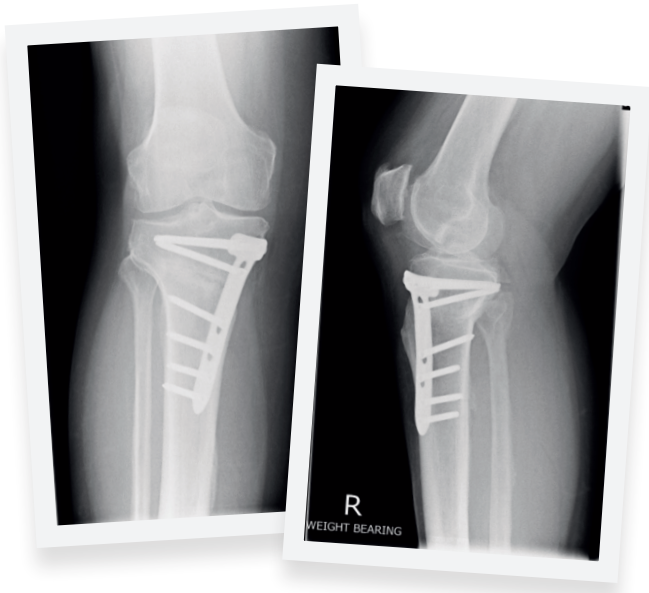


Intraoperative x-rays of high tibial osteotomy being performed according to pre-operative plan and subsequently securely fixed with locking plate.



This is less invasive and the surgeon works through 2 windows to expose the proximal tibia.

Post-operative leg alignment views showing mechanical axis now just lateral to neutral. Now the majority of the load passes through the preserved lateral compartment.



AP and lateral x-rays at 9 months with evidence of bone union.

Recovery

Post-operative patients remain in hospital for 2-3 days. When the patient is mobile on crutches and pain is controlled they can go home. In the first 2-3 weeks the emphasis is on helping the soft tissues heal with the use of elevation, rest and ice to control bruising and swelling. At the same time it is important to maintain range of movement and prevent muscle wasting with early active knee exercises. In my experience most patients use crutches for several weeks, though the plate is strong enough to permit full weight bearing much earlier. Returning to sedentary employment after 6 weeks is usual but manual work may not be possible for considerably longer and will depend on the exact role and the response to surgery.

Complications

Potential complications include intra-operative tibial plateau fracture, iatrogenic neurovascular injury, compartment syndrome, deep infection, over/under correction, non-union, fixation failure, instability, venous thromboembolism, stiffness. In the past these complications were not uncommon with rates of 20-40% complications reported. Many of these risks have now been mitigated with modern surgical techniques, pre-operative planning, better implants and improved post-operative care, however osteotomy remains a significant intervention and patients must be counselled about the risks as well as the benefits in order that they can make an informed decision about their care.

Results

The wide variety of different surgical techniques and indications makes interpretation of the literature difficult. However, most series suggest that osteotomy surgery for arthritis should delay knee replacement for at least 10-15 years in the majority of patients and that subjective and objective clinical outcome scores are significantly improved. The recently developed United Kingdom Knee Osteotomy Register (UKKOR) aims to collect surgical and patient reported outcome data and allow accurate long-term follow-up in a huge number of patients to establish if refined patient selection, better planning and improved implants truly translates into better function and reduced complications.

Summary

It is no longer the case that patients have to put up with arthritis until they are old enough or bad enough for a joint replacement. This is particularly true in symptomatic young and middle aged patients with unicompartamental changes on xray or MRI who have seen little improvement with non-operative measures and who may well benefit from joint preserving osteotomy both in terms of delaying knee replacement and improving function.