



Osteotomy: General Concepts and Indications

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Introduction

Before the introduction of the total knee arthroplasty into clinical practice, an osteotomy was the treatment of choice for osteoarthritis. Today, an osteotomy is considered technically difficult for the surgeon and demanding for the patient. Nevertheless, in our daily practice osteotomies are an important treatment option for arthritis of the knee because they allow a return to a high level of activities including sports. An osteotomy delays the need for a total knee prosthesis in young active patients. Obviously, the following variables have to be taken into account: the type of arthritis, clinical and radiological criteria, and patient expectations. In this chapter, we will not discuss the criteria that make us chose an osteotomy over a total knee prosthesis for degenerative knee pathology, but rather which type of osteotomy is indicated in different clinical situations.

The Goal of the Osteotomy

Once we have decided what type of osteotomy to perform, we need to decide the exact goal of the procedure beforehand. Much work has gone into improving the accuracy of osteotomy, including better preoperative imaging and measurement, and patient-specific guides and computer navigation. But consistently hitting a suboptimal target will not achieve the clinical success that is being sought (Figs. 15.1,

15.2, and 15.3). Overcorrection is poorly tolerated and risks degeneration in another compartment, and undercorrection may lead to early failure of the procedure. Defining the ideal anatomical goal of the correction in each individual, however, is a complex and evolving subject. Broad guidelines have been established; for instance, the correction to 3–6° valgus after osteotomy in medial femorotibial osteoarthritis. However, logic tells us that these figures need fine tuning to the individual's circumstance. In addition to recommendations defined by research into lower limb biomechanics, there are many clinical parameters which may suggest a particular target for each patient. These include anatomic factors such as the weight, torsional profile of the lower limb, and knee laxity, as well as general factors such as the age, and level and type of activity the patient aspires to. In the past, experience has been the backbone of the art form called osteotomy. Gradually, we are learning the science behind the art.

Type of Arthritis

Medial Osteoarthritis

Certain factors support the use of a tibial osteotomy:

- the origin of the varus in medial gonarthrosis is usually on the tibial side and is usually in the proximal metaphyseal region.
- the clinical outcome of an osteotomy in medial osteoarthritis is reported to be good, reliable, and durable with a survivorship of approximately 70% at 10 years.
- an osteotomy restores the morphology with a horizontal joint line.
- technically, the objective of this procedure is to obtain an overcorrection between 3 and 6° of valgus, as measured on the mechanical tibiofemoral angle between 183° and 186°.

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Fig. 15.1 Consistent and accurate achievement, but incorrect target. Poor clinical results



Fig. 15.3 Correct target, consistent and accurate achievement. Good clinical results



Fig. 15.2 Correct target, but inconsistent and inaccurate achievement. Variable clinical results

Opening Wedge Tibial Osteotomy

Advantages:

- very precise correction
- fewer problems with the peroneal nerve

Disadvantages:

- need for bone graft with large corrections, consolidation is more difficult (8–10 weeks)
- tensioning of the extensor system and to a less degree the medial collateral ligament and medial tendinous structures

We prefer an opening wedge high tibial osteotomy in the young patient with preosteoarthritis or limited osteoarthritis.

Closing Wedge Tibial Osteotomy

Advantages:

- easy consolidation (7–8 weeks)
- natural tendency to decrease posterior tibial slope

Disadvantages:

- peroneal nerve at risk
- more variability in the obtained correction

We prefer a closing wedge high tibial osteotomy in the somewhat older patient with advanced osteoarthritis. In case of evolving osteoarthritis secondary to chronic anterior laxity, this is the technique of choice.

Lateral Osteoarthritis

- this type of OA is of mixed origin both in the femur (hypoplasia of the lateral femoral condyle) and in the tibia.
- the clinical outcome is less reproducible.
- we aim for a correction between 0 and 2 degrees of varus.

Opening Wedge Femoral Osteotomy

Since the origin of the valgus knee is often situated in the distal femur, an osteotomy of the distal femur seems logical. Nevertheless, we have to understand that a correction by osteotomy is only obtained in the frontal plane, in extension (P. Chambat). The anatomy and alignment is not changed in flexion and thus a valgus knee will persist in flexion after a distal femoral osteotomy. Therefore, the indication for a distal femoral osteotomy is a valgus knee in extension (Figs. 15.4, 15.5, and 15.6). If the knee is well aligned in extension but a joint space narrowing is observed on the tunnel view, the options for treatment are a medial high tibial closing wedge osteotomy or a unicompartmental prosthesis. For the moment, we believe that the classification of the valgus knee according to the origin of the deformity is not yet well understood and that deformities at the level of the diaphysis are not yet

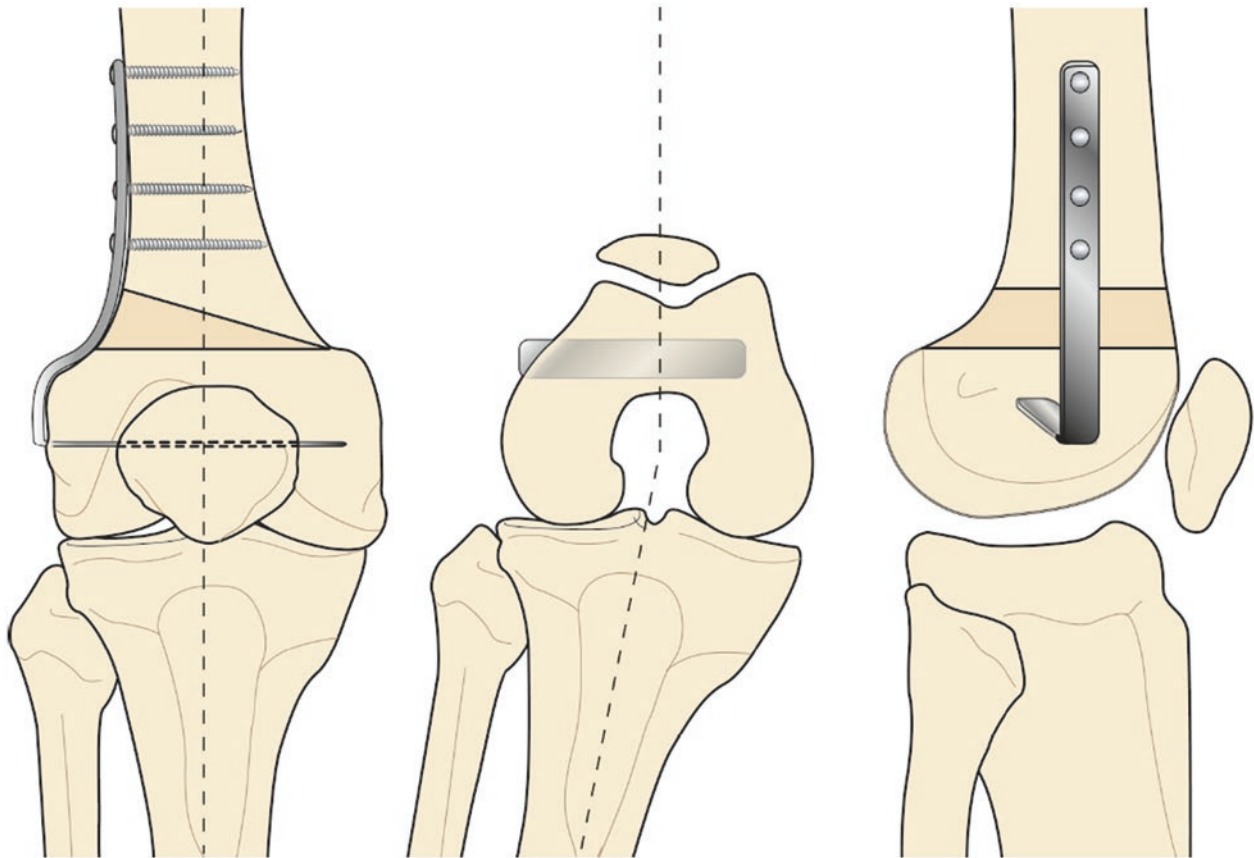


Fig. 15.4 A correction by femoral osteotomy is only obtained in the frontal plane, in extension (P. Chambat)



Fig. 15.5 After femoral osteotomy, in extension the valgus has been corrected

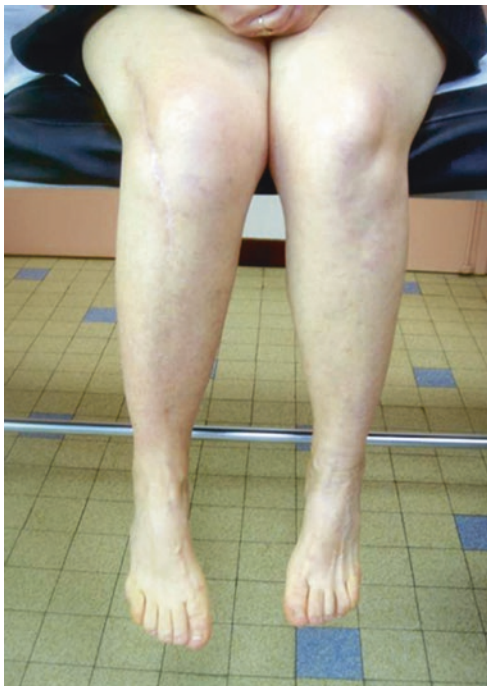


Fig. 15.6 After femoral osteotomy, the valgus remains in flexion

included. A distal femoral osteotomy requires rigid fixation is associated with more blood loss and has a high risk for arthrofibrosis.

We generally perform a distal femoral osteotomy in younger patients with a valgus of distal femoral origin. The patients should be well motivated.

Medial Closing Wedge Tibial Osteotomy

This type of osteotomy on the contrary will have an effect both in extension and in flexion. It is indicated and justified in those valgus knees of a mixed origin. However, it is accompanied with a risk of significant obliquity in the joint line. This obliquity, if superior to 10° , can generate excessive stress on the patellofemoral joint, especially on the medial side. We propose a medial closing wedge high tibial osteotomy for the patient around 60 with a high level of activities including sport, with a valgus knee of mixed origin or of tibial origin which is less than 8° .

Clinical and Radiological Criteria

Age

In a young patient with limited or early medial gonarthrosis, we prefer an opening wedge high tibial osteotomy.

Weight

Morbid obesity has a negative influence because of both loss of correction in the osteotomy and of difficulties during the non-weightbearing period.

Arthritis Secondary to ACL Rupture

Because the wear pattern is located more posteriorly on the tibial plateau (due to the ACL rupture) decreasing the tibial slope will limit the anterior tibial translation. Therefore, a closing wedge high tibial osteotomy is more appropriate.

Origin of the Deformity

- if extra-articular (constitutional or malunion), the osteotomy is considered “corrective” since it will correct the bony deformity.
- if intra-articular (wear), the osteotomy is considered “palliative” because the wear deformation is compensated by creating a bony deformity.

Expectations of the Patient

The preoperative level of activity and the expected postoperative level of activity of the patient will influence the indications for an osteotomy. We are more likely to treat an older patient with a high level of activity, including sports, with an osteotomy.

Advice to Give to the Patients Before Surgery

- adapt your home (carpets, animals, stairways) to decrease the risk of a fall.
- physiotherapy should be initiated preoperatively to learn how to walk with crutches.
- advise weight loss preoperatively (this is possible in the young patient but it remains difficult in the older patient).
- advise to quit smoking since this has a negative effect on the achievement of union and on wound healing.

In Conclusion Our Main Indications Are as Follows

Medial Osteoarthritis

Opening wedge high tibial osteotomy:

- young patient.
- early OA: stage 1 and 2.
- specific case: combination ACL reconstruction and osteotomy.
- in the exceptional case of a constitutional varus knee without OA (constitutional varus superior to 8° , if bilateral or with more than 4 finger widths of space between the condyles). In this rare cases, the aim is to leave some residual varus ($2\text{--}3^\circ$).

Closing wedge high tibial osteotomy:

- older patient but active
- stage 3 and 4

- patella infera
- chronic anterior laxity with posterior wear on the tibial plateau

Femoral osteotomy and double osteotomy are exceptional: these techniques are indicated in secondary arthritis due to malunion, Vit D deficiency, etc.

Lateral Arthritis

Tibial osteotomy:

- to correct abnormalities of mixed origin (femoral and tibial) only if the obliquity of the joint line will not be superior to 10° after your osteotomy and in a valgus knee inferior to 8° .
- we prefer a medial closing wedge osteotomy.
- lateral opening wedge high tibial osteotomy with a revision osteotomy of the fibula is only indicated secondary to an excessive lateral closing wedge high tibial osteotomy with an overcorrection.

Femoral osteotomy:

- valgus knee of femoral origin.
- valgus with a fixed flexion deformity or a hyper extension of more than 20° : this pathology can be addressed more appropriately with a femoral osteotomy than with a tibial osteotomy. However, the morbidity of the femoral osteotomy is more significant and has to be integrated into the indications flowchart in order to prevent complications.

In case of a large deformity:

- double osteotomy combining a lateral distal femoral opening wedge osteotomy and a medial closing wedge high tibial osteotomy can be considered.