

# Osteotomy around the painful degenerative varus knee

Matthieu Ollivier and Matt Dawson



# Osteotomy around the painful degenerative varus knee

Section 1: Indications and contraindications  
Section 2: Planning



Alejandro Espejo-Reina

## Section 1

# INDICATIONS and CONTRAINDICATIONS



**Alejandro Espejo Reina**  
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## Is knee osteotomy (KO) for varus medial osteoarthritis preferentially indicated for a specific age group or gender?

The general status of the patient is considered more important than age alone. There is no clear cut-off value that preferentially indicates osteotomy at any specific age. Similarly, no outcome data exist to suggest superior or inferior clinical outcome in younger patients compared with those over 55 years of age. Older patients will enjoy improved outcomes where otherwise appropriate indications are followed.

**Grade C**

Agreement 8/9





# Is knee osteotomy (KO) for varus medial osteoarthritis preferentially indicated for a specific age group or gender?

There is no evidence that male or female gender influence KO outcomes.

**Grade B**



Agreement 8/9

## Do extreme values of Body Mass Index (BMI) contraindicate KO?



BMI influences KO outcomes, with higher complication rates in patients with BMI > 30 or BMI < 21. Whilst no recommendation can be extracted from the literature on a specific 'cut off' value, a case by case assessment must be made if the BMI > 35 and patients counselled regarding the high risks involved.

**Grade C**

Agreement 8.1 /9

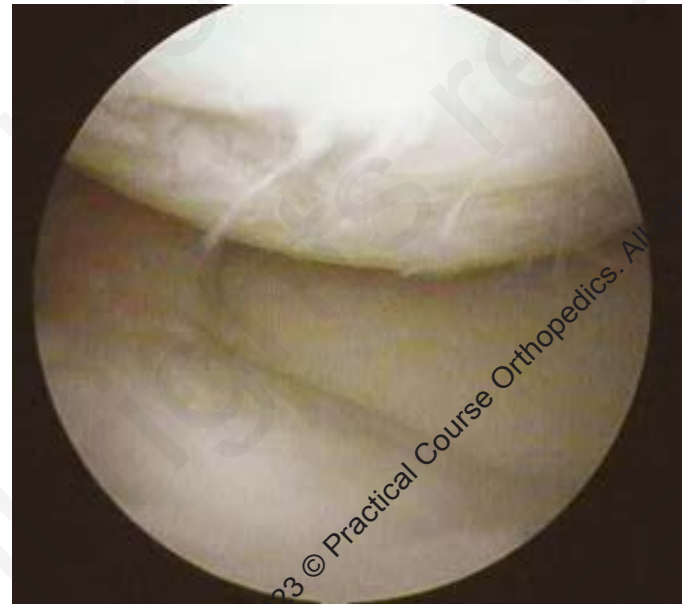


# Is early lateral compartment osteoarthritis (OA) a contraindication to KO?



Early signs of OA (diagnosed by radiography, MRI or arthroscopy) do not impair outcomes and are therefore not contraindications to KO surgery.

## Grade D



Agreement 8/9



## Is early lateral compartment osteoarthritis (OA) a contraindication to KO?

Substantial lateral compartment OA (Kellgren Lawrence 3 and 4) is a relative contraindication to KO. Positioning of the weight bearing line (WBL) into the lateral compartment in such a circumstance may accelerate lateral compartment disease.

A more neutral positioning of WBL may therefore be a more viable alternative.

**Grade D**

Agreement 8/9



## Is significant bone loss with intra-articular varus deformity a contraindication to osteotomy?



Intra-articular deformity questions the indication for KO as the usual emphasis is on extra-articular deformity correction.

### Grade D

In case of isolated Intra-articular wear, KO outcomes are unpredictable.

### Grade C

In case of combined intra- and extra-articular deformity, the amount of “potential” soft tissue correction should be estimated to avoid massive over-correction.

### Grade C

## Section 2

# PLANNING



**Ronald van Heerwaarden**  
*Netherlands*

# What is the ideal radiographic evaluation to facilitate osteotomy planning?



## Agreement 8.9 /9

The gold standard for quantification of coronal alignment is the double leg stance long leg radiograph with the patient appropriately positioned with the limbs correctly rotated so as not misrepresent coronal alignment.

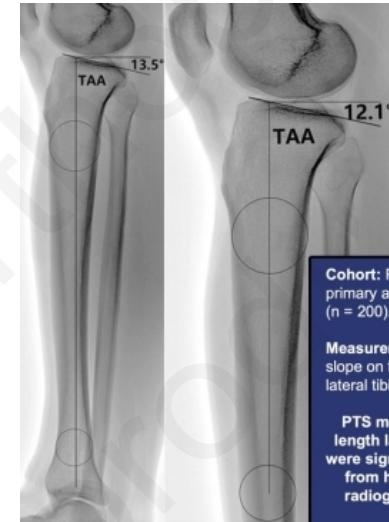
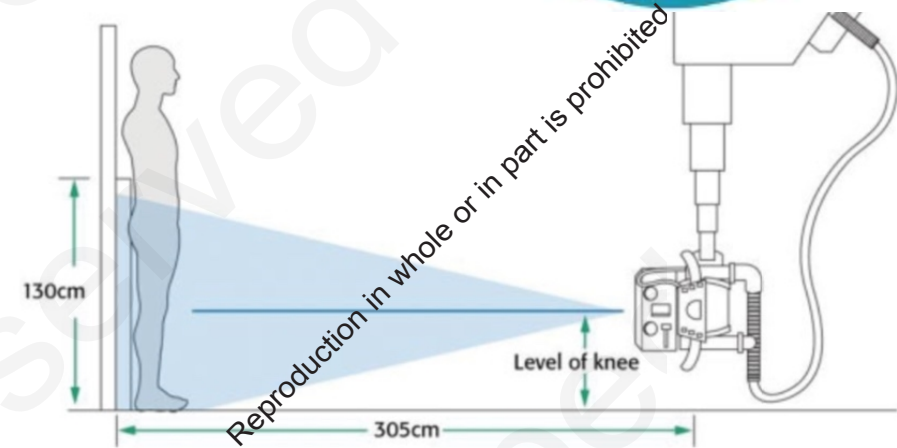
### Grade C

Standard lateral knee view is a routine requirement. In addition, for sagittal plane deformity analysis and planning, whole length views of femur and/or tibia should be performed

### Grade D

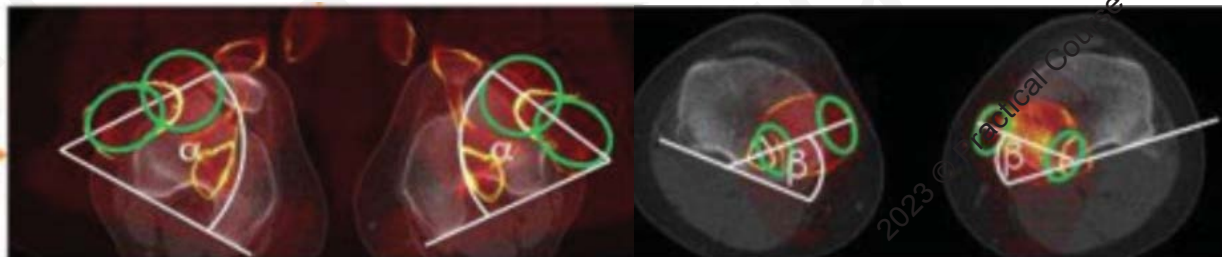
If torsional deformity is suspected clinically, axial plane planning CT scan slices at predefined heights are preferred

### Grade D



**Cohort:** Patients undergoing primary and revision ACL-R (n = 200).  
**Measurements:** Posterior tibial slope on full-length and half-length lateral tibial radiographs.  
**PTS measurements from full-length lateral tibial radiographs were significantly larger than that from half-length lateral tibial radiographs (15.9° vs 14.1°).**  
**49.5% of patients had ≥ 2° difference.**

Ni et al. KSSTA. 2022.



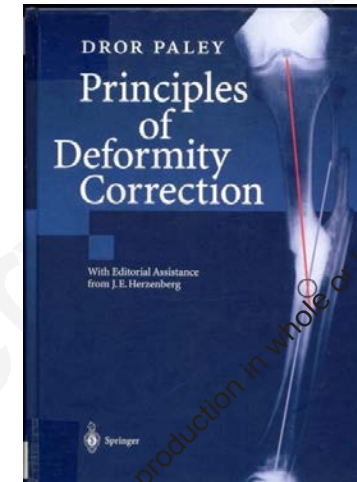
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# What are the normal values in lower-limb coronal alignment, femoral and tibial morphology?

## Agreement 8.8 /9

Normal lower limb alignment and standard ranges can be defined according to Paley et al.<sup>21</sup> in the coronal plane. These normal values should be considered in the context of recognized ethnic and gender differences and clinical examination findings.

**Grade B**



mTFA	Mechanical Tibio Femoral Angle	Acute angle between the mechanical axes of the femur and tibia	1° to 1.3° varus
MPTA	Medial Proximal Tibial Angle	Medial angle between tibial mechanical axis and tibial plateau tangent	87° (85° to 90°)
LDFA	Lateral Distal Femoral Angle	Lateral angle between mechanical femoral axis and femoral condylar tangent	88° (85° to 90°)
JLCA	Joint Line Convergence Angle	Angle between the femoral condylar tangents and the tibial plateau tangents	0-2°



# When correcting a varus arthritic knee how is intra-articular deformity factored into the plan?

## Agreement 8.5 /9

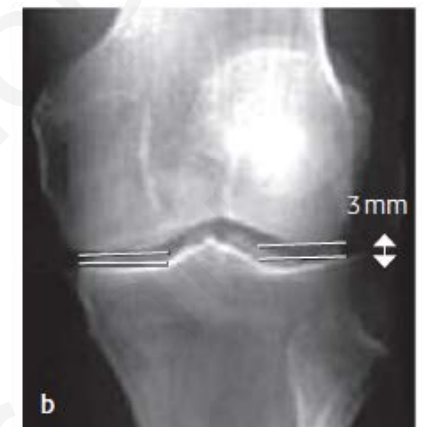
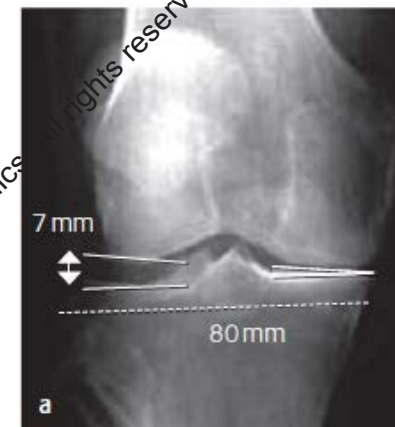
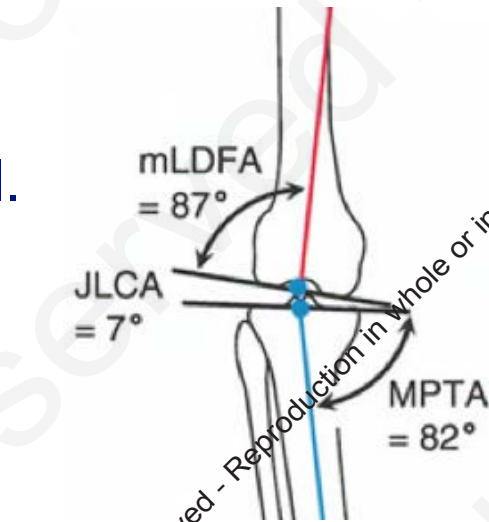


Additional ligament laxity and intra-articular deformity increasing the varus deformity can be measured using the joint line convergence angle (JLCA) according to Paley et al. JLCA  $>2^\circ$  is considered abnormal and should be accounted for in overall alignment planning to prevent bony overcorrection.

The degree to which this abnormality will reverse following bony correction and upon resumption of weight-bearing varies between individual cases.

Various pre-operative and intra-operative methods are described to help prevent bony overcorrection in abnormal JLCA cases

**Grade C**



# Where should the weightbearing line be positioned to treat a knee with medial OA knee in varus malalignment?



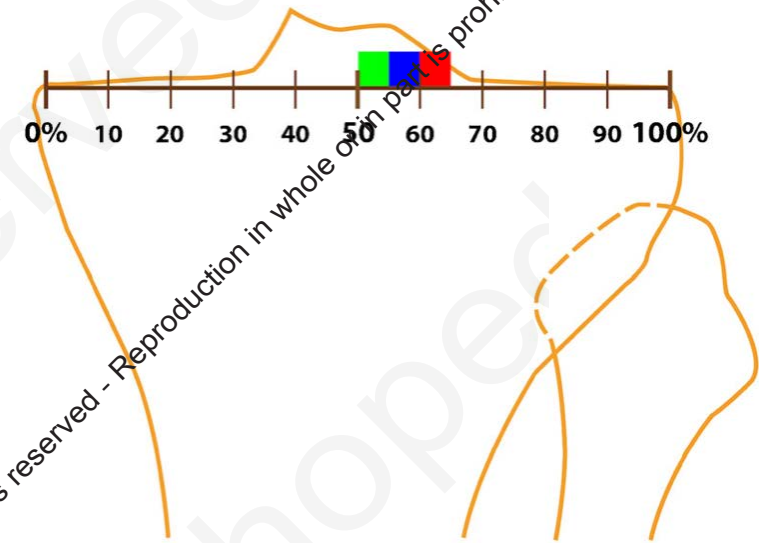
## Agreement 8.2 /9

An individualized approach is recommended which recognises that each patient has differing characteristics which include degree of deformity, radiographic osteoarthritis severity and indication for osteotomy surgery.

No specific target point can be recommended but based on historic results target ranges of between 50% and 68% have been proposed and may be implemented depending on patient specificity and degree of OA. In the light of the more recent evidence relating to joint line obliquity the consensus group would aim at the lower range of correction

Specific attention should be paid to the postoperative morphology of the long bone.

**Grade C**



# Which knee joint line orientation is acceptable after planning an osteotomy?



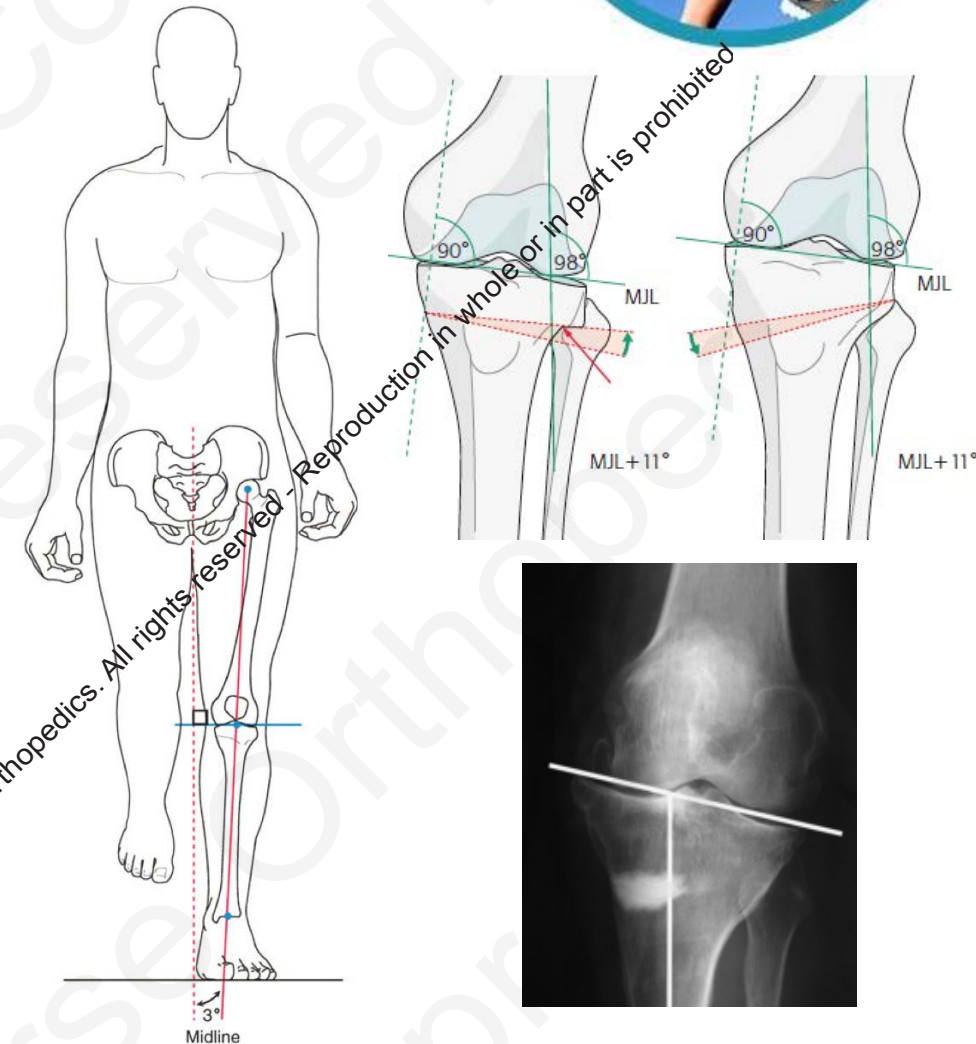
Agreement 8.6 /9

The knee joint line orientation defined as the position of the knee joint tangent relative to the horizontal is known to be important to reduce shear forces in the knee.

Joint line orientation reflects a challenging compromise between mechanical WBL modification and resulting tibial and femoral anatomical morphology.

**Planning should therefore aim to target a resulting knee joint line orientation below or equal to 5°.**

**Grade B**



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# When is a double level osteotomy (DLO) indicated to correct a varus malaligned knee?

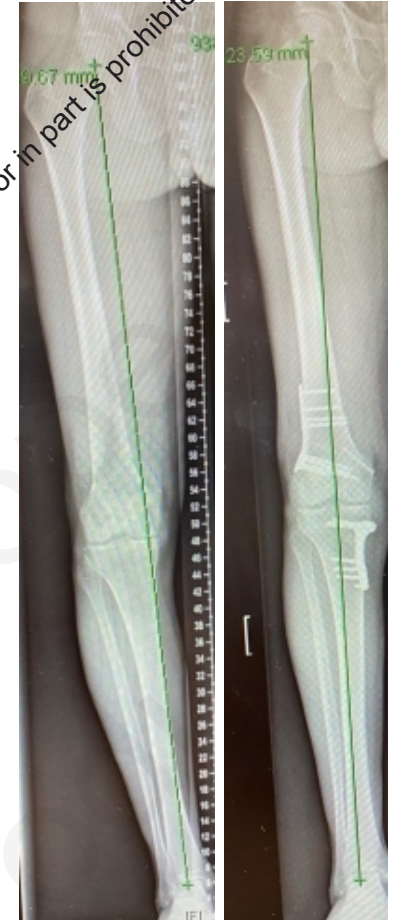
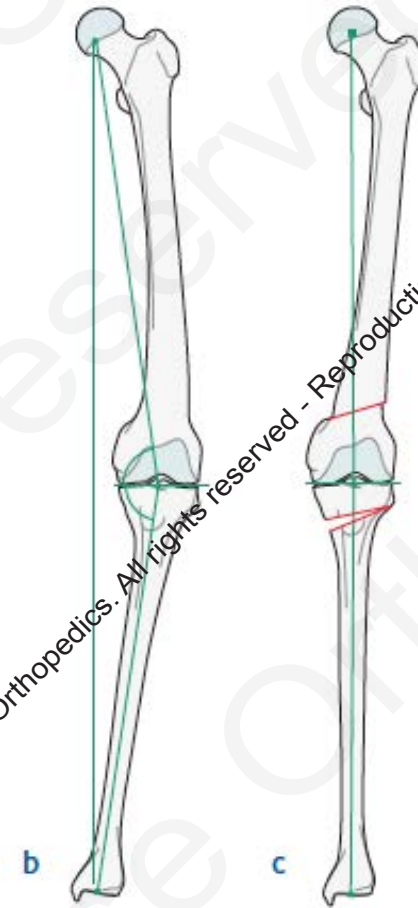
Agreement 8.8 /9



**A DLO correcting the varus malignment in both the femur and the tibia should be considered if deformity analysis identifies a significant deformity in both bones.**

DLO may also be considered if when planning a single level correction, the resultant knee joint line orientation exceeds  $5^\circ$  or MPTA exceeds 94

**Grade C**





# Osteotomy around the painful degenerative varus knee

Section 3: Surgical strategy

Section 4: Rehabilitation

Section 5: Complications



## Section 3

# SURGICAL STRATEGY

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Consultant Trauma and Specialist Knee Surgeon  
Guys and St Thomas' Hospitals  
Honorary Senior Lecturer – Kings College London  
Orthopaedic Specialists



# Hinge Management

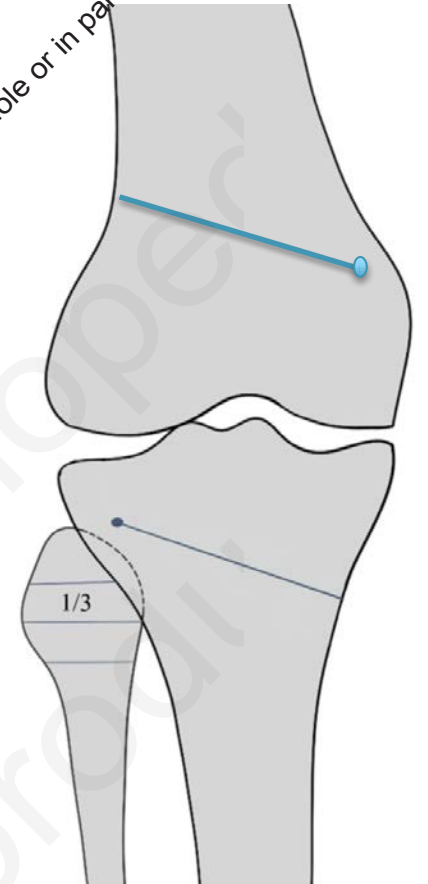


## Is there an ideal position of the Hinge for varus knee MOWHTO and LCWDFO?

- The final hinge position for the MOWHTO should be in the region of the proximal third of or just above the fibula head.
- The hinge should be in a “antero-lateral” position to avoid changes in the posterior tibial slope.
- **Grade C**

## Should the hinge be protected when doing an osteotomy?

- Despite some technical notes supporting the use of a temporary hinge wire or screw in providing additional protection there is no clear evidence, in the literature, supporting the use of a hinge wire or screw during osteotomy surgery.



**Grade D**



# Is there an advantage of biplanar cut in MOWHTO and LCWDFO?



- In general, the biplane osteotomy provides additional stability, a larger surface contact area for bony union and rotational control in the presence of a hinge fracture.
- Further benefit is derived from avoidance of the patella tendon insertion during HTO.

## Grade C

- Despite the lack of strong clinical evidence, biomechanical studies suggest the use of biplanar cut in DFO.

## Grade D



## Should the tibial osteotomy technique (Opening Wedge, Closing Wedge or direction of biplane cut) patello-femoral disorder including patella baja?



- There are no clinical studies to strongly influence surgical technique in the presence of patello-femoral disorders.
- The effect of reducing patella height in medial opening wedge osteotomies and increasing the patella height in lateral closing wedge osteotomies appears negligible for routine corrections and therefore should not influence surgical strategy for this indication.

### Grade B

- Pending results of further investigation and in large opening wedge corrections a distal tuberosity osteotomy may be considered to prevent adverse effects on patella height and patellofemoral cartilage forces.

### Grade D



# Should the gap be filled in MOWHTO?



- The use of graft to fill the osteotomy gap is not required for routine use in MOWHTO surgery.
- Where required additional stability may be achieved with the use of structural void fillers. Ideally a choice of void fillers where required should be available to the surgeon.
- Autograft bone void fillers can increase the rate of bony union but may be associated with donor site morbidity.
- Allograft options provide a potential solution especially in larger opening gaps but availability is not universal due to regulatory restrictions in some countries.
- Synthetic void fillers may have an increased risk of non-union and infection.



**Grade B**

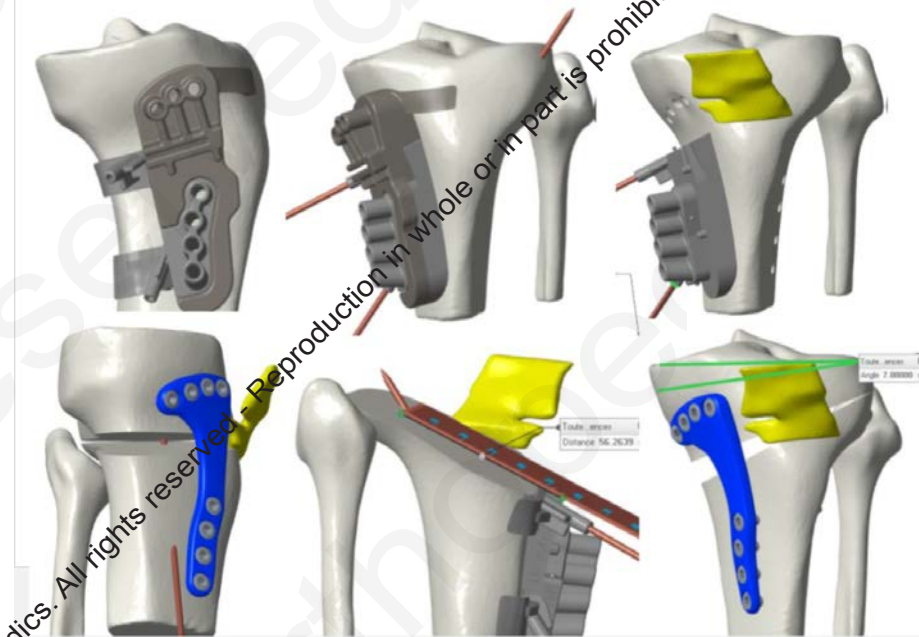


Agreement 8.2 /9

# What is the place for PSI in MOWHTO and LCWDFO?



- The steering group recommends gaining experience with conventional techniques prior to adopting the use of PSI which may be a demanding technique.
- The adoption of PSI for basic MOWHTO or LCWDFO is recommended for experienced surgeons who require familiarisation prior to using the technique for more demanding cases.
- Nuanced presentations with the existence of multiplanar deformity (especially including elements such as torsion and intra-articular malunion) are ideal situations for the PSI in the hands of an experienced surgeon who has ascended the learning curve in this technique .



**Grade D**

## Section 4

# REHABILITATION



**Dr Vlad Predescu**

*Ponderas Academic Hospital Bucharest Romania*



## How soon can full weight-bearing commence in MOWHTO, LCWHTO / LCWDFO surgery?



Rehabilitation is the same after surgery in both MOWHTO and LCWHTO managed with **plate fixators** and is aimed at **functional mobilization** and early full weightbearing, provided that **soft tissue healing is not compromised**.

### Grade B

no hinge fracture, stable locking plate, non-smoker, no evidence of osteoporosis, no infection

Agreement 8.4 /9

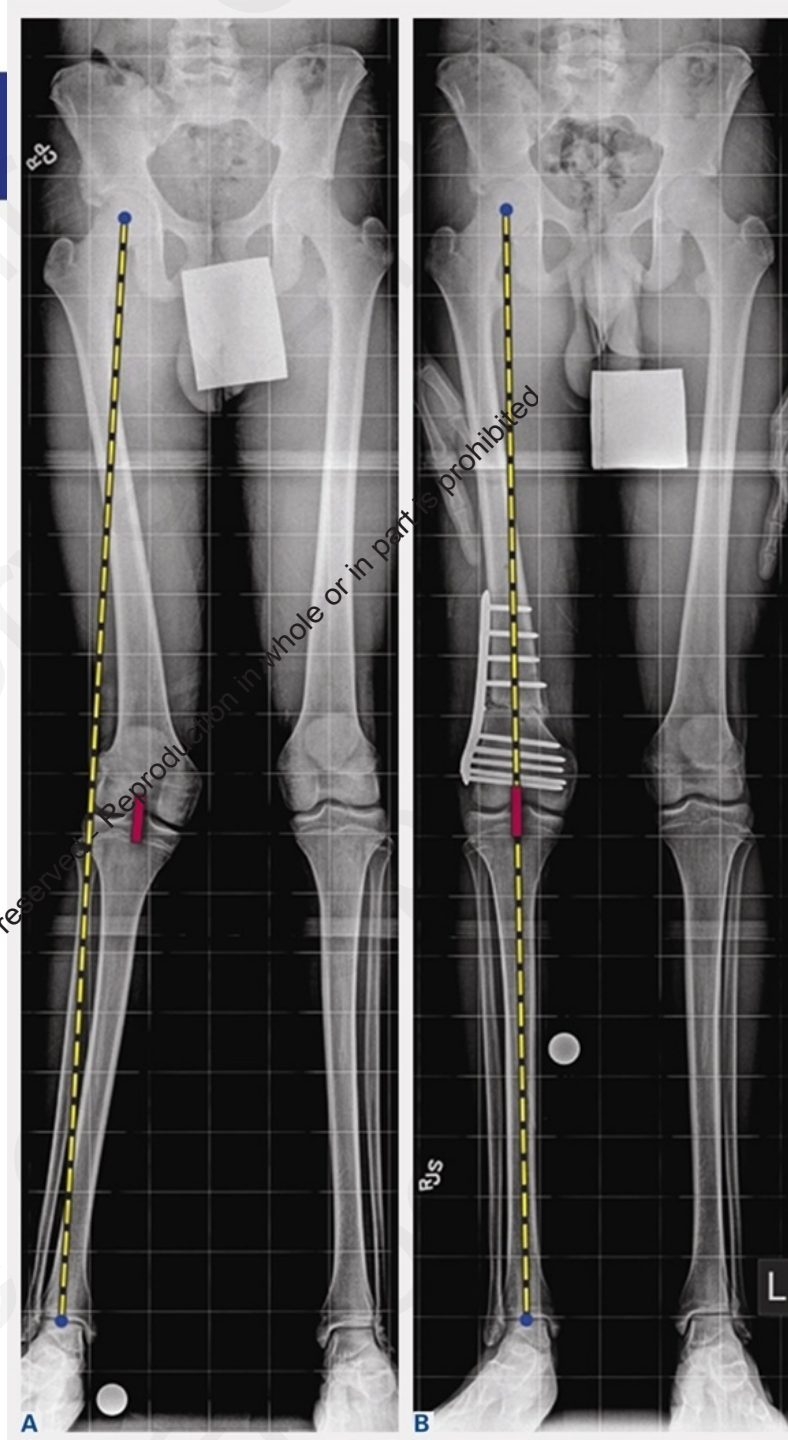
## How soon can full weight-bearing commence in MOWHTO, LCWHTO / LCWDFO surgery?

The biomechanical situation is less stable in distal femoral osteotomy compared to the high tibial osteotomy and therefore requires greater discretion with regards to weightbearing. A LCWDFO therefore requires a more cautious approach to weight-bearing than HTO. The steering committee agrees to a period of **restricted weight-bearing** followed by carefully monitored **FWB at 6 weeks**.

**Grade C**



Agreement 8.4/9



## When may patients return to work after osteotomy for the painful varus degenerative knee?



Employment with low levels of physical stress may be compatible with return in under three months but higher levels of physical burden are likely to exceed 3 months. Mental health must be factored in, but **patients can generally be reassured that they are likely to return to the same or higher level of work after surgery.**

Agreement 8.6/9

### Grade C

- Hoorntje et al (2017) - systematic review - 7 studies - 364 patients (85%) from 429 were able to return to work
- 276 patients were unable to work for 16.3 weeks

Review > Sports Med. 2017 Nov;47(11):2219-2244. doi: 10.1007/s40279-017-0726-y.

> Orthop J Sports Med. 2019 Dec 27;7(12):2325967119890056. doi: 10.1177/2325967119890056. eCollection 2019 Dec.

### High Rates of Return to Sports Activities and Work After Osteotomies Around the Knee: A Systematic Review and Meta-Analysis

Alexander Hoorntje<sup>1 2</sup>, Suzanne Witjes<sup>1 2</sup>, P Paul F M Kuijjer<sup>3</sup>, Koen L M Koenraadt<sup>1</sup>, Rutger C I van Geenen<sup>1</sup>, Joost G Daams<sup>4</sup>, Alan Getgood<sup>5</sup>, Gino M M J Kerkhoffs<sup>6</sup>

Affiliations + expand

PMID: 28401426 PMCID: PMC5633634 DOI: 10.1007/s40279-017-0726-y



### Predictors of Return to Work After High Tibial Osteotomy: The Importance of Being a Breadwinner

Alexander Hoorntje<sup>1 2 3 4</sup>, P Paul F M Kuijjer<sup>5</sup>, Berbke T van Ginneken<sup>6</sup>, Koen L M Koenraadt<sup>4</sup>, Rutger C I van Geenen<sup>4</sup>, Gino M M J Kerkhoffs<sup>2 3 4</sup>, Ronald J van Heerwaarden<sup>7 6</sup>

Affiliations + expand

PMID: 31909053 PMCID: PMC6935877 DOI: 10.1177/2325967119890056

## When may patients return to sports (RTS) after osteotomy for the painful varus degenerative knee?



Patients may be counselled that RTS is highly likely after osteotomy **provided that rehabilitation is completed**. The majority can expect RTS **within 6 months** especially those practicing **low impact** activities.

- safe when the osteotomy had radiographically healed
- weekly frequency of practicing certain sports may decrease postoperatively

Agreement 8.8 /9

## Section 5

# COMPLICATIONS

**Steven Claes**  
*Belgium*



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# What routine measures aid in prevention of soft tissue, nerve and vascular injury?

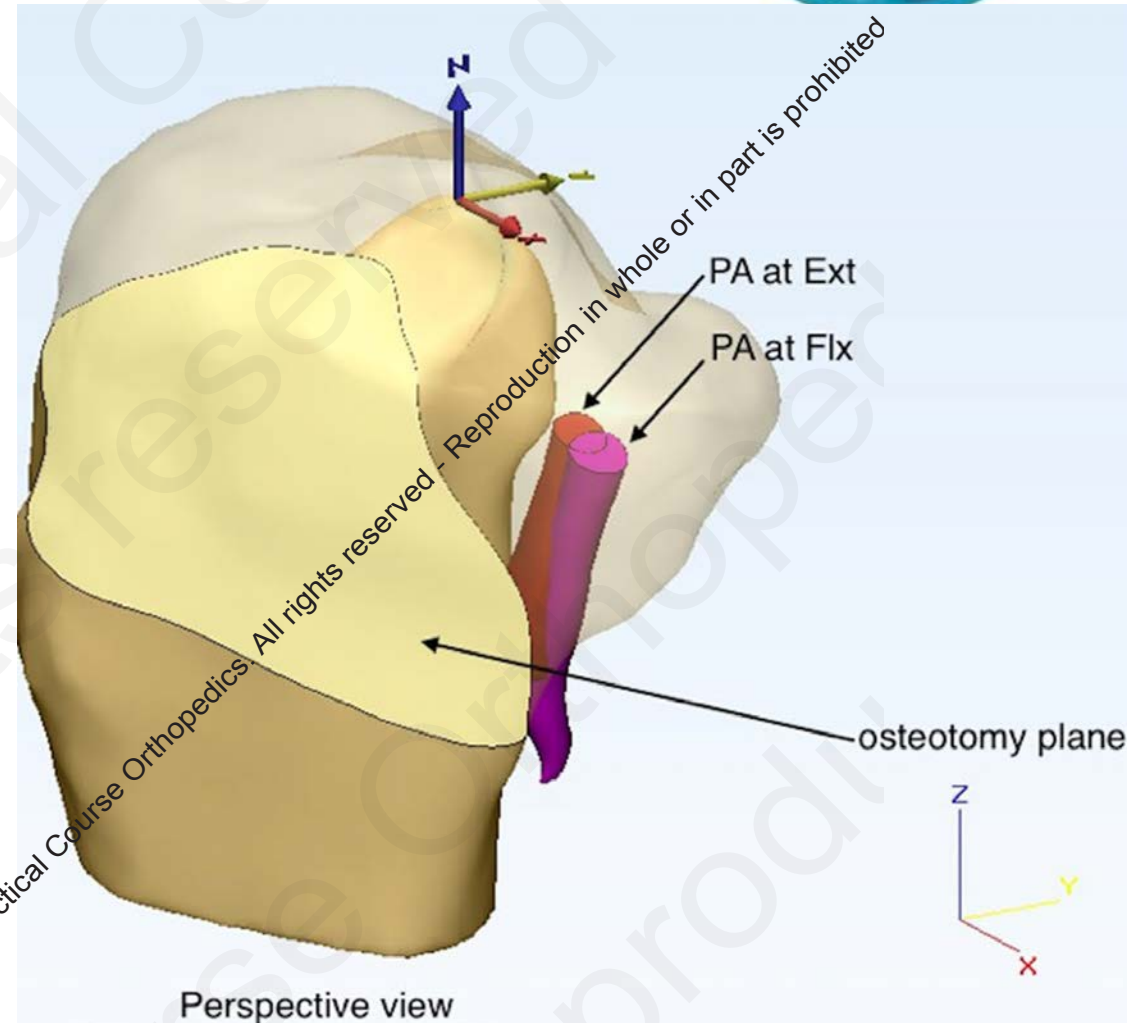


During HTO particular attention must be paid to the direction of the saw blade which after cutting the immediately visible cortical bone should be directed so that the long axis of the saw blade is angled at a minimum of 30 degrees anteriorly to the posterior cortex in MOWHTO and 40 degrees in LCWHTO.

There is no scientifically proven evidence that knee flexion or extension protects the neurovascular bundle.

**Grade C**

Agreement 8.4 /9



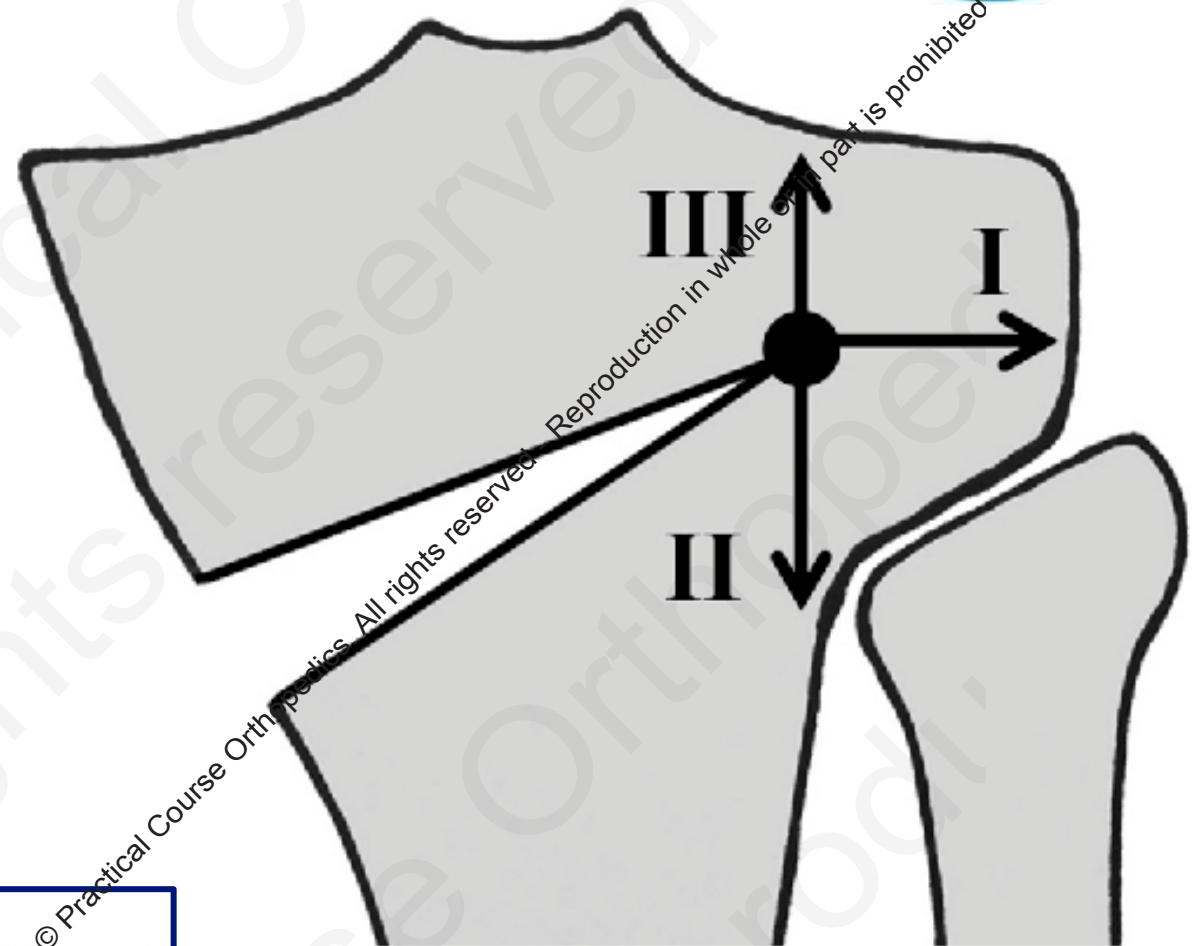
# What is the definition of a hinge fracture and how should it be managed intra-operatively during MOWHTO?



All hinge fractures (especially type II and III) may become **unstable**.

Any displacement discovered intraoperatively under scrutiny by image intensifier must be addressed by reduction and fixation.

A type I fracture may be satisfactorily reduced, and the hinge compressed by the selected medial plate fixator, but displaced type II and III fractures will require reduction and interfragmentary screw or small additional lateral locking plate fixation in addition to the osteotomy plate.



# How is infection diagnosed and treated in MOWHTO?



No diagnostic criteria exist to distinguish between superficial and deep infection which is specific to osteotomy. Because MOWHTO does not involve muscular or fascial coverage of the fixator **any suspected osteotomy infection must be regarded as potentially requiring surgical intervention** because of the proximity of the implant to the skin surface. The consensus group recommends that antibiotics are not commenced prior to review by the surgical team.

**Grade C**

Agreement 8.8 /9







# How is aseptic non-union diagnosed and treated after osteotomy?

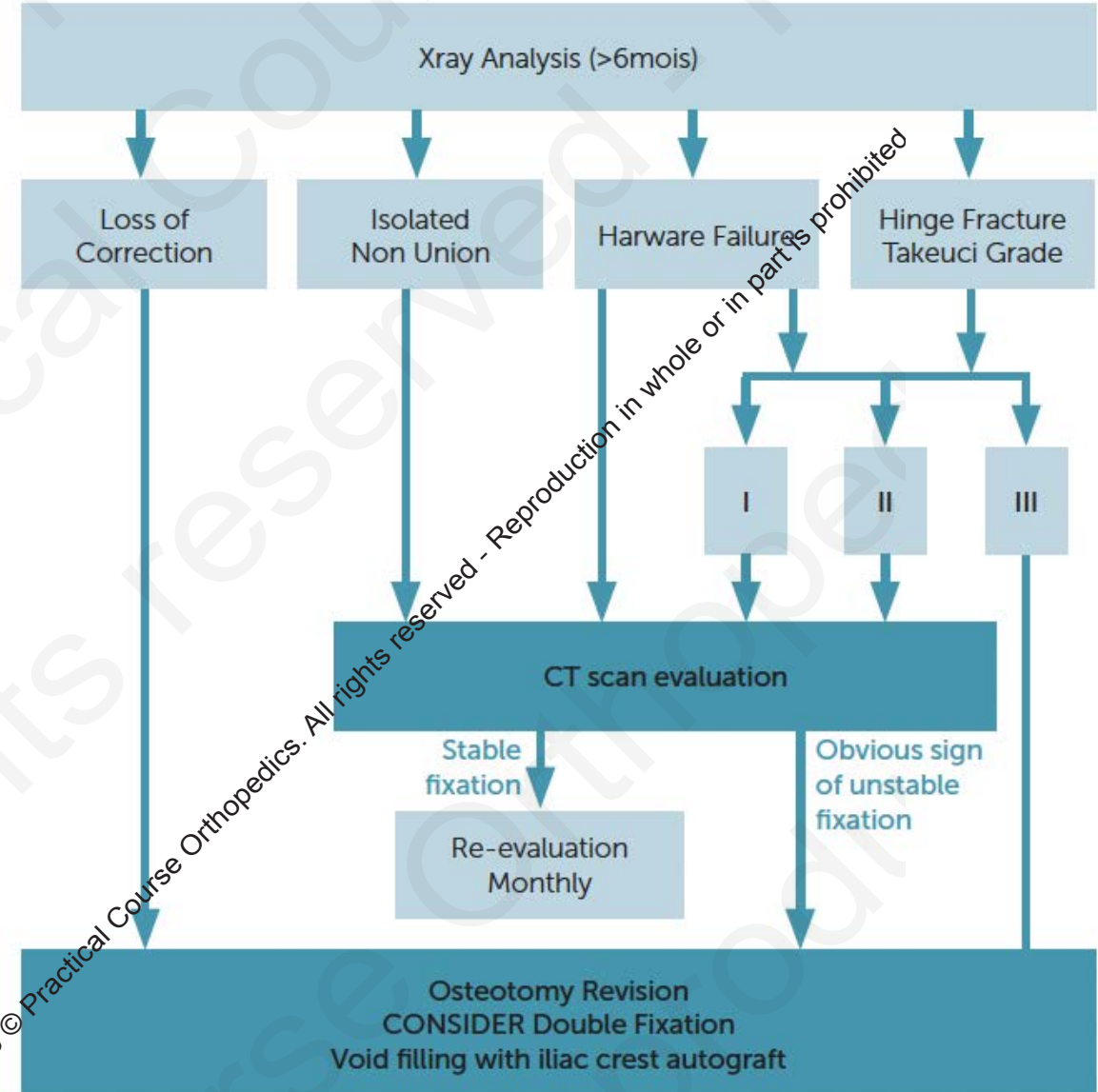
Aseptic non-union is a **rare complication** of MOWHTO even when performed without void filler.

It is essential to combine clinical assessment with the radiological findings on a case-by-case basis.

Obvious mechanical factors including loss of correction, hardware failure or lateral hinge fracture may confirm the diagnosis and should direct surgical management. Close clinical follow up is essential and CT scan may be helpful.

**Grade C**

Agreement 8.6 /9



## Section 4

# Summary and Conclusions



**Matthieu Ollivier**  
*France*

# Indications

Any patient

With predominantly extra-articular (varus) deformity

Causing intra articular pain

and Preserved lateral compartment

Will benefit from Knee Osteotomy



# Planning implies

Assessment of bone deformity  
and articular wear  
performed on multiple Xrays  
(±CT and ±MRI)

In frontal, sagittal  
(and potentially horizontal) plane

To identify normal  
and abnormal figures  
and Define potential surgical site(s)  
and optimal correction



# Surgery Should

- be performed at the level of the deformity
- avoid creating anatomical abnormalities or joint line obliquity.
- protect the hinge and soft tissue.
- promote bone healing  
(gap filler, optimal plating, biplanar cuts)



# Patients will

- Return to their preoperative jobs at around 3 months
- Return to sports at 6 months if they follow full rehabilitation programme



# Complications

May be avoided by identification and minimisation of risk

May be anticipated and diagnosed early intra or post-operatively

May be treated in a standardised way following expert guidance

