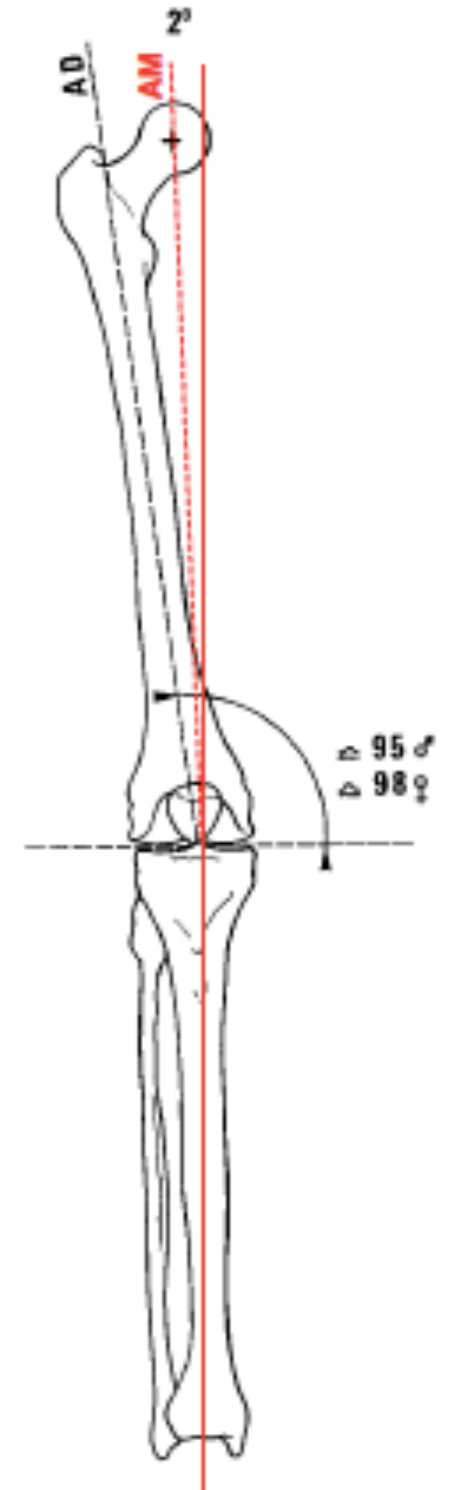


Choice of spacer material for HTO

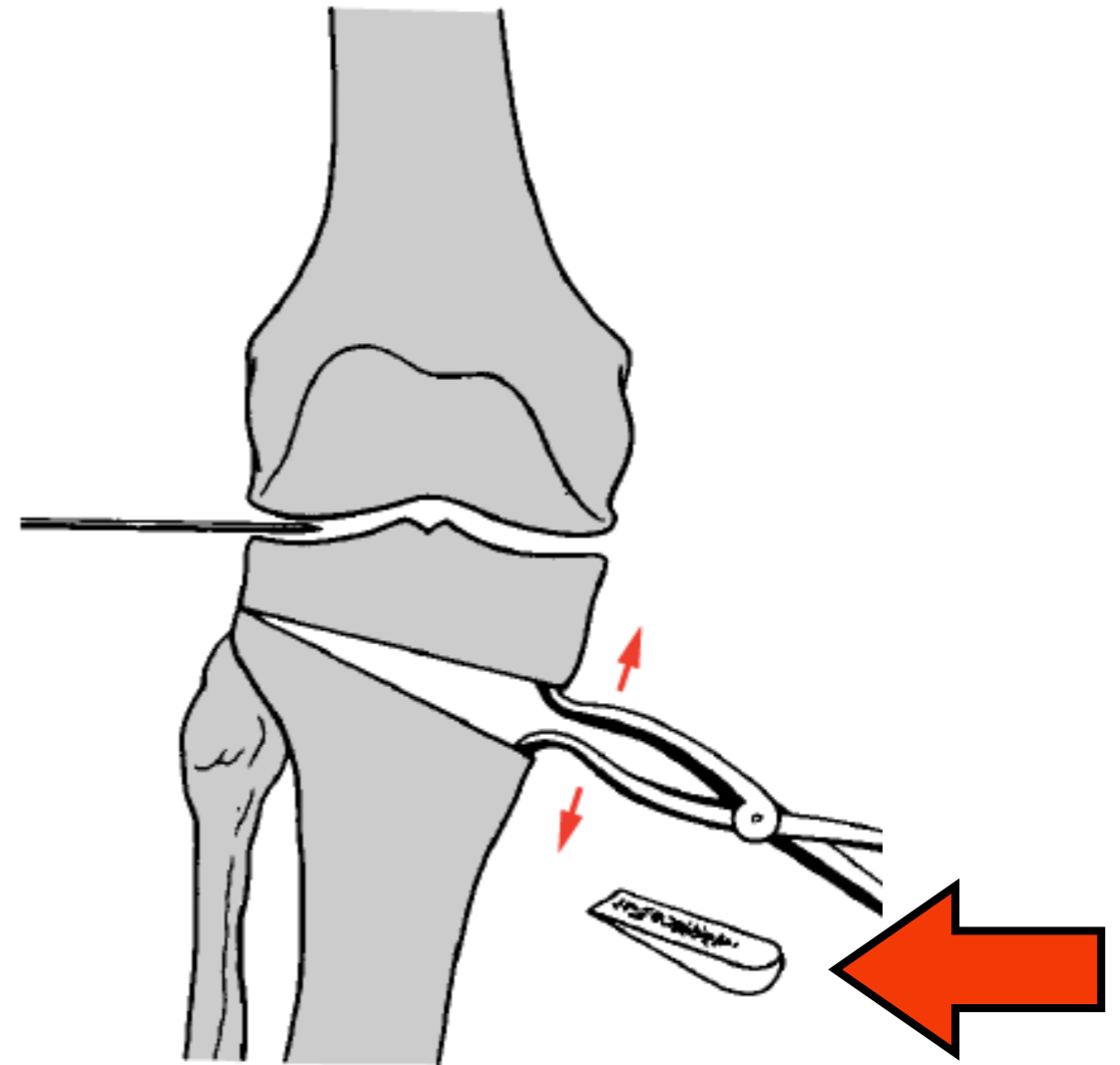
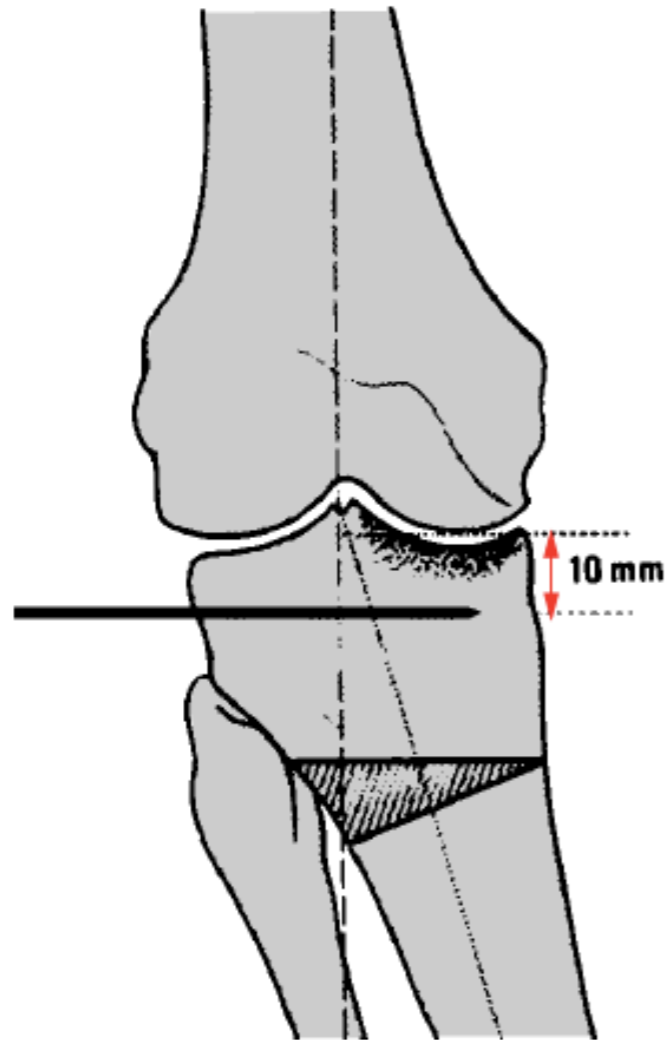
P. Landreau, MD
Chief of Surgery
Aspetar, Orthopaedic and Sports Medicine Hospital
Doha, Qatar

High Tibial Osteotomy: HTO

- Valgisation HTO
- Intended to transfer the mechanical axis from medial to slightly lateral to the midline of the knee to decrease the load and subsequently delay osteoarthritis.
- Good results



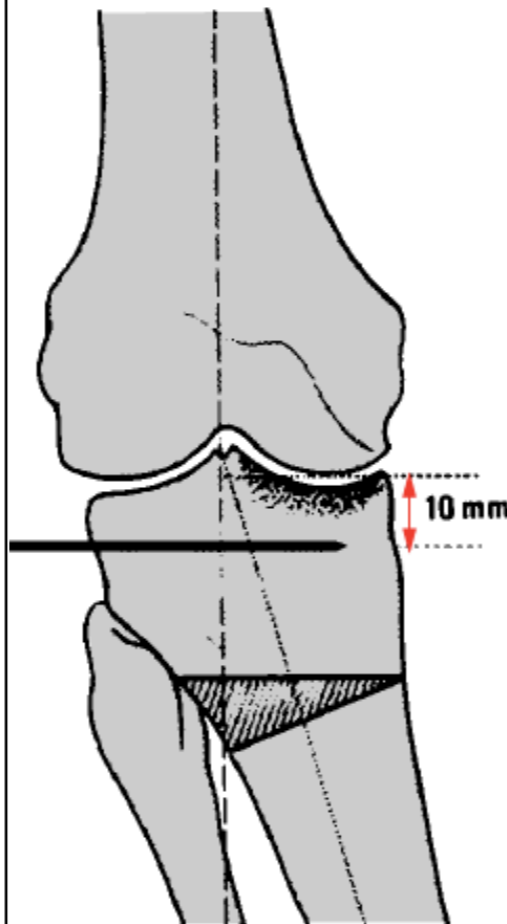
Closing wedge vs Opening wedge



Lateral closing wedge osteotomy

Advantages

- Greater potential of correction
- No need for bone grafting
- Faster healing



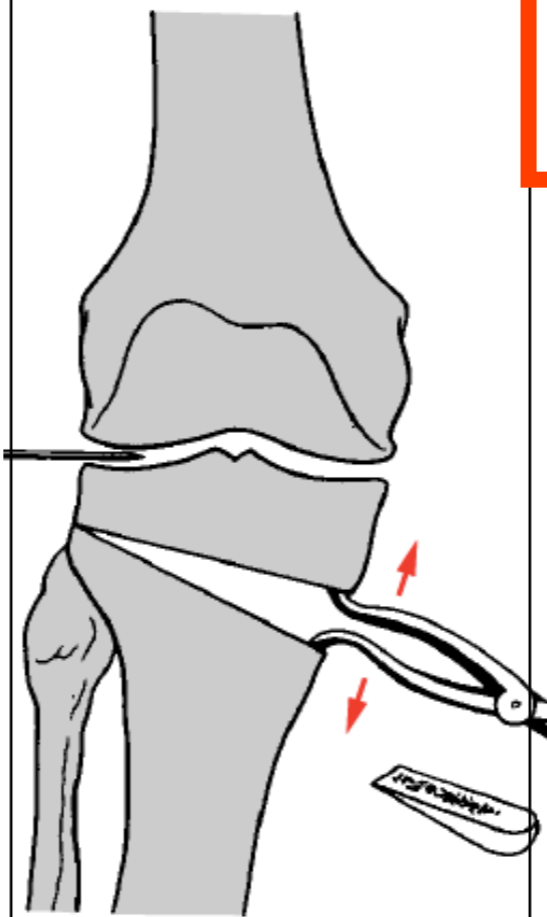
Disadvantages

- Fibular osteotomy or release of proximal TF joint
- risk of peroneal injury (3-12%)
- Muscle detachment
- Difficult to correct in 2 plans
- Shortening of the leg
- Loss of bone stock
- further arthroplasty...

Medial opening wedge osteotomy

Advantages

- Accurate correction
- No fibular osteotomy
- Correction in 2 plans
- Lower risk for peroneal nerve
- No limb shortening
- No bone loss
- Easier arthroplasty



Disadvantages

- Bone graft / spacer material
- Risk of delayed and non-union
- Stiffness (MCL)
- Risk to increase posterior tibial slope, patella height and patella-femoral pressure

Plate fixation

i.e. Puddu plate

- **Spacer plates**

- small, low profile implants that require small incision with less soft tissue damage
- but less rigid with the possibility of delayed union, nonunion, and failure of fixation leading to increased posterior tibial slope. Locking version ++



Plate fixation

i.e. TomoFix plate

- **Plate fixators**

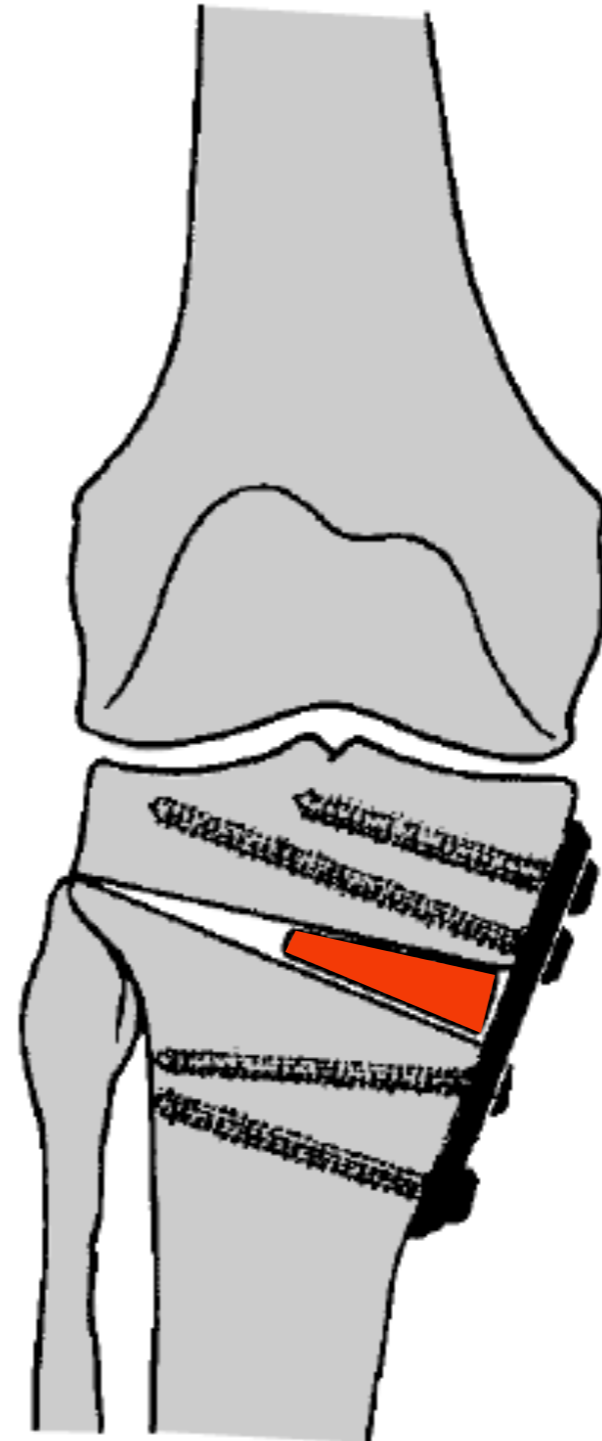
- rigid fixation (long locking compression plate), possibility of early weight bearing after two weeks, and early start of motion
- but less rigid with the possibility of delayed union, nonunion, and failure of fixation leading to increased posterior tibial slope



Before spacer material,
fixation is crucial

Which spacer material?

- Nothing
- Spacer plate itself
- Autograft
- Allograft
- Synthetic: Bone substitute
- Other



No filling / spacer plate

- Healing starts from the lateral hinge and gradually progresses toward medial.
- Callus formation and ossification is visible three months after surgery.
- The new bone fills 75% of the gap 6 months after surgery.
- Almost 90% of the patients achieve full consolidation.



Usually iliac crest

Autograft

Gold Standard

- Better results with lower complications in comparison with allograft and bone substitutes

Kuremsky MA, Schaller TM, Hall CC, Roehr BA, Masonis JL. Comparison of autograft vs allograft in opening-wedge high tibial osteotomy. *J Arthroplasty*. 2010; 25(6):951-7.

- But prolonged operation time, additional preparation of the donor site, and morbidity.

Lobenhoffer P, Agneskirchner JD, Zoch W. Open valgus alignment osteotomy of the proximal tibia with fixation by medial plate fixator. *Orthopaede* 2004 Feb;33(2): 153-60.

Allograft

- Easy, time of surgery
- But cost and potential for transmitting diseases



Synthetic: Bone substitutes

- Hydroxyapatite, Tricalcium phosphate (TCP)
- To address the limitations of autogenous and allogeneous bone grafts.
- Availability
- No donor site morbidity

Which bone substitute?

- Locking plate fixation and ceramic spacers
- Post operative alignment and clinical outcome were comparable between **hydroxyapatite** (HAp) and **beta-tricalcium phosphate** (TCP)
- but **TCP was significantly superior** for osteoconductivity and bioabsorbability after 18 months.

TCP better?

Onodera J, Kondo E, Omizu N, Ueda D, Yagi T, Yasuda K. Beta-tricalcium phosphate shows superior absorption rate and osteoconductivity compared to hydroxyapatite in open-wedge high tibial osteotomy. *Knee Surg Sports Traumatol Arthrosc.* 2014; 22(11):2763-70.

Allograft or synthetic?

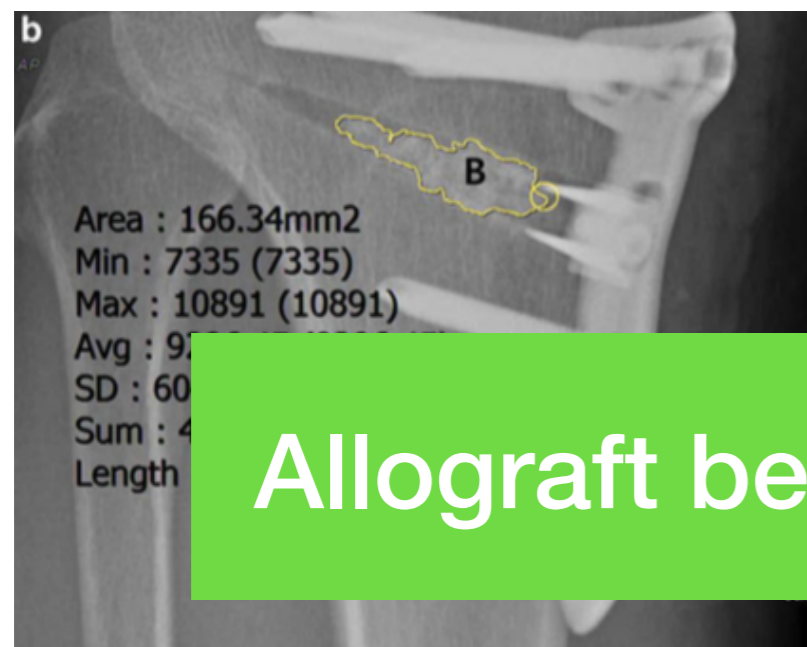
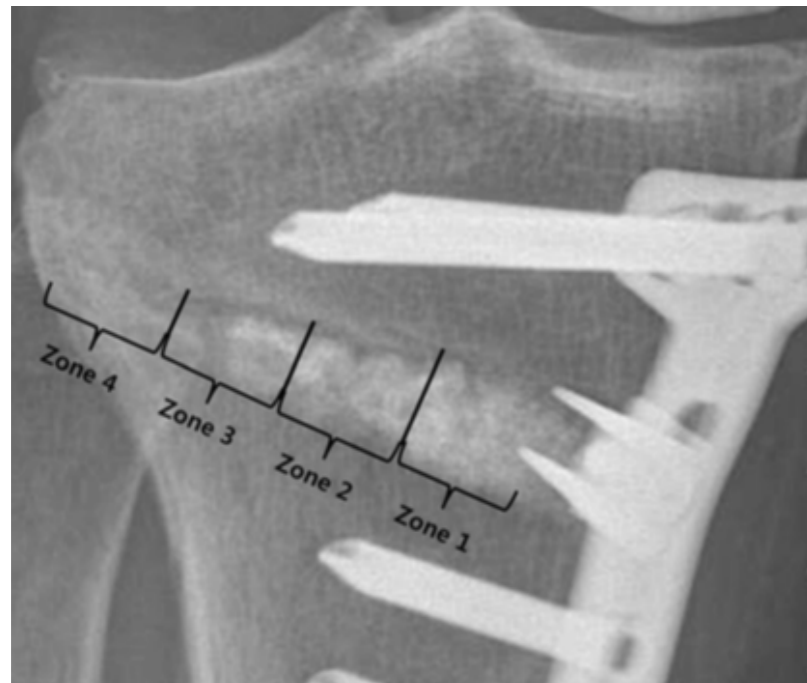
Allogeneous bone chips VS hydroxyapatite (HA)

53 patients

41 patients

Conclusion:

The allogeneous bone chips and HA chips showed **similar outcomes of bone healing** after OWHTO. However, the **allogeneous bone chips** showed a **greater osteoconductivity** at the early postoperative period (6 weeks) and **greater absorbability** at the late postoperative period (6 months and 1 year) than the HA chips.



Allograft better?

J Mater Sci: Mater Med (2017)28:189
DOI 10.1007/s10856-017-5998-0



CLINICAL APPLICATIONS OF BIOMATERIALS

Original Research

Comparison of bone healing and outcomes between allogeneous bone chip and hydroxyapatite chip grafts in open wedge high tibial osteotomy

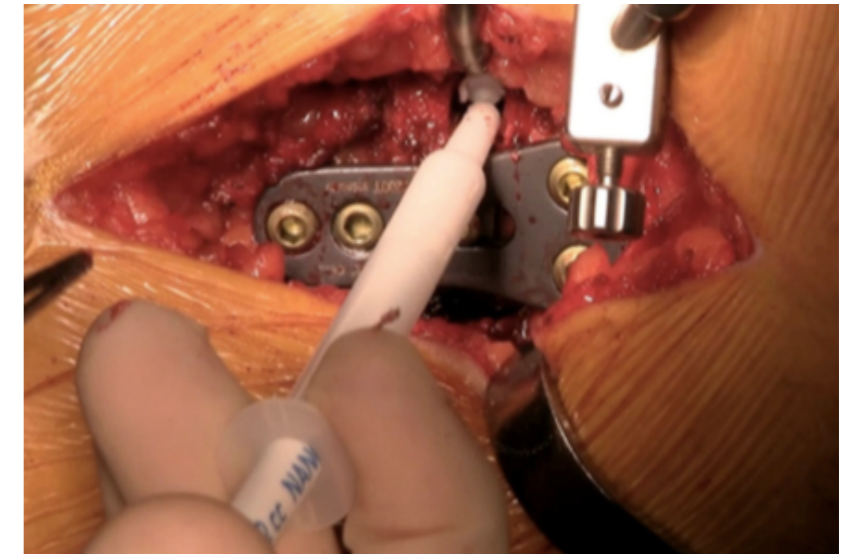
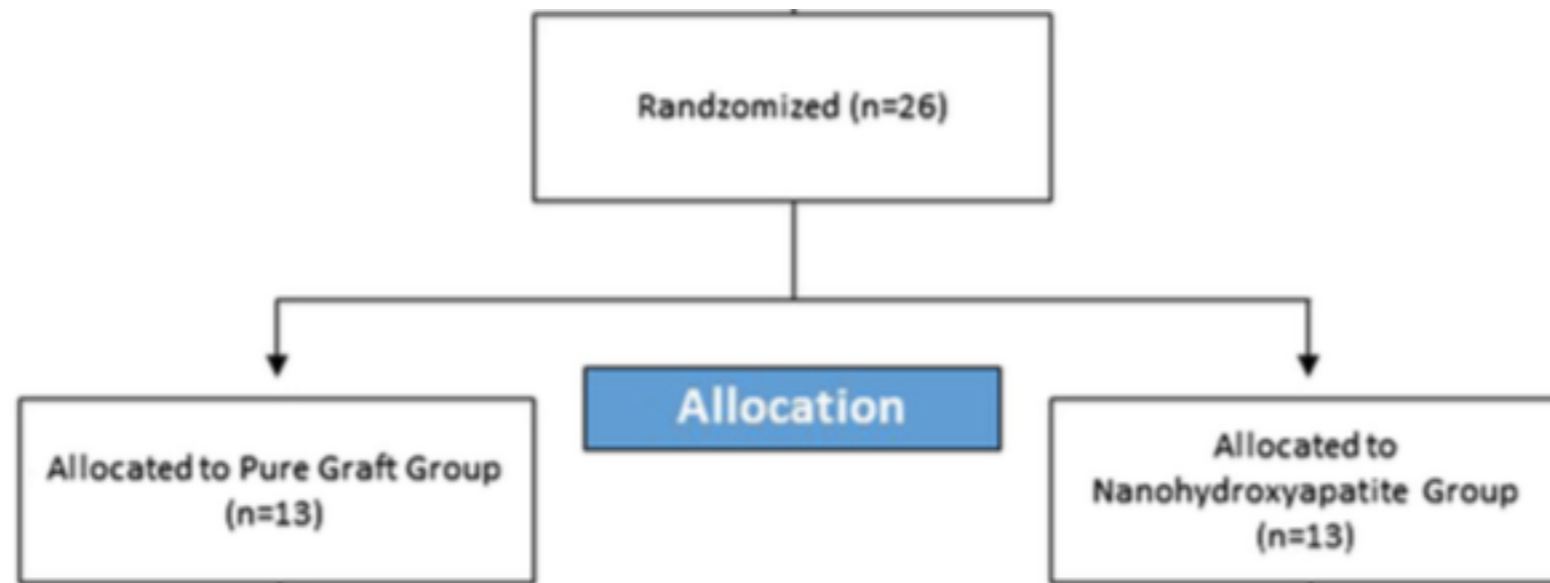
O-Sung Lee¹ · Kyung Jae Lee¹ · Yong Seuk Lee¹

Nanohydroxyapatite promotes the healing process in open-wedge high tibial osteotomy: A CT study

The Knee

2016

F. Conteduca, P. Di Sette *, R. Iorio, L. Caperna, G. Argento, D. Mazza, A. Ferretti



Allograft or Synthetic
Both?

Better osseointegration of the heterologous graft when nanohydroxyapatite is added

Significantly higher rate of non-union after augmentation with synthetic bone graft

**19 knees
Tricalcium Phosphate (TCP)**



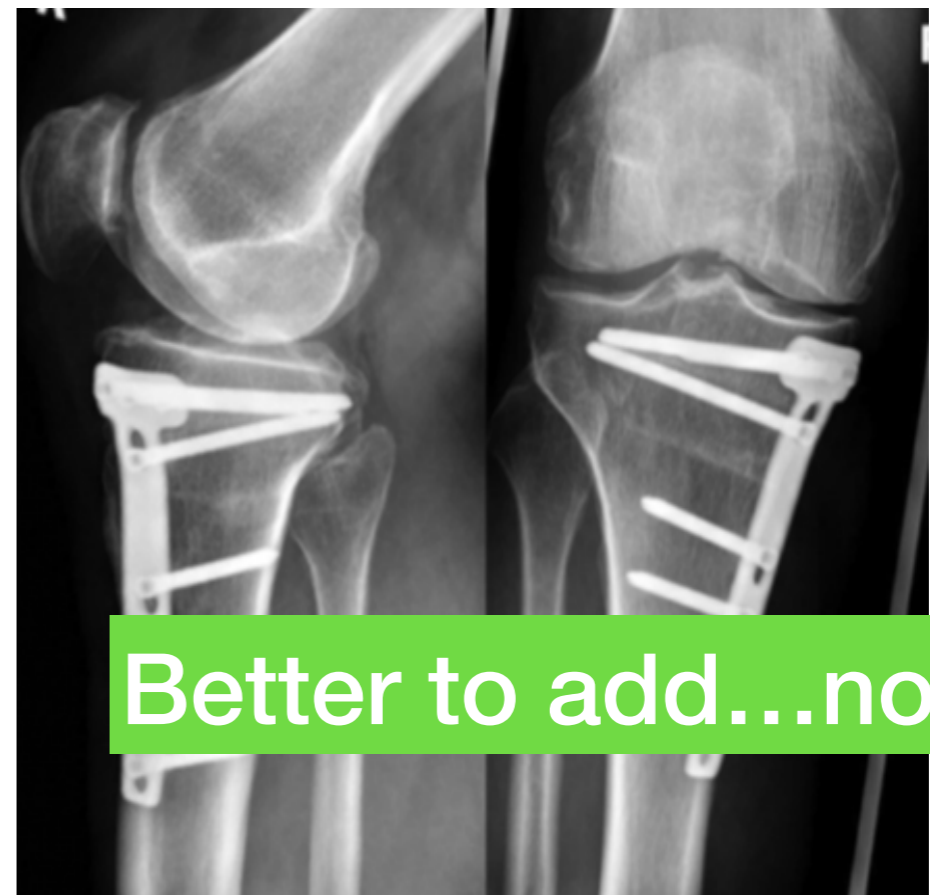
**30 knees
No Augmentation**

Group	Number of MOWHTO	Number of non-union	Opening-angle	Gender	Mean age (range)	Number of extension correction	Cigarette smoker
A*	n = 19	n = 5 (28%)	9.6° (6-18°)	8 females (42%) 11 males	44 yrs (26-59 yrs)	n = 13 (68%)	n = 2 (11%)
B**	n = 30	n = 1 (3.3%)	8.6° (4-15°)	8 females (27%) 22 males	50 yrs (24-77 yrs)	n = 16 (53%)	n = 6 (20%)



9 months

28%

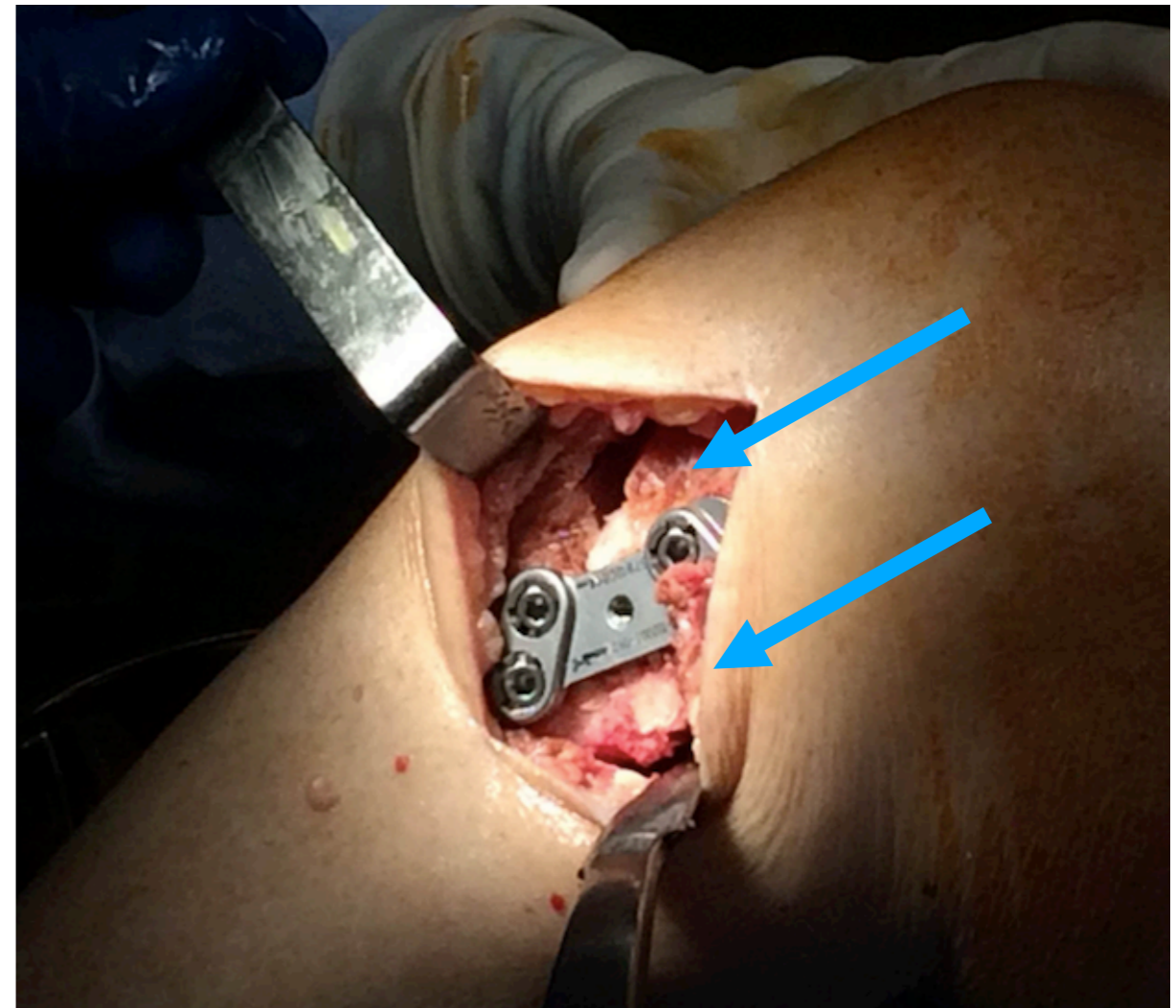


10 months

Better to add...nothing?

3.3%

Local autograft



Conclusion

- **Wide range of spacer options** are possible
- Autograft, Allograft or Synthetic
- But nothing is acceptable in small correction
- **Stability** of the plate fixation is crucial
- The healing period after open wedge HTO is actually **6 months** (Yokoyama et al. 2016)

Thank you