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SPEAKER

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(13 CPD POINTS)

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Indication for Osteotomy Around the Knee

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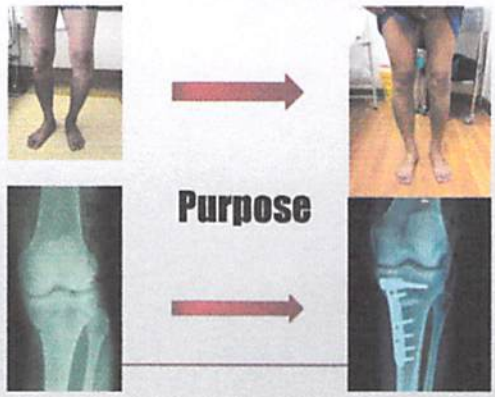
Indication of Osteotomy Around the Knee

Unicompartemental osteoartritis with malalignment

Thank You



Purpose

Prevalence of realignment osteotomy has steadly declined

The used of osteotomy has incerase in patient who are undergoing other surgical procedures

Pain relief

Function improvement

Capacity to maintain heavy function demans

Goal of Osteotomy

Carefull patient selection

skillful surgical technique

The key to success after osteotomy

- Unicompartemental degeneratif arthritis
- Associated with malalignment
- Conjuction with ligamentous reconstruction, transplantation of cartilage or meniscal allografts

Primary Indication

Indications

Malalignment + Arthritis	Malalignment + Instability	Malaignment + Arthritis + Instability	Malalignment + Focal cartilage resurfacing/ meniscus transplantation

Absolute

- Diffuse, nonspesific knee pain
- Primary compalin of patellofemoral pain
- Menisectomy in the compartement intended for weight bearing
- Arthrosis in the compartement intended for weight bearing
- Underlying diagnosis of inflamatory disease
- Unrealitic pateint expatation

Contraindication

Relative

- Age older than 60 years
- ROM arc less than 90 degrees
- Obesity (1.3x ideal body weight)
- Severe arthrosis
- Tibiofemoral subluxation
- Moderate or severe ligamentous instability

Contraindication

Patient Selection Factors

- Historical
- Radiologic
- Examination
- Miscellaneous

- Age (Chronologic, Physiologic)
- Thin, actice
- Pain (location, character, patello femoral)
- Stable knee
- Rheumatoid status
- Previos meniectomy
- Infection history
- Patients desired activity level
- Smoking

Selection Factors

- Historical
- Examination
- Radiologic
- Miscellaneous

- Malalignment
- Previous incision
- ROM (total arc, flexion, contracture)
- Ligamentous deficiencies
- Patellofemoral mechanic
- Ipsilateral hip function
- Abductor thrust
- Body habitus

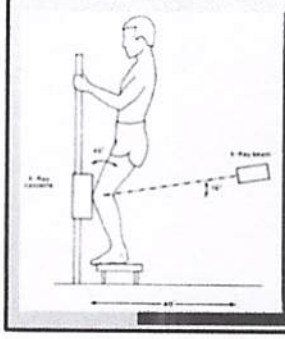
Patient Assessment

Selection Factors

- Historical
- Examination
- Radiologic
- Miscellaneous

- Severity of arthrosis
- Tibiofemoral subluxation
- Status of othert compartment
- Anatomical and mechanical axis
- Magnitude of deformity
- Amount of articular cartilage loss
- Osseus defect
- Deformity away from the joint

Radiological Examination



STANDING RADIOGRAPHS CANNOT DETERMINE THE CORRECTION IN HIGH TIBIAL OSTEOTOMY

K. OGATA, I. YOSHII, H. KAWAMURA, H. MIURA, T. ARIZONO, Y. SUGIOKA

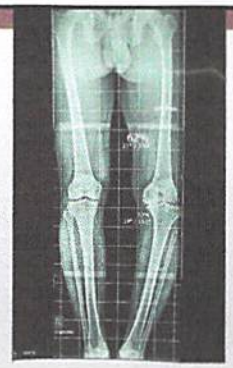
From Kyushu University, Fukuoka, Japan

The use of standing radiographs to determine correction angle for correcton osteotomy is not appropriate because the relative angle of the articular surfece (condylar plateu angle) in the weigh bearing knee change after the osteotomy

We found that the condylar-plateu angle in postoperative standing film is very similar to that seen in non weight bearing supine view.

1991

MRI



Double-Long Standing
Anteriorposterior Radiograph

The principle concideration in osteotomy include :
- Location
- Direction
- Magnitude of malalignment

Premature failure → undercorrection or overcorrection

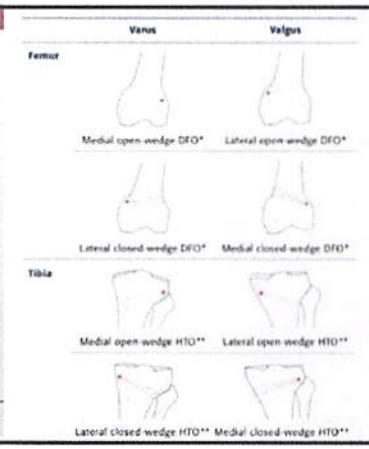
Preoperative Planning

- Location
  - Extraartucular
    - Femur
    - Tibia
  - Intraarticular
    - Joint line obliquity
    - Ligamentous laxity
    - Articular cartilage defisiency
    - Osseous deficiency
- Direction
  - Sagital : flexion/ extention
  - Coronal : varus / valgus
- Magnitute
  - Mild (<10 degree)
  - Moderate (10 to 20 degree)
  - Severe (>20 degree)

Componen of Malalignment

Tibial	Femur
• Lateral closing wedge • Medial closing wedge • Distraction histogenesis • Barrel vault (dome) osteotomy • Oblique metaphyseal wedge	• Medial closing wedge • Oblique methaphyseal wedge • Lateral opening wedge • Lateral closing wedge

Corrective osteotomy Technique



Varus deformities → HTO

Valgus deformities → distal femoral osteotomy

Excessive malalignment may contraindicated HTO → tilted

Malalignment exceed 12-15^0 → supracond femoral osteotomy or dome barrel vault osteotomy

Severe deformity → dual (double) osteotomy

Preoperative Planning

Opening wedge VS Closing wedge

Opening wedge	Closing wedge
Advantages	Advantages
• More precise correction of valgus • More freedom in adjusting tibial slope • No need to disrupt the fibula or the proximal TFJ	• More stable • Higher union rate • Immediate full weight bear • Shouldn't theoretically produce patella baja - but does due to fat pad scarring
Disadvantages	Disadvantages
• Less inherent stability • Requires bone graft of some sort • Higher rate of non-union • Need a period of partial weight bearing • Produces patella baja	• Tendency for Over & Under Correction • Creates Overhang of upper tibia • Tends to reduce Tibial Slope • Possible Neuro Vascular problems • Adherence of patellar ligament • Difficulties in future TKR

CHANGING of TIBIAL SLOPE

Closing wedge HTO causes a decrease in posterior tibial slope, and posterior translation of the tibia; it stabilizes a knee with anterior instability

Opening wedge HTO causes an increase in posterior tibial slope, and anterior translation of the tibia; it stabilizes a knee with posterior instability

OSTEOTOMY FOR MEDIAL OA

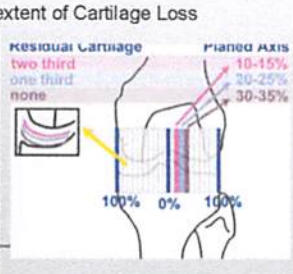
CHANGING TIBIAL SLOPE

ACL deficient decrease tibial slope

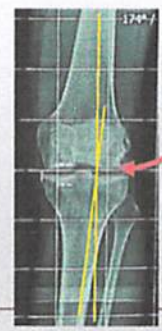
PCL deficient increase tibial slope

How much post op valgus is needed

- Hernigou : Ideal post op 3° – 6° valgus from the mechanical axis
- "Fujisawa" Point @ 62% of the Joint width
- Jacob & Jacobi :Based on extent of Cartilage Loss



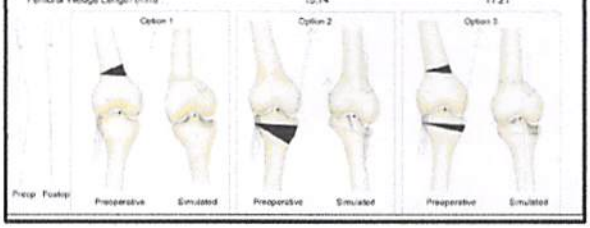
Level of the osteotomy



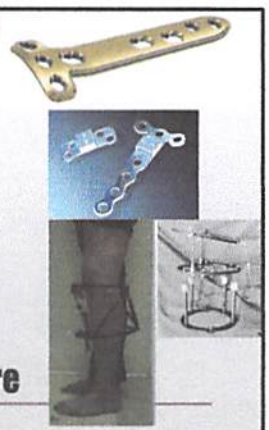
X-ray magnification : 103%	Preop	Option 1	Option 2
FTA (degrees) :	169.52	176.38	176.69
Joint Obliquity (degrees) :	-1.67	4.35	6.22
Medial Load (%) :	100	41.73	40
Mechanical Deformity (degrees) :	9.57 varus	3.62 valgus	3.31 valgus
Peak Pressure (Mpa) :	3.68	0.61	0.59
Ligamentous Tension (N) :	160.62	0.00	0.00
Leg Length (cm) :	77.28	76.79	76.74
Tibial Closed Angle (degrees) :		14.00 valgus	9.00 valgus
Tibial Elevation (mm) :		20.00	20.00
Tibial Wedge Length (mm) :		15.61	11.20
Femoral Closed Angle (degrees) :			5.00 valgus
Femoral Elevation (mm) :			50.00
Femoral Wedge Length (mm) :			4.19

OASIS (Osteotomy Analysis and Simulation Software)

X-ray magnification : 105 %	Preop	Option 1	Option 2	Option 3
FTA (degrees) :	169.14	180.89	183.55	181.50
Joint Obliquity (degrees) :	-3.02	7.90	-15.73	-0.29
Medial Load (%) :	3.95	76.65	62.47	76.81
Mechanical Deformity (degrees) :	20.86 valgus	0.89 varus	3.58 varus	1.50 varus
Peak Pressure (Mpa) :	12.72	1.62	10.65	2.54
Ligamentous Tension (N) :	403.40	2.02	153.03	9.77
Leg Length (cm) :	74.16	74.22	73.89	74.26
Tibial Closed Angle (degrees) :			25.00 varus	9.00 varus
Tibial Elevation (mm) :			20.00	20.00
Tibial Wedge Length (mm) :			26.53	9.80
Femoral Closed Angle (degrees) :		25.00 varus		18.00 varus
Femoral Elevation (mm) :		50.00		50.00
Femoral Wedge Length (mm) :		15.74		11.21



- Lateral LockedPlating
- Medial Locked Plating
- External Fixation using Ilizarov device



Choice of Hardware

Knee Surg Sports Traumatol Arthrosc. 2006 Mar;14(3):284-300. Epub 2005 Nov 12.

Primary stability of four different implants for opening wedge high tibial osteotomy.

Agneskirchner JD, Freiling D, Hurschler C, Lobenhoffer P
Department of Trauma and Reconstructive Surgery, Henriettenstiftung Hannover, Germany. jora@agneskirchner.com

Abstract
Since a significant number of implant failures have been reported in association with the procedure of open wedge valgus high tibial osteotomy, the initial biomechanical stability of different fixation devices was investigated in this study. Fifteen third generation Sawbones composite tibiae were used as a model. Four different plates were tested: a short spacer plate (OWO) (n = 4), a short spacer plate with multi-directional locking bolts (MSO) (n = 5), a prototype version of a long spacer plate with multi-directional locking bolts (MSOnew) (n = 2), and a long medial tibia plate fixator with locking bolts (MPF) (n = 4). All opening wedge osteotomies were performed by the same surgeon (PL) in a standardized fashion. Axial compression of the tibiae was performed using a materials testing machine under standardized alignment of the loading axis. Single load to failure tests as well as load-controlled cyclical failure tests were performed. The required force and cycles to failure were recorded. Osteotomy gap motion was measured using linear displacement transducers. Residual stability after failure of the opposite lateral cortex was analysed. Failure occurred at the lateral cortex bone-bride in all tested implants. The rigid long plate fixator (MPF) resisted the greatest amount of force (2,881 N) in the single load to failure tests. In the cyclical load-to-failure tests, the constructs with MPF resisted more than twice the amount of loading cycles when compared to the short spacer plates. The osteotomy gap motion was smallest in the MPF, with a reduction of the displacements of up to 65, 66 and 68%, when compared to OWO, MSO and MSOnew, respectively. The highest residual stability after failure of the lateral cortex was observed in MPF as well. The results suggest that the implant design strongly influences the primary stability of medial opening wedge tibial osteotomy. A rigid long plate fixator with angle-stable locking bolts yields the best results.

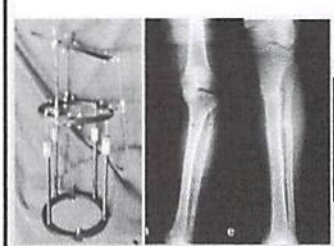
Finite element analysis of Puddu and Tomofix plate fixation for open wedge high tibial osteotomy

Raja Mohd Akrat Raja Izaham[a], Mohammad Rafiq Abdul Kadir[a, b], Abdul Halim Abdul Rashid[c], Md. Golam Hossain[a], T. Kamarul[a]

Abstract
The use of open wedge high tibial osteotomy (HTO) to correct varus deformity of the knee is well established. However, the stability of the various implants used in this procedure has not been previously demonstrated. In this study, the two most common types of plates were analysed (1) the Puddu plates that use the dynamic compression plate (DCP) concept, and (2) the Tomofix plate that uses the locking compression plate (LCP) concept. Three dimensional model of the tibia was reconstructed from computed tomography images obtained from the Medical Implant Technology Group datasets. Osteotomy and fixation models were simulated through computational processing. Simulated loading was applied at 60:40 ratios on the medial:lateral aspect during single limb stance. The model was fixed distally in all degrees of freedom. Simulated data generated from the micromotions, displacement and, implant stress were captured. At the prescribed loads, a higher displacement of 3.25 mm was observed for the Puddu plate model ($p < 0.001$). Coincidentally the amount of stresses subjected to this plate, 24.7 MPa, was also significantly lower ($p < 0.001$). There was significant negative correlation ($p < 0.001$) between implant stresses to that of the amount of fracture displacement which signifies a less stable fixation using Puddu plates. In conclusion, this study demonstrates that the Tomofix plate produces superior stability for bony fixation in HTO procedures.

Cengiz Sen
Mehmet Kocaoglu
Levent Eralp

The advantages of circular external fixation used in high tibial osteotomy (average 6 years follow-up)



Knee Surg Sports Traumatol Arthrosc (2003) 11 : 139–144

We conclude that this technique ca be successfully applied in experianced handsfor varus gonarthrosis

Can J Surg. 2006 August; 49(4): 245–250. PMCID: PMC3207506

High tibial osteotomy with use of the Taylor Spatial Frame external fixator for osteoarthritis of the knee

Darius G. Viskontas, Mark D. MacLeod, and David W. Sanders

Conclusion Go to

The Taylor Spatial Frame is a valuable asset in performing HTOs for isolated medial compartment osteoarthritis of the knee in active patients requiring large corrections.