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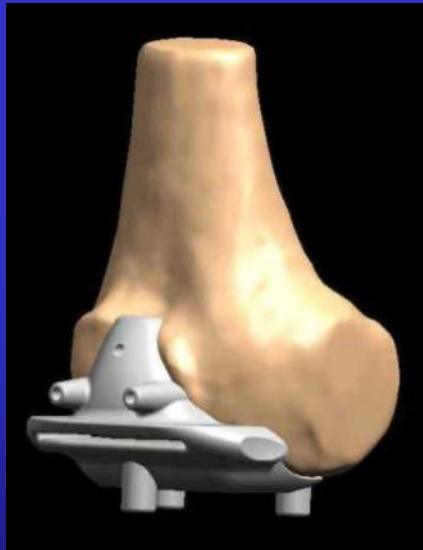


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Dr Doron Sher
Knee & Shoulder Surgery

Patient Matched Total Knee Replacement



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Knee Replacement is a good operation

- >95% success rate
- Cost effective
- Restores function
- Reduces burden on the community
- Lasting ~15yrs



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Knee Replacement is a good operation

- Problems
 - Blood loss
 - Fat Embolism
 - Fracture from pins for computer guidance
 - Component malrotation
 - Component Malalignment
 - Cost
 - Inventory
 - Lack of planning



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Malalignment leads to increased failure of implants

- Computer navigation helps with coronal alignment only
- Rotation very important for patella tracking
- Rotation, sizing and AP translation much better



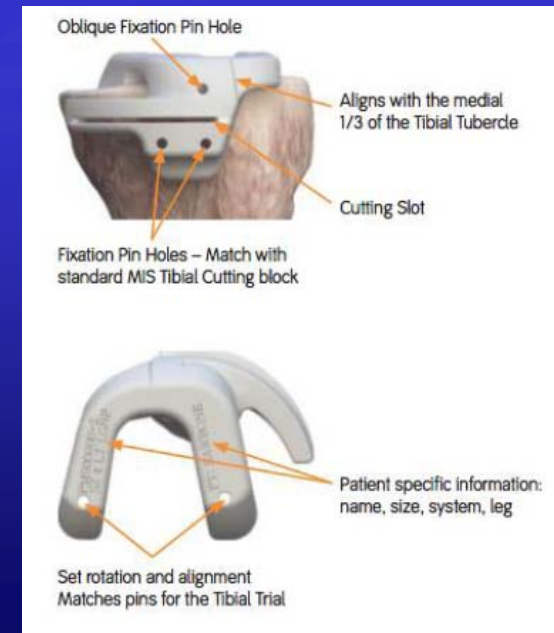
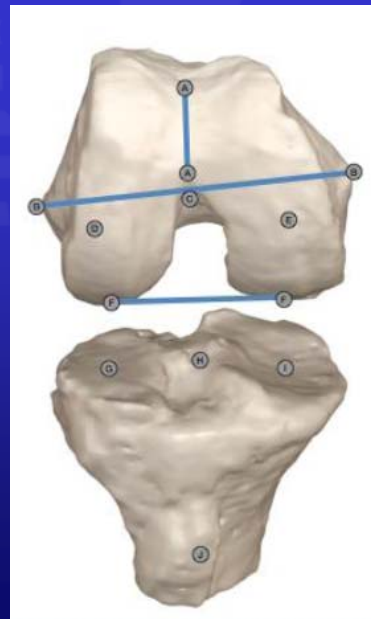
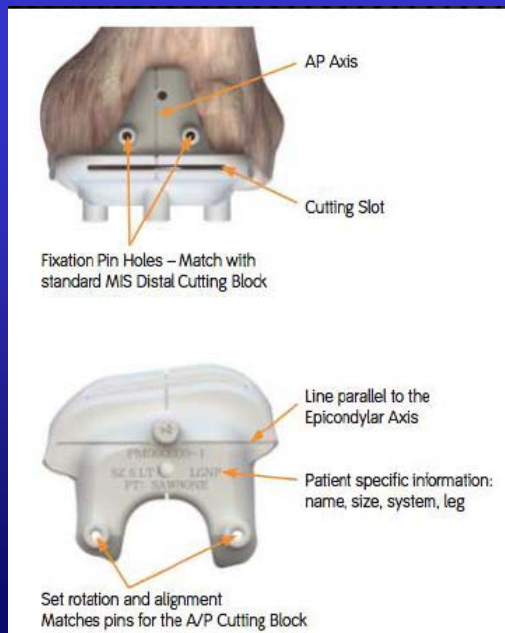
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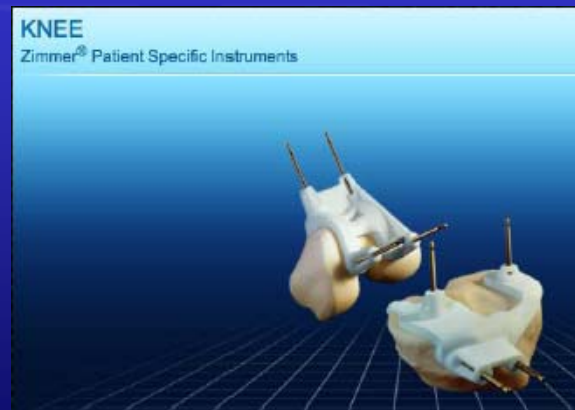
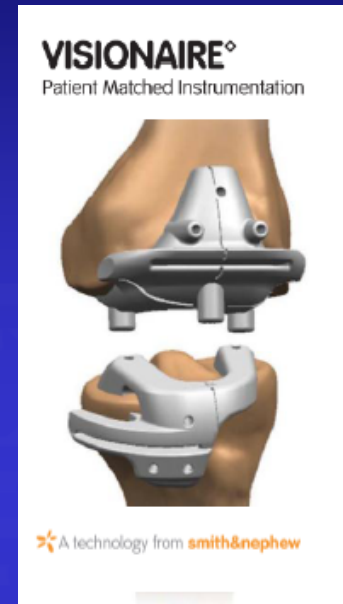
Customised patient specific cutting blocks

The idea is to make the operation more accurate, more reproducible and create less complications



Current Systems Available

- Smith & Nephew
- OtisMed Custom
- Depuy
- ConforMIS
- Biomet

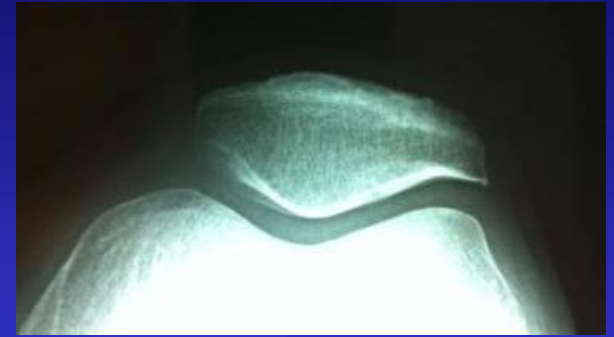


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Routine Imaging

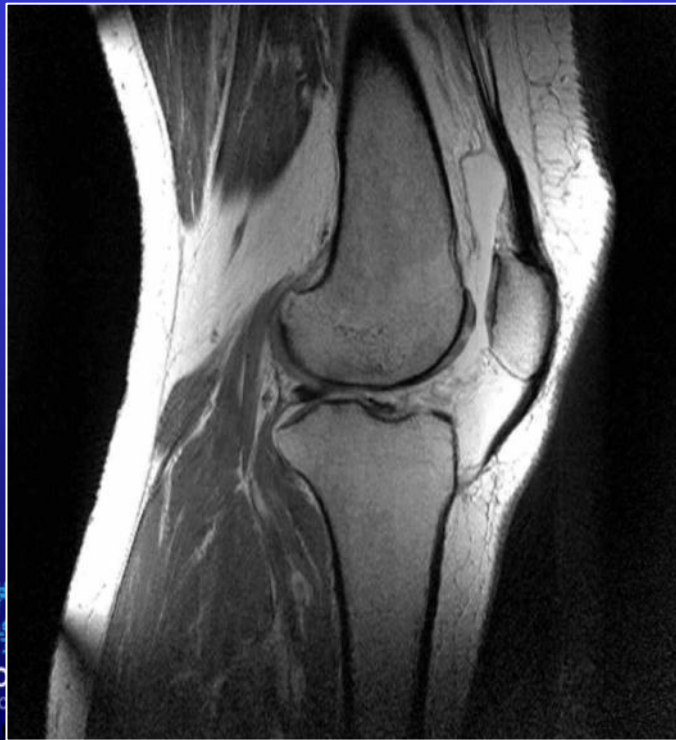
- Weight Bearing AP
- Lateral
- Notch View
- Skyline Patella



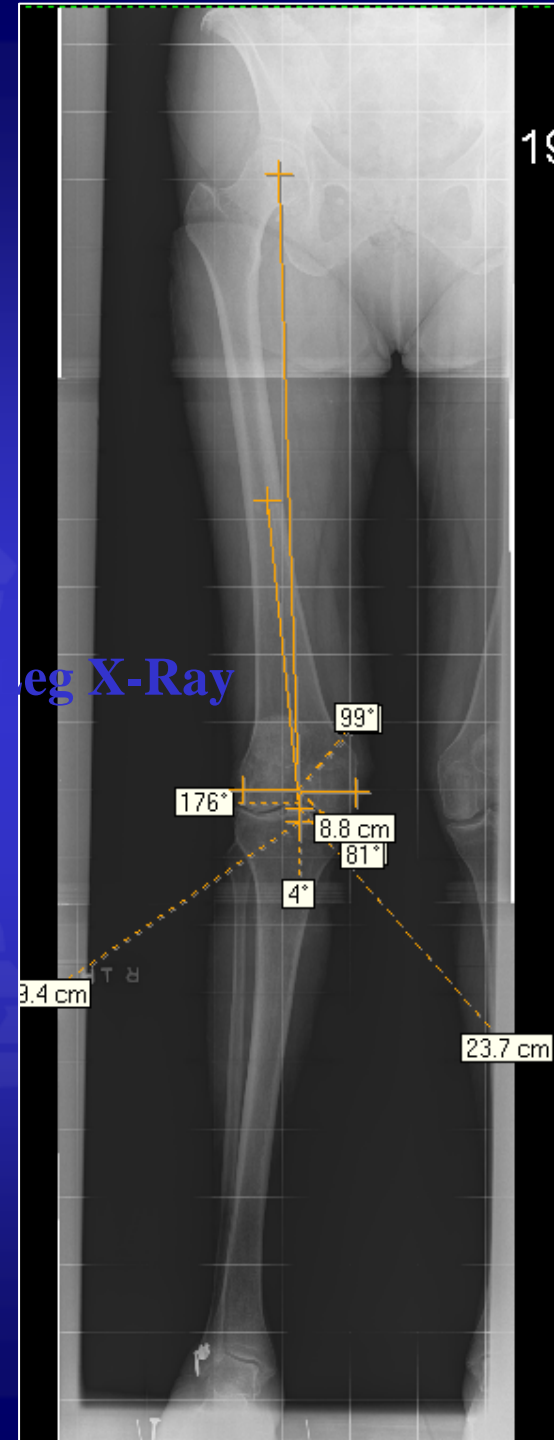
Imaging for this technique

- MRI (or CT)
- Long leg alignment to reproduce mechanical axis
 - Morphology of the knee itself
- 3D computer model made by segmenting the scan
 - Gives patient anatomy
 - Landmark identification – same as those for any knee replacement





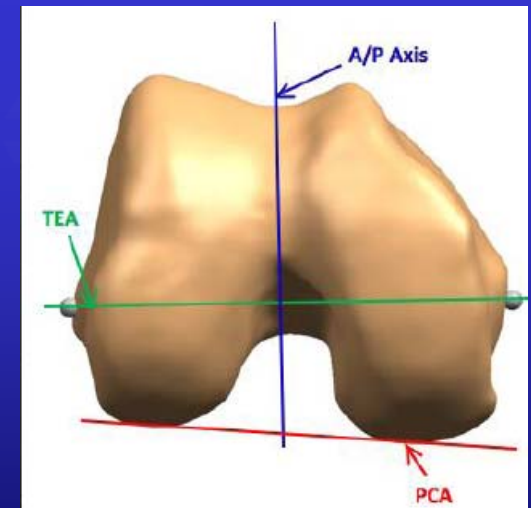
Full Leg X-Ray



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Imaging uploaded to the web

- Engineer makes a plan for the operation
- Surgeon reviews the plan
- Adjusts for flexion deformity
- Changes size, cuts etc
- Plan approved
- Bone models produced
- Blocks produced







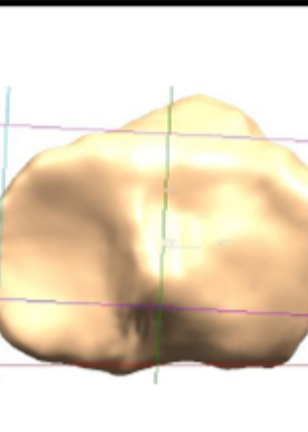




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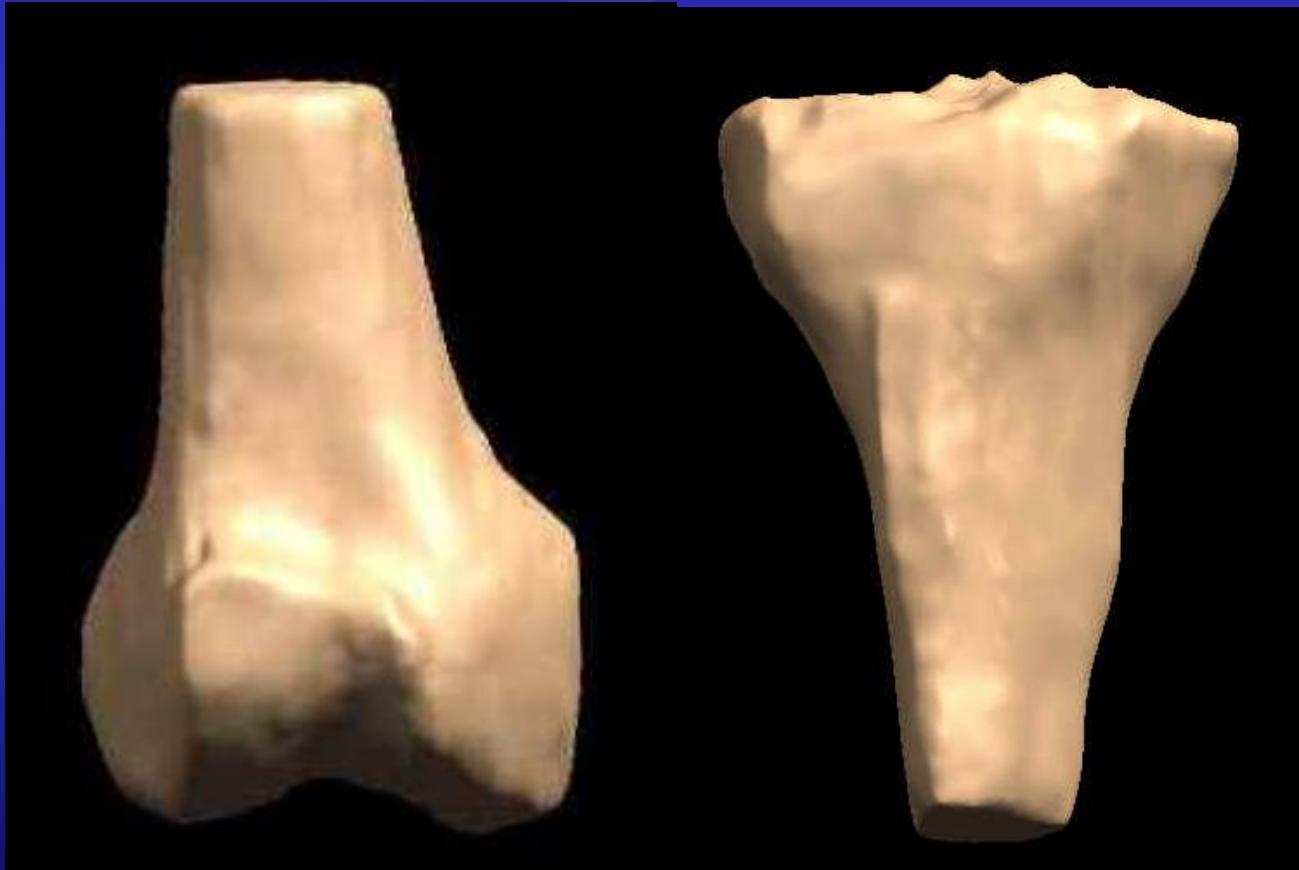
Tibia Alignment

| | | | |
|---|--|--|--|
| <p>Lateral</p> <p>Proximal Resection:</p> <p>7.5 mm from Medial</p> <p>9 mm from Lateral</p> <p>Posterior Slope:</p> <p>3 deg</p> |  |  |  |
| <p>Anterior</p> <p>Proximal Resection:</p> <p>7.5 mm from Medial</p> <p>9 mm from Lateral</p> <p>Tibia Varus/Valgus Deformity</p> <p>Mechanical Axis of Shaft</p> <p>WL Implant Width:</p> <p>Vertical Lines</p> |  |  |  |
| <p>Proximal (90 deg flexion)</p> <p>Rotation:</p> <p>Medial 1/3 of Tibia Tubercle</p> <p>Proximal Resection:</p> <p>7.5 mm from Medial</p> <p>9 mm from Lateral</p> <p>WL Implant Width:</p> <p>Vertical Lines</p> <p>Posterior Implant Boundary</p> <p>Most Posterior Horizontal Lines</p> |  |  |  |

Femur Alignment

| | | | |
|--|--|--|--|
| <p>Lateral</p> <p>Distal Resection:</p> <ul style="list-style-type: none"> 10.5 mm from Medial 9 mm from Lateral 1 mm into Sulcus <p>Posterior Resection:</p> <ul style="list-style-type: none"> 11 from Medial 12 from Lateral <p>Anterior Resection:</p> <p>Flush to Anterior Shaft</p> |  |  |  |
| <p>Anterior</p> <p>Distal Resection:</p> <ul style="list-style-type: none"> 10.5 mm from Medial 9 mm from Lateral 1 mm into Sulcus <p>Femur Valgus:</p> <p>Mechanical Axis-Coronal Plane</p> <p>WL Implant Width:</p> <p>Vertical Lines</p> |  |  |  |
| <p>Distal (90 deg flexion)</p> <p>Rotation:</p> <p>AP Axis</p> <p>Posterior Resection:</p> <ul style="list-style-type: none"> 11 mm from Medial 12 mm from Lateral <p>WL Implant Width:</p> <p>Vertical Lines</p> <p>Implant Boundary</p> <p>Most Posterior Horizontal Lines</p> |  |  |  |

Models Produced



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Planning

- Much more info than we had before
- Size and alignment can now be planned accurately
- Block manufacture: mainly made of nylon
- Can cut through blocks or use them to guide the metal cutting blocks
- 4 weeks from planning to surgery to get them manufactured — will improve as it becomes more mainstream



Preop planning forced on you

- This is the beginning of the technology and is likely to improve with time
- Initially the engineers got it wrong 1 in 10
- Now the plan is rarely changed



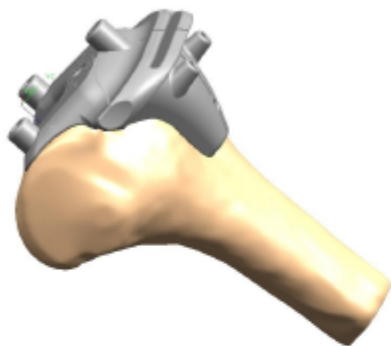
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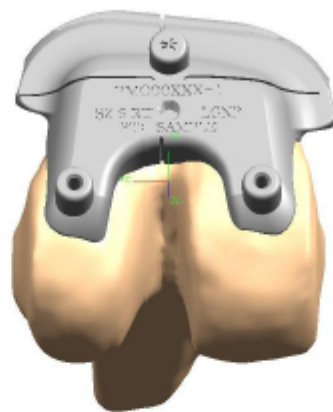
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Visionaire Cutting Block Placement

Femur



Medial



Distal

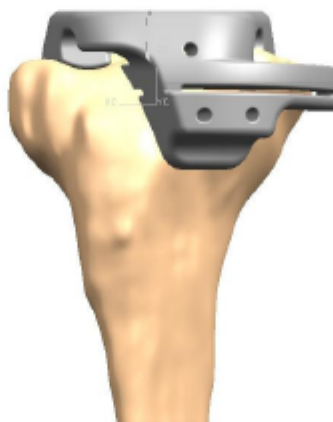


Lateral

Tibia



Medial



Anterior



Lateral



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Nylon blocks produced to fit the models



Final design manufactured



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The Operation

- Size is known before the operation accurately
- Less implants sent on the day
 - Typically 1 above and below predicted for the moment
 - Multiple Poly for each femur as usual
 - TOTAL 6 metal & 21 poly components
- Usually TOTAL 12 metal and 49 poly
- Very rare not to use predicted size
 - Soon only that will be sent – 2 metal, 7 poly



More efficient

- Less courier costs with fewer implants
- Less likely for mistakes to be made sending the wrong implants
- Less 'checking in' for theatre staff
- Less equipment sterilisation
- Can we keep the results the same or better??



The Surgery

- The blocks DO NOT replace surgical thinking
- Every step still checked by the surgeon
- Traditional equipment can still be used even with the blocks
- The blocks can be discarded if the surgeon feels they are wrong



During the operation

- Routine exposure of the knee
- Less violation of intramedullary canals and so less fat embolism
- No pins as for computer guidance
- Everything double checked in routine fashion



Femoral side excellent

- “Locks” into place
- Perfect fit and control of rotation
- Size of implant known and planned for
- Tibia not yet quite as good but can be double checked using jigs more easily than the femur anyway



Instrumentation designed to patient specific
anatomical features and supplied sterile



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Much more efficient

- Fewer operative steps
- Set up and change over time much better
- COST – make the blocks \$450
- Less sterilisation - saves money (\$130 per tray, 5 less trays), less courier costs
- Saves \$750



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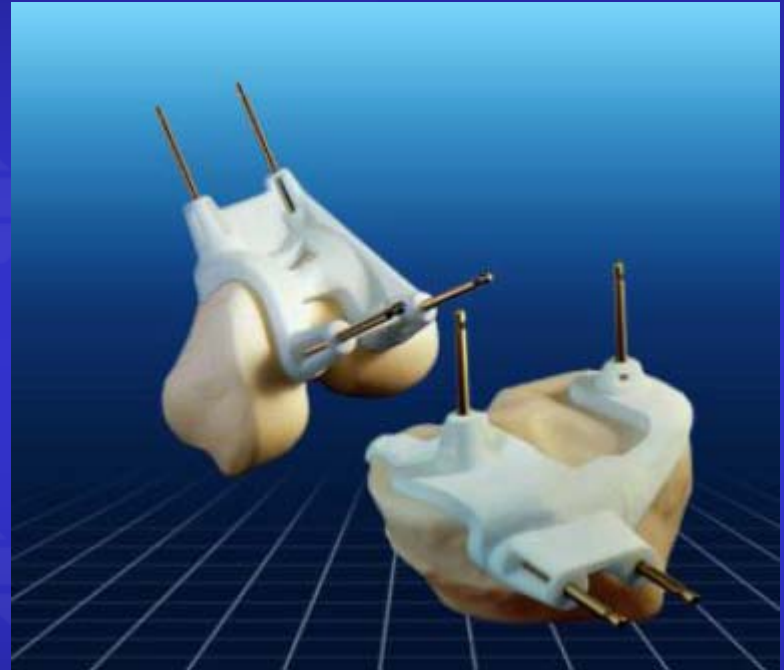
Surgical steps that can be eliminated

Distal Femur

- Alignment (6 steps)
- Sizing (5 steps)

Proximal Tibia

- Alignment (3-5 steps)
 - Extramedullary- (3 Steps)
 - Intramedullary (5 Steps)
 - Sizing (6 steps)
- 20-22 total steps that can be eliminated*



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Who can have it?

Any primary TKA patient is a candidate for
Patient Matched Instrumentation

(as long as they can have a MRI or CT)



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Video



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Summary

- Exciting new technology
- Early results look great
- Room for improvement
- Should reduce complications significantly



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