Bone Resection Planning for Medial UKA Using Stress Views is Efficient: Protocol Validation Using an Image-Based Robotic System

ISAKOS CONGRESS 2025 | MUNICH GERMANY June 8-11

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- Disclosure:

- Gaggiotti Gabriel: Consultant for Bioimpianti
- Elvire Servien: Consultant for Corin
- Sebastien Lustig: Consultant for Stryker, Smith Nephew, Heraeus, Depuy Synthes; institutional research support from Groupe Lepine, Amplitude; editorial board for Journal of Bone and Joint Surgery (Am)

- Gaggiotti Stefano, Foissey Constant, Rossi Valentina, Batailler Cecile and Gaggiotti Santino: no competing interests.

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Introduction

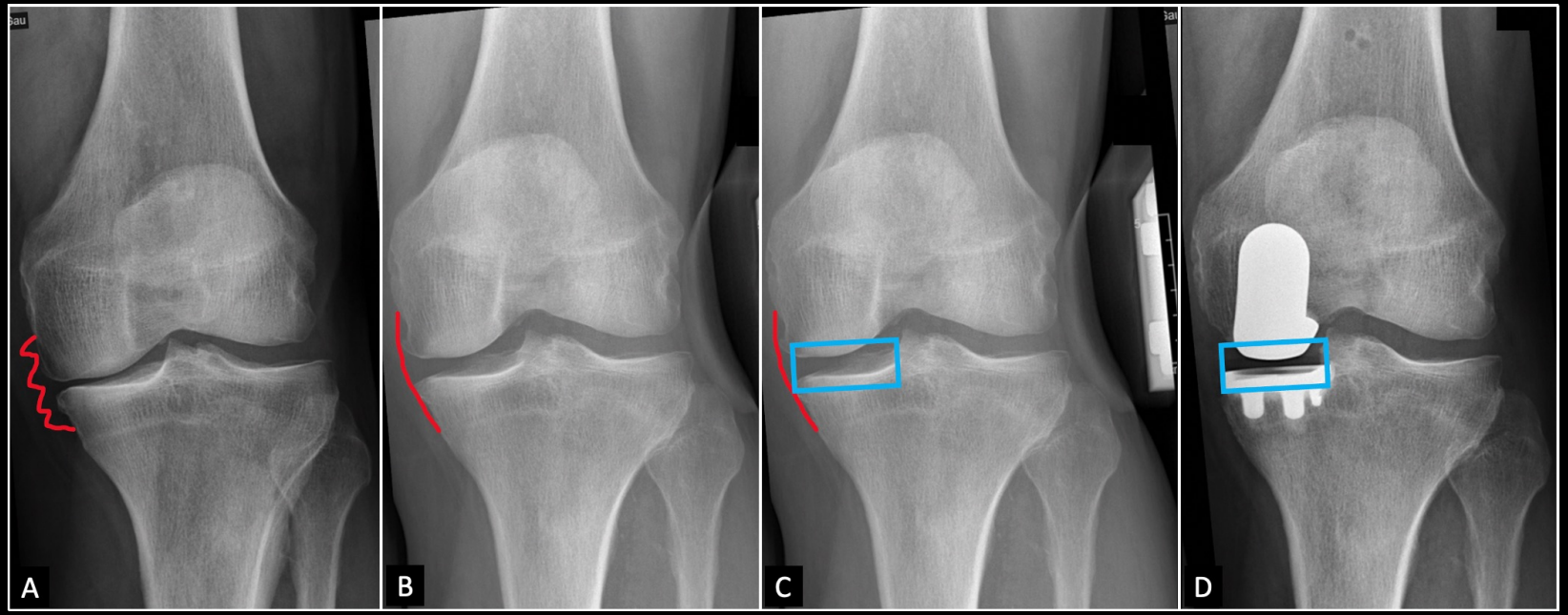
- **Unicompartmental Knee Arthroplasty (UKA)**

- Could be used in nearly 50% of knee replacements
- Technique less reproducible than total TKA
- Restoring the joint line

→ **Essential to achieve long-term implant survival**

- Preoperative valgus stress radiographs allow to
  - Assess varus deformity correction
  - Predict postoperative alignment
  - Identify primitive joint line

Introduction



Purpose:

"To describe a planning method for medial UKA implantation using preoperative stress radiographs to measure the thickness of tibial and femoral bone resections, and to validate this method with data from an image-based robotic surgery system"

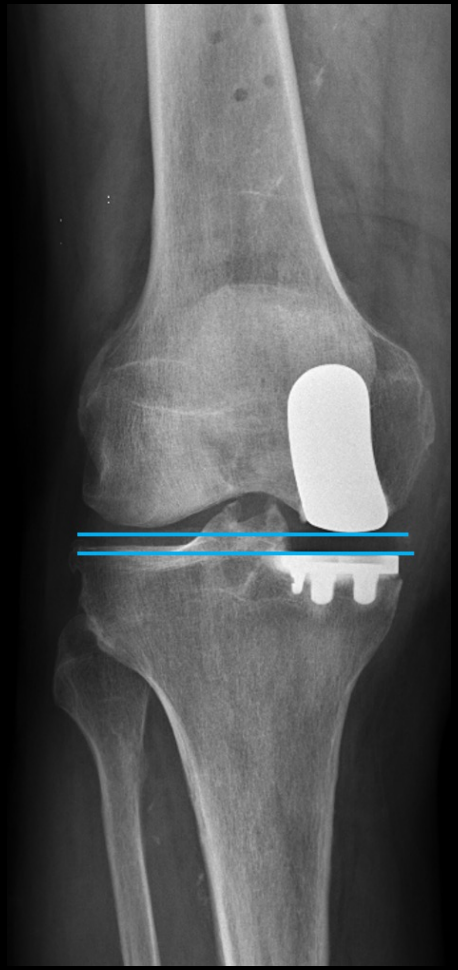
Methods

New planning method for medial UKA based on:

- Valgus stress radiographs
- Validated with an image-based robotic surgery system

- Retrospective radiographic study
- 76 imaged-based robotic medial UKA (April 2022 – February 2023)
- Radiographic measurements to simulate UKA implantation

UKA technique based on:
- Cartier's angle
- Aimed at restoring the joint line
- 2mm medial safety laxity



Methods

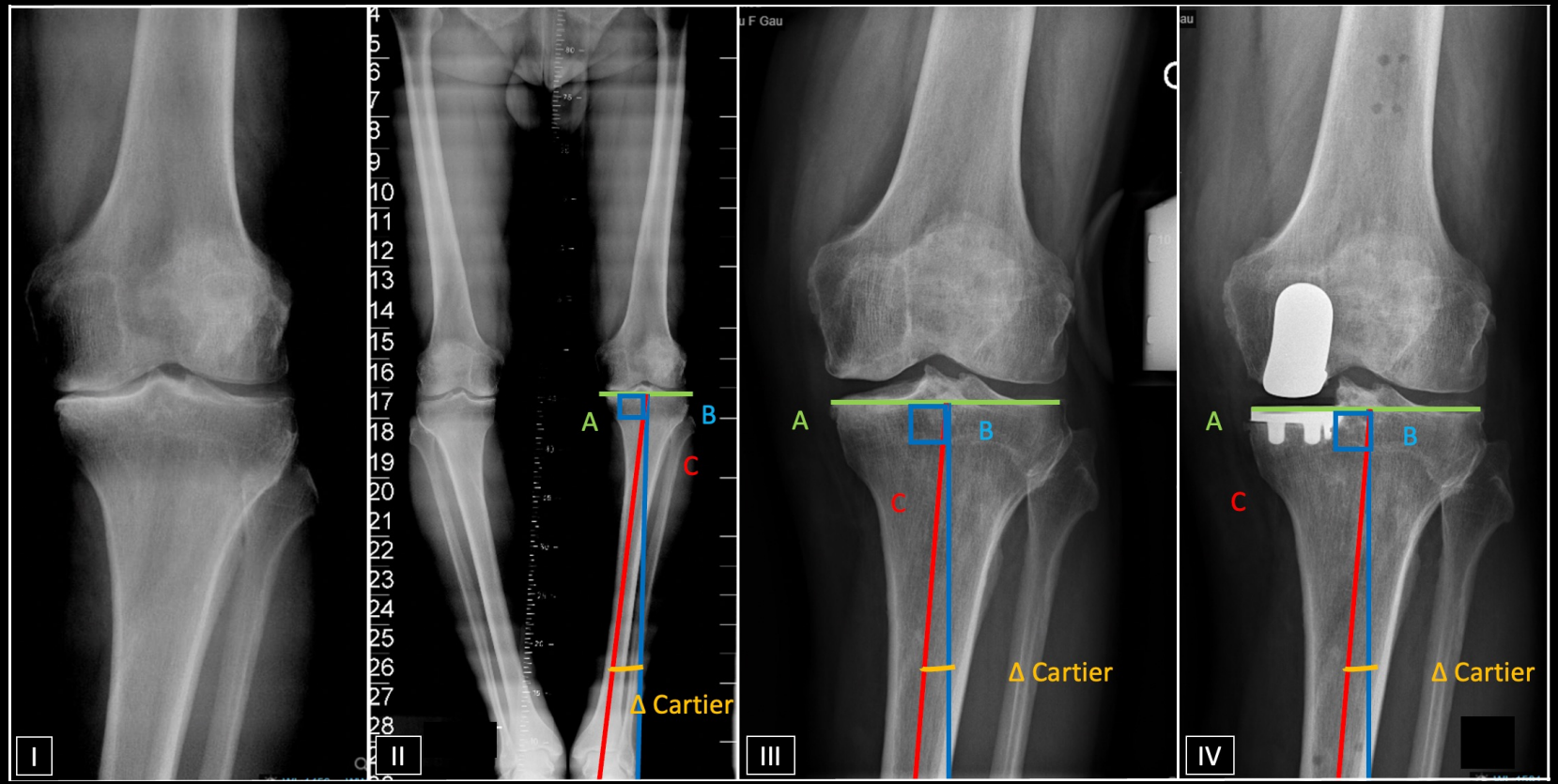


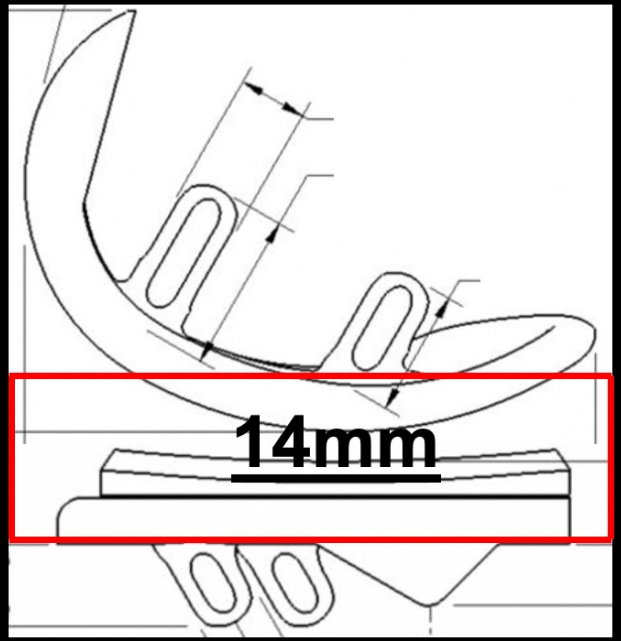
Image. Cartier's angle is formed between the line perpendicular to the tibial epiphyseal line and the mechanical axis of the tibia.

Methods

Tibial and Femoral bone resections in mm were measured in:
- Preoperative valgus stress radiographs
- Intraoperative bone resection data provided by the robotic system
- Inter- and intra-observer reliability was assessed using 25 measurements

Total GAP to fill = 14mm

8mm Tibial Component and Polyethylene
+
4mm for Femoral Component
+
2mm for Safety Laxity



Planning method

Based on Preoperative valgus stress radiographs

- A. tibial epiphyseal line
- B. primitive joint line (JL) that has to be restored

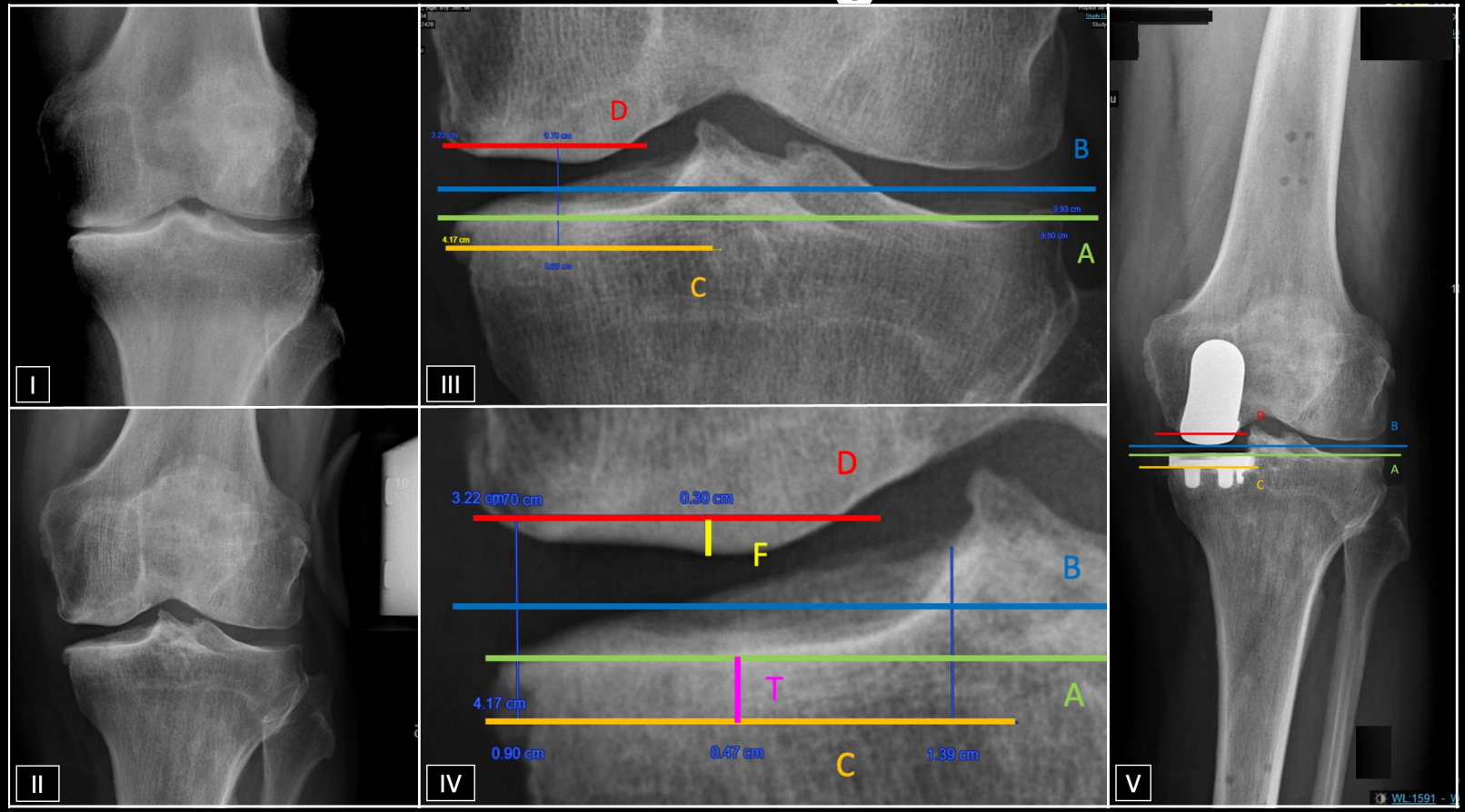
- It runs through the center of the healthy lateral femorotibial space (the limit between the tibial and the femoral hyaline cartilage) and projects towards the medial femorotibial compartment running parallel to the tibial epiphyseal line (A)

- C. represents the level of tibial bone resection (8mm down the JL)
- D. represents the level of femoral bone resection (6mm up the JL)

All lines are parallel between them

- T. Distance between lines A and C = **tibial bone resection in mm**
- F. Distance between line D and the distal end of the medial femoral condyle, and corresponds to = **femoral bone resection in mm**

Planning method



A. *Tibial ephyfiseal line*

B. *Joint line height*

C. *Tibial bone resection level*

D. *Femoral bone resection level*

T. *Tibial bone resection thickness*

F. *Femoral bone resection thickness*

Planning method

Comparison with robotic data

Intraoperative Bone resection (mm) quantified at tibial and femoral levels

Tibial resection
=
8mm - proud

Femoral resection
=
4mm - proud

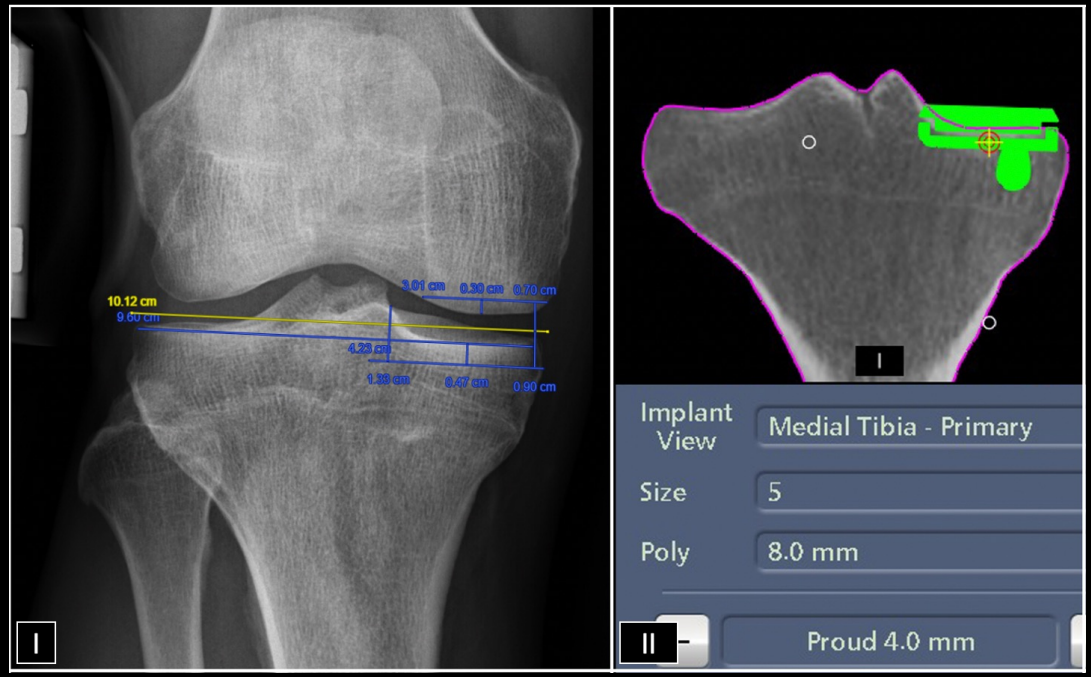


Image. Comparison of tibial bone resection measured on valgus stress x-rays with the information provided intraoperatively by the robot.

Results

Bone Resection	Tibia	Femur	P-value
RX	4.3 ± 0.4 mm	2.7 ± 0.7 mm	<0.001
Robotic system	4.2 ± 0.5 mm	2.5 ± 0.9 mm	<0.001
Mean difference	0.15 mm	0.21 mm	<0.001

- There was a strong correlation between the values (P<0.001)
- Intra- and inter-observer reliability were strong (P<0.001 and P<0.001, respectively)

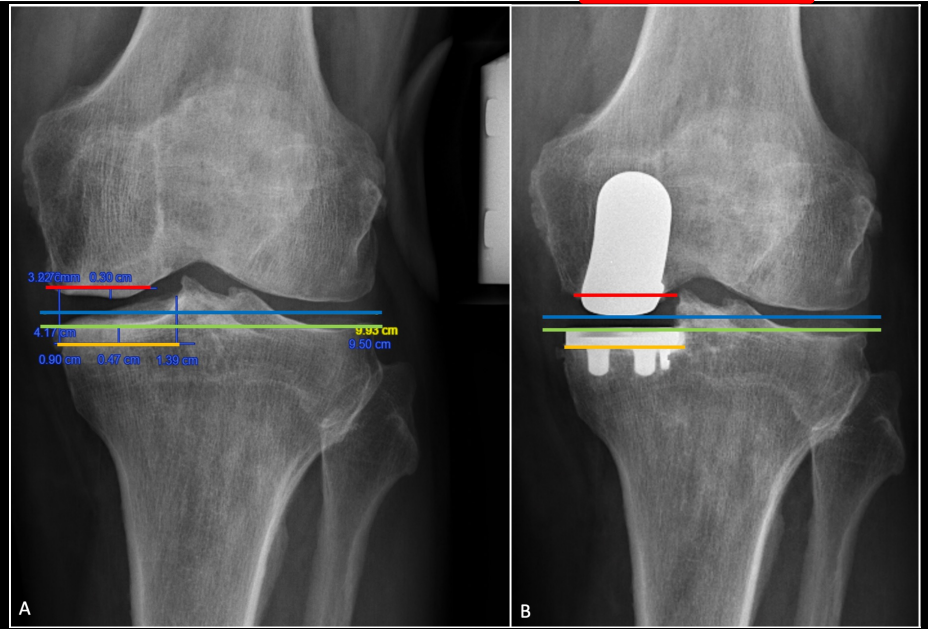


Image. Comparison between preoperative valgus stress x-ray and medial UKA postoperative x-ray.

Conclusion

Medial UKA Planning Method

- **Simple**
- **Reproducible**
- **Accurate**

It represents a very valuable contribution to

- Understanding UKA principles
- Extend its indications
- Increase surgical technique reproducibility

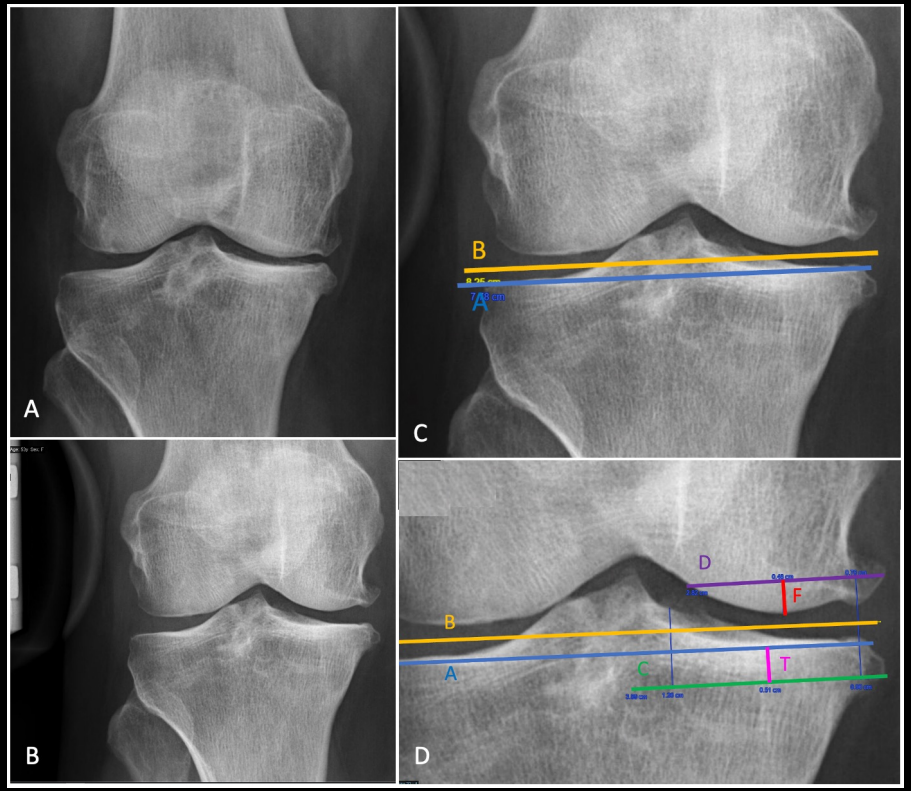


Image. Another example of the preoperative medial UKA planning method done with valgus stress x-rays.

Bone Resection Planning for Medial UKA Using Stress Views

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