Tibio-femoral instability: Etiology, diagnosis and prevention

(Case based approach)

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Why is instability important ?

- Top 2-3 reasons for early revision
  1. Aseptic loosening(31.2%),
  2. **Instability (18.7%),**
  3. Infection(16.2%),
  4. Polyethylene wear (10.0%),
  5. Arthrofibrosis (6.9%)
  6. Malalignment(6.6%).

Schroer WC: J Arthroplasty. 2013 Sep;28(8 Suppl):116-9

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Thiele K. Current failure mechanisms after knee arthroplasty have changed: polyethylene wear is less common in revision surgery.

J Bone Joint Surg Am. 2015 May 6;97(9):715-20.

- Aseptic loosening (21.8%)
- **Instability (21.8%)**
- Malalignment (20.7%)
- Periprosthetic infection (14.5%)
- Polyethylene wear (7%)

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Risk factors

- Local or systemic neuromuscular problems
- Obesity
- Advanced deformity requiring extensive soft tissue release
- Hip & foot deformities
  - *Paratte S: JBJS 2008, 90-A:184.*

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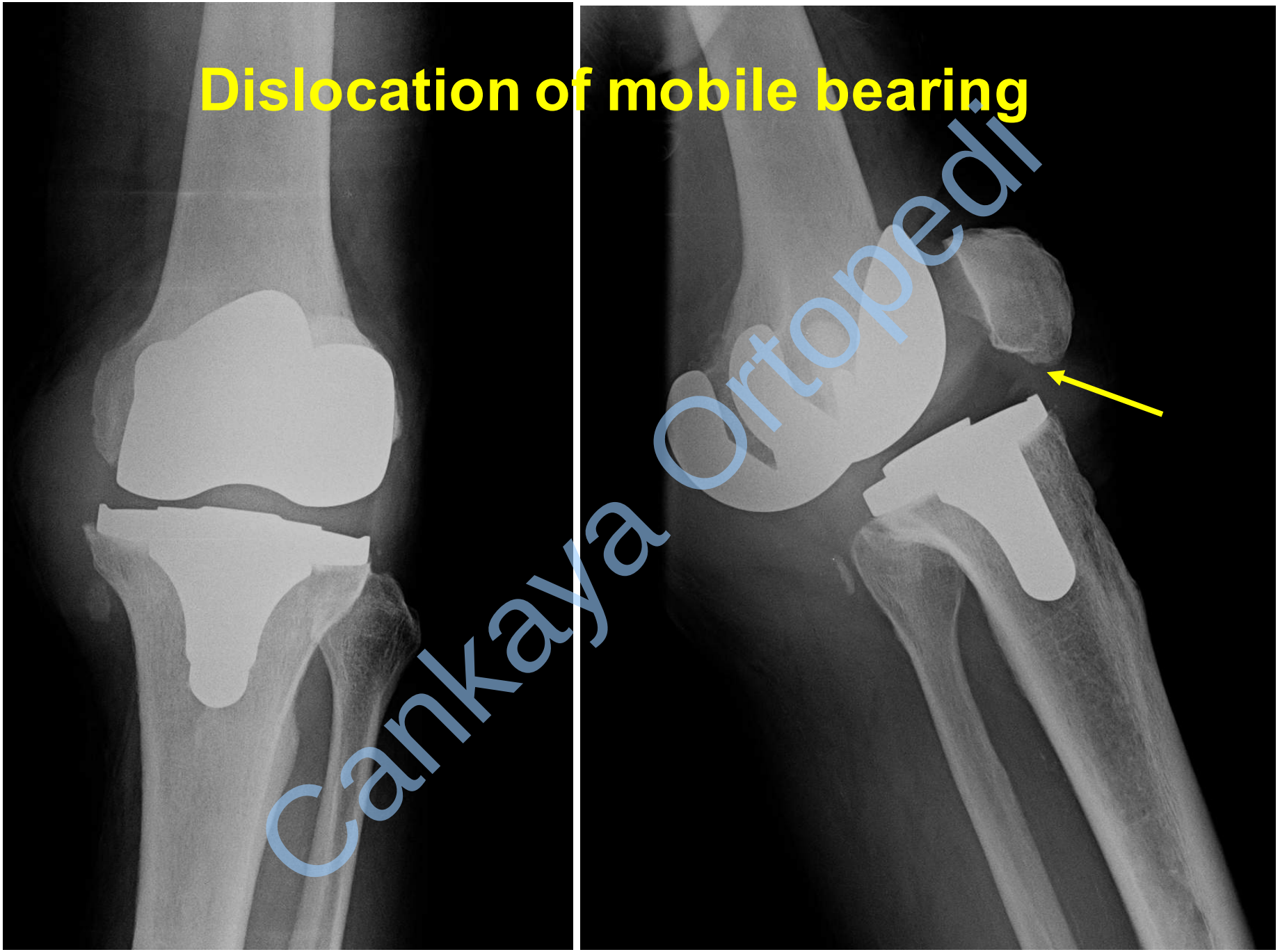
Rare causes

- Joint hyperlaxity *(Ehlers Danlos Syndrome)*
- Neuro-muscular problems
  - Polio
    - *Giori NJ: J Bone Joint Surg 2002 84-A: 1157-61*
    - *Jordan L : J Arthroplasty. 2007;22(4):543-8.*
  - Multiple sclerosis
    - *Rao V: J Bone Joint Surg 2003 85-A: 731-2*
- Dislocation of mobile bearings
    - *Ridgeway S: J Arthroplasty 2004, 19:686-93*
    - *Hwang CH: Clin Orthop 2002, 405:198-94*

Dislocation of mobile bearing



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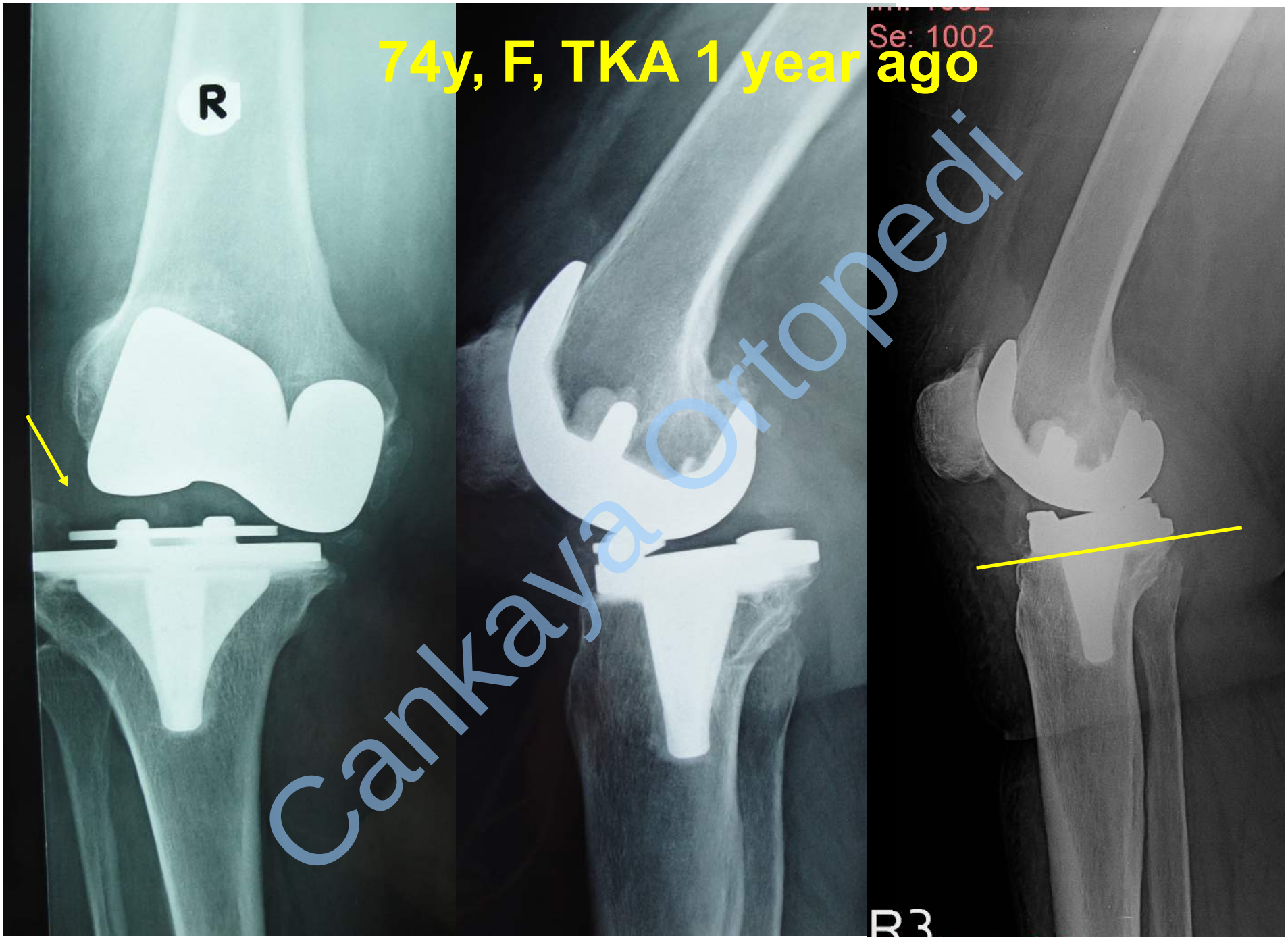
Causes of instability

- **Failure to obtain capsulo-ligamentous balance during the inital arthroplasty**
  - Over or under release
  - Improper component sizing or malposition
  - Flexion-extension gap mismatch
- Abnormal stretching of peri-articular soft tissues in time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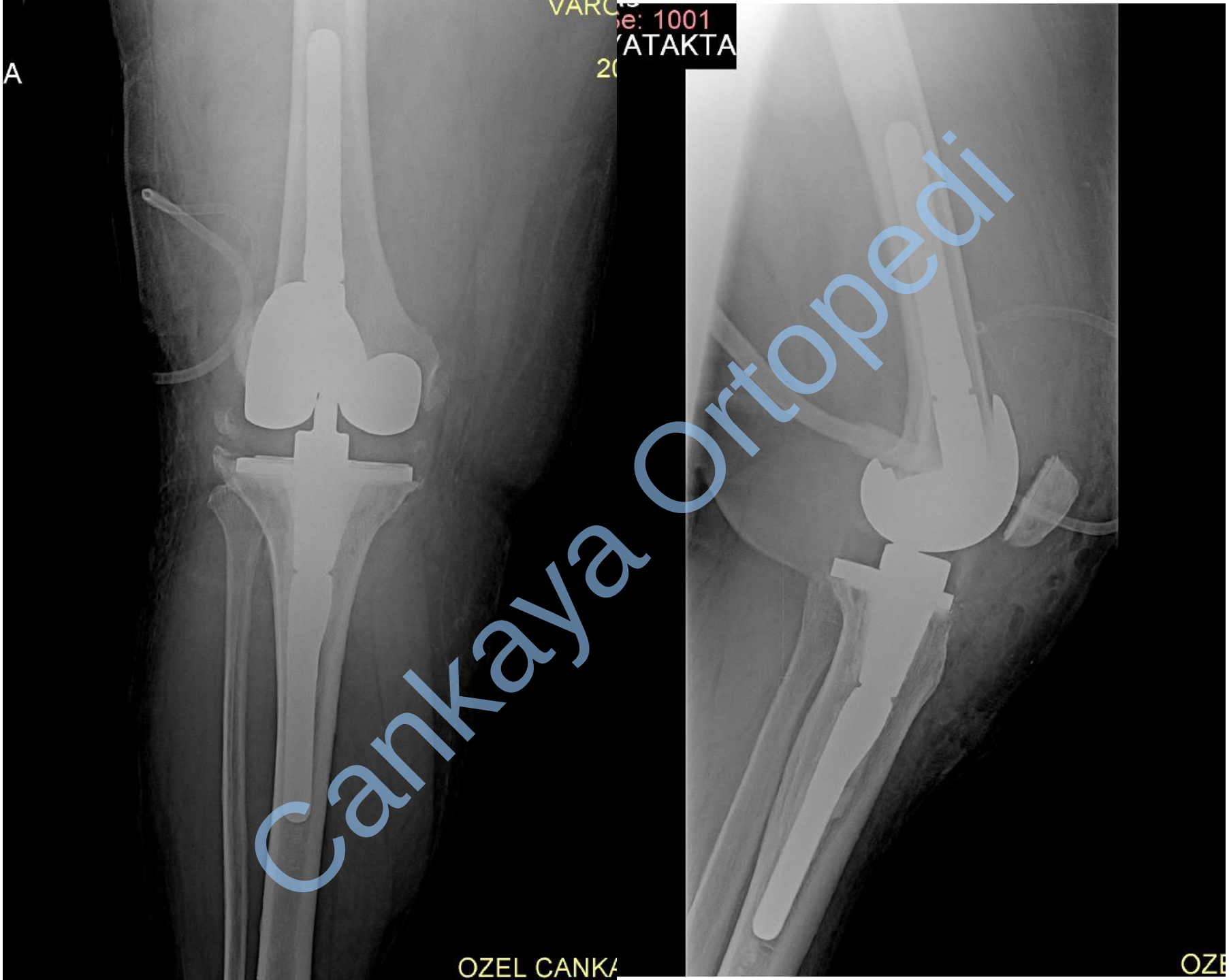

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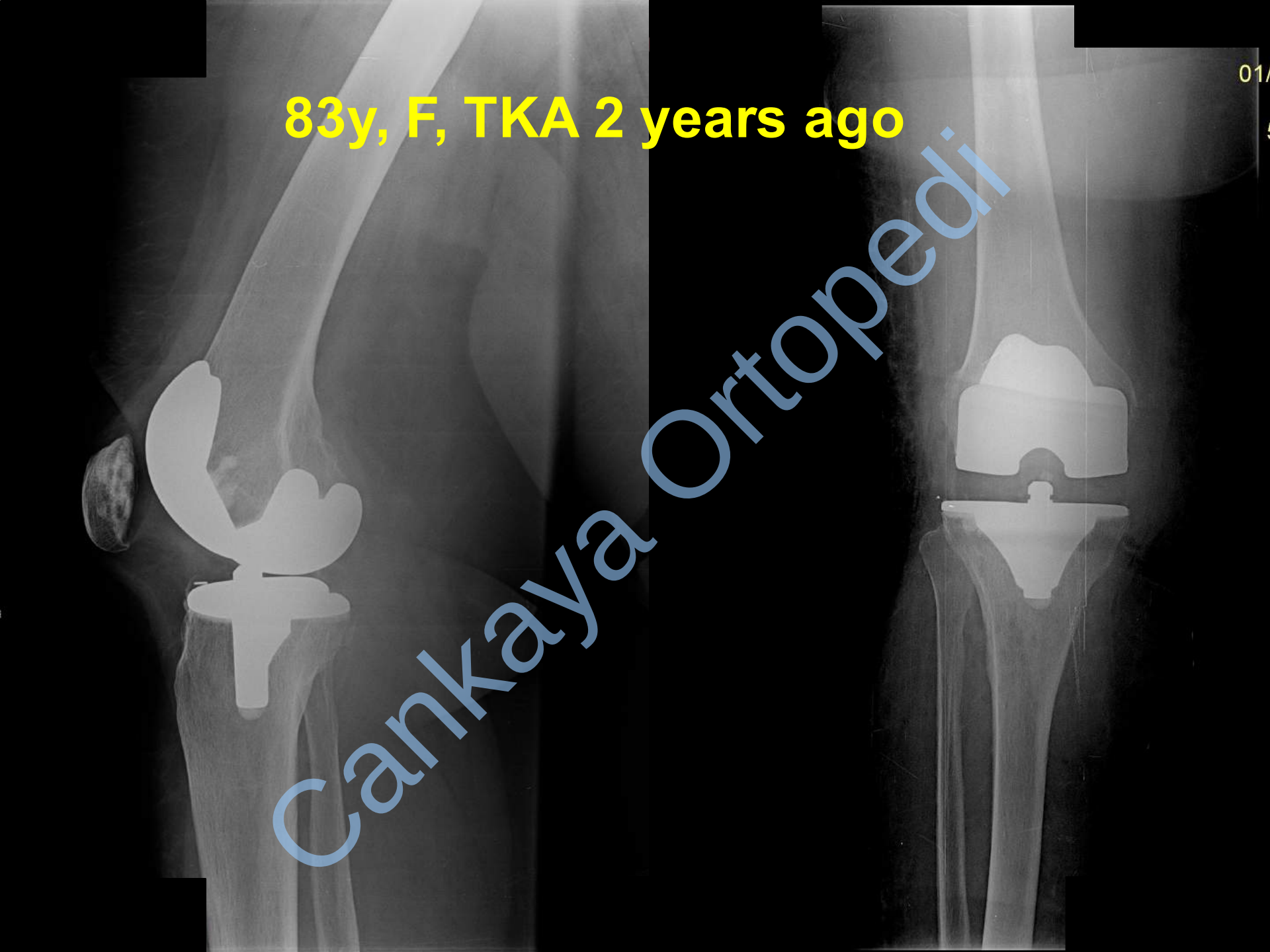
Causes of instability

- Asymmetrical bone resection
- Atraumatic rupture of an attenuated or partially released ligament (PCL)
- Poly wear or implant breakage
- **Trauma**

  - *Krackow K: J Arthroplasty 2003, 18 (Suppl1): 45*


83y, F, TKA 2 years ago
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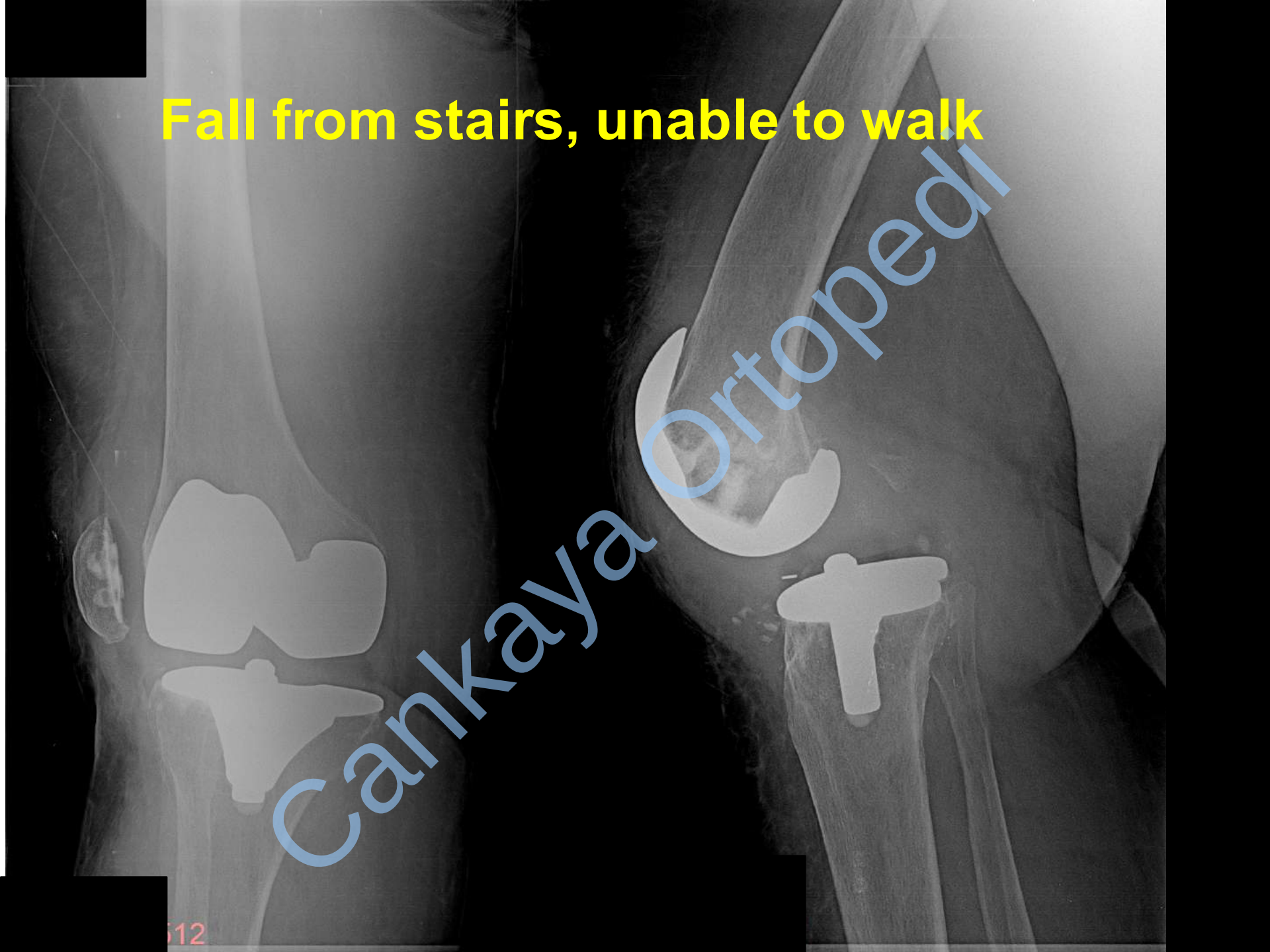
Fall from stairs, unable to walk
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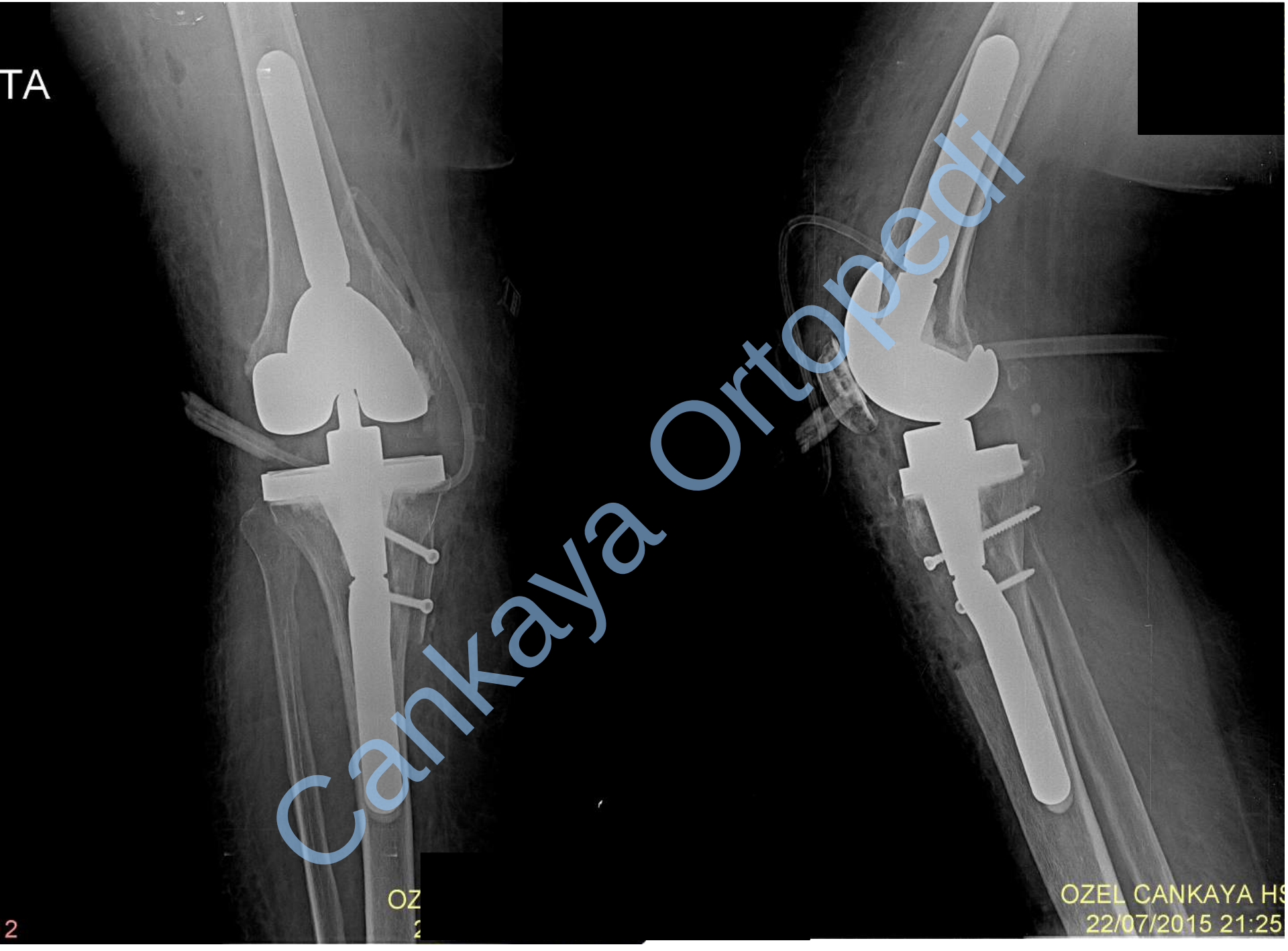
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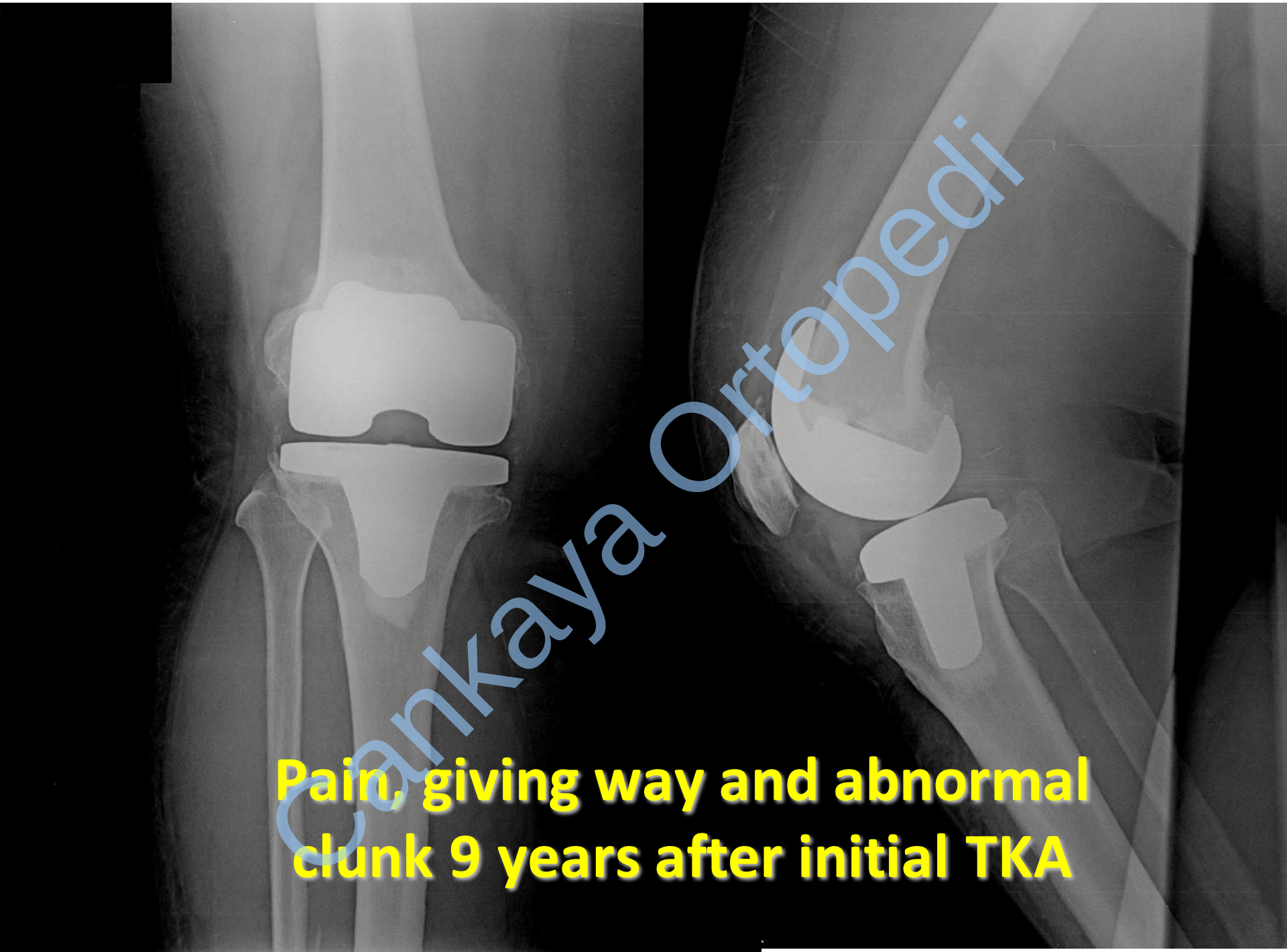

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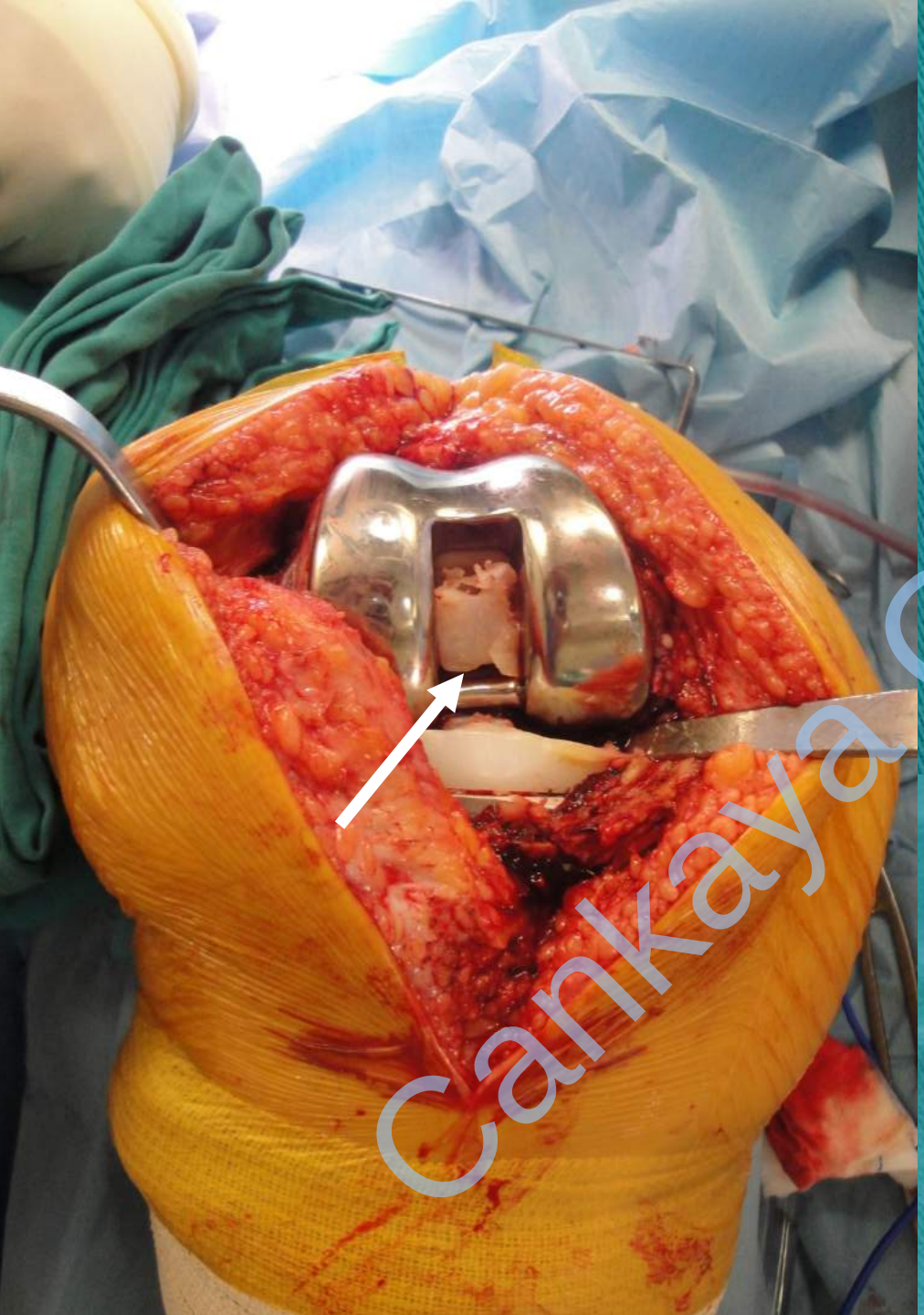

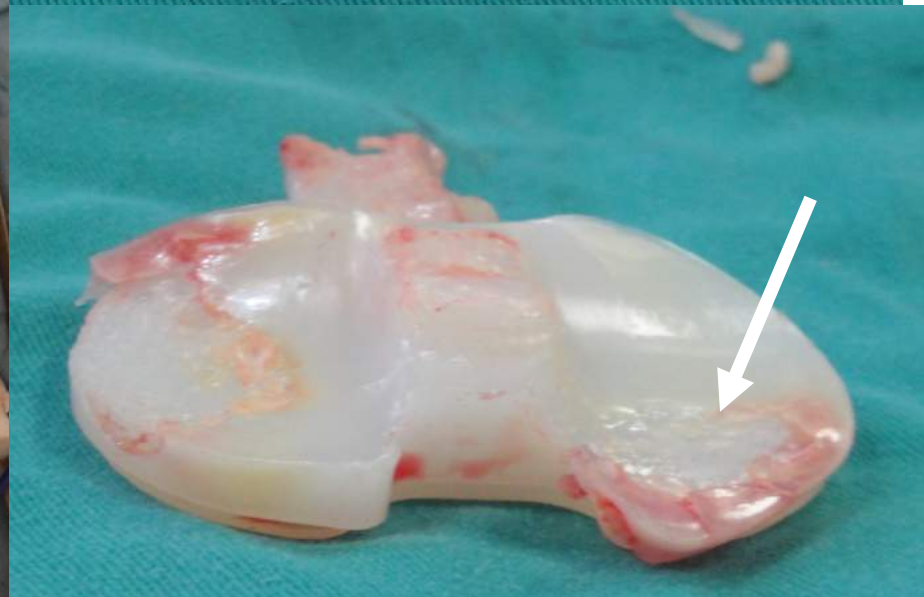

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Symptoms & signs

- Major instability
  - Unable to bear weight
  - Major laxity /Deformity

→ **Easy diagnosis**

- Flexion instability
  - Giving way not evident
  - Pain/recurrent effusions
  - Difficulty in stairs
    - *Vince KG. J Arthroplasty 2006;21:44–49.*

→ **Tricky diagnosis**

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History

- Reason for primary TKA/Previous surgery
- Co-morbidities
  - Neuromuscular disorders (Charcot, polio, MS)
  - Rheumatoid arthritis
  - Ehlers-Danlos syndrome,
- Type of primary implant
  - Releases
  - Complications
- Onset of symptoms
- Trauma/ gradual ?

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Physical exam

- Extremity alignment
- Knee ROM
- Gait pattern
  - Varus-valgus thrust
  - Hyperextension
- Ligament exam at 0, mid-flexion, 90 degrees
  - Antero-posterior
  - Varus-valgus
- Posterior sag/quadriceps active test
- Patellar tracking/Extensor mechanism

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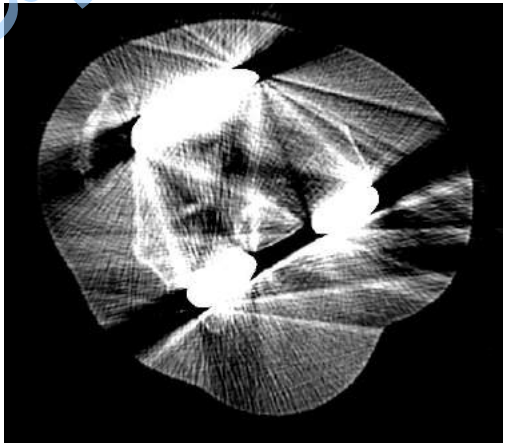
Imaging

- Alignment, sizing, and rotation & sizing of components
- Attention to
  - Femoral sizing/posterior off-set
  - Tibial slope
  - Joint line elevation
  - Tibial subluxation
- Wear, breakage and loosening of components
- CT scans for rotational alignment



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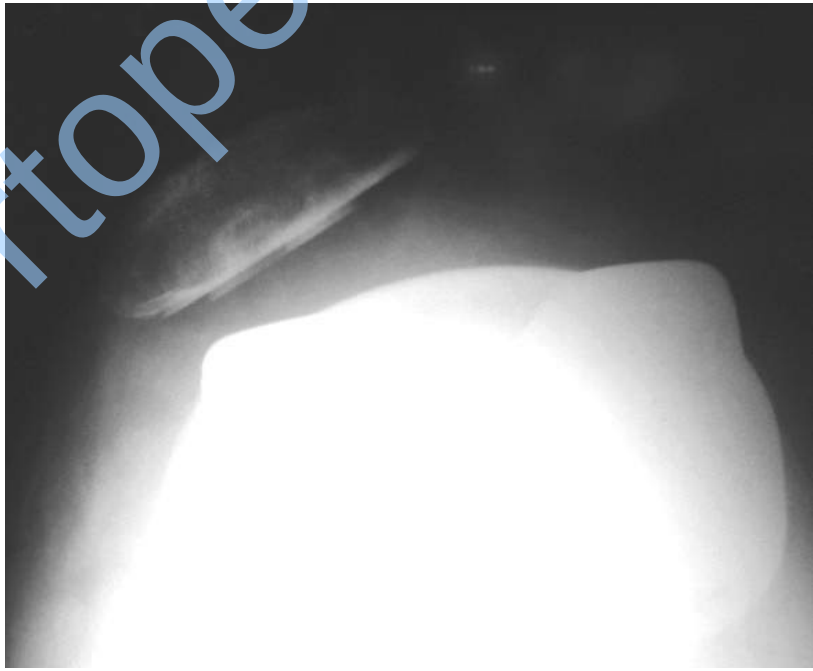
R/o other causes that may mimic symptoms

- Patellar instability
- Patellar clunk
- Reflex quadriceps inhibition due to pain
- Radiating pain from the hip
- Infection ??



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Types of instability

- Instability in extension
  - Symmetric
  - Asymmetric
- Flexion instability
- Mid-flexion instability
- Genu recurvatum
- Global instability in multi-operated knee
  - *Petrie JR. Bone Joint J. 2016 Jan;98-B(1 Suppl A):116-9.*

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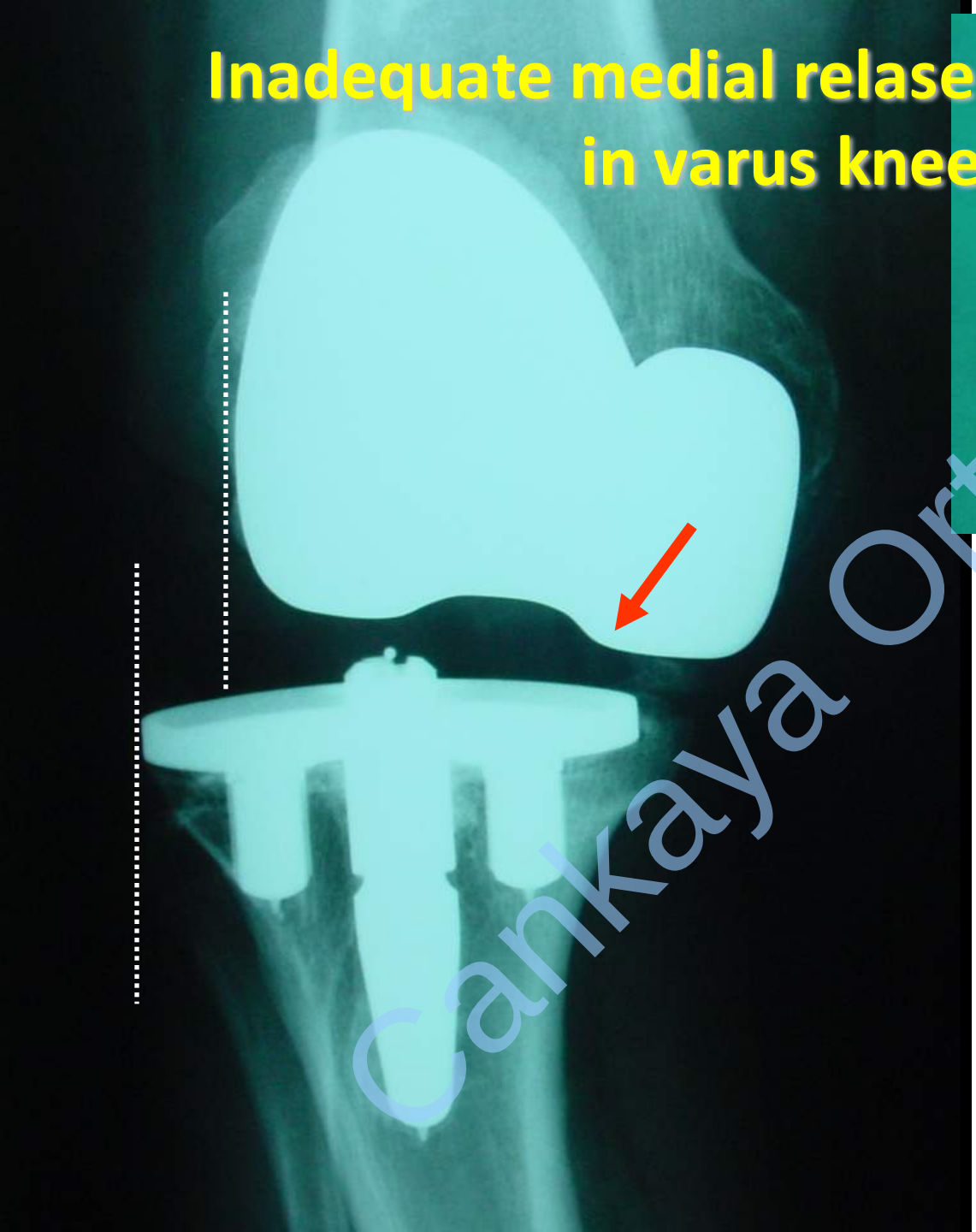
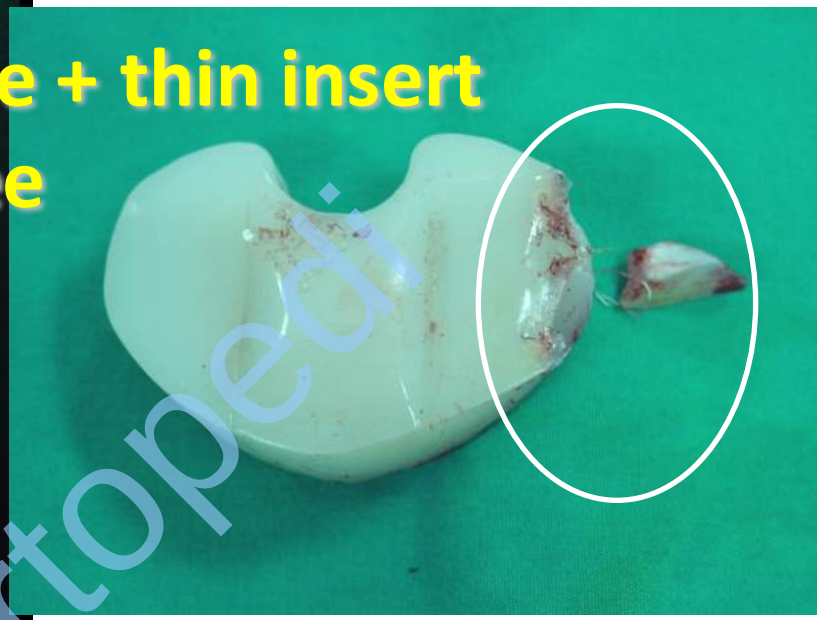
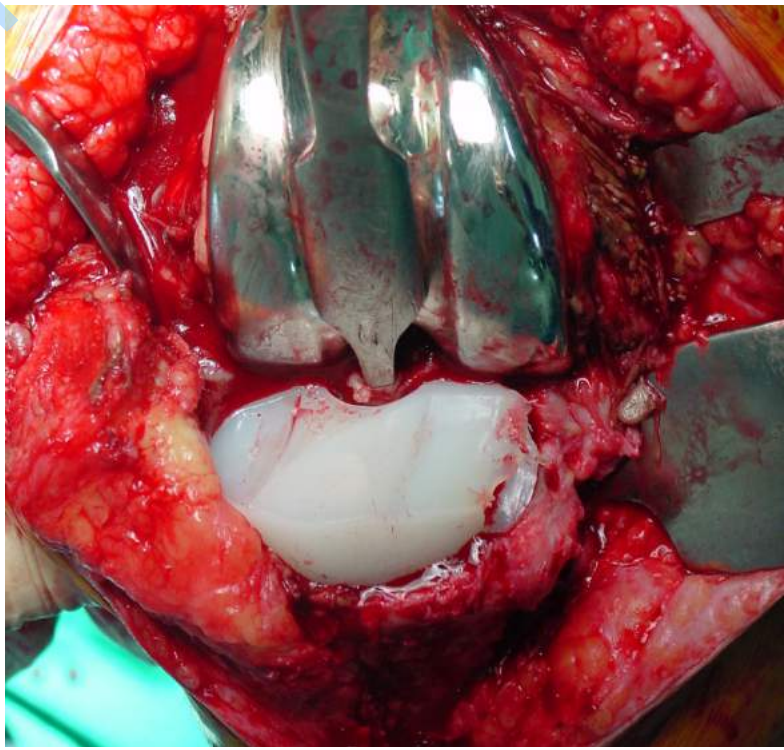
Instability in extension

- Symmetrical
  - Over resection of distal femur or proximal tibia
  - Thin poly insert
- Asymmetrical
  - Underrelease of tight structures + thin poly

Inadequate medial relase + thin insert in varus knee





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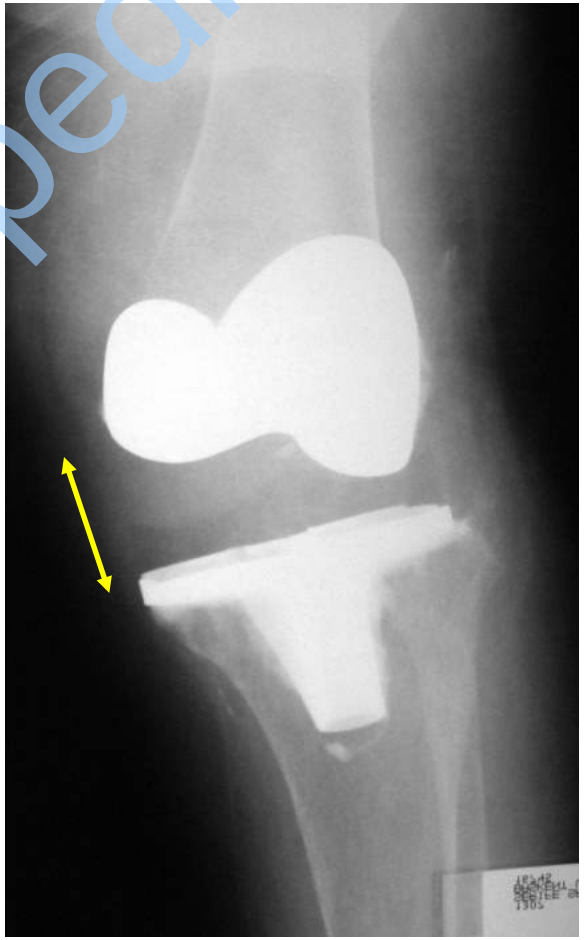
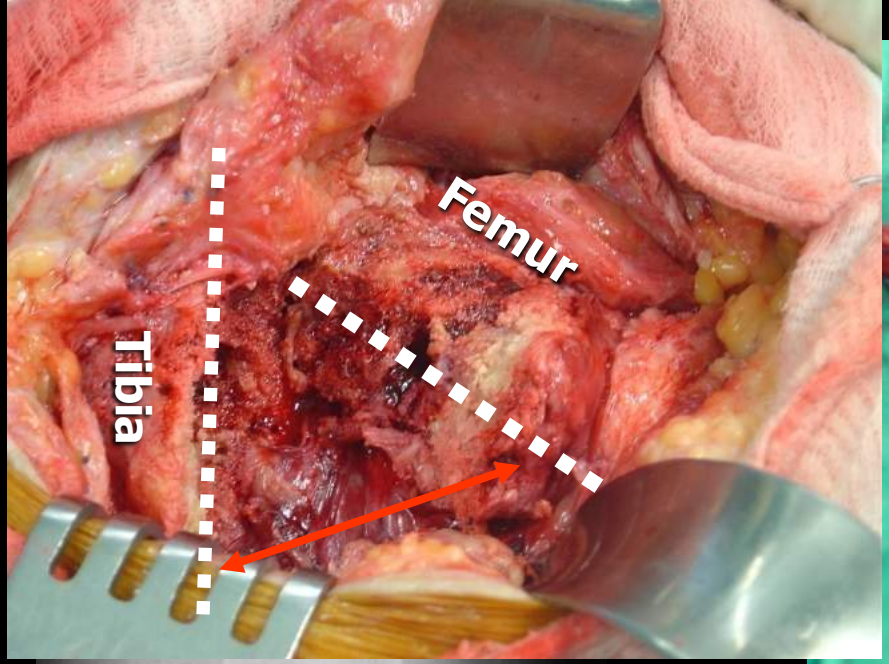
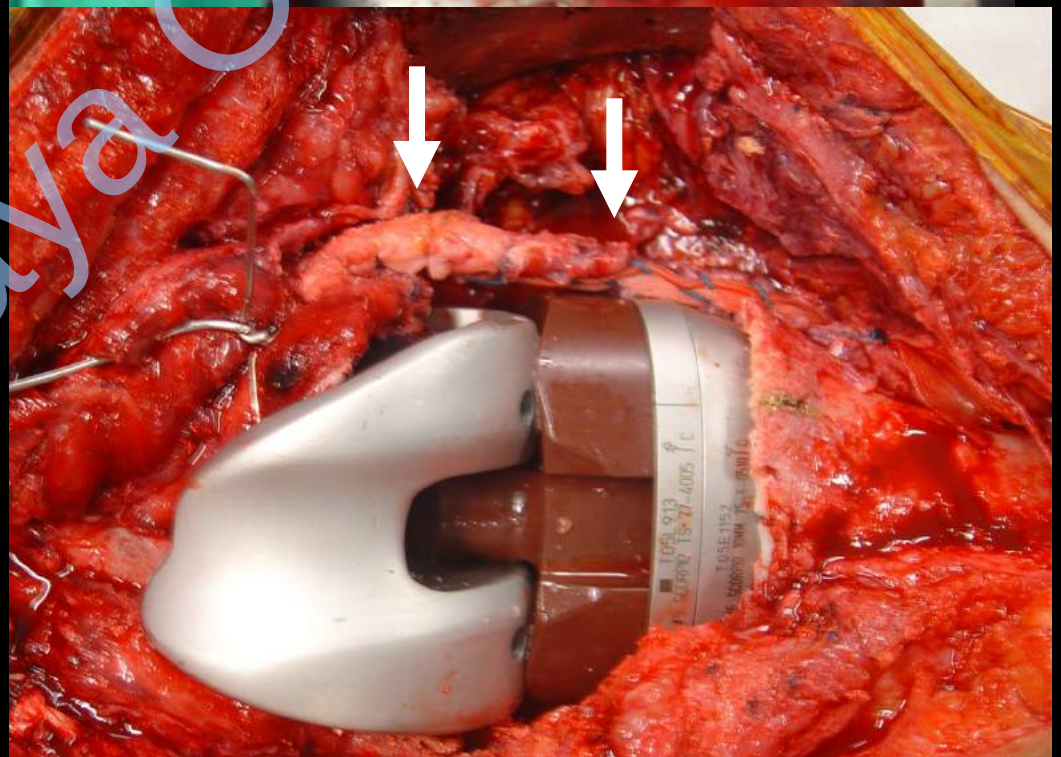
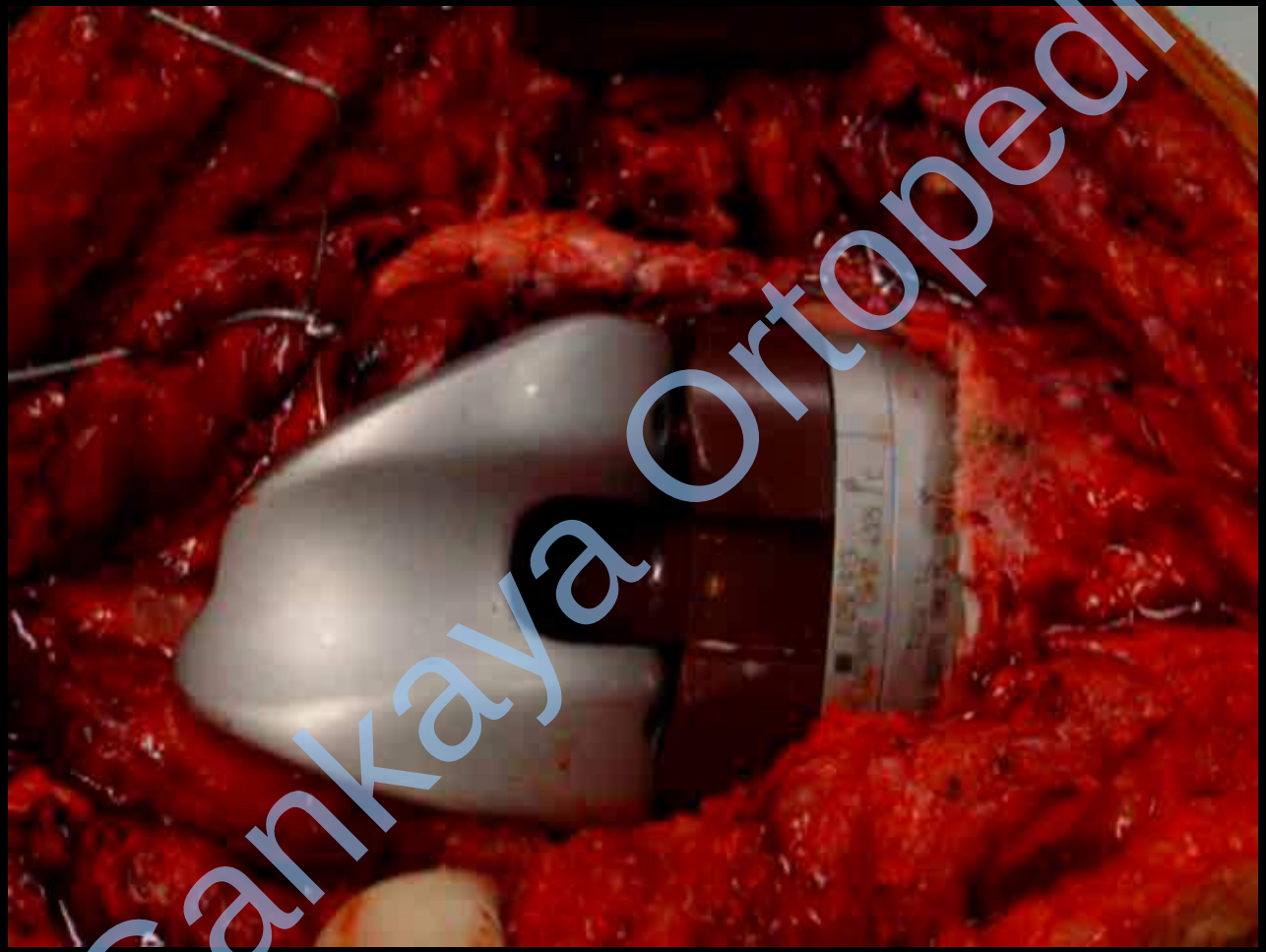
Medio-lateral instability

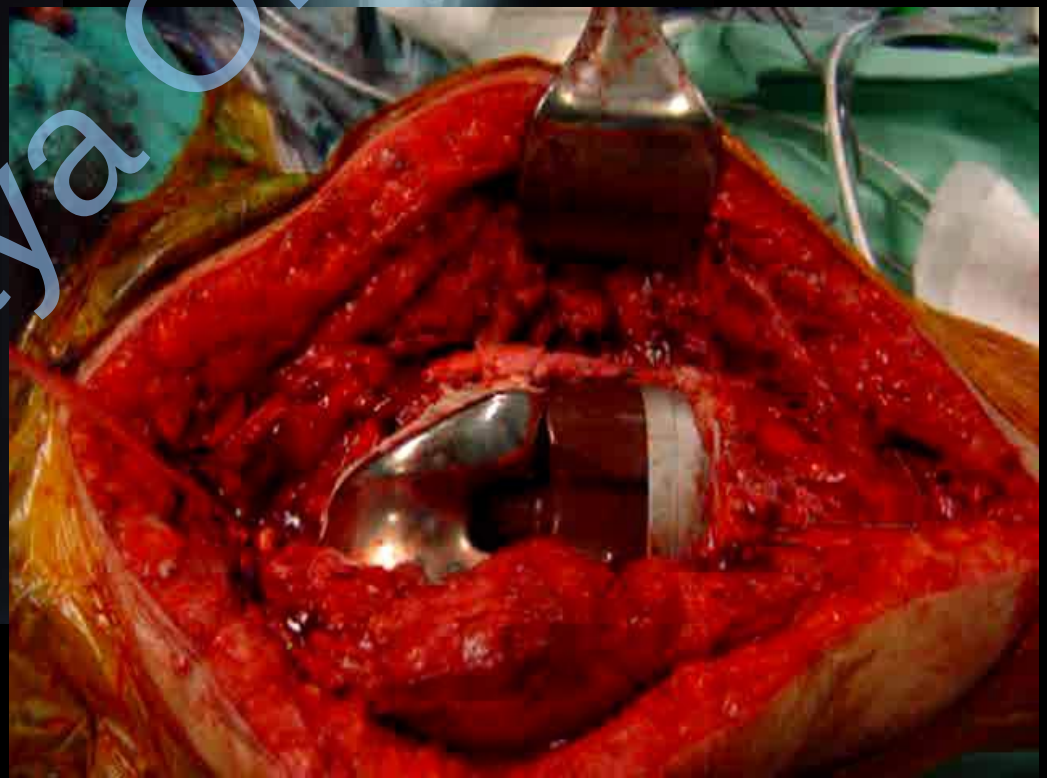
- Aggressive release of MCL/trauma
- Intra-operative section of MCL
- Flexion instability in valgus knees after complete section of popliteus/LCL











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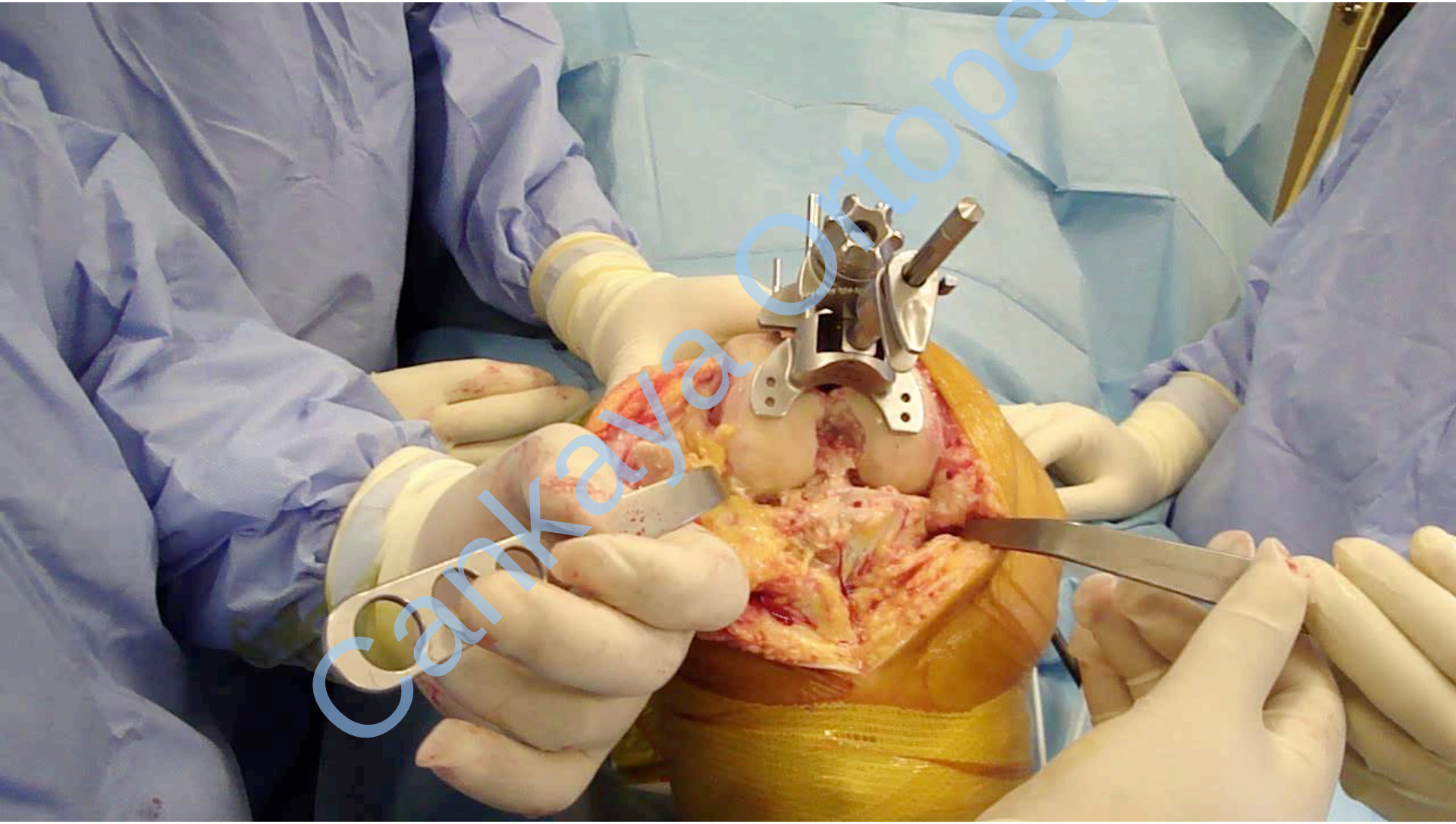
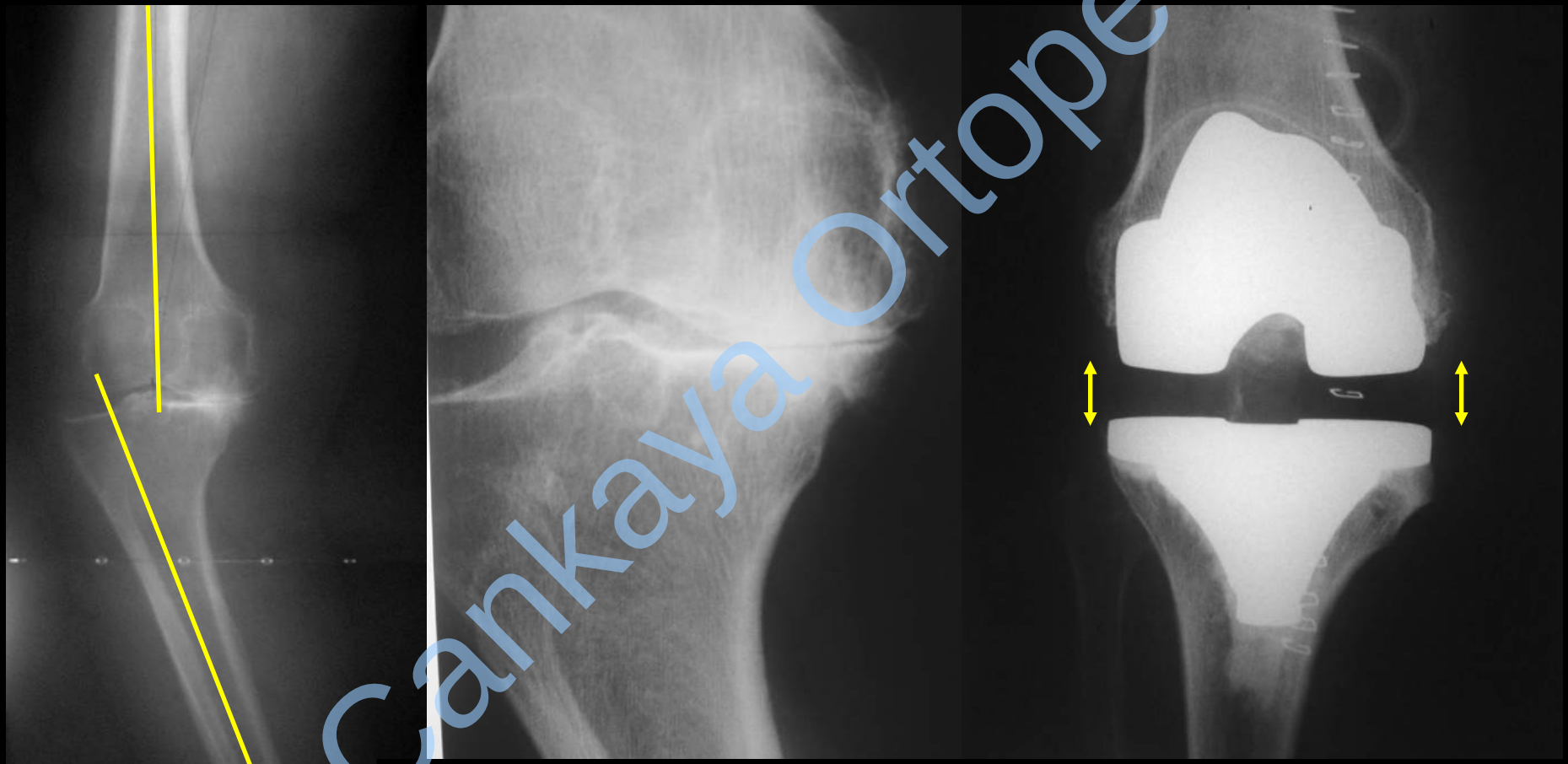
Prevention of iatrogenic MCL injury

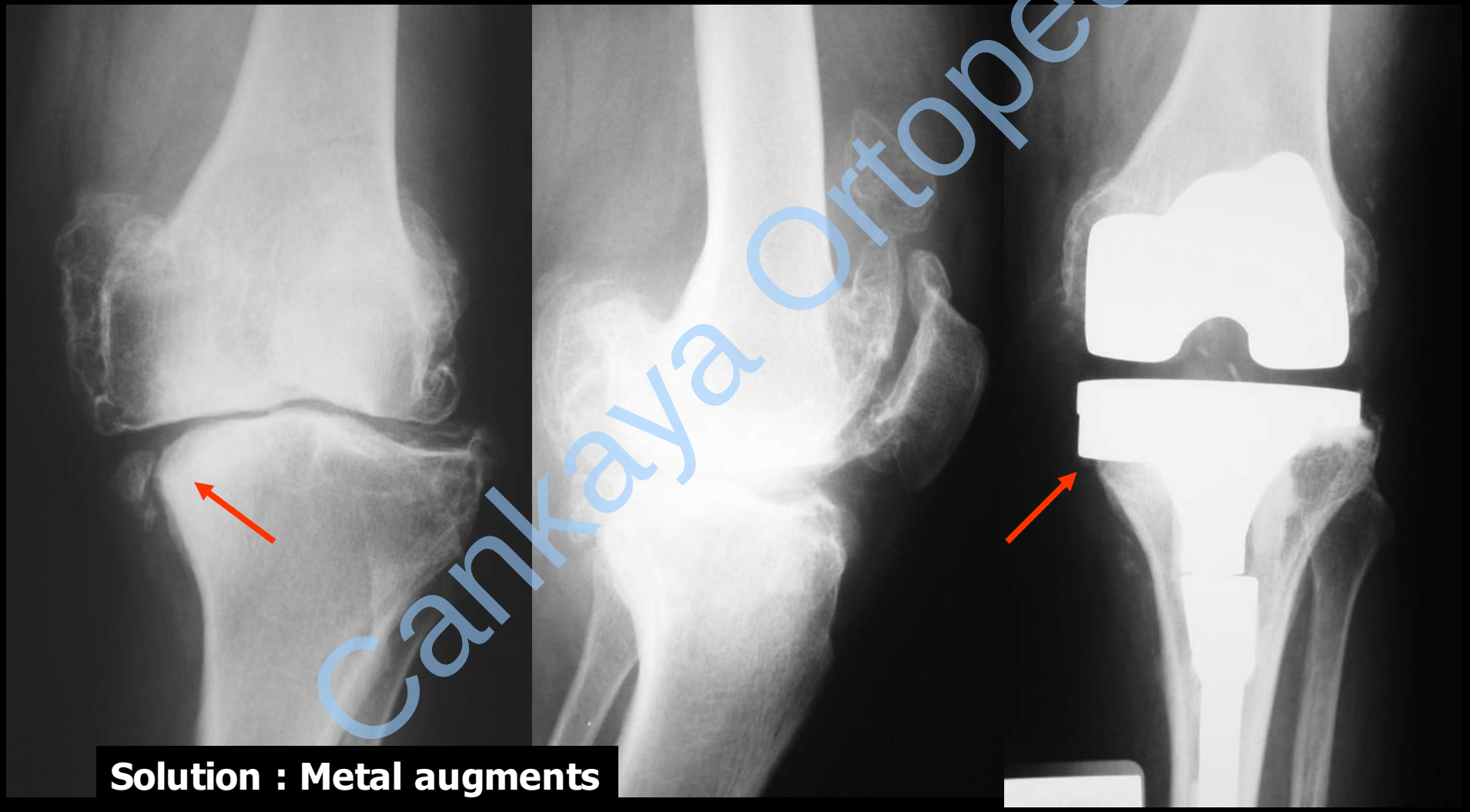


Restoration of medio-lateral balance in primary TKA: Problem soft tissues



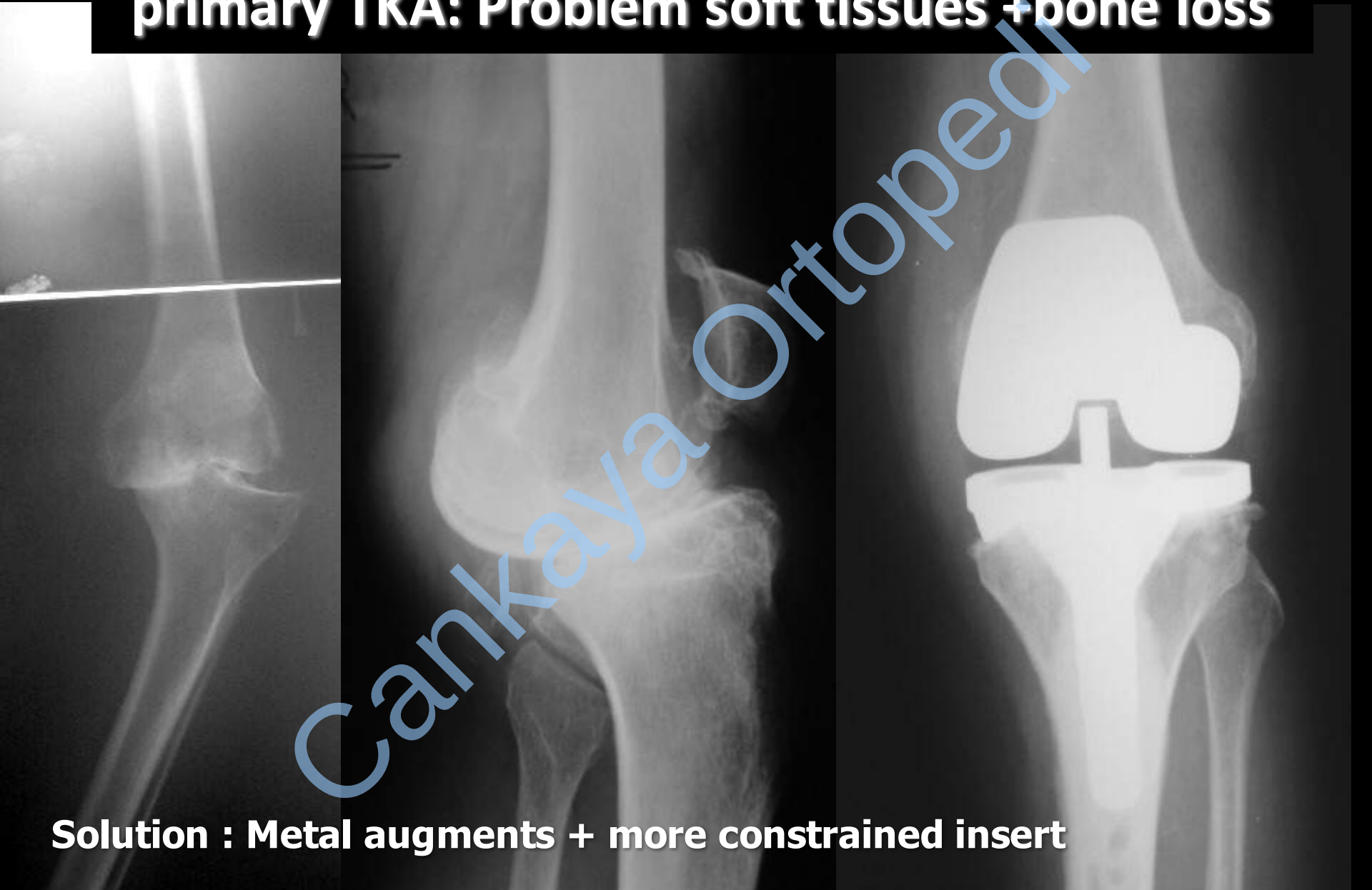
Solution: Minimal bone resection medial release, thicker poly

Restoration of medio-lateral balance in primary TKA: Problem bone loss



Solution : Metal augments

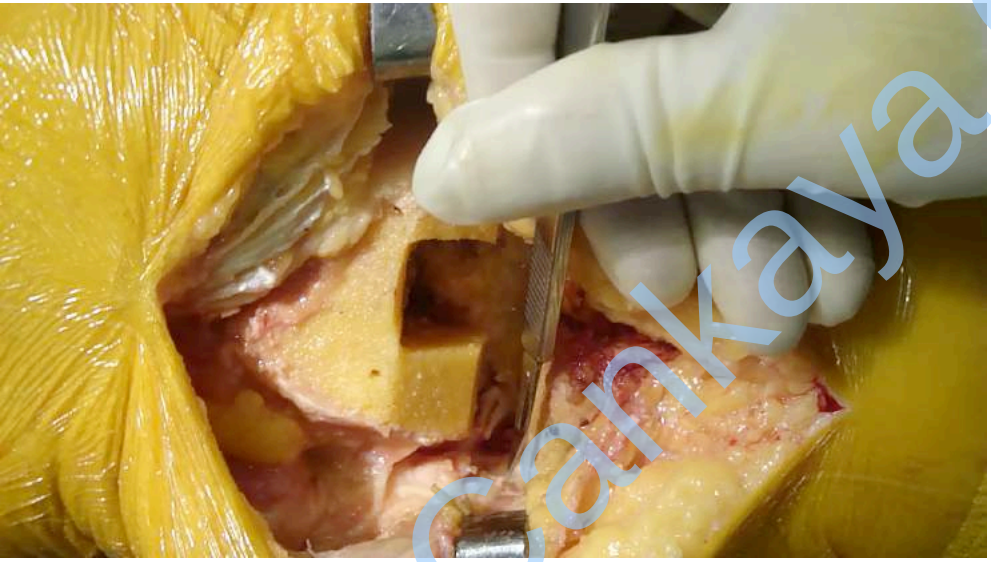
Restoration of medio-lateral balance in primary TKA: Problem soft tissues +bone loss

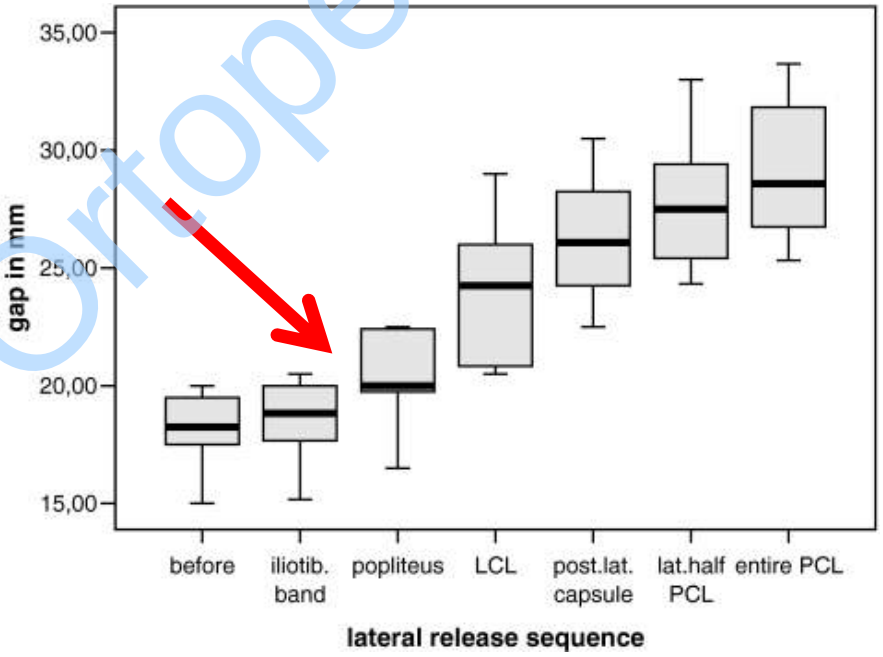


Solution : Metal augments + more constrained insert

Avoid complete release of LCL & popliteus in valgus knees

- Late instability
- Abnormal laxity in flexion





Luring C: Int Orthop. 2008; 32(2): 229–235

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How much medio-lateral laxity is acceptable ?

- Up to 4mm laxity in varus-valgus plane does not cause problems
  - *Ishii Y:J Orthop Sci 2003; 8(4):538-42*
- Lax knees do not have better flexion
  - *Yamakado K: Arch Orthop Trauma Surg 2003, 123:1-4*

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Mid-flexion instability

- Knee stable in 0 & 90 degrees flexion
- İnstability in mid range of flexion

- Proposed etiology
  - Undersized femoral component placed proximal
    - *Martin JW. Clin Orthop 1990;259:146–156*
  - Additional distal femoral resection to correct flexion contracture
    - *Sharma KJ: Bone Joint J 2013, 95-B:Supp 15 326*
  - Uncorrected flexion contracture
    - *Vince K : Bone Joint J 2016;98-B(1 Suppl A):84–8.*
  - Overrelase of MCL
  - Prosthesis design
    - Multi-Radius femoral component
    - PS & high flex designs

■ CONTROVERSIES IN KNEE ARTHROPLASTY

Mid-flexion instability after total knee arthroplasty

WOOLLY THINKING OR A REAL CONCERN?

K. Vince

The term mid-flexion instability has entered the orthopaedic literature as a concept, but has not been confirmed as a distinct clinical entity. The term is used freely, sometimes as a

No published series on correction of midflexion instability

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Flexion laxity

- Flexion gap > Extension gap
- Frank dislocation 0.15%
  - *McAuley JP & Engh GA:J Arthroplasty 2003*
  - *Ross JP. Orthopedics. 2015; 38(12):e1155-e1159*
- Small femoral component in anterior referencing systems
- Thin poly to correct flexion contracture
- Femoral component malrotation
  - *Kelly MA, AAOS ICL 2001:399-401*

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Precautions in primary TKA

- CR designs
  - Ensure proper tibial slope
  - Careful PCL release
  - Choose smaller size for in-between sizes
- PS designs
  - Minimal posterior tibial slope
  - Choose larger size for in-between sizes
  - Preserve popliteus tendon
    - *Callaghan JJ: J Arthroplasty 2004, 19(4, Suppl 1):31-4*

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Antero-posterior instability

- PCL release
  - *Straw R: J Bone Joint Surg 2003, 85-B:671-4*
- Attenuation of PCL in time
  - *Pagnano MW: Clin Orthop 1998,(356):39-46*
  - *Waslewski GL :J Arthroplasty 1998, 13(7):763-7*
- Flexion gap> extension gap
  - *Clarke HD, Scuderi GR:J Knee Surg 2003 16:123-8.*

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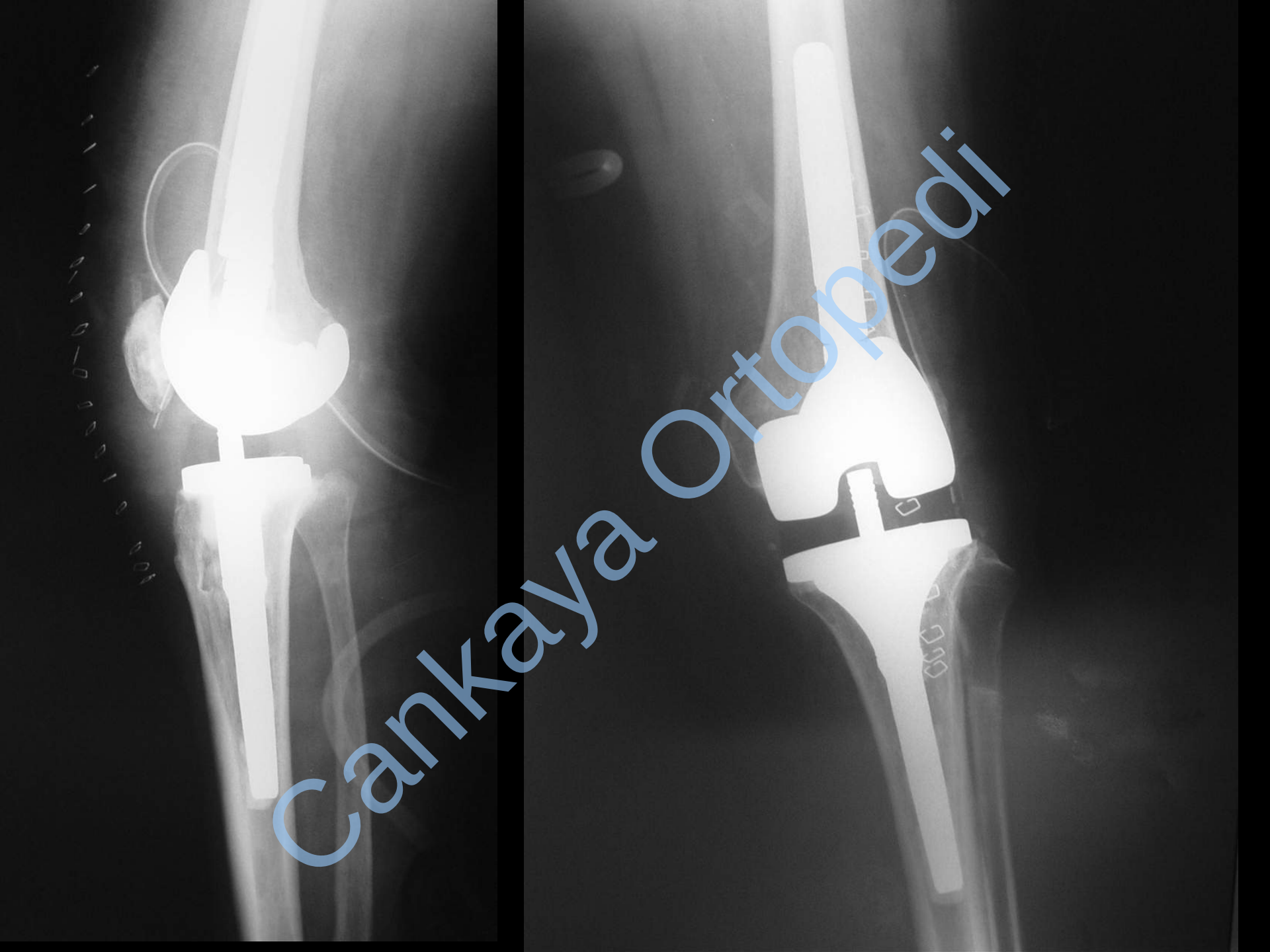
72 y, F, primary TKA 3 years earlier

- Anterior knee pain
- No history of trauma
- Gradual decrease in walking distance
- Repeated effusions
- Difficulty in chairs & stairs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Genu recurvatum

- Extension gap>Flexion gap
- Deficient extensor mechanism + Lax posterior capsule
- Distal femoral augments / Rotating hinge

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Take home messages..

- One of the top 5 reasons for early revision
- Diagnosis not always easy
  - History
  - Clinical exam
  - Dedicated imaging
- Most cases can be prevented with careful surgical technique during initial TKA


Thank you …
Cankaya Ortop