

DIFETTI TORSIONALI

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Gruppo San Donato



XXVI CONGRESSO NAZIONALE SITOP
Società Italiana di traumatologia e ortopedia pediatrica

Il piede piatto e le patologie segmentarie. L'osteosintesi delle ossa lunghe dell'arto inferiore in età di transizione.

Presidente del Congresso:
Fabio Verdoni
Istituto Ortopedico Galeazzi Sant'Ambrogio - Milano

MILANO, 10 - 12 OTTOBRE 2024

AUDITORIUM, Centro Congressi
Istituto Ortopedico Galeazzi Sant'Ambrogio
Via Cristina Belgioioso 173 - Milano

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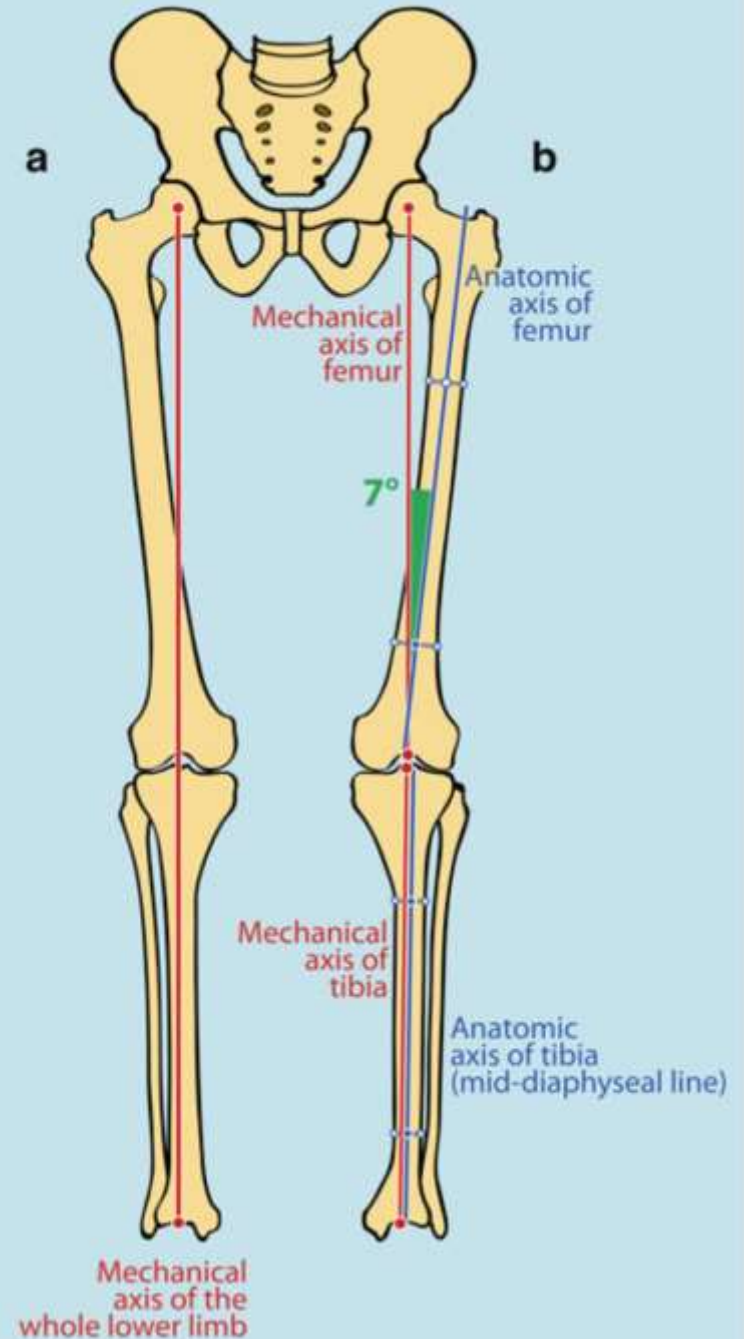
PROGRAMMA PRELIMINARE

NORMAL ALIGNMENT OF THE LOWER LIMB IN CORONAL PLANE

(a) Mechanical axis of the whole lower limb.

(b) Mechanical and anatomical axes of the femur and tibia

Normal Alignment of the Lower Limb



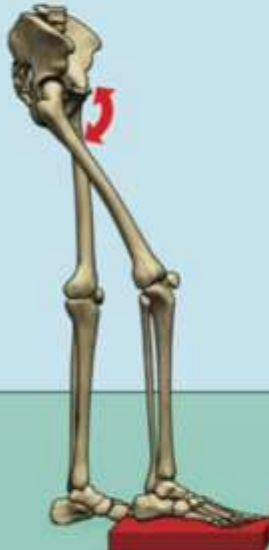
Causes of apparent limb length discrepancy and deformity

CAUSES OF APPARENT SHORTENING

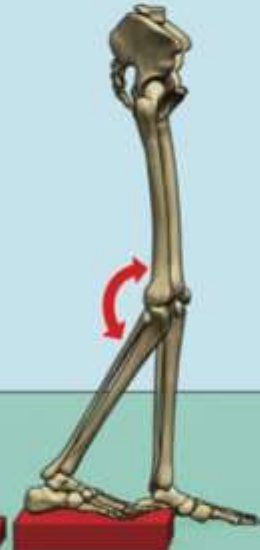
Normal



Flexion contracture of the hip



Flexion contracture of the knee



Sacral agenesis



Adduction contracture



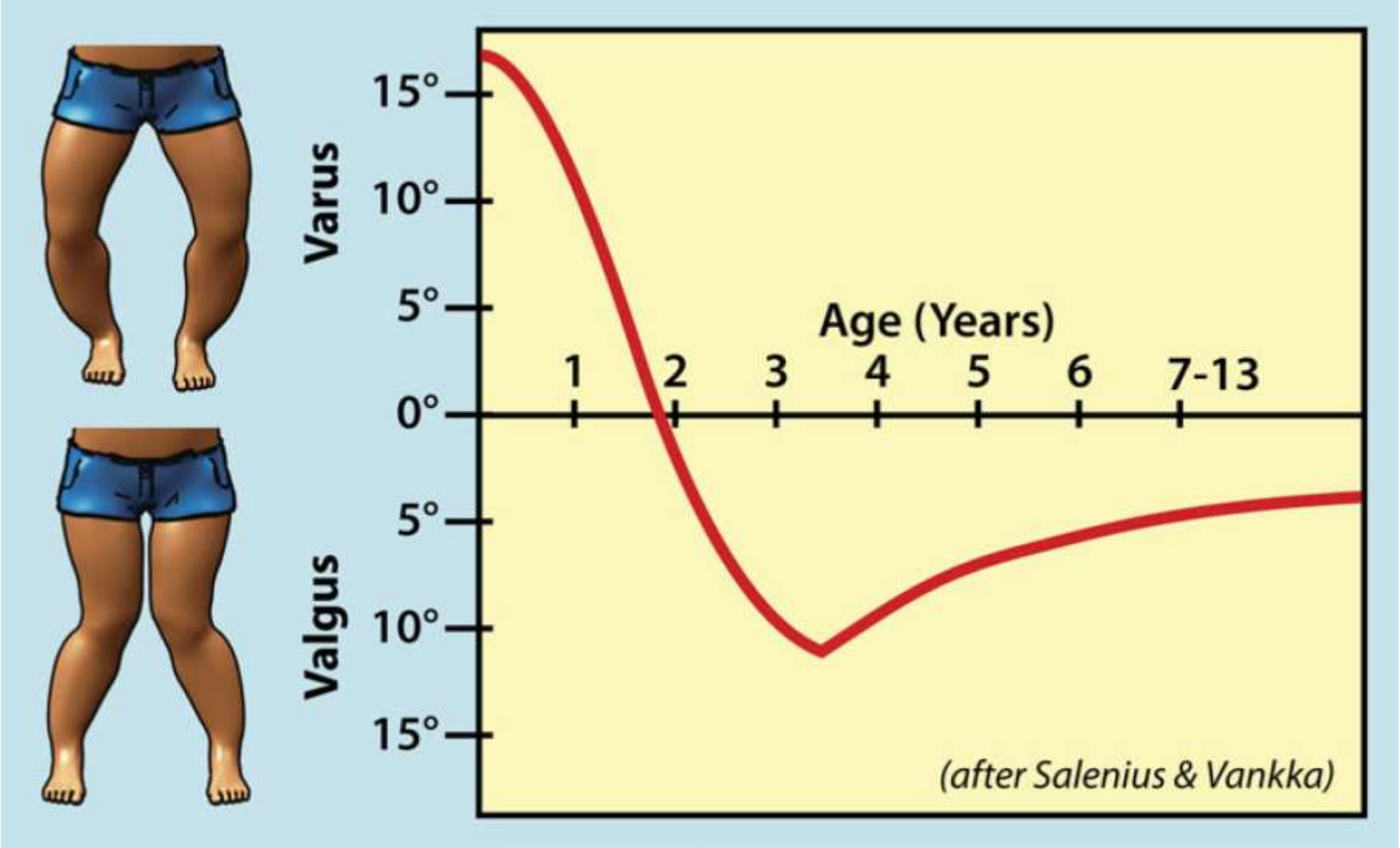
Genu varum



Genu valgum



Normal Age Limits For Physiological Genu Varum And Genu Valgum



Overview

- Physical exam
- **Rotational deformities**
 - In-toeing
 - Out-toeing
- Angular deformities
 - Genu valgum
 - Genu varum

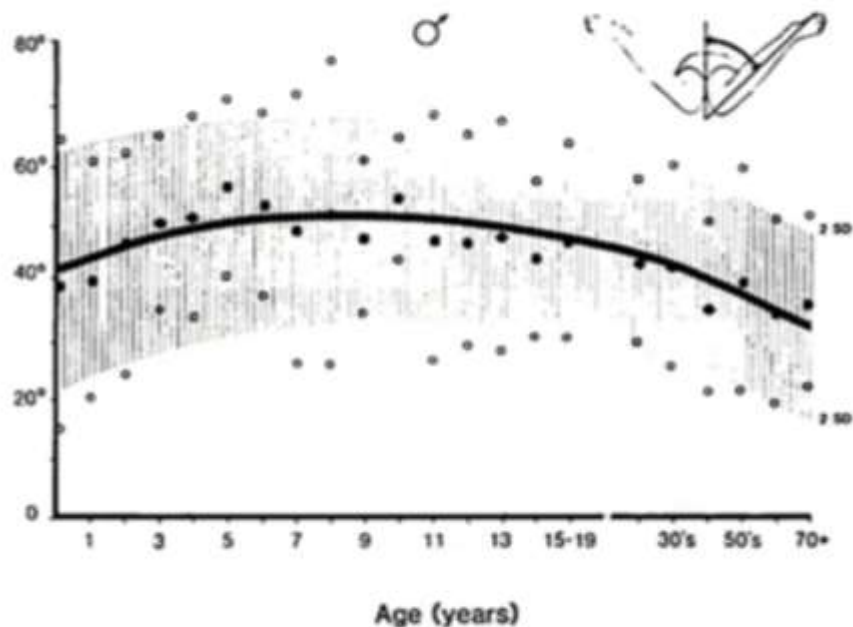
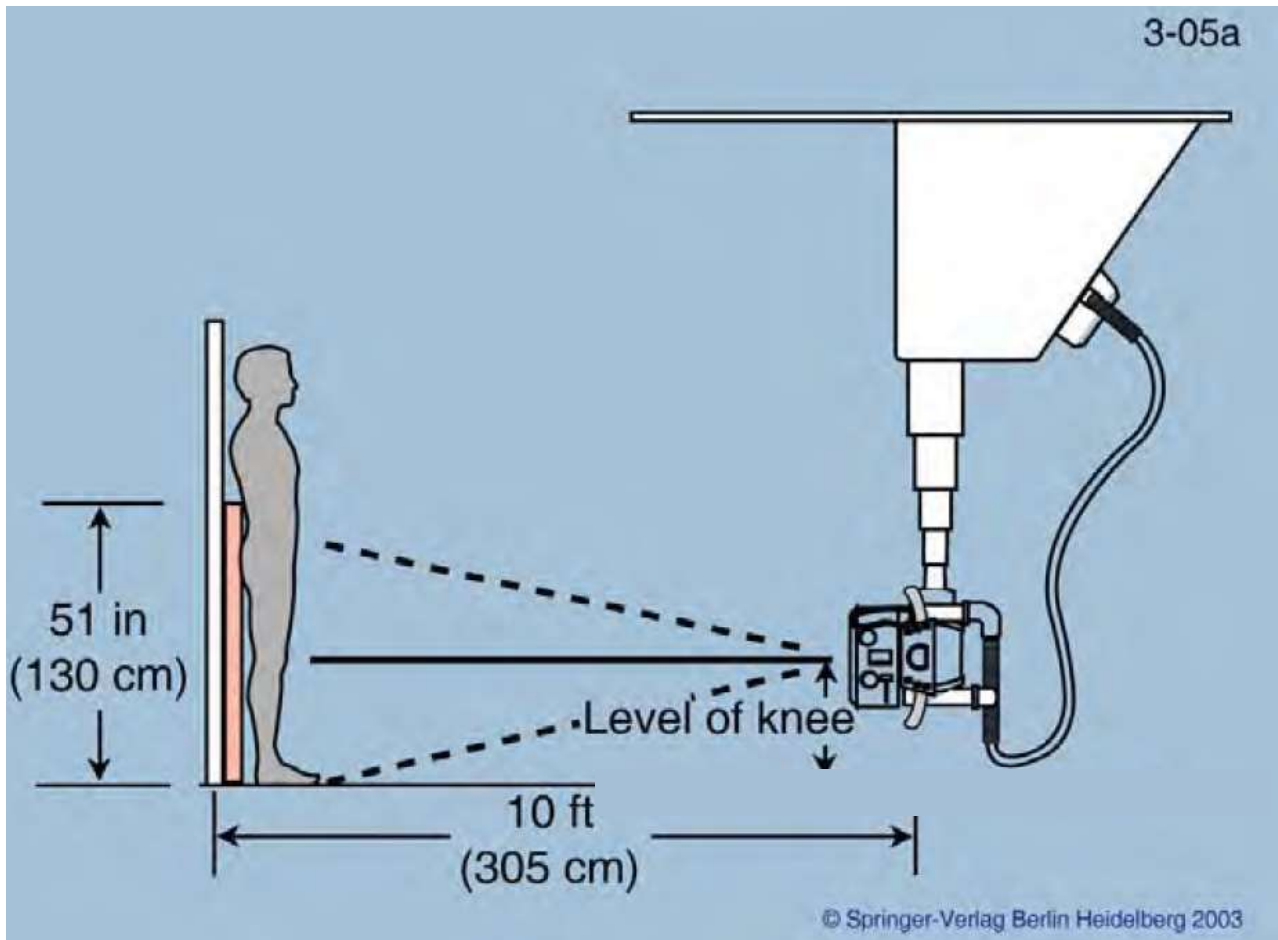
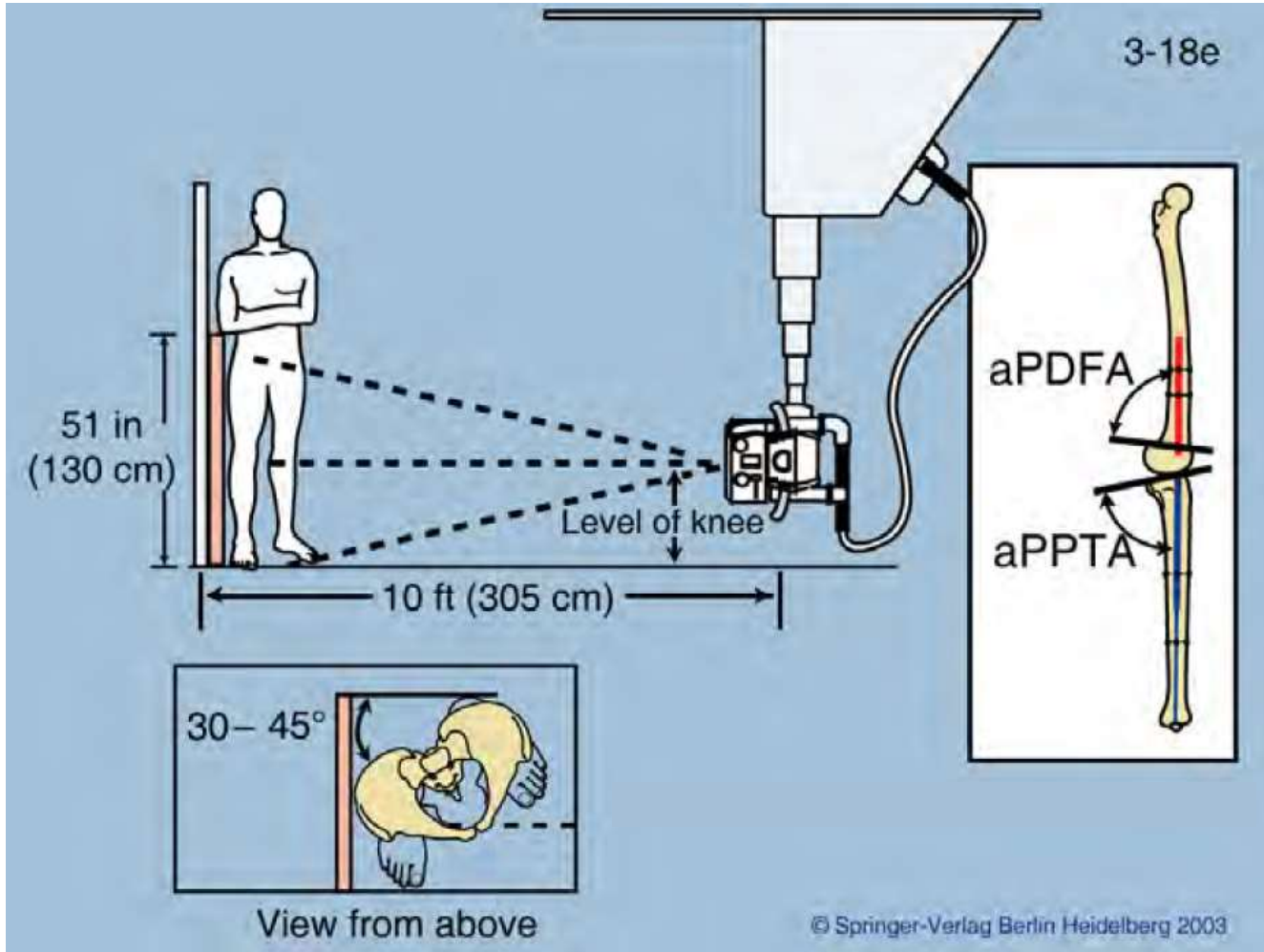


FIG. 2-B
Medial rotation of the hip in male subjects.

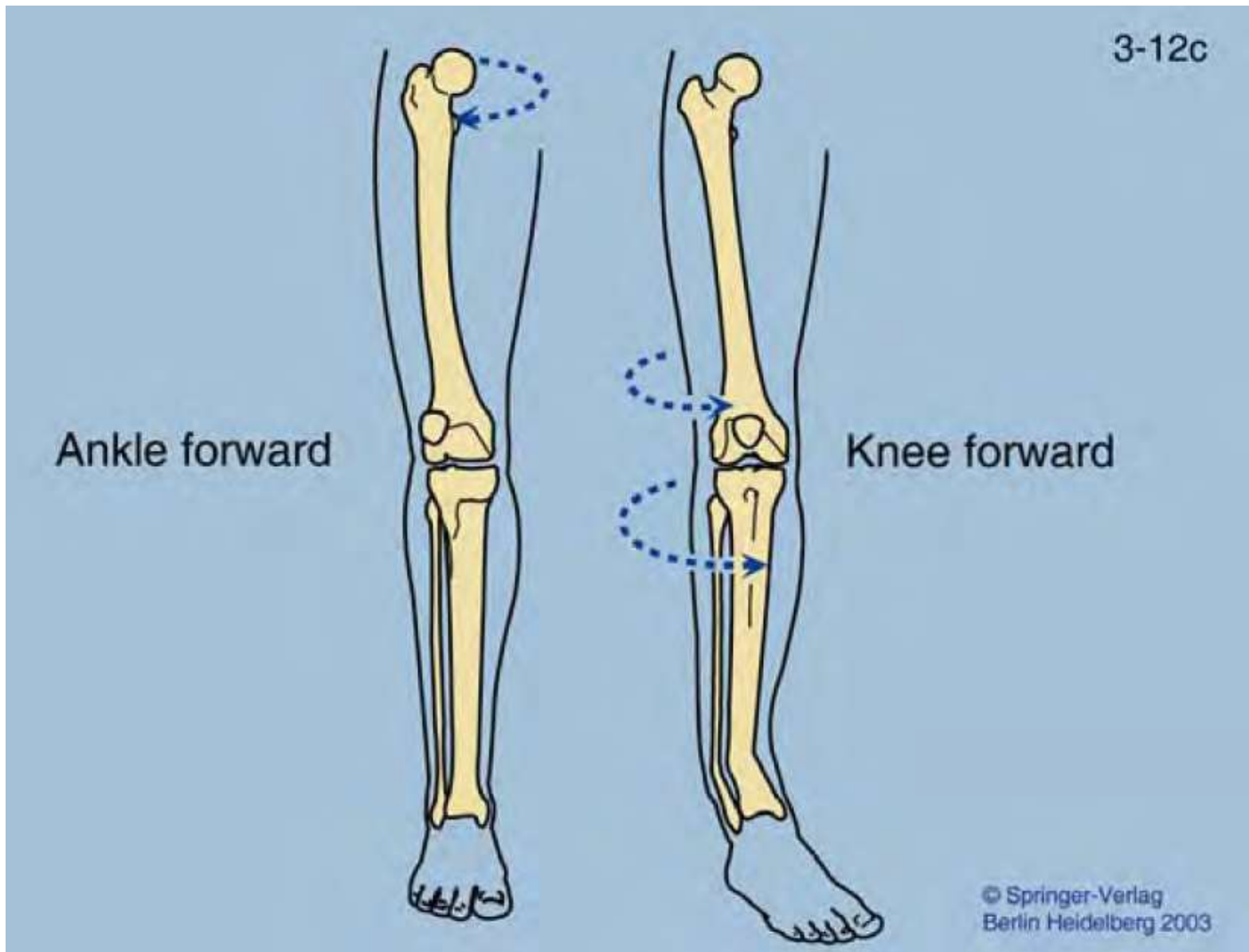
Radiological assessment of bony deformities, frontal view



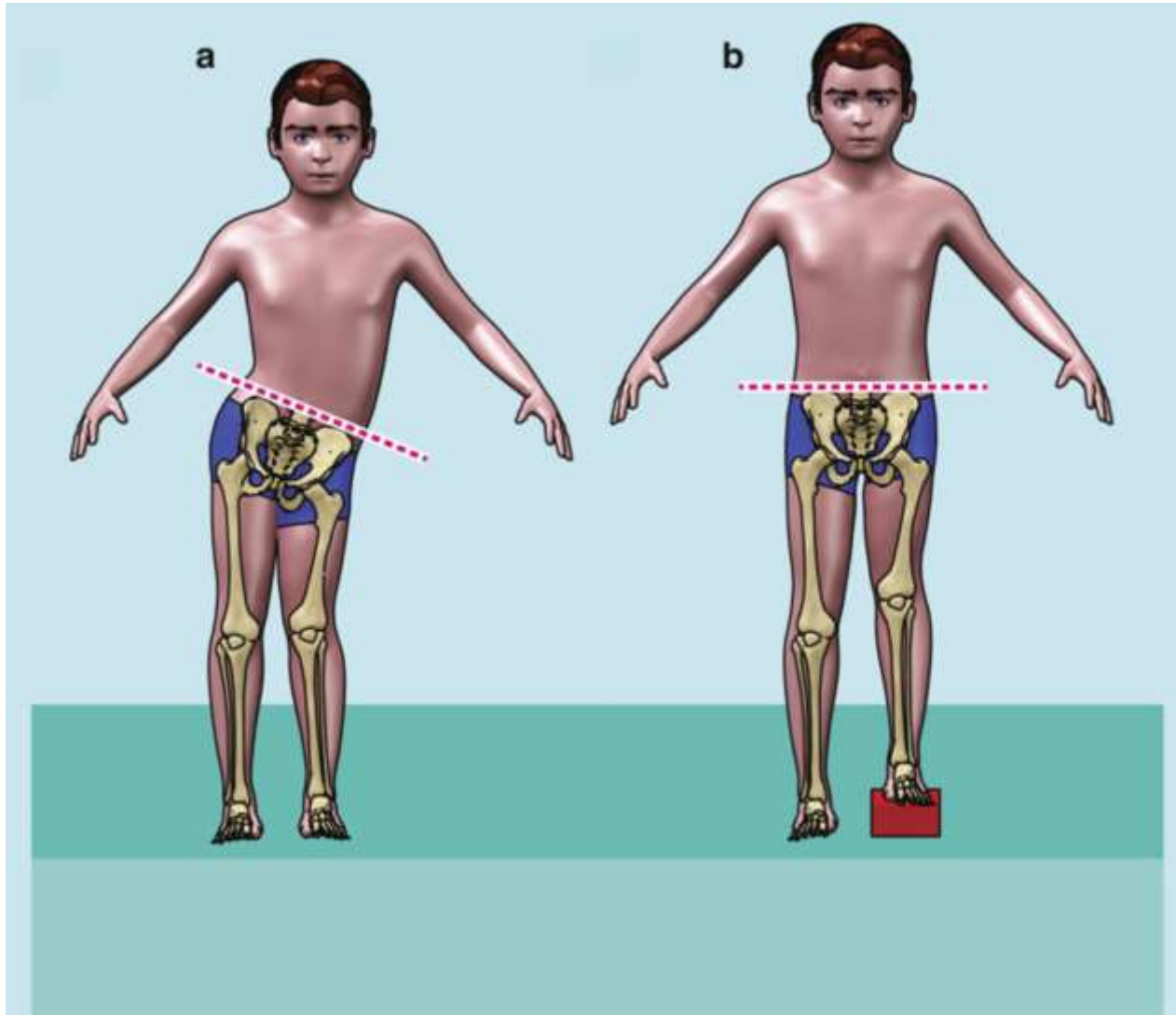
Radiological assessment of bony deformities, lateral view



Accurate assessment requires the joint of interest or joint of reference to be placed in a true AP and lateral position



Measurement of LLD with wooden blocks. (a) Without block, the pelvis is oblique. (b) With wooden block elevation equal to the LLD, the pelvis is level. This method takes into consideration the heel height, but cannot be used in the presence of knee or hip contractures



Rotational Alignment Of The Lower Limbs.

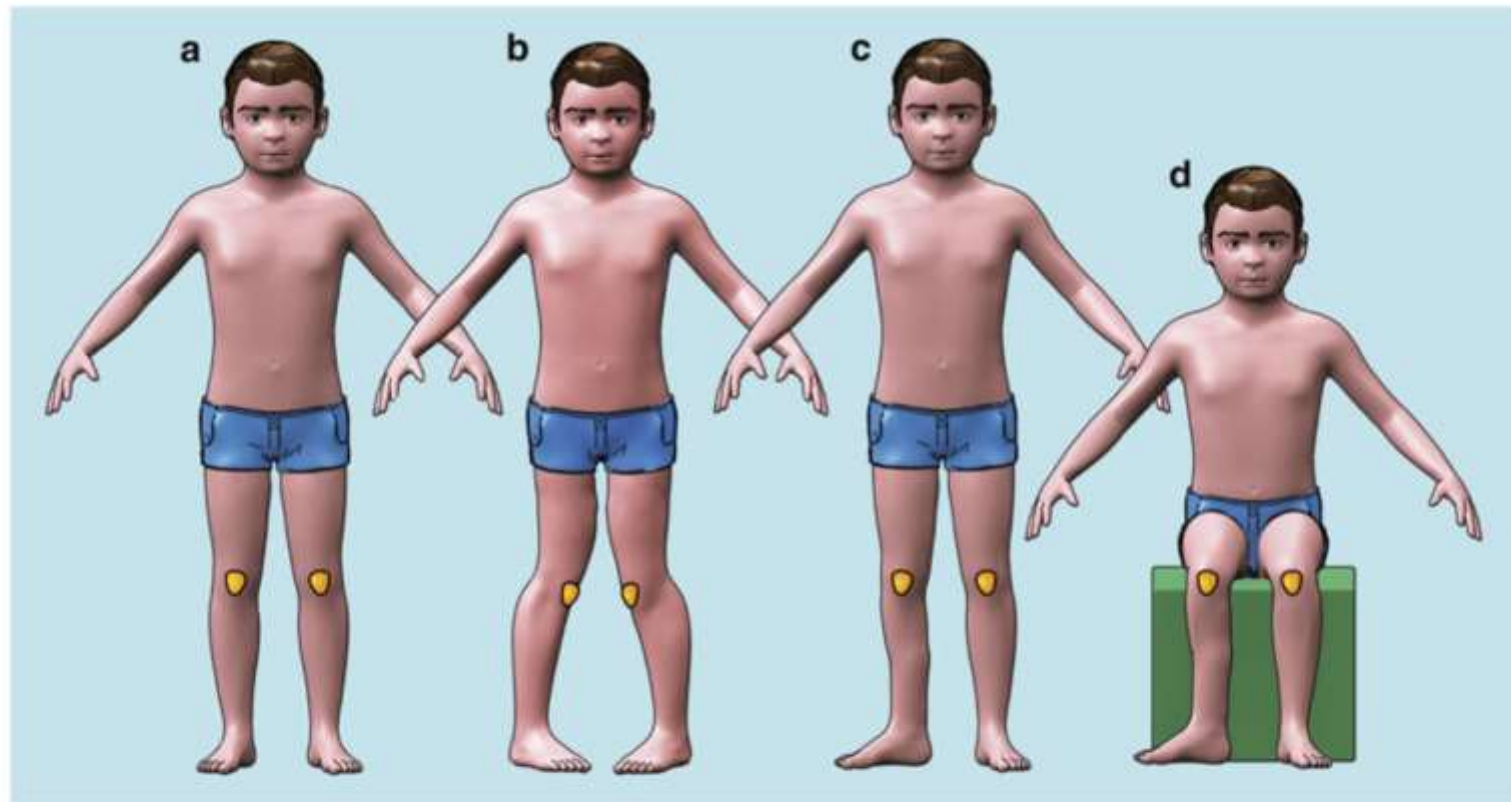


Fig. 2 (a–d) (a) Normal rotational alignment of the lower limbs. (b) Bilateral Internal rotation deformity of the lower limbs (in-toeing), partly due to exaggerated femoral anteversion, as the patella are

“kissing” each other. (c) Right-side external rotation deformity due to external tibial torsion (patella is pointing forwards). (d) Sitting position showing external rotation deformity of the right tibia

Rotational alignment in the prone position. (a) Hip external rotation. (b) Hip in neutral position. (c) Hip internal rotation

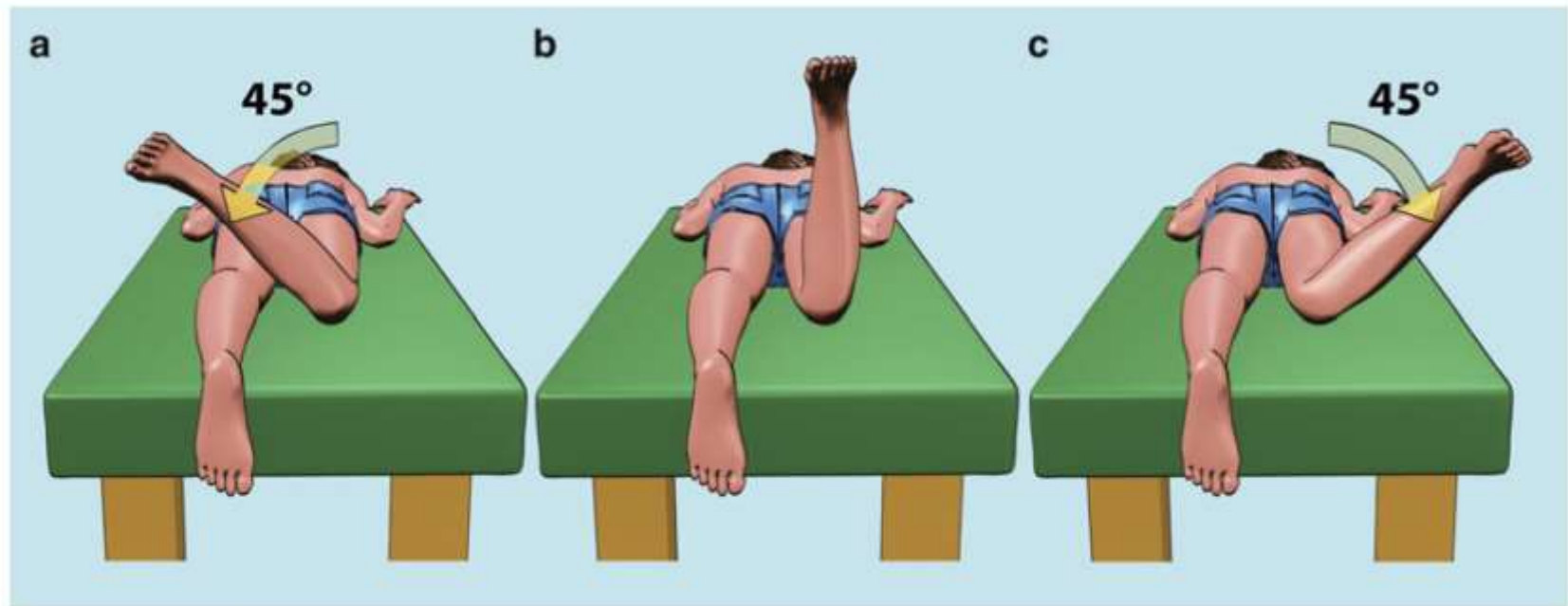
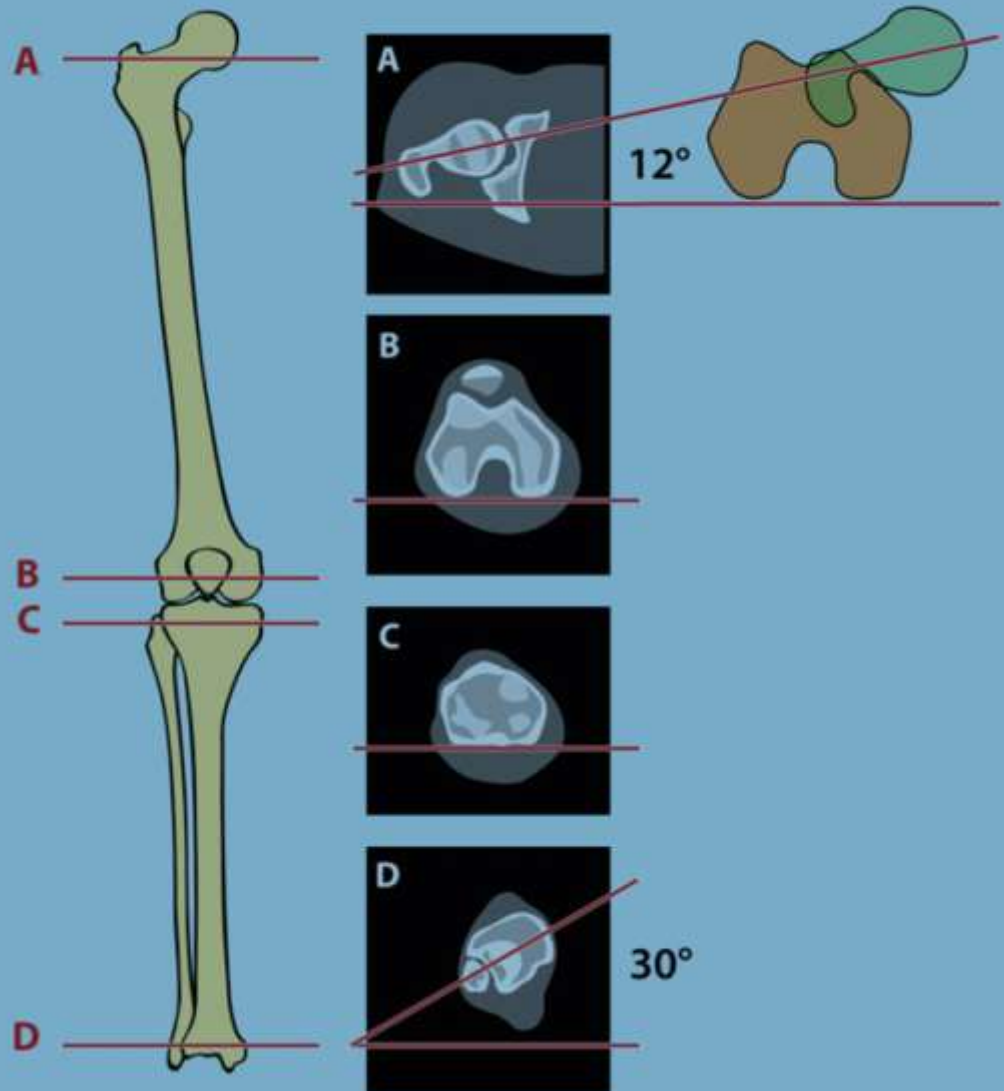


Fig. 3 Rotational alignment in the prone position. (a) Hip external rotation. (b) Hip in neutral position. (c) Hip internal rotation

Imaging CT Sections to Evaluate the Rotational Profile of the Lower Limb



CT SCAN MEASUREMENT OF ROTATIONAL PROFILE, USING TRANSVERSE CUTS THROUGH

- (a) Proximal femur (femoral anteversion) – normal 12
- (b) Distal femur (femoral condyle alignment)
- (c) Proximal tibia
- (d) Distal tibia

Ex: 4018.03099998758092
Se: 1 SCOUT
Im: 1
XY
DFOV 82.7cm

F197/Jun 21 200
196273
Oct 21 201
12:38:27 P
820 X 157

Mag = 1.0
FL
ROT

R
4
1
4

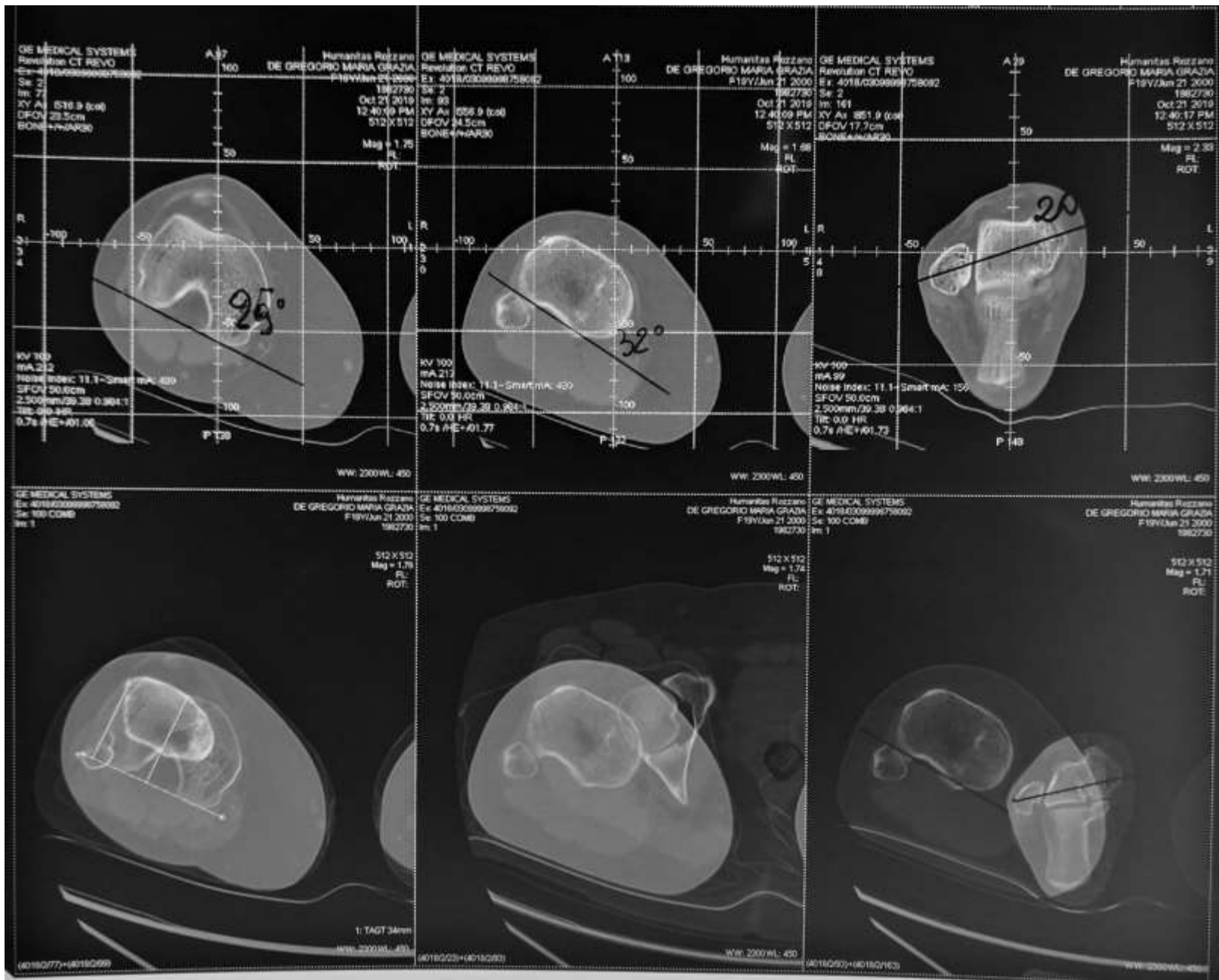
Az 0
KV 100
mA 30

SINISTRO

WW: 500WL

I 1000





GE MEDICAL SYSTEMS
Revolution CT REVO
Ex: 4018/G309999758092
Se: 2
In: 77
XY Ax: 516.9 (cm)
DFOV: 29.5cm
BONE+HARP30

A 17
100

Humanitas Rozzano
DE GREGORIO MARIA GRAZIA
F19Y/Jun 21 2000
1862730
Oct 21 2019
12:40:16 PM
XY Ax: 556.9 (cm)
DFOV: 34.5cm
BONE+HARP30
Mag = 1.75
FL
ROT

GE MEDICAL SYSTEMS
Revolution CT REVO
Ex: 4018/G309999758092
Se: 2
In: 99
XY Ax: 556.9 (cm)
DFOV: 34.5cm
BONE+HARP30

A 13
100

Humanitas Rozzano
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F19Y/Jun 21 2000
1862730
Oct 21 2019
12:40:09 PM
XY Ax: 551.9 (cm)
DFOV: 17.7cm
BONE+HARP30
Mag = 1.66
FL
ROT

GE MEDICAL SYSTEMS
Revolution CT REVO
Ex: 4018/G309999758092
Se: 2
In: 161
XY Ax: 551.9 (cm)
DFOV: 17.7cm
BONE+HARP30

A 29
50

Humanitas Rozzano
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F19Y/Jun 21 2000
1862730
Oct 21 2019
12:40:17 PM
512 X 512
Mag = 2.38
FL
ROT

kV: 100
mA: 212
Noise Index: 11.1 - Smart mA: 430
SFOV: 30.0cm
2.500mm/39.38 0.364:1
TR: 0.0 HR
0.7s A/E+01.00

P 128

WW: 2000WL: 450

kV: 100
mA: 212
Noise Index: 11.1 - Smart mA: 430
SFOV: 30.0cm
2.500mm/39.38 0.364:1
TR: 0.0 HR
0.7s A/E+01.77

P 132

WW: 2000WL: 450

kV: 100
mA: 99
Noise Index: 11.1 - Smart mA: 150
SFOV: 30.0cm
2.500mm/39.38 0.364:1
TR: 0.0 HR
0.7s A/E+01.73

P 148

WW: 2300WL: 450

GE MEDICAL SYSTEMS
Ex: 4018/G309999758092
Se: 100 COMB
In: 1

Humanitas Rozzano
DE GREGORIO MARIA GRAZIA
F19Y/Jun 21 2000
1862730
In: 1

512 X 512
Mag = 1.75
FL
ROT

GE MEDICAL SYSTEMS
Ex: 4018/G309999758092
Se: 100 COMB
In: 1

Humanitas Rozzano
DE GREGORIO MARIA GRAZIA
F19Y/Jun 21 2000
1862730
In: 1

512 X 512
Mag = 1.74
FL
ROT

GE MEDICAL SYSTEMS
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Se: 100 COMB
In: 1

Humanitas Rozzano
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1862730
In: 1

512 X 512
Mag = 1.71
FL
ROT

1: TAGT 34mm

WW: 2300WL: 450

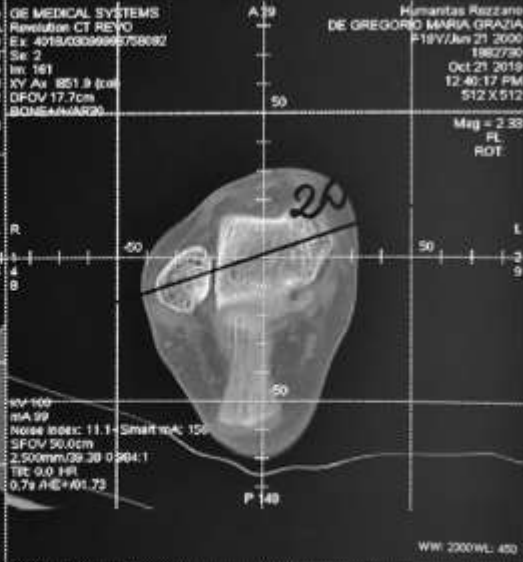
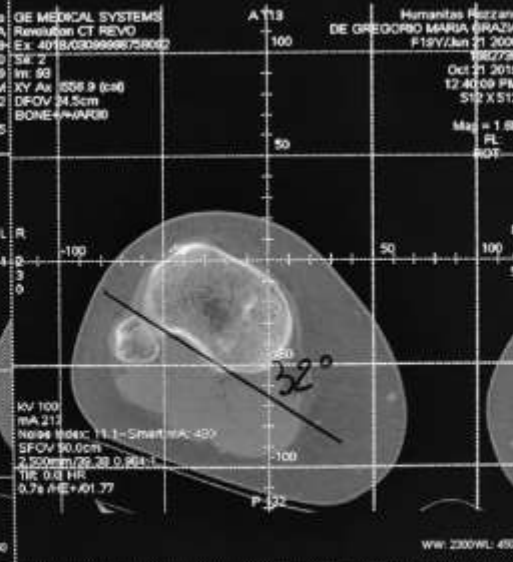
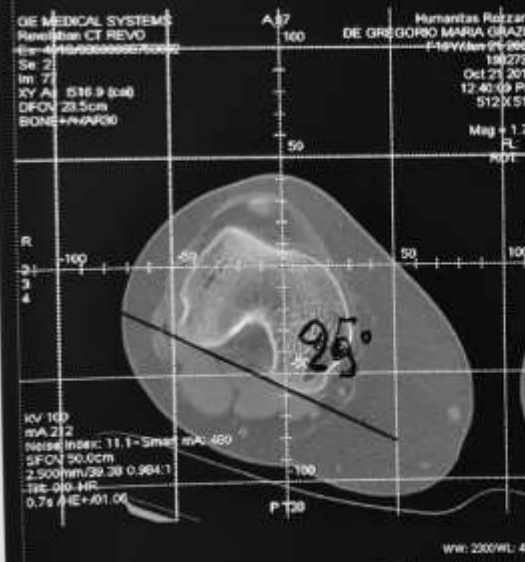
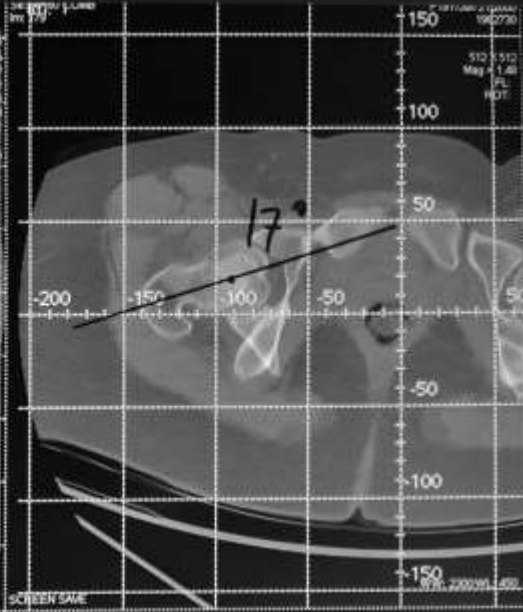
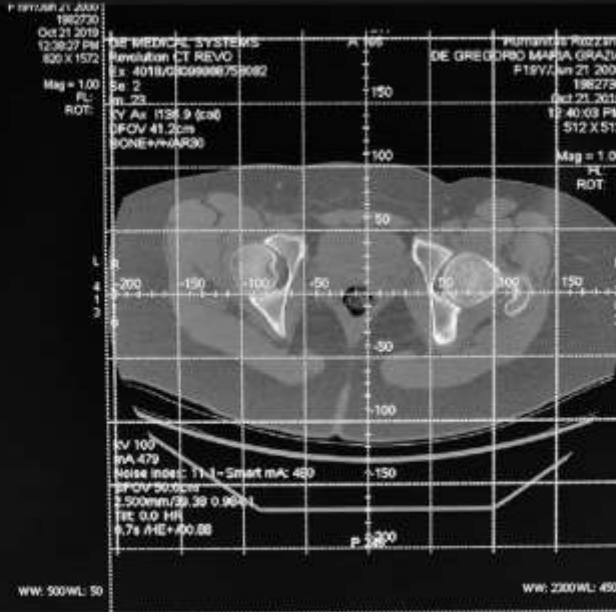
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(4018/023)+(4018/283)

WW: 2000WL: 450

(4018/093)+(4018/163)

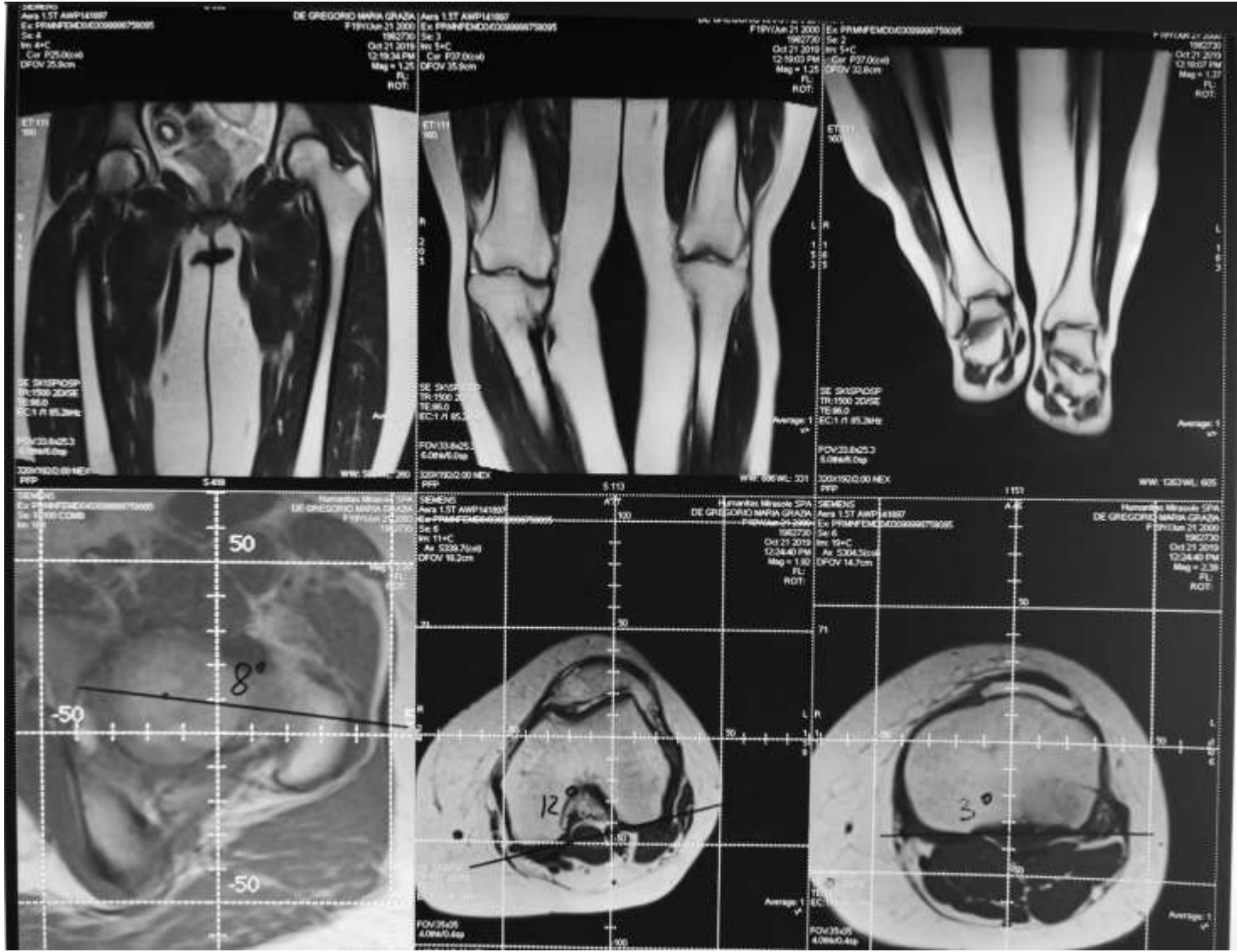
WW: 2300WL: 450



GE MEDICAL SYSTEMS
Revolution CT REVO
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Se: 100 COMB
Im: 1

Humantas Rezzano
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F 19V/Jan 21 2000
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Humantas Rezzano
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F 19V/Jan 21 2000
Se: 100 COMB
Im: 1



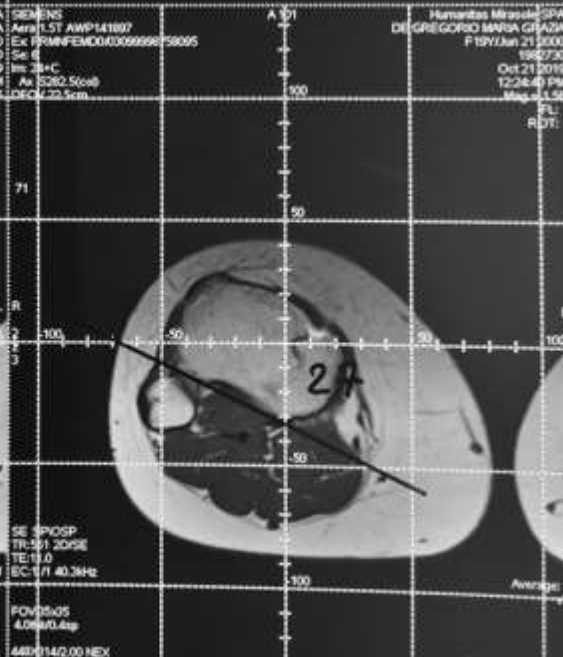
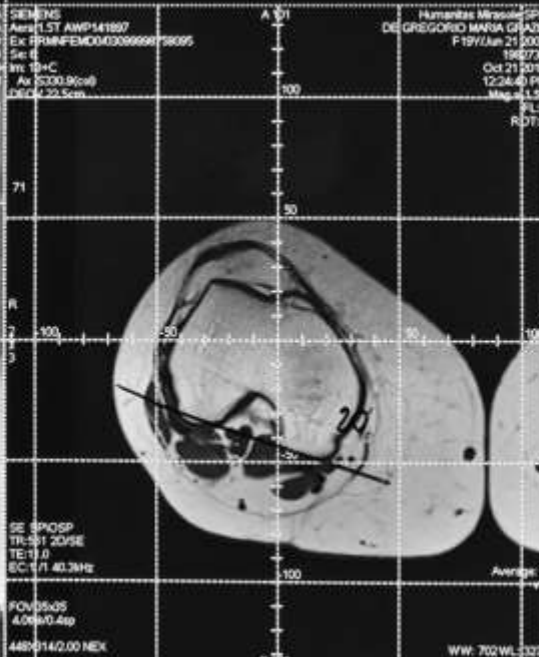
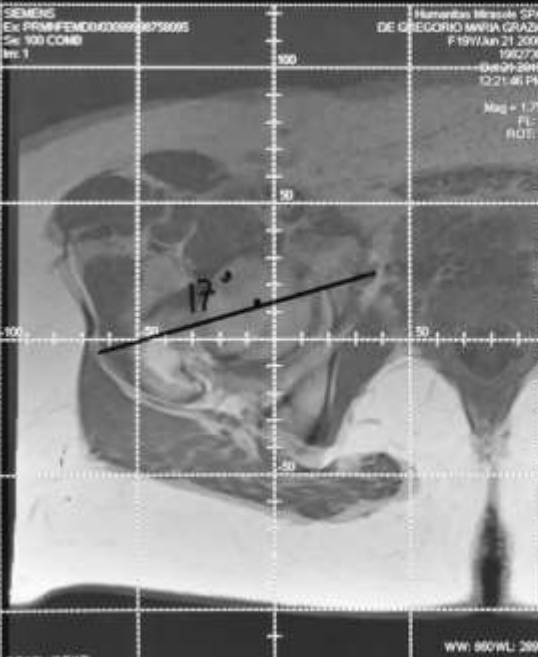
Ex: PRMFEM0000999758095
Se: 4
Int: 4HC
Ac: Cor P37.0(cw)
DFOV: 35.8cm

F 19/Jan 21 2000
Se: 3
Int: 5+C
Ac: Cor P37.0(cw)
Mag: 1.25
DFOV: 35.8cm
FL:
ROT:

F 19/Jan 21 2000
Se: 2
Int: 5+C
Ac: Cor P37.0(cw)
Mag: 1.25
DFOV: 32.8cm
FL:
ROT:

F 19/Jan 21 2000
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Int: 5+C
Ac: Cor P37.0(cw)
Mag: 1.37
DFOV: 35.8cm
FL:
ROT:

DESTRO

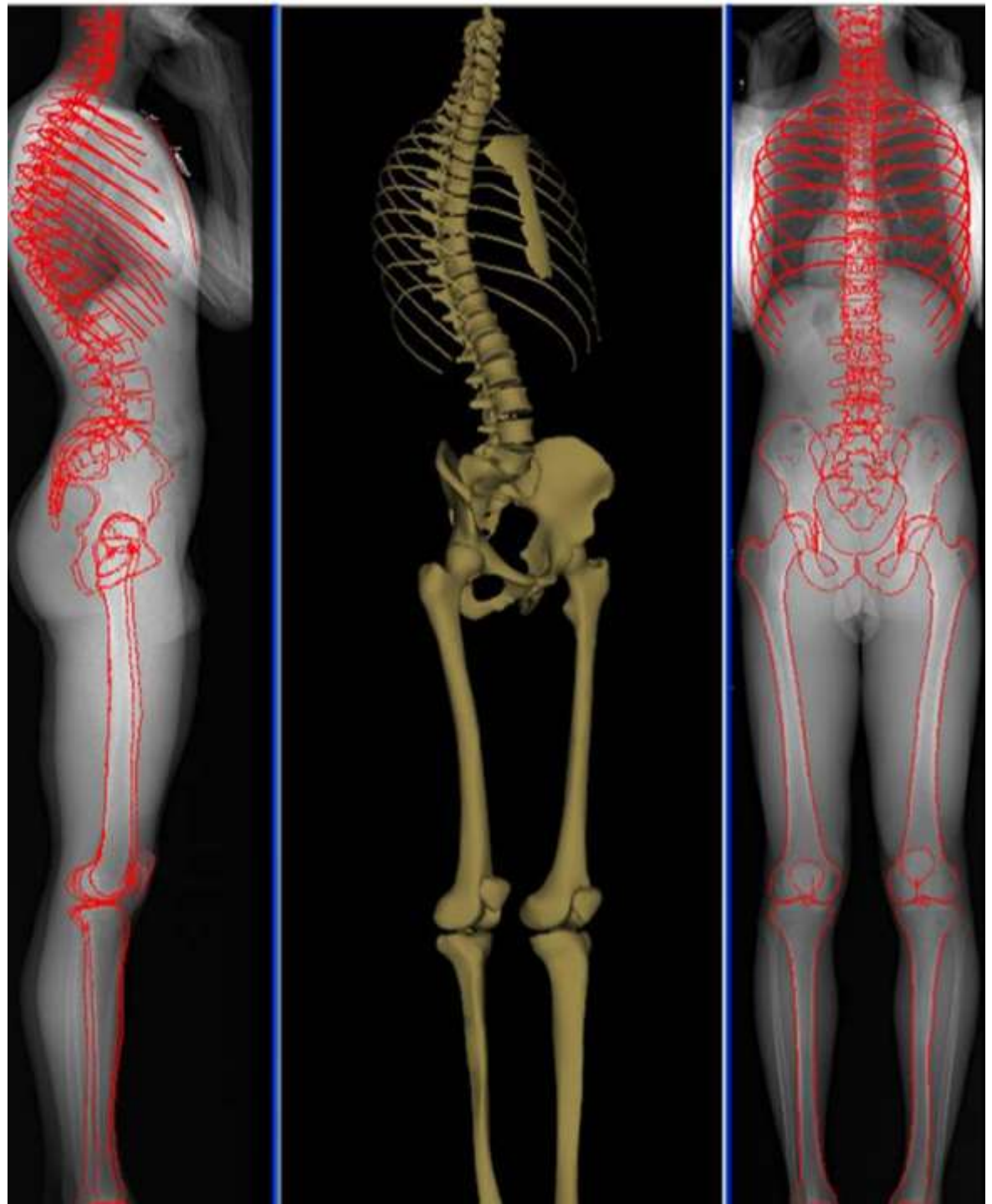


The **EOS system** provides low dose, full body, stereo-radiographic images of your patient in a functional position

Produces two simultaneous frontal and lateral, low dose images of the whole body or an anatomical segment



Two simultaneous
frontal and lateral view
and 3D reconstruction



13 y.o. female,
Hypophosphatemic
rickets

resistance to
treatment with
ultraviolet radiation
or vitamin D
ingestion. The term
rickets evolved from
the old English word
wrick, which means
"to twist."







Complex deformity

right femur:

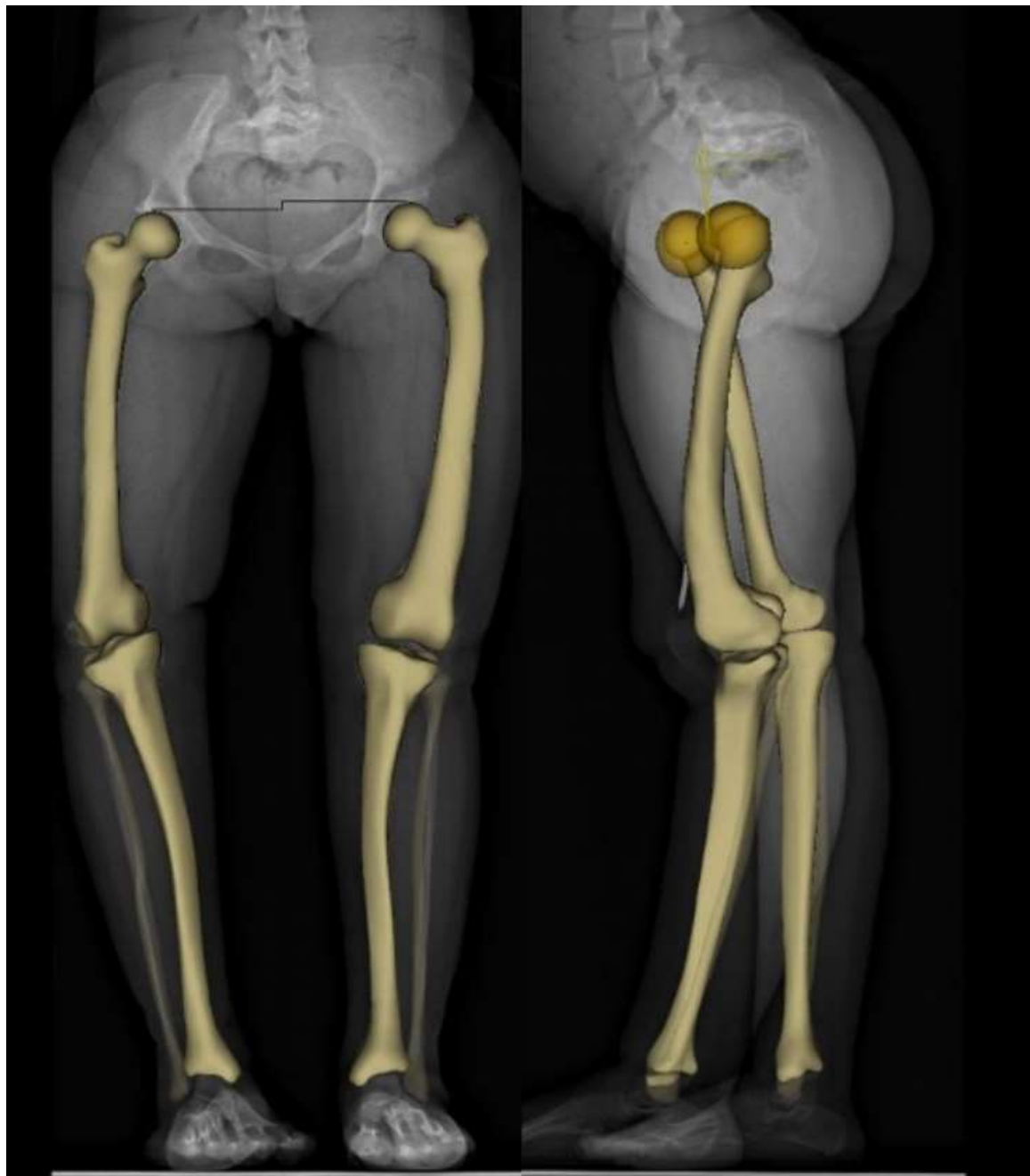
- distal varus
- procurvatum

right tibia:

- proximal valgus
- recurvatum
- internal rotation



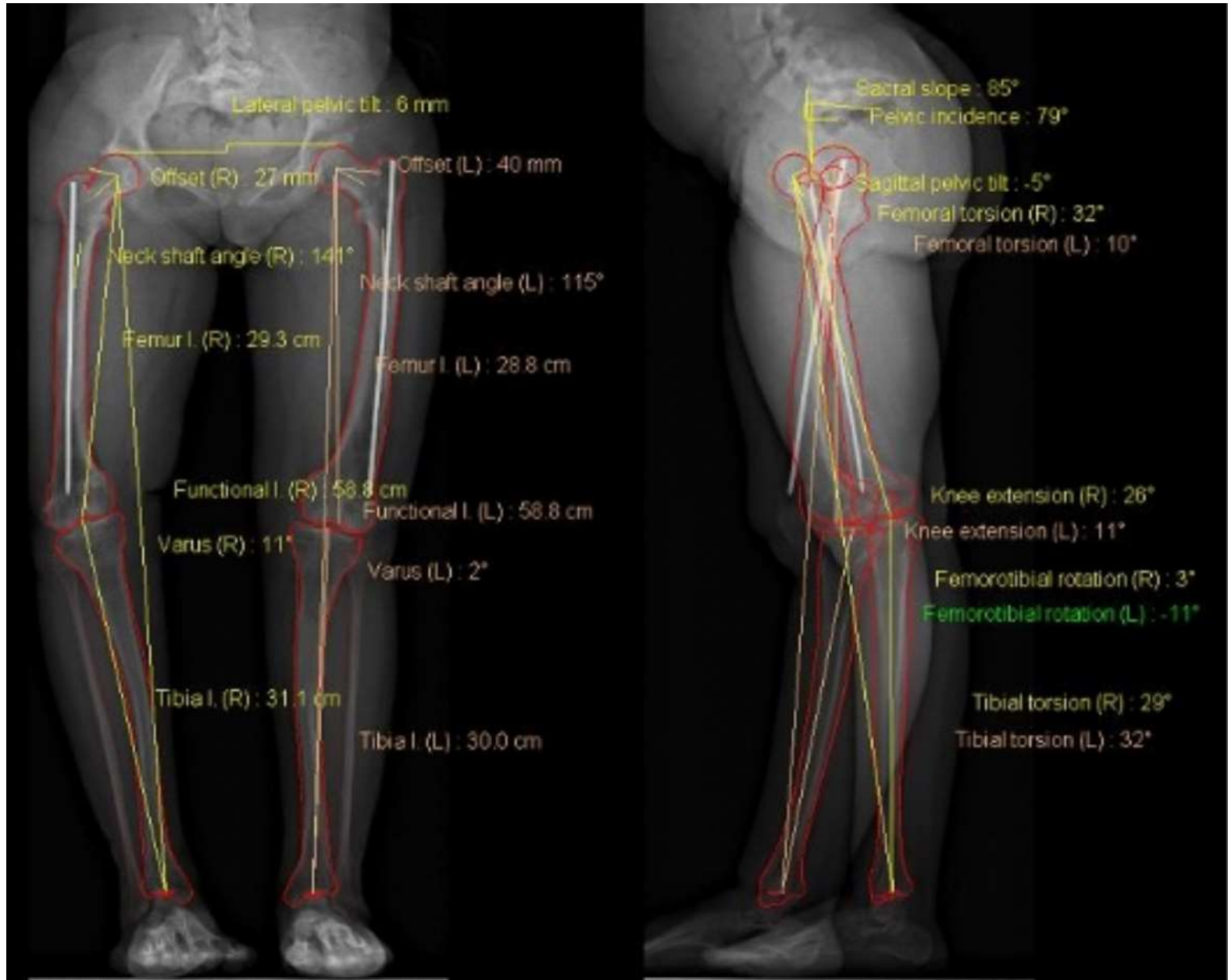
3D imaging of the complex deformity



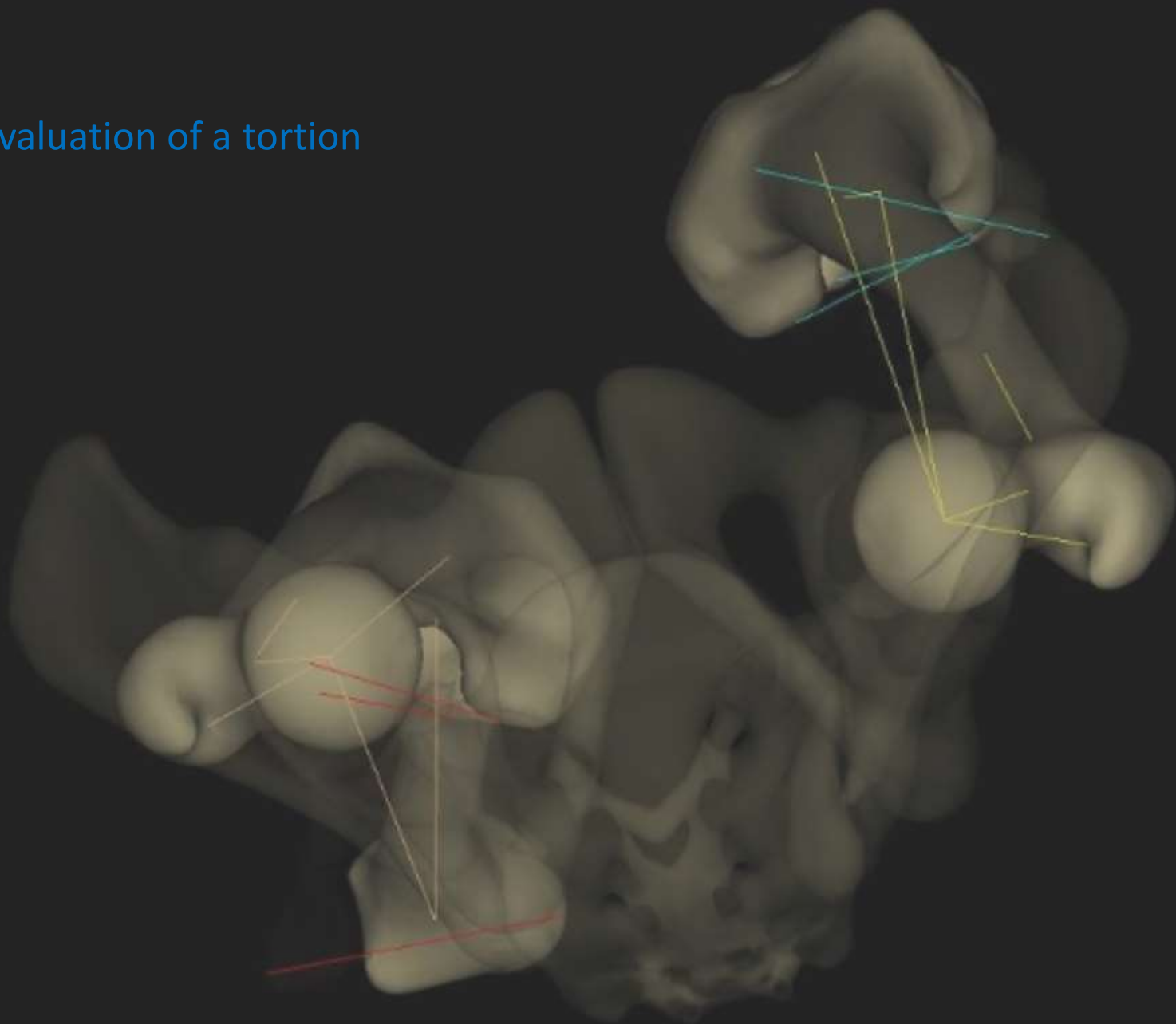
Reconstruction of the axis



EOS soft wear measurement



Evaluation of a torsion



Knee parameters

Lengths (3)	Right	Left	
Femur length	29.3 cm	28.8 cm	
Tibia length	31.1 cm	30.0 cm	
Functional length	58.8 cm	58.8 cm	
Anatomical length	60.3 cm	58.8 cm	

Femur (3)	Right	Left	
Femoral head diameter	34 mm	36 mm	
Femoral offset	27 mm	40 mm	
Neck length	42 mm	45 mm	
Neck shaft angle	141°	115°	

Knee (4)	Right	Left	
Valgus/Varus	Varus 11°	Varus 2°	
Knee flexion/Knee extension	Extens. 26°	Extens. 11°	
Femoral mechanical angle	71°	74°	
Tibial mechanical angle	108°	103°	
HKS	11°	14°	

Knee (4)	Right	Left	
Valgus/Varus	Varus 11°	Varus 2°	
Knee flexion/Knee extension	Extens. 26°	Extens. 11°	
Femoral mechanical angle	71°	74°	
Tibial mechanical angle	108°	103°	
HKS	11°	14°	

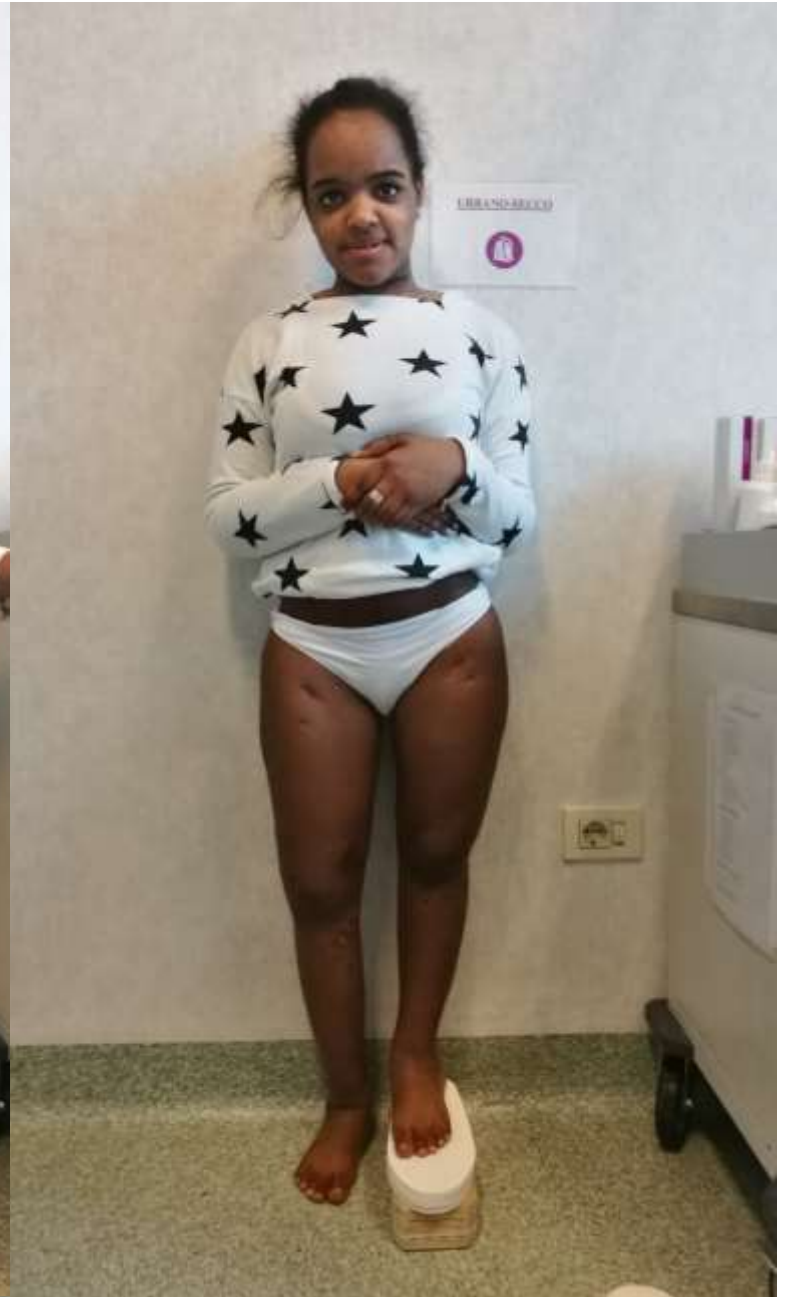
Torsions	Right	Left	
Femoral torsion	32°	10°	
Tibial torsion	29°	32°	
Femorotibial rotation	3°	-11°	

(3) Parameters calculated in 3D.

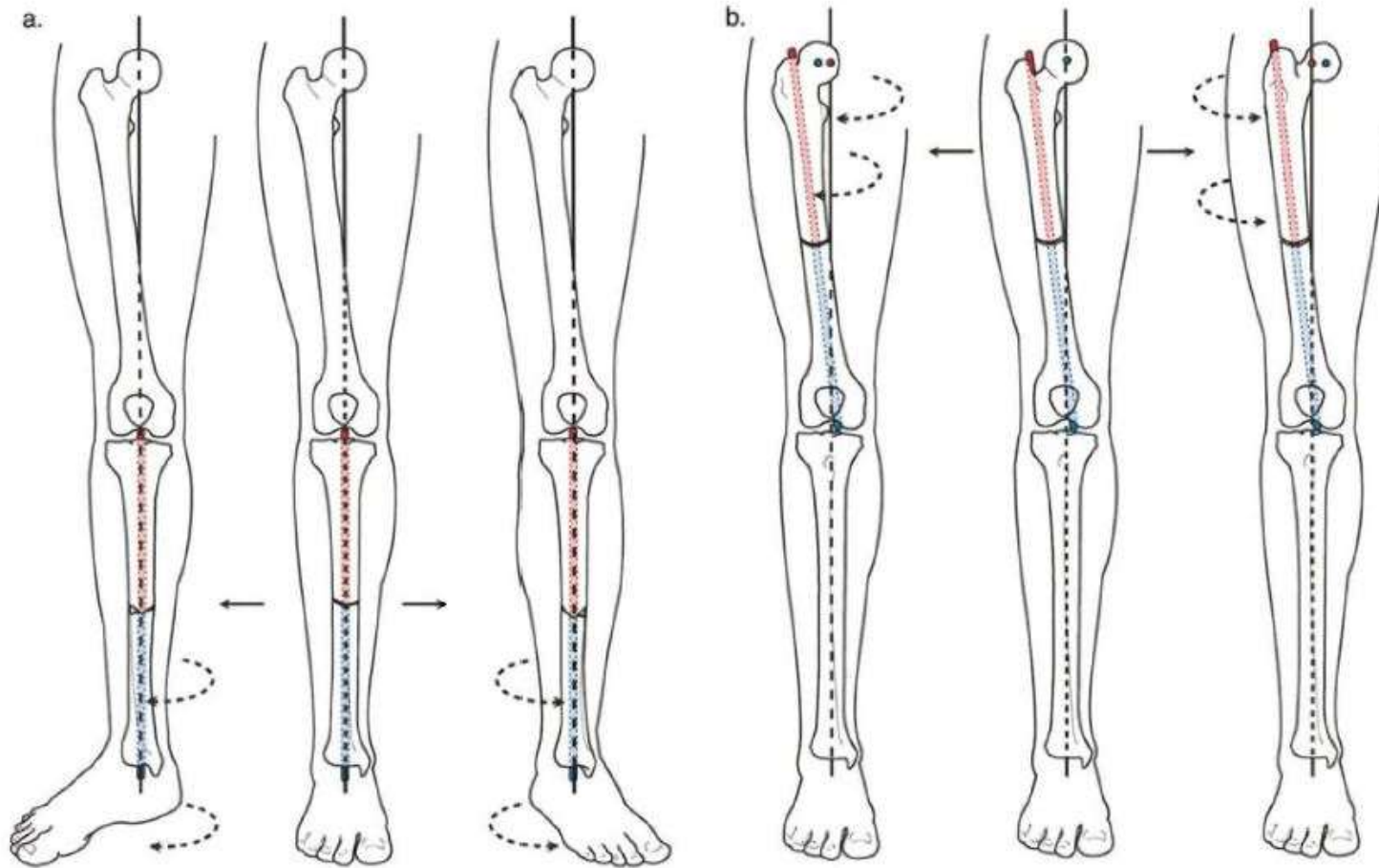
(4) Parameters calculated relative to posterior bi-condylar plane.

Last page of report

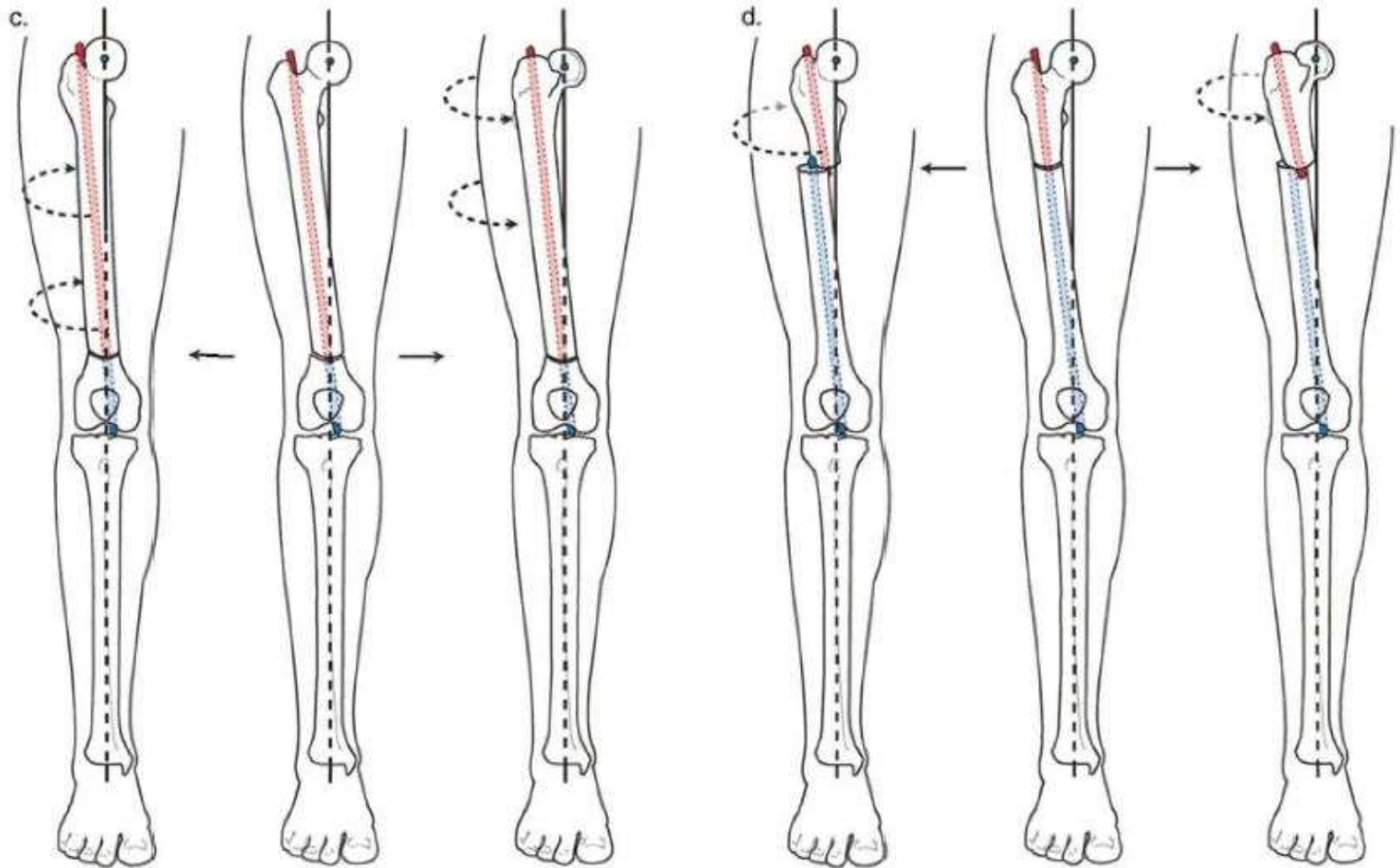
After correction of right femur and tibia



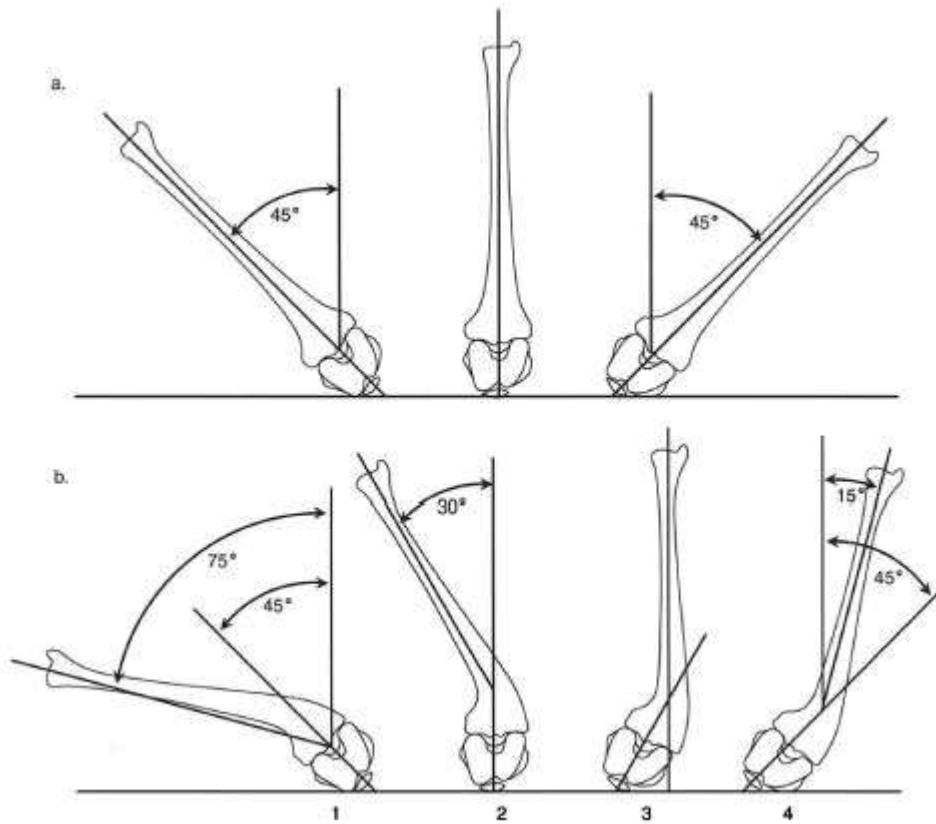
Analisi delle deformità su un piano rotazionale



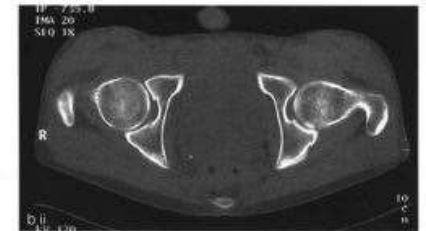
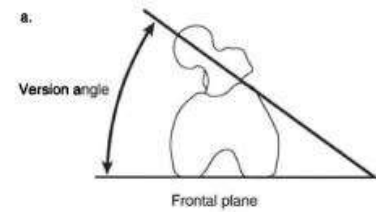
Analisi delle deformità su un piano rotazionale



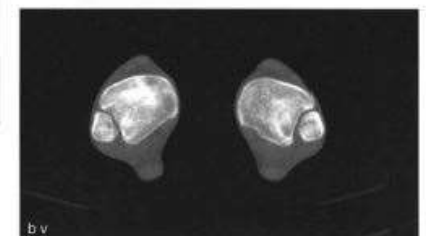
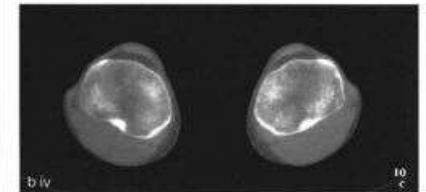
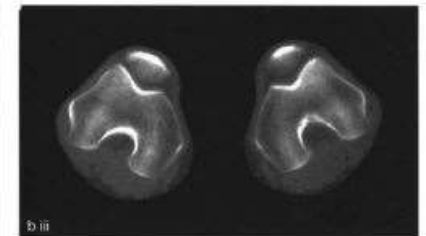
Analisi delle deformita' su un piano rotazionale

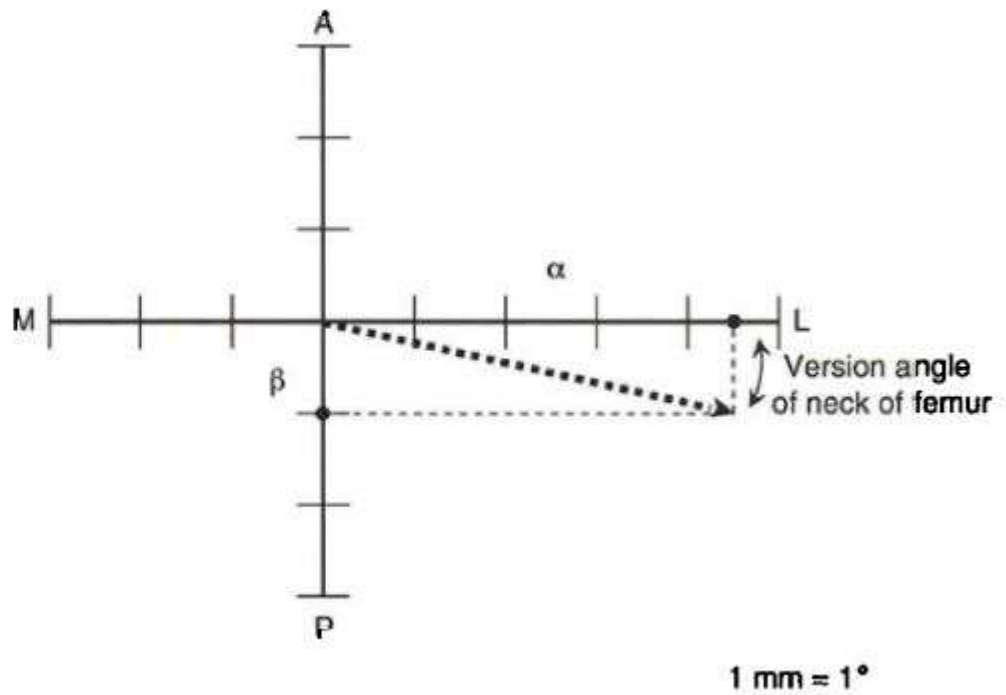
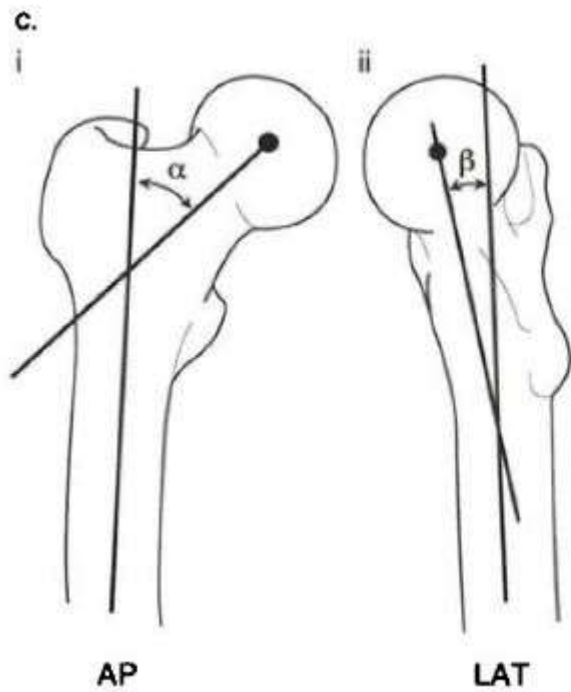


Analisi delle deformita'su un piano rotazionale

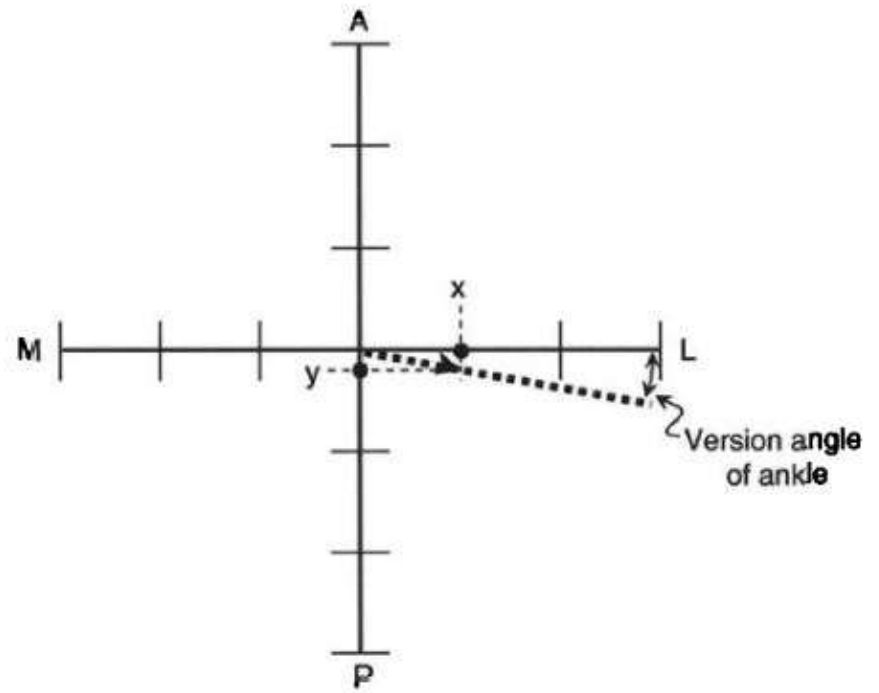
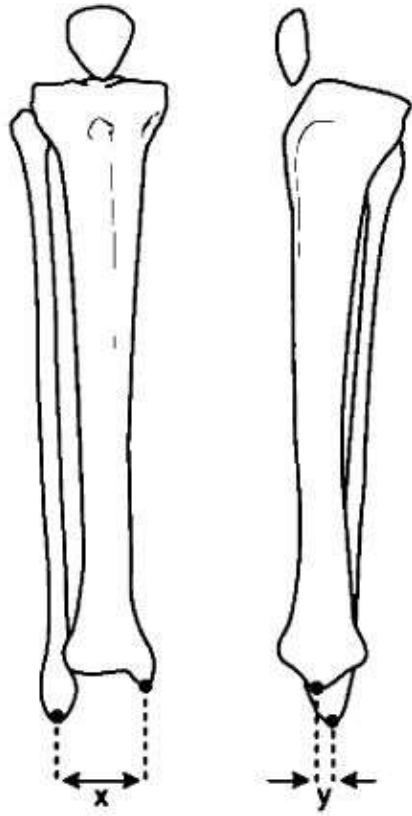


- Anteversione femorale 24,1 (+-17.4°)
- Extratorzione tibiale 34.85 (+- 15.85°)



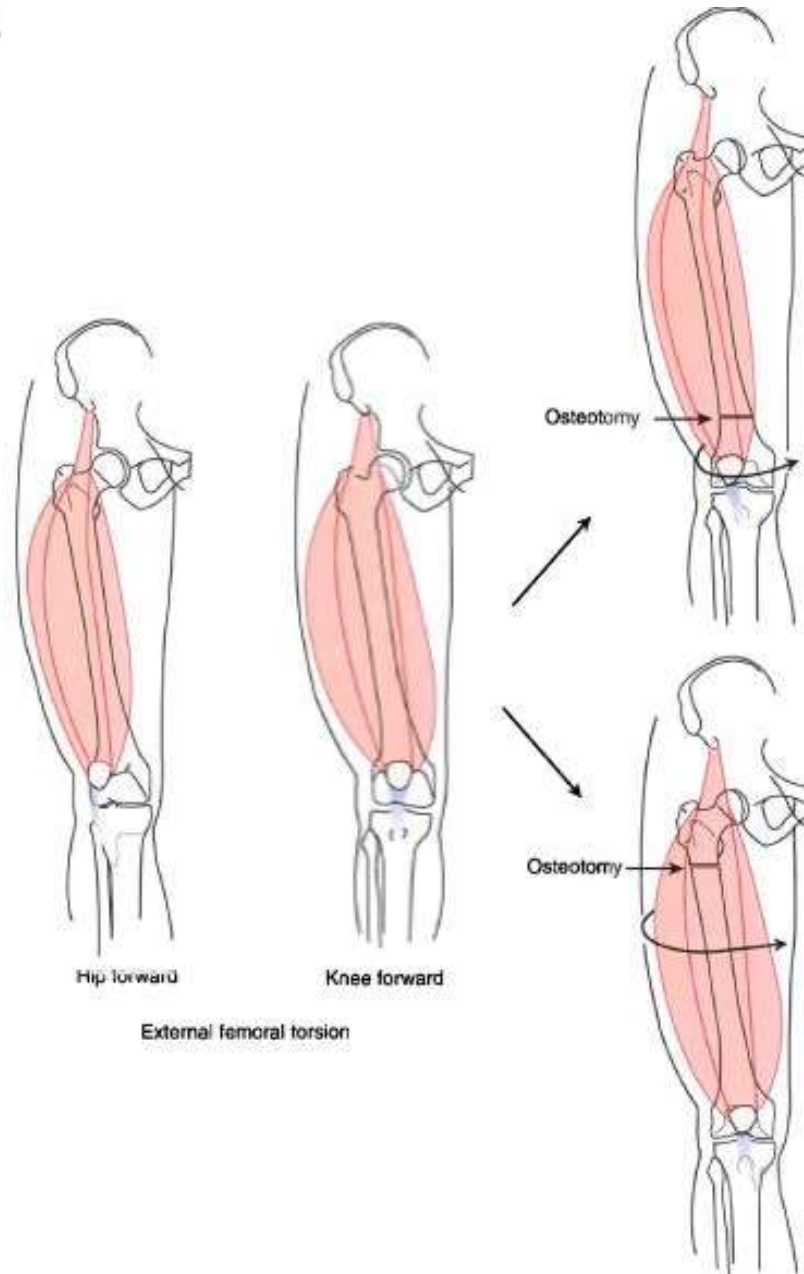


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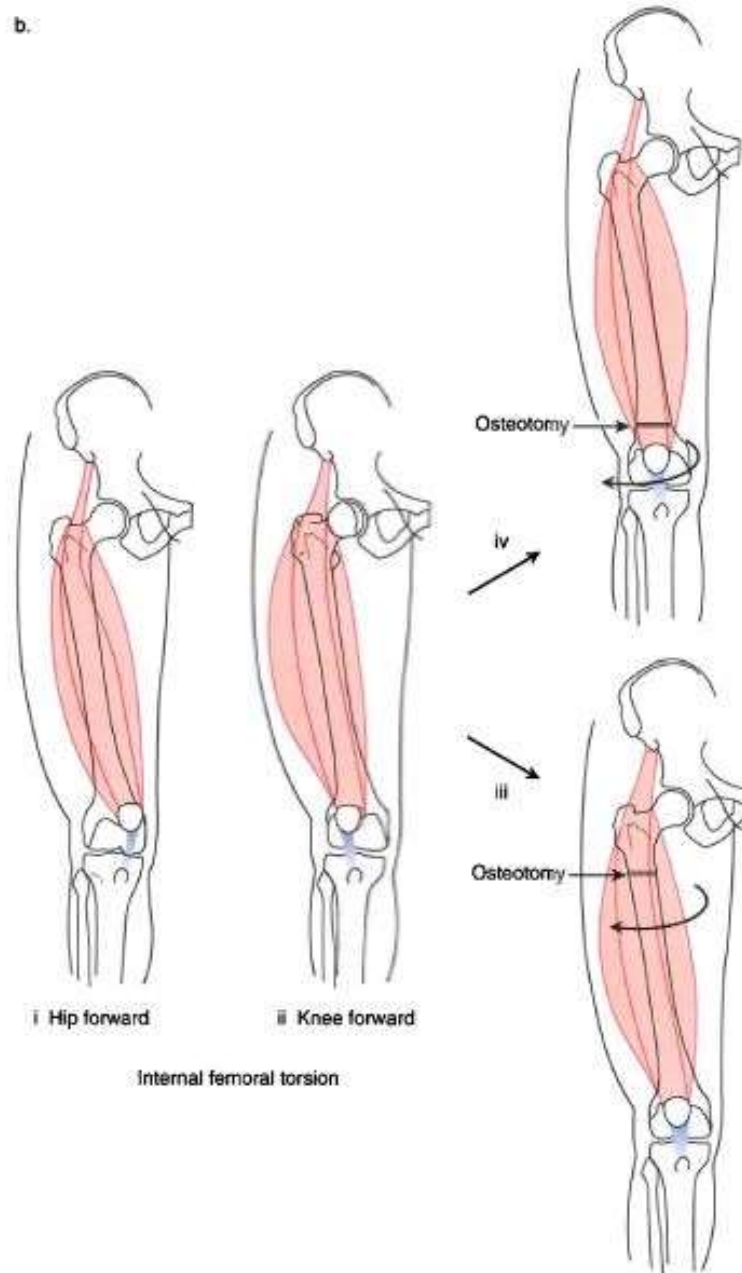


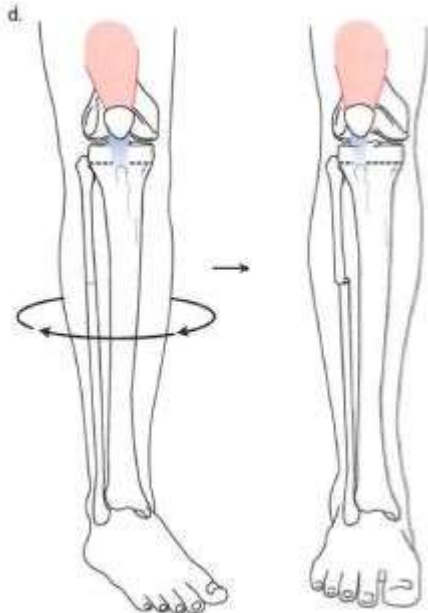
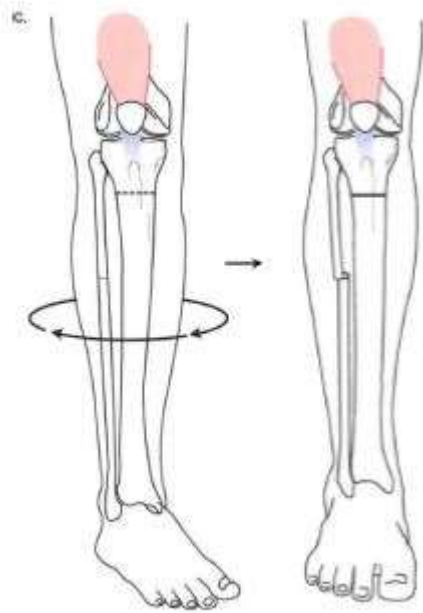
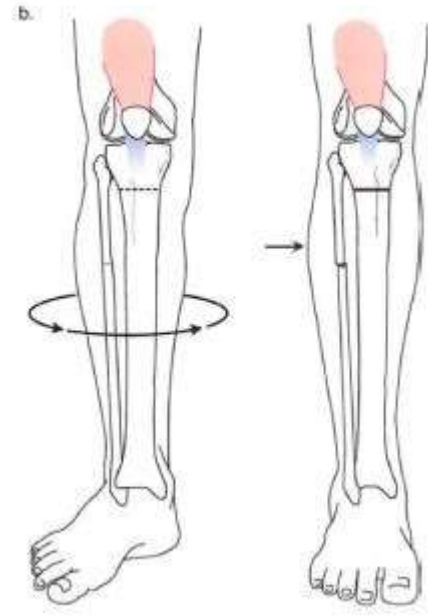
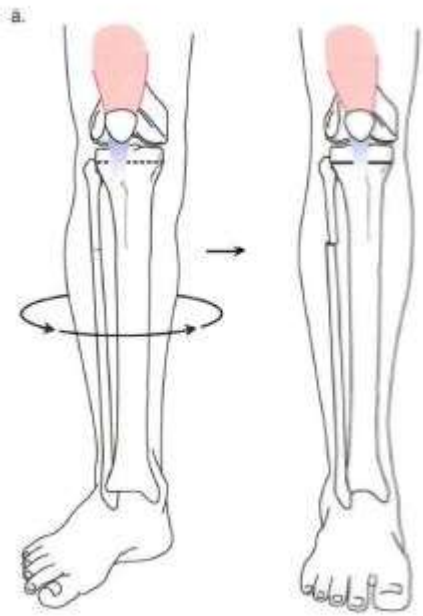
Analisi delle deformità su un piano rotazionale (estratorsione)

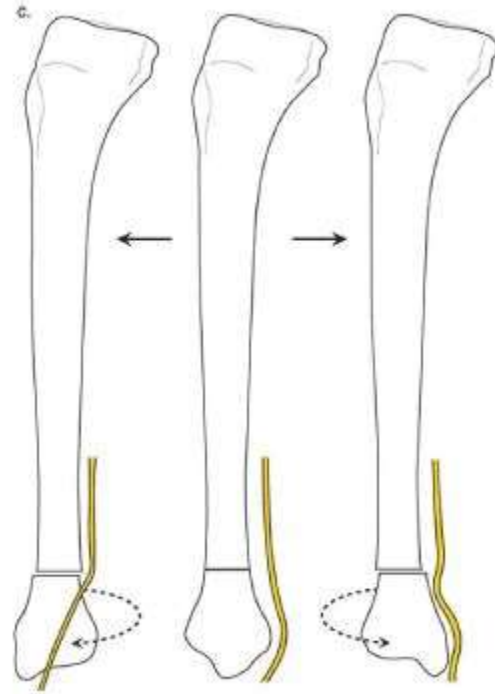
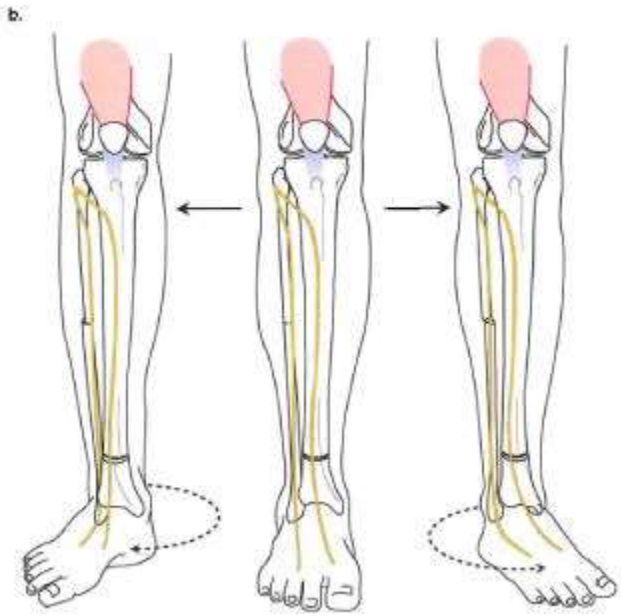
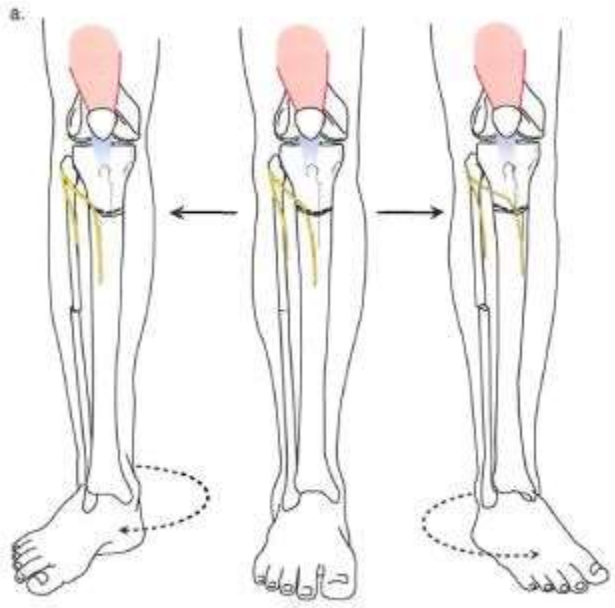
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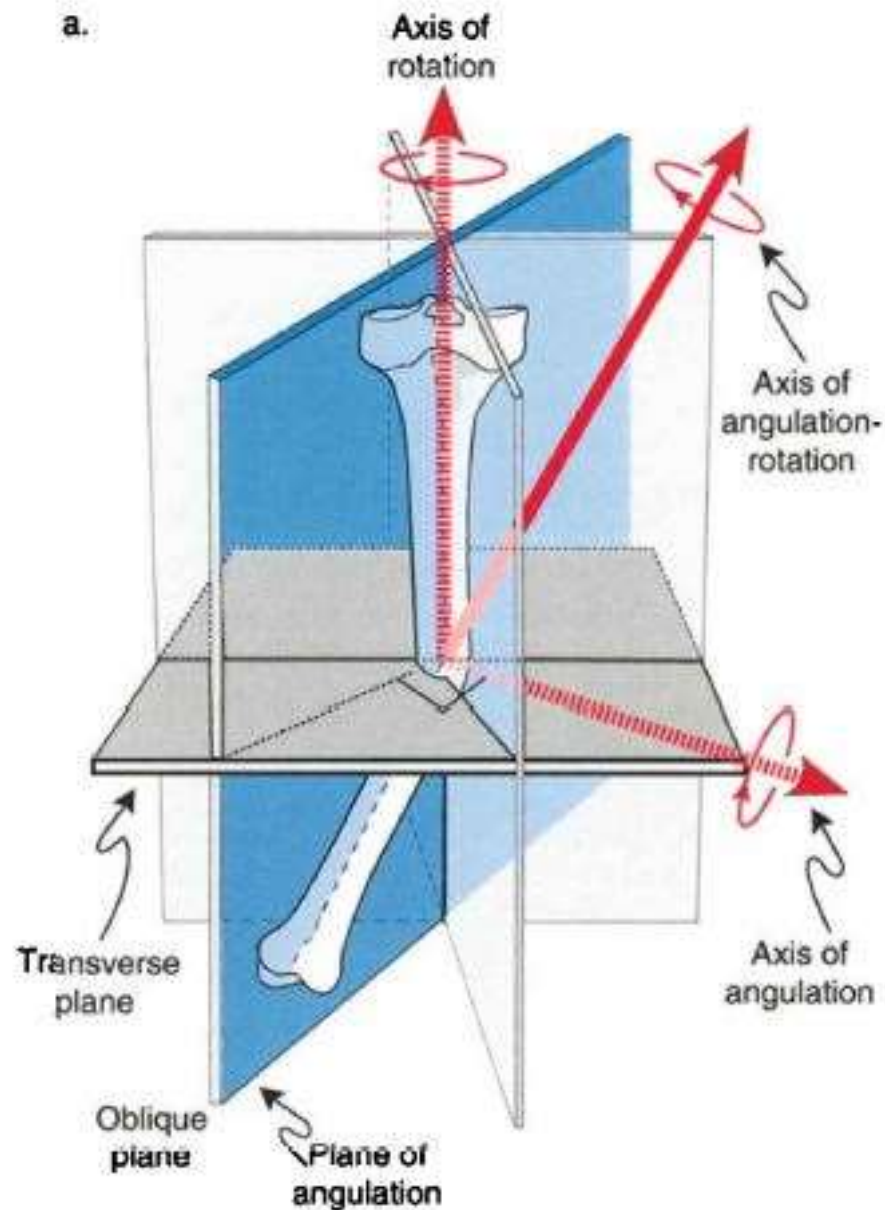


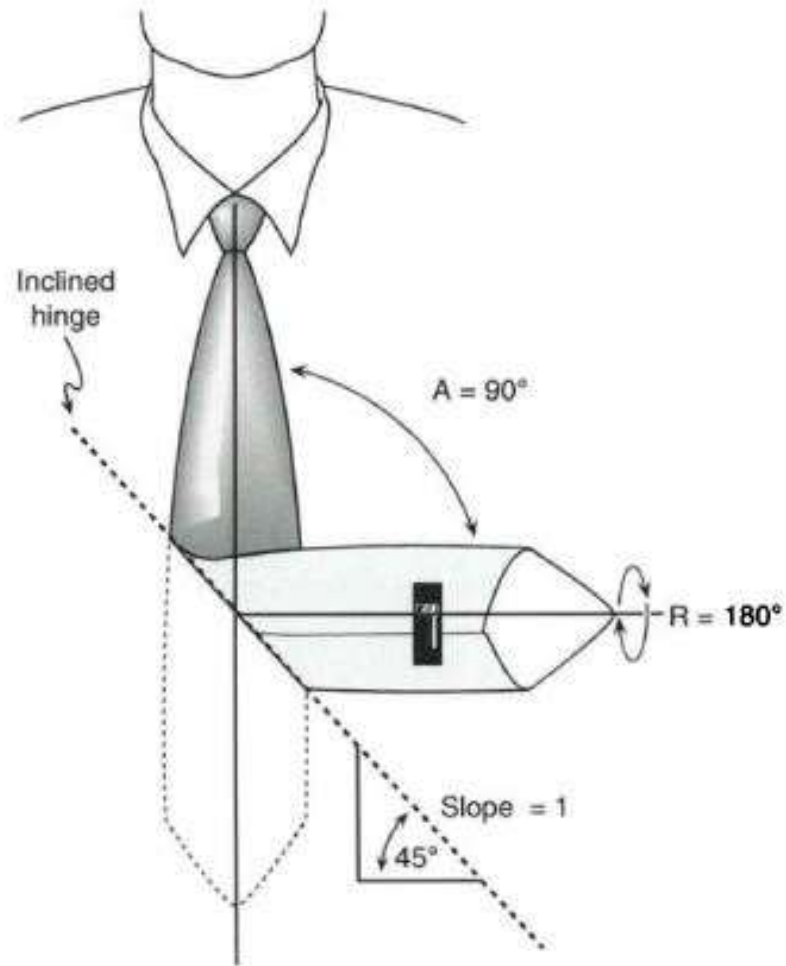
Analisi delle deformita'su un piano rotazionale (intratorsione)

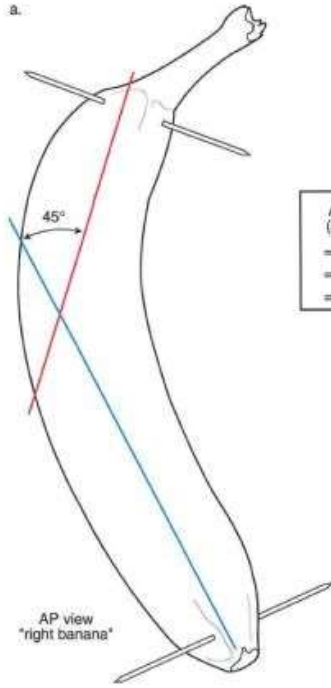






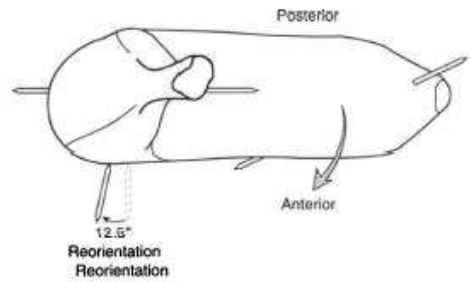
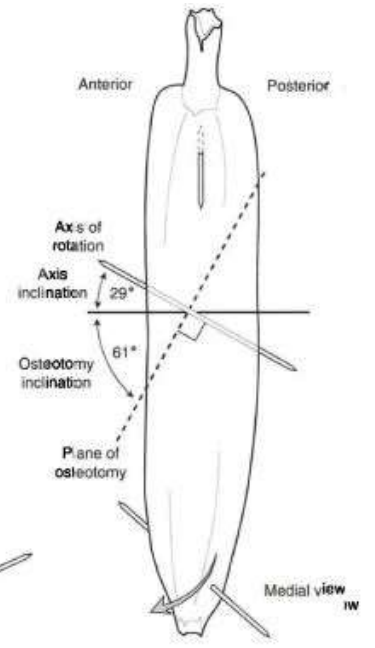
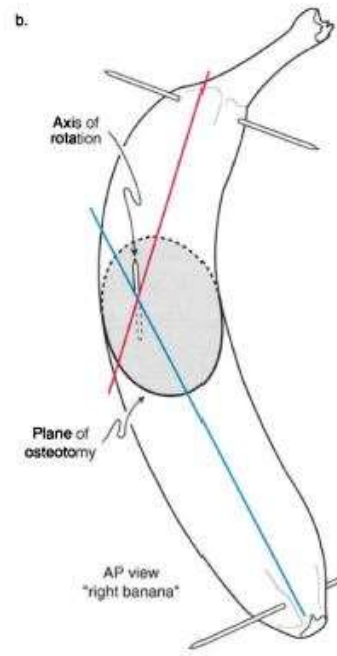
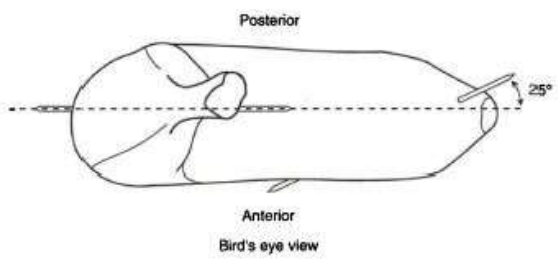
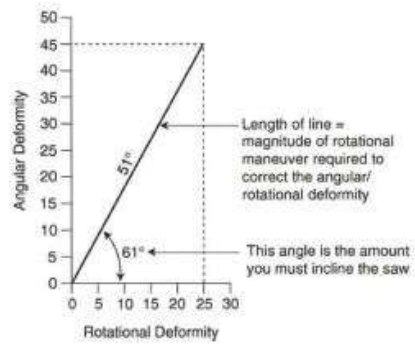




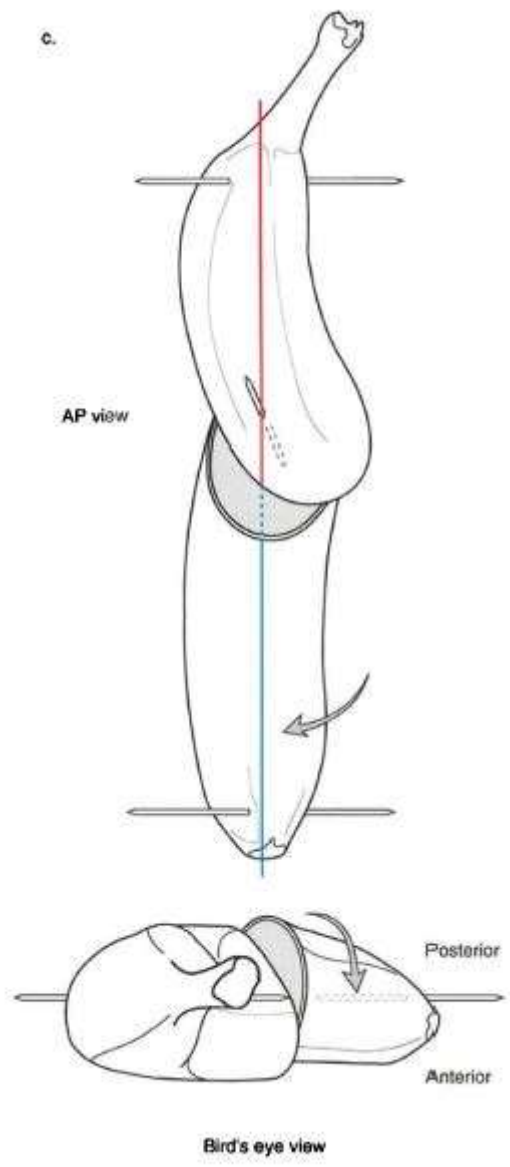


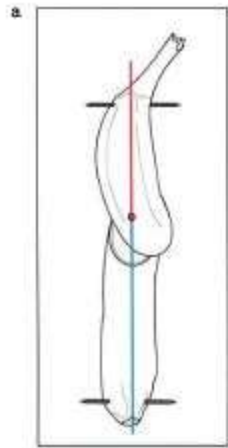
A = 45° (varus)
R = 25° (internal rotation)

<p>Axis inclination (approximation)</p> <p>= $\arctan R/A$</p> <p>= $\arctan 25^\circ/45^\circ$</p> <p>= 29°</p>	<p>Axis inclination (alternate approximation)</p> <p>Axis = $(R/A)50$</p> <p>= 28°</p>	<p>Osteotomy inclination (approximation)</p> <p>= $\arctan A/R$</p> <p>= $\arctan 45^\circ/25^\circ$</p> <p>= 61°</p>
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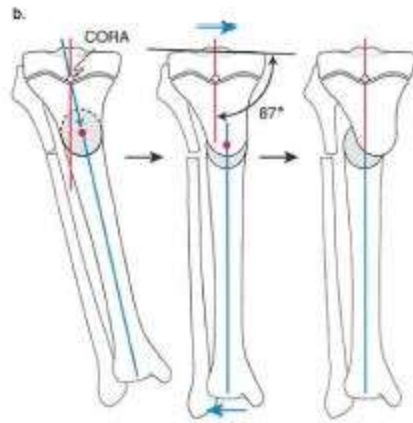
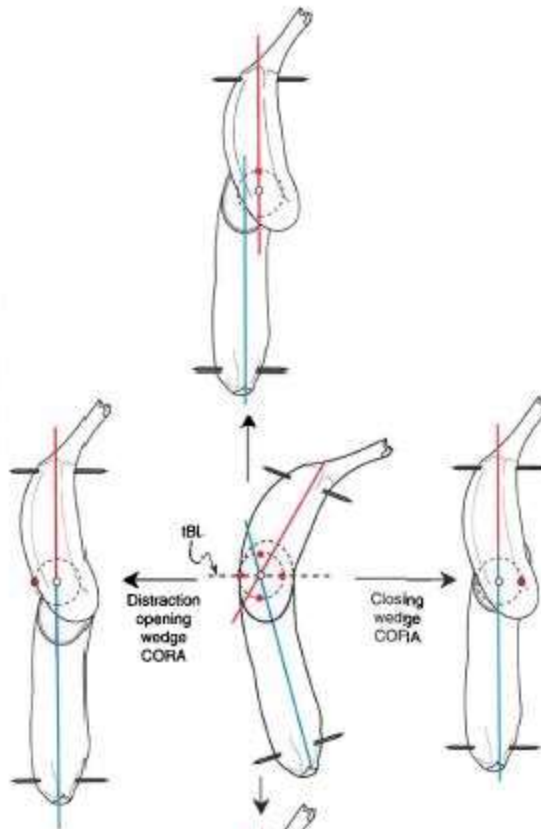


c.





Rotation around CORA
No translational deformity



12 Y.O. GIRL WITH EXTERNAL TORSION OF BOTH LEGS.





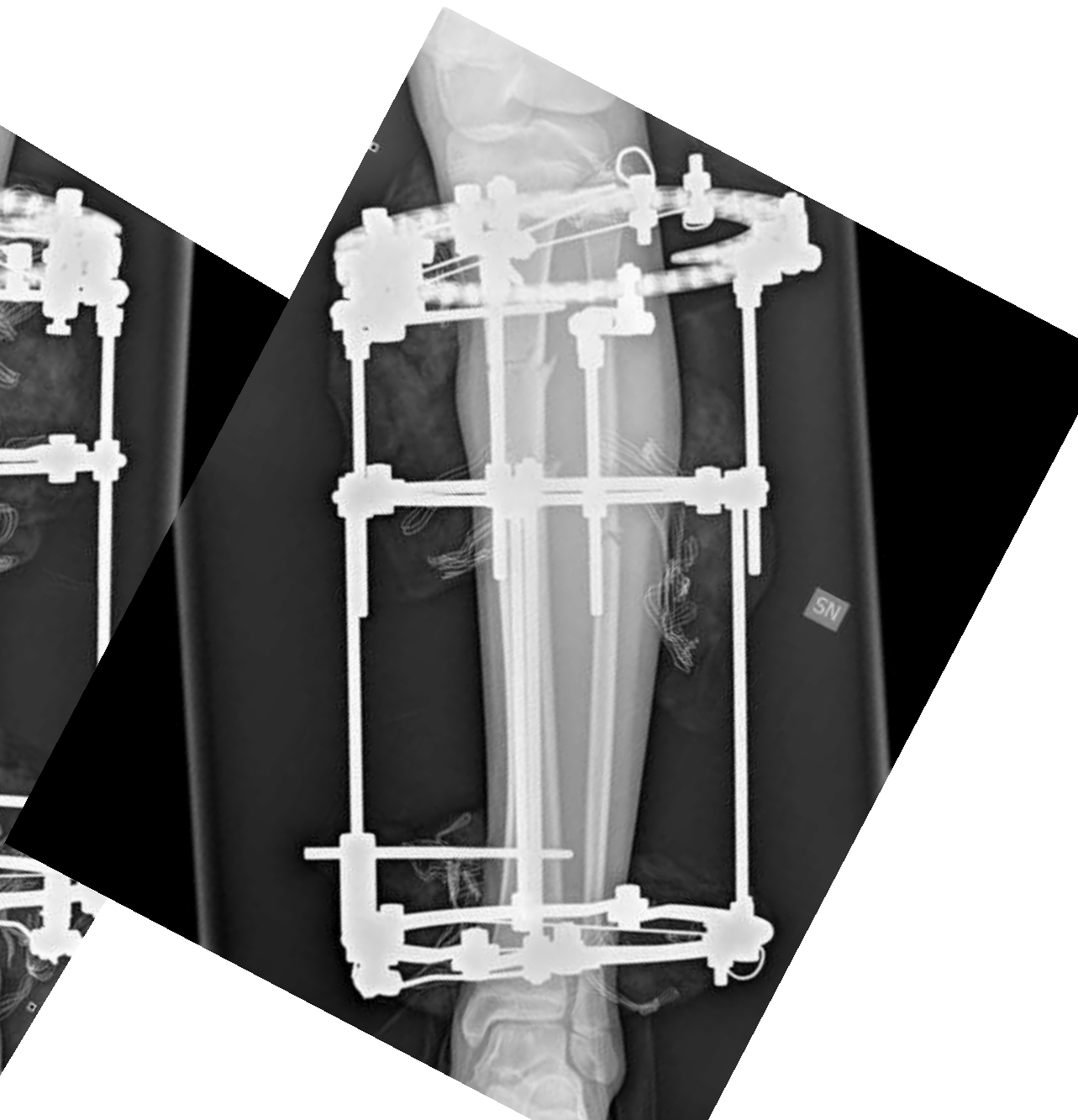
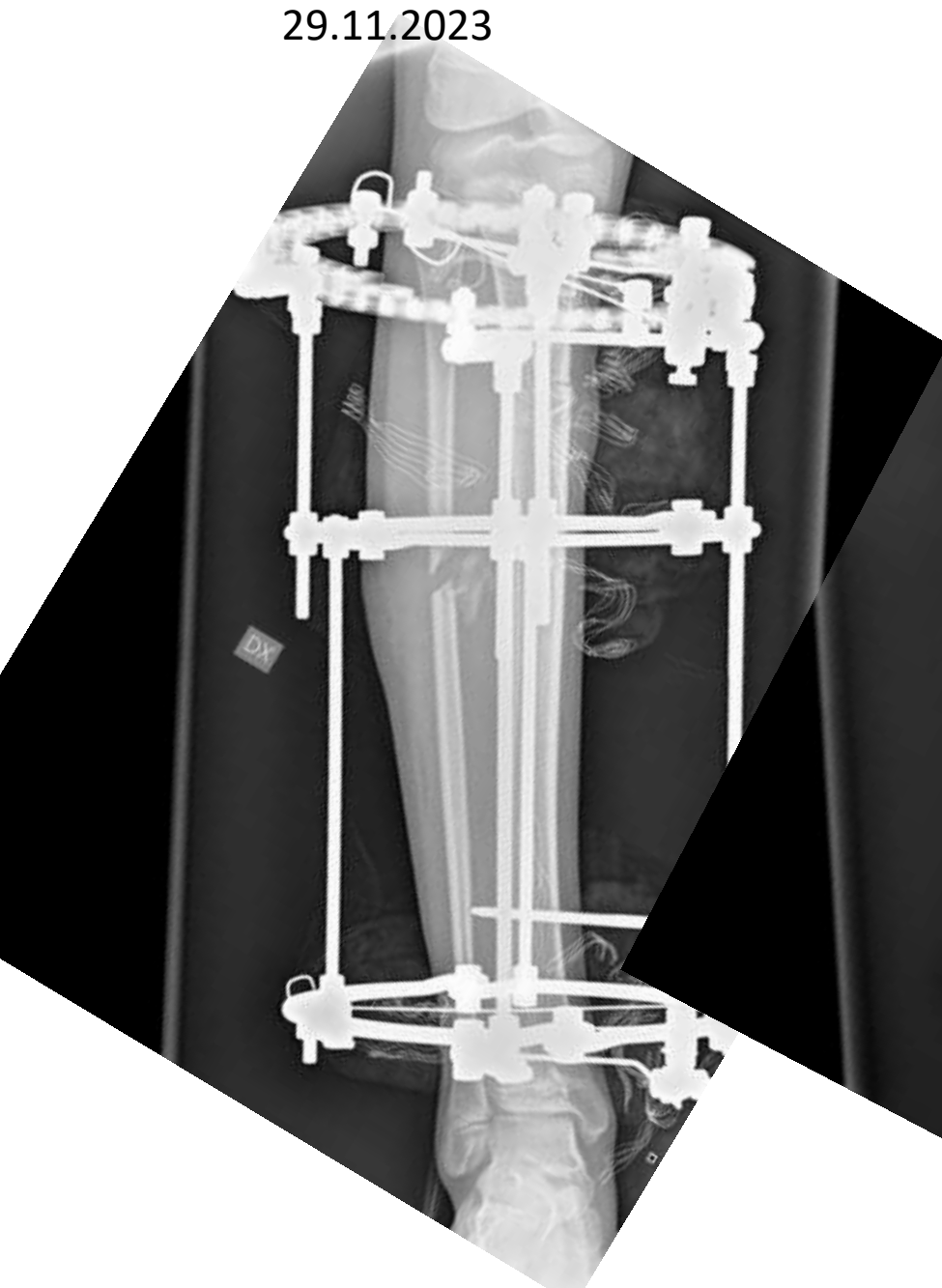




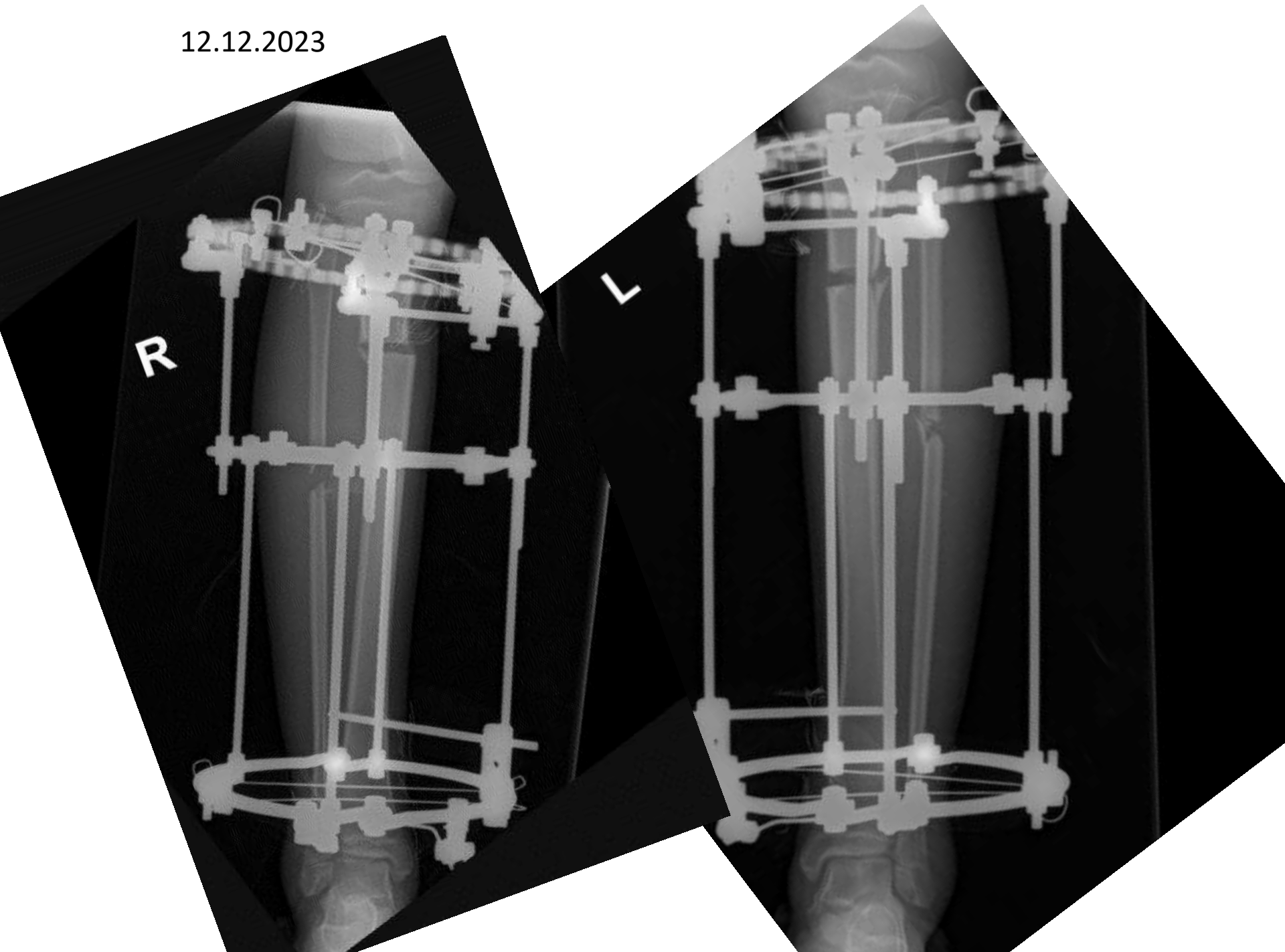




29.11.2023



12.12.2023



08.01.2024

R

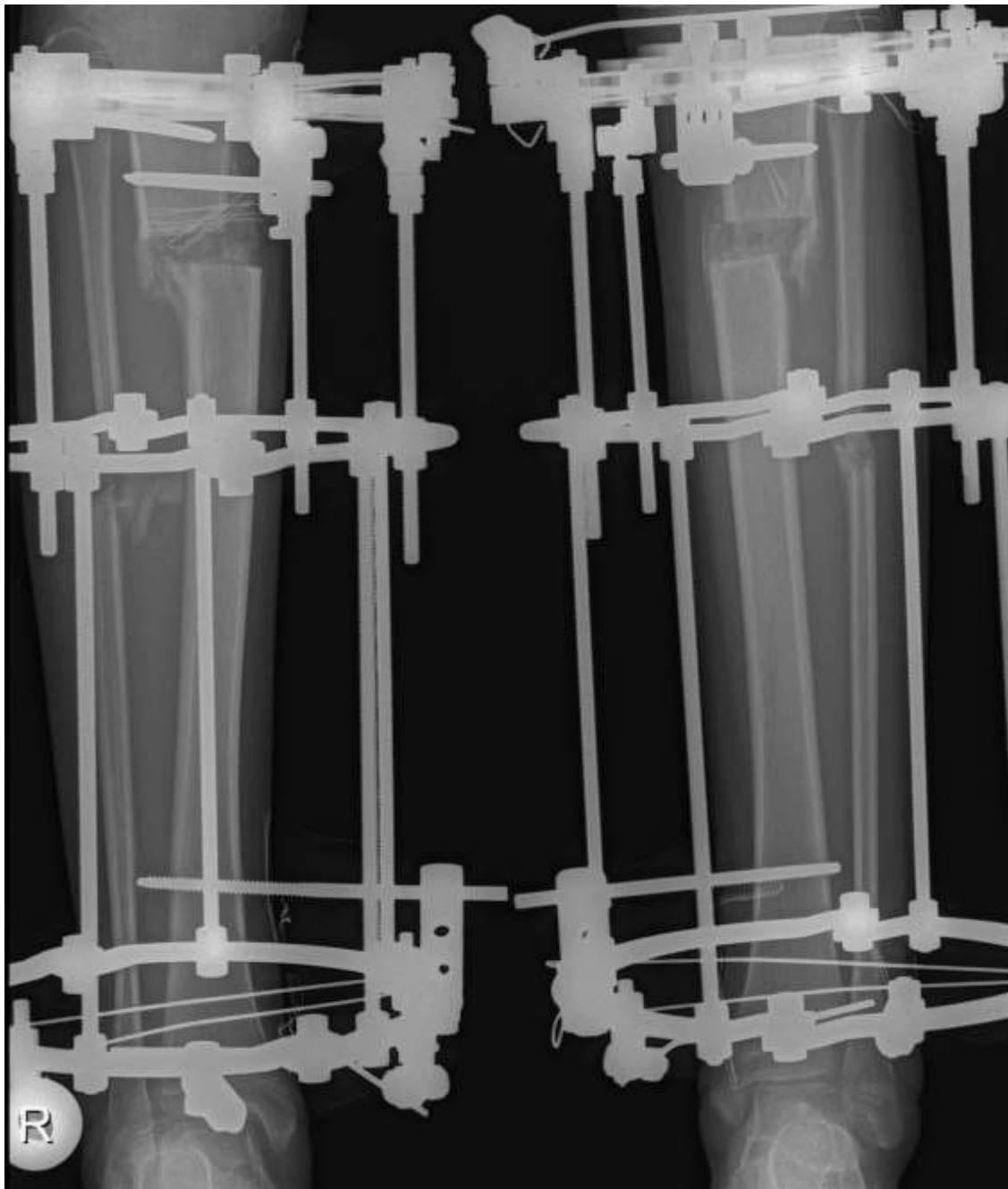


L





15.01.2024



13.06.2024









Complex deformity. Valgus knee, internal torsion of the femur and external torsion of the tibia



Correction of the right femur and tibia simultaneously



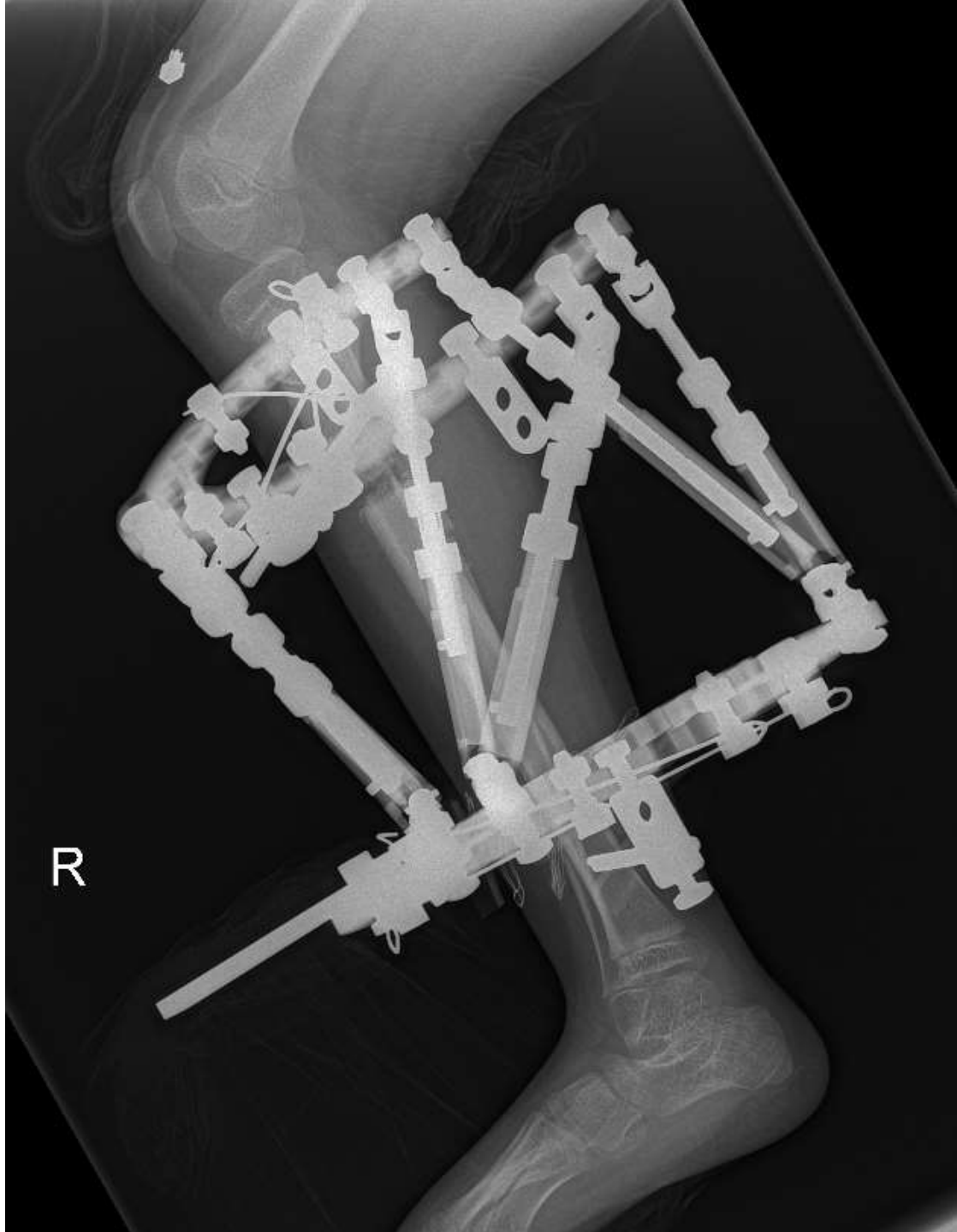
After correction of the both legs

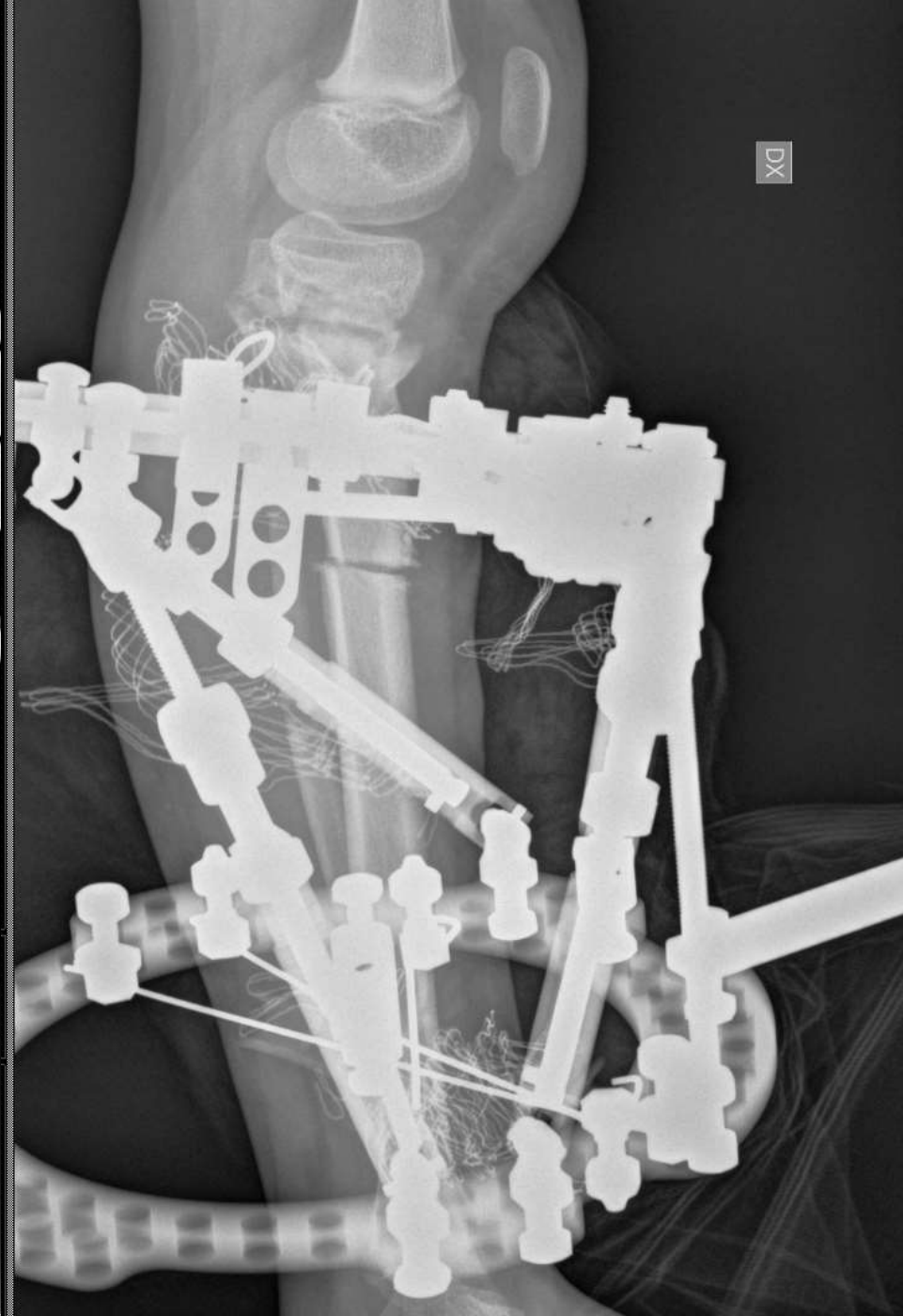
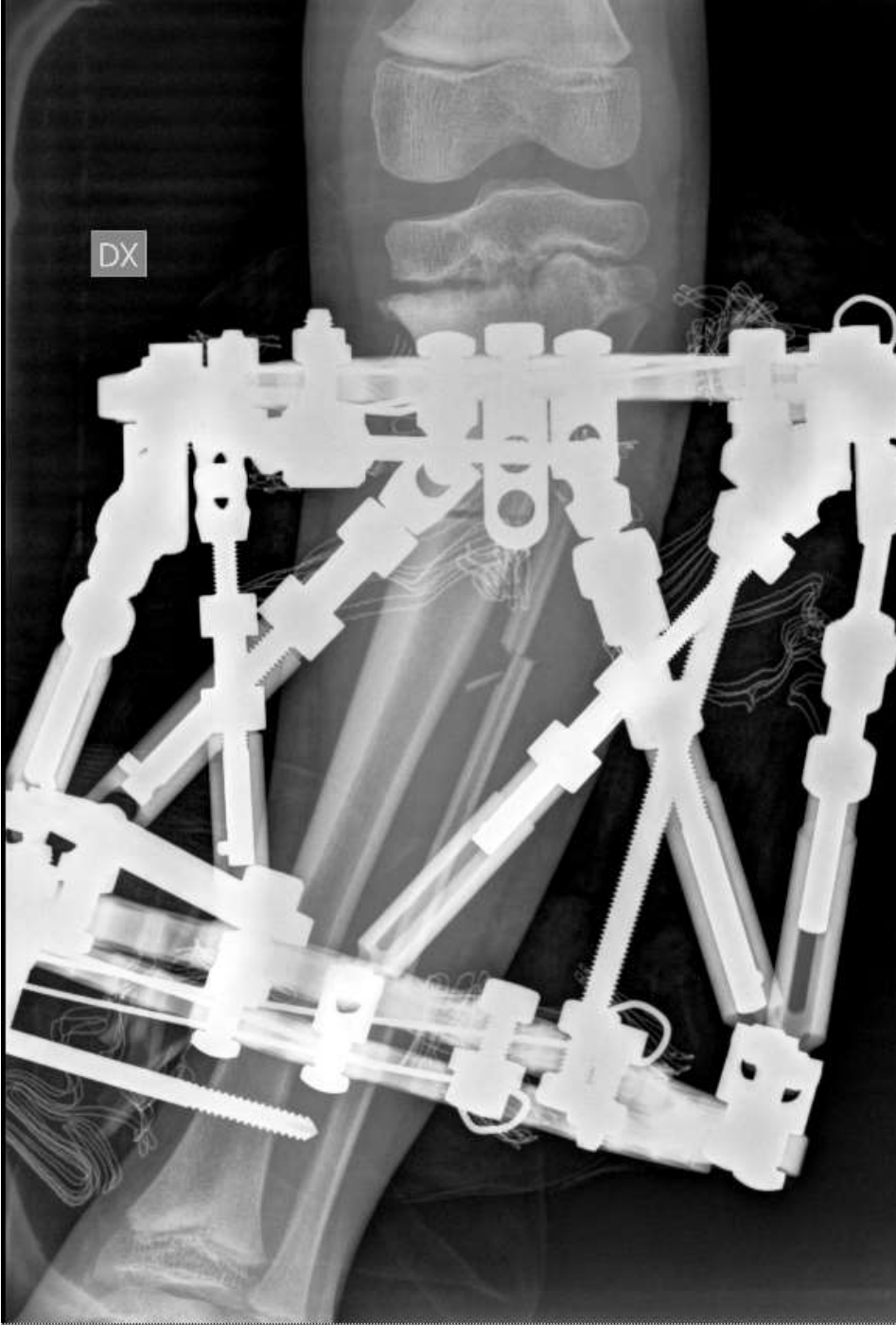


6 y.o. girl with varus and hyperextension of the knee, internal torsion











Radiological and Clinical result





18 y.o. Male. Congenital hemimelia





Varus of the femur in midshaft and valgus knee



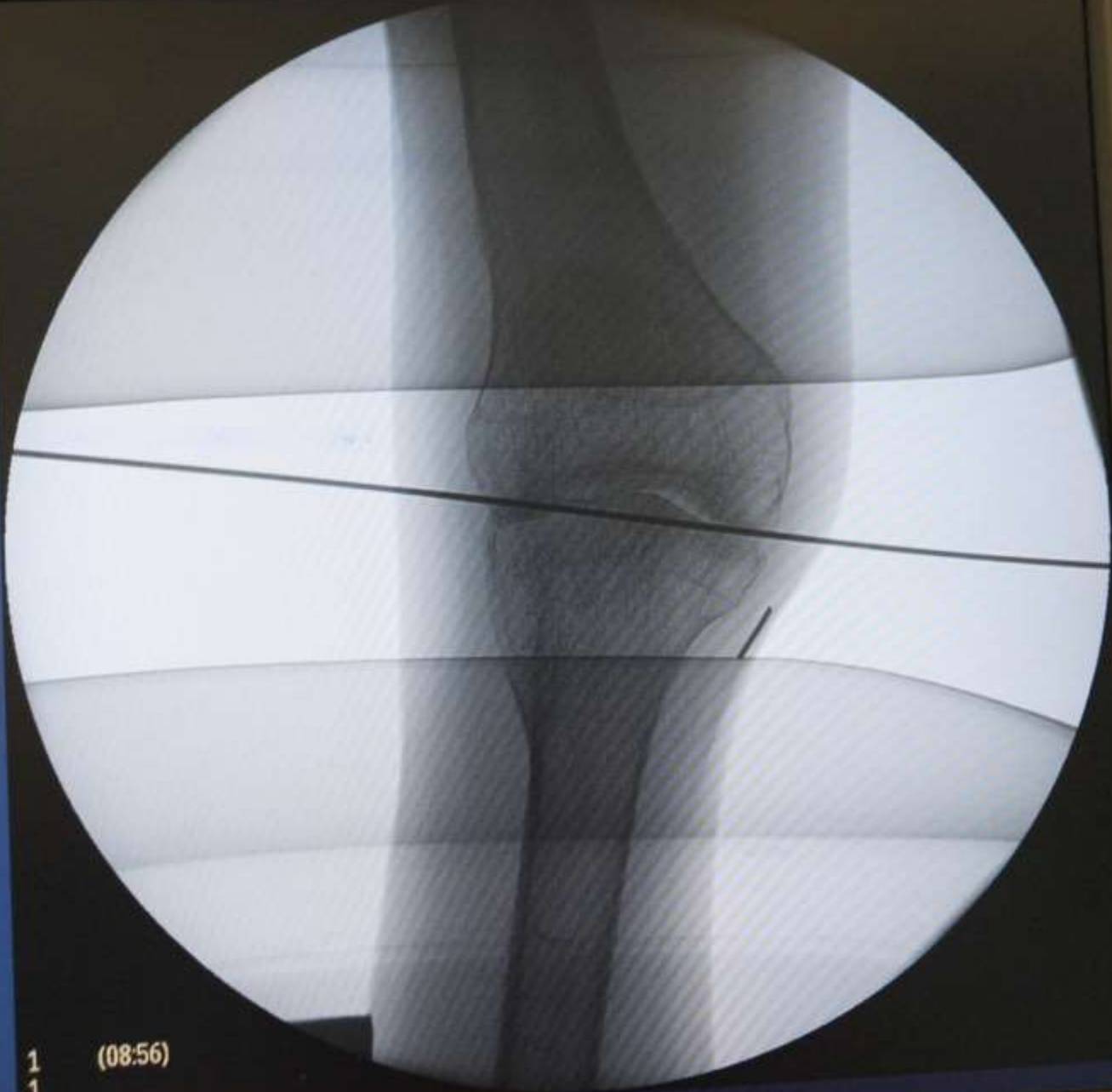
Stru



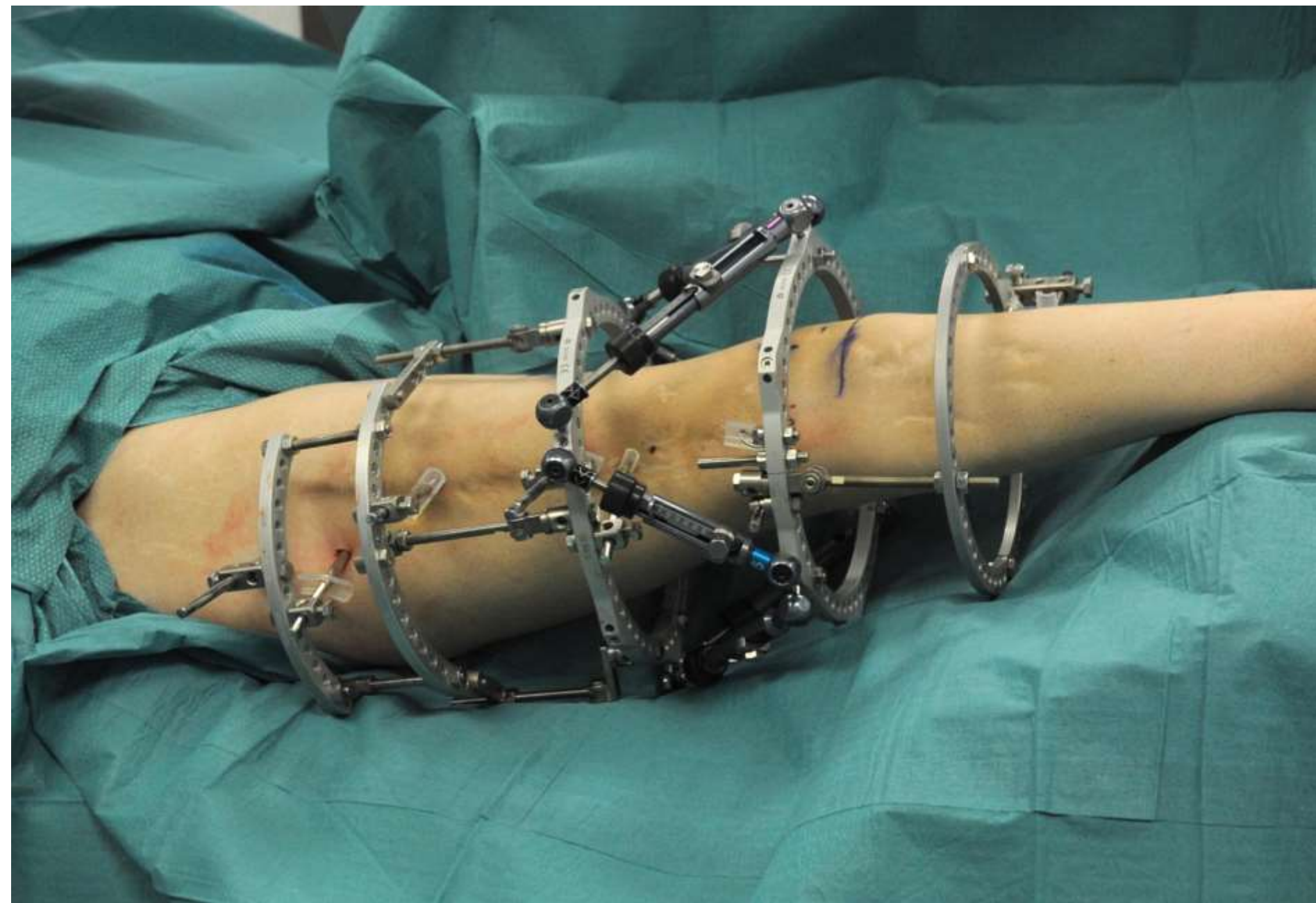
V Pulsera

andro

M



1 (08:56)
1



Finale



PHILIPS BV Pulsera

CH

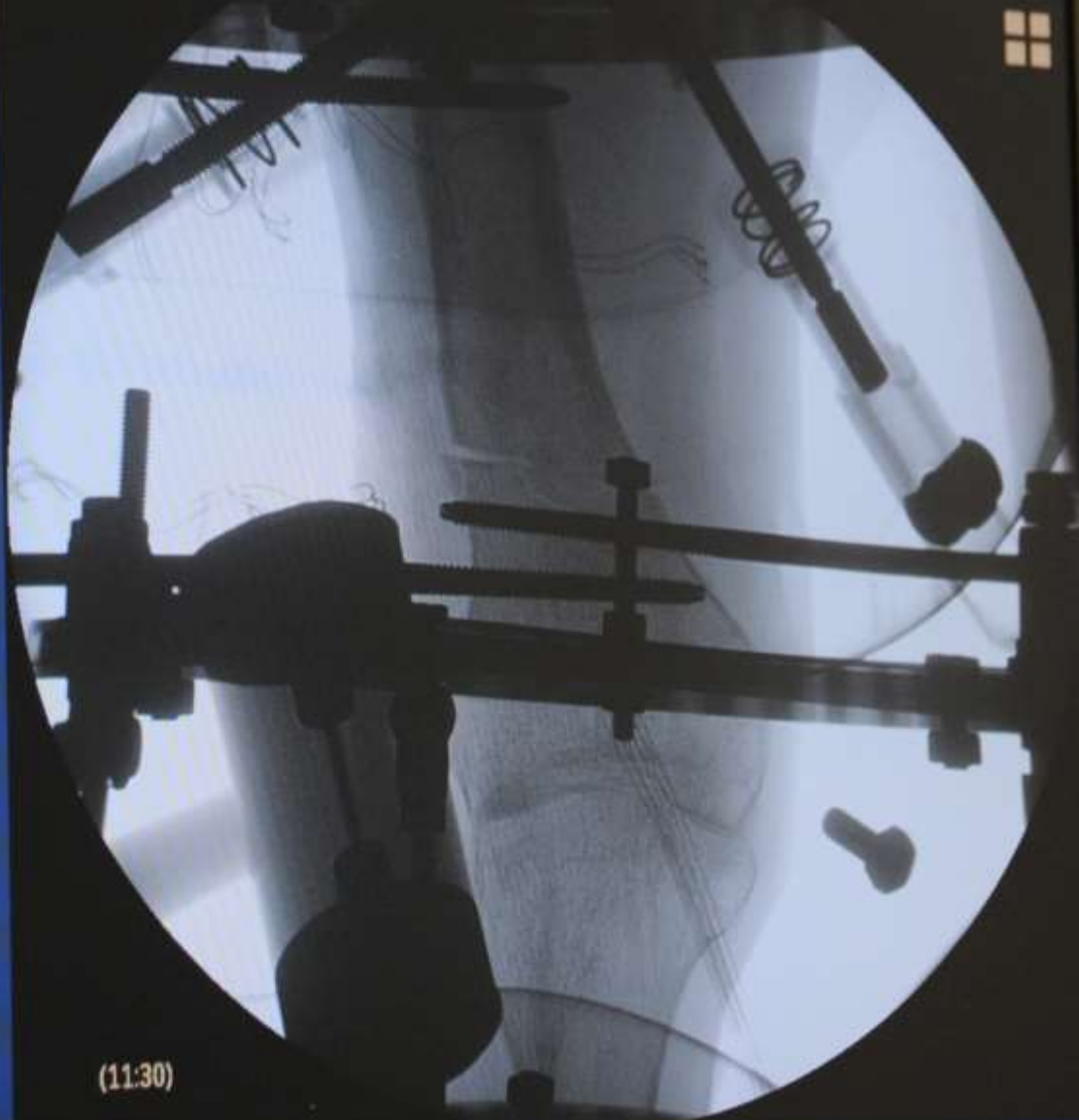
Paziente

bongio alessandro

16-10-1998 M

Esame

Ortopedia
22-10-2014



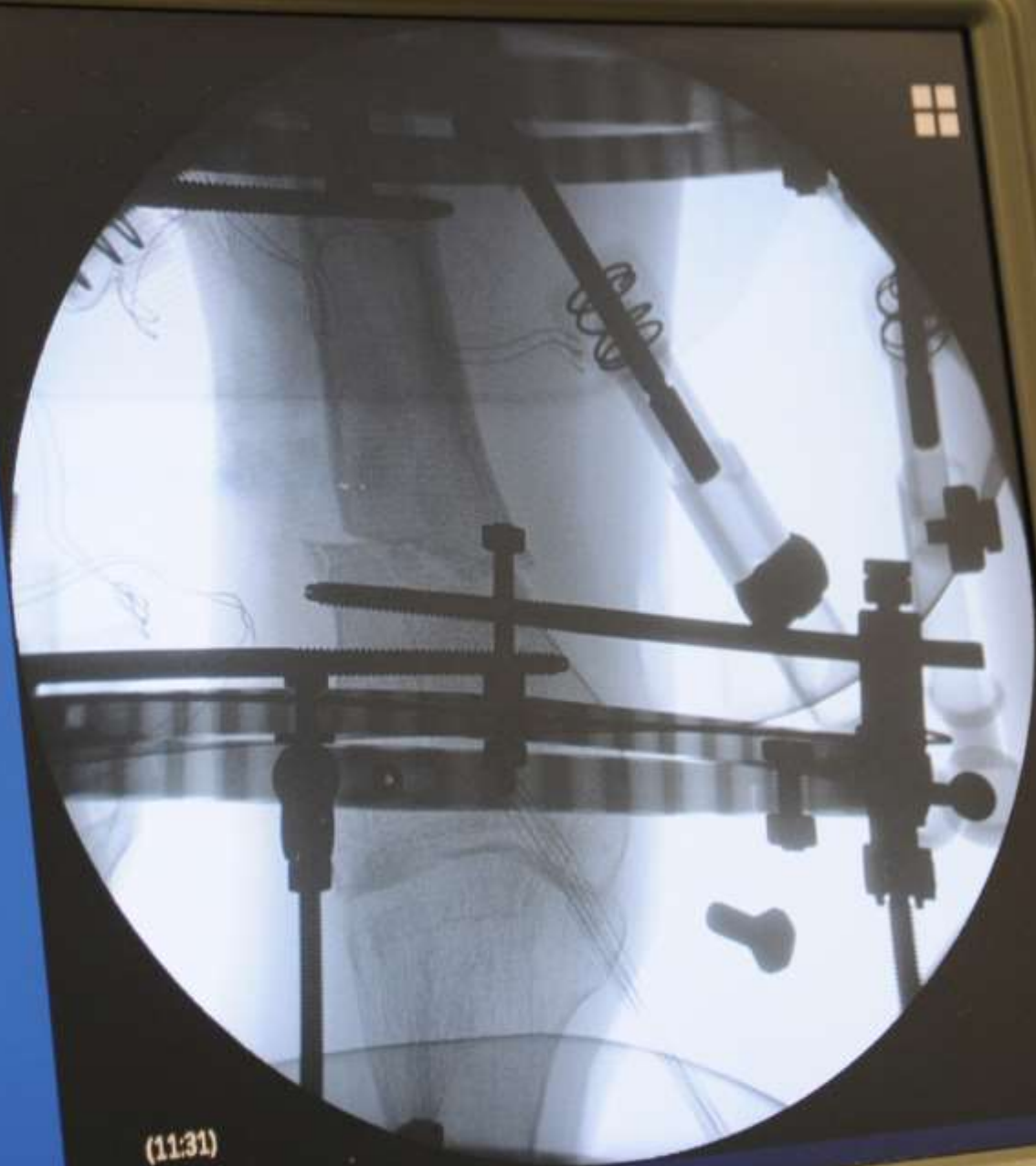
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PHILIPS BV Pulsera

cliente
Pongio alessandro

16-10-1998 M
nome

Ortopedia
22-10-2014



(11:31)



19 (11:42)

1



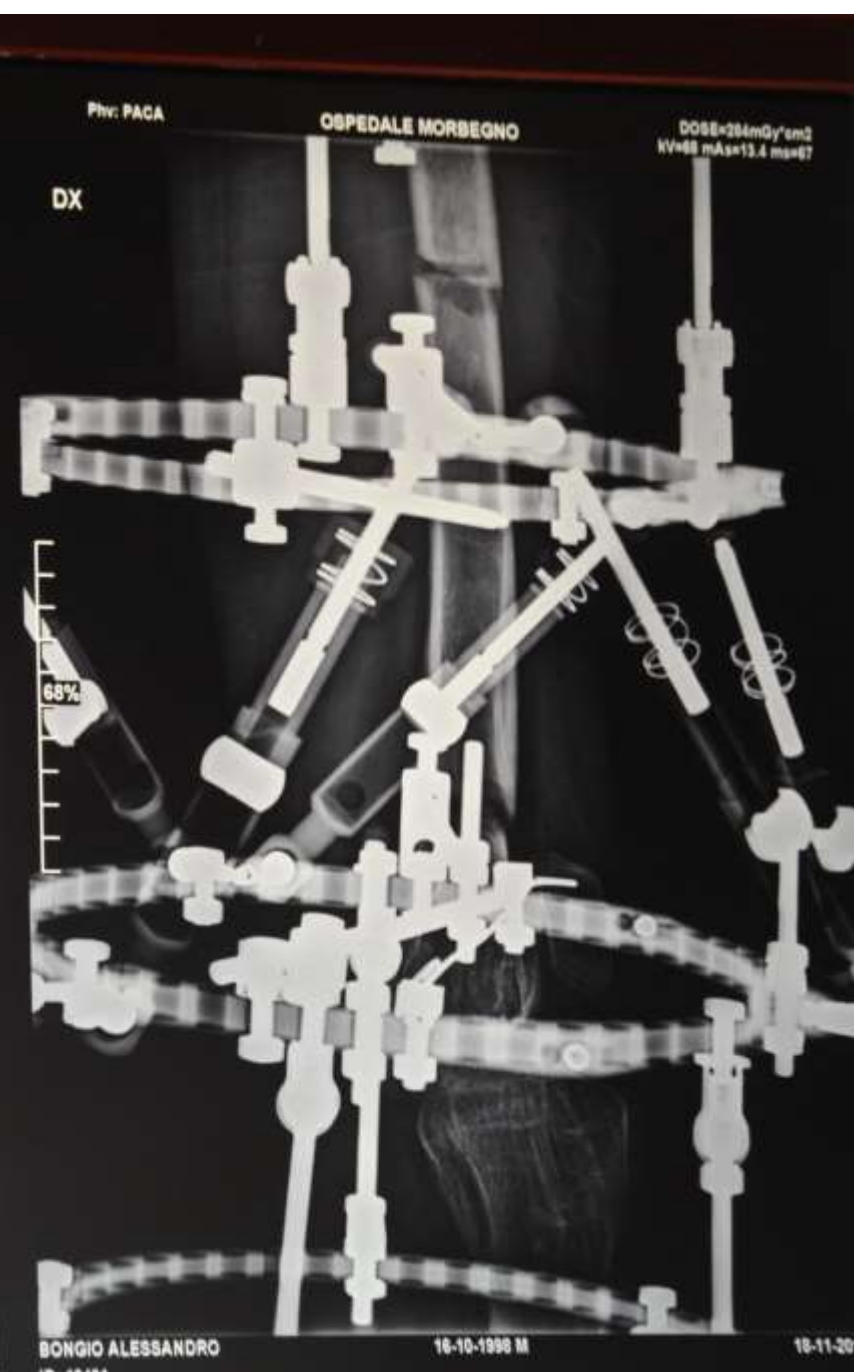
1:1.8 cm

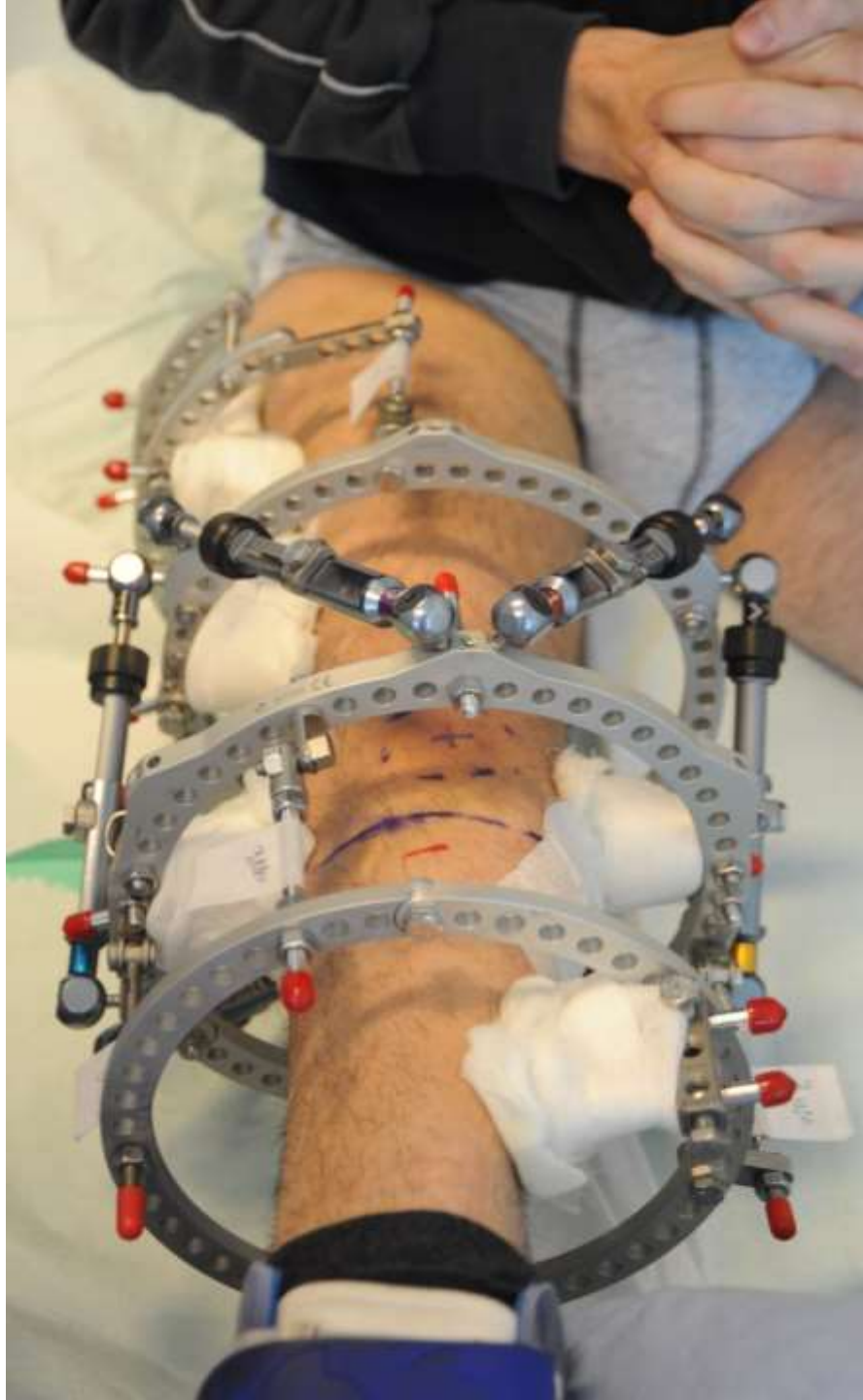


BONGIO ALESSANDRO
ID: 19431

16-10-1998 M

10-11-2014 09:19







14 Y.O. BOY, Rickets. Varus Deformity Of Femur And Tibia, Internal Torsion.















Conclusioni

- Torsione varia in eta pediatrica e necessita' controllo e valutazione nel tempo
- Correzione deve essere fatta in eta di adolescenza o alla fine della crescita
- Piccoli difetti - Chiodo o placca
- Severi difetti e dismetrie – fissatore esterno circolare
- Deformiita' complesse e torsione – FE esapodalico



Thank you