Knee Realignment with Osteotomy

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Disclosure:

I do have a relevant financial relationship and will be discussing products/services of the commercial interests with which relationships exist:

Consultant for Smith and Nephew Inc.

Consultant and Royalties, Small Bone Innovations inc.

Realignment Osteotomy

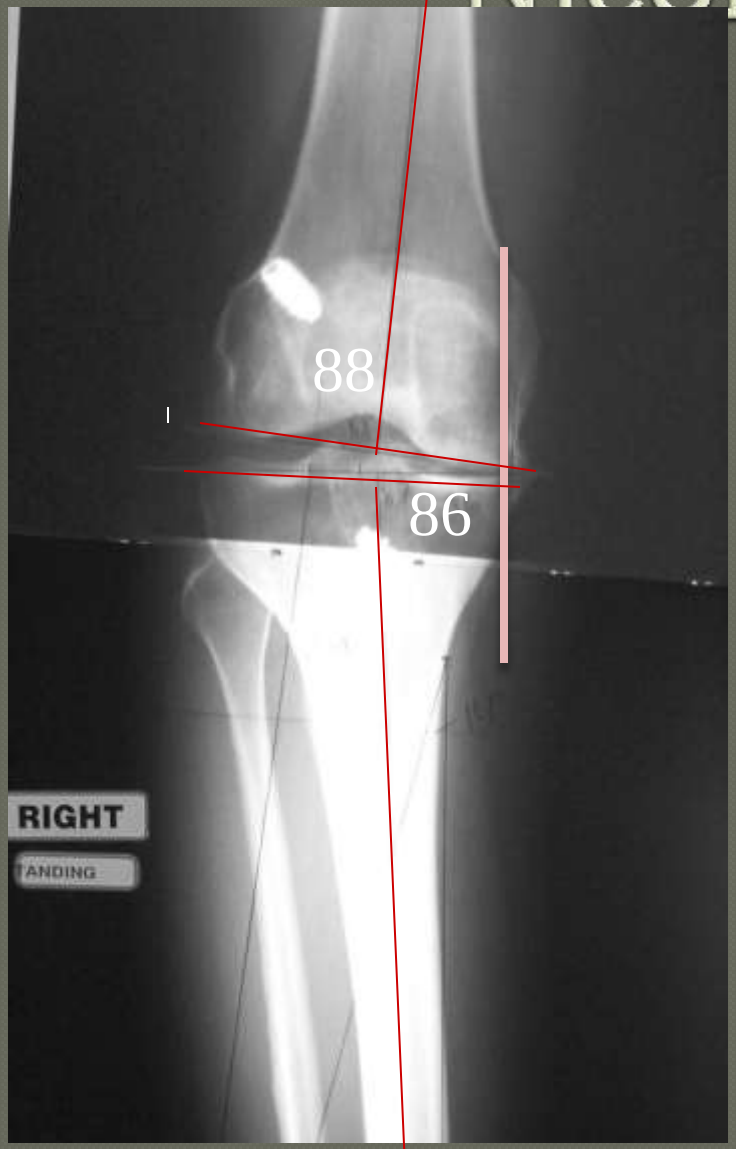

DING


RIGHT


R
L


R
L

Nicole



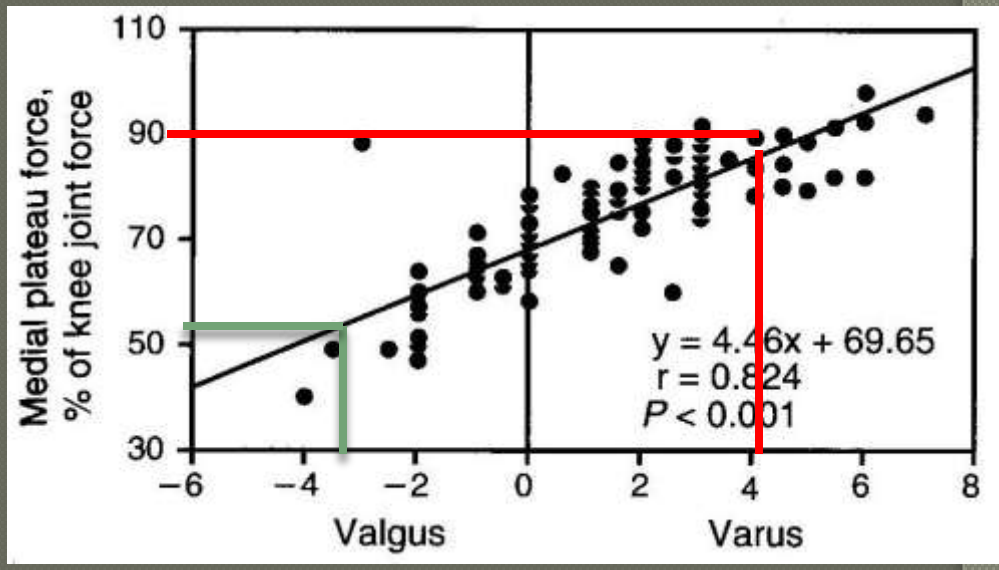
End Distraction

3 months

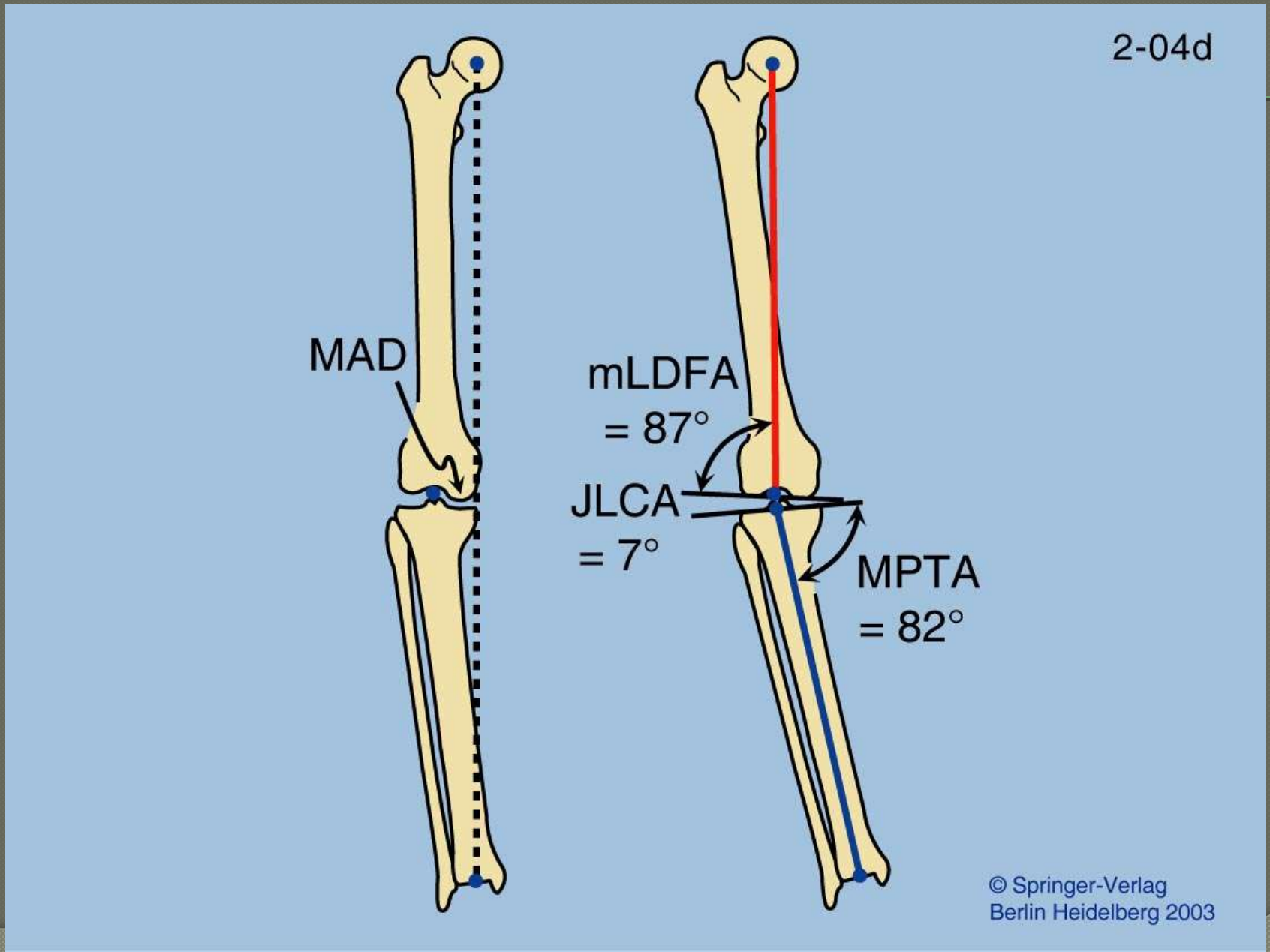
3.5 months

Rationale for Re-alignment
Normal Force Transmission

- 70% of force is on medial side in single leg stance
  - Adductor moment during gait
- With 4^0-6^0 varus this increases to 90%
- (rigid body spring model)
- Hsu et al 1990

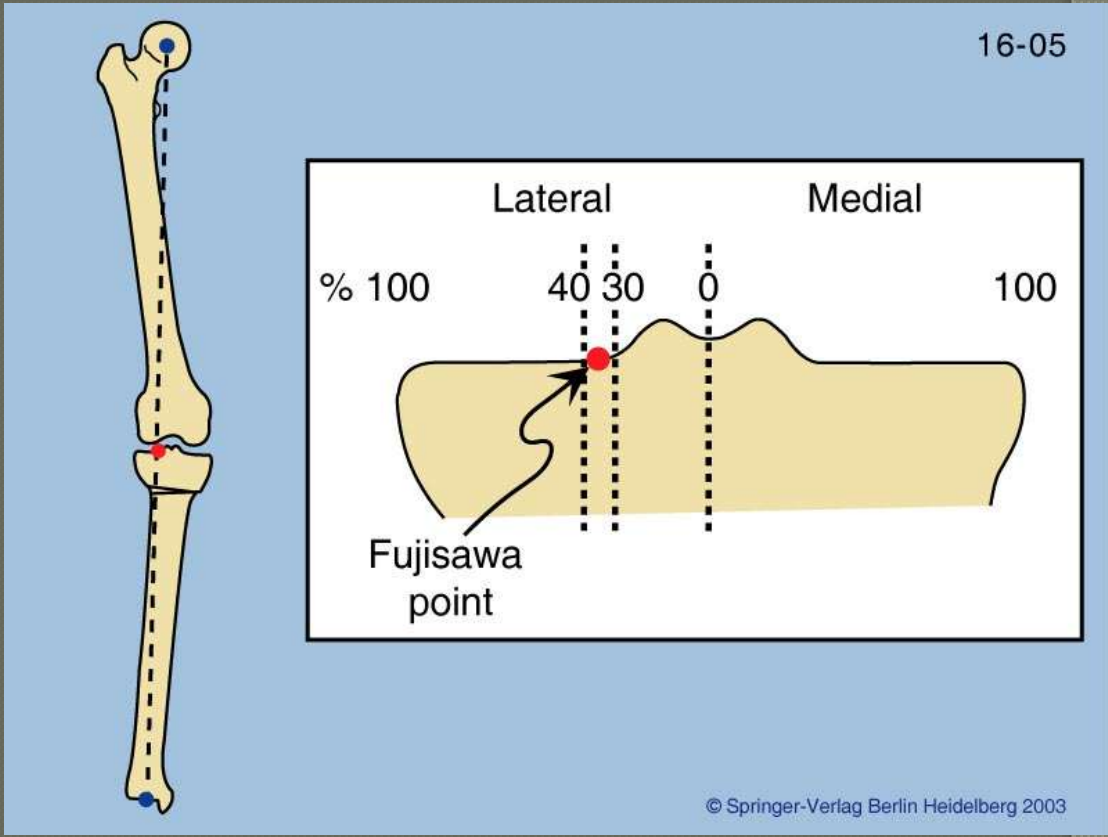


Source of MAD



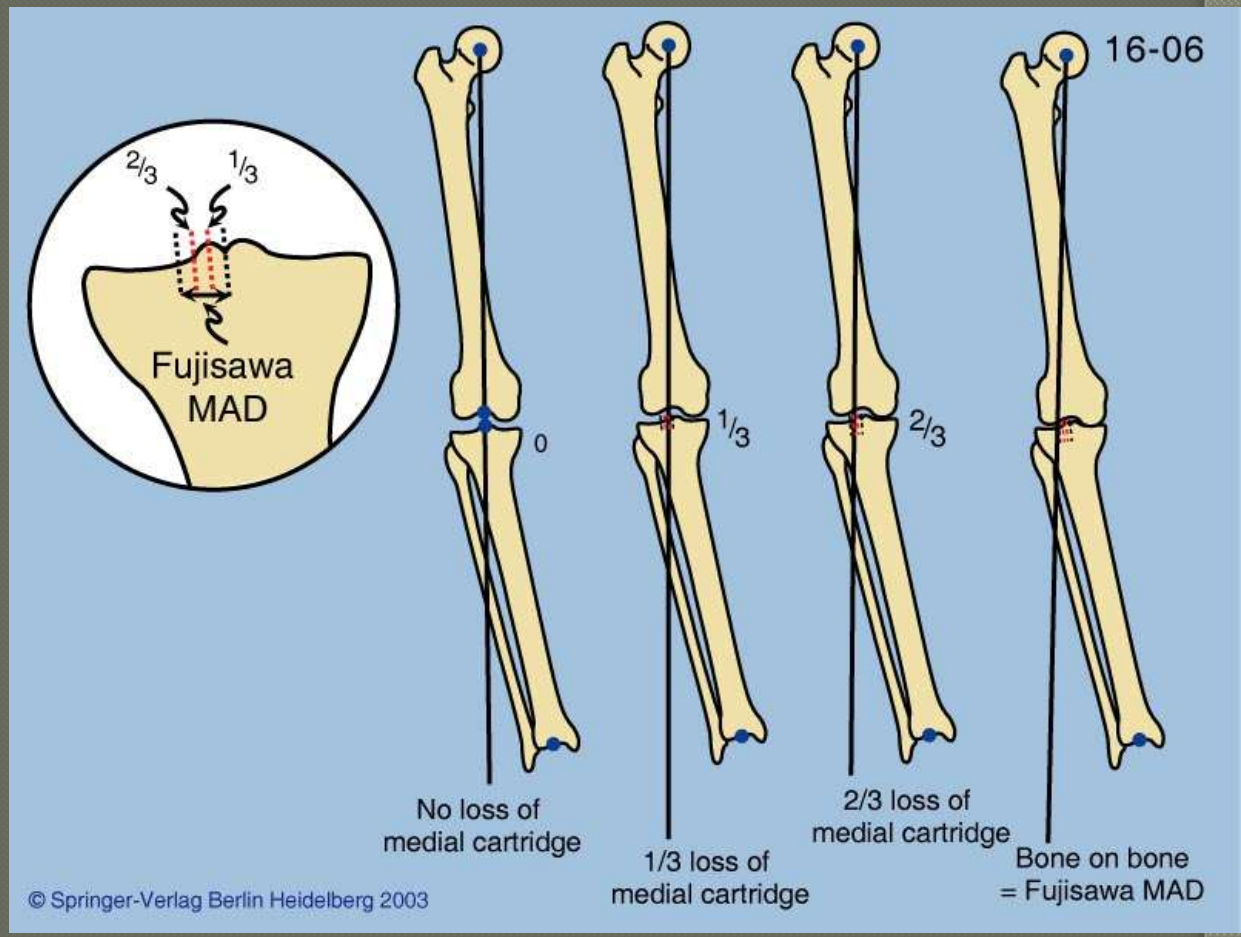
Goal for realignment

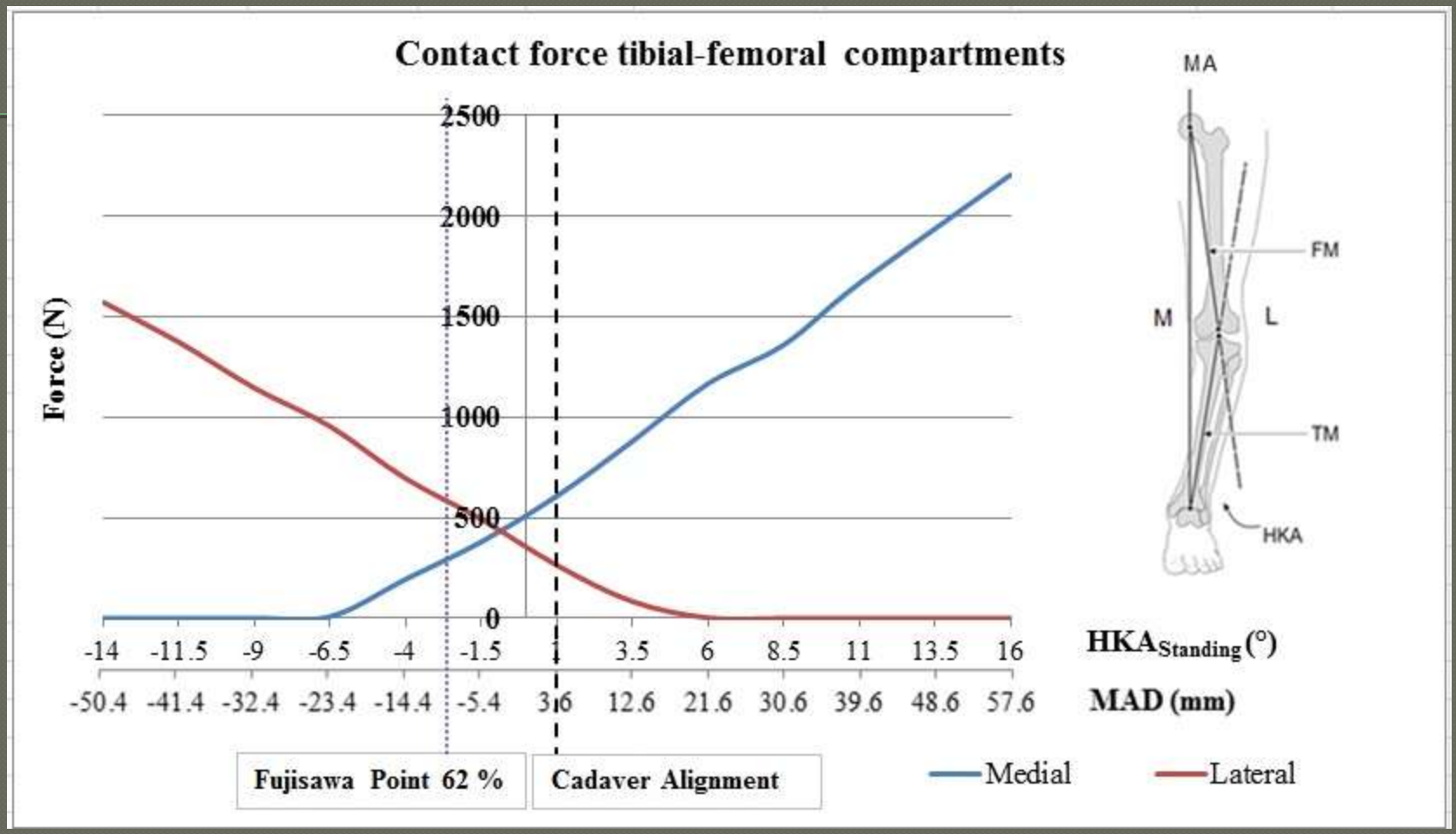
- Most studies suggest overcorrection is desirable and correlates with better results
  - Fujisawa point
  - Femorotibial angle 10 degrees valgus
- Yasuda et al 1992,
- Coventry et al, 1979
- Fujisawa, 1979



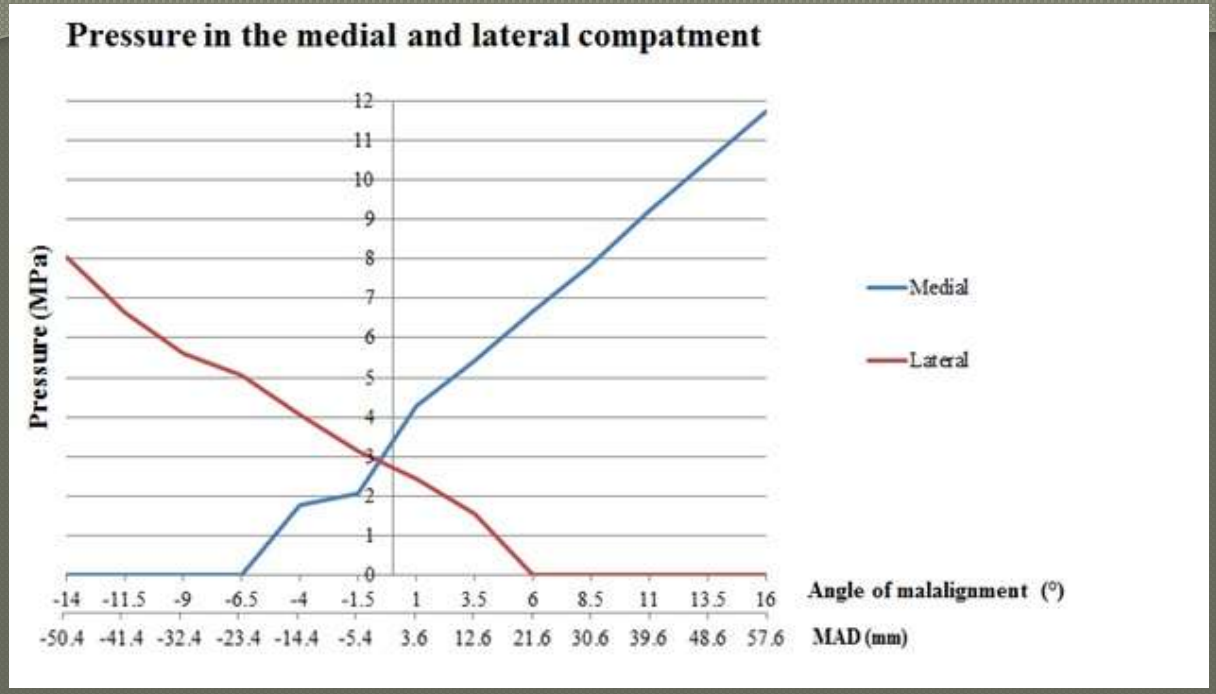
Goal for realignment

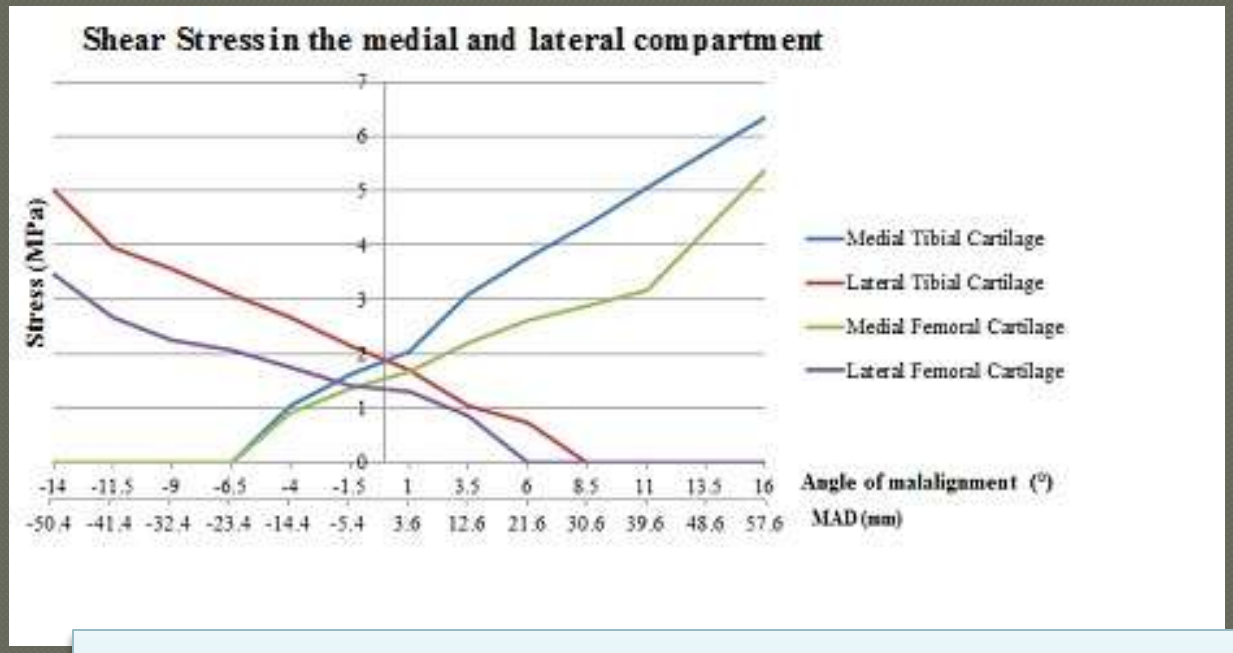
- Fujisawa et al, 1979
  - Point 1/3 of way on lateral plateau
- Jakob & Murphy 1992
  - Modified point depending on level of degeneration
- Anatomic angle goal is limiting





Moonta et al: to be published in……
J of Computer Methods in Biomechanics and Biomedical Engineering 2014





Reisse et al: Virtual osteotomies. Hillistrom lab 2014

25 y/o, bilat. Knee pain

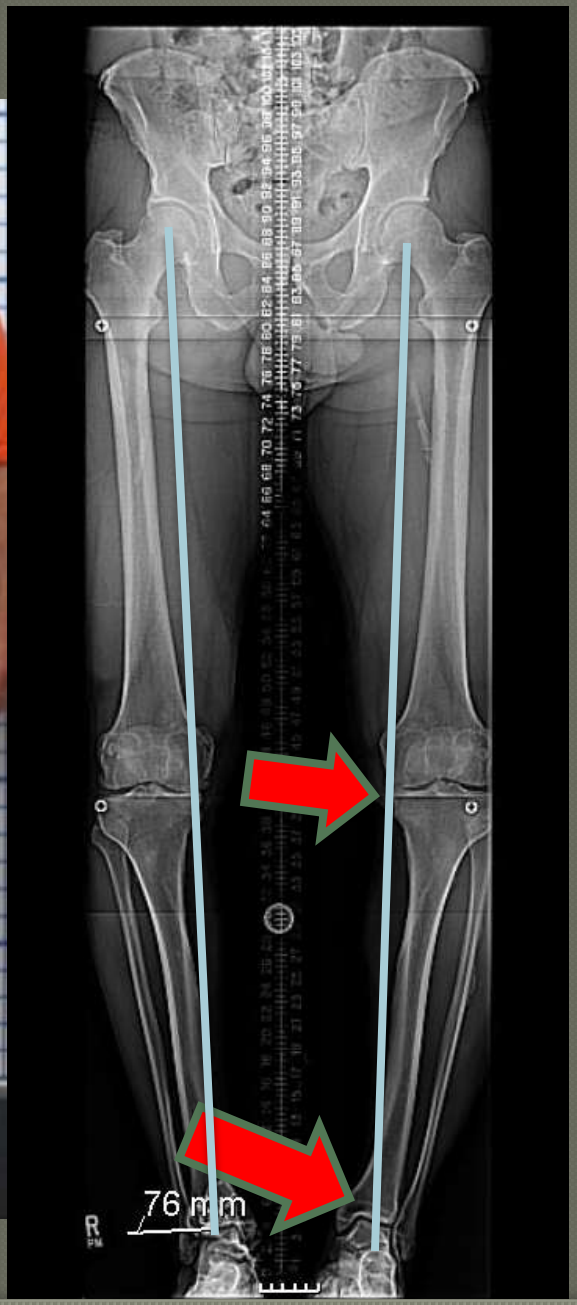
This should last until forever !?!?

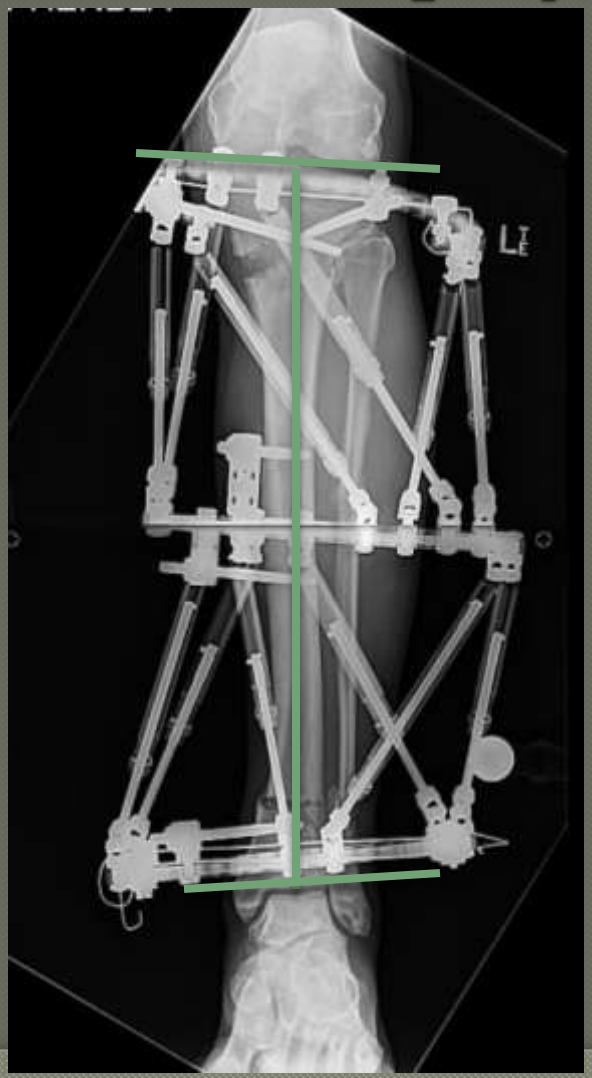
45 y/o active guy with tibial and some joint convergence

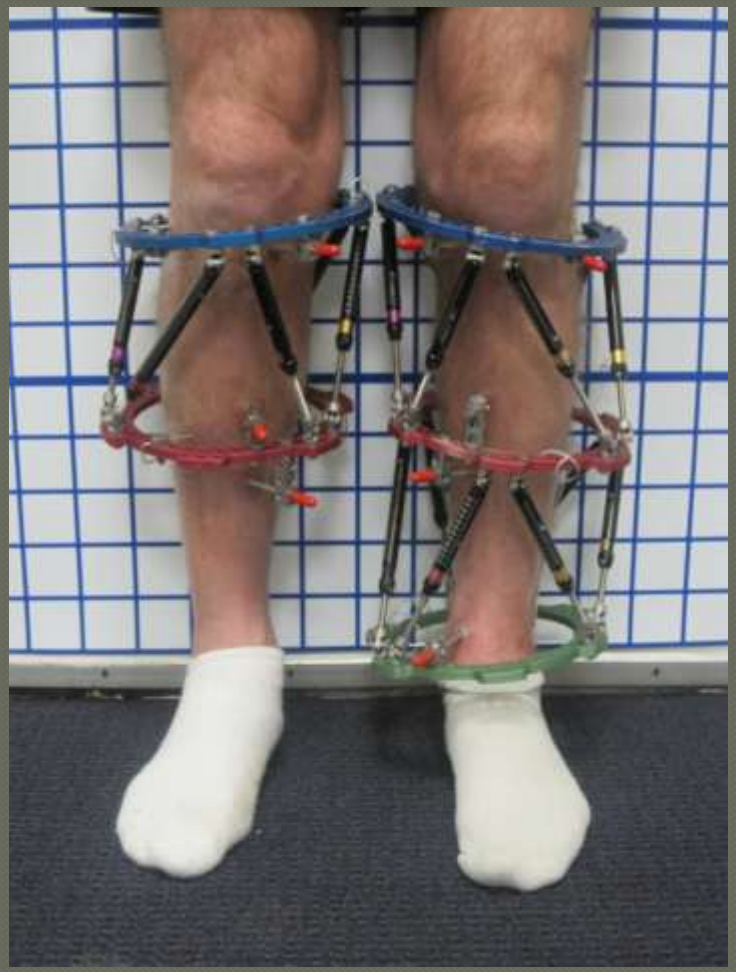

RT,C


RT,C

2 level deformity
50 year old, active soccer player








ENBLA


THEW, STEPHENBLA
VIEWS

Clin Orthop Relat Res (2010) 468:1352–1361
DOI 10.1007/s11999-009-1161-7

CLINICAL RESEARCH

Does the Taylor Spatial Frame Accurately Correct Tibial Deformities?

S. Robert Rozbruch MD, Kira Segal BA, Svetlana Ilizarov MD, Austin T. Fragomen MD, Gabriel Ilizarov MD

Received: 23 March 2009 / Accepted: 27 October 2009 / Published online: 13 November 2009

Abstract

Background Optimal leg alignment is the goal of tibial osteotomy. The Taylor Spatial Frame (TSF) and the Ilizarov method enable gradual realignment of angulation and translation in the coronal, sagittal, and axial planes, therefore, the term six-axis correction.

Questions/purposes We asked whether this approach would allow precise correction of tibial deformities.

Methods We retrospectively reviewed 102 patients (122 tibiae) with tibial deformities treated with percutaneous osteotomy and gradual correction with the TSF. The proximal osteotomy group was subdivided into two sub-

with a varus deformity and from 96° to 85° in patients with a valgus deformity. In the middle osteotomy group, all patients had less than 5° coronal plane deformity and 15 of 17 patients had less that 5° sagittal plane deformity. In the distal osteotomy group, the lateral distal tibial angle improved from 77° to 86° in patients with a valgus deformity and from 101° to 90° for patients with a varus deformity.

Conclusions Gradual correction of all tibial deformities with the TSF was accurate and with few complications.

Level of Evidence Level IV, therapeutic study. See the Guidelines for Authors for a complete description of levels

Preoperative vs. Postoperative MAD: Proximal Group (mm)

	Preop MAD	Postop Goal 0		Postop Goal Overcorrection	
		Medial	Lateral	Medial	Lateral
MAD Medial	39	5	5	_	8
P value		<0.001	0.03		0.004
MAD Lateral	33	8	3	12	_
P value		0.01	0.05	0.1	

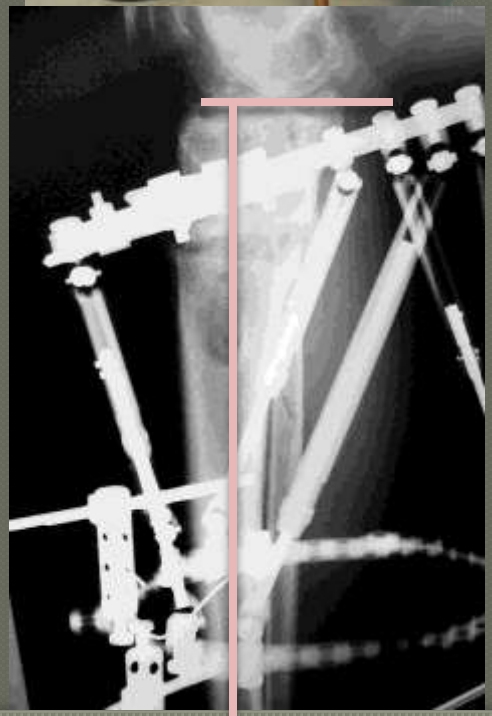
Rozbruch et al.: TSF for Tibial Deformity Correction; CORR 2009

Flexion contracture

- Osteotomy
  - Extend at osteotomy site
- Uni-knee
  - Remove osteophytes and will gradually regain flexion

Varus
Flexion
IR

3 months



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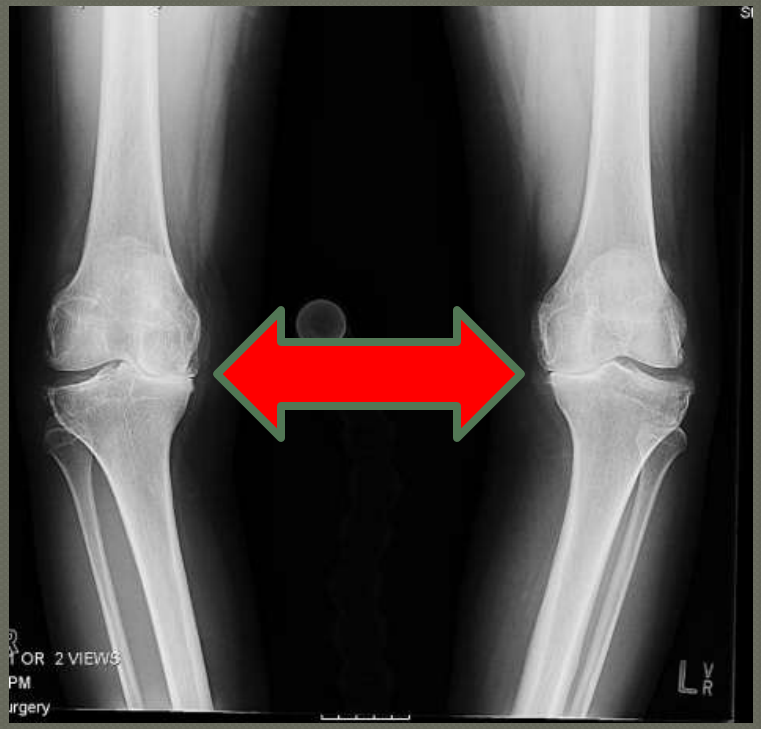
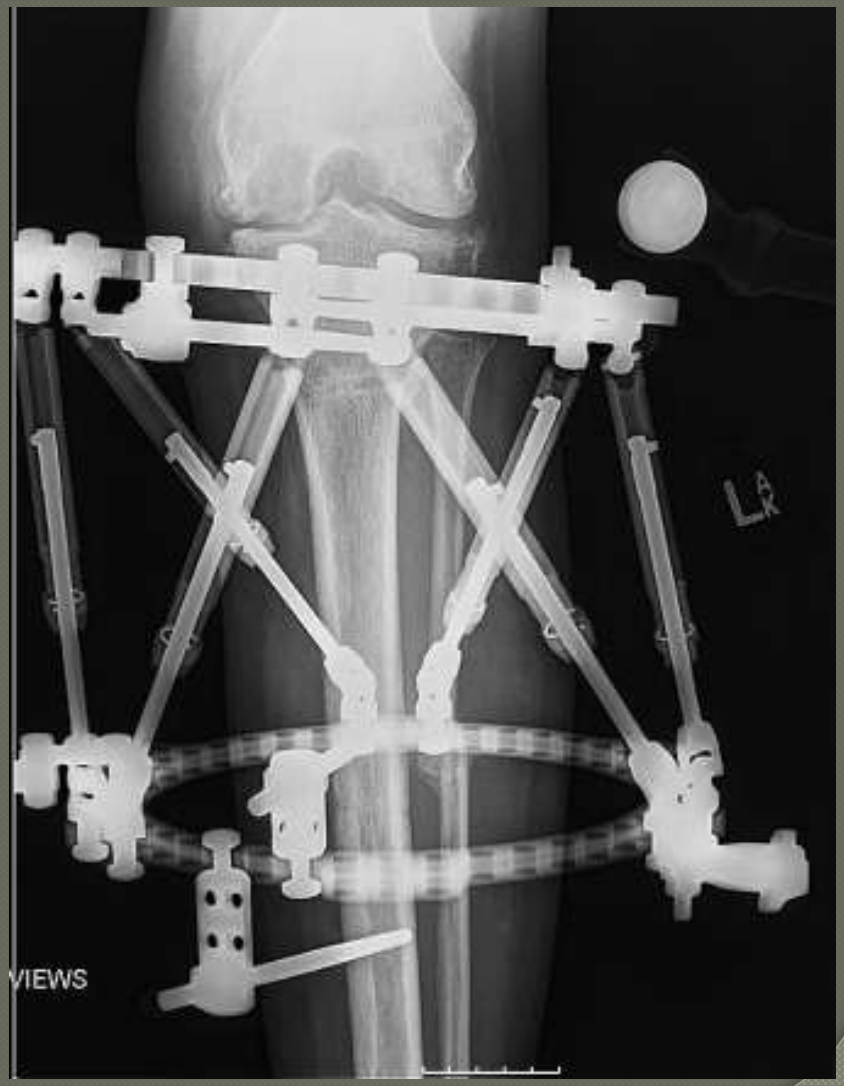

OR 2 VIEWS
PM
urgery


VIEWS


R
H 1 OR 2 VIEWS
7 PM
Surgery
L V R


2 VIEWS

Protocol

- **EBI monolateral frame**
  - Varus deformities less than 10 degrees.

TSF frame

- Deformities greater than 10 degrees, or associated sagittal and/or axial plane deformities.

Ashfaq K, Fragomen AT, Nguyen JT, Rozbruch SR: Correction of proximal Tibia Varus with External Fixation. J Knee Surgery 2012, 25(5):375-384.

Patients	Limbs	TSF	EBI Frame
72	93	57	36

Patients were subdivided into two groups:

- **Neutral** (MAD goal of 0 mm).
- **Overcorrected** (MAD goal 10 mm lateral)

Preoperative vs Postoperative MAD (EBI)

	Preop MAD (mm)	Postop Goal (Neutral)		Postop Goal (Overcorrection)	
		Medial	Lateral	Medial	Lateral
Average	21	3	5	5	10
Range	10-44	0-12	2-10	-	4-20
N =	36	15	8	1	12

TSF deformity parameters

	Varus	Apex Anterior	Apex Posterior	Internal Rotation	External Rotation
Avg	**13** (4-46)	**10** (2-30)	**8** (5-15)	**16** (10-40)	**15** (7-25)
	N= **57**	**19**	**8**	**9**	**16**

Preoperative vs Postoperative MAD (TSF)

	Preop MAD	Postop Goal (Neutral)		Postop Goal (Overcorrection)	
		Medial	Lateral	Medial	Lateral
Avg	39 (10-75)	4 (0-30)	5 (2-8)	* 35	11(3-18)
N=	(57)	(23)	(6)	(1)	(27)


Poor skin


MAD


STAND

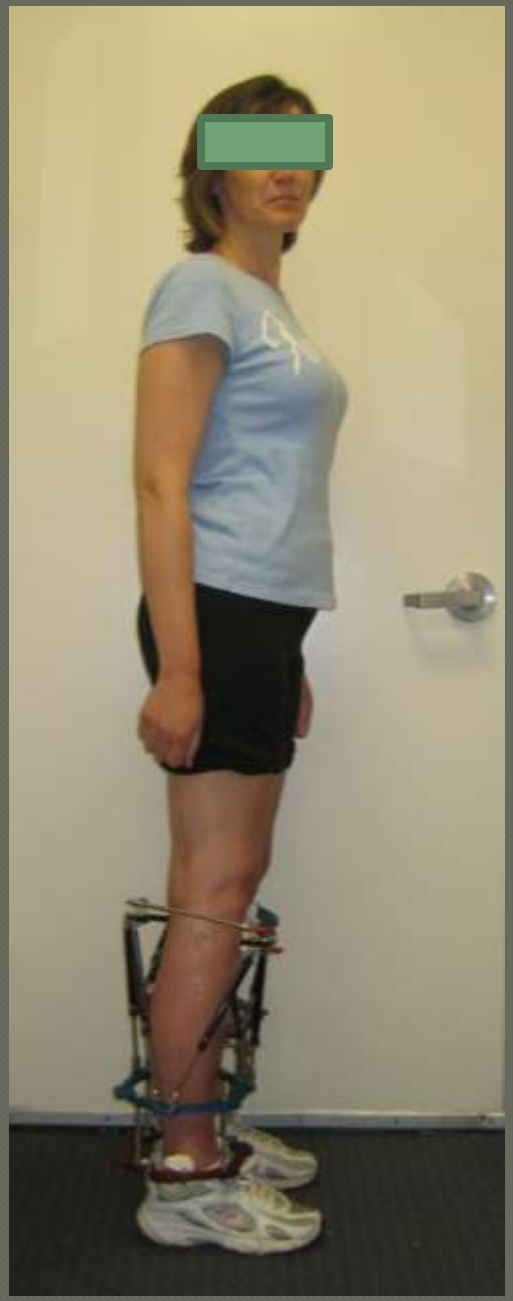
Results

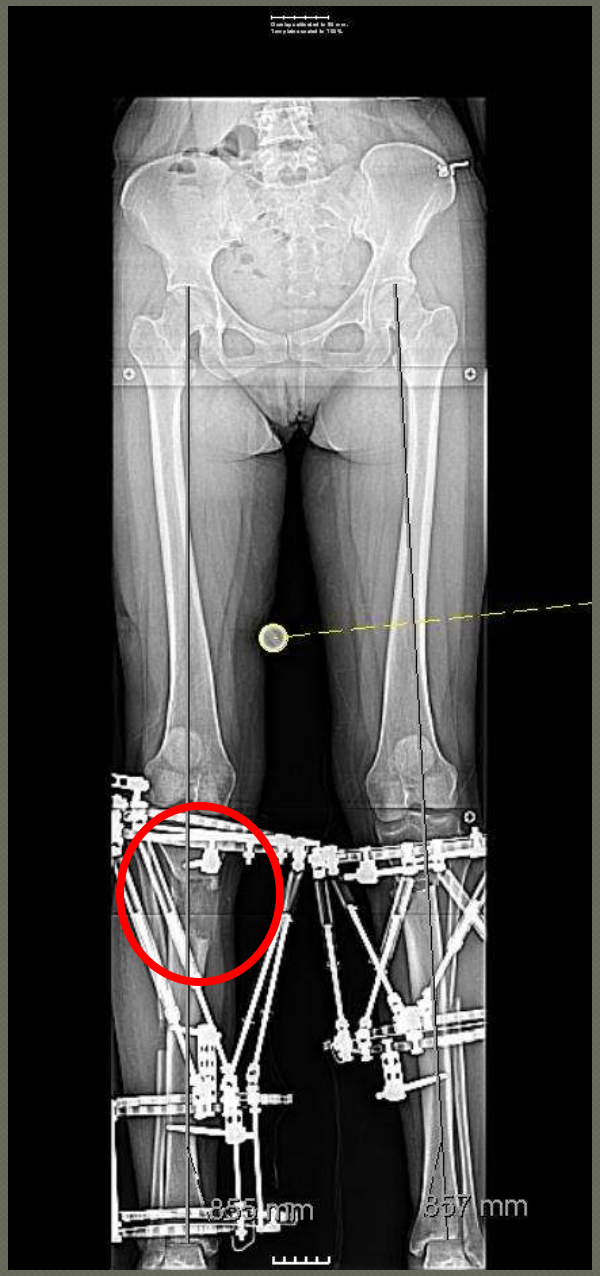
- There was no significant change in ankle or knee range of motion.
- There was one complication which was a collapse.

Discussion

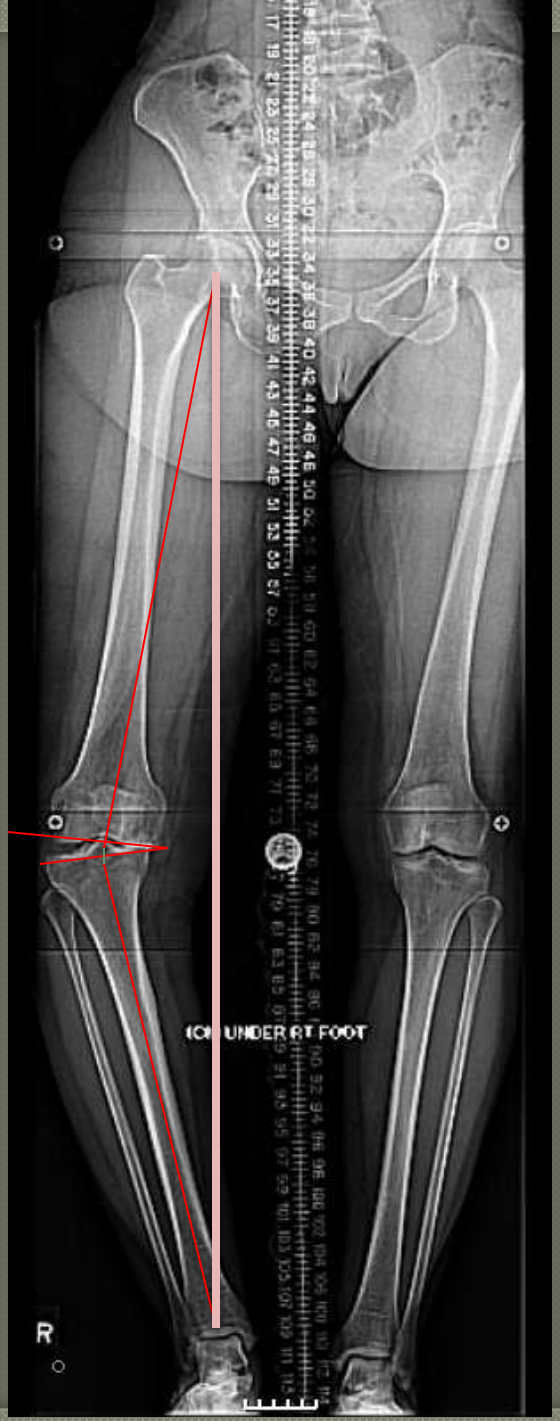
- Our treatment algorithm of treating proximal tibial varus deformities of less than 10 degrees with EBI monolateral frames and more than 10 degrees alone or in association with any of the sagittal or axial plane deformity with TSF frame is safe and highly effective.


43 mm
33 mm
827 mm




855 mm
857 mm

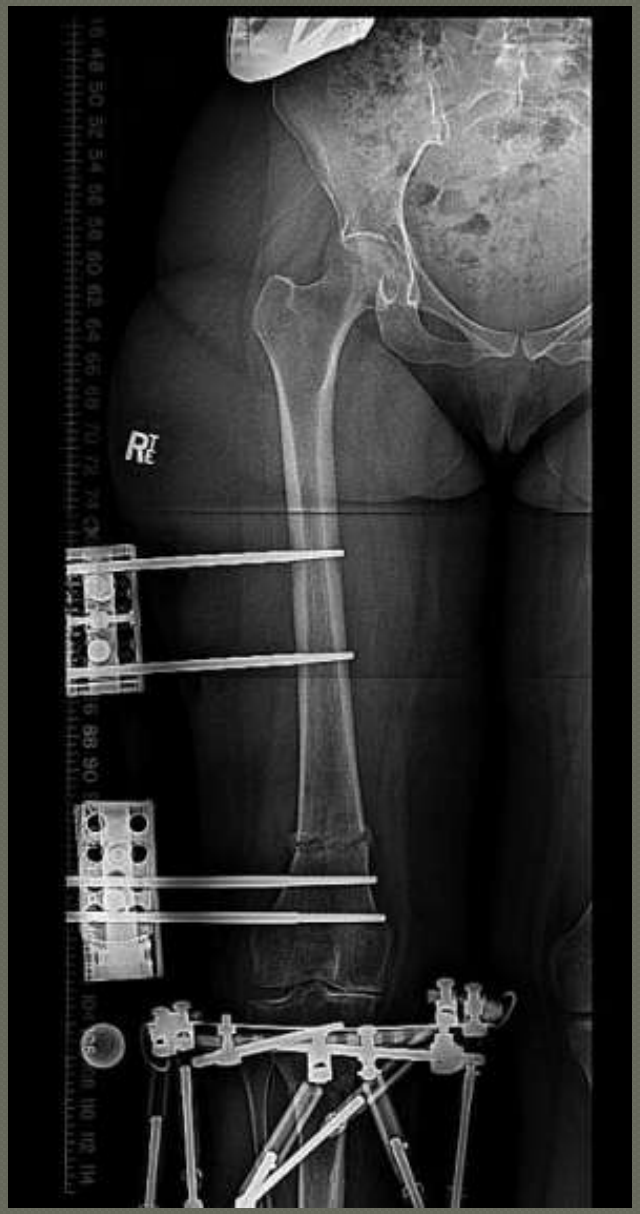

L

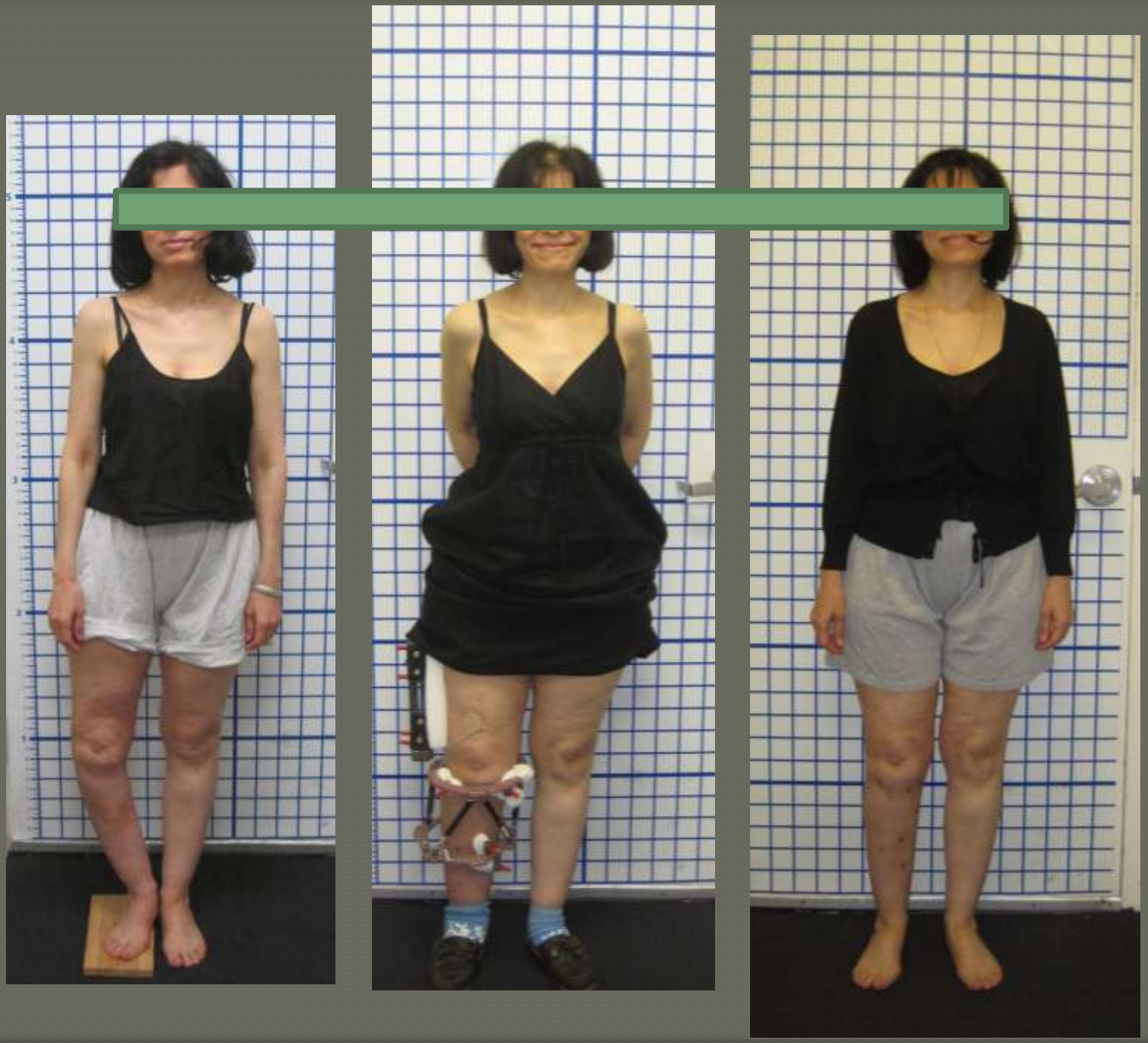


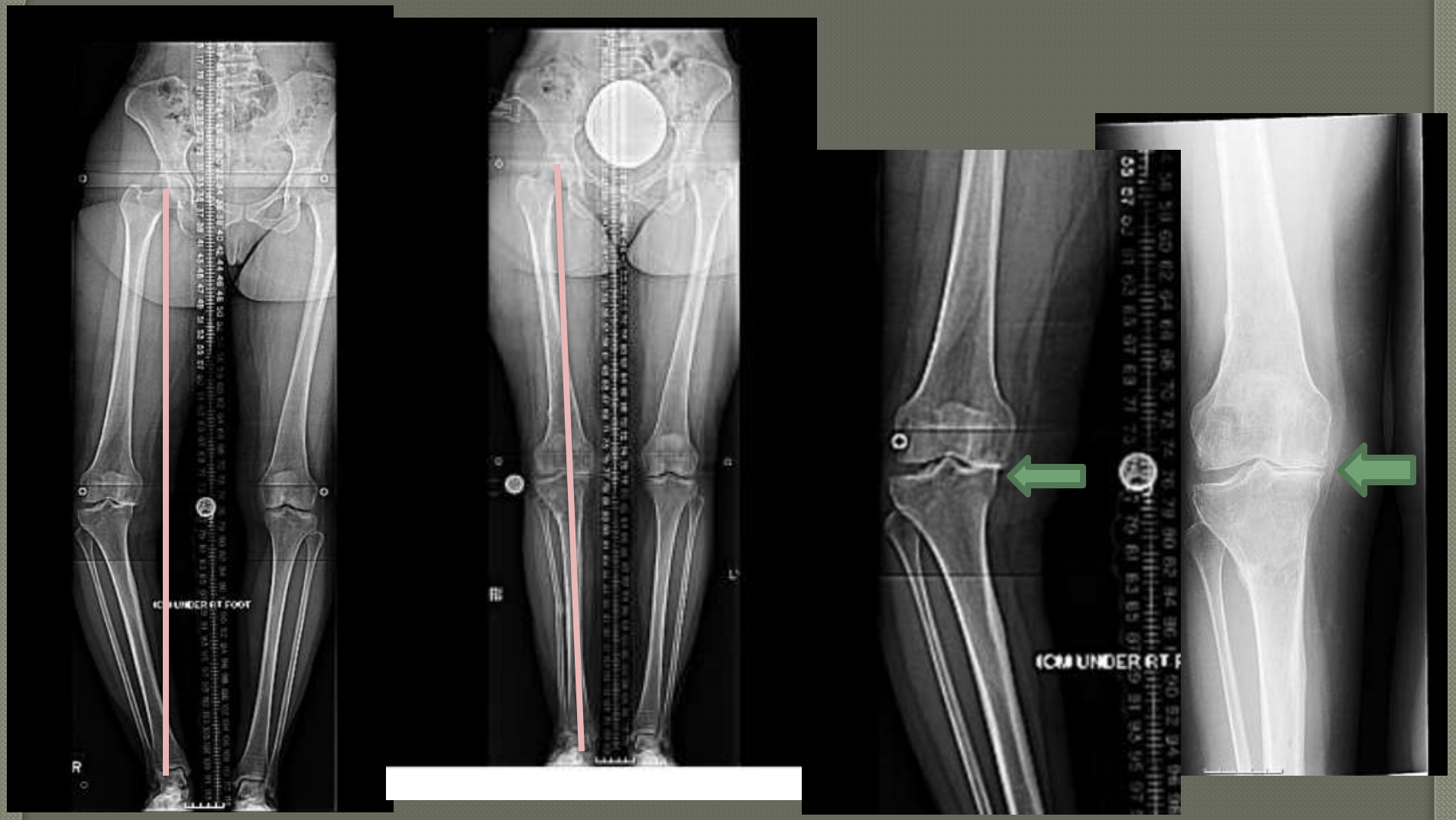
24 deg deformity

8 deg femur
8 deg joint
8 deg tibia

Osteotomy or TKR







Ligamentous Insufficiency

- ACL Insufficiency
  - Decrease posterior slope
- PCL Insufficiency
  - Increase posterior slope
- LCL Laxity
  - Correct varus
- MCL laxity
  - Correct valgus

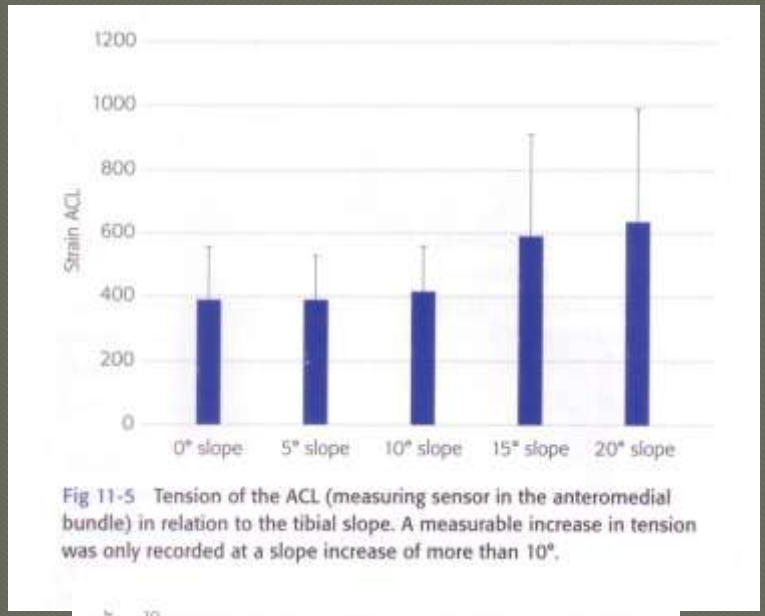


Fig 11-5 Tension of the ACL (measuring sensor in the anteromedial bundle) in relation to the tibial slope. A measurable increase in tension was only recorded at a slope increase of more than 10°.

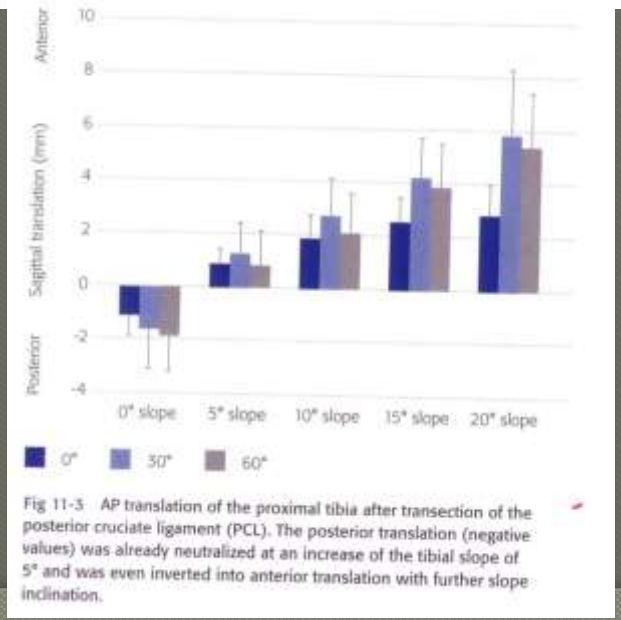


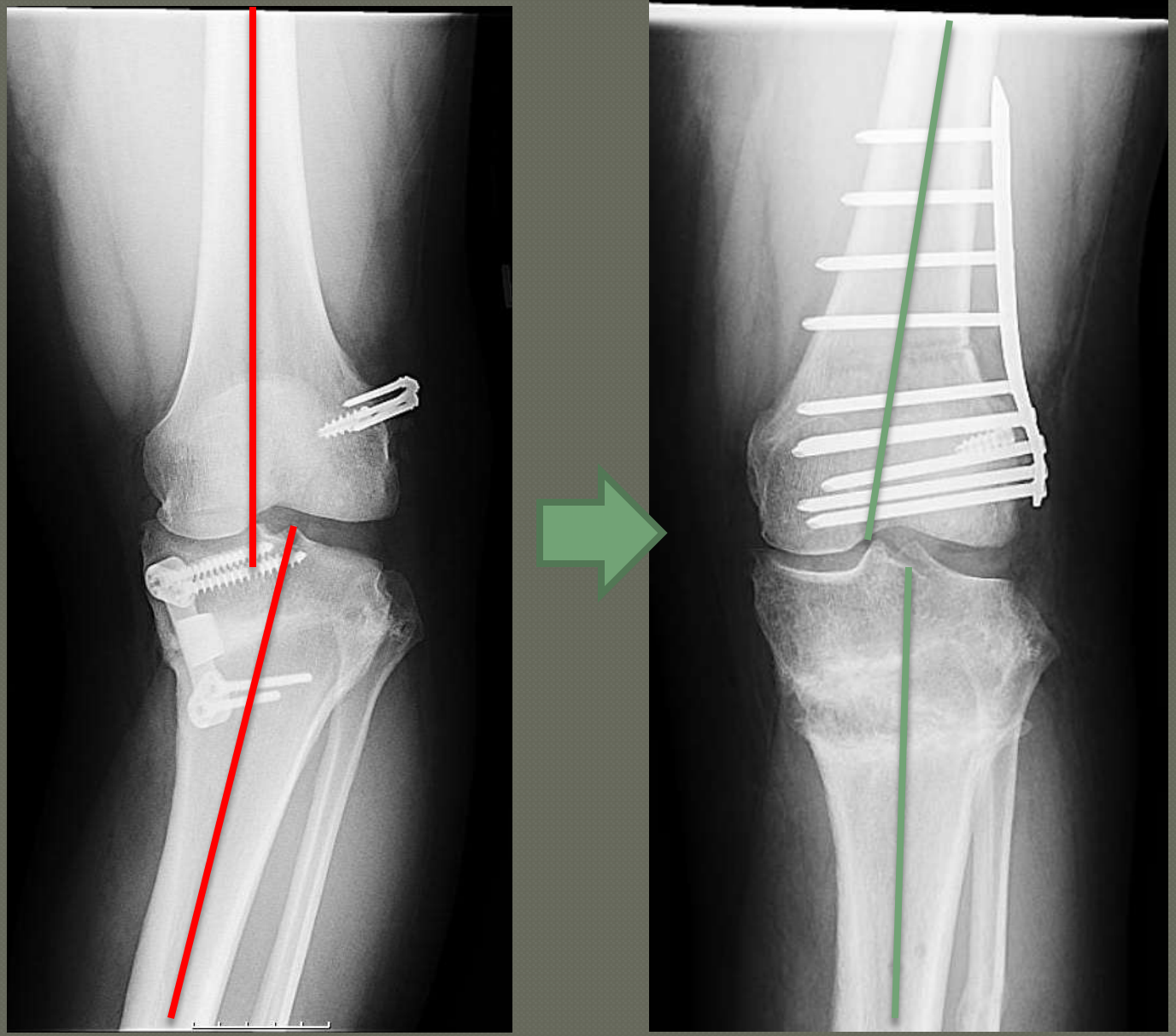
Fig 11-3 AP translation of the proximal tibia after transection of the posterior cruciate ligament (PCL). The posterior translation (negative values) was already neutralized at an increase of the tibial slope of 5° and was even inverted into anterior translation with further slope inclination.

Lobenhoffer: Osteotomies Around the Knee, Thieme, 2008

35 year old, femur + tibial deformity, LCL laxity, LLD, ACL laxity

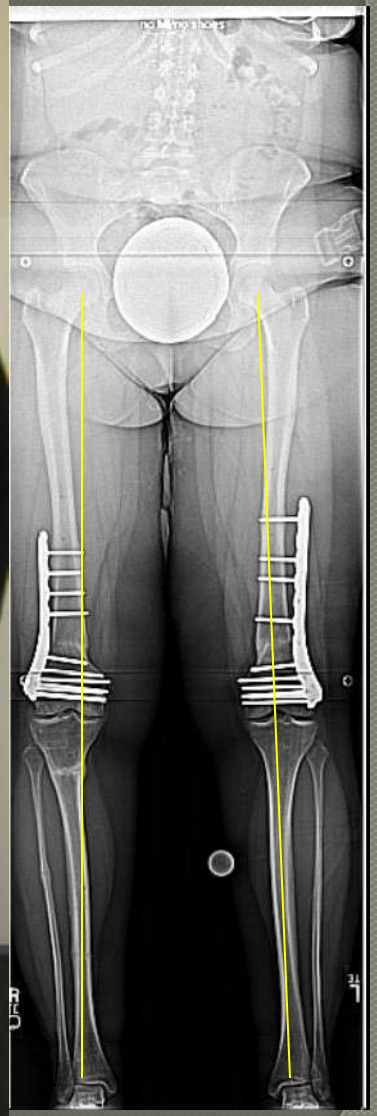

TAPOUT


no lift/no shoes

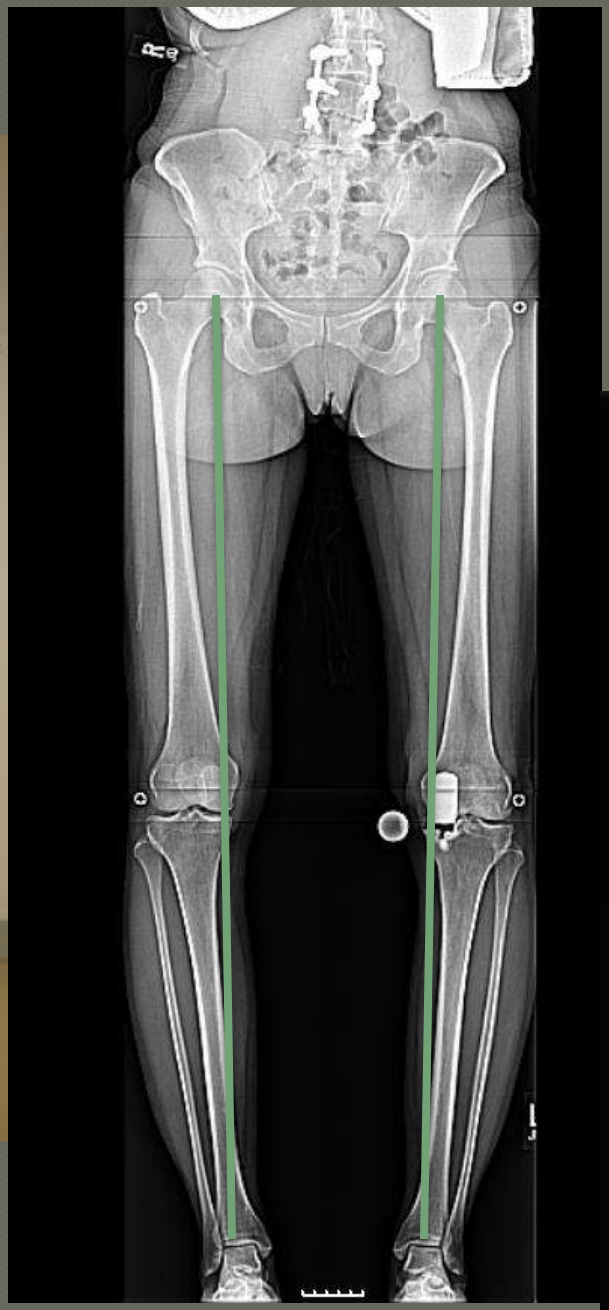


65 year old , femur deformity, some joint convergence

25 y/o, valgus, knee pain, lat compt DJD on scope, femur +tibia



46 y/o, bilat, medial knee pain.
Uni done 1 yr ago

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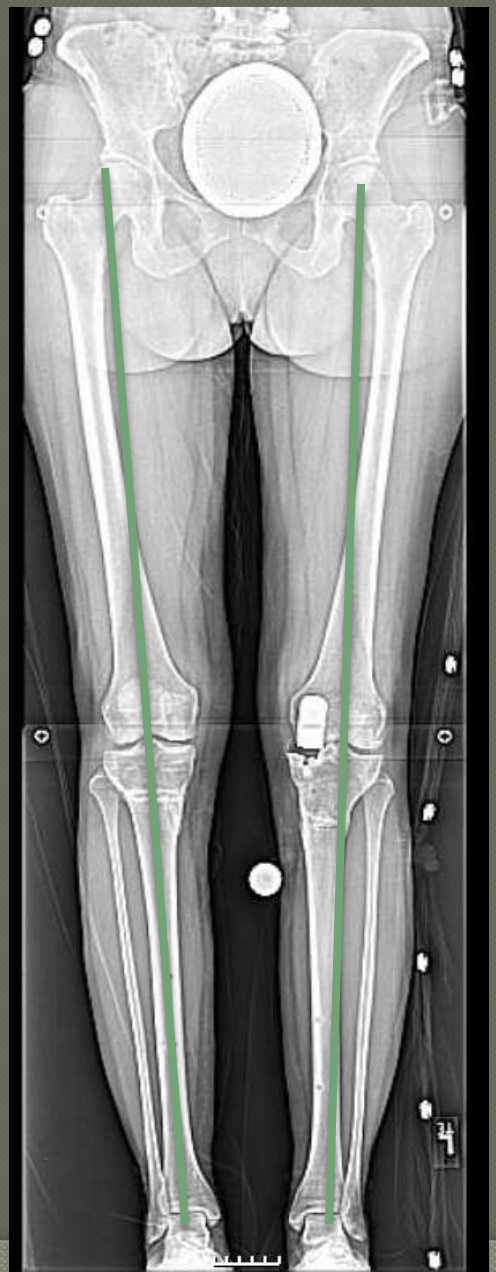

Pain resolved; uni was poor choice

25 year old: This should last forever too!!!!?????


OEC

W. H. Auden, Poet 1907-1973

- " Healing is not science but the intuitive art of wooing nature"
- Osteotomy is more like gardening than carpentry

Realignment osteotomy

- Alternative to arthroplasty
- Prevent arthrosis when done early
- In presence of arthrosis
  - Improve pain
  - Delay progression
  - Make arthroplasty easier in many cases
- Severe arthrosis
  - Improve pain , gait, balance

Future of joint reconstruction and joint preservation

- Biological solutions
- Mechanical principles
  - *"You can't cheat the laws of physics"*

Future

- Knee distraction
- Improved biologics
  - Stem cells
  - Growth hormone
  - Cartilage growth factors

Thank You

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