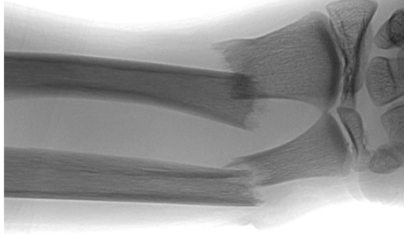


Lessons learned from forearm fractures in children



Joost Colaris MD, PhD
Orthopedic Traumasurgeon
EBHS Handsurgeon



1



Fracturen bij kinderen

2



Fracturen bij kinderen

Published in 2019

**NEWS
FLASH**

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5



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Treatment



7

Impaired rotation



Erasmus MC
Erasmus

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Malunions



Erasmus MC
Erasmus

9

Introduction

Erasmus MC
Erasmus

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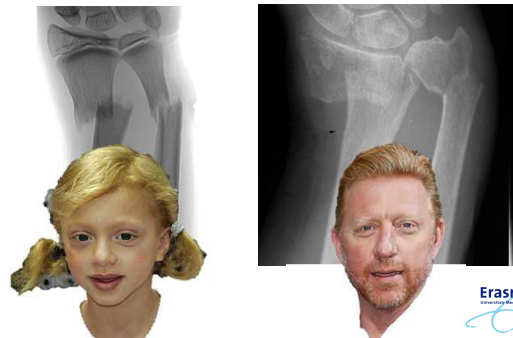
Same, same but different



Erasmus MC
Erasmus

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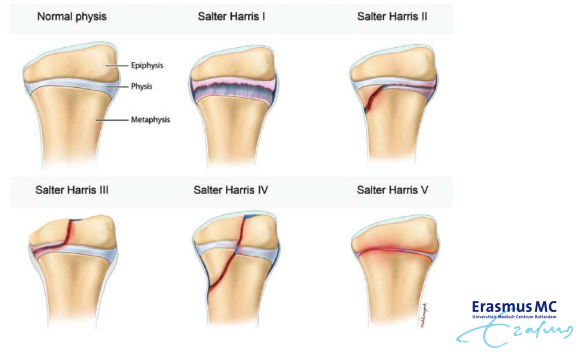
Same, same but different



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Growthplates



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Growthplates



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Elastic bone



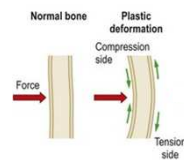
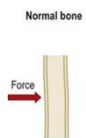
15

Elastic bone



16

Elastic bone

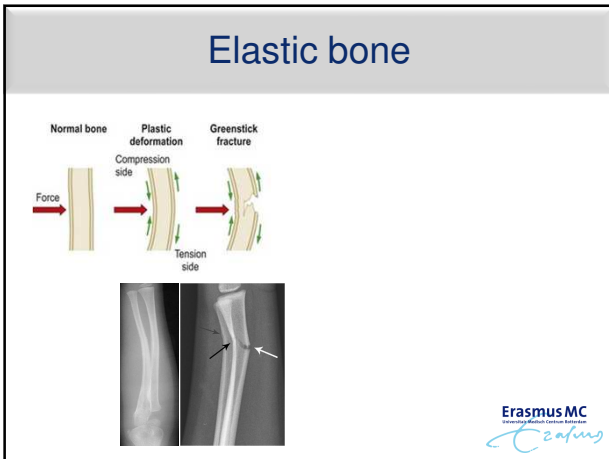


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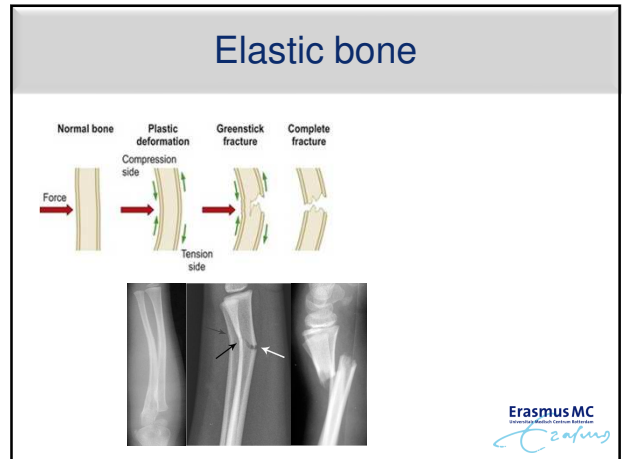
Elastic bone



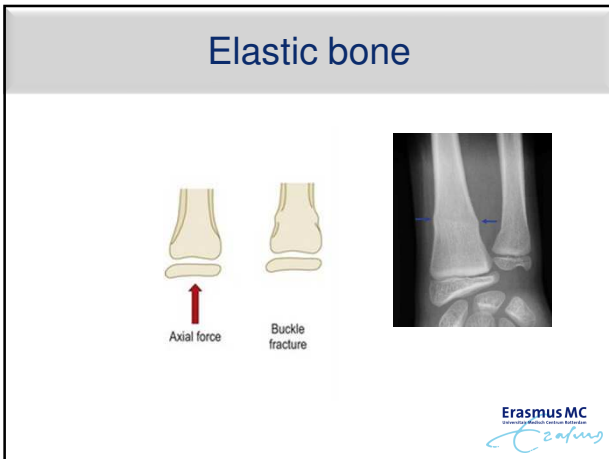
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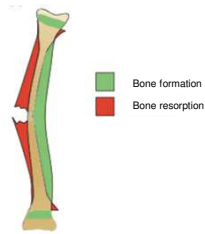


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Correction by growth

Asymmetrical growth of growthplate, **75%**

Periost, **25%**



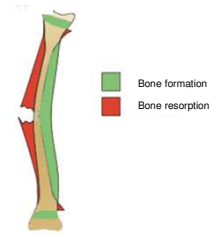
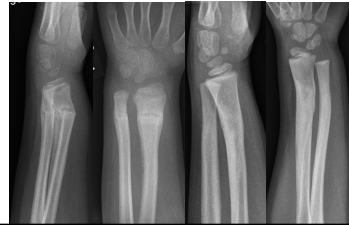
Dr. M.Heeg Dr. JD Visser
Een consult kinderorthopedie

25

Correction by growth

Asymmetrical growth of growthplate, **75%**

Periost, **25%**



Dr. M.Heeg Dr. JD Visser
Een consult kinderorthopedie

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More correction

Younger age



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More correction

Younger age

Boy



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More correction

Younger age

Boy

Distal fracture (close to the most active distal growth plate)



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More correction

Younger age

Boy

Distal fracture (close to the most active distal growth plate)

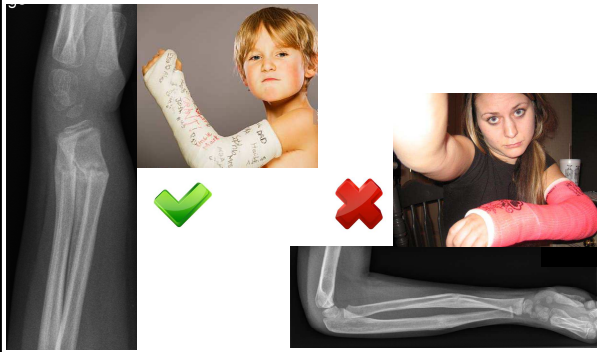
Angulation in sagittal direction (most function)



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Best correction by growth?

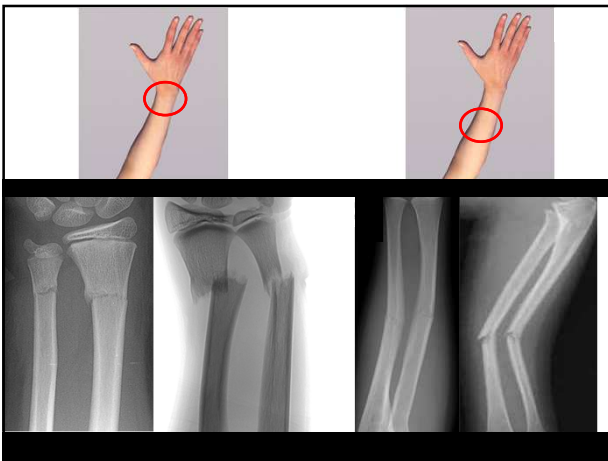


31

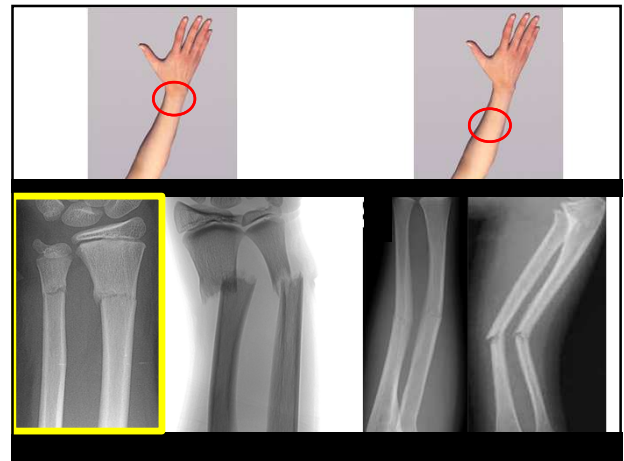
Fractures

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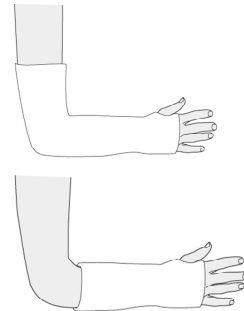
DISTAL, minimally displaced



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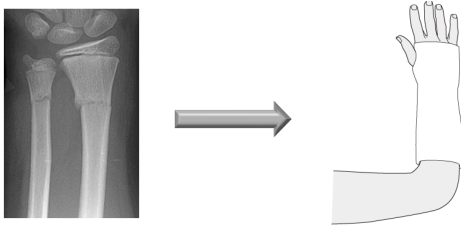
DISTAL, minimally displaced



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DISTAL, minimally displaced



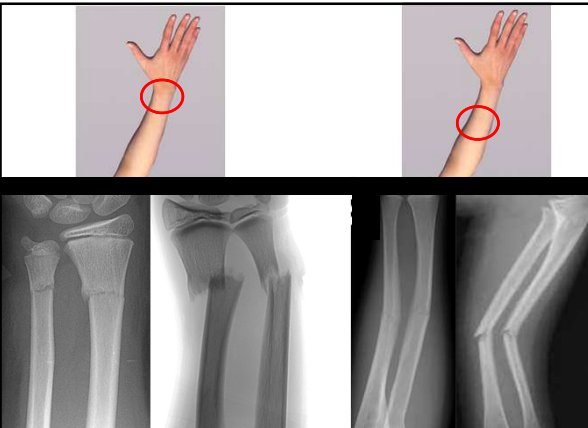
Bohm. Above and below-the-elbow plaster casts for distal forearm fractures in children. A randomized controlled trial. J Bone Joint Surg Am. 2006

Colaris. Below-elbow cast for metaphyseal both-bone fractures of the distal forearm in children: A randomised multicentre study. Injury 2012

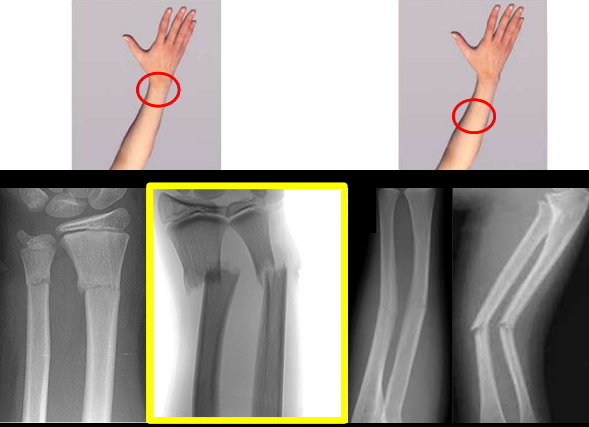
Webb. Comparison of short and long arm plaster casts for displaced fractures in the distal third of the forearm in children. J Bone Joint Surg Am. 2006

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Erasmus Universiteit Rotterdam

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DISTAL, displaced



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Federatie Medisch Specialisten

Fracturen bij kinderen

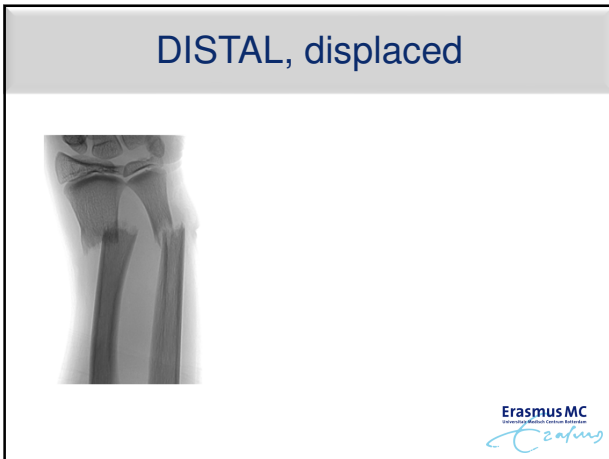
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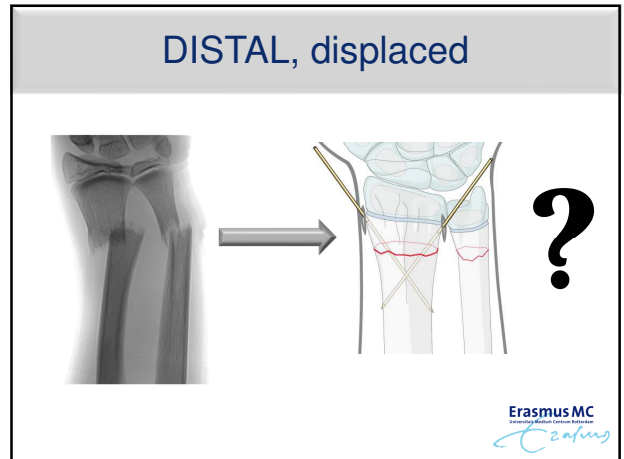
DISTAL, displaced

Age	Angulation in degrees
0-5	25
5-10	15
>10	10-15
50% bone contact	

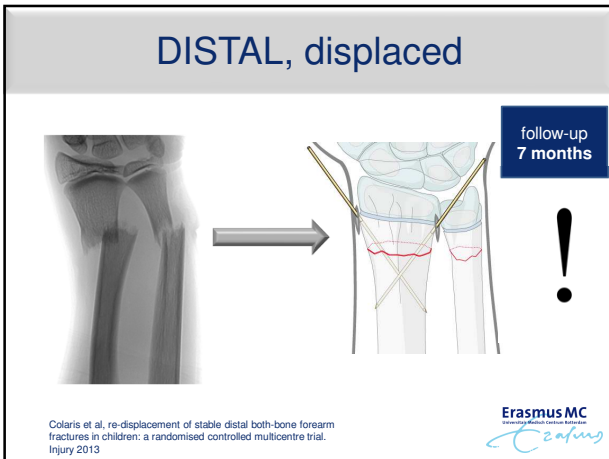
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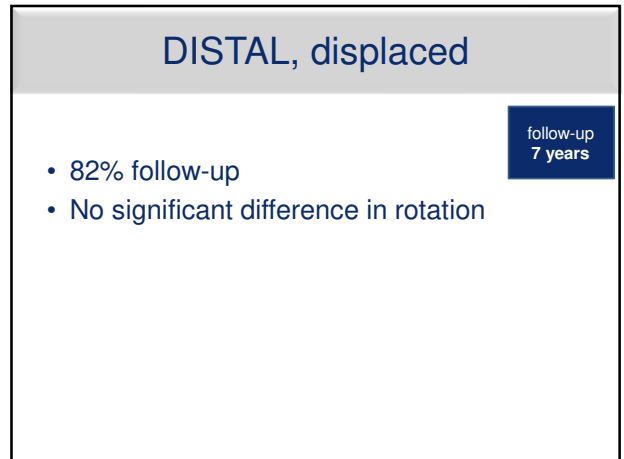
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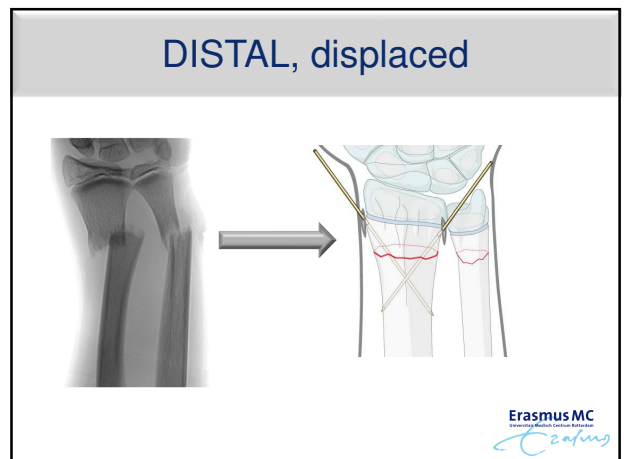
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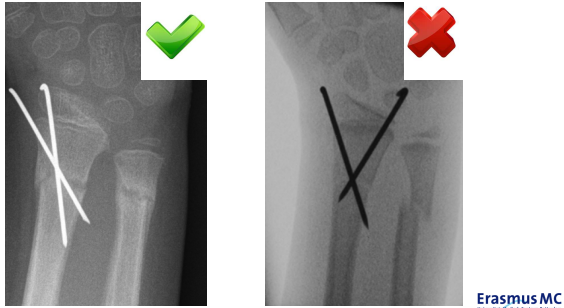


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K-wires not crossing in fracture



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Don't cut the K-wires too short!



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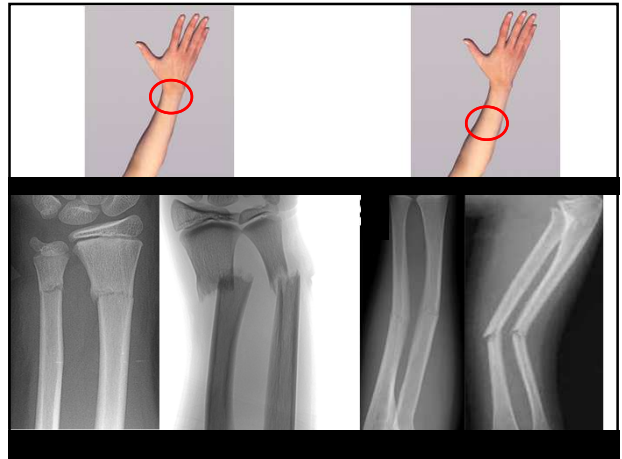
50

Remove K-wires outdoor patient clinic

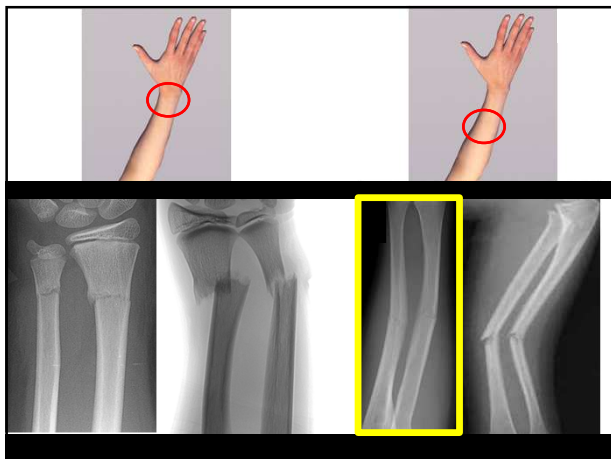


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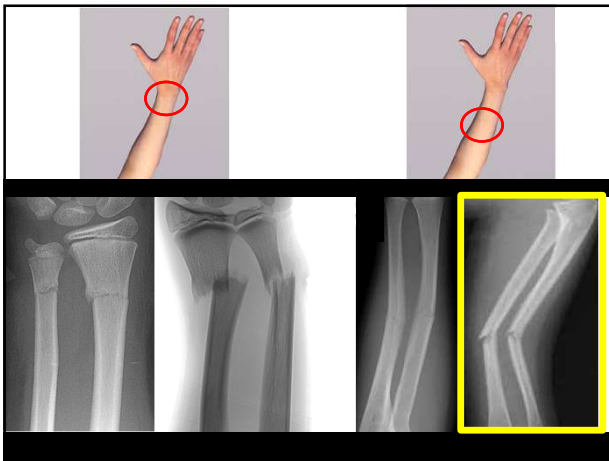
MIDSHAFT



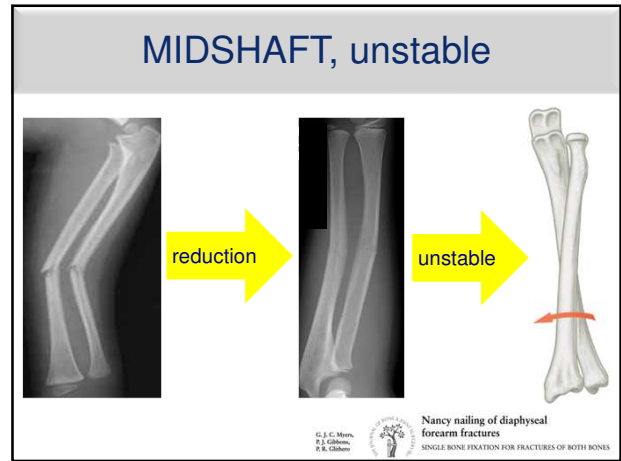
reduction

?

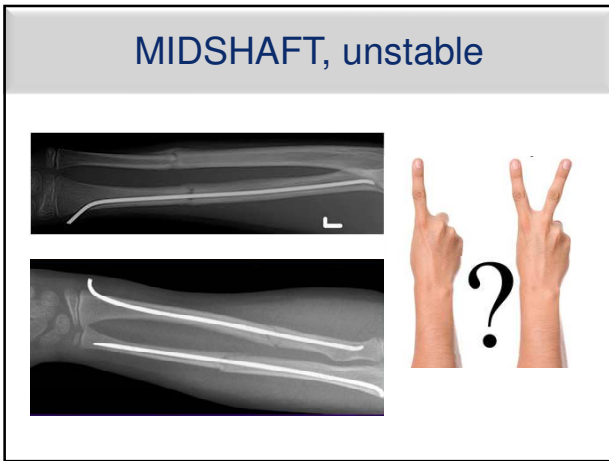
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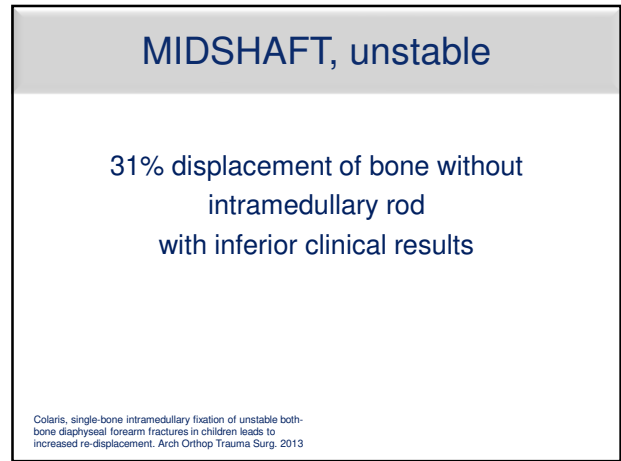
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66

MIDSHAFT, unstable

Journal of Orthopaedic Trauma, 28(1):e8-e14, JAN 2014
 DOI: 10.1097/BOT.0b013e31829203ea, PMID: 23542745
 Issn Print: 0890-5339
 Publication Date: 2014/01/01

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Both Bone Forearm Fractures in Children and Adolescents, Which Fixation Strategy Is Superior – Plates or Nails? A Systematic Review and Meta-Analysis of Observational Studies

Keith Baldwin; Martin J. Morrison; Lauren A. Tomlinson; Rey Ramirez; John M. Flynn

MIDSHAFT, unstable

Abstract

Objectives: To determine which method of fixation is superior for pediatric both bone forearm fractures (BBFF).

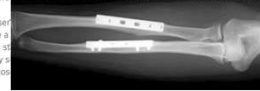
Data Sources: PubMed, EMBASE, and Cochrane.

Study Selection: We selected for detailed review with IMN or open reduction internal fixation (ORIF) for BBFF. Outcomes of interest including fracture union, complications, functional outcomes.

Data Extraction: Data were extracted from each study; publication bias was assessed using the standardized method described by Zaza et al.

Data Synthesis: A DerSimonian and Laird random-effects model was used to assess differences between dichotomous variables. A continuity correction was applied in cases of zero events.

Conclusions: All studies identified were observational. The literature fails to demonstrate a significant difference regardless of fixation strategy. Although the difference was not statistically significant, IMN provides improved cosmetic results in the fixation of pediatric BBFF. The results were excellent in nearly 9 of 10 patients, although the type of complication may vary. IMN provides improved cosmetic results.



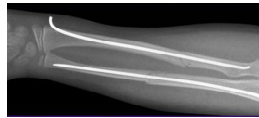
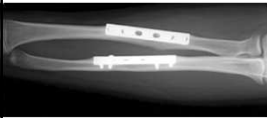
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Fracturen bij kinderen

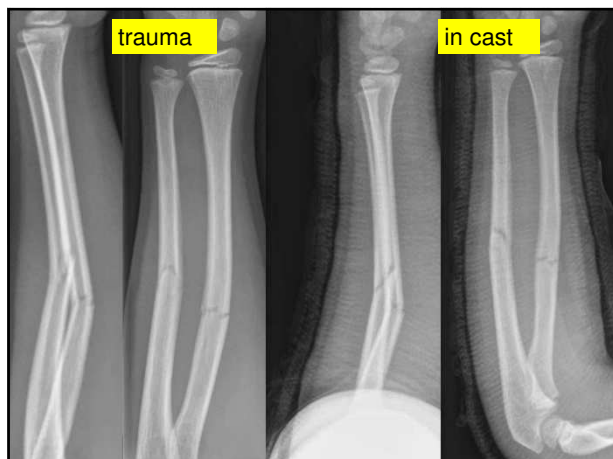


Complications

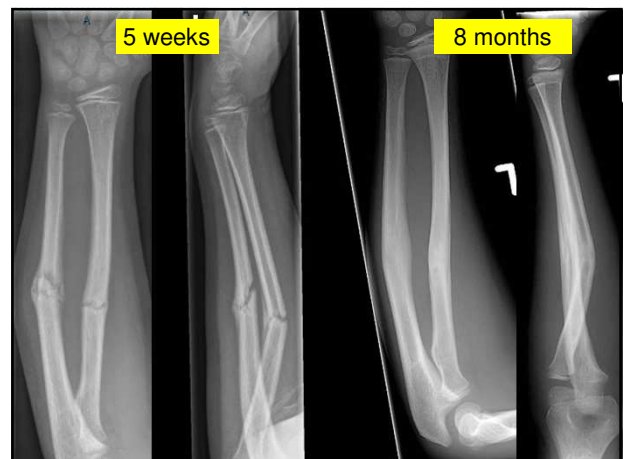
Erasmus MC
Erasmus

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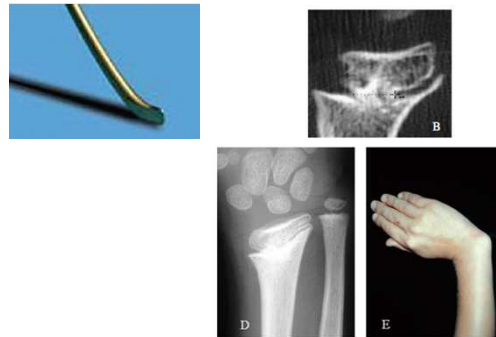
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Malposition K-wires



73

Growth arrest



74

Growth arrest



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Re-fractures



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Fracture displacement



77

Fracture displacement


30% of fractures treated in cast!



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Fracture displacement

30% of fractures treated in cast!

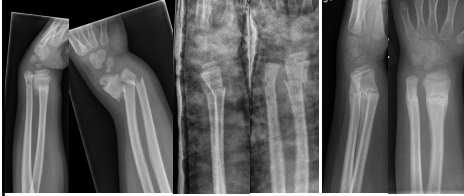


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Fracture displacement

30% of fractures treated in cast!




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Fracture displacement

30% of fractures treated in cast!



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Fracture displacement

Risk factors

Non-dominant arm	p 0.024
Complete fracture	p 0.040
Translation ulna lateral X-ray	p 0.014
Shortening fracture	p 0.019

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Colaris et al, risk factors for the displacement of both bones forearm fractures, Bone Joint J, 2013

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Fracture displacement

Risk factors

Non-dominant arm	p 0.024
Complete fracture	p 0.040
Translation ulna lateral X-ray	p 0.014
Shortening fracture	p 0.019


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Colaris et al, risk factors for the displacement of both bones forearm fractures, Bone Joint J, 2013

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Fracture displacement

Risk factors



Colaris et al, risk factors for the displacement of both bones forearm fractures, Bone Joint J, 2013

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Impaired rotation



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7 months follow-up:
39% impaired rotation $\geq 15^\circ$

Colaris et al. Which factors affect limitations of pronation/supination after forearm fractures in children? A prospective multicentre study. Injury. 2014

87



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2011

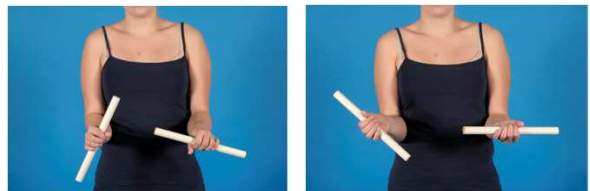


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2011



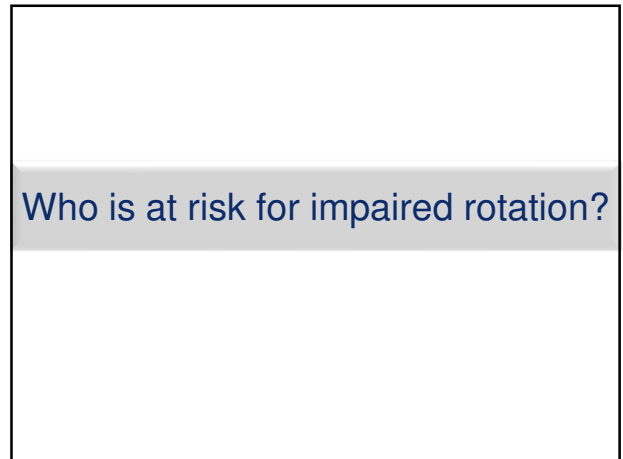
2016



90



91



92

follow-up 7 months

Malunion (degrees)	Impaired rotation (%)
0-5	9
6-10	9
11-15	13
>16	60

93

follow-up 7 months

Malunion (degrees)	Impaired rotation (%)
0-5	9
6-10	9
11-15	13
>16	60

94

At risk for impaired rotation

Logistic regression analysis

follow-up 7 months

Re-fracture	OR 11.7
Midshaft fracture	OR 3.3
Less physiotherapy	OR 1.1

Colaris, which factors affect limitation of pronation/supination after forearm fractures in children? A prospective multicentre study. Injury. 2014

95

At risk for impaired rotation

Logistic regression analysis

follow-up 7 years

Re-fracture	OR 1.9
-------------	--------

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Re-fracture

17% midshaft fractures
11% distal fractures



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Re-fractures

17% midshaft fractures
11% distal fractures



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Re-fractures



Fracturen bij kinderen



Prohibition of sports during 3 months
children >10 years old with midshaft fracture



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Malunion



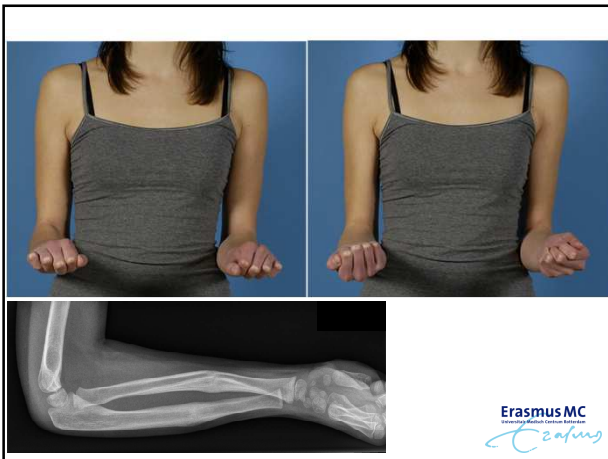
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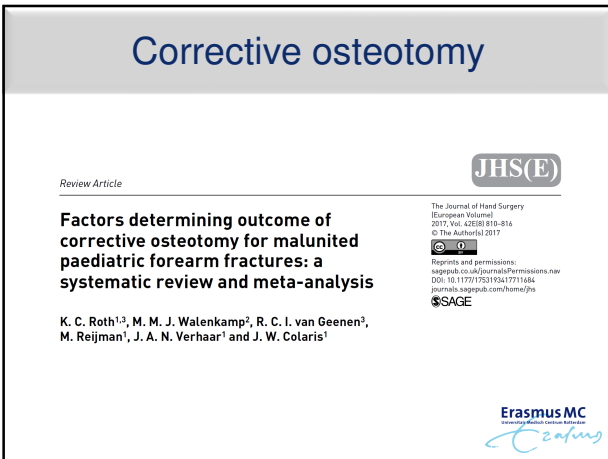
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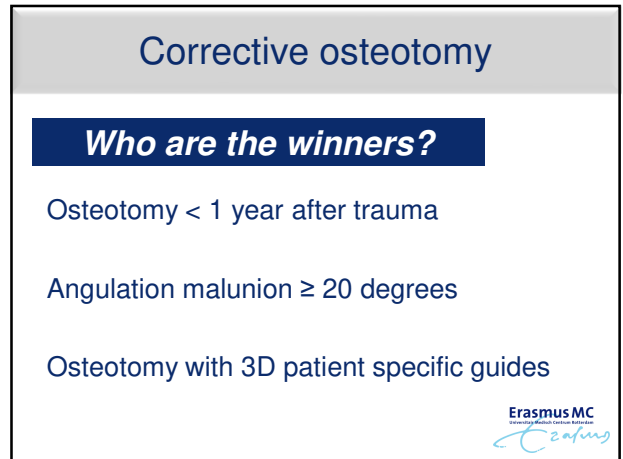
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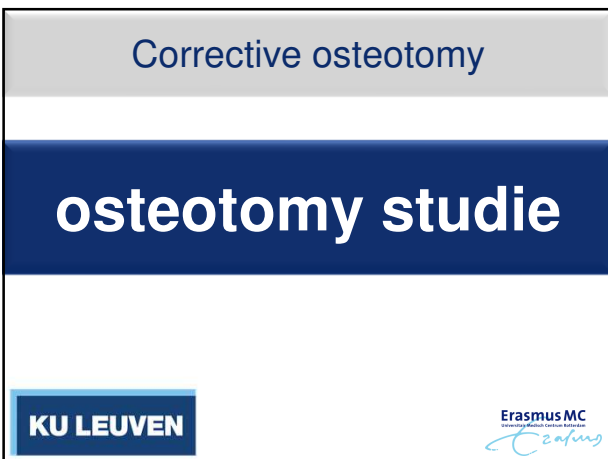
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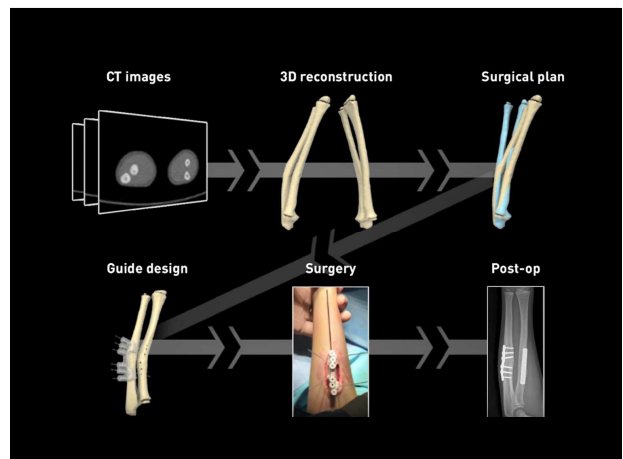
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Osteotomy study

Inclusion

- ≥ 10 years
- Symptomatic malunion after both-bone forearm fracture
- Pronation or supination < 50 degrees

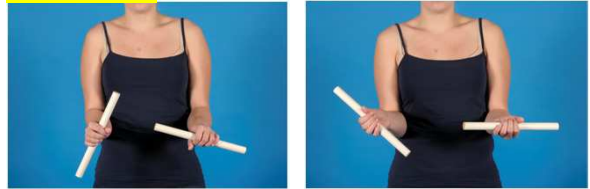
Exclusion

- Bone deformity of contralateral arm



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Pre-operative



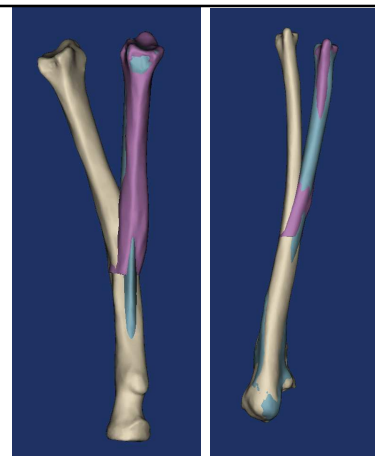
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Pre-operative



111

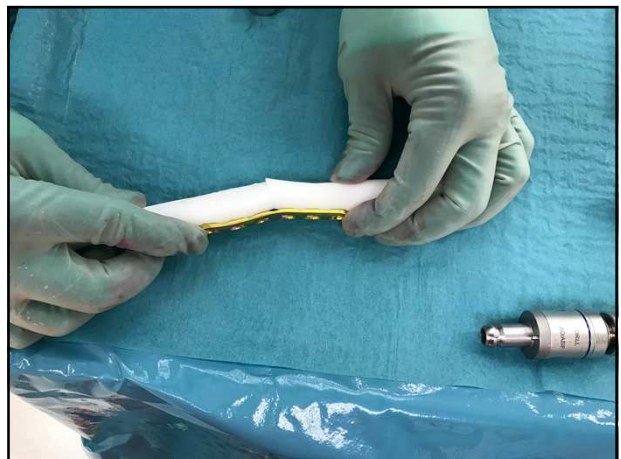
Pre-operative



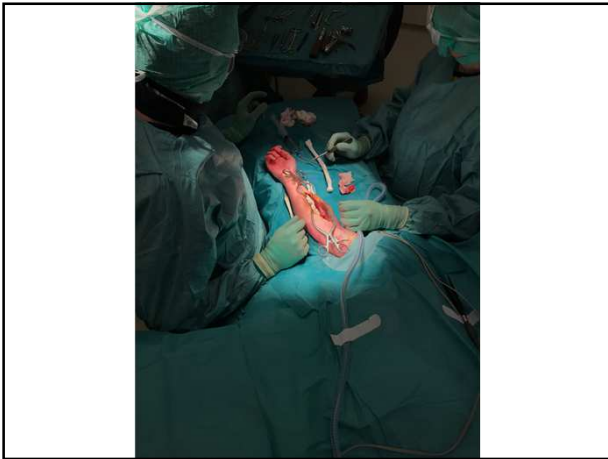
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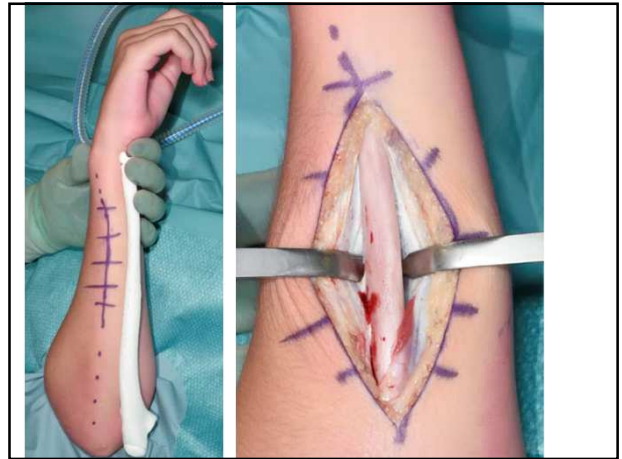
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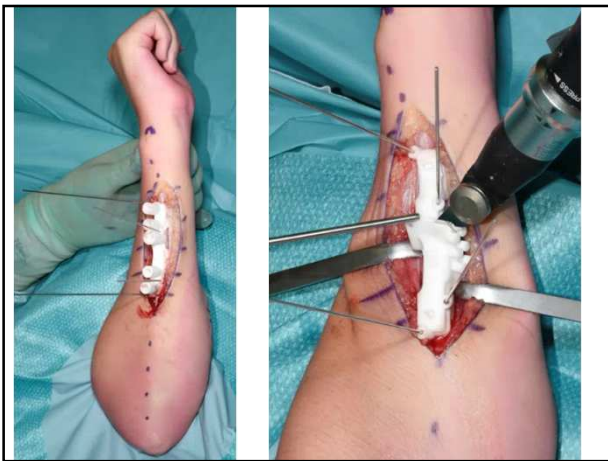
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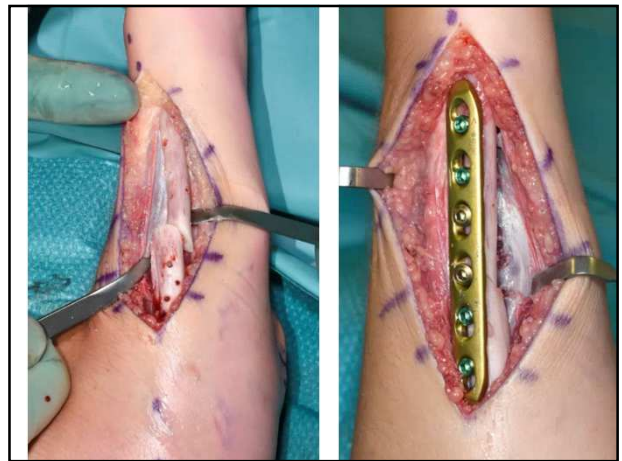
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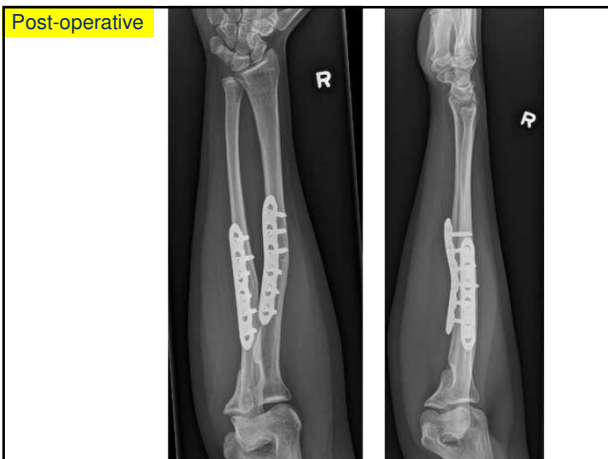
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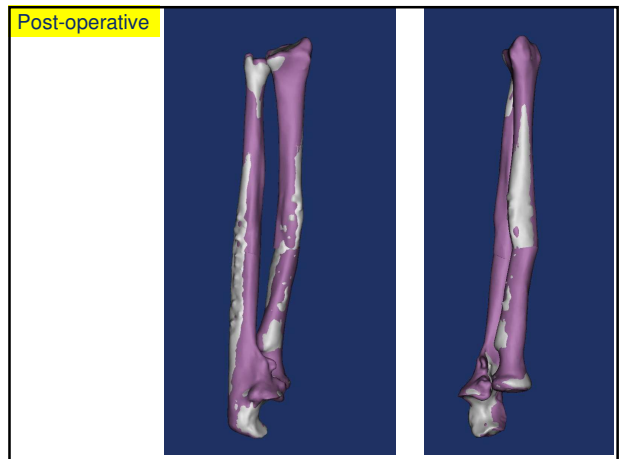
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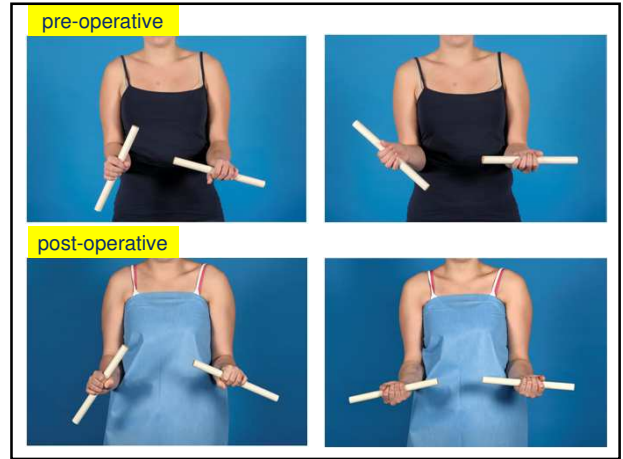
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Osteotomy study		
	Mean pro-supination	
Before osteotomy	66 degrees	follow-up 1 year
After osteotomy	124 degrees	

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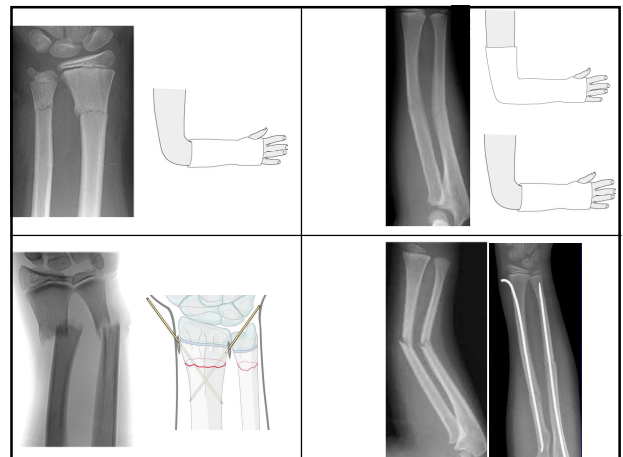
Osteotomy study		
	Mean pro-supination	
Before osteotomy	66 degrees	follow-up 1 year
After osteotomy	124 degrees	
Impaired rotation from 66% to 17%!		

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High risk of impaired rotation

Mild malunion midshaft fractures

Severe malunion distal fractures

Re-fractures



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Corrective osteotomy

Winners

Osteotomy < 1 year after trauma

Angulation malunion ≥ 20 degrees

Osteotomy with 3D patient specific guides



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Corrective osteotomy

Good results osteotomy study



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Thank you!



j.colaris@erasmusmc.nl



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