Extra-articular fractures of the distal radius

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Historical perspective

In 1814, when Dr. Colles' described the fracture, there was no anesthesia (1846), no aseptic surgery (1865), no radiography (1895), and no electricity (1879)

He stated that:

> *… these fractures tended to do well despite considerable permanent deformity…*

Treatment has long been defined by the lack of correlation between anatomic reduction and function

This idea is only true in extremely elderly, dependent patients, with low functional needs

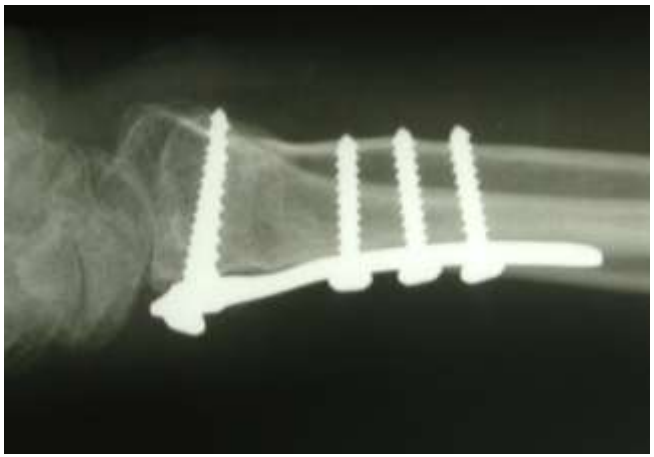
Thus, today **anatomic reduction** is the goal because it makes it possible to limit loss of function

When the dorsal angle is greater than 20◦, radial inclination is below 10◦, and radial shortening is more than 6 mm, there are definite functional consequences

A fracture with malunion is going to affect both the

radiocarpal joint (alignment, loss of flexion—extension, loss of wrist strength)

radioulnar joint (loss of pronosupination, ulnocarpal impingement syndrome).



The problem is not the type of fixation or the immobilization technique, but the **quality** and **stability** of reduction.

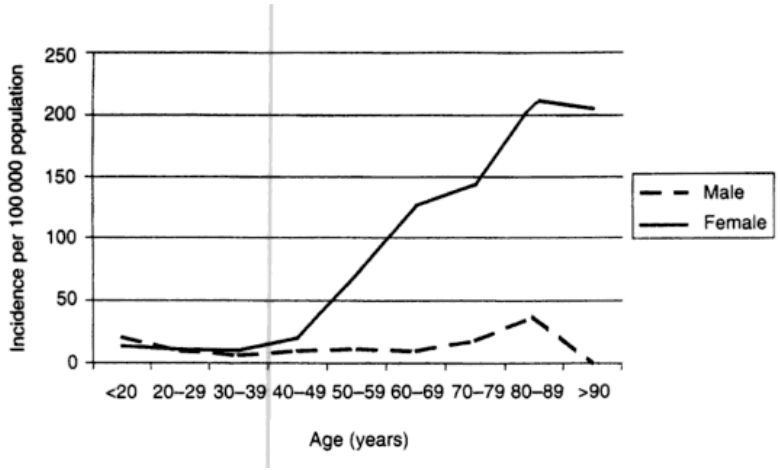
Incidence

16% of all fractures treated in the emergency room in the US and 75% of fractures of the forearm

Difficult to documented Type A #

Frykman 36%

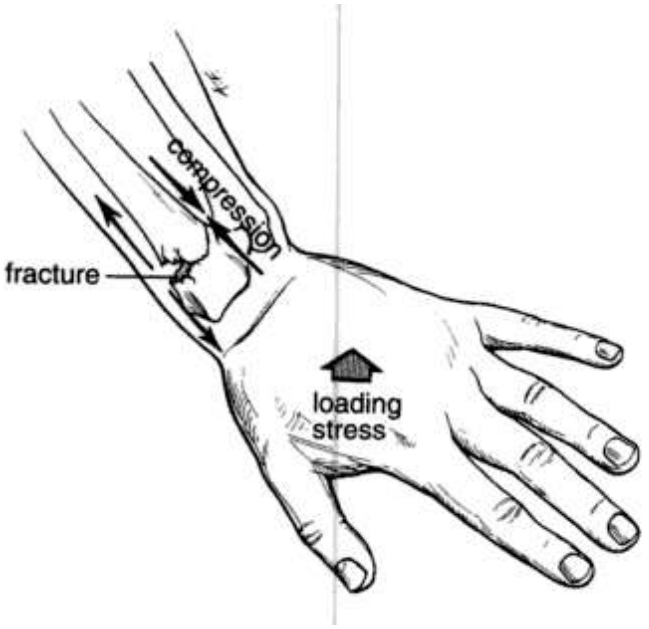
McQueen 48%

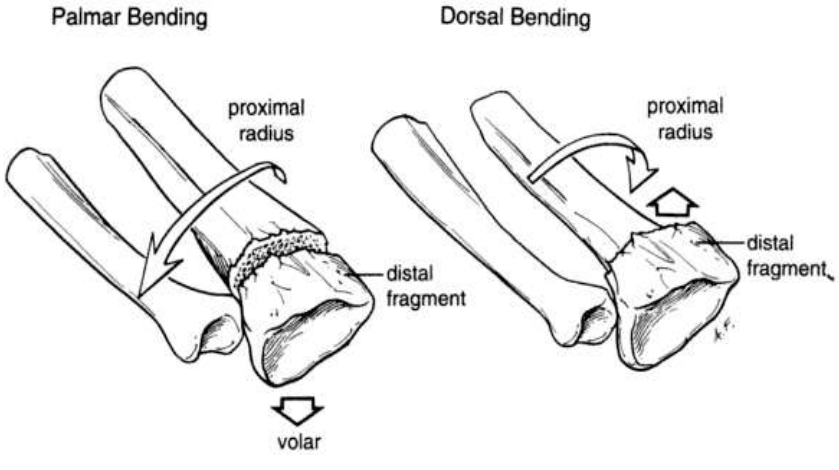


Mechanism

Fall on the outstretched hand

Thrust of the torso transmitted along the radius long axis counteracted by the ground reaction force acting in a proximal direction through the carpal bones

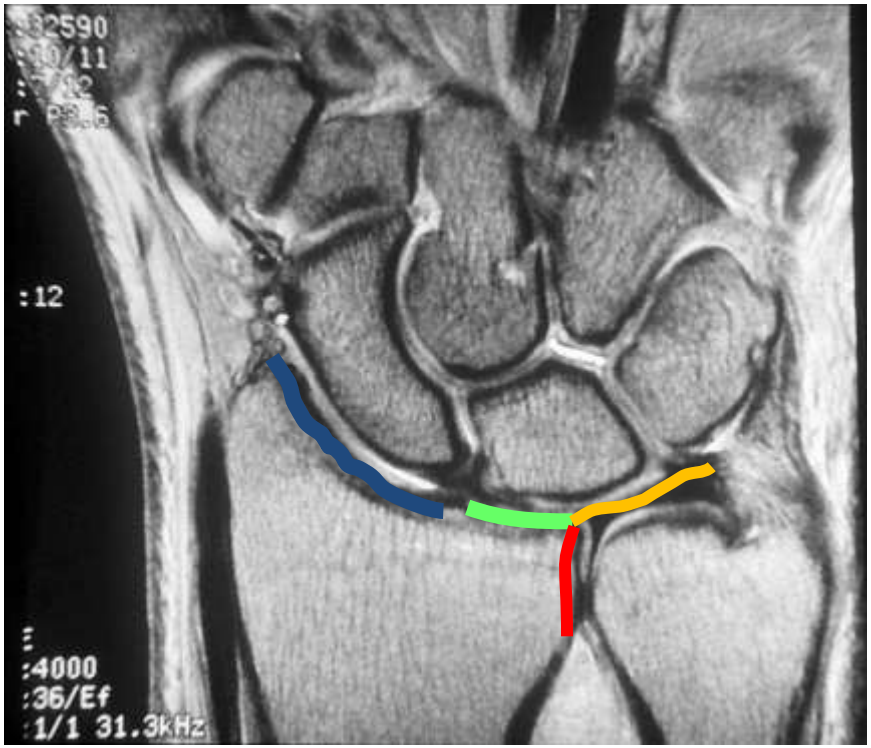




Anatomy

scaphoid and lunate fossa

Ridge normally exists between these two



sigmoid notch:

second important

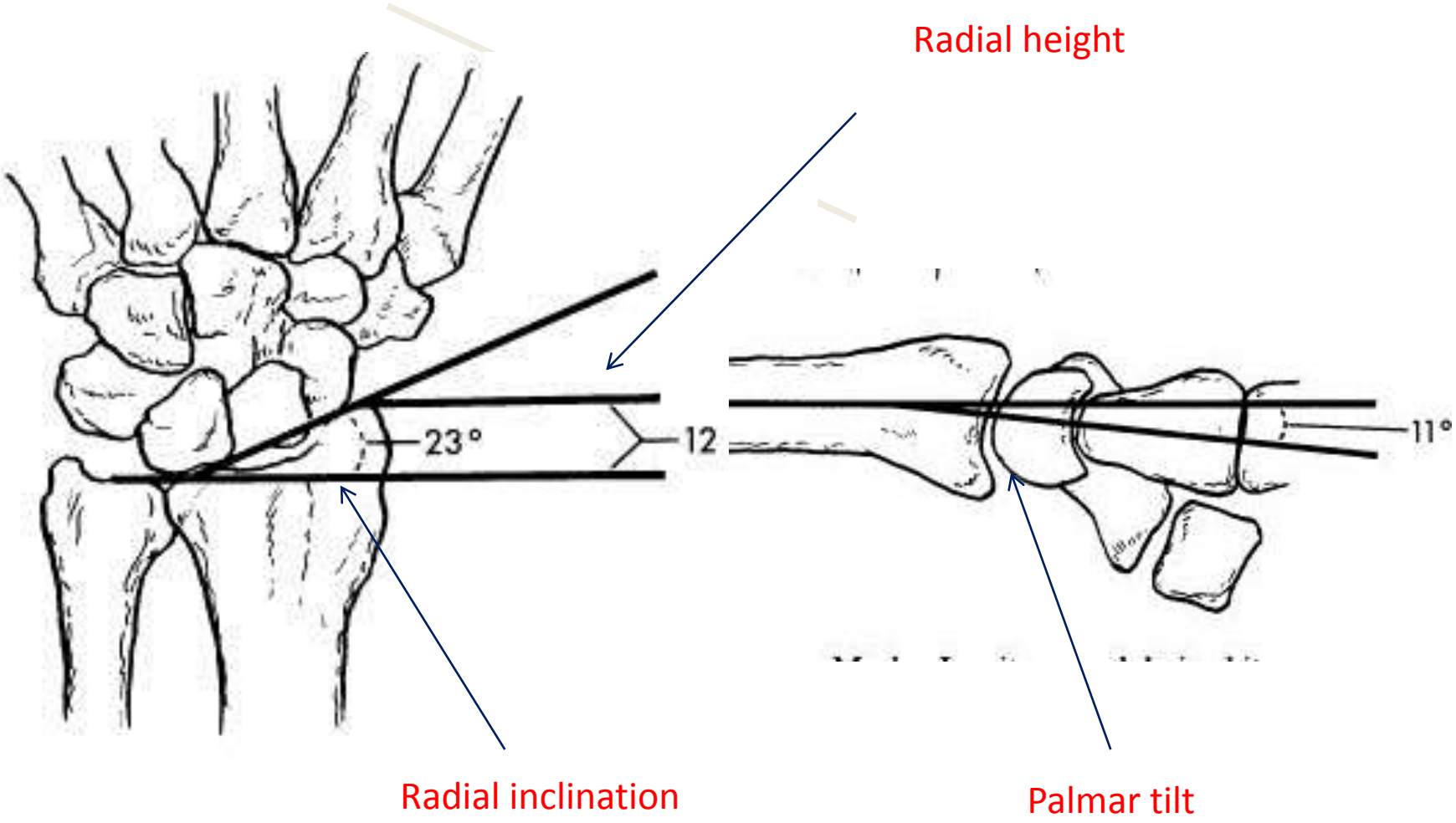
articular surface

TFCC:

distal edge of radius

to base of ulnar styloid

Radiological evaluation



CT scan

Intra-articular # with multiple fragments

centrally impacted fragments

DRUJ incongruity

Dorsal angulation and comminution

Volar subluxation of carpus with fracture fragment

Classification

presence or absence of intra-articular involvement,

- degree of comminution,
- dorsal vs. volar displacement,
- involvement of the distal radioulnar joint.

Classification

Ideal system should describe:

- Type of injury
- Severity
- Evaluation
- Treatment
- Prognosis

Common classifications

- Gartland/Werley
- Frykman
- Weber (AO/ASIF)
- Melone
- Column theory
- Fernandez (mechanism)

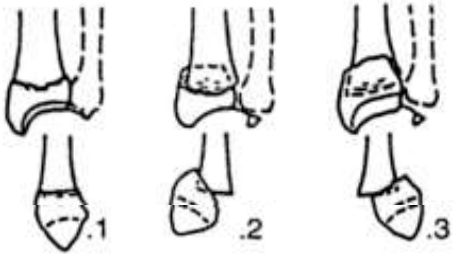
AO Classification

A1 EXTRAARTICULAR: Fractures neither affect the articular surface of the radiocarpal nor the radio-ulnar joints.

A1 Extra-articular fracture, of the ulna, radius intact

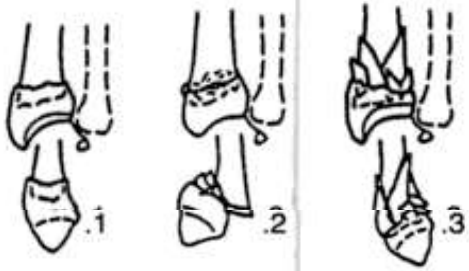
1 styloid process
2 metaphyseal simple
3 metaphyseal multifragmentary

A2 Extra-articular fracture, of the radius, simple and impacted



1 without any tilt
2 with dorsal tilt (Pouteau-Colles)
3 with volar tilt (Goyran-Smith)

A3 Extra-articular fracture, of the radius, multifragmentary



1 impacted with axial shortening
2 with a wedge
3 complex

Figure 5.8. AO/ASIF classification identifies the presence and extent of comminution as well as the direction of displacement of the distal fragment.

A1	Isolated extraarticular fracture of the ulna
	.1 Ulnar styloid
	.2 Simple metaphyseal fracture
	.3 Comminuted metaphyseal fracture
A2	Extraarticular fracture of the radius, simple and impacted
	.1 Nondisplaced
	.2 Dorsal displacement
	.3 Volar displacement
A3	Extraarticular fracture of the radius with varying degrees of metaphyseal impaction and comminution
	.1 Impacted (shortened)
	.2 With metaphyseal com minution
	.3 With metaphyseal-diaphy seal comminution

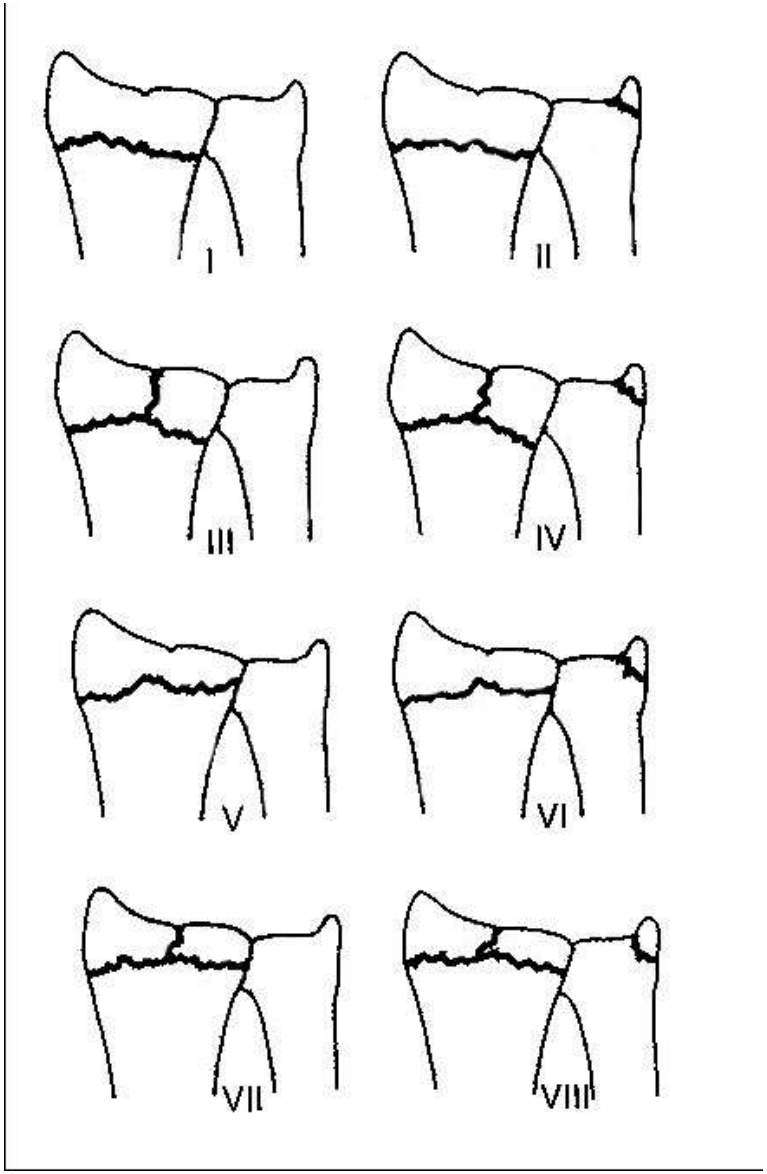
Frykman Classification

Extra-articular

Radio-carpal joint

Radio-ulnar joint

Both joints



{ Same pattern as odd numbers, except ulnar styloid also fractured

Column Theory

Radial Column

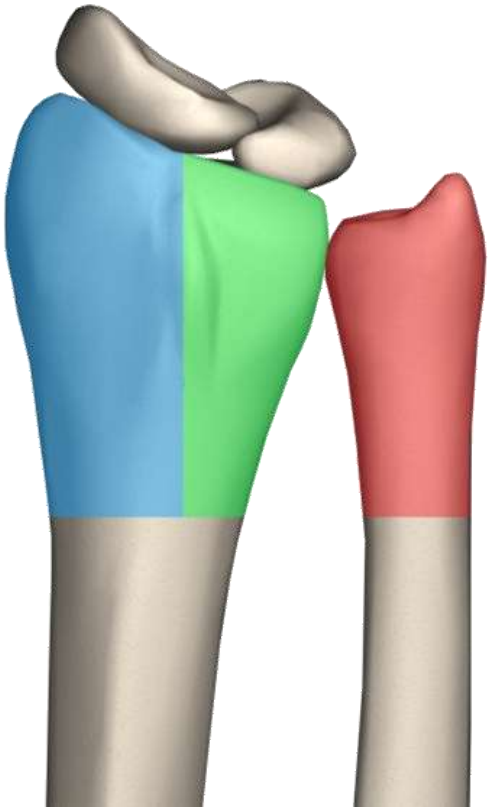
Lateral side of radius

Intermediate Column

Ulnar side of radius

Ulnar Column

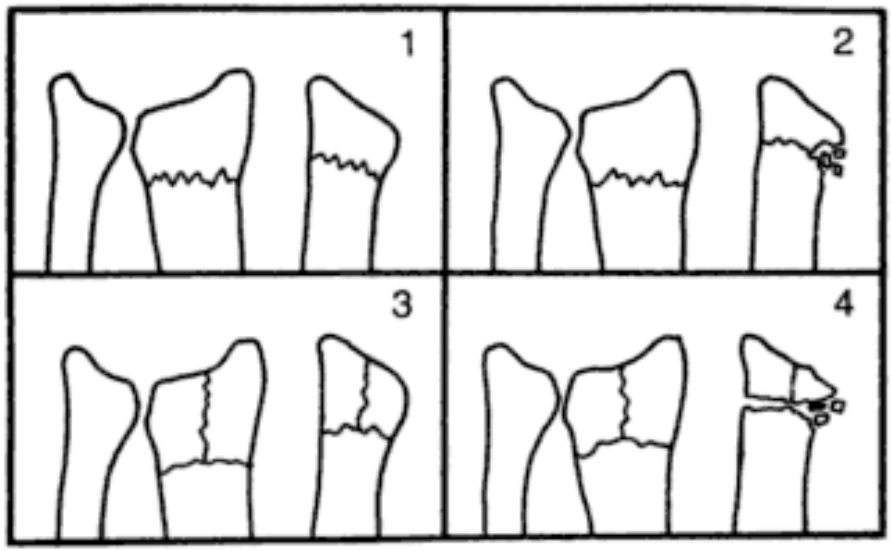
distal ulna



Classification

Jenkins' classification of dorsally displaced bending fractures

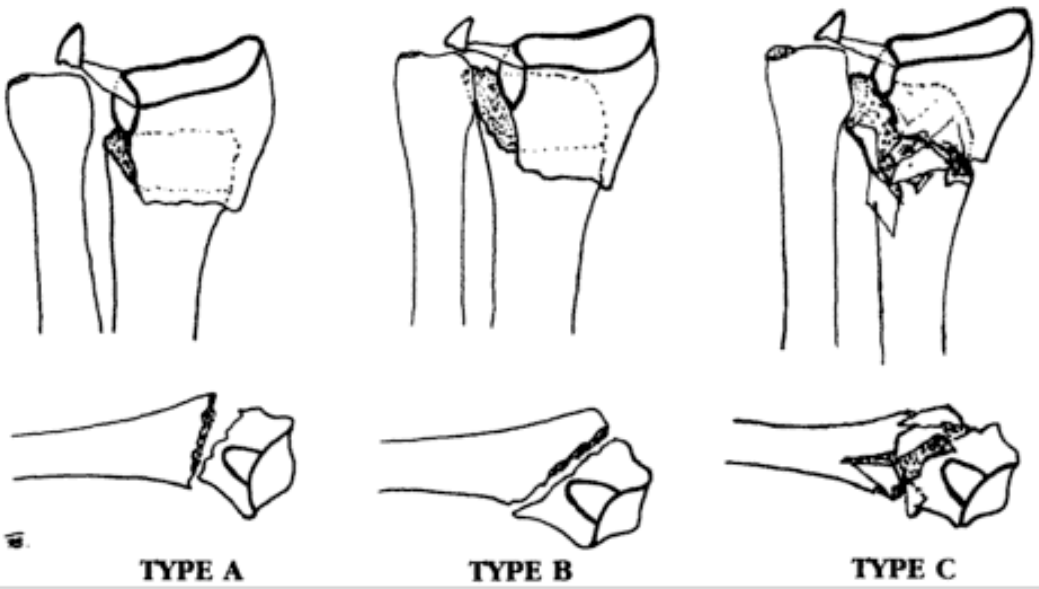
I. No visible comminution
II. Comminution of the dorsal cortex w/out comminution of the fracture fragment
III. Comminution of the fracture fragment w/out comminution of the dorsal cortex
IV. Comminution of both the dorsal cortex and the fracture fragment



Fernandez Classification of Extraarticular Palmar Displaced Bending Fractures

See Figure 5.12.[72]

Type A	Transverse metaphyseal fracture
Type B	Oblique metaphyseal fracture
Type C	Metaphyseal comminution



Treatment Goals

- Preserve hand and wrist function
- Realign normal osseous anatomy
- Promote bony healing
- Avoid complications
- Allow early finger and elbow ROM

Treatment options

Casting
- Long arm vs short arm
- Sugar-tong splint
- Cast and supplementary KW

External Fixation
- Joint-spanning
- Non bridging

Percutaneous pinning
- **radial styloid**
- **listers tubercle**
- **intrafocal Kapandji**

Internal Fixation
- Dorsal plating
- Volar plating
- Combined dorsal/volar plating
- Fracture specific plating

Bone graft or artificial void filler?

Indications for Closed Treatment

Low-energy fracture

Low-demand patient

Medical co-morbidities

Minimal displacement

Acceptable alignment

Acceptable Reduction Criteria

No dorsal angulation

> 15 degrees of inclination

Articular step-off < 2mm

< 5 mm shortening

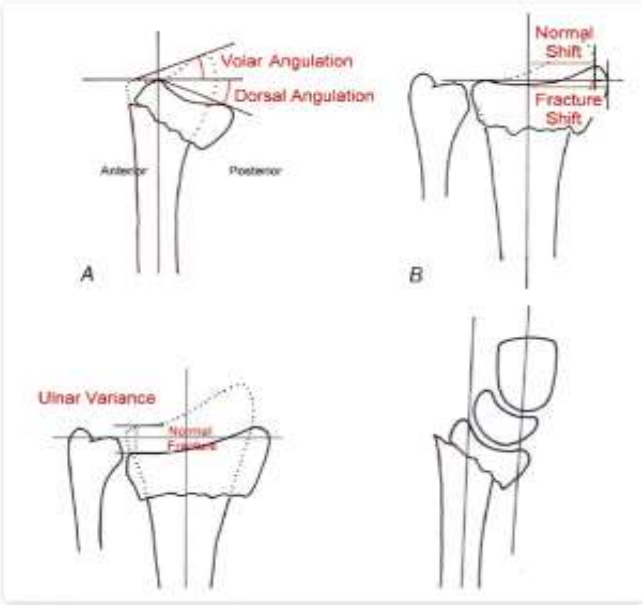
DRUJ congruent

http://www.trauma.co.uk/wristcalc

Wristcalc

This calculator can be used to estimate the risk of redisplacement and malunion following conservatively fractures of the distal radius.

The calculator is based upon the equations reported in Mackenney & McQueen, JBJS(Am) 2006.



Distal Radius Diagram

Dorsal angle	15
Ulnar variance	4
Age	68
Comminution	Dorsal
Independence	Independent

Submit

Predicted probability malunion:	**76 %**

Diagnostic Data:

DA 15
Ulnar 4
Comminuted 1
Age 68
Displaced 1
Independence 1
PI 1.16
EXPPI 3.18993327612

Injury, Int. J. Care Injured (2005) 36, 81–83

ELSEVIER

INJURY

www.elsevier.com/locate/injury

Which Colles' fractures should be manipulated?

Sean Dixon[a], Patricia Allen[b], Gordon Bannister[c,*]

Where the initial radial shortening was **3 mm** or more, the probability of malunion was 65% and if > **5 mm** the probability of malunion was 73%

with less than 3 mm, the probability of malunion was 28%

At 3 months, 18% excellent outcome, 34% good, 45% fair and 3% poor, according to the modified Gartland and Werley score

Injury, Int. J. Care Injured 40 (2009) 400–404

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Colles' fracture: Dorsal splint or complete cast during the first 10 days?

Tina Strømdal Wik [a,*], Åse T. Aurstad [a], Vilhjalmur Finsen [a,b]

There was no difference between the two treatments groups in reported pain or cast problems

Slight better radiological parameters in the full cast group

Unstable extra-articular fractures of the distal radius

A PROSPECTIVE, RANDOMISED STUDY OF IMMOBILISATION IN A CAST *VERSUS* SUPPLEMENTARY PERCUTANEOUS PINNING

T. Azzopardi,
S. Ehrendorfer,
T. Coulton,
M. Abela

J Bone Joint Surg [Br]
2005;87-B:837-40.

57 patients older than 60 years of age with unstable, extra-articular fractures of the distal radius

Percutaneous pinning provides only a marginal improvement in the radiological parameters compared with immobilisation in a cast alone.

This does not correlate with an improved functional outcome in a low-demand, elderly population.

Indications for Surgical Treatment

High-energy injury

Open injury

Secondary loss of reduction

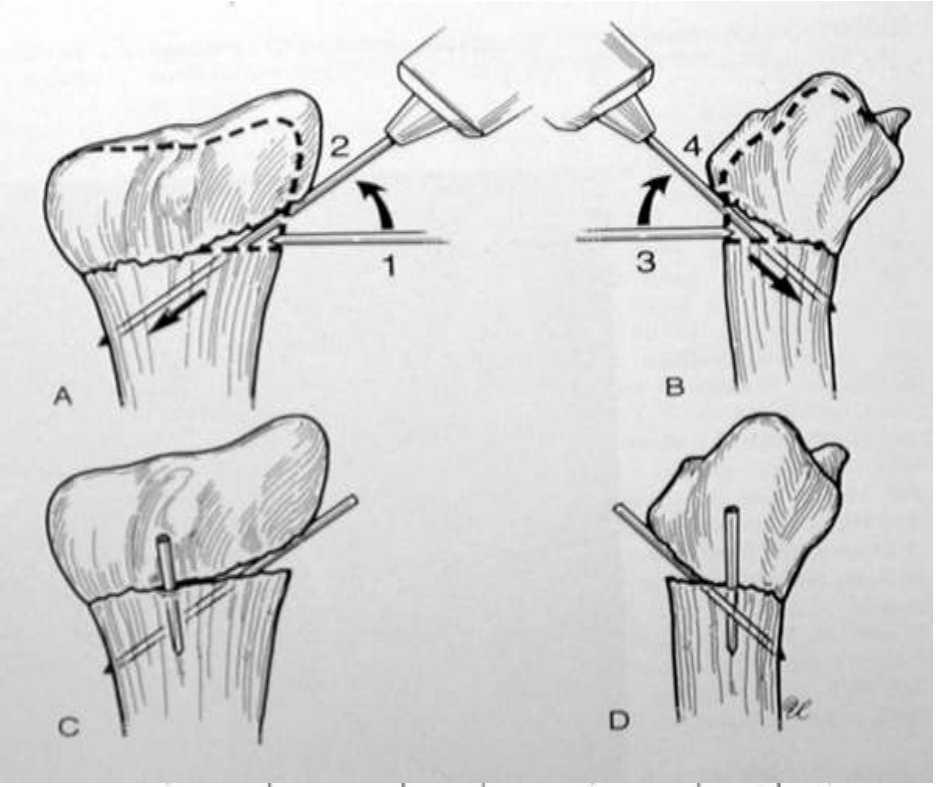
Articular comminution, step-off, or gap

Metaphyseal comminution or bone loss

Loss of volar buttress with displacement

DRUJ incongruity

Percutaneous Pinning-Methods

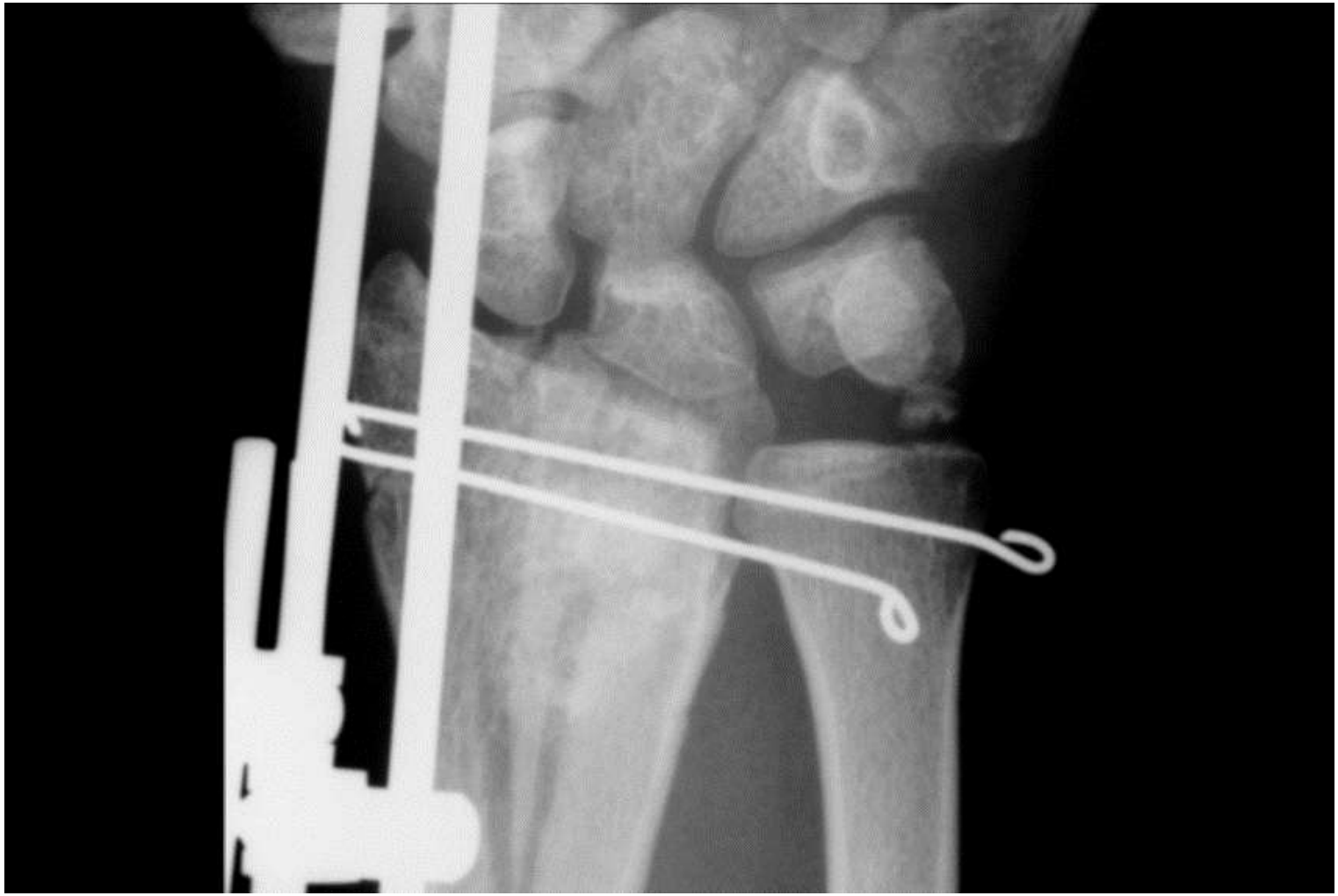


intrafocal pinning through fracture site

buttress against displacement

good results in literature

Support with cast or splint
Augmented external fixation

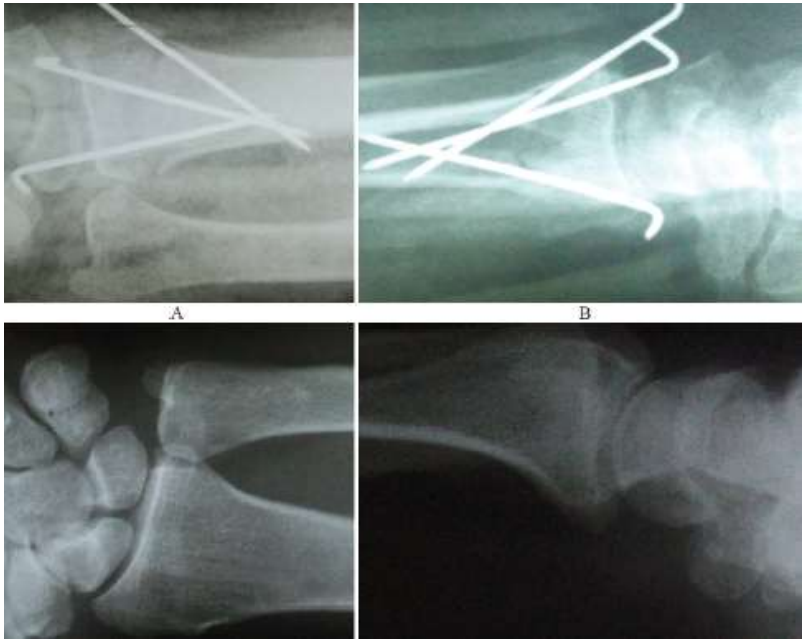


Int J Clin Exp Med 2013;6(2):133-139
www.ijcem.com /ISSN:1940-5901/IJCEM1210007

Original Article

A prospective comparison between Kapandji and percutaneous extra-focal fixation in extra articular distal radius fractures

Seyed Mehdi Mirhamidi[1], Farzad Merrikh Bayat[2]



23 pt extra-focal
22 Kapandji technique.

4-6 weeks in long arm cast

At 6 months 73% excellent and good result in extra-focal and 86% in Kapandji

There were no statistically significant differences in functional score or radiologic and anatomic parameters

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Available online at SciVerse ScienceDirect www.sciencedirect.com

Elsevier Masson France EM|consulte www.em-consulte.com

CHIRURGIE DE LA main

Chirurgie de la main 32 (2013) 17–24

Original article

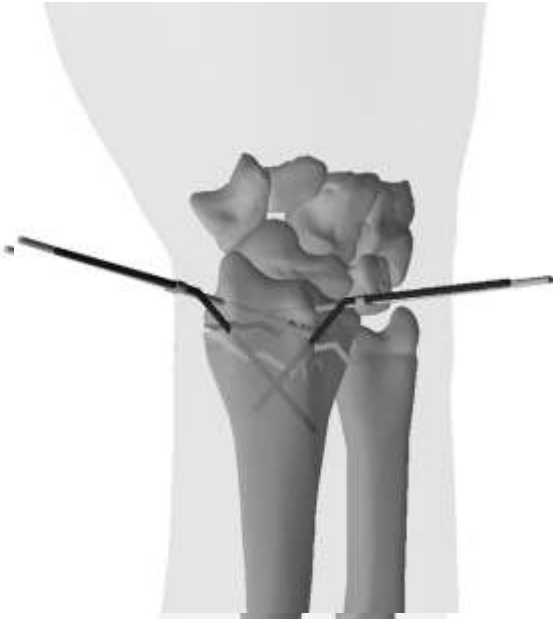
Prospective continuous study comparing intrafocal cross-pinning HK2® with a locking plate in distal radius fracture fixation

Étude prospective continue comparant brochage intrafocal bloqué HK2® versus plaque à vis bloquées dans la fixation des fractures du radius distal

N. Maire, F. Lebailly, A. Zemirline, A. Hariri, S. Facca, P. Liverneaux *

No major difference in the 2 groups

Plates are more stable and are associated with fewer complications, while intrafocal cross-pinning is quicker and less costly.



External fixation

The treatment of choice for distal radius fractures in the 90's

Ideal in high energy fractures for ligamentotaxis
Supplemental device after internal fixation
Bridging or spanning

Complication rates high

- Mal-union
- Pin track infection
- RSD / arthrofibrosis
- Finger stiffness/fracture
- Loss of reduction
- Tendon rupture
- Nerve irritation

ELSEVIER

Injury, Int. J. Care Injured 31 (2000) 56–70

INJURY

www.elsevier.com/locate/injury

Principles of external fixation and supplementary techniques in distal radius fractures

T. Gausepohl*, D. Pennig, K. Mader

Open technique
(to avoid nerve injury)

Incision on the periosteum
(to decrease pop pain)

Supplementary KW fixation

Neutral position , slight ulnar deviation (avoid extreme positions)

Bone grafting or Norian (mini insision) in metaphyseal comminution

Injury, Int. J. Care Injured 41 (2010) 1006–1011

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

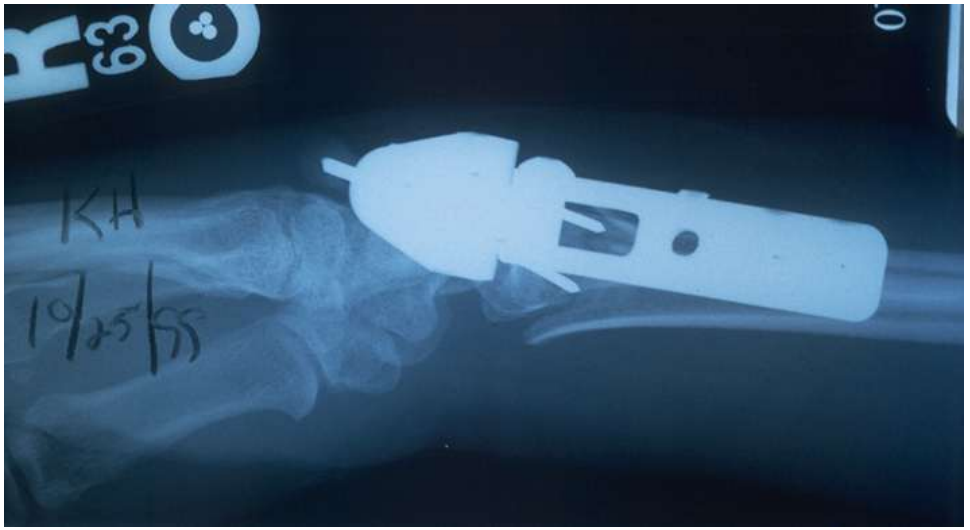
Dynamic and static external fixation for distal radius fractures—A systematic review

Chetan S. Modi *, Kevin Ho, Chris D. Smith, Ronald Boer, Stephen M. Turner

The evidence suggests that there are no functional or radiological benefits

There are no benefits in **older** patients but there do appear to be clear benefits both functionally and radiologically when considering patients of all ages


KH
9/14/95


KH
10/25/95

Internal Fixation of Distal Radius Fractures

Volar fractures for buttressing

Useful for elevation of depressed articular fragments
and bone grafting of metaphyseal defects

Required if articular fragments can not
be adequately reduced with percutaneous methods

More stable and durable fixation

Dorsal and/or volar approaches both used

Approach

Based on location of comminution

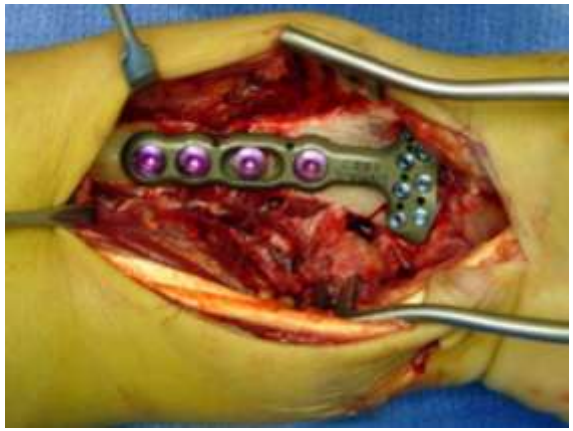
Dorsal for dorsally angulated fractures

Volar for volar rim fractures

Combined approaches for high-energy fractures with significant axial impaction

Double plating for column restoration

Volar plates for dorsal displacement



Dorsal plates

The dorsal plate stabilizes reduction of posterior tilt

Two main types of dorsal plates
- console-type plate fixation
- column plates

Tendonitis or tendon rupture

Routine removal?

Long-term Results of Dorsally Displaced Distal Radius Fractures Treated With the Pi-Plate: Is Hardware Removal Necessary?

MINOS E. TYLLIANAKIS, MD; ANDREAS M. PANAGOPOULOS, MD, PHD; ALKIS SARIDIS, MD

ORTHOPEDICS

JULY 2011 | Volume 34 • Number 7

However, our study found that if patients are not having dorsal problems in the early stages, they probably will not have a problem later.

Volar plates

Palmar displacement (Smith fracture)

Palmar plate for dorsal displacement

- the injured zone is avoided
- intact areas have more resistant cortex
- reduction is obtained with the wrist in hyperflexion with a periosteal elevator placed in the fracture
- avoid bicortical screws more than 18—20 mm in the Lister's tubercle
- no protrusion of the diaphyseal screws (10-12 mm)

Focal plating

Radial Styloid Fragment
Dorsal ulnar fragment

70 – 90 degrees apart

Injury, Int. J. Care Injured 42 (2011) 162–166

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Should unstable extra-articular distal radial fractures be treated with fixed-angle volar-locked plates or percutaneous Kirschner wires? A prospective randomised controlled trial

I. McFadyen [a], J. Field [b], P. McCann [a,*], J. Ward [a], S. Nicol [a], C. Curwen [a]

56 adult patients with isolated, closed, unilateral, unstable extra-articular fractures into two treatment groups, one fixed with K-wires and the other fixed with a volar locking plate

Clinical scores were statistically better in the plate group at 3 and 6 months.

Radiological assessment showed statistically better results at 6 weeks, 3 months and 6 months, postoperatively.

In the plate group, there was no significant loss of fracture reduction.

Injury, Int. J. Care Injured 44 (2013) 409–416

Contents lists available at SciVerse ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

External fixation versus open reduction with plate fixation for distal radius fractures: A meta-analysis of randomised controlled trials

John Esposito, Emil H. Schemitsch, Michel Saccone, Amir Sternheim, Paul R.T. Kuzyk*

ORIF with plate fixation provides lower DASH scores, better restoration of radial length and reduced infection rates as compared to external fixation for treatment of distal radius fractures.

Orthopaedics & Traumatology: Surgery & Research (2013) 99, 216–234

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REVIEW ARTICLE

Fixation of distal radius fractures in adults: A review

L. Obert*, P.-B. Rey, J. Uhring, N. Gasse, S. Rochet, D. Lepage, A. Serre, P. Garbuio

With the new generations of palmar plate, secondary displacement is becoming a thing of the past

Conclusions

Need to be able to use all tools for treatment of distal radius fractures

Both external fixation and ORIF are useful.

- ORIF better in high-energy fractures associated with depression of articular surface

- ORIF gives better anatomic restoration, although not necessarily higher patient satisfaction

Conclusions

External fixators still have a role in the treatment of distal radius fractures

Spanning ex fix does not completely correct fracture deformity by itself

Should usually combined with percutaneous pins (augmented fixation)

Conclusions

new plating techniques allow for accurate and rigid fixation of fragments

Plating allows early wrist ROM

Volar, smaller and more anatomic plates are better tolerated

combination treatment is often needed