Distal Radius Fractures: Considerations and Treatments

Frank A. Liporace, MD
Associate Professor – Director Orthopaedic Trauma Research
New York University / Hospital for Joint Diseases, NY, NY

Chief – Department of Orthopaedics
Jersey City Medical Center / Barnabas Health, Jersey City, NJ

Updated 2016
Incidence

• Upward of $\frac{1}{6}$th of all ER fractures
  – $>250,000$ / yr in USA

• Bimodal distribution

• $>35$ yo
  – $4 \, F : 1 \, M$

• $>60$ yo
  – $7 \, F : 1 \, M$

“My teacher says little girls can grow up to be anything they choose! Why did you choose to be an old lady?”
Incidence

• Common injury which is steadily becoming public health issue
  – Among woman > 60 years risk of fracture
    • Distal Radius 17%
    • Hip 14%
  – 4 times greater with lowest quintile of BMD
    • Gardsell Calc Tissue Int., 1989
    • Hui Ann Int Med, 1989

• Younger adults
  – Higher energy injuries; post-traumatic arthrosis; functional disabilities
BMD mechanical effect

- Post menopausal
- Increased diameter
- Decrease strength
- Decreased Estradiol levels

1SD : ↑3.8 \text{rr}

*Correlate better with BMD than with radiographs*
Mechanisms of Injury
Mechanism of injury

- **Fall**
  - Onto outstretched hand
    - Bending
    - Shearing

- **High Impact**
Abraham Colles - 1814

“The absence of crepitus and of the other usual symptoms of fracture rendered the diagnosis extremely difficult”

“One consolation only remains, that the limb will at some remote period again enjoy perfect freedom in all its motions and be completely exempt from pain”.

???????
Robert William Smith - 1847

- “A fracture of the lower end of the radius - to 1 inch from the articular surface, in which the lower fragment and the carpus were displaced forwards in relation to the forearm”
“Subluxation of the wrist, consequent to a fracture through the articular surface of the carpal extremity of the wrist”

John Rhea Barton - 1838
Anatomy

- Distal radius: 80% load
- Metaphyseal flare
- Biconcave articular surface - triangular in shape
- Two facets for scaphoid and lunate
Radiological Assessment

- **Radial Inclination**
  - 22-23°

- **Palmar inclination**
  - 11-12°

- **Radial length**
  - 11-12mm

- **Ulnar variance**

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Journal of the American Academy of Orthopaedic Surgeons:
May/June 2005 - Volume 13 - Issue 3 - p 159–171
Radiological Assessment

- Radial Inclination
  - 22-23°
- Palmar inclination
  - 11-12°
- Radial length
  - 11-12mm
- Ulnar variance

Radiological Assessment

- **Radial Inclination**
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Radiological Assessment

- Radial Inclination
  - 22-23°

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  - 11-12mm

- Ulnar variance
MANY Classifications – Anatomy means most...

- Destot - 1923
- Taylor & Parsons – 1938
- Nissen-Lie – 1939
- Gartland & Werley – 1951
- Lidstrom – 1959
- Older – 1965
- Frykman - 1967
- Sennwald & Segmuller - 1984
- Jenkins – 1989
- Rayhack – 1990
- Cooney - 1990
- Mayo - 1992
- Melone – 1993
- McMurry – 1993
- Fernandez Classification
Overall Evaluation

• Volar Tilt

• Radial height

• Articular incongruity

• Concomitant Instability
  – DRUJ
  – Carpal: DISI, VISI, etc.
### Stability

<table>
<thead>
<tr>
<th></th>
<th>Dorsal Angulation</th>
<th>Comminution</th>
<th>Radial Length Shortening</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stable</strong> (Closed Red. Success)</td>
<td>&lt; 9°</td>
<td>Mild</td>
<td>&lt; 4mm</td>
</tr>
<tr>
<td><strong>2° Instability</strong> (Closed Red. Failure)</td>
<td>&gt;10°</td>
<td>Moderate</td>
<td>&gt; 5mm</td>
</tr>
<tr>
<td><strong>Unstable</strong></td>
<td>&gt;20°</td>
<td>Severe</td>
<td>&gt; 10mm</td>
</tr>
</tbody>
</table>
Treatment Options

• Conservative
  – Reduction
  – Splinting
  – Casting

• Operative
  – Pinning
  – Ex-fix
  – Plate
Treatment options

Distal Radius Fractures

Non-Displaced

- Closed tx 6 wks - radiographs at weeks 1, 2, 4, 6

Displaced

- Attempt Closed Reduction
  - Radial shortening, 
  - >1-2mm articular step-off, 
  - Volar tilt >10 deg contralateral, 
  - Dorsal tilt > neutral

NO

- Splint
  - Weekly radiographs for 2 weeks with cast at 1-2 weeks
  - Reduction maintained

YES

Operative Intervention

- Percutaneous Pinning if:
  - Extra-articular, 
  - Metaphyseal w/o significant comminution, 
  - Good bone quality

- Ex-fix + Percutaneous pinning if:
  - Able to attain reduction through ligamentotaxis 
  - Surgeon preference

- ORIF if:
  - Irreducible with ligamentotaxis, 
  - Joint depression, 
  - Cannot maintain reduction with pins or ex-fix, 
  - Surgeon preference

FAILURE OF FIXATION
Functional Bracing

- Sarmiento
  - Study of 44 patients
  - 82% good to excellent results
  - 73% -reduced grip strength
  - 39% -significant deformity

- “The method does not entirely prevent collapse of the fracture”
Closed Tx

- Early Instability (1wk)
  - Radial shortening
  - Volar tilt >20 deg

- Late Instability (6wks)
  - Radial inclination <10 deg
  - Radial shortening
  - Age > 65
  - Volar tilt > 20 deg
Operative Tx

- Intrafocal pinning
- **Ex-fix**
  - Bridging
  - Non-bridging
- ORIF
  - Dorsal / Volar
    - Dorsal plating btw. 20-40% extensor tendon problems
  - Fragment Specific Fixation (Trimed)
  - Standard Plating / LOCKED PLATING
    - Locked Plating with better maintenance of reduction after cyclical loading
- Osteobiologic Supplementation
- Concomittant Ulnar Styloid fixation / DRUJ
Closed Tx vs Fixation

- Parameters historical
  - 20 degrees dorsal tilt
  - 50% dorsal comminution
- Reduction loss usually within 1 week
- Mathematical Formulas do not provide the answer
- **Displaced Fx’s (Good or Excellent results)**
  - Closed tx – 43%
  - Ex-fix / ORIF – 60-80%
Complications of cast treatment

- Finger stiffness
- RSD
- Carpal tunnel syndrome
- Skin breakdown
Bridging ex-fix vs cast

- Kreder H: 2006 JOT
  - 113 patients
  - 2 yr f/u
  - SF-36 and grip strength
  - *Improved results for ex-fix ± k-wires*
Functional Deficit after Casting

• Prospective study found 40% impairment of pronation
  – 50% reduction (6-27 months):
    • Flexion / Extension
    • Radial / Ulnar deviation
  – Less functional impairment in those with fixation, no cast

Byl NN, Kohlhase W, Engel G. J Hand Ther 1999
Complications of Non-Operative Treatment

- Malunion..... “Just let it heal and if it bothers her I’ll do a Darrach”
- Outcomes of Darrach procedure run from 91% to 50% Good and excellent
- Pain is improved, grip strength is not
- Patient still had surgery

Field J, Majkowski RJ, Leslie IJ. JBJS 1993

Tulipan DJ, Eaton RG, Eberhart RE JHS 1991
Operative Tx - Principles

- Articular surface restoration
- Length
  - Radial styloid
  - Ulna variance
- Volar Tilt
- Buttress as needed
Indications

• Absolute
  – Open Fracture
  – Significant soft tissue trauma
  – Acute Median n. Sxs

• Failure to achieve satisfactory reduction
Indications

- High-energy injury
- Secondary loss of reduction
- DRUJ incongruity
- Multi-extremity injury

- *Loss of volar buttress*
- *Articular comminution, step-off, gap*
Radiographic Reduction Criteria

<table>
<thead>
<tr>
<th>Result</th>
<th>Deformity</th>
<th>Dorsal Angulation</th>
<th>Shortening</th>
<th>Radial Deviation</th>
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</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>none</td>
<td>&lt;0°</td>
<td>&lt;3mm</td>
<td>&lt;4°</td>
</tr>
<tr>
<td>Good</td>
<td>slight</td>
<td>1-10°</td>
<td>3-6mm</td>
<td>5-9°</td>
</tr>
<tr>
<td>Fair</td>
<td>moderate</td>
<td>11-14°</td>
<td>7-11mm</td>
<td>10-14°</td>
</tr>
<tr>
<td>Poor</td>
<td>severe</td>
<td>&gt;15°</td>
<td>&gt;12mm</td>
<td>&gt;15°</td>
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- Displacement of >2mm, Shortening of >5mm, and Dorsal Angulation of >20° has shown to cause an increased incidence of arthritis, decreased wrist motion, 50% decrease in grip strength, and wrist instability in the long run.
## Factors Affecting Functional Outcome

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<tr>
<th>Author</th>
<th>Length</th>
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<th>Volar Tilt</th>
<th>Gap</th>
<th>Step-off</th>
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</thead>
<tbody>
<tr>
<td>ARO (1988)</td>
<td>++++</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>VILLAR (1987)</td>
<td>++++</td>
<td>+</td>
<td>0</td>
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<td>WOLFE (1994)</td>
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<td>0</td>
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<td>JUPITER (1986)</td>
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<td>0</td>
<td>+</td>
<td>++++</td>
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<td>BACORN (1953)</td>
<td>++</td>
<td>++</td>
<td>0</td>
<td>+</td>
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<tr>
<td>OLDER (1966)</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>0</td>
<td>0</td>
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<tr>
<td>TRUMBLE (1994)</td>
<td>++++</td>
<td>--</td>
<td>--</td>
<td>++++</td>
<td>++++</td>
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<tr>
<td>McQUEEN (1989, 1995)</td>
<td>++</td>
<td>--</td>
<td>++++</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>TALIESNIK (1984)</td>
<td>0</td>
<td>++</td>
<td>++++</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
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Factors Affecting Functional Outcome

- **Stability**
  - Age
  - Radial Length
  - Initial dorsal angulation

- **Radial shortening**
  - Decreases functional tendon length --> Decreased grip strength
- Can we think of the Distal Radius as the Tibial Plateau of the Upper Extremity?
Column Theory (Rikli / Regazzoni)

- Buttress radial inclination
- Buttress dorsal tilt
- Radial column
- Ulnar column
- Intermediate column
- How to “think” about fixation needs?

- What about the 3 joints of the wrist?

- What about the 3 columns of the wrist?
What can we do when we fix it?

- Ex-fix
- ORIF volar
  - Henry
  - Extended CTR
- ORIF dorsal
External Fixation

- Dynamic or Static
- Bridging or Non-Bridging
External Fixation vs Cast

- Meta-analysis have shown *superior results with external fixation* compared to non-op
  - Functional
  - Radiographic

Kreder H et al: JOT 2006
Cochrane review 2000
Paksima et al 1998
External fixation of *intra-articular* fractures of the distal radius in young and old adults.

- 40 patients (18-89 years old, mean 58 years)
- *AO-type C 2 or C 3*: 2.3 years
- 82.5% Good and Excellent radiological and functional results.

Huch K, Hunerbein M, Meeder PJ.
Arch Orthop Trauma Surg 1996
Dynamic External Fixation

• Maintain joint distraction

• **Center of wrist rotation** must be maintained in the **head of the capitate**

• Bending motions occur at the joint not the fracture site.

• **No benefit but increased complications**
Dynamic

COR: head of capitate
Anterior View
Center of rotation

Capitate
Lunate
Dynamic

Lateral View

*COR*- head of capitate

Dorsal to the Center of Radius

Dorsal!
Dynamic

- Ishikawa (1999): carpal kinematics significantly altered with \textit{wrist distraction}
  - distraction preferentially increases strain in the volar intrinsic ligaments to the proximal carpal row, thus \textit{limiting flex/ext motions of the radial-carpal joint and producing greater flex/ext motions in the mid-carpal joint.}
  - felt to be the source of clinical inefficacy of most dynamic fixators
    - Result: Pain, Worse Function, Decreased Grip Strength
- Kawaguchi S (1998) JHS:
  - \textit{Dynamic exfix did not consistently stabilize Colles fractures w/ pre-op dorsal angulation > 20 degrees}
## Non-Dynamic Fixators: Restoration of Anatomy

<table>
<thead>
<tr>
<th>Type</th>
<th>Length</th>
<th>Radial Tilt</th>
<th>Volar Tilt</th>
<th>Gap</th>
<th>Step-off</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPANNING</td>
<td>++++</td>
<td>++++</td>
<td>-----------</td>
<td>++</td>
<td>--------</td>
</tr>
<tr>
<td>NONSPANNING</td>
<td>++++</td>
<td>++++</td>
<td>++++</td>
<td>++</td>
<td>--------</td>
</tr>
</tbody>
</table>
Non-Bridging

- Radio-Radial fixator
- Metaphyseal pins

*Provided the distal fragment is large enough, and of good quality*
Factors Affecting Functional Outcome

- McQueen (1996): carpal alignment after distal radius fractures is the main influence on final outcome
  - malalignment has significant negative effect on function
  - failure to restore volar tilt predisposes to carpal collapse and carpal malalignment
Non-Bridging vs. Bridging Fixator

- McQueen, JBJS-B, 1998
- Prospectively studied 30 spanning vs 30 non-spanning fixator patients
- 50% less complications
- **Non-spanning** better preserved *volar tilt*, prevented *carpal malalignment*, gave *better grip strength* and *hand function* (all with p<.001)

Similar results:
Gradl G and Jupiter JB: 2005 JHS-A
Uchikura C: 2004 J Orthop Sci
Bridging Ex-fix

- Metaphyseal fracture
- ± Simple joint
  - No depression
- Damage control
- Soft tissue injury
- Reduction tool
- Surgeon preference

25yo m s/p Multi-GSW w/ iliac a. injury
Bridging Ex-fix & >65 yrs old

- Kamiloski V: 2006 Prilozi
  - ~80% G to E results
  - Low operative risk

- Ochman S: 2006 Unfallchirurf
  - 87% excellent / good
  - 100% union rate
Bridging Ex-fix & >65 yrs old

- Is non-bridging better?
- Atroshi I: 2006 Acta Orthop
  - Non-bridging: better radial length
  - *Shorter OR time bridging vs non-bridging*
  - *No diff DASH scores*
  - *No diff ROM, grip, satisf.*
  - *Overall no clinical diff*

- Bridging w/ supplemental k-wire
- Fu Y: 2006 J Trauma
  - 32 pts >65 yo vs 66 pts <60 yrs old
  - 18 mo f/u
  - *87.5% excellent / good*
  - *No diff in radiographic radial length or volar tilt*
Bridging Ex-fix

- Metaphyseal fracture
- ± Simple joint
  No depression
- Damage control
- Soft tissue injury
- Reduction tool
- Surgeon preference

25yo m s/p Multi-GSW w/ iliac a. injury
Bridging Ex-fix

- Avoid
  - Mid carpal distraction
  - Excessive ulna deviation
  - Excessive palmar flexion

Papadonikolakis A: 2005 JHS
>2-5mm distraction at jts affects ability of FDS on MCPs

Volar ligaments
- stout

Dorsal ligaments
- lax with zig-zag pattern

Relies on ligament distraction
Bridging Ex-fix

• Avoid
  – Mid carpal distraction
  – Excessive ulna deviation
  – Excessive palmar flexion

“Cotton-loader” position
• Nerve Sxs
• Contractures
• Stiffness
• Poor tendon length
Bridging Ex-fix

• Avoid
  – Mid carpal distraction
  – Excessive palmar flexion
  – Excessive ulna deviation

*Becomes neutralization device with pins

25yo m s/p Multi-GSW w/ iliac a. injury
REMEMBER ALL 3 JOINTS

19 yo m s/p GSW
Fall in gravel
Very contaminated
REMEMBER ALL 3 JOINTS

19 yo m s/p GSW
Fall in gravel
Very contaminated
19 yo m s/p GSW
Fall in gravel
Very contaminated

Don’t forget the DRUJ!
19 yo m s/p GSW
Fall in gravel
Very contaminated

Remember???
37 yo m
Fall 25 feet off ladder
Ex-fix as a temporary reduction tool
Dissection

- Beldner S: 2005 JHS-A
  - *SRN emerges from under* *brachioradialis 9cm proximal to radial styloid*

- Superficial radial n.
  - Btw. Brachioradialis & ECRL

- Go btw ECRL & ECRB
Supplements w/ ex-fix

- Wolfe SW (1999): JHS -A
  - *Supplemental k-wires* improve rigidity in 3 planes of rotation

- Moroni A (2001): JBJS - A
  - *Hydroxyapatite-coated* tapered pins w/ increased extraction vs insertion torques

  - *Calcium phosphate augmentation*
Treatment of external fixation pins about the wrist: a prospective randomized trial

• Egol KA: 2006 JBJS-A
• 120 wrists
  – Dry dressing changes q wk
  – Daily H₂O:H₂O₂
  – Biopatch (chlorhexidine)
• 19% pin tract infections
  – All tx’d w/ po abx
• No difference btw groups
Bridging Ex-fix

- Risks
  - Stiffness
    - Wrist
    - Fingers
  - Pin track infections
  - Delayed Loss of Reduction
  - RSD
Vitamin C – Avoid RSD / CRPS?

- AAOS 2010 CPG
  - Moderate Strength
  - 500mg / q day
  - 50 days
Vitamin C – Avoid RSD / CRPS?

No strong evidence in Meta-analysis or RCT

Vitamin C to Prevent Complex Regional Pain Syndrome in Patients With Distal Radius Fractures: A Meta-Analysis of Randomized Controlled Trials

Nathan Evaniew, MD, Colm McCarthy, MD, CM, Ydo V. Kleinlugtenbelt, MD, Michelle Ghert, MD, FRCSC, and Mohit Bhandari, MD, PhD, FRCSC

The Influence of Vitamin C on the Outcome of Distal Radial Fractures

A Double-Blind, Randomized Controlled Trial

Ingri Ekrol, MRCSEd, Andrew D. Duckworth, MSc, MRCSEd, Stuart H. Ralston, MD, FRSE, Charles M. Court-Brown, MD, FRCSEd(Orth), and Margaret M. McQueen, MD, FRCSEd(Orth)

Investigation performed at the Edinburgh Orthopaedic Trauma Unit, Royal Infirmary of Edinburgh, Edinburgh, United Kingdom
A meta-analysis of outcomes of external fixation vs plate osteosynthesis for unstable distal radius fractures

- Margaliot Z: 2005 JHS-A
- 917 patients
- **No difference**
  - Pain
  - Grip strength
  - ROM
  - X-ray
- Exfix -> hardware failure, infection, neuritis
- ORIF -> tendon complications, ROH

Paksima N (2007) AAOS: No diff @ 6 months
Ex-Fix and ORIF: Is there a difference? If there is, when???
Ex-Fix and ORIF: Is there a difference?
If there is, when???

NO – Not when done for the right indications and done well!

Don’t use EX-FIX with:
- Isolated Articular injury: “dye punch”
- Independent articular fragments
- Shear (B1-type) injuries
Ex-fix: NOT always the answer

19 yr old Roofer Fall 20 feet Presents 4 wks out
Ex-fix: NOT always the answer

Articular Depression
Aricular Comminution

4 YEARS OUT
Internal Fixation Strategies
Internal fixation

- Simple screws
- Buttress plate
- Locked / Non-locked plates
- Combinations
ORIF Technique

- Find FCR
- Draw incision
- Can be extended to carpal tunnel

*Pre-incision Allen's Test
*Post-op DRUJ exam
ORIF Technique

- Incise FCR volar sheath
- Retract FCR ulnarly
- Incise FCR dorsal sheath
ORIF Technique

Reflect FCR Ulnarly

Pronator Quadratus
ORIF Technique

- Incise Pronator Quadratus
- “L-shaped” incision
- *Avoid Radiocarpal Joint arthrotomy*
ORIF Technique

• Can release Brachioradialis for styloid exposure

• Can bone graft dorsally from volar incision

• *Watch for 1st dorsal compartment*
37 yo m s/p 25’ fall off “cherry picker”
35 yo M s/p “hammer injury” – Yet he’s not a carpenter…

Like a Shatzker 5
41 yo m s/p fall off of ladder

Radial shortening,
Intra-articular
Dye punch

Like a Shatzker 5
21 yo male
B/L injuries after climbing fence, while “fleeing”

Like B/L Shatzker 5
21 yo male
B/L injuries
after climbing
fence, while
“fleeing”
21 yo male
B/L injuries after climbing fence, while “fleeing”
Like a Shatzker 6

84 YO F mva DISTAL RADIUS
84 YO F mva DISTAL RADIUS
INTRA-OP

Ex-fix as a reduction tool
(like a Femoral Distractor)
84 YO F mva DISTAL RADIUS POST-OP
Nascent Malunion - Missed Injury

33 yo M w/ pelvic ring injury, open floating knee, ipsilateral hip fracture

- Multi-trauma w/ 5-10%
- Distal aspects of UE & LE
- Contra-lateral films !!!

Ring D: CORR 2005
Nascent Malunion - Missed Injury
33 yo M w/ pelvic ring injury, open floating knee, ipsilateral hip fracture

4 weeks from DOI
Intubated

Ring D: CORR 2005
Nascent Malunion - Missed Injury

33 yo M w/ pelvic ring injury, open floating knee, ipsilateral hip fracture

Principles:
- columns - buttress
- bone graft / joint
- frag. stabilization
- bridging fixation

Ring D: CORR 2005
What about the more chronically missed injury?
• Shortened Dorsally
• Contracted Dorsal Tissues & Extensor Tendons
• Multi-planar Fixation
• Volar approach
  • Dorsal grafting
• Supplemental stability
• Allows “robust” volar FA plate

Prommersberger KJ et al:
Tech Hand Up Extrem Surg 2004
Volar Ulna Fragment - Alternate Approach (Extended CTR)

56 y.o. male MVA, mulit trauma
VOLAR

Classical Henry approach  Extended carpal tunnel approach
Ulnar Extensile Exposure

Excellent access to volar ulnar fragment
What about the Ulna Column?
Do we need to fix the distal ulna?

- Base of ulna styloid with low incidence of concomitant DRUJ problems
- Test DRUJ and that is your answer if you fix

- What about the distal ulna shaft / articular surface?
  - Significant comminution
  - Osteoporosis
  - Prevent Instability / Supply support

May MM et al: J Hand Surg 2002
Noda K et al: J Hand Surg 2009
Souer JS et al: JBJS Am 2009
TD

COLUMNS THEORY:
1. Stabilize Radial / Intermediate
2. Stabilize Ulna articular surface
3. Multiplanar stabilization
4. Protect DRUJ & Fixation
MC

3 – COLUMNS affected!
VOLAR displacement (very unstable)!
3 – COLUMNS affected!
VOLAR displacement (very unstable)!
MC
6 months
Go dorsal?
Benefits of dorsal? Should we go retro?

- More resistance to mechanical deformity?
  - No

- Not many complications?
  - No

- Capture Dorsal Ulna Fragment?
  - Yes

- If no volar access?
  - Yes
Benefits of dorsal?  Should we go retro?

- More resistance to mechanical deformity?  
  - Yes  
  - No

- Not many complications?  
  - No

- Capture Dorsal Ulna Fragment?  
  - Yes

- If no volar access?  
  - Yes

References:
- Axelrod TS et al: J Hand Surg 1990
- Tavakolian JD et al: Hand Clin 2005
- Liporace et al: JOT 2005
How do we go dorsal?
Reduce fracture and stabilize with low profile fixation.
Reduce fracture and stabilize with low profile fixation.
Reduce fracture and stabilize with low profile fixation
Close Retinaculum! Leave EPL free!
- Bone Graft
- Subchondral Support
- Reconstruct facets
Intact Volar Cortex
Depression dorsal
Rotation dorsal
• Bone Graft
• Subchondral Support
• Reconstruct
  Scaphoid facet
  Lunate facet
• Buttress columns
Radiographic Reduction Criteria

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</tbody>
</table>

- Displacement of >2mm, Shortening of >5mm, and Dorsal Angulation of >20° has shown to cause an increased incidence of arthritis, decreased wrist motion, 50% decrease in grip strength, and wrist instability in the long run.
Complications of Neglect in Treatment

• Malunion….. “Just let it heal and if it bothers her I’ll do a Darrach, Suave Kapanje, Osteotomy, Fusion…”

• Outcomes of Darrach procedure run from 91% to 50% Good and excellent – ALLEGEDLY

• Pain is improved at times, grip strength is NOT!

• Patient still had surgery!

Field J, Majkowski RJ, Leslie IJ. JBJS 1993
Tulipan DJ, Eaton RG, Eberhart RE JHS 1991
Malunion & Salvage

- Osteotomy
- Arthrodesis
- Prox row Carpectomy
- Wrist Arthroplasty
- Suave Kapandji
Remember: Malunions → BAD!

- **Change in load-bearing from NORMAL**
  (80% DR, 20% DU)

- **Arthritis**
  - 1mm scaphoid fossa
  - 2-3mm lunate fossa

- DISI

- DRUJ instability
REMEMBER ➔ Treatment options

Distal Radius Fractures

Non-Displaced
Closed tx 6 wks—radiographs at weeks 1, 2, 4, 6

Displaced
Attempt Closed Reduction
- Radial shortening,
- >1-2mm artic step-off,
- Volar tilt >10 deg contralat,
- Dorsal tilt > neutral

NO
Splint
Weekly radiographs for 2 weeks with cast at 1-2 weeks

YES
Operative Intervention

Percutaneous Pinning if:
- extra-articular,
- metaphyseal w/o significant comminution,
- good bone quality

Ex-fix + Percutaneous pinning if:
- able to attain reduction through ligamentotaxis
- surgeon preference

ORIF if:
- irreducible with ligamentotaxis,
- joint depression,
- cannot maintain reduction with pins or ex-fix,
- surgeon preference

Reduction maintained
Unacceptable displacement

FAILURE OF FIXATION
Take home messages…

1) Evaluate all 3 joints of the wrist
2) Determine which columns are affected
3) Start reconstruction with “simple side”
4) Think like a tibia plateau
5) Consider Fragment Specific Fixation
6) Don’t forget the ulna for mechanical supplementation
7) Use low profile dorsal fixation when necessary
8) If dorsal approach:
   – Keep EPL free after approach, repair retinaculum
9) Test for stability of DRUJ at end of procedure
10) Are the goals achieved? Ready for Early ROM?
Volar Standard

Extended CTR

Dorsal

Radial Border FCR
Radial a. → R
FPL & FCR → U
PQ release R → U
BR release

Ulna to Palmaris
Btw Ulna NV &
muscles / median n.

Mid Radius
Open 3rd comp
Btw 2 & 4
Btw 1 & 2