Fragment Specific Fixation in the Management of Distal Radius Fractures

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Functional Anatomy of Distal Radius

- Distal Radius composed of 3 concave articular surfaces
  - Scaphoid fossa
  - Lunate fossa
  - Sigmoid notch

- Stability maintained by intrinsic & extrinsic ligaments
Anatomic Goals In Management of Distal Radius Fractures

- Articular congruity within 1mm
- Loss radial inclination $< 5^0$
- Radial shortening $< 2-3mm$
- Neutral to volar tilt better (0 to $11^0$ volar)
When to Operate on Closed Distal Radius Fractures

Unstable Fracture

1. Dorsal comminution
2. Dorsal angulation $\geq 20^\circ$
3. Intraarticular involvement
4. Ulnar fracture
5. Shortening $\geq 5$ mm
6. Carpal malalignment
Treatment Methods

- Cast
- Pins & plaster
- Intrafocal pinning
- External fixation +/- k wire fixation
- Dorsal plates
- Volar plate fixation
- Distraction plating
- Intramedullary fixation
- Fragment specific fixation
One Treatment Does Not Suit All !!!

Individualise tx based on the frx
Volar Plating

A GAME CHANGER
Volar Plating - Advantages

- Good soft tissue envelope
- Can see volar cortex well for fx reduction
- Fixed angle construct
- Preserve dorsal soft tissue
Volar Plating - Advantages

- Avoids dorsal hardware & tendon irritation

- Locked subchondral distal peg construct → ↓ subsidence

- Obviates need for bone graft

- Stable fixation → Early ROM
Volar Plating - Disadvantages

• If placed too distal → intra-articular hardware

• Extensor & flexor tendon rupture

• One plate doesn’t suit all fractures !!!!
Volar Plate - Limitations

• **Indirect reduction**
  - No visualization of the articular surface or interosseous ligaments

• **Difficult to address**
  - Unstable dorsal-ulnar frx
  - Communited radial styloid frx

• ? role in mx of volar rim fractures (past watershed line)
Volar Marginal Rim Fractures

Inadequate fixation
• 7 pts (volar shearing frx)

• ORIF (volar plate)

• ALL pts → carpal subluxation (loss of volar corner fixation)

• 4 pt → repeat ORIF, 1 pt → radiocarpal fusion
Principles of Fragment Specific Fixation
What are the fracture fragments?

- Ulnar corner
- Volar rim
- Intraarticular
- Radial column
- Dorsal wall
Putting this back into the column concept

• Radial Column
  • Radial styloid

• Intermediate Column
  • Dorsal ulnar / *volar* ulnar corner
  • Dorsal wall
  • Free intra-articular
  • Metaphyseal defects

• Ulnar Column
  • Ulnar fractures
Build from the strongest foundation

- Volar Ulnar Corner
Fixation Order

1. Volar rim
2. Ulnar corner
3. Intraarticular
4. Dorsal wall
5. Radial column
Fragment Specific Systems

- Acumed
- Synthes
- Stryker
- TriMed
- DePuy

Innovative orthopedic implants and accessories
Trimed Fragment Specific Fixation Components

- Radial pin plate
- Ulnar pin plate
- Volar buttress pin
- Small fragment clamp
- Dorsal buttress pin
What Does The Literature Show As To Efficacy of Tx !!!
Biomechanical stability of volar locking screw plate vs fragment specific fixation in distal radius fracture model Cooper et al 2007

- Cadaver model
- Volar locking plate vs fragment specific
- Osteotomy with 4mm dorsal wedge excised
- 4 point bending machine
- Stiffness ≡ both groups
- Frag specific fixation: ↓ linear displacement & angulation
• **81 pts over 32 month** (85 intra-articular DRF)

• **Gartland & Werley:** 51 exc & 24 good

• **DASH score:** 9

• **ROM:** ~ 88% uninjured side

• **Grip:** 92% uninjured side

• **62% pts:** normal rotation by 6 wks

• **Complications:** 10 pts DSRN & 5 pts ROH
• 14 pts [frag specific] & 85 pts [volar plate] over 1 yr

• Volar plate
  • ↑ grip, pinch, ROM & MHQ scores (6M)
  • ↑ radiographic parameters
  • ↓ complications [3 major & 1 minor] 5%

• Frag specific fixation:
  • ↑ complications (p<0.05) [8 major] 57%
    • ROH (tendon or nerve irritation)
    • Loss of radial height & volar tilt
But the devil is in the details!!!
• Frag specific cohort

• ↑ intra-articular frx (type C)

• ↓ ability to correct initial volar tilt in OR

• Learning curve with technique !!!
- 21 pts [AO type C2 & C3] over 1 yr

- ROM:
  - Flexion & extension → 50° & 63°
  - Pronosupination arc → 149°
  - PRWE score → 20

- Post op radiographs
  - Articular step off <2mm → 20/21 pts
  - Mean volar tilt → 8°
  - Radial inclination → 25°

- Complications
  - ↑ OR times (120-236 mins)….learning curve!!!
  - 3 major complications

“powerful tool to treat difficult frx”
Summary
• Each DRF is unique & should be treated as such

• Carefully assess the frx to determine optimal fixation

• It’s the SURGEON & not the hardware that is most important for the eventual outcome
• Fragment specific fixation is a powerful tool for tx of multifragmented DRF

• Restores articular congruity

• Steep learning curve !!!

• Combined techniques may be best in complex fractures

• Need better outcome studies to assess efficacy