Radial Deficient Hand

Frontiers in Upper Extremity Surgery
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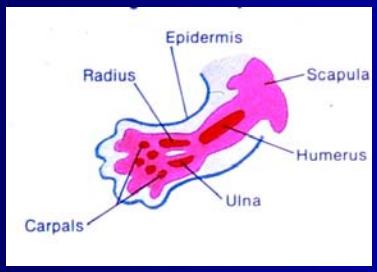
Precartilage Mesenchymal Cell Concentrations at 6 Weeks Gestation



18 Weeks Gestation

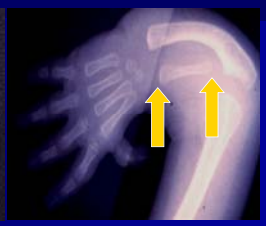
Radial Dysplasia Classification

- 0 Hypoplastic Radial Carpus
- I Short distal radius
- II Hypoplastic radius
- III Proximal or distal absence
- IV Total absence of radius

Type I

- Radius is slightly shorter than ulna
- Proximal and distal radial physes

Type II

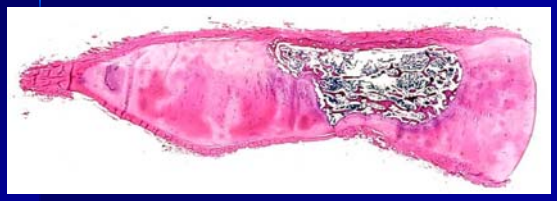


- Radius in miniature
- Proximal and Distal Radial Physes

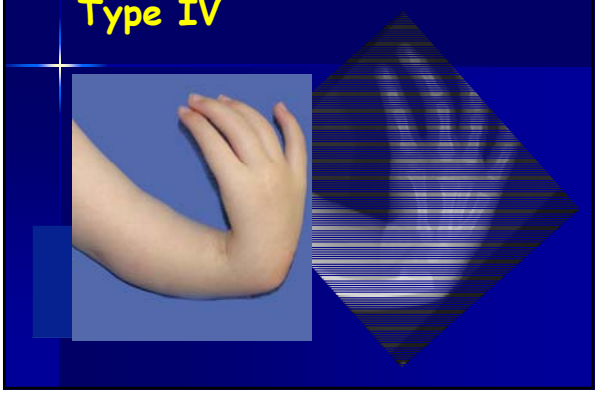
Type III

- Absent proximal or distal phyis
- Post-natal ossification is common

Excised Cartilaginous Type III Anlage



Type IV



Clinical Abnormalities

- Appearance
- Wrist Instability
- Forearm Length
- Thumb dysfunction
- Stiff fingers
- Ulnar prehension

Anatomy - MUSCULOTENDINOUS

- Fusion of ECRB / ECRL / BR
- Tight FCR / PL / FDS / FDP
- Classification does not grade SOFT TISSUE

Radial Deficiency

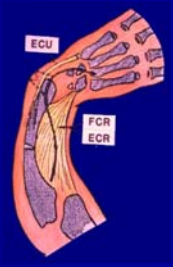
The Dysplastic Radius grows to 50 to 65 percent of Normal Ulnar Length

Wrist (Ulno-Carpal) Stabilization

- For the child with more than 90 degrees elbow flexion
- In the absence of effective radius support of the carpus
- The carpus is stabilized on the end of ulna

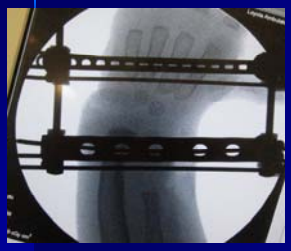
How I do it

- Soft tissue relaxation
  - Splinting
  - Distraction Lengthening
- Volar Release
- Operative Stabilization of Carpus on Distal Ulna
- Long Term Splinting or Pin Fixation



Ilizarov - multiplanar

Kessler Distractor



Ulnar Uniplanar Distractor

- Simple
- No joints in frame
- Stretches soft tissues
- Away from volar radial release incision
- Excisable pin sites
- Imperfect X-rays

Uniplanar fixator well tolerated Distraction direction unimportant

Distraction Considerations

- Go slow
  - Premature consolidation is not a problem
  - One half mm per day
- Wait a month after reaching distraction goal to allow soft tissues to come to equilibrium

Volar Radial Soft Tissue Release

- At Frame application or at Single Stage Procedure
- Flexor Retinaculum Fascia Defined and Resected

Volar Radial Soft Tissue Release

- Soft tissue release
  - Radial / Median Nerve Protected
  - FCR Tendon Released

Incision

- Should address radial skin tightness and ulnar skin redundancy

Two Months After Distractor Application

Frame & Pins Removed

Sterile Tourniquet

Ellipse Out Ulnar Pin Sites

Excise Skin & Fibrous Tissue

Curette Out Pin Sites

Free Extensor Tendons

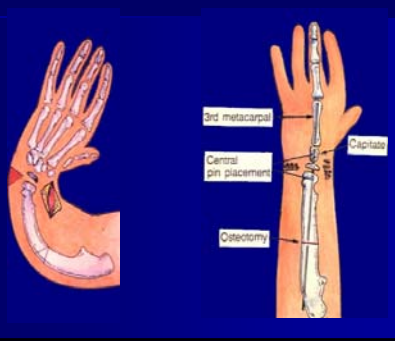
Expose Radial Border of Carpus

Proximal Row Carpectomy

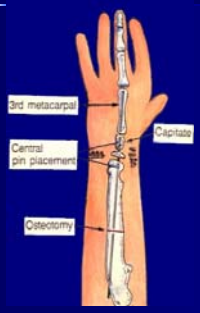
Shave Distal Ulna Platform

Ream Track for Ulnar Pin

Centralization



Centralization



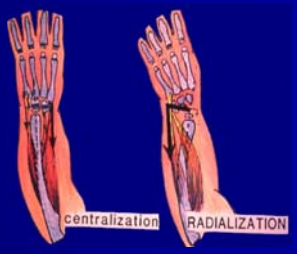
- Technically simple
- Aligns pin with middle metacarpal
- Surprisingly unbalanced muscle forces
- Frequent recurrence of radial deviation

Radialization

- Wrist is ulnarly deviated
- Pin begins in INDEX metacarpal
- Technically fussy
- Less recurrence of radial deviation
- Lousy name

Radialization

- Carpus is translated ulnarward
- Improved muscle balance



Insert Pin in Index MC/Carpus

Use Pin as Joystick

Advance Pin Thru Ulnar Tract

Trim Pins Beneath Skin

Ideal Pin Placement

Close Dorsal & Ulnar Capsule

Suture ECU to Ring MC Base
Suture ECRL/B Tendon to ECU

Leave Extensor Tendons Unconstrained

Close Skin

Sugar Tong Splint

Radialization

- Ulnar osteotomy prn
- Pin removal at 6 months
- SPLINT until ulnar modeling
- Follow until skeletal maturation

Long Term Splinting

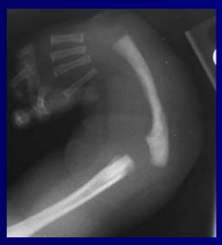

Long Term follow-up is essential to assessment of treatment


Case Study

- VATER - Vertebral Abnormalities (tethered cord), Imperforate Anus, Radial Deficiency,

Stretching and Splinting

Right - Type 4
Stiff



Left - Type 2
Supple

Wrist Stabilization

Right – 2 stage

Left – 1 stage

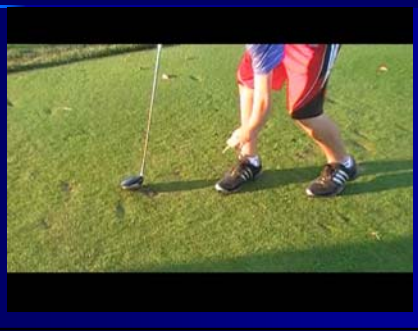
Diligent post-pin removal splinting
Bilateral Pollicization
Variable soft tissue pliability persists

Radial Deficiency

14 Year Old

Right

Left



Variable Digital Dexterity

What's wrong with wrist stabilization?

- If a supple joint is preserved, it is vulnerable to recurrent angulation
  - Radial deviation
  - Flexion
- Skeletal surgery doesn't address soft tissue compliance in dysplastic muscle

Arc of motion = flexion

Untoward Effects

- Growth arrest of distal ulna physis
  - Over aggressive ulnar exposure
  - Excessively tight construct
- Recurrent radial deviation
  - Immobilization in insufficient ulnar deviation
  - Failure to splint after pin removal
  - Inadequate soft tissue release
- Wrist flexion contracture

Ulno-Carpal Stablization

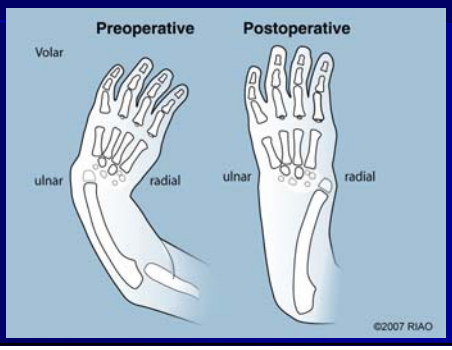
- Doesn't make a normal joint or limb
- Radial digit stiffness persists
- Positions the hand in space

Late Salvage Post-Centralization

Alternatives

- Soft tissue release only
  - Ezaki/Oishi
- Release – shift to ulnar pocket – late lengthening
- Paley
- Microvascular transfer of second toe metatarso-phalangeal joint transfer to radial border of wrist – Simo Vilkki

"Ulnar-ization" - Paley



Vilkki Procedure 2nd Toe Transfer

- First Stage
  - Distraction lengthening
- Second Stage
  - Comprehensive soft tissue release
  - Vascularized 2nd toe MTP joint transfer with filet flap

Vilkki Procedure 2nd Toe Transfer

- Results
  - Balanced Flexion – Extension
  - Nearly balanced longitudinal growth

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