Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Metacarpal and Phalangeal Fractures: Does Intramedullary Fixation Work?

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Disclosures

None

Take Home Point

Metacarpal and Phalangeal Fractures: Does Intramedullary Fixation Work?

YES

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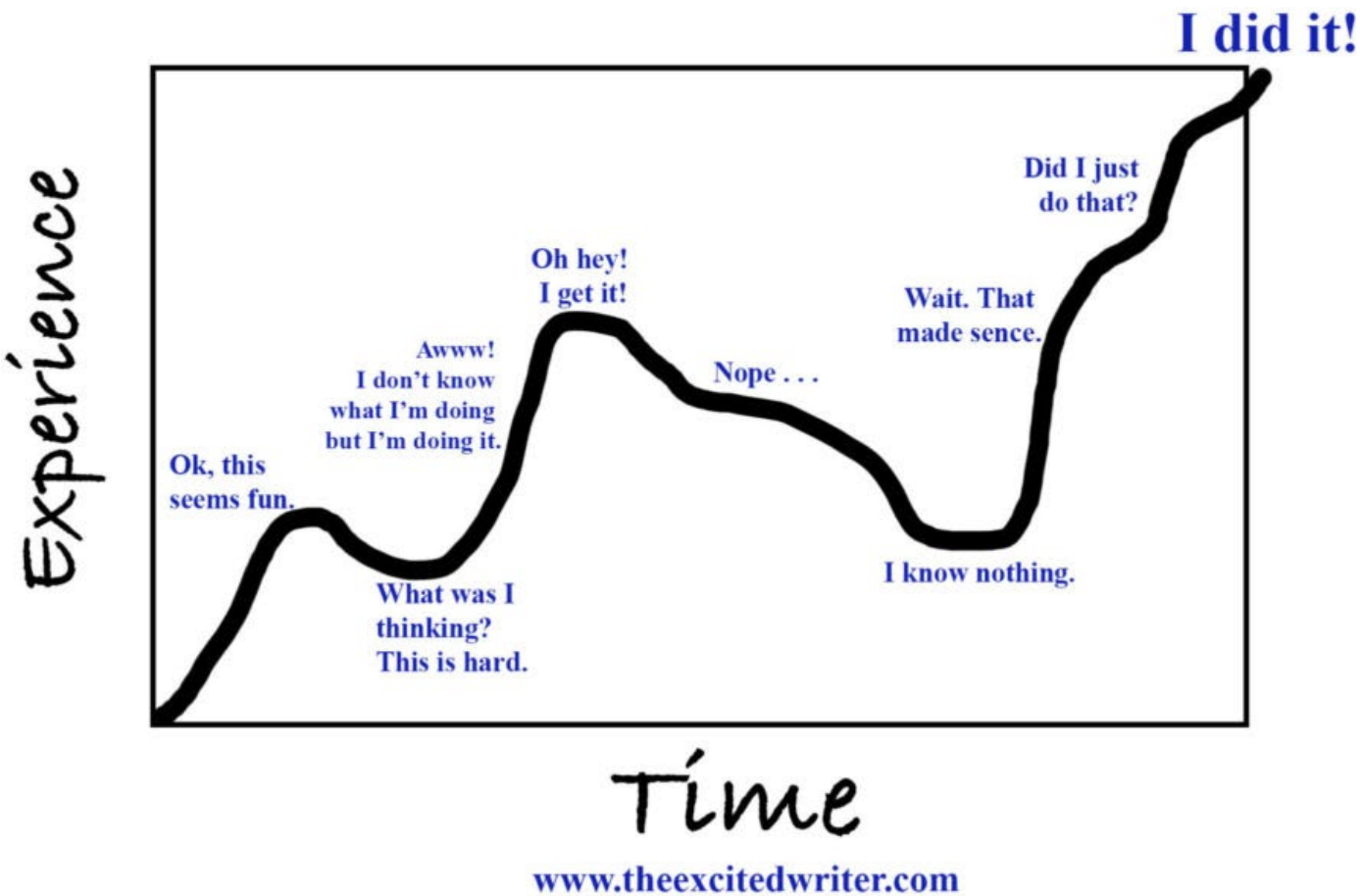
The Learning Curve



Metacarpal – Which fixation is better?

Metacarpal – Which fixation is better?

Considerations:

1. Cost
a. Implants
b. Surgical time
c. Healthcare cost

2. Time to union

3. Early mobilization

4. Return to work and sports

5. Biomechanics

6. Soft tissue dissection

7. Complications

Indications

- Metacarpal transverse/short oblique (< 2x shaft diameter)

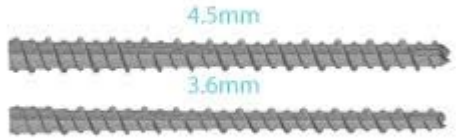
Relative indications (“Harder”)

- Proximal 1/3 metacarpal fractures (antegrade technique)
- Long oblique > 2 x shaft diameter (use **non compressive screw**)
- Comminution (use **non compressive screw**)

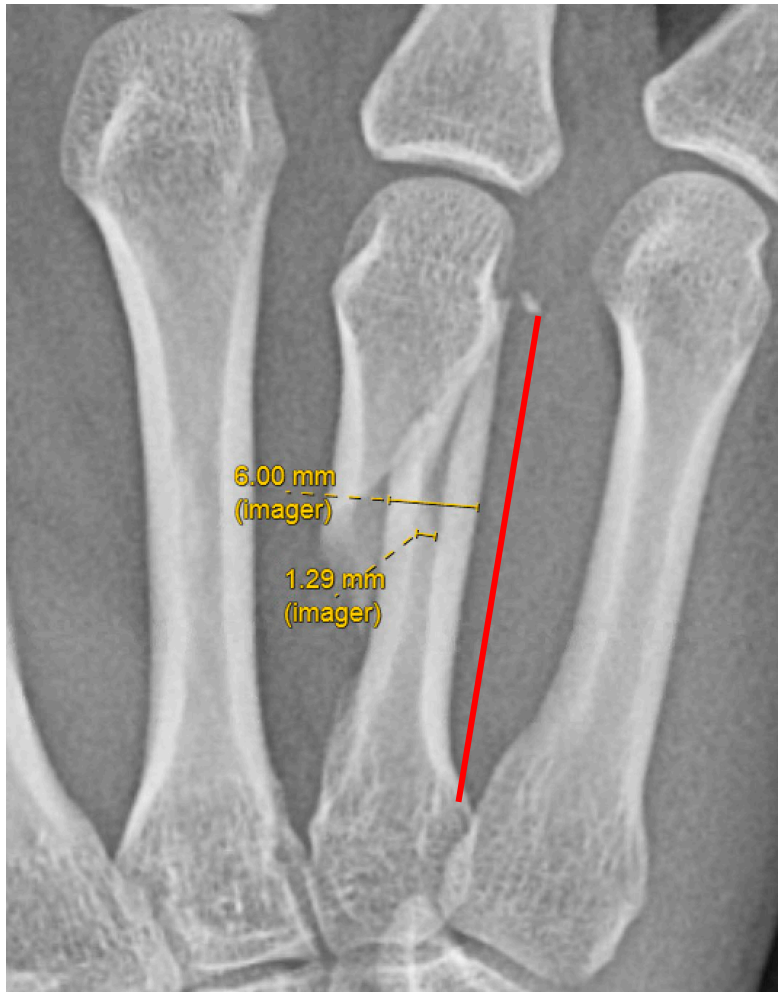
Screws

Compressive

Non-compressive



Tip # 1 -Preop Plan on PA view (Use longest, widest nail)



Metacarpal Bony Dimensions Related to Headless Compression Screw Sizes

Michael Okoli[1] Kevin Lutsky[1] Michael Rivlin[1] Brian Katt[1] Pedro K. Beredjiklian[1]

Table 1 CT measurements of metacarpal bones

	N	Mean	SD	Min	Max
Age	57	41.2		15	88
Index isthmus diameter	56	2.6 mm	0.9	0.7	5.5
Long isthmus diameter	56	2.7 mm	1.0	0.8	5.6
Ring isthmus diameter	55	2.3 mm	0.8	0.7	4.3
Small isthmus diameter	56	3.0 mm	0.9	1.2	5.3
Index isthmus location	56	40.3 mm	4.1	27.7	48.7
Long distance to the isthmus	56	39.5 mm	4.2	31.0	47.7
Ring distance to the isthmus	55	34.4 mm	3.8	25.9	41.1
Small distance to the isthmus	56	31.0 mm	4.7	20.9	37.9
Index metacarpal length	56	67.6 mm	4.5	52.9	75.8
Long metacarpal length	56	65.6 mm	4.9	49.7	74.2
Ring metacarpal length	55	58.0 mm	4.1	43.8	66.4
Small metacarpal length	56	52.5 mm	4.1	40.7	59.4
Index isthmus location/MC length	56	0.6 mm	0.0	0.5	0.7
Long isthmus location/MC length	56	0.6 mm	0.0	0.5	0.7
Ring isthmus location/MC length	55	0.6 mm	0.1	0.4	0.8
Small isthmus location/MC length	56	0.6 mm	0.1	0.4	0.7
Index MC head to the midshaft	56	33.8 mm			
Long MC head to the midshaft	56	33.0 mm			
Ring MC head to the midshaft	55	29.0 mm			
Small MC head to the midshaft	56	26.2 mm			

Abbreviations: CT, computed tomography; MC, metacarpal; SD, standard deviation.

Table 1
Recommended screw diameter based on characteristic metacarpal widths

	Headless Compression Screw (HCS) Diameter General Recommendations	
Metacarpal	Appropriate Screw Width (mm)	Appropriate Screw Length (mm)
Index and middle metacarpal	3.5–4.0 mm	45–55 mm
Ring metacarpal	3.0–3.5 mm	35–50 mm
Small metacarpal	4.0–4.5 mm	35–45 mm

Bui et al

Metacarpal Bony Dimensions Related to Headless Compression Screw Sizes

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Table 2 Screw specifications

Implant	Leading thread diameter (mm)	Thread length	Length (mm)	
Acumed Acutrak Micro[a]	2.5	n/a	8	20
Acumed Acutrak Mini[a]	3.5	n/a	16	30
Acumed Acutrak Standard[a]	4	n/a	16	34
Acumed Acutrak Fusion[a]	2	n/a	14	24
Zimmer Mini Herbert[b]	2.5	Not stated	14	24
Zimmer Herbert 3.0[b]	3	Not stated	12	30
Zimmer HCS 4.5[b]	4.5	8.2, 12, 16.0 mm	25	100
ExsoMed Innate 4.0[c]	4	n/a	35	75
DePuy Synthes HCS 2.4 (ST)[d]	2.4	20% screw length	9	40
DePuy Synthes HCS 2.4 (LT)[d]	2.4	40% screw length	17	40
DePuy Synthes HCS 3.0 (ST)[d]	3	20% screw length	10	40
DePuy Synthes HCS 3.0 (LT)[d]	3	40% screw length	10	40
DePuy Synthes HCS 4.5 (ST)[d]	4.5	20% screw length	16	110
DePuy Synthes HCS 4.5 (LT)[d]	4.5	40% screw length	16	110
Stryker AutoFIX 2.0[e]	2	Not stated	10	30
Stryker AutoFIX 2.5[e]	2.5	Not stated	10	30
Stryker AutoFIX 3.0[e]	3	Not stated	12	60
Stryker AutoFIX 4.0[e]	4	Not stated	20	50
Stryker Fixos 2.5[e]	2.5	Not stated	10	30
Stryker Fixos 3.5[e]	3.5	Not stated	14	24
Stryker Fixos 4.0[e]	4	33% screw length	14	80
Skeletal Dynamics Reduct 2.5[f]	2.6	Not stated	10	30
Skeletal Dynamics Reduct 3.5[f]	3.4	Not stated	10	30
TriMed Cannulated Screw 1.7[g]	1.7	Not stated	8	14
TriMed Cannulated Screw 2.3[g]	2.3	Not stated	10	28
TriMed Cannulated Screw 3.0[g]	3	Not stated	10	36
TriMed Cannulated Screw 3.5[g]	3.5	Not stated	20	45
Arthrex Micro Compression FT 2.5[h]	2.5	n/a	8	30
Arthrex Mini Compression FT 3.5[h]	3.5	n/a	12	34
Arthrex Standard Compression FT 4.0[h]	4	n/a	16	50
Arthrex Headless Compression PT 2.5[h]	2.5	33% Screw Length	8	34
Arthrex Headless Compression PT 3.0[h]	3	33% Screw Length	10	36
Arthrex Headless Compression PT 4.3[h]	4.3	33% Screw Length	14	80
Range	1.7 - 4.5		8	110


R
MCL

Tip # 2 – Open and clamp

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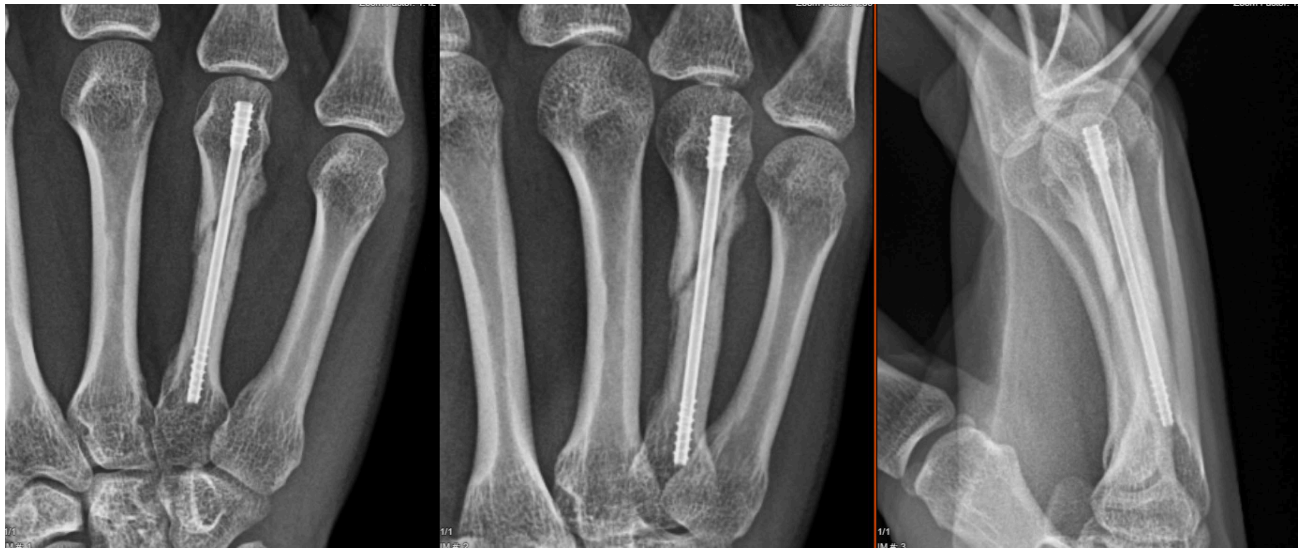

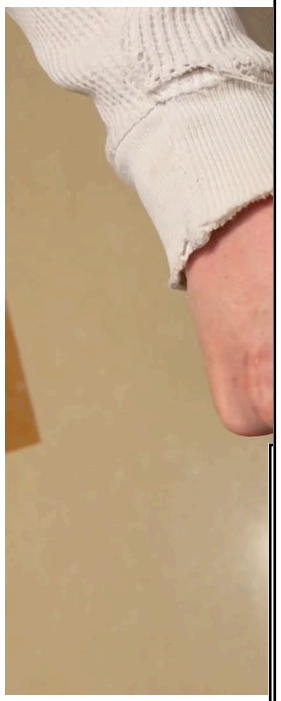

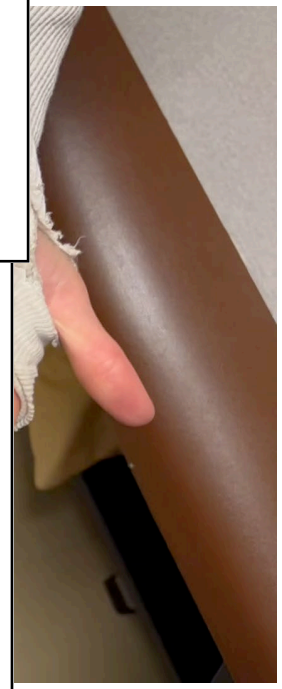

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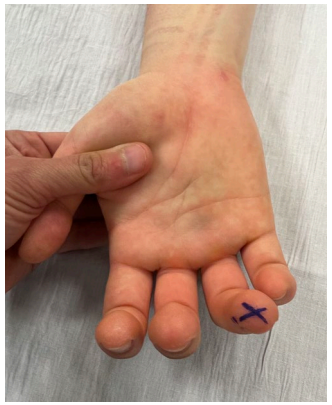
Courtesy: Dr. Lauren Shapiro

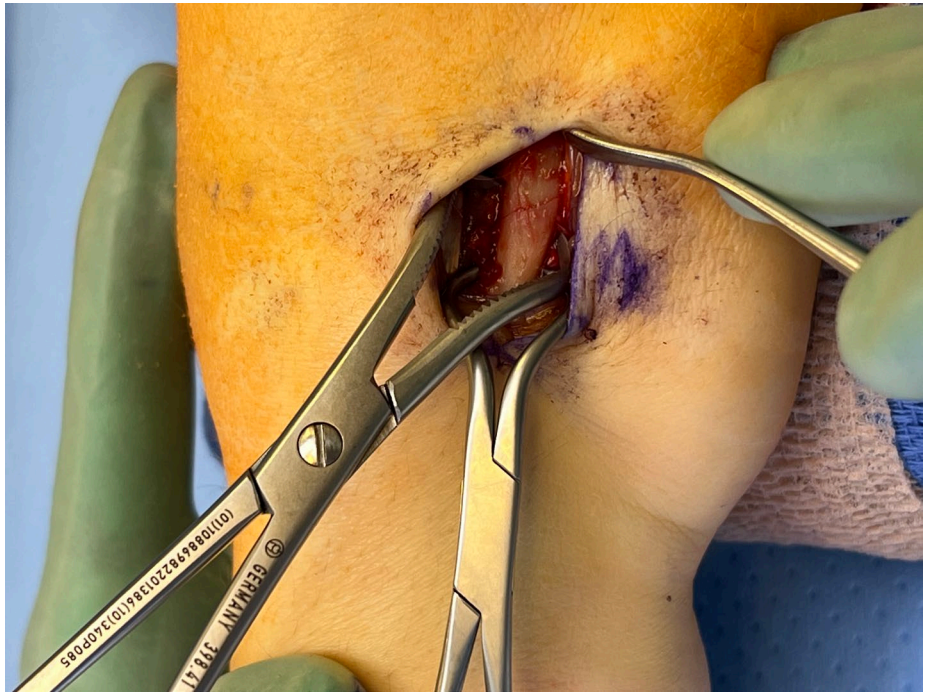
Earlier Return to Sports/Work

26F Rower with a MC fx, Nationals in 2mo



Courtesy: Dr. Lauren Shapiro

Tip #3 – Predrill over guidewire



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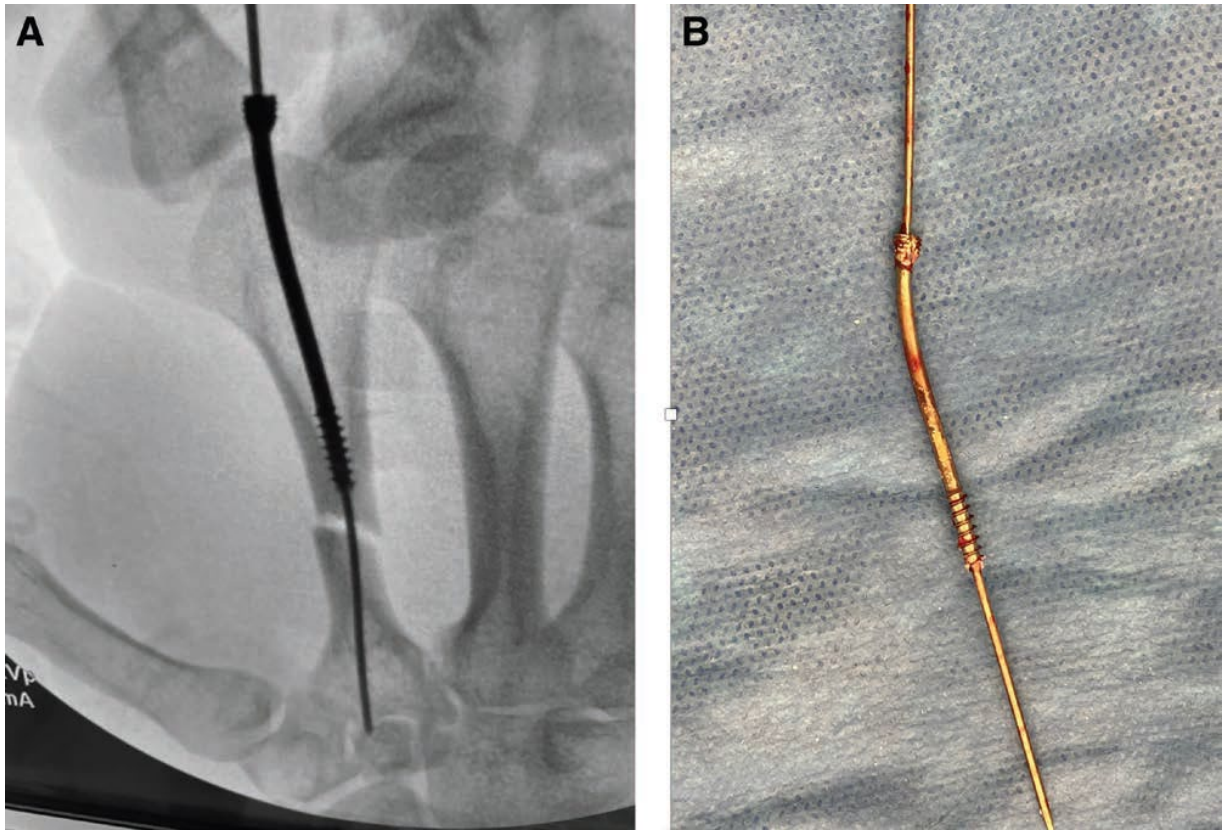
Not pre-drilling can bend/break the screw!



OPEN

PRS GLOBAL OPEN

ORIGINAL ARTICLE

Hand/Peripheral Nerve

Intramedullary Screw Fixation Comprehensive Technique Guide for Metacarpal and Phalanx Fractures: Pearls and Pitfalls

John Chao, MD*
Anup Patel, MD, MBA†
Ajul Shah, MD‡

Background: Phalangeal and metacarpal fractures are the second and third most common upper extremity fractures after distal radius fractures with varying methods of fixation techniques. Intramedullary screw fixation is an increasingly pre-

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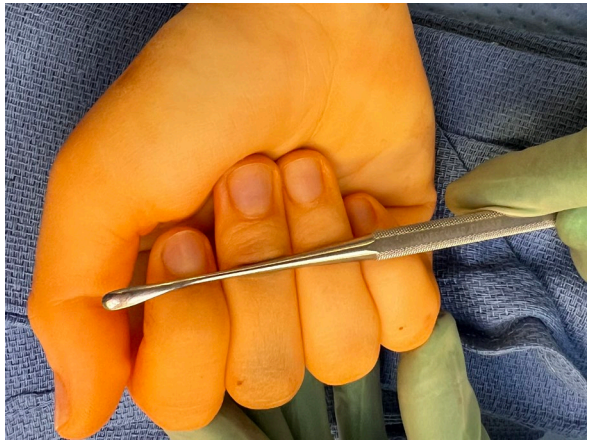
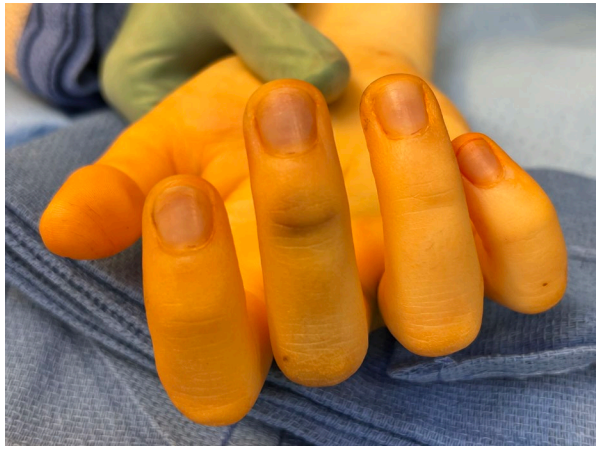
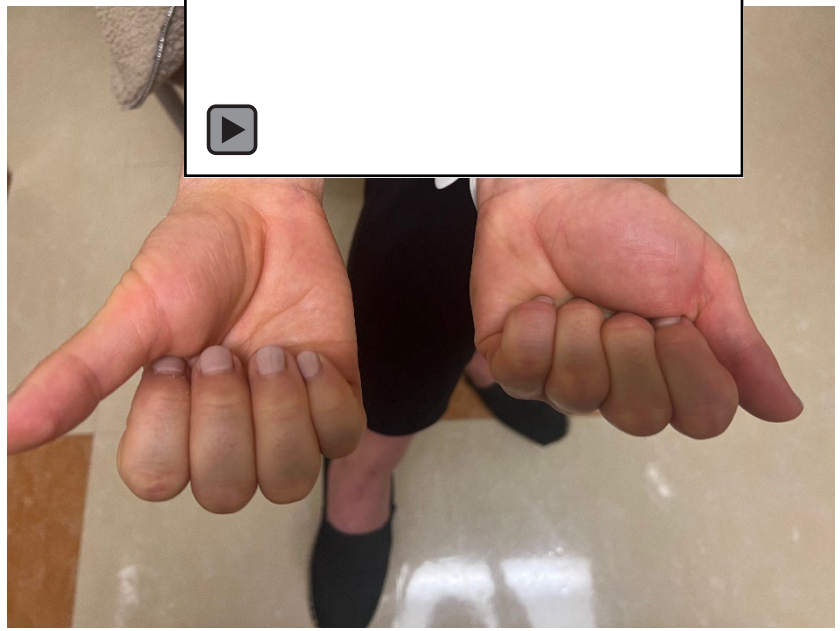


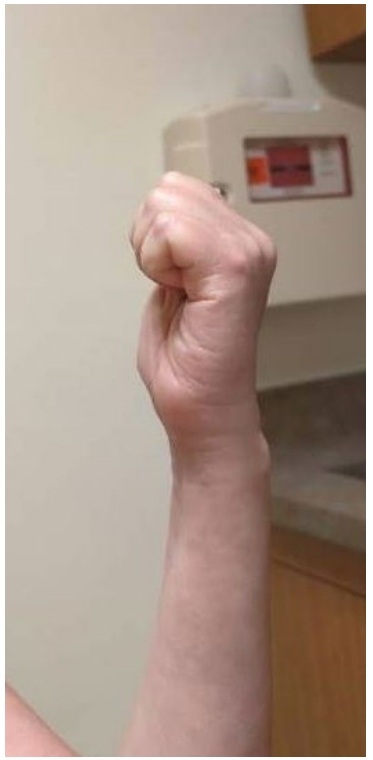




Multiple Metacarpal fractures

Courtesy Dr. Gopal Lalchandani

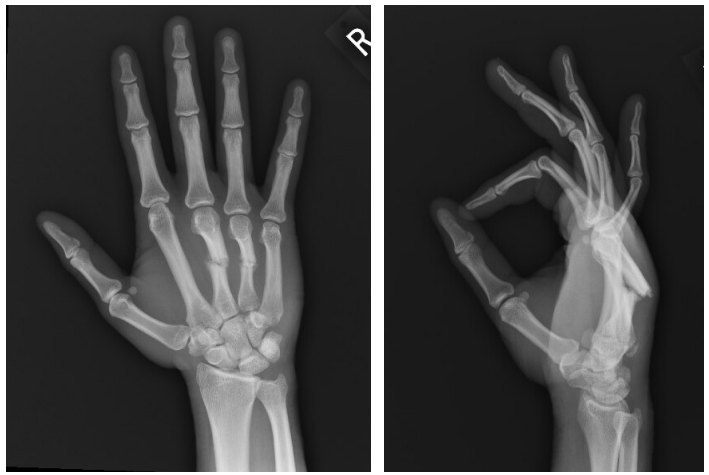

Series Time : 9:43:31



Revision

2 weeks postop

6 weeks postop



Courtesy: Dr. Anthony Ding


R
GCC

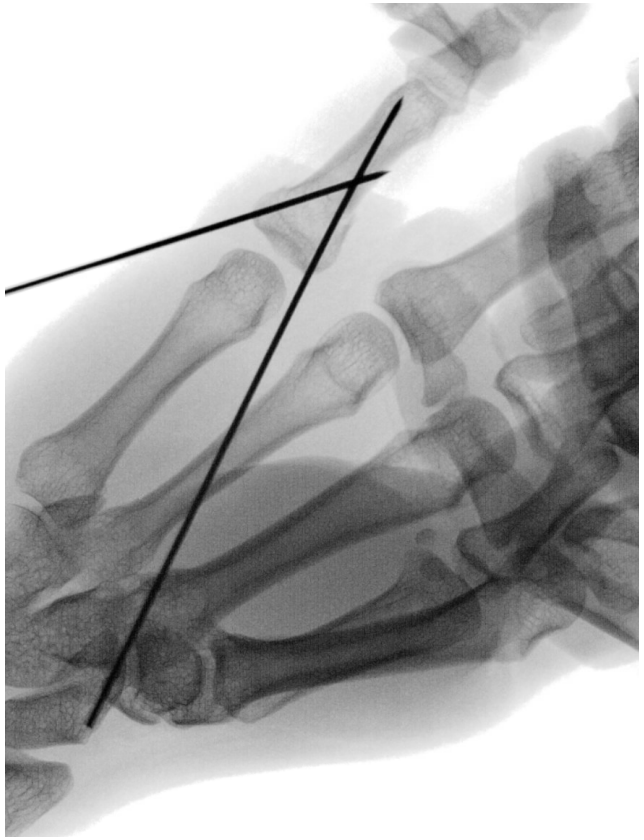

R
GCC
1 of 3

Tip # 3 – Avoid Malrotation

1 degree of malrotation in the metacarpal = 5 degrees of malrotation in the fingertip

1. Open and clamp
2. Forearm block or WALANT
3. Flex the fingers into the palm when inserting the screw

Phalanges – Which one is better?



Complications and Range of Motion Following Plate Fixation of Metacarpal and Phalangeal Fractures

Steven M. Page, BA, Peter J. Stern, MD, Cincinnati, OH

Table 1. Complications (66 Metacarpal and 39 Phalangeal Fractures)

Complications	*Phalangeal Fractures*	*Metacarpal Fractures*	*Total Fractures*
Major extensor lag or stiffness (lag ≥35° or ROM <180°)	14	4	18
Minor extensor lag or stiffness (lag >15° or total flexion MCP <75°, PIP <80°, or DIP <40°)	8	10	18
Major contracture (MCP or PIP flexion contracture ≥35° or extension contracture with ROM <180°)	11	5	16
Minor contracture (MCP or PIP flexion contracture >15° and <35°)	3	1	4
Minor malunion (no functional problems)	2	1	3
Delayed union (minor complication)	1	3	4
Nonunion (major complication)	1	1	2
Major plate problem (plate prominence requiring procedure solely for removal)	0	3	3
Minor plate problem (asymptomatic plate loosening or breakage)	1	1	2
Major infection (deep infection requiring surgical drainage)	1	1	2
Minor infection (superficial infection)	0	1	1
Tendon rupture	1	1	2

ROM, range of motion; MCP, metacarpophalangeal; PIP, proximal interphalangeal; DIP, distal interphalangeal.

Table 2. Range of Motion Following Plate Application*

Final Range of Motion	*Phalangeal Fractures (%)*	*Metacarpal Fractures (%)*	*Total (%)*
Excellent (240°–full)	3 (8)	39 (62)	42 (42)
Good (220°–239°)	1 (3)	9 (14)	10 (10)
Fair (180°–219°)	10 (27)	8 (13)	18 (18)
Poor (<180°)	23 (62)	7 (11)	30 (30)
Total	37	63	100

* Additional surgery (tenolysis/capsulotomy) had not been performed.

56% extensor lag

28% major contracture

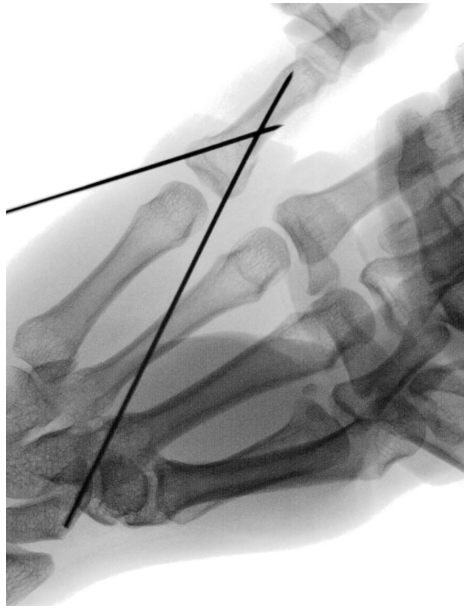
11% Good-excellent ROM

62% Poor ROM

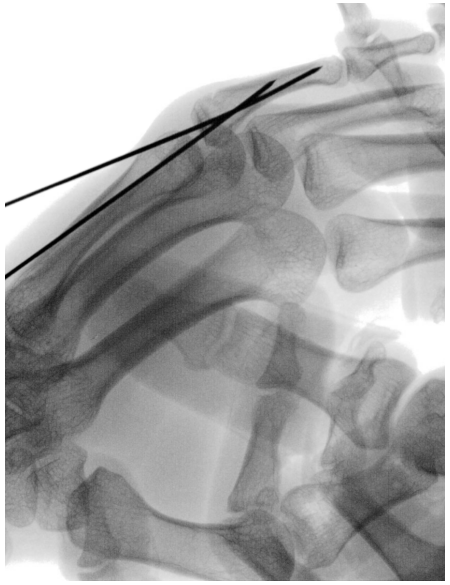
SCIENTIFIC ARTICLE

Percutaneous Pinning of Fractures in the Proximal Third of the Proximal Phalanx: Complications and Outcomes

Safi Faruqui, DO, Peter J. Stern, MD, Thomas R. Kiefhaber, MD



Total Active Motion – 200^0 (normal 270)
PIP flexion loss (50%) – 20^0
Fixed flexion contracture (30%) – 15^0

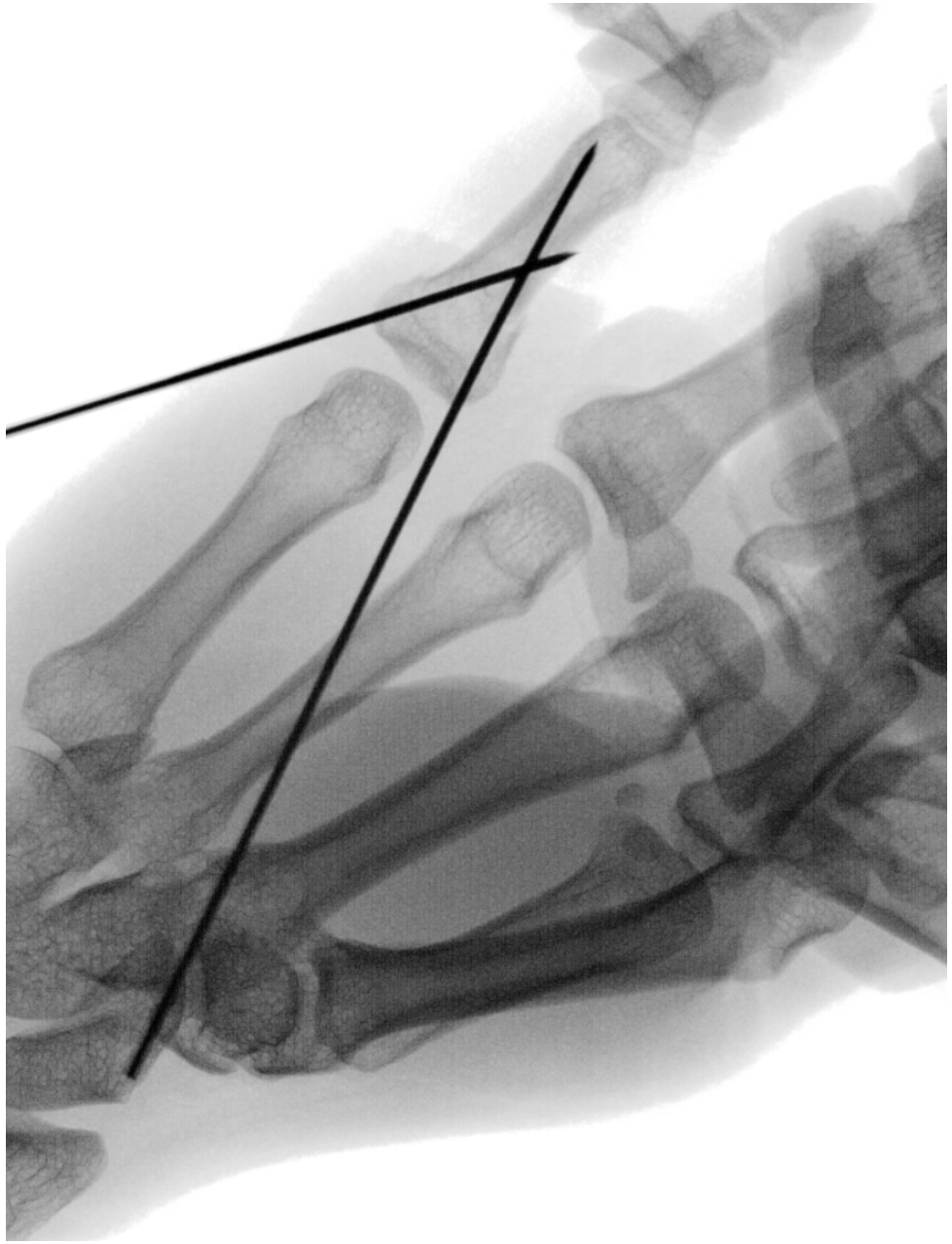


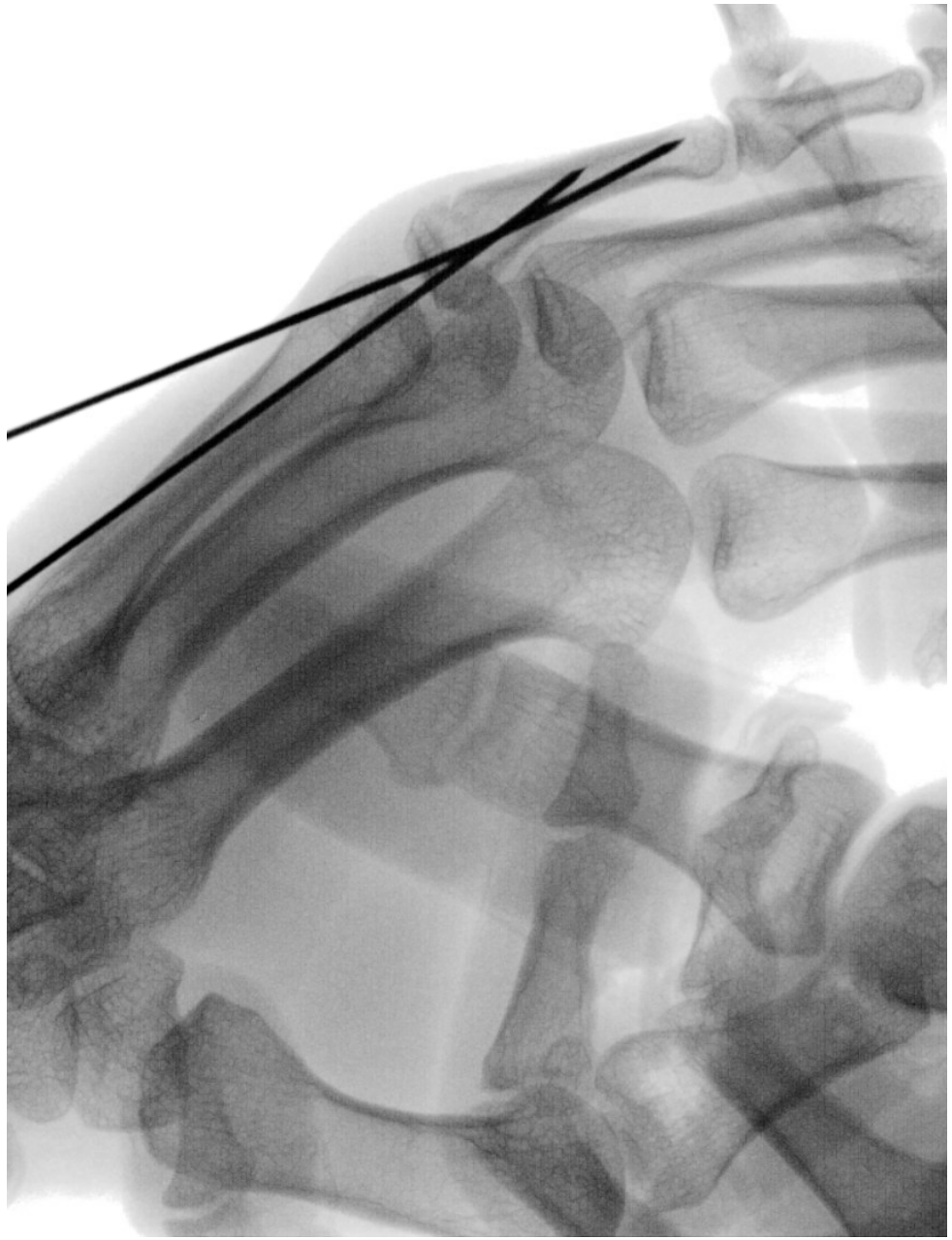
31F s/p fall

26^0 apex volar angulation

Joshi BB. Percutaneous internal fixation of fractures of the proximal phalanges. Hand 1976;8:85–92.

Expected extension lag with 27^0 apex volar angulation = ~ 24^0





4 weeks later – 26^0 apex volar angulation

Review Article

HAND
2022, Vol. 17(4) 595–601

DOI: 10.1177/1558944720928503
journals.sagepub.com/home/HAN

Intramedullary Compression Screw Fixation of Proximal Phalangeal Fractures: A Systematic Literature Review

Brahman S. Sivakumar[1], Vincent V. G. An[2], David J. Graham[3], James Ledgard[1], Richard D. Lawson[1], and Dominic Furniss[4]

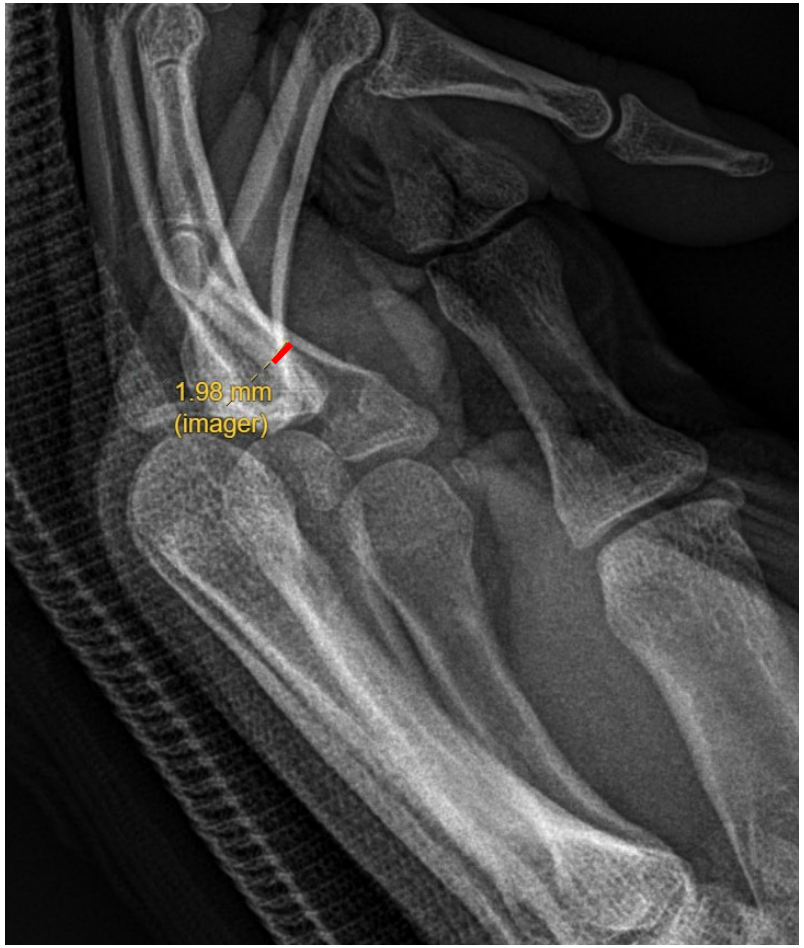
Table 2. Complications and Outcomes for Cohort of Proximal Phalanges Only.

Reference	Follow-up in weeks	Motion	Outcome measures	Major complications	Minor complications	Return to work
Del Pinal et al[15]	76 [20-216]	TAM 243 [150-270]	–	1 fracture had unrecognized articular extension with early displacement1	Nil	Mean 10.9 weeks [3.4-60]
Aita et al[16]	68 [48-104]	TAM 97% contralateral side [252 assuming norm of 260]	DASH 3.56 Pain VAS 1.52 [1 for normal]	1 infection requiring removal, 3 long screws requiring removal	Nil	35 fractures to same occupation
Itadera and Yamazaki[17]	47 [44-48]	MPJ 72 [50-80]	–	Nil	1 symptomatic stiffness	
Gaspar et al[18]	84 [61-106]	TAM 258 [245-270]	Grip strength 97% [84-104] of contralateral DASH 3.9 [0-13.6]	Nil	Nil	Mean 6.4 weeks [0.9-16.7]

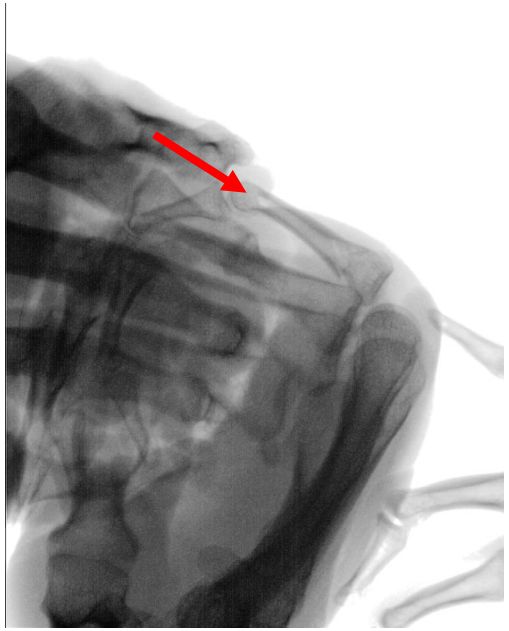
Note. TAM = total active motion; VAS = visual analog scale; DASH = Disabilities of the Arm, Shoulder, and Hand; MPJ = metacarpophalangeal joint.

Mean TAM = 248^0

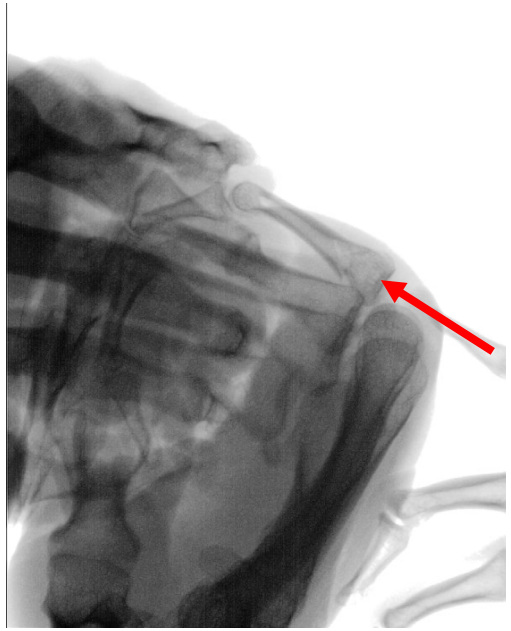
Tip # 1 - Preop Plan lateral view



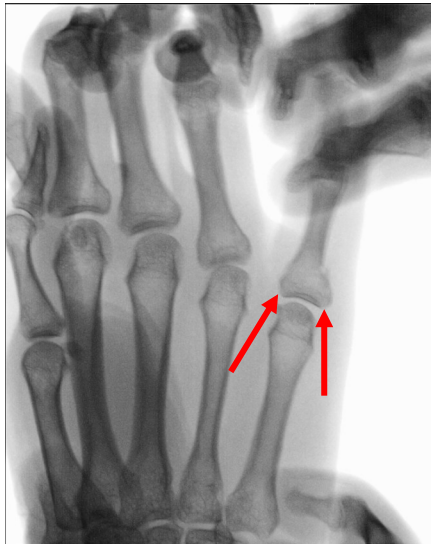
Retrograde



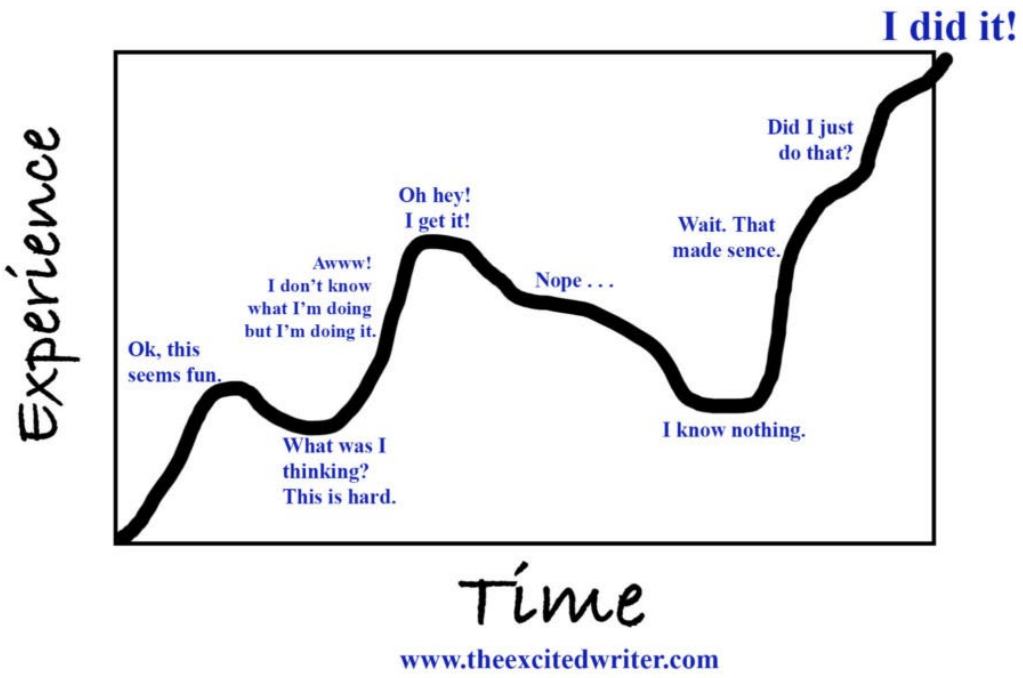
Antegrade

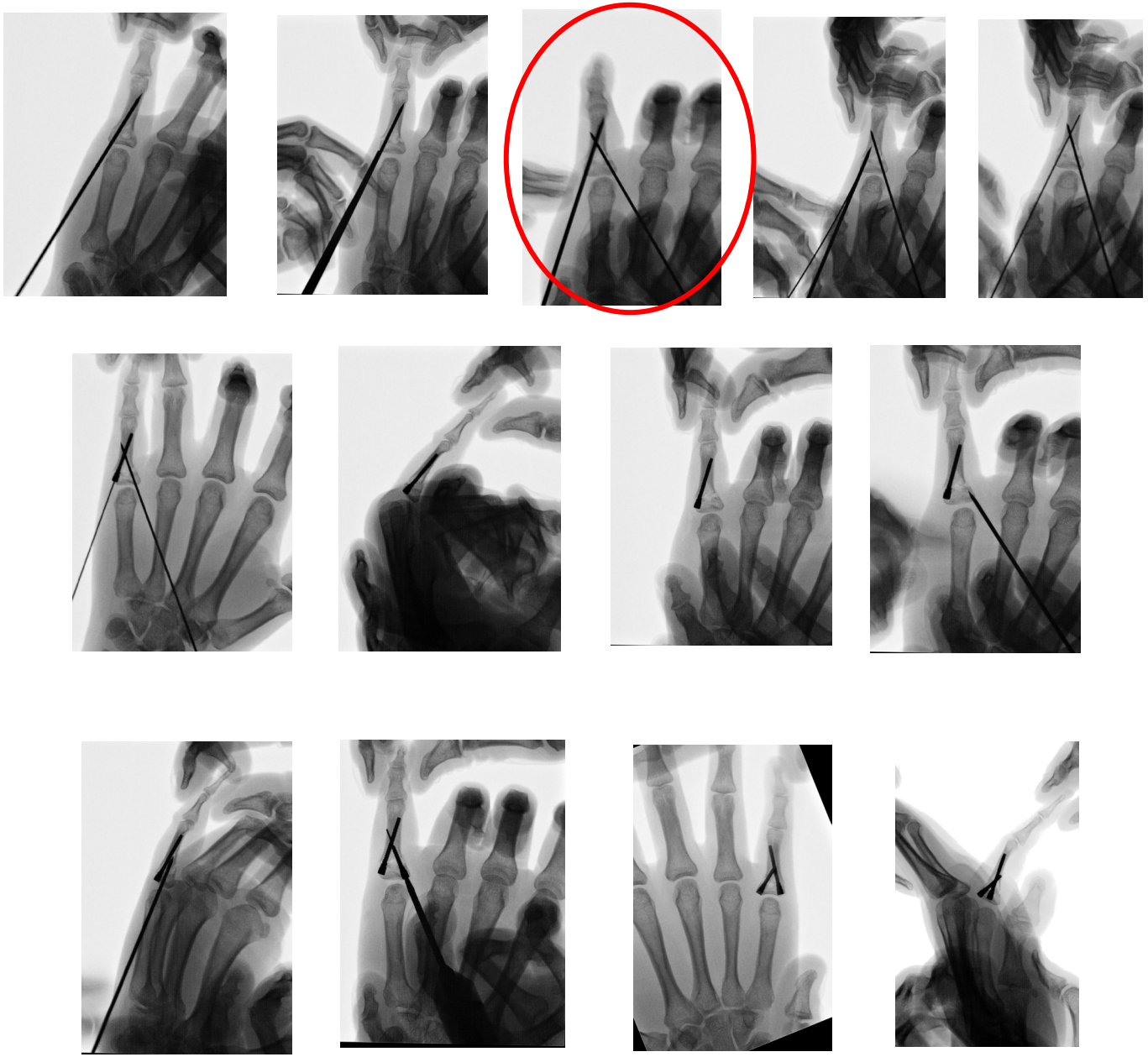


Extra-articular cross



The Learning Curve





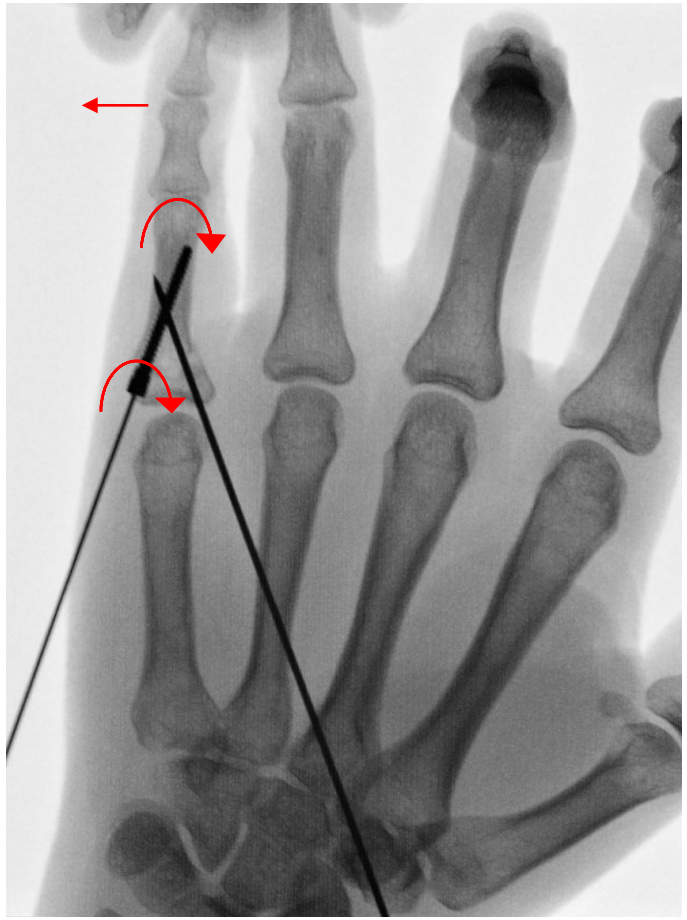
10 days postop

3 months postop

Tip # 2 - Proximal Phalanx Rotation

LEFT HAND

Distal fragment pronates



RIGHT Hand - Uninjured

LEFT HAND

Take Home Point

Metacarpal and Phalangeal Fractures: Does Intramedullary Fixation Work?

YES! **and Thank You**

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