Academy of Minimally Invasive Foot & Ankle Surgery

Bosch/SERI Bunionectomy

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Conflict of Interest Disclosure

Jordan Sullivan has no financial relationship with companies and/or products which could affect the objectivity of this lecture.

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Outline

1. Procedure selection
2. Fixation vs non-fixation
3. Bosch/SERI technique
4. Tips, Pearls, Pitfalls
5. Cases

All xrays shown are mine

Learning objectives

1. Learn Basic history of procedure and relevant publications
2. Understand technical details of performing procedure
3. Understand how to apply procedure to multiple types of bunions and how to address common complications

Procedure selection

1. Surgeon experience
2. Bunion severity
3. Patient complaints, needs and expectations
    a. Very important and often neglected by surgeon
    b. Elderly/high risk -> less is more
    c. Short vs Long term pt expectations
    d. Recovery needs, how demanding is their lifestyle/obligations, are they a caregiver?
    e. Does the patient want perfect xrays?
4. Facility, insurance, costs of implants
    a. Hospital, ASC, in-office procedures are very different
5. Med/surgical literature

Fixation vs non-fixation

1. Lack of fixation can scare away residents who are trained to use hardware and have never been exposed to secondary bone healing outside of trauma or stress fractures
2. MIS can be thought of as controlled trauma with osteotomies allowing specific and stable movement to correct adjacent joint and soft tissue alignment and balance.
3. Advantages of non-fixated bunions
    a. No permanent hardware, no need for hardware removal
    b. Decreased expense (important for ASC/office)
    c. Secondary Bone healing vs primary bone healing (faster, stronger)
    d. Decreased risk of infection
    e. Ability to adjust osteotomy post-operatively
    f. Faster OR time
4. Disadvantages
    a. Perhaps a steeper learning curve for traditionally trained surgeons
    b. Less stability
    c. Arguably requires more patient compliance/trust
    d. Limited by ability of bandage to hold position (reduced shift)

Bosch/SERI: bridging the gap between fixation/non fixation

1. In my hands, the use of temporary pin can achieve the best of both worlds.
2. Utilizes inexpensive temporary hardware (steinman pin) with whatever osteotomy you desire (transverse, chevron, wilson, hohmann...)
3. Achieves greater relative stability
4. Allows greater lateral translation of the capital fragment
5. Well documented in literature
6. No permanent hardware
7. Potential disadvantage: Increased risk of pin-tract infection (can be minimized with proper pin site care and surgical technique)
8. Well tolerated by patients, less post op pain
9. No draining/trauma to joint capsule, minimal postop stiffness/arthritis
10. Versatile (mild up to severe)

Literature

Jeyaseelan, Luckshmana, and Francesc Malagelada. "Minimally invasive hallux valgus surgery—A systematic review and assessment of state of the art." *Foot and Ankle Clinics* 25.3 (2020): 345-359.

2020 MIS review analyzed 13 studies specifically “Bosch” albeit with slight differences across the board

- 1719 feet, avg follow up of 35 months
- Variable results. Largest was performed by Gianni et al, 2013

Gianni et al. 896 feet, avg of 7 year follow up

- Included 1st IMA up to 20 degrees
- AOFAS 46.9 to 89
- HVA 32 to 13
- IMA 14 to 6.9
- 0 non-unions or AVNs
- 5.3% recurrence rate
- 2% pin irritation
- 0 deep infections
- 0 hallux varus

Table 1
Overview of included studies

Surgical Technique	Author, Year of Publication	Level of Evidence	Study Design	Number of Patients	Number of Feet	Male (%)	Age	Follow-Up
BOSCH (including SERI)	Magnan et al,[20] 2005	IV	Case series	82	118	5 (6)	56.3 ± 13 (17–79)	35.9 ± 10.9 (24–78)
	Lin et al,[21] 2009	IV	Case series	31	47	4 (13)	40.8 (13–63)	23.7 (16–68)
	Maffulli et al,[22] 2009	III	Retrospective comparative	36	36	0	51.5 ± 13.1 (21–70)	25 ± 3.2
	Siclari et al,[23] 2009	IV	Case series	49	59	5 (10)	54.6 (24–70)	31.48 (12–48)
	Enan et al,[24] 2010	IV	Case series	24	36	4 (16)	37.8 ± 12.7 (17–52)	21(12–36)
	Tong et al,[25] 2011	IV	Case series	20	23	2 (10)	55.1 (29–75)	22 (12–60)
	Radwan et al,[26] 2012	II	Prospective comparative	29	31	4 (14)	32.7 ± 7.4	21.7 (12–36)
	Scala et al,[27] 2013	IV	Case series	126	146	11 (9)	52.6 (16–87)	29.1 (12–54)
	Giannini et al,[29] 2013	II	Prospective comparative	20	20	0	53 ± 11	7 y
	Gadek et al,[28] 2013	IV	Case series	54	54	?	45.7	18
	Giannini et al,[30] 2013	IV	Case series	577	896	61 (10)	49 (20–65)	7 y (5–10)
	Liuni et al,[32] 2018	IV	Case series	52	58	3 (5%)	64 (28–82)	25 (12–48)
	Lucattelli et al,[31] 2019	IV	Retrospective case series	195	195	18(9)	49.4 (20–70)	
Total/Mean				1295	1719	9% (n = 117)	49.4	

Numerous studies, some variability

Faour-Martín, Omar, et al. "Long-term results of the retrocapital metatarsal percutaneous osteotomy for hallux valgus." *International orthopaedics* 37.9 (2013): 1799-1803.

1. 115 feet, 10 year follow up Bosch Bunionectomy, same surgeon single hospital
2. Inclusion: no previous bunion surgery, IM <20, no lat release, no akin, no shaving of bump
3. Results: AOFAS significantly improved by avg of 42.2 at 10 yrs, IM improved from 17.6 to 8.1 and HVA 34 to 14.6 ($p<0.000$)
4. Recurrence rate of 2.6% at 10 years (defined as HVA >20)

Kadakia, Anish R., Jonathan P. Smerek, and Mark S. Myerson. "Radiographic results after percutaneous distal metatarsal osteotomy for correction of hallux valgus deformity." *Foot & ankle international* 28.3 (2007): 355-360.

1. Concluded unacceptable results after 18 consecutive patients, 38% recurrence rate within 3 months

Magnan, Bruno, et al. "Percutaneous distal metatarsal osteotomy for correction of hallux valgus." *JBJS* 87.6 (2005): 1191-1199.

1. Clinical and radiographic success after 118 consecutive feet, pt satisfaction of 91% at follow up of 35 months
2. IM from 12.3 to 7.3, HVA from 31.5 to 13.7 ($p<0.005$)
3. Recurrence rate of 2.5%
4. Comparable success to traditional open

Many other studies with variable results. One can conclude that there is indeed a learning curve and cases early in surgeon's career tend to have less satisfactory results. This is true of almost any surgical procedure in my opinion

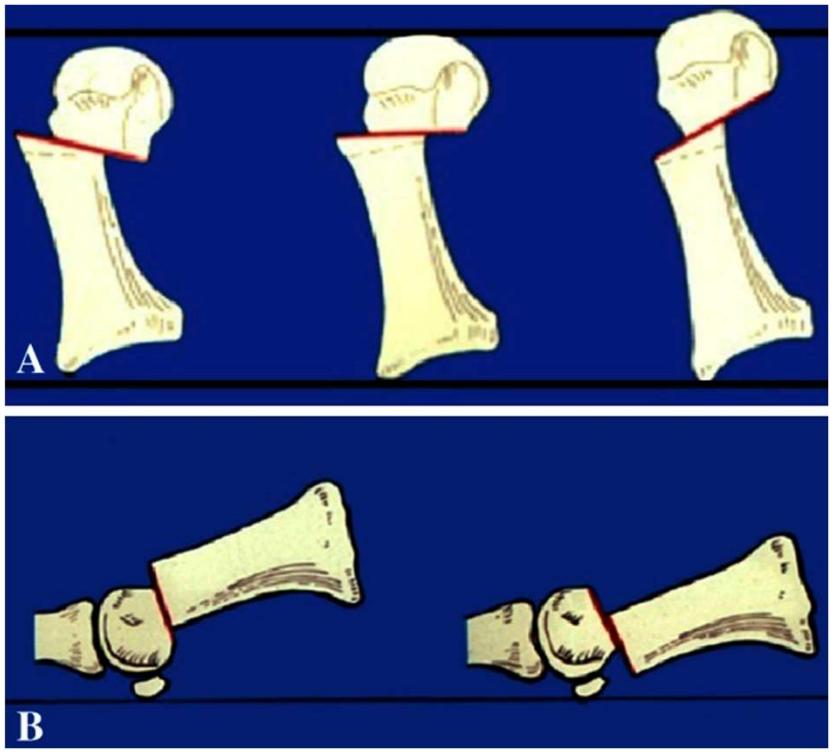
Versatility of Transverse Bosch/SERI

Transverse cut, can be angulated to shorten, lengthen, DF or PF.

Can be done with long shannon burr, or with slightly larger incision a small sagittal saw.

Can be done w/wo akin, w/wo shaving and w/wo lat release

I do NOT do lat release with these anymore, intact lat capsule adds 2nd point of fixation and dramatically increases stability.



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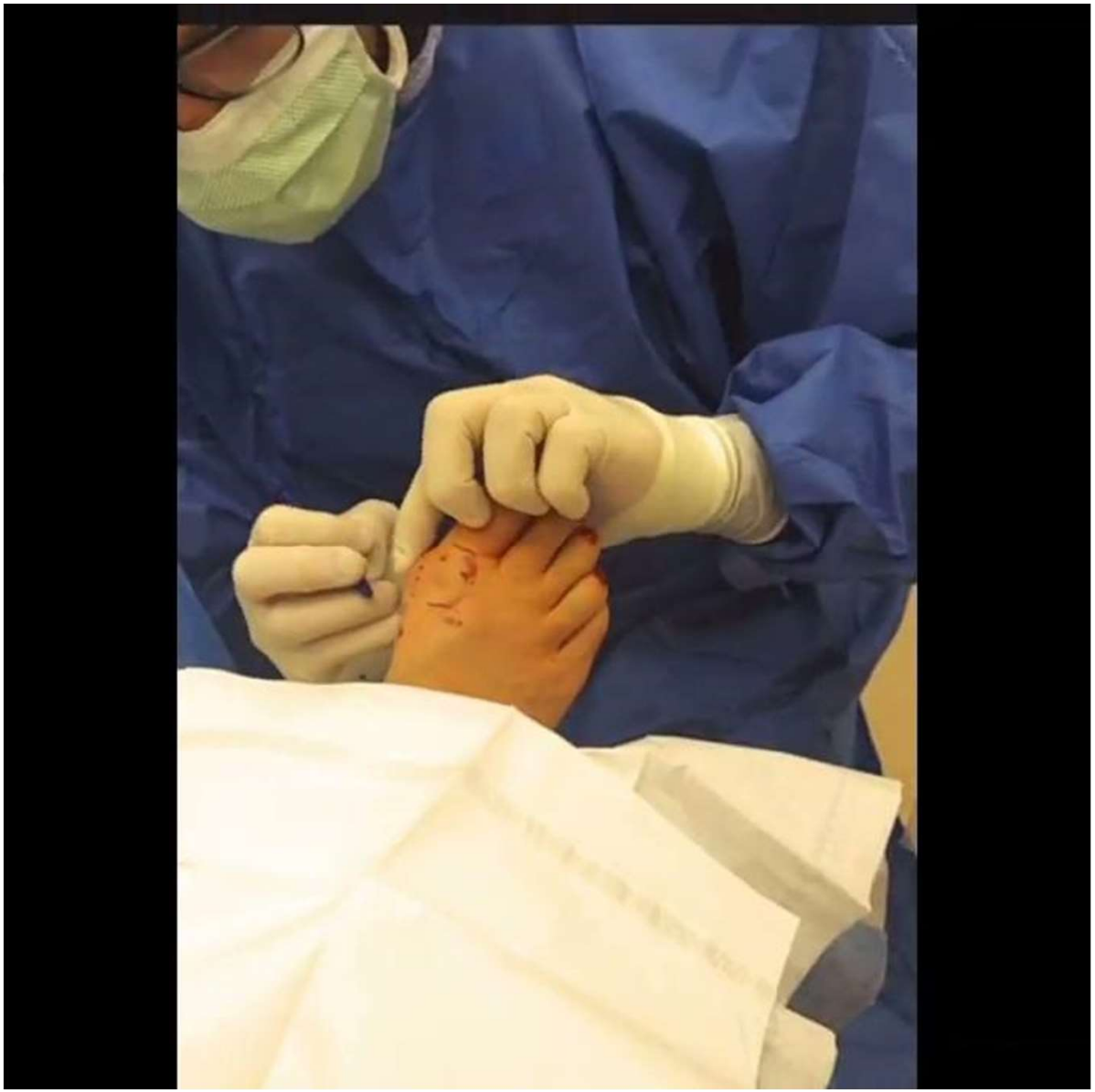


Bosch tips, pearls, pitfalls

1. No need to shave bump 90% of the time (large bone spur or dorsal spur needs removal)
    a. If you do shave, don't overdo it, this reduces integrity of medial cortex which interfaces with pin and also will enable less lateral translation. This can be done strategically if you WANT less lateral translation (for bump heavy, deformity light bunion)
2. Pin insertion critical, take your time
    a. Directly medial, along dorsal/plantar midline of prox phalanx and 1st metatarsal head
    b. Hold hallux in varus with dorsal pressure on met head (to prevent plantarflexion of met osteotomy)
    c. Initial tendency to insert pin too dorsal leading to slight plantarflexion of osteotomy (may be desired for MPE)
    d. Can use driver with wire collet, but be careful as too much spinning can irritate skin and increase your risk of pin tract infection
    e. I insert with my hand only and sometimes a pickup for additional leverage. Alcohol swab to pin site with weekly dressing change.
3. Use 2mm steinman pin 99% of the time.
4. Use pin insertion tool if available, can also use freer or curved stat
5. If pin is difficult to get around the corner (bump), +/- akin osteotomy to reduce tension on pin, or use larger burr to shorten an extra couple mm
6. Straight transverse cut very stable and least amount of dorsal or plantar met head displacement in my experience. Can also achieve frontal plane rotation and get fantastic sesamoid alignment with this osetotomy. Recent cadaveric MICA study with 2 screws revealed transverse and chevron had identical load to failure (1)

1. Aiyer A, Massel DH, Siddiqui N, Acevedo JI. Biomechanical Comparison of 2 Common Techniques of Minimally Invasive Hallux Valgus Correction. Foot & Ankle International. 2021;42(3):373-380. doi:10.1177/1071100720959029

Protocols

1. Local anesthesia only, +/- nitrous oxide, +/- ativan
2. Immediate WB in surgical sandal with standard bandage
    a. Encourage mobility, some walking, ankle circles, pain as guidance
    b. low/zero muscle atrophy
3. Bandage and surg shoe for 4 weeks progressively increasing activity
4. Pull pin at 4 weeks, back into a normal shoe with small compression sleeve, encourage immediate PF/DF ROM of 1st MPJ until normal.

Additional advantages of note

1. Can be done on mild to severe bunions
2. Can push the limits on osteoporotic bone due to large surface area/friction of pin
3. Pt able to take care of themselves at home
4. Reduced soft tissue trauma -> less pain in my experience, less narcotic reliance

Case studies and examples

- All my own cases
- Xrays taken pre, 1 week post, 4 weeks post, 8 weeks post
- Most before/after pics are taken pre-op and 8 weeks post op (swelling often still present)

74 y/o female

78 y/o male, Bunion and 2nd HT pain

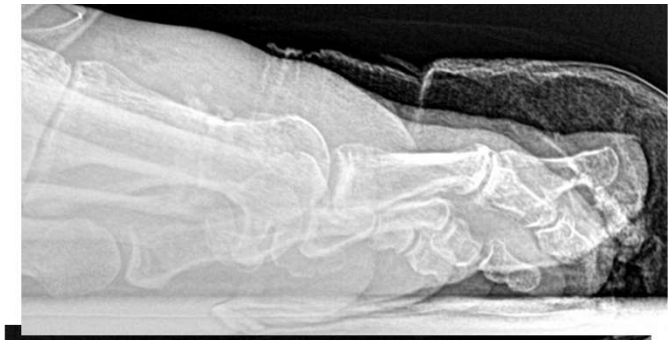
Preop, 1 week, 8 weeks

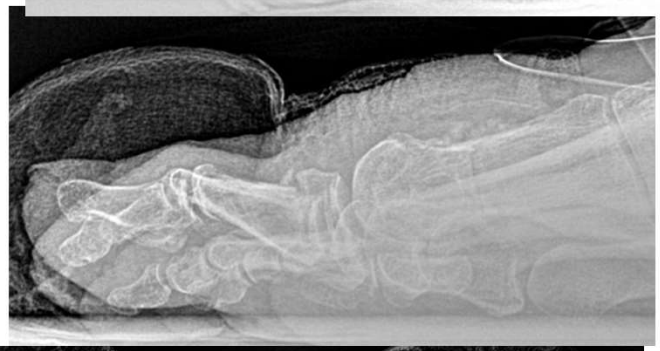
58 yo male, 4 weeks post op

Very tight/stiff. Use downhill shortening cut to really decompress 1st MPJ

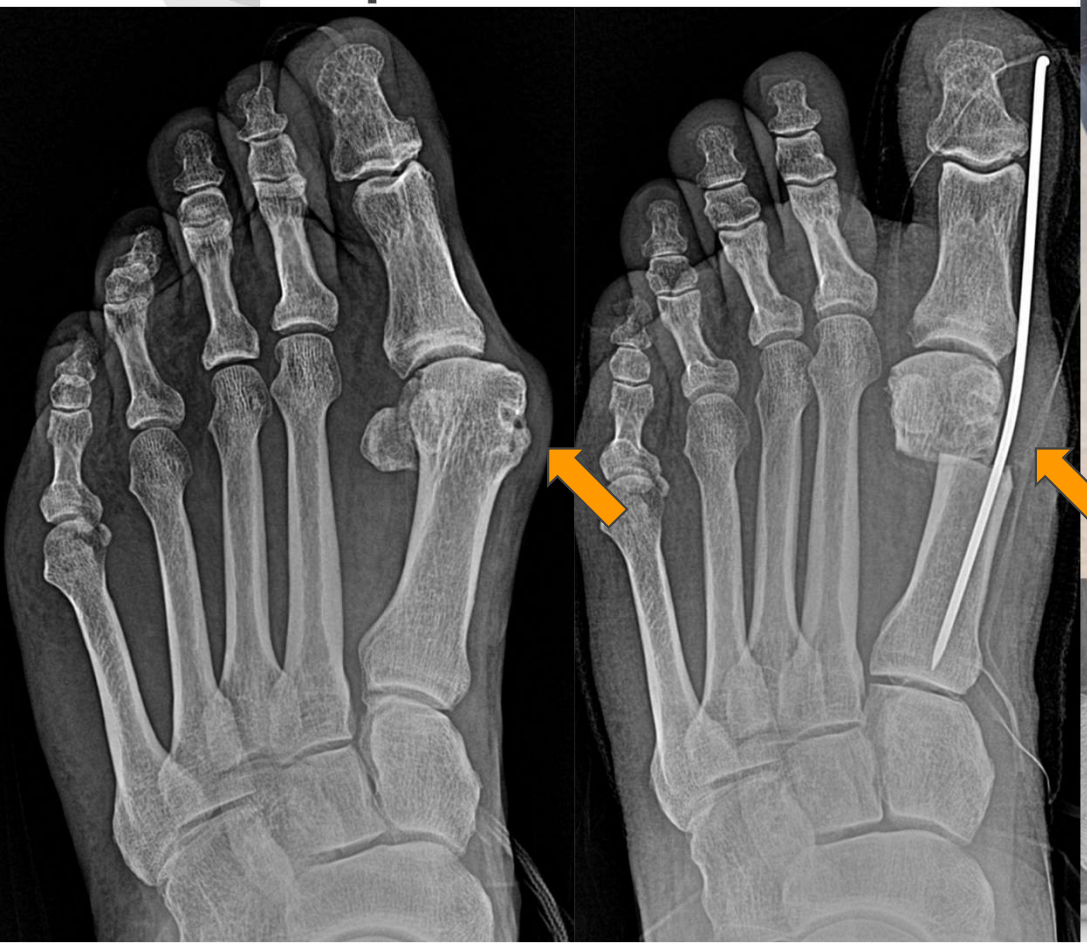
Notice amount of bone callus present only 4 weeks post-op

Pic at 8 weeks, still some swelling





1 week post op, WB XRs, foot often supinated, no shave except medial clip



Significant Bunion, HTs, 8 wks post

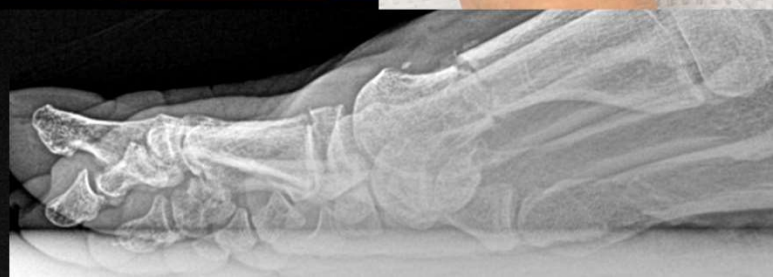
46 y/o male, 4 weeks post op

Pin out, XR taken

8 weeks post op

78 y/o male, enjoys skiing, feels unstable on his foot

62 y/o female, lives in Vail, active hiker/skier/shopper



72 y/o female Bunion pain only

Gap between digits will disappear over 6-12 months. Don’t necessarily need to address valgus digits every time

74 y/o female, significant bunion pain in shoes

Example of pin too dorsal, still great outcome

Last xrays ~6 months post up. Full bony consolidation, pt seen for tailor’s bunion later on

67 y/o F, large IM, only have 4 week PO

49 y/o F runner, multiple revisions, opted for lapidus/tailor's shave initially. Came back with tailor's pain, 2nd metatarsalgia, then recurrent bunion pain and 2nd HT

Early cases in my career, would approach a bit different

Again, would likely do better today. Manage expectations (Improvement, not perfection)



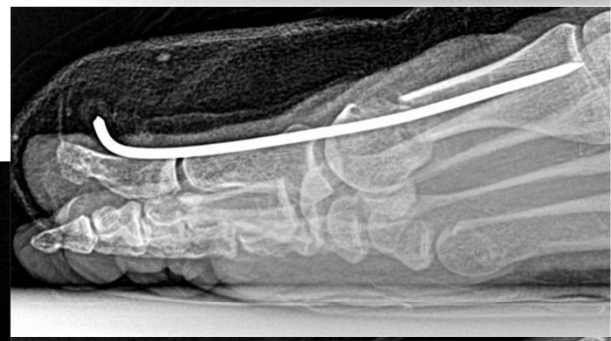



RA pt, simple approach

Example of full healing

Pre, 1wk, 4wk, 1yr

Biased with slight PF. Notice joint space alignment on AP and joint opening up nicely on lateral



A few Complex metadductus type cases

Case #1

45 y/o F. Significant hallux valgus with valgus 2nd and 3rd digits (bilaterally). MAA 25 left, 20 right.

Case #1

Bilat Bosch and 2nd/3rd met osteotomies. Met osteotomies long and shallow, bandaged as varus as possible for 4 weeks.

Case #1

Lateral at 4 and 8 weeks

Case #1

8 week AP and obliques

Bone healing evident

Some valgus recurrence

Case #1

Case #2 80 y/o female

Flexibility/reducibility

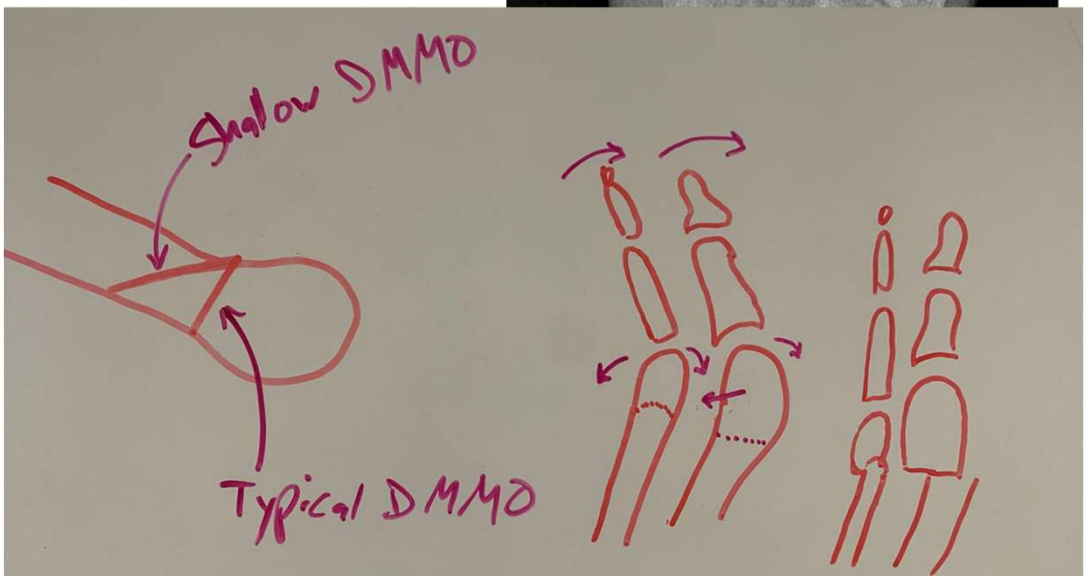
Case #2

Immediate post, 8 weeks post

HTs?

Shallow weil type met osteoto

1. Typical DMMO is ~45 deg to WB surface
2. Shallow DMMO as close to parallel to WB surface as possible using long shannon burr with no fixation
3. This allows increased shortening
    a. Add slack to extensors/flexors
4. This allows transverse plane manipulation (pivot)
    a. Use digit as the lever with bandage
    b. Kling/coban surgical bandage
    c. Apply KT tape at 1st bandage change, pulling digits as varus as possible
5. Capsular ligaments untouched allowing toe to move the met head in transverse plane (into varus)
6. Joint and capsule untouched preventing stiffness, scarring, elevation like a typical weil




PIVOT!
PIVOT!!!!

Case #2 at 8 weeks, final x-rays at 1 year

Case #3

1. PP medially based wedge osteotomies
2. Less pivot, but straighter toes?
3. Which is better?
    a. Do DMMO, assess flexibility of met head under flouro, if stiff, proceed with PP osteotomy

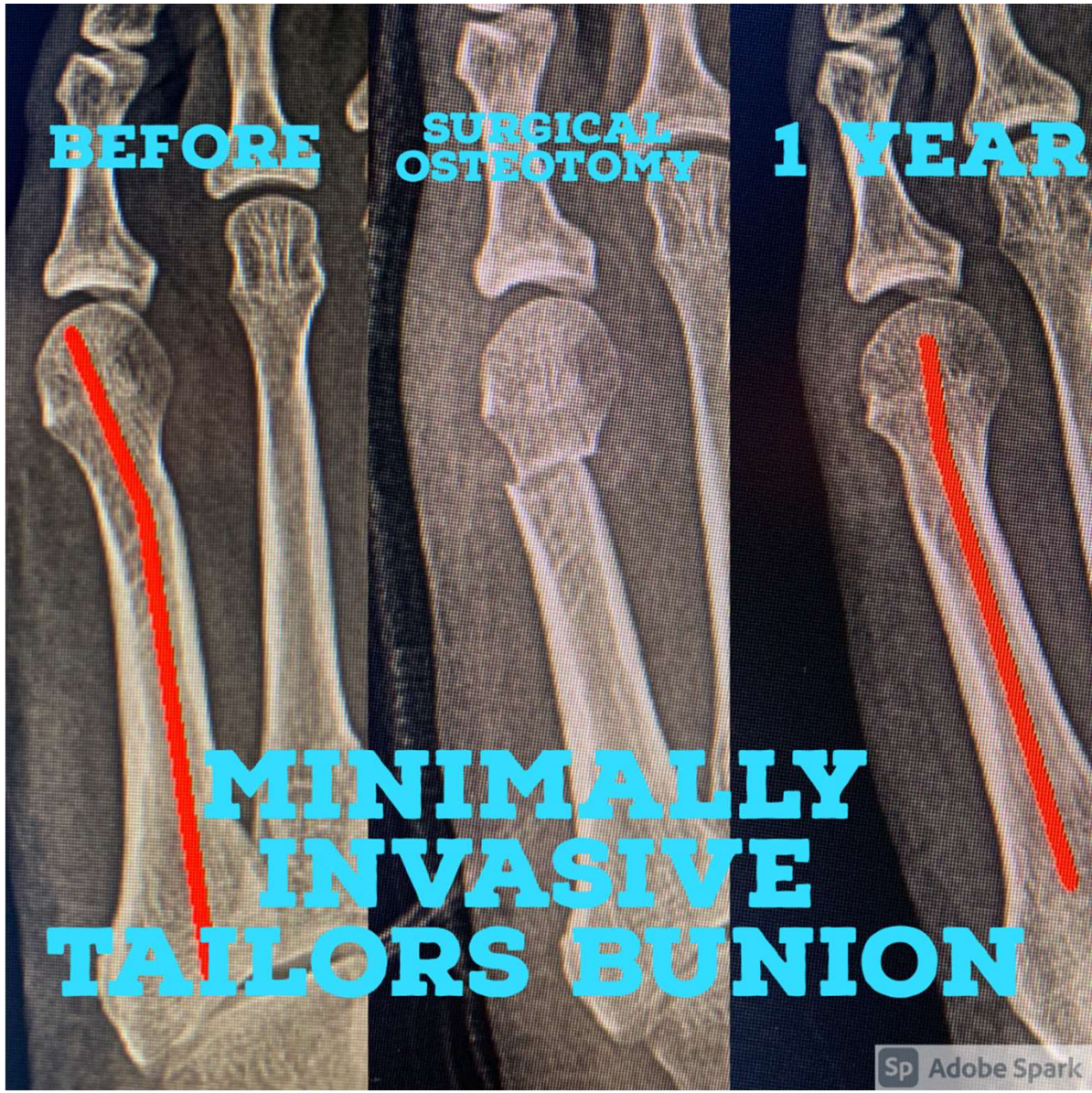
Tough revision, post lapidus, overlapping hallux, very stiff

Pre/8 weeks post

Lapidus revision

Bosch, perc EHL lengthening, 8 wks post op.

Osteotomies heal,
just as fractures heal.



Thank you

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