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Minimally Invasive Bunion Surgery: Methods and Outcomes

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Disclosures

- No financial disclosures
- I will not be discussing off the market products

MIS Bunion: Outline

- MIS History
- Soft Tissue and Bone Physics
- Principles in Fracture Healing
- MIS Anatomy Review
- Indications
- Contraindications
- Methods
- Literature Review
- Outcomes

MIS Bunion: History

- 1836 (Gernet) performed the earliest reports of surgical hallux valgus correction
- 1940s: Early reports of percutaneous HV, Podiatrist trying to circumvent the restrictive laws of surgery for Podiatric Physicians.
- 1960s: Power equipment for MIS osteotomy were developed.
- 1960s: Intraoperative Fluoroscopy became available.
- 2000 (Bosch, P): Subcapital osteotomy technique (SCOT)
- 2008 (Giannini): Modification SERI (Simple, Effective, Rapid, Inexpensive)
- 2014/2016 (Siddiqui): A Guide to the Percutaneous Bunioneconomy.

MIS: Bone Physics

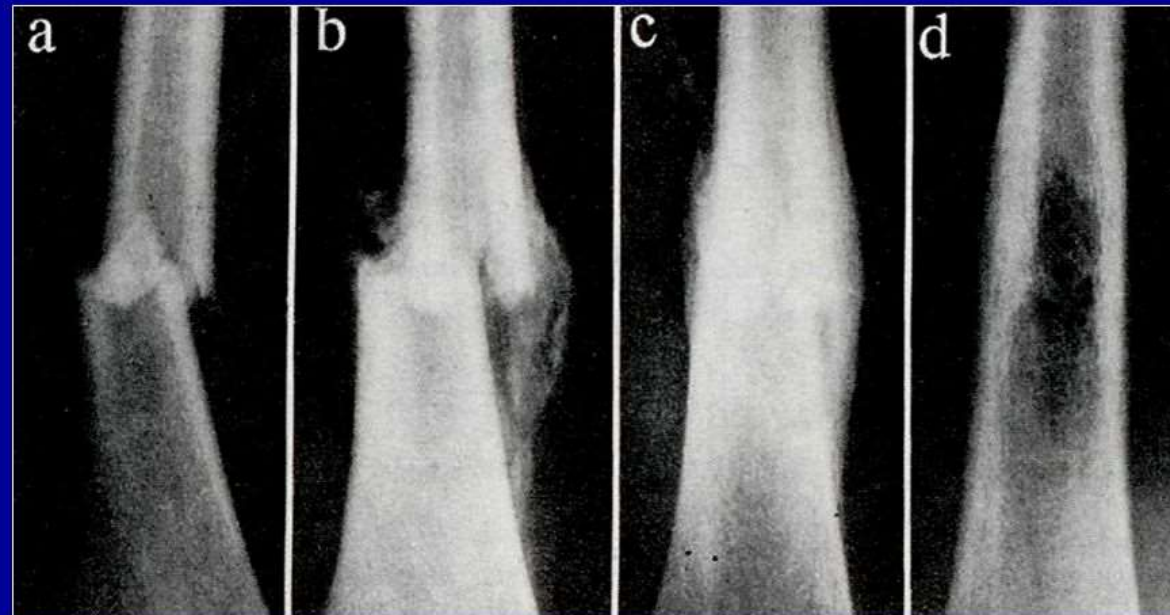
- **Davis's law** is used in anatomy and physiology to describe how [soft tissue](#) models along imposed demands.
- [Wolff's law](#), which applies to [osseous tissue](#). It is a physiological principle stating that soft tissue heal according to the manner in which they are mechanically stressed.[\[1\]](#)

MIS: Phases of bone healing



MIS: Principles of Fracture Healing

Principles of Fracture Healing



MIS: Bone remodeling



Remodelling

- Influenced by Wolff's law



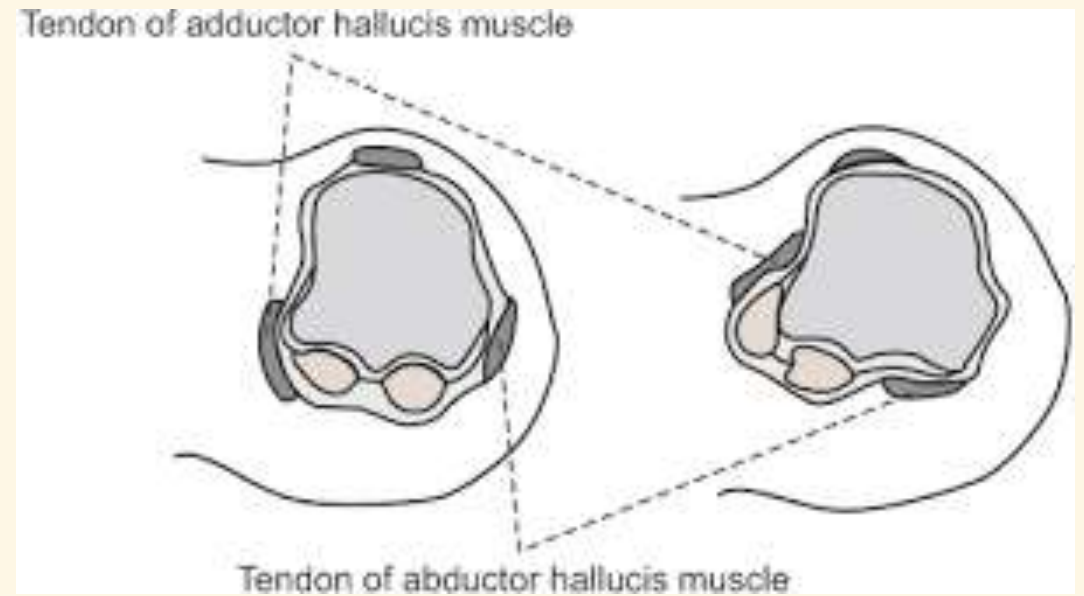
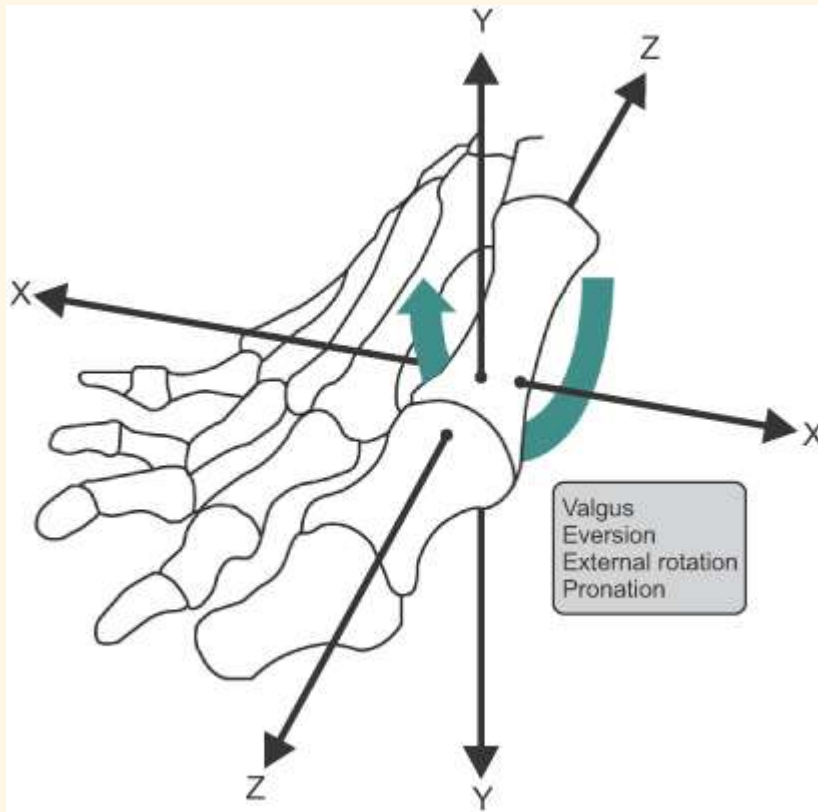
36



Bunion preop/ post op



MIS: Bunion Anatomy



MIS: Anatomy

Plastination plays an important role in long-term preservation of tissue and anatomical teaching.

[Malal JJ¹](#), [Shaw-Dunn J](#), [Kumar CS](#). **Blood supply to the first metatarsal head and vessels at risk with a chevron osteotomy.** [J Bone Joint Surg Am.](#) 2007 Sep;89(9):2018-22.

10 Cadavers

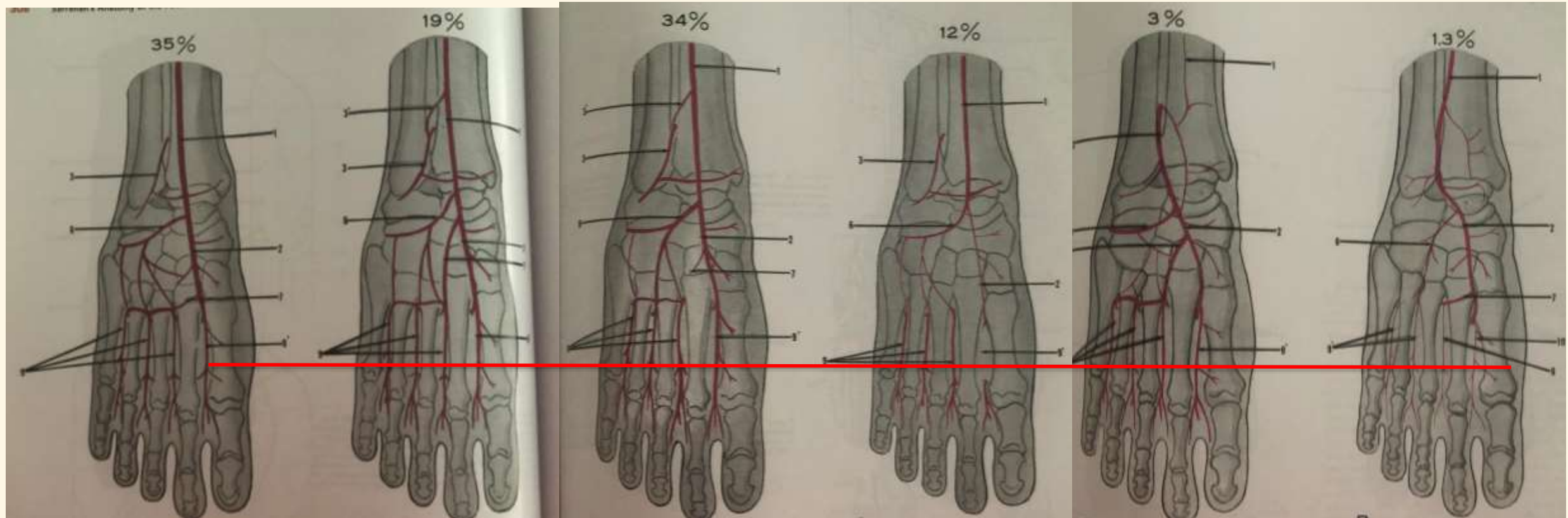
First dorsal metatarsal: Dominant vessel 8/10

First plantar metatarsal

Medial plantar arteries

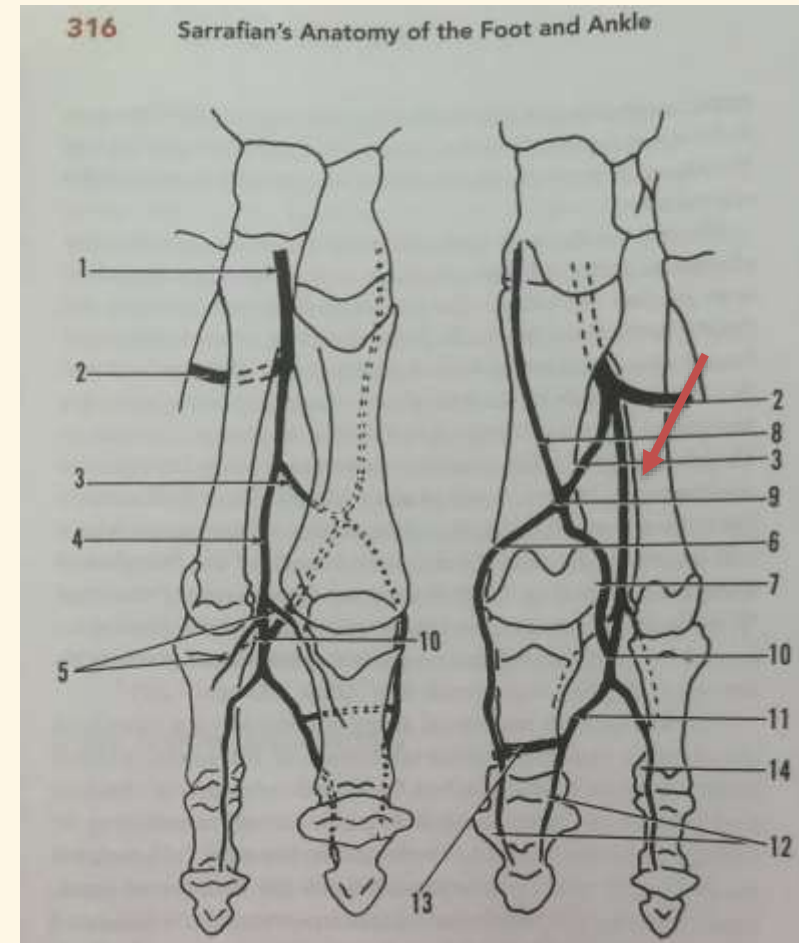
Plantar-lateral plexus was formed along the metatarsal neck, just proximal to the capsular attachment, with a varying number of branches from the plexus then entering the metatarsal head.

MIS: Bunion Anatomy



MIS: Bunion Anatomy

- Sub-periosteal dissection
 - Dorsal plane only
 - Preserve the plantar-lateral corner of the metatarsal neck



[Kuhn MA¹](#), et al. **Blood flow to the metatarsal head after chevron bunionectomy.** [Foot Ankle Int.](#) 2005 Jul;26(7):526-9.

N: 20 patients, chevron bunionectomy without tourniquet control by two surgeons.

Blood flow recordings: Periflux PF3 laser Doppler probe

Baseline → medial capsulotomy (45%) → adductor tenotomy (13%) → lateral release (13%) → chevron (13%)

TOTAL: 71% ↓

There was a statistically significant decrease in blood flow to the metatarsal head at each portion of the procedure.

No evidence of AVN at 3 months

All patients had radiographic evidence of union without recurrence or overcorrection.

MIS Bunion: Patient Criteria

Inclusion

- **Vascular Intact**
- IMA: 10-20+°
- +/- Deviation in HAA
- **Vitamin D-25: > 40 nmol/dl**
- Revision bunion (>6 mo)
- Spastic or Non-Spastic Bunion
- Medically Stable Co-Morbidities

Exclusion

- Vascular compromise
- Severe OA Joint
- Osteomyelitis surgical site
- Bursa
- History of wound along pin fixation consider internal fixation
- Surgeon Skills

MIS Bunion: Surgical Goals

- Realign the hallux joint access in all three planes
- Improve IM angle
- Restore and maintain a pain free joint
- Improve foot cosmesis
- Return to shoes

MIS: AO Principles Surgical Approach

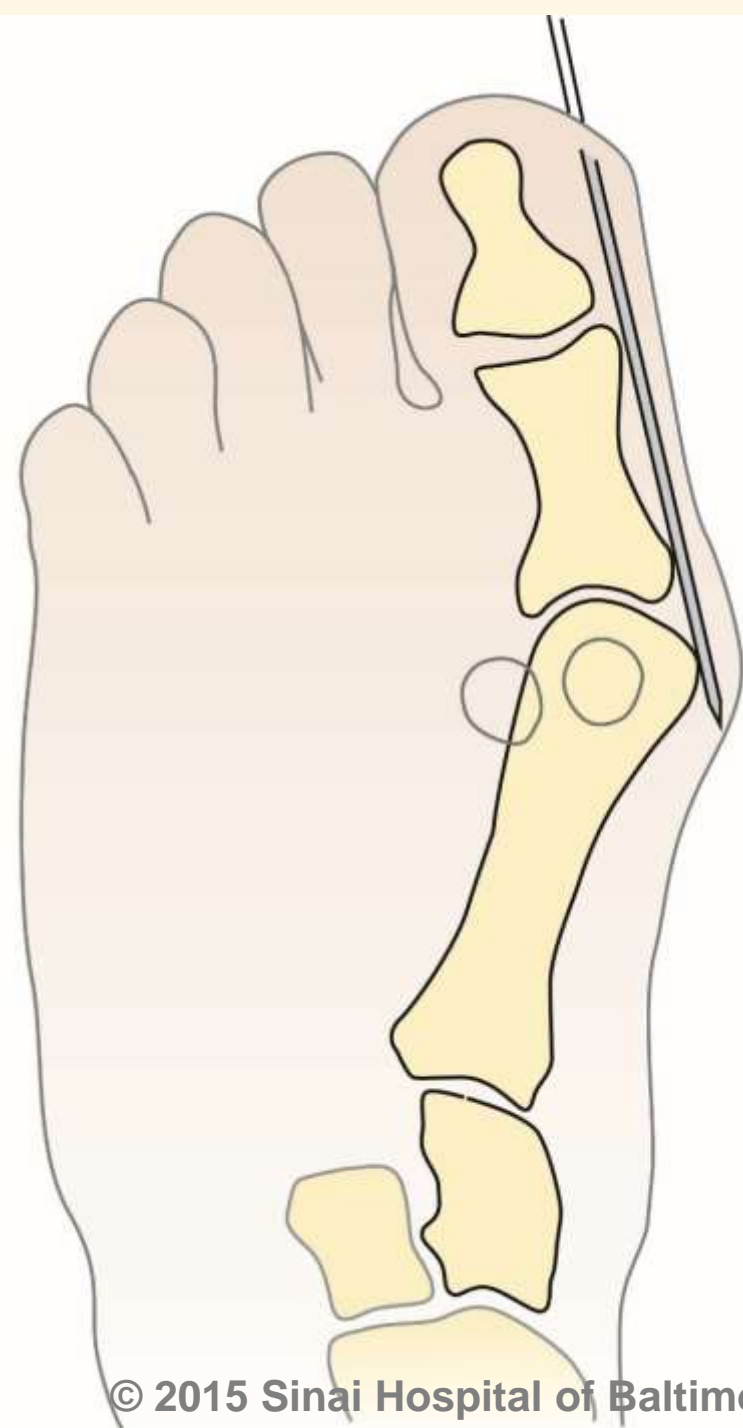
- Anatomic Reduction
 - IM/ HA reduction in mild to severe
- Stable fixation
 - Internal vs. External
- Preservation of blood supply
 - MIS approach
- Early, active mobilization
 - Immediate WB

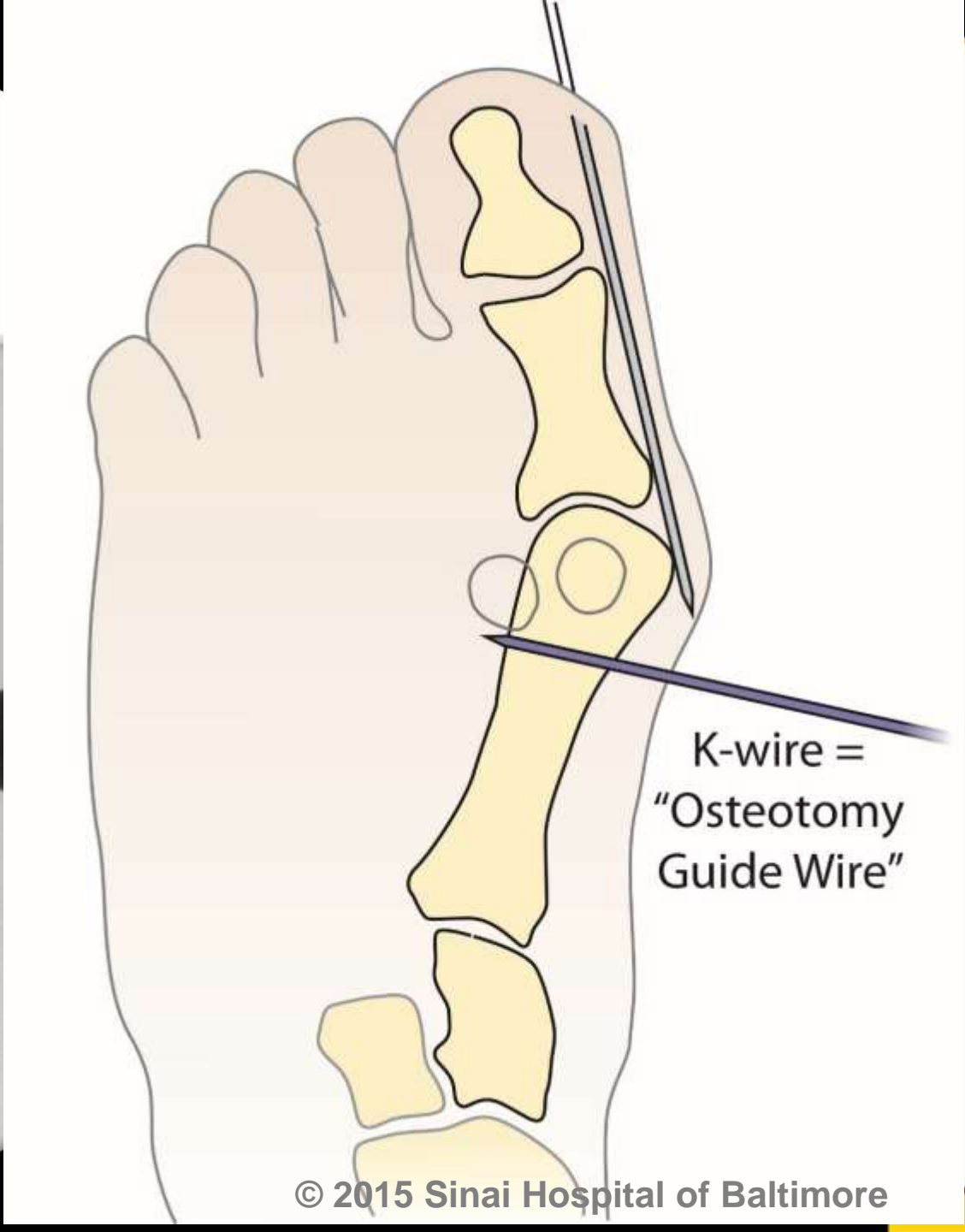
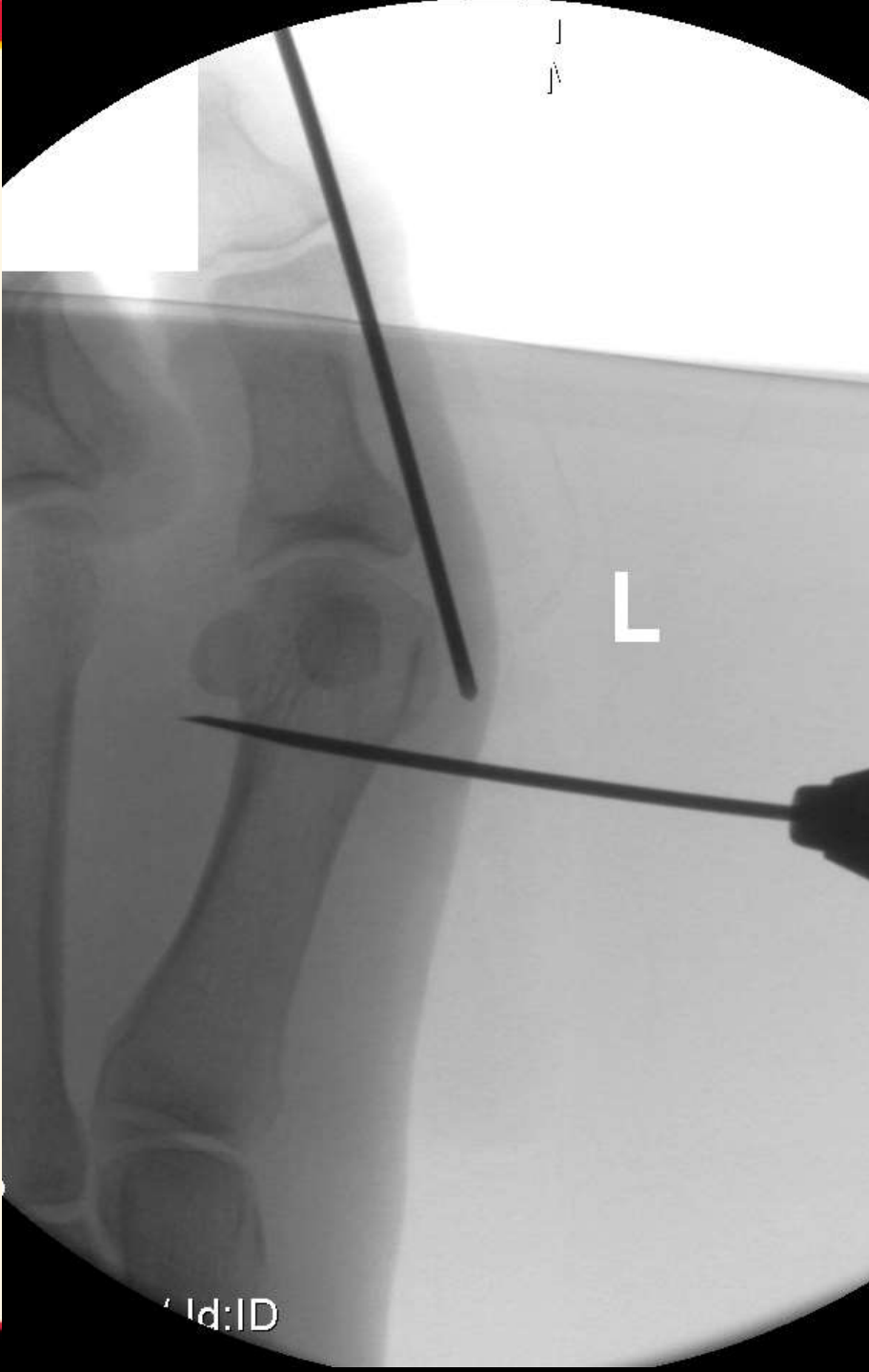


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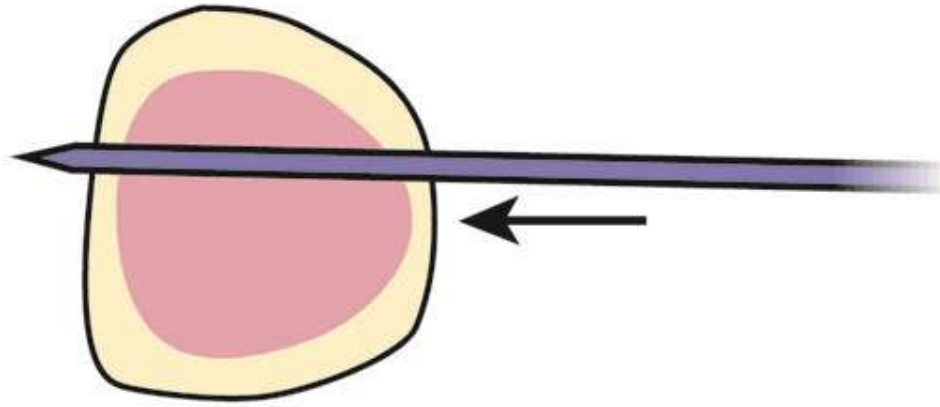
MIS: Intra-operative set up



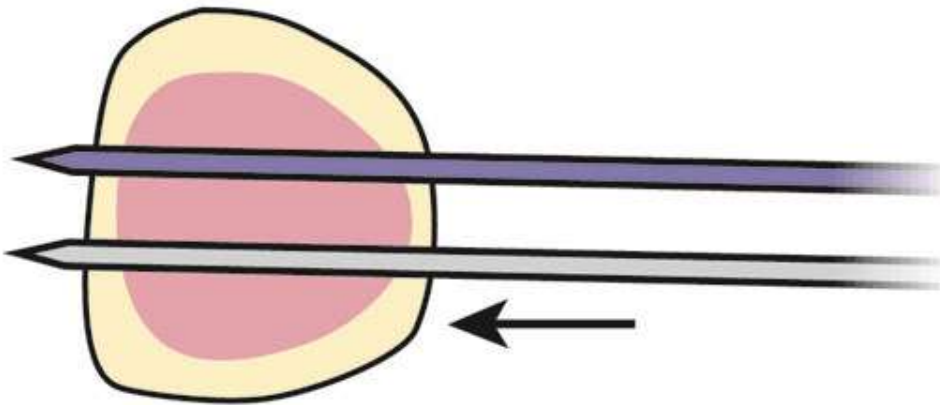




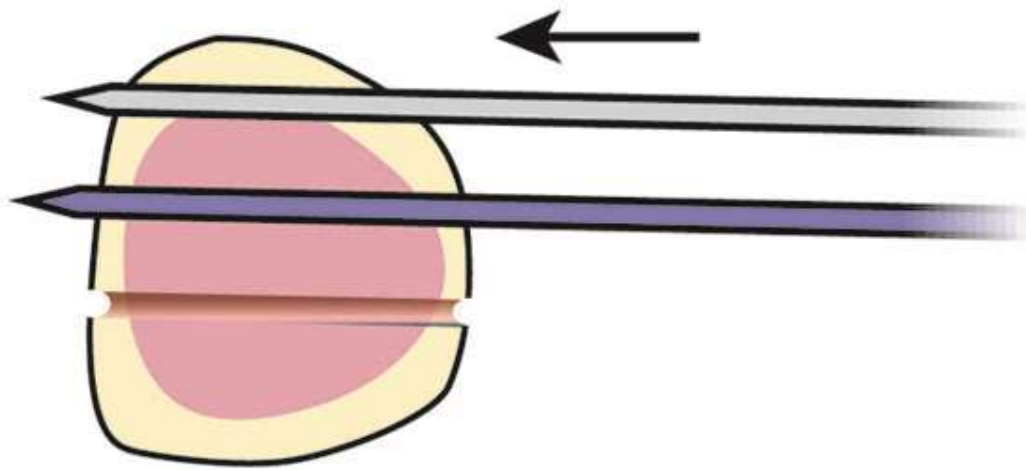
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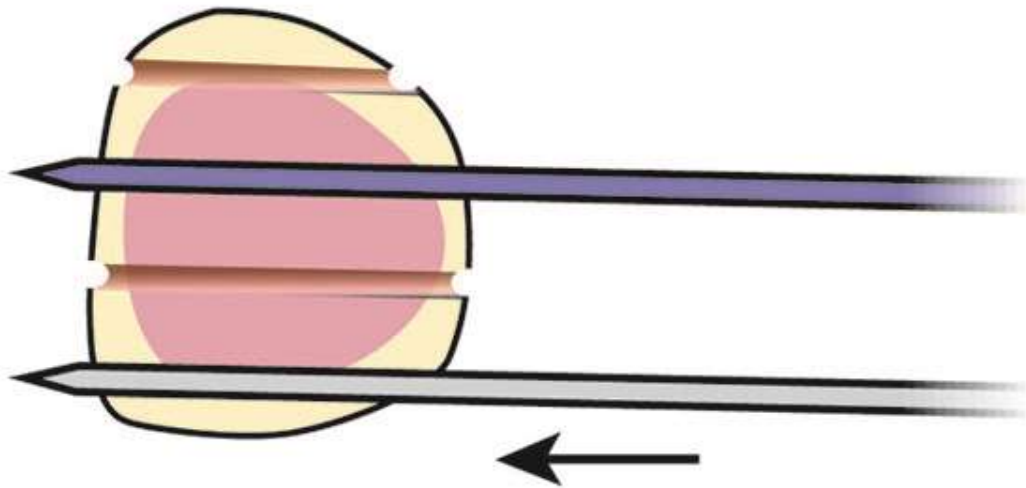
1st drill hole =
"Osteotomy
Guide Wire"



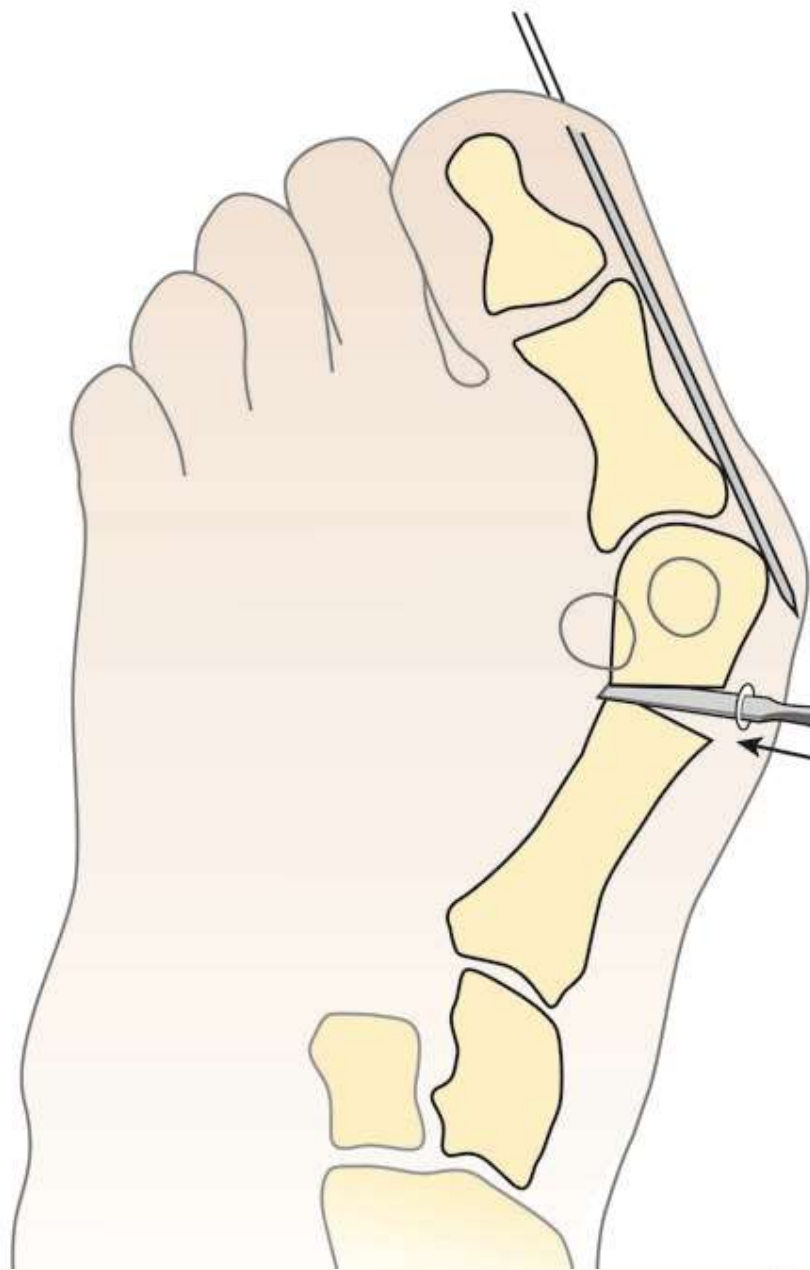
2nd drill hole



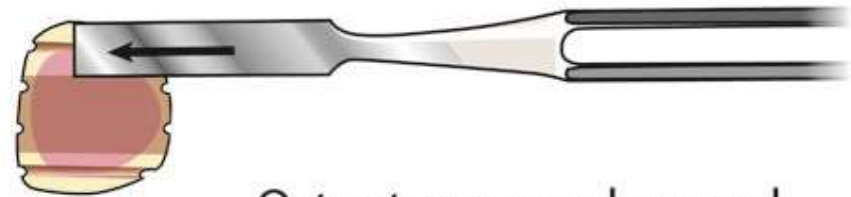
3rd drill hole



4th drill hole



Saw divides
center cortex

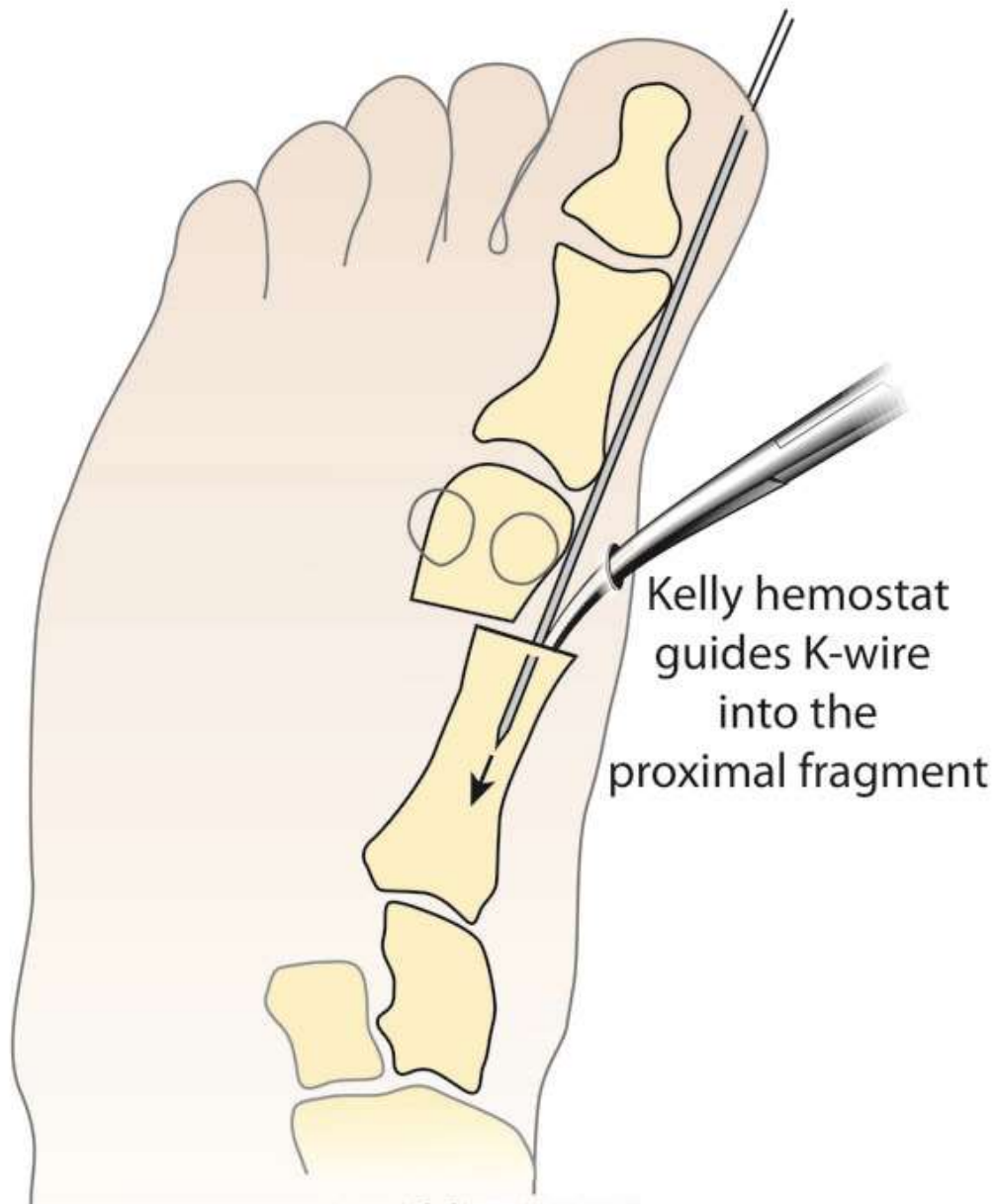


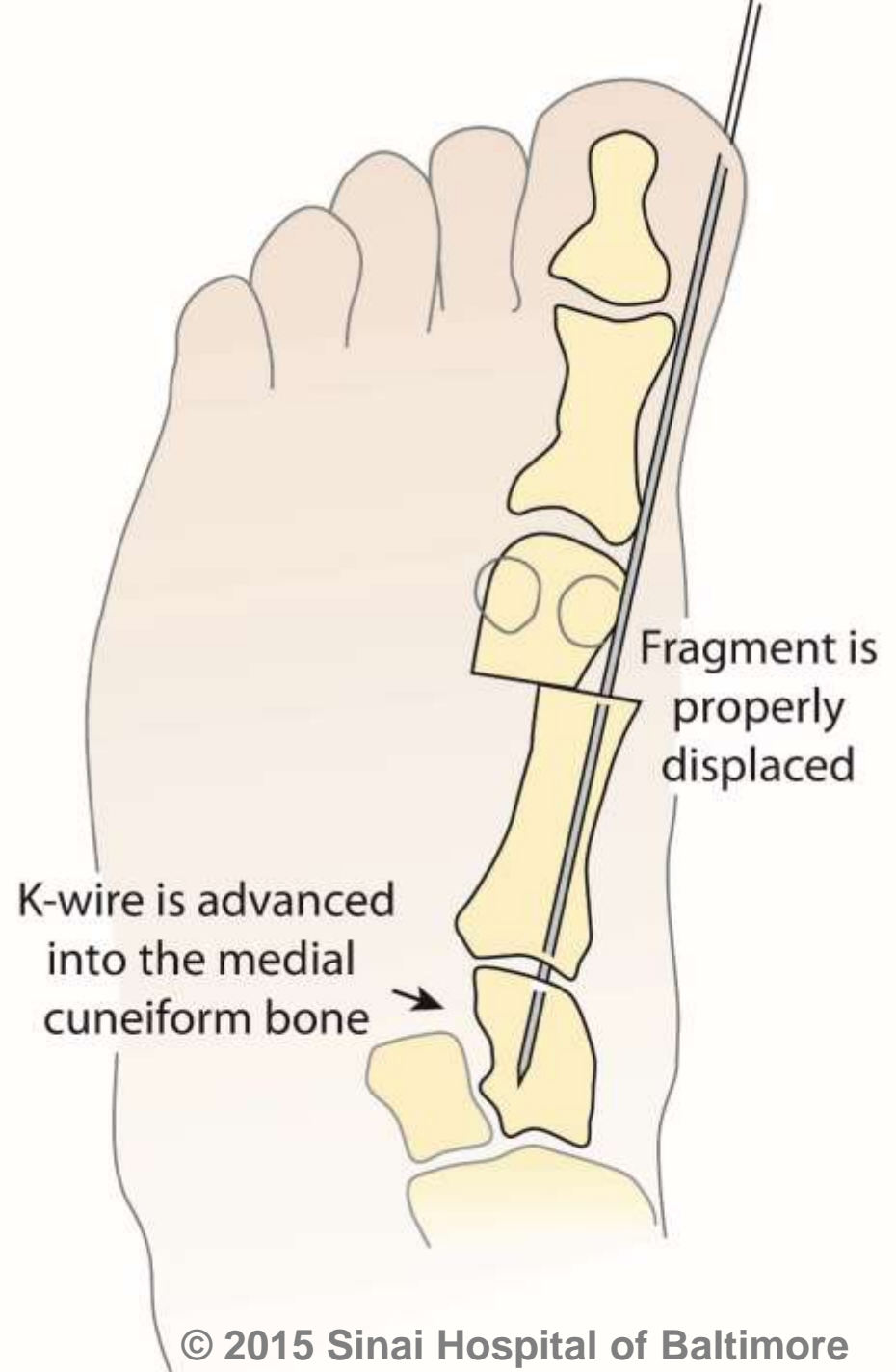
Osteotome can be used
to complete osteotomy

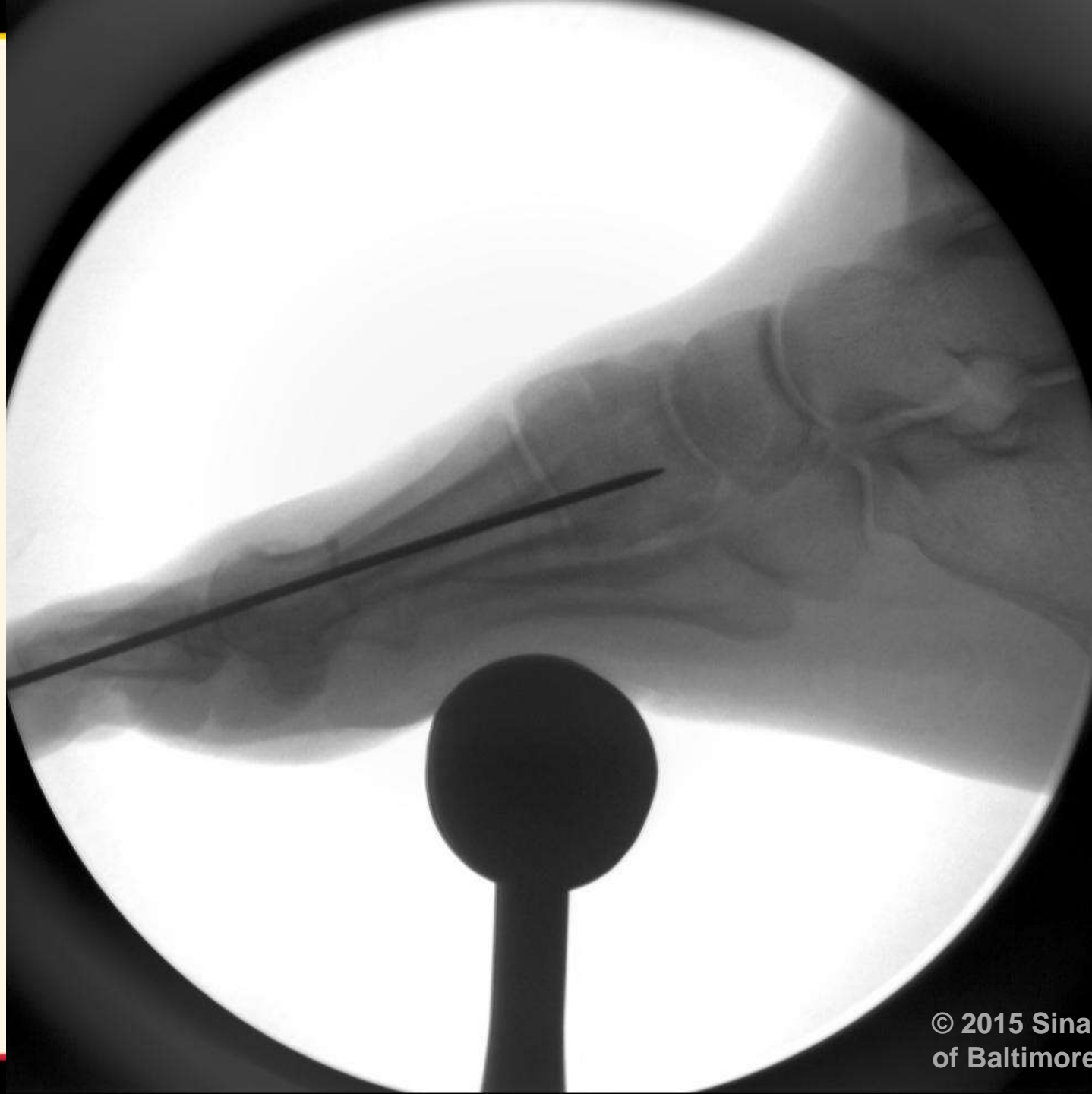


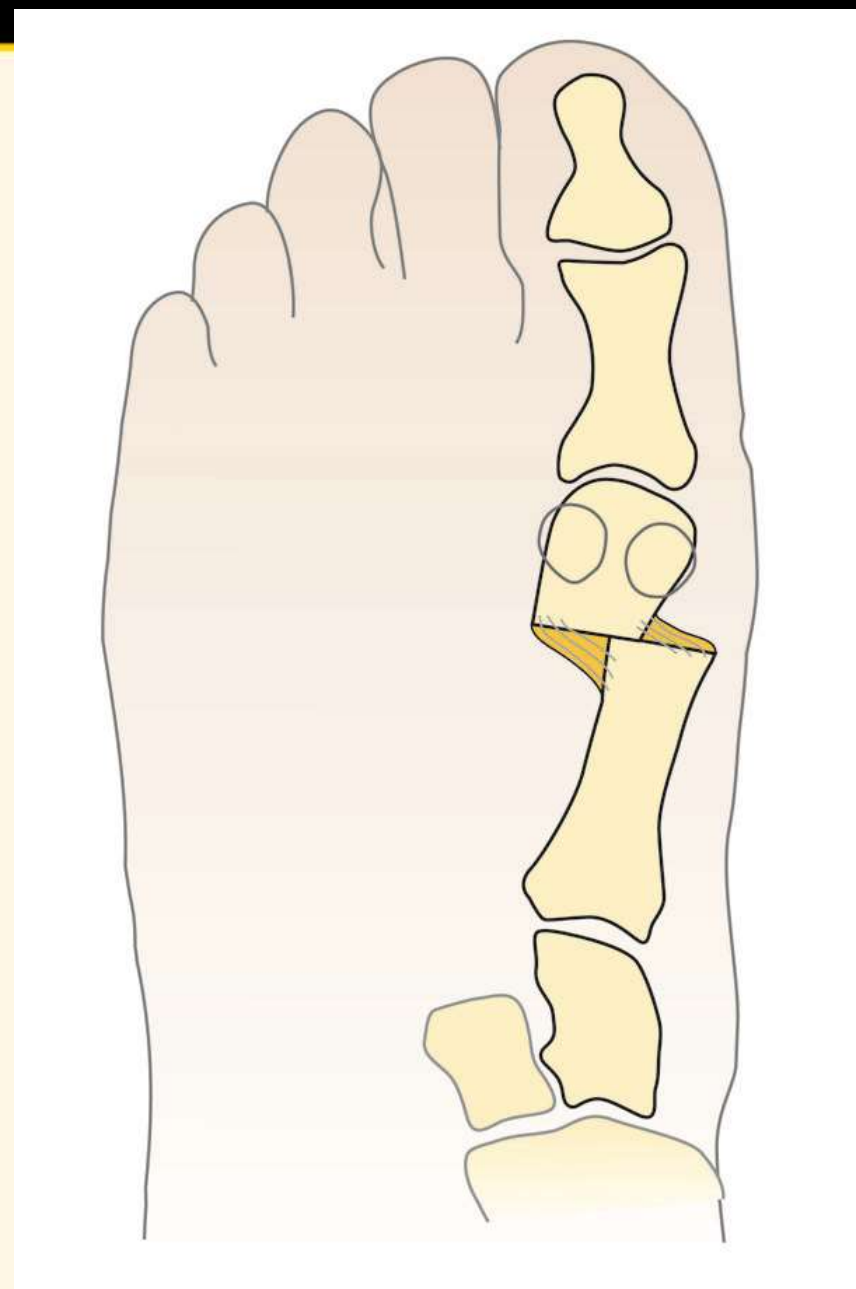














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Pre-Op and Immediate Post-op





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3 Months Post-op





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MIS: Revision Bunion





Post op Course:

POV # 1: 2-3 weeks

Wound Check, Suture Removal

No X-Rays

POV #2: 4-6 weeks (X-rays)

Pin removal

Pre-Pin Removal

- Weight bearing:
- WBAT in Surgical Shoe/ Short Cam Boot
- All CP/ TBI patients Casted and NWB
- Tourniquets:
immunocompromised patients



MIS: 2014-2017

- N: 43
- Combined Procedures: HT, Weil, GR, Winograd Procedure, PMR, Flatfoot Recon
- Adductor/ Lateral Release: 7 (Spastic, Frontal Plane)
- Smoker: 3 Active, 5 Unknown
- Co-morbidities: DM I and II (5), Hep C (2), HIV (5), CAD, CP (6), TBI, Methadone (2), Active Drug use (1)
- Complications:
 - 2 Pin site infections
(1 Surgery, 1 PO Antibiotics)
 - 1 Delayed Union (Vitamin D Def)



MIS: Outcomes

- Pin Pulled: 3-7 weeks
- Cost: \$20-64
- CPT: 28306
- Early pin removal:
 - < 6 weeks: 3 (all due to inadequate pin fixation)
 - 6 weeks: optimal removal time

MIS Bunion: Internal vs. External Fixation

J.M. Yanex Arauz, et al. Bosch osteotomy in hallux valgus. Does the osteosynthesis prevent loss of correction?

- Method:

49 feet with symptomatic HV, Bosch osteotomy with percutaneous Akin osteotomy and release of Adductor hallucis tendon

- Group A: WITH osteosynthesis
- Group B: WITHOUT osteosynthesis
- Age: 18-73
- Mean Follow up: 28 months

- Results:

- IM angle- no statistical difference
- Loss of IM angle higher in group without screw fixation, but NO statistical difference in “P” value
- NO pseudoarthrosis in any cases
- 2 infections at K-wire entry site

- Conclusion:

- **No statistical difference** in osteosynthesis with screw fixation in the Bosch osteotomy vs pin fixation.



MIS: Literature Review

BRITISH MEDICAL BULLETIN

Maffulli, N. Hallux valgus: effectiveness and safety of minimally invasive surgery. A systematic review. March 2011

- 21 Studies (1991 to 2009)
- Total number of patients: 1,830
- Total number of procedures: 2,197
(percutaneous, MI, or arthroscopic HV surgery)

MIS: Literature Review

No	Study	Level of evidence	Type of study	Year of publication	Procedures	Number of patients (feet)	CMS
1	Baietta <i>et al.</i> ⁷⁰	IV	Case series	2007	Bosch osteotomy	84 (98)	34
2	Barragan-Hervella <i>et al.</i> ³⁹	IV	Case series	2008	Percutaneous	29 (number of feet not specified)	17
3	Bauer <i>et al.</i> ³⁶	IV	Case series	2009	Percutaneous	168 (189)	51
4	Bianchi and Cavenago ⁷¹	IV	Case series	2002	Bosch osteotomy	27 (27)	12
5	Bösch <i>et al.</i> ⁶³	IV	Case series	2000	Mini-incision	64 (98)	45
6	De Giorgi <i>et al.</i> ⁷²	IV	Case series	2003	Bosch osteotomy	24 (27)	11
7	Giannini <i>et al.</i> ³⁷	IV	Case series	2003	Mini-incision	37 (54)	45
8	Giannini <i>et al.</i> ³⁸	IV	Case series	2007	Mini-incision	190 (299)	62
9	Kadakia <i>et al.</i> ⁴⁷	IV	Case series	2007	Mini-incision	13 (13)	37
10	Leemrijse <i>et al.</i> ⁶⁰	V	Expert opinion	2008	Percutaneous	Not reported	31
11	Lin <i>et al.</i> ⁴⁰	IV	Case series	2009	Arthroscopy	31 (47)	31
12	Lostia <i>et al.</i> ⁷³	IV	Case series	2007	Bosch osteotomy	71 (82)	34
13	Lui <i>et al.</i> ²⁶	IV	Case series	2008	Arthroscopy	83 (94)	38
14	Maffulli <i>et al.</i> ¹⁴	III	Retrospective comparative study	2009	Mini-incision versus Bosch osteotomy	36 (36) per group	57
15	Maffulli <i>et al.</i> ²³	IV	Case series	2005	Mini-incision	15 (15)	36
16	Magnan <i>et al.</i> ³³	IV	Case series	2005	Mini-incision	82 (118)	46
17	Markowski <i>et al.</i> ⁷⁴	IV	Case series	1991	Bosch osteotomy	45 (63)	28
18	Martinez-Nova <i>et al.</i> ⁴²	IV	Case series	2008	Percutaneous	26 (30)	29
19	Portaluri <i>et al.</i> ⁷⁵	IV	Case series	2000	Mini-incision	156 (197)	39
20	Roth <i>et al.</i> ⁴³	III	Retrospective comparative study	1996	Mini-incision versus Kramer osteotomy	105 (124): subcutaneous group, 88 ft; open group, 36 ft	37

MIS: Literature Review

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20	Roth <i>et al.</i> ⁴³	III	Retrospective comparative study	1996	Mini-incision versus Kramer osteotomy	105 (124): subcutaneous group, 88 ft; open group, 36 ft	37
21	Sanna and Ruiu ⁵⁷	IV	Case series	2005	Mini-incision	83 (90)	40
22	Siclari and Decantis ⁴¹	IV	Case series	2009	Mini-incision and arthroscopy	49 (59)	38
23	Solarino <i>et al.</i> ⁷⁶	III	Retrospective comparative study	2006	Bosch versus Hallux splint	80 (80): Bosch group, 40 ft; Hallux splint, 40 ft	40
24	Weinberger <i>et al.</i> ⁷⁷	IV	Retrospective case series	1991	Percutaneous	204 (301)	35

MIS: Literature Review

	Pre-OP	Post-OP
HVA	29.95°	16.76°
IMA	13.28°	7.66°
DMMA	14°	6.45°

MIS Literature: A Systematic Review

- **Roukis, Thomas. Percutaneous and Minimum Incision Metatarsal Osteotomies: A Systematic Review. J Foot and Ankle Surgery May 2009; 48: 380-387.**
 - 3 case series (Level IV)
 - Provide structural realignment that maintained at least 12 month post operative follow up
 - High degree of postoperative patient satisfaction
 - No difference in post operative complication rate in either Open vs Percutaneous Group.

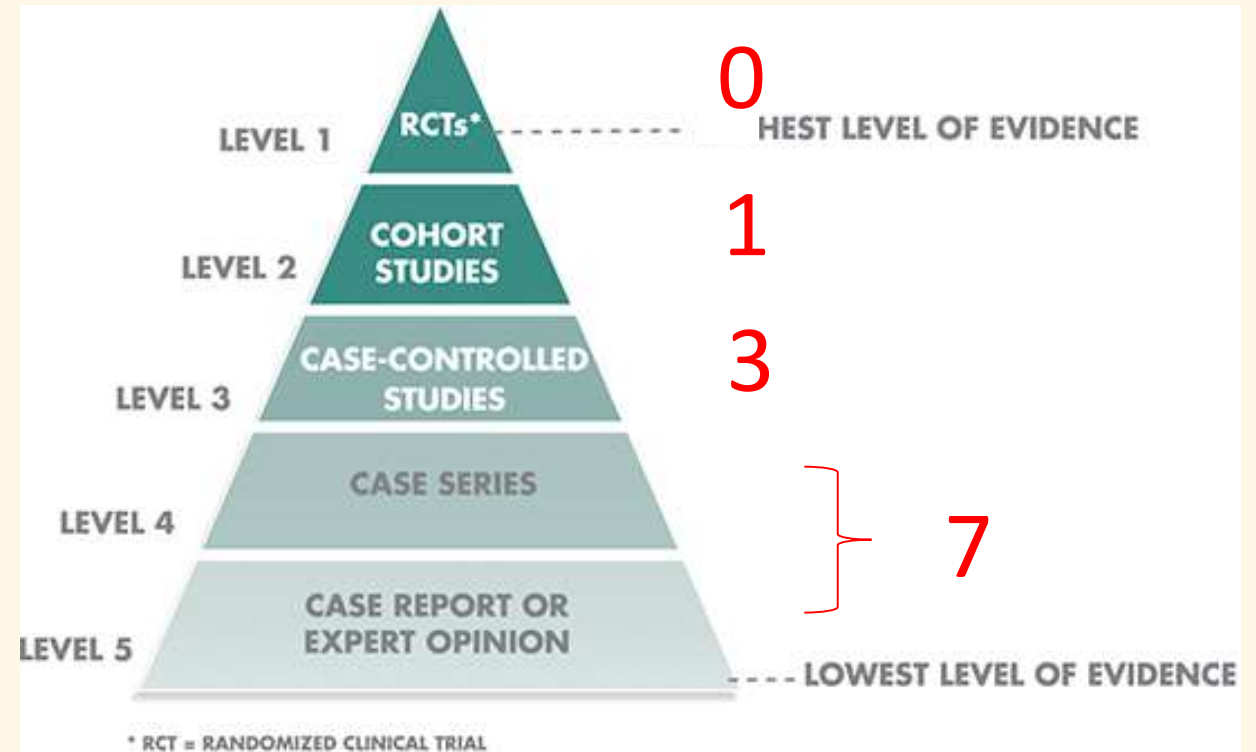
MIS: Literature

Advantage

1. Reduced surgery time
2. Cost effective
3. Quicker recovery
4. Immediate Weight bearing

Disadvantage

1. Studies of higher levels of evidence with larger numbers of cases should be conducted.
2. Pre and Post Op



N Siddiqui, et al. Radiographic Outcomes of a Percutaneous, Reproducible Distal Metatarsal Osteotomy for Mild and Moderate bunions: Multi-center Study. To be published

- 217 HAV, Mean age 49
- Four Centers North America
- Pre-op (Mean): IMA 14.6, HVA 30.7, TSP 5.4
- Post-op (Mean): IMA 4.7, HVA 8.4, TSP 2.0
- All 217 Feet achieved union
- Asymptomatic malunion: 3
- Superficial pin site infection: 42 (19.4%)
- Concluded percutaneous technique apparat to be reproducible across the multiple centers and superior in correcting IM and HVA.
- All patient were immediate WB.

MIS Bunion: Conclusion

- Surgeon comfort with MIS approach
- Patient selection: **Check vitamin D 25**
- Internal vs. External fixation
- SERI
- Limitation in high level published research

JUST DO IT.



MIS: Foot for thought

“The Important thing is to never stop questioning.”

~Albert Einstein



Thank You!