Minimally Invasive Hallux Valgus Correction

Elvis Danne Jr, DPM, AACFAS, DABPM

Clinical Fellow

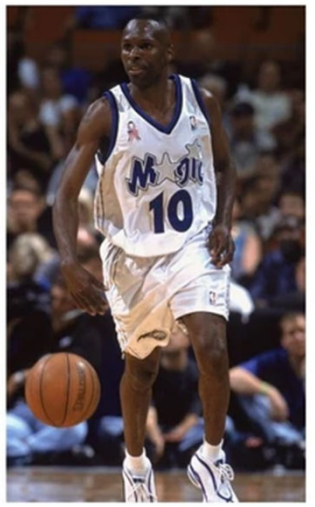
Limb Deformity Correction Fellowship

Disclosures

- None

Overview

- History
- Deformity Planning
- Patient selection
- Techniques
- Complications
- Cases
- Pearls



HISTORY OF BUNION SURGERY

9th –11th century AD

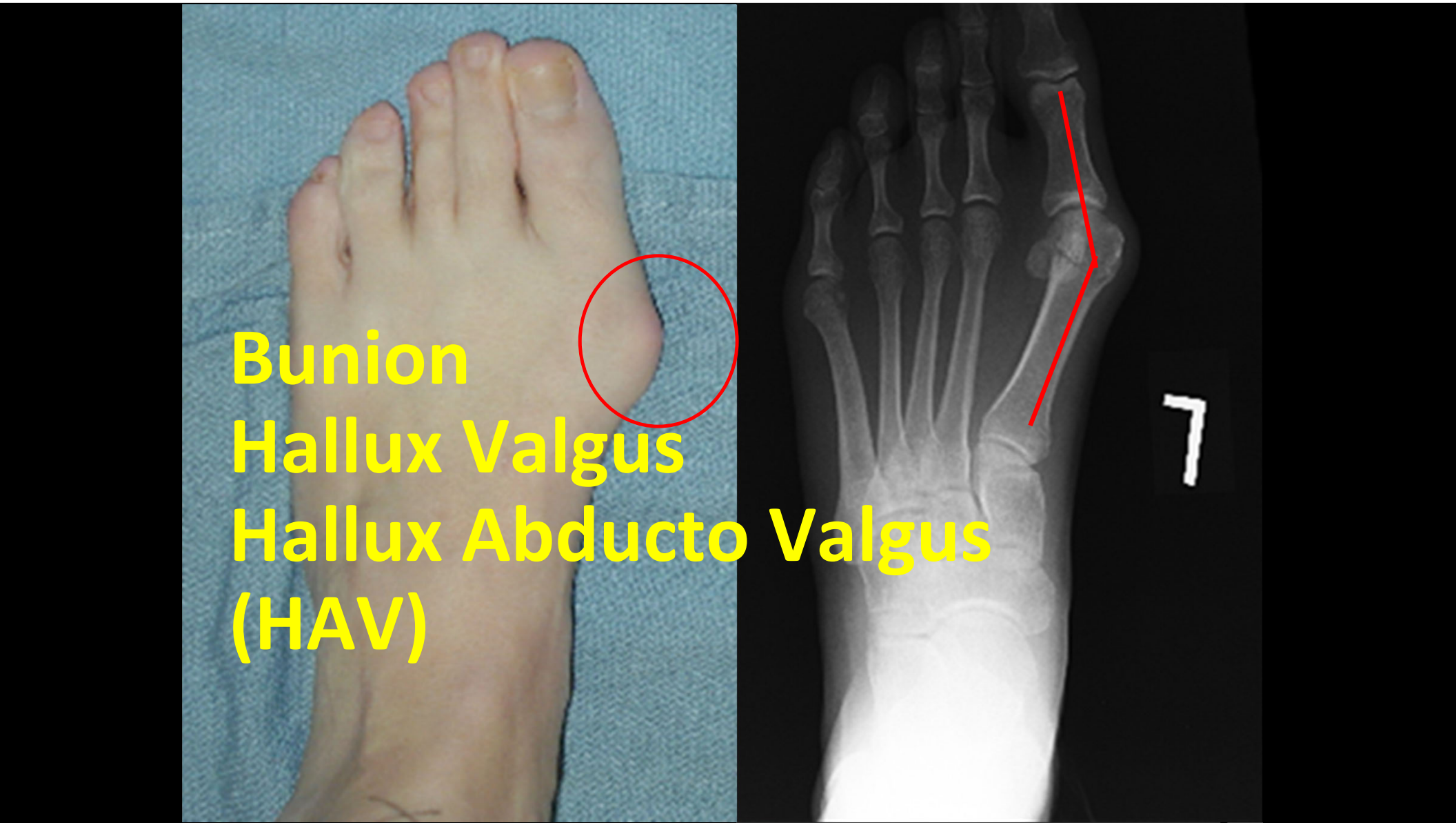
Excavations from Church Burial Grounds Ipswich, Suffolk, England

Black friars

Mays SA. Am J Phys Anthropol. 2005 Feb;126(2):139-49.

Bunion

Anglian dialectic *bunny* "lump, swelling" or
French *buigne* "bump on the head"


Bunion
Hallux Valgus
Hallux Abducto Valgus
(HAV)

Coined Hallux Abducto Valgus

- Lateral deviation of hallux.
- Increased intermetatarsal angle.
- Enlarged medial eminence.

Hueter C. Klinik der Gelenkkrankheiten mit Einschluß der Orthopädie. 1877.

TRADITIONAL OPEN SURGERY

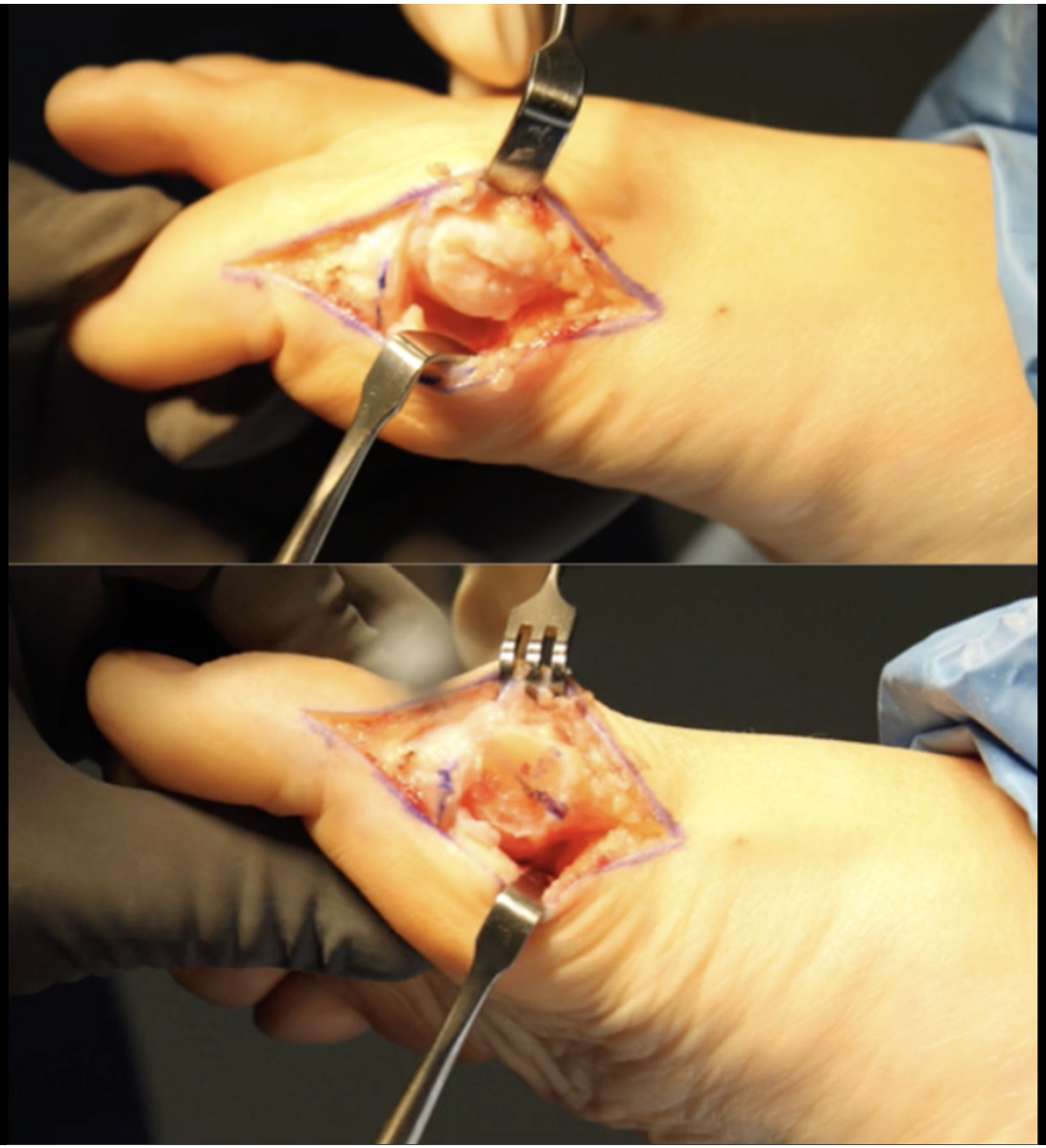
Allows direct visualization and exposes the joint

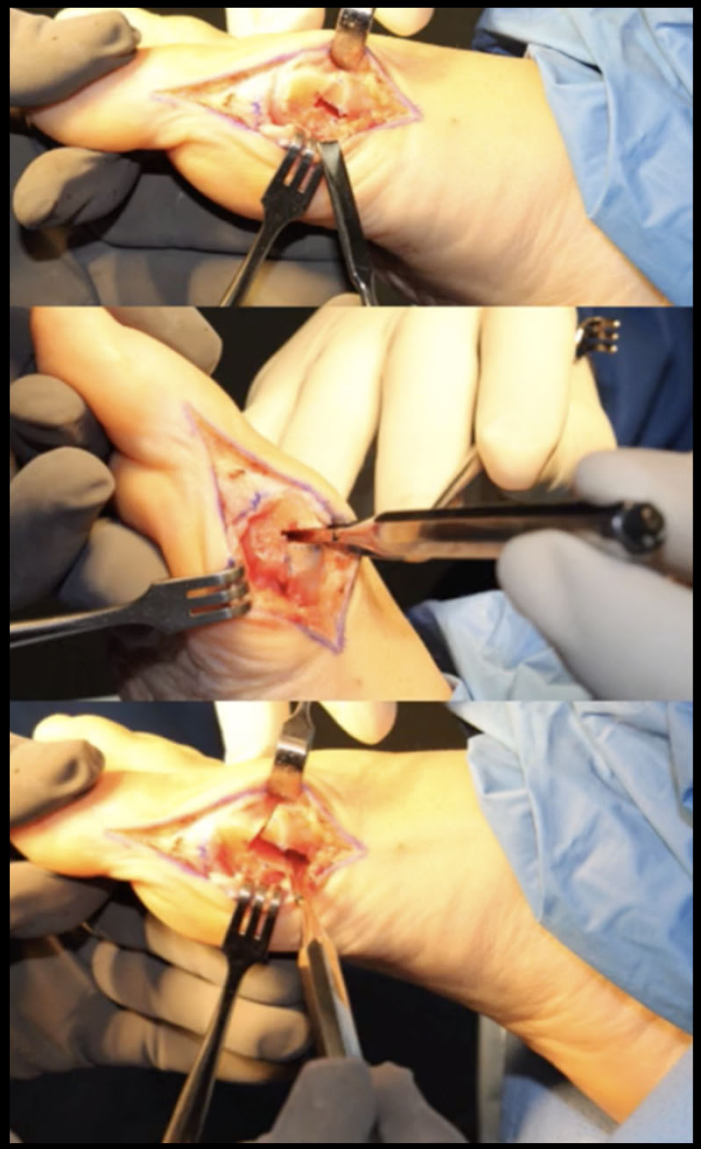
Disrupts the capsule

Reports of increased pain and swelling

Increased stiffness

Longer incision





International Orthopaedics (SICOT) (2013) 37:1731–1735
DOI 10.1007/s00264-013-2077-0

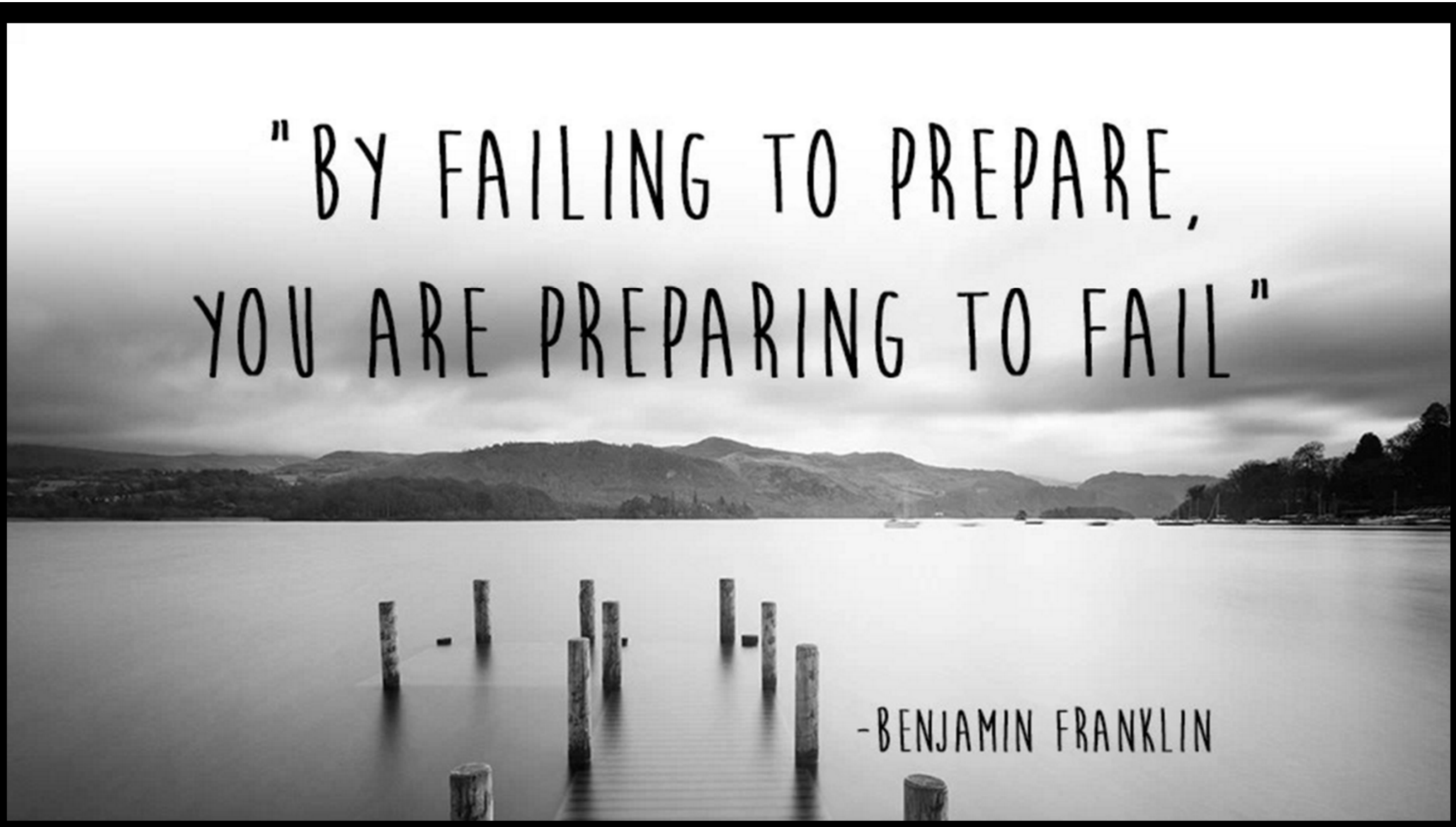
REVIEW ARTICLE

Minimally invasive hallux valgus surgery: a critical review of the evidence

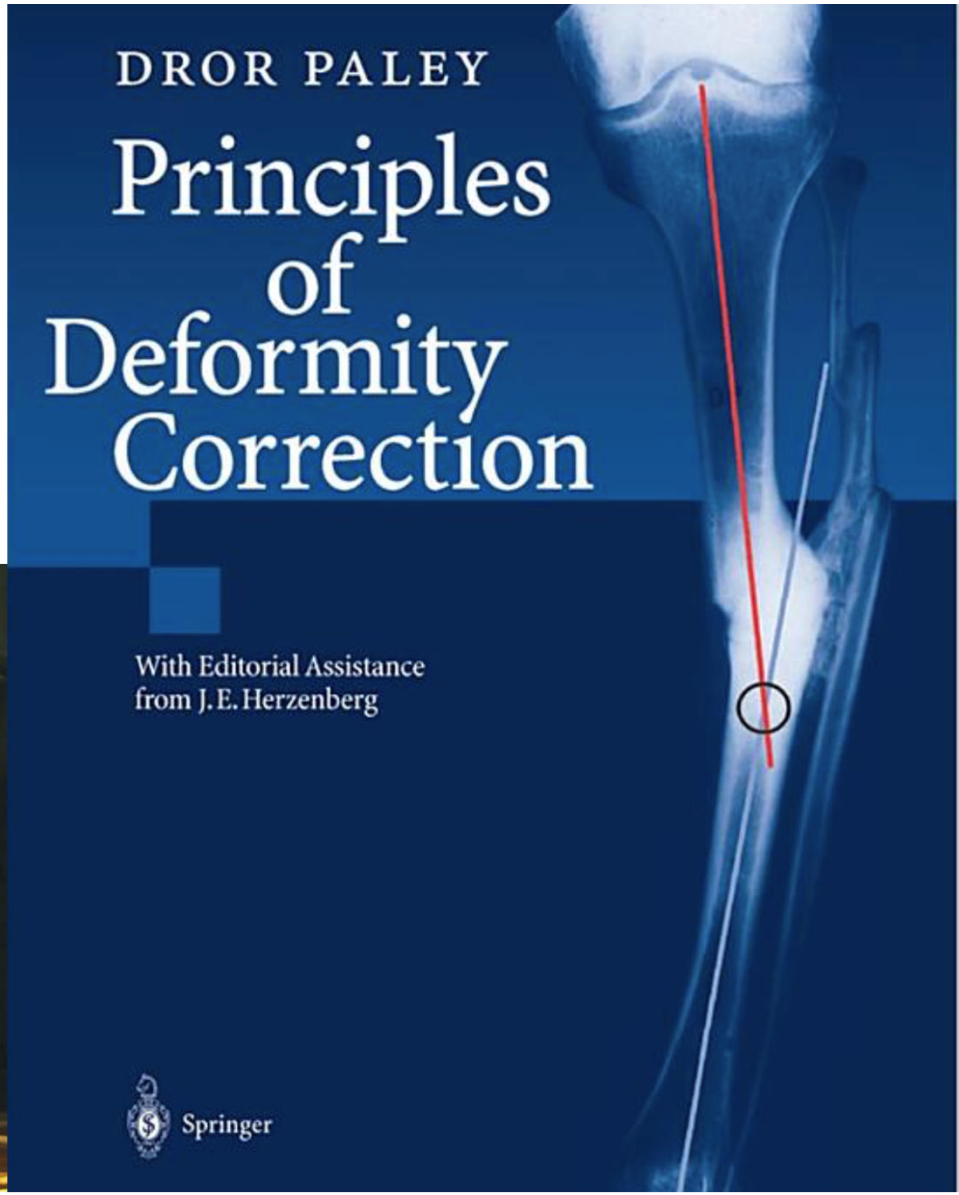
Hans-Joerg Trnka · Sabine Krenn · Reinhard Schuh

HISTORY OF MIS CORRECTION

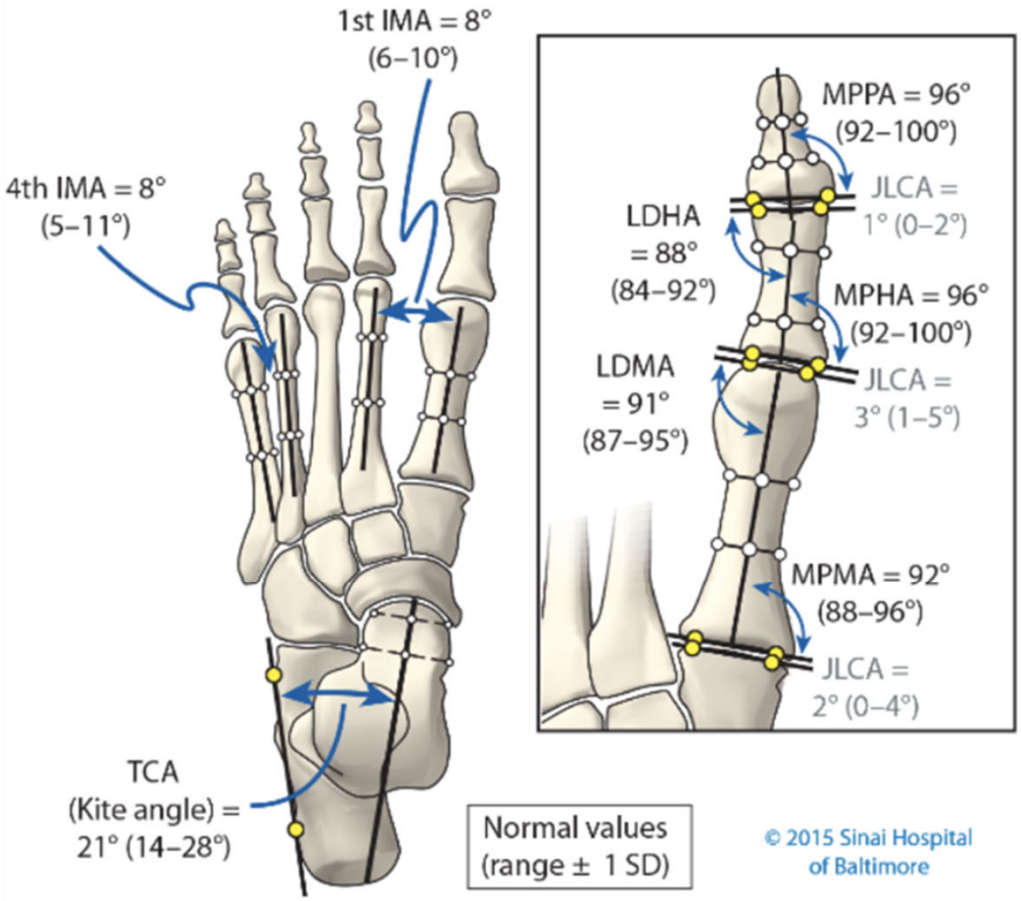
- 1940's - Kramer Osteotomy: Early reports of percutaneous HV correction
- 1960's - Power equipment for MIS osteotomy developed, Intra-operative fluoroscopy available
- 2000: (Bosch, P): Subcapital osteotomy technique (SCOT)
- 2005: Magnan (Instrumentation - High speed burr) - 118 procedures (91% satisfied)
- 2008 (Gianni): Modification: SERI (Simple, Effective, Rapid, Inexpensive) 1,000 feet with zero nonunions
- Vernois and Redfern (Stable screw fixation)


"BY FAILING TO PREPARE,
YOU ARE PREPARING TO FAIL"
-BENJAMIN FRANKLIN

DEFORMITY PLANNING

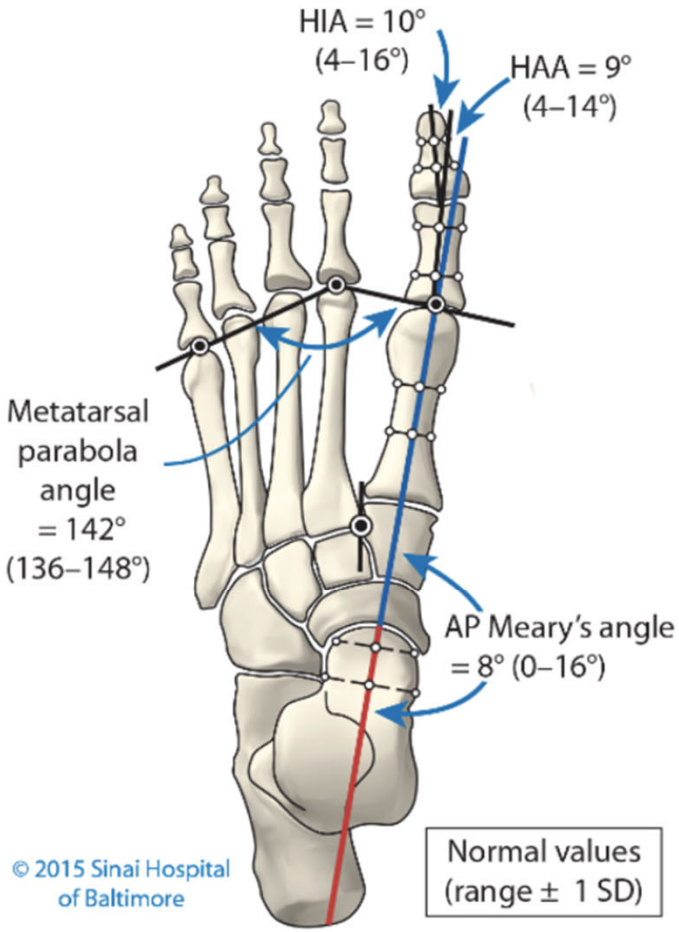


Standard Measurements of the Foot: AP View



Normal values
(range ± 1 SD)

Standard Measurements of the Foot: AP View



Normal values
(range ± 1 SD)

- Mild Bunion:
  - IM angle of ~10° and HAA ~25°
- Moderate Bunion:
  - IM between 13°-20° & HAA = 25°-35°
- Severe Bunion:
  - IM ≥ 14° & HAA >35°

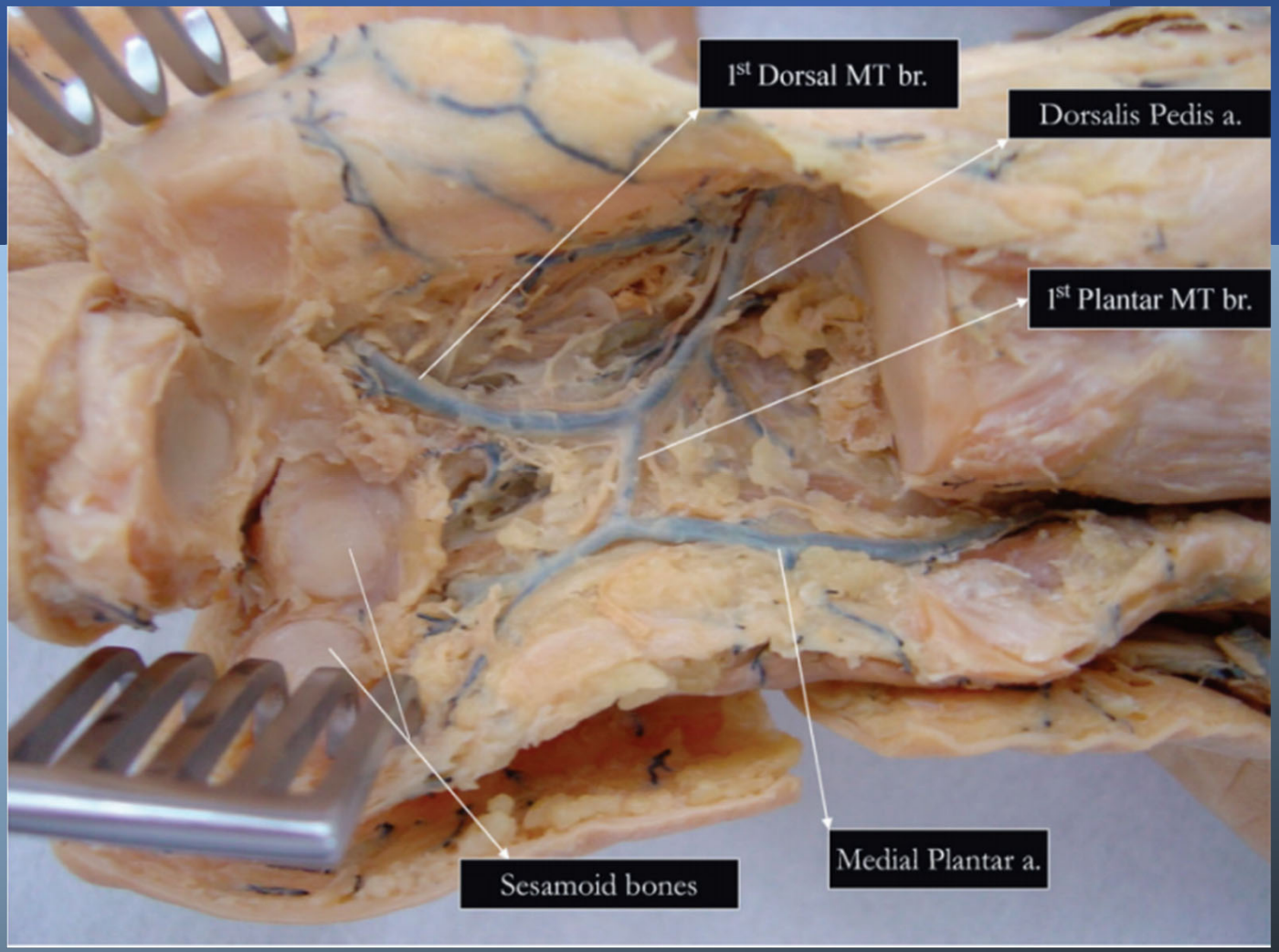
Minimally Invasive Hallux Valgus Correction

Indicated for Mild and Moderate HAV, not Severe

Blood Supply to the First Metatarsal Head and Vessels at Risk with a Chevron Osteotomy

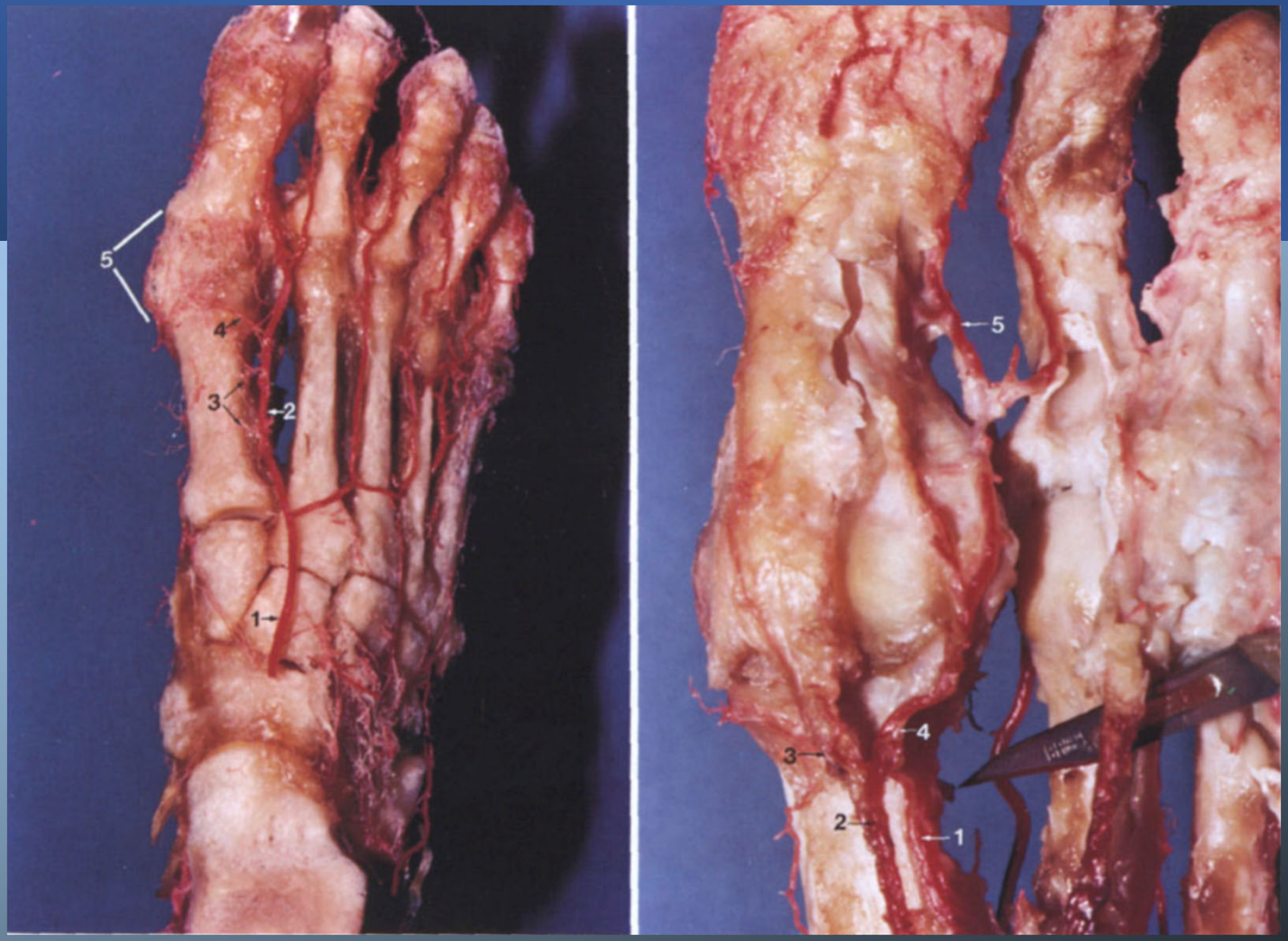
By J.J. George Malal, MBBS, DOrtho, MS(Ortho), DNB(Ortho), MRCS,
J. Shaw-Dunn, BSc, MBChB, PhD, FRCS, AIAS, and C. Senthil Kumar, FRCS(Tr&Orth)

Investigation performed at the Department of Human Anatomy, University of Glasgow, Glasgow, United Kingdom


1st Dorsal MT br.
Dorsalis Pedis a.
1st Plantar MT br.
Sesamoid bones
Medial Plantar a.

Extraosseous and Intraosseous Arterial Supply to the First Metatarsal and Metatarsophalangeal Joint

Michael J. Shereff, M.D.,* Quing Ming Yang, M.D.,† and Frederick J. Kummer, Ph.D.‡
New York, New York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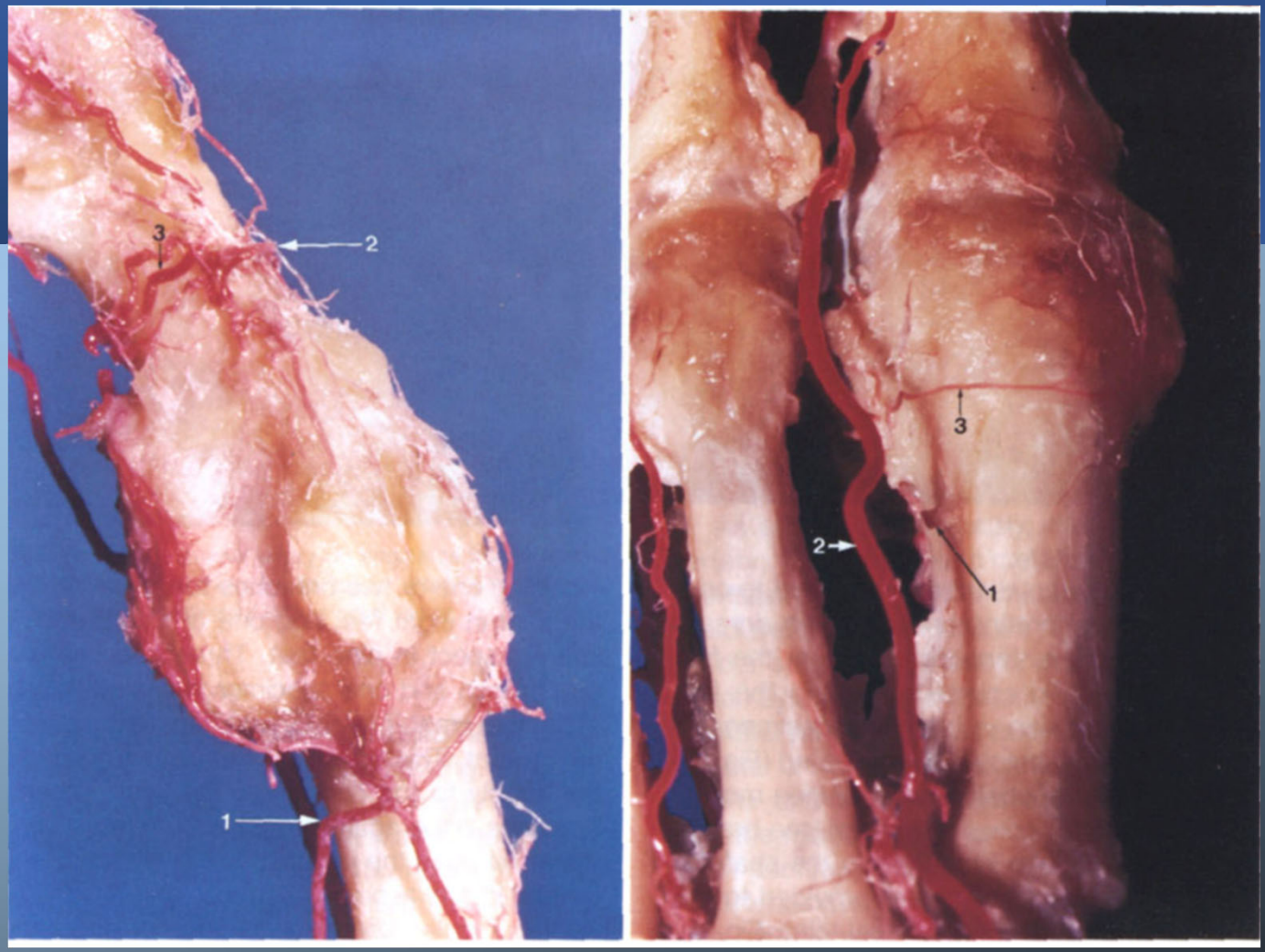
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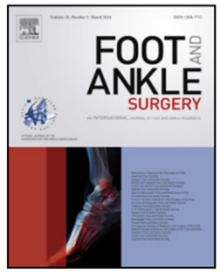
Contents lists available at ScienceDirect

Foot and Ankle Surgery

journal homepage: www.elsevier.com/locate/fas



Location and direction of the nutrient artery to the first metatarsal at risk in osteotomy for hallux valgus

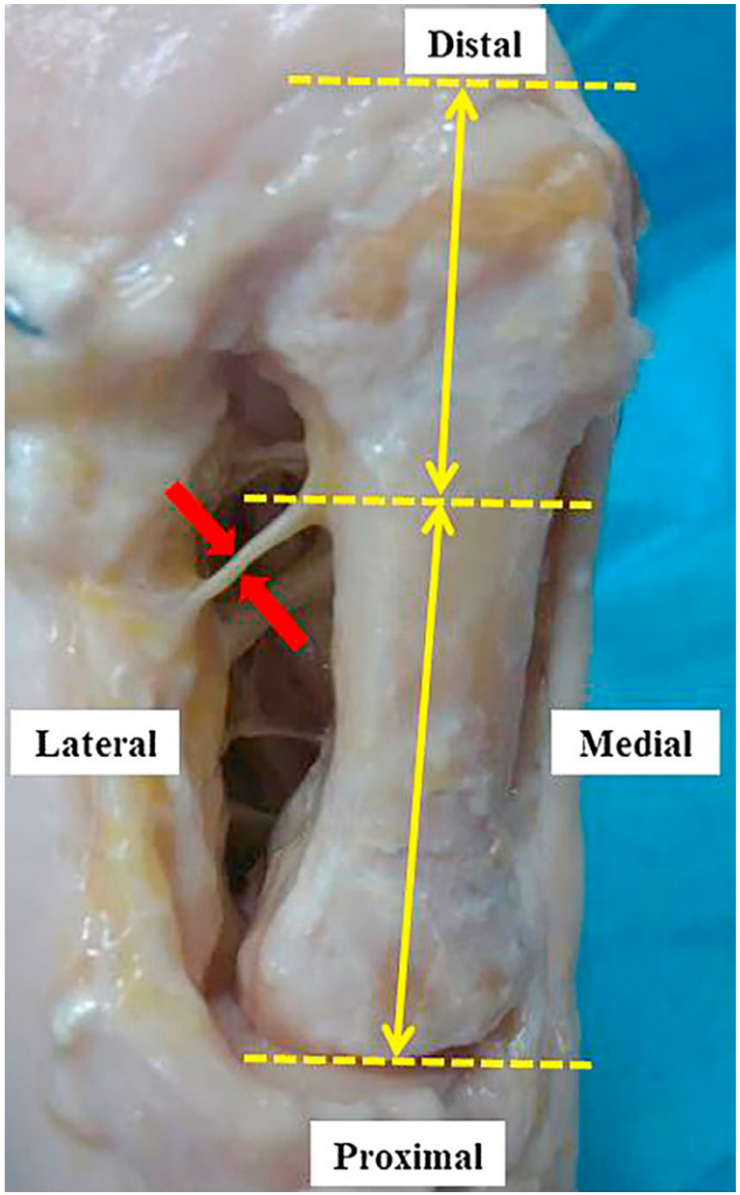
Ichiro Tonogai[a], Keizo Wada[a], Kosaku Higashino[a], Yoshihiro Fukui[b], Koichi Sairyo, MD PhD[b,*]

[a] *Department of Orthopedics, Institute of Biomedical Science, Tokushima University Graduate School, 3-18-15 Kuramoto, Tokushima 770-8503, Japan*
[b] *Department of Anatomy and Developmental Neurobiology, Tokushima University Graduate School, Japan*

Sarrafian

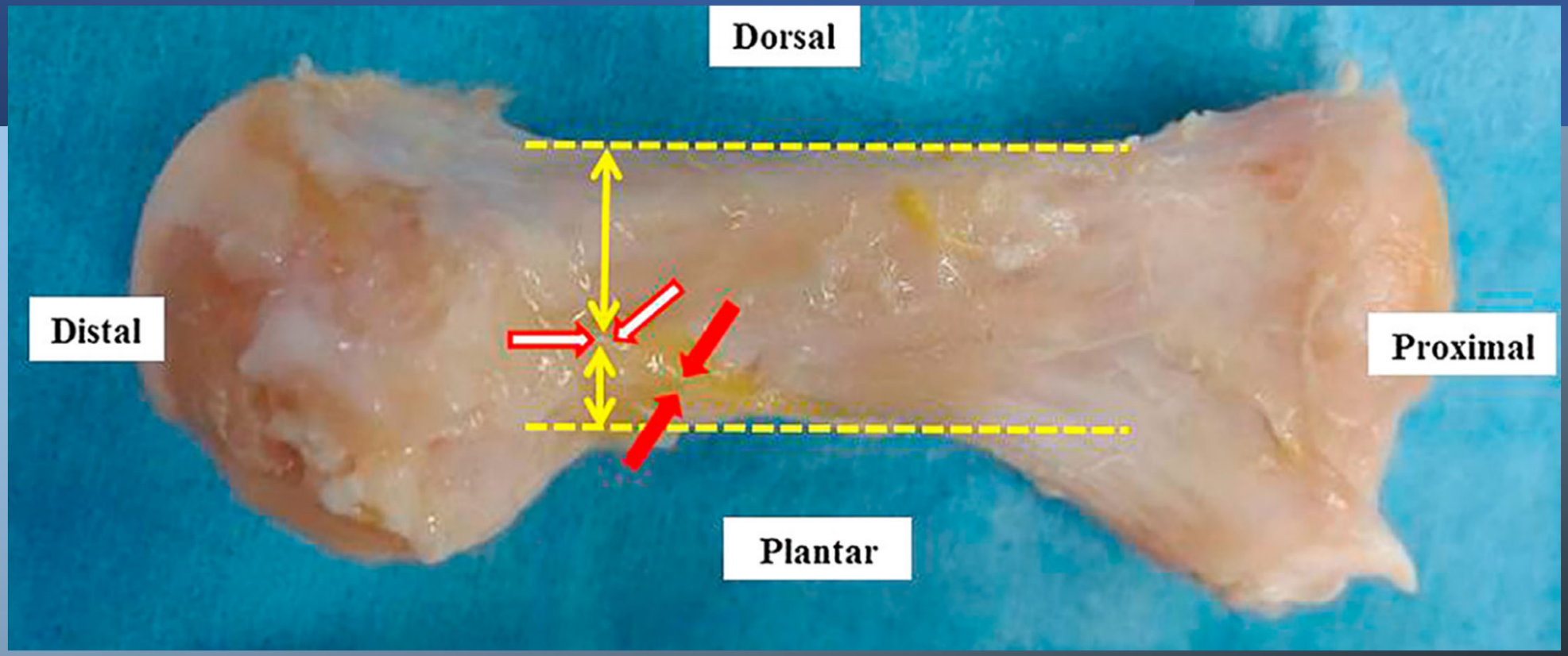
- nutrient artery penetrates the diaphysis in the middle of the lateral surface at a 90 degree angle

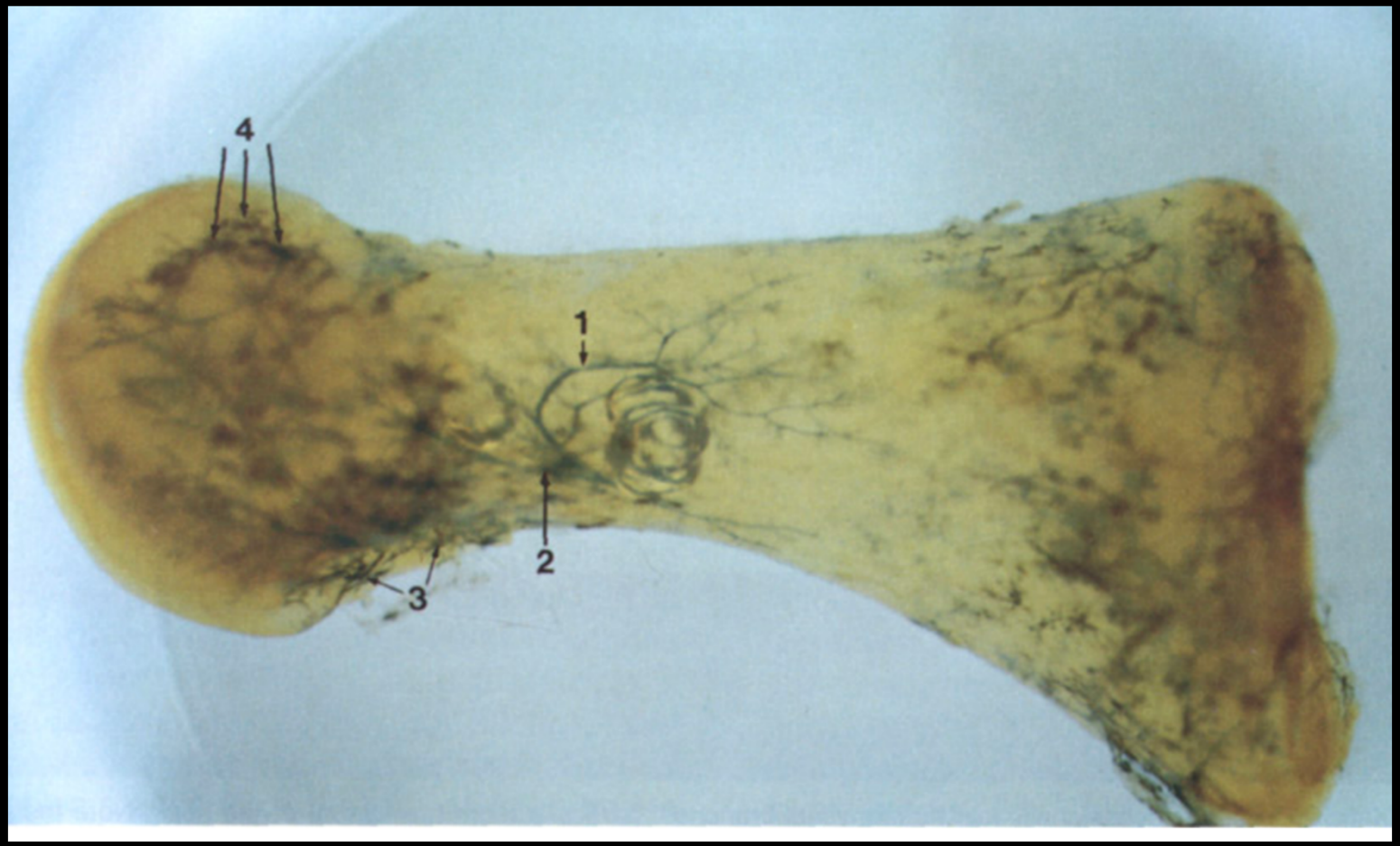
Nutrient artery might be damaged from
- **over-penetration** of the saw blade
- scalpel from extensive lateral release



Nutrient artery injury may lead to:

- necrosis of 1st metatarsal head
- nonunion
- delayed union


Dorsal
Distal
Proximal
Plantar


4
1
2
3

Principles of Percutaneous Surgery

1. **Anatomy** of the foot should be deeply known to adopt the most appropriate approach to minimize the risk of injury
2. Appropriate **equipment** allows efficient and effective surgery
3. **Image intensification** should be used intraoperatively to check the exact position of surgical instruments to prevent complications arising from the lack of direct vision of the surgical field

Goals of MIS Correction

- Realign 1st MTPJ in all planes
- Improve IM angle
- Pain free joint
- Improve cosmesis
- Early weightbearing
- Early return to shoes and activity

MIS Patient Selection

Inclusion

Healthy, active individuals

Primary cases

Mild to moderate reducible deformity

Need to remain WB

Vascular intact

Exclusion

Mobile foot

Vascular compromise

Severe osteoarthritis

Osteomyelitis

Open wound

AO Principles

In 1958, AO formulated four basic principles, which have become the guidelines for internal fixation

Anatomic Reduction

Fracture reduction and fixation to restore functional anatomical relationships.

Stable Fixation

Stability by rigid fixation or splintage, as the personality of the fracture and the injury requires.

Preservation of Blood Supply

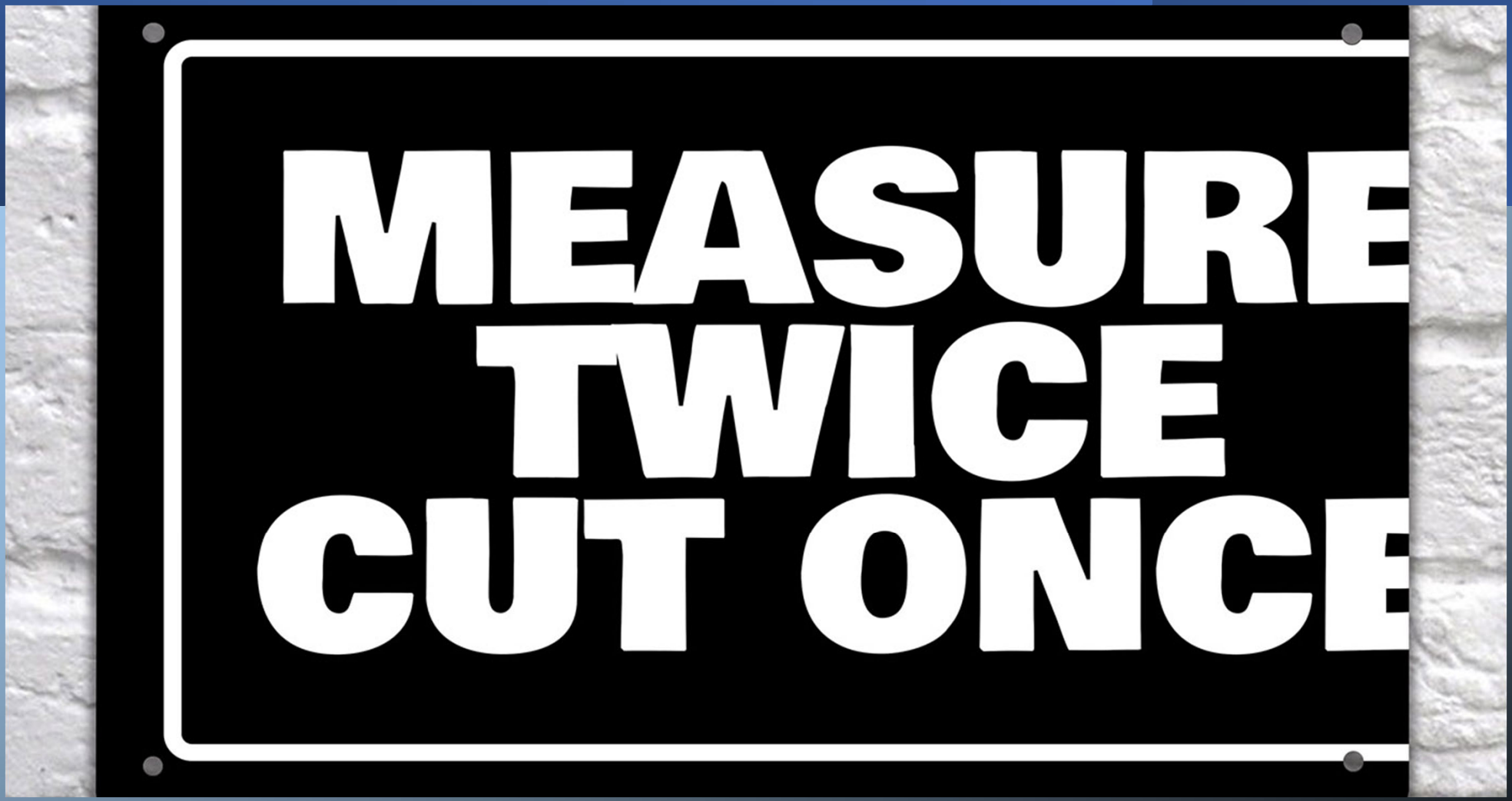
Preservation of the blood supply to soft tissue and bone by careful handling and gentle reduction techniques.

Early Mobilization

Early and safe mobilization of the part and patient.

Surgical Approach to MIS

- Anatomic reduction: of IMA and HA (mild to severe)
- Stable fixation: (internal versus external)
- Preservation of blood supply: (MIS approach) (extra periosteal)
- Early, active mobilization: (immediate WB)


MEASURE
TWICE
CUT ONCE

Percutaneous Kirschner wire Bösch method

J Clin Orthop Trauma. 2013 Sep; 4(3): 123–128.
Published online 2013 Sep 6. doi: 10.1016/j.jcot.2013.07.003

PMCID: PMC3880427
PMID: 26403551

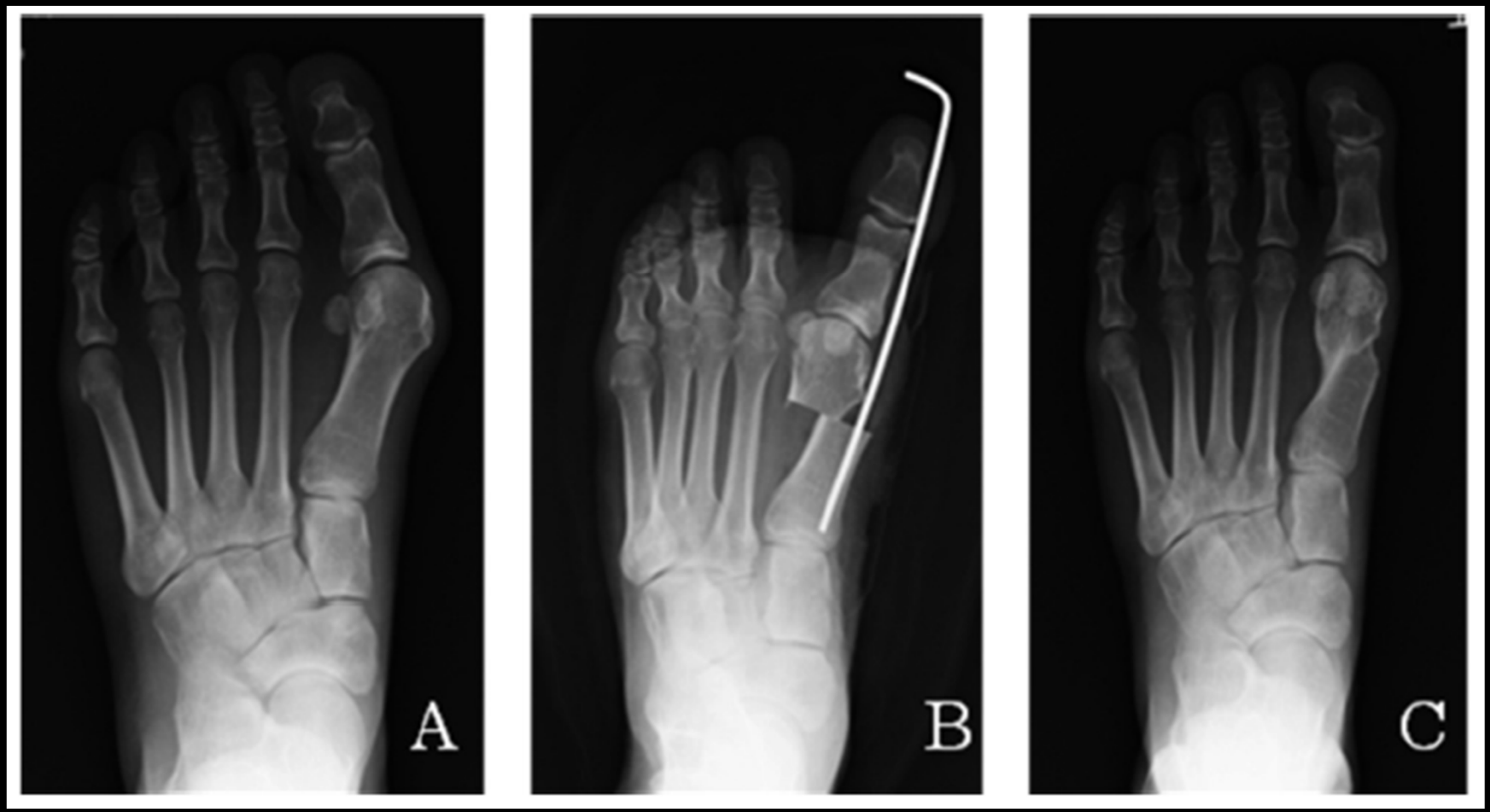
Bösch technique for hallux valgus surgery in a tropical setting

Essoh J.B. Sié, MD (Ortho),* Aka D. Kacou, MD (Ortho), A. Traoré, MD (Ortho), C. Mobiot, MD (Ortho), and Y. Lambin, MD (Ortho)




B
55 kVp
1.39 mA
10
OEC


B

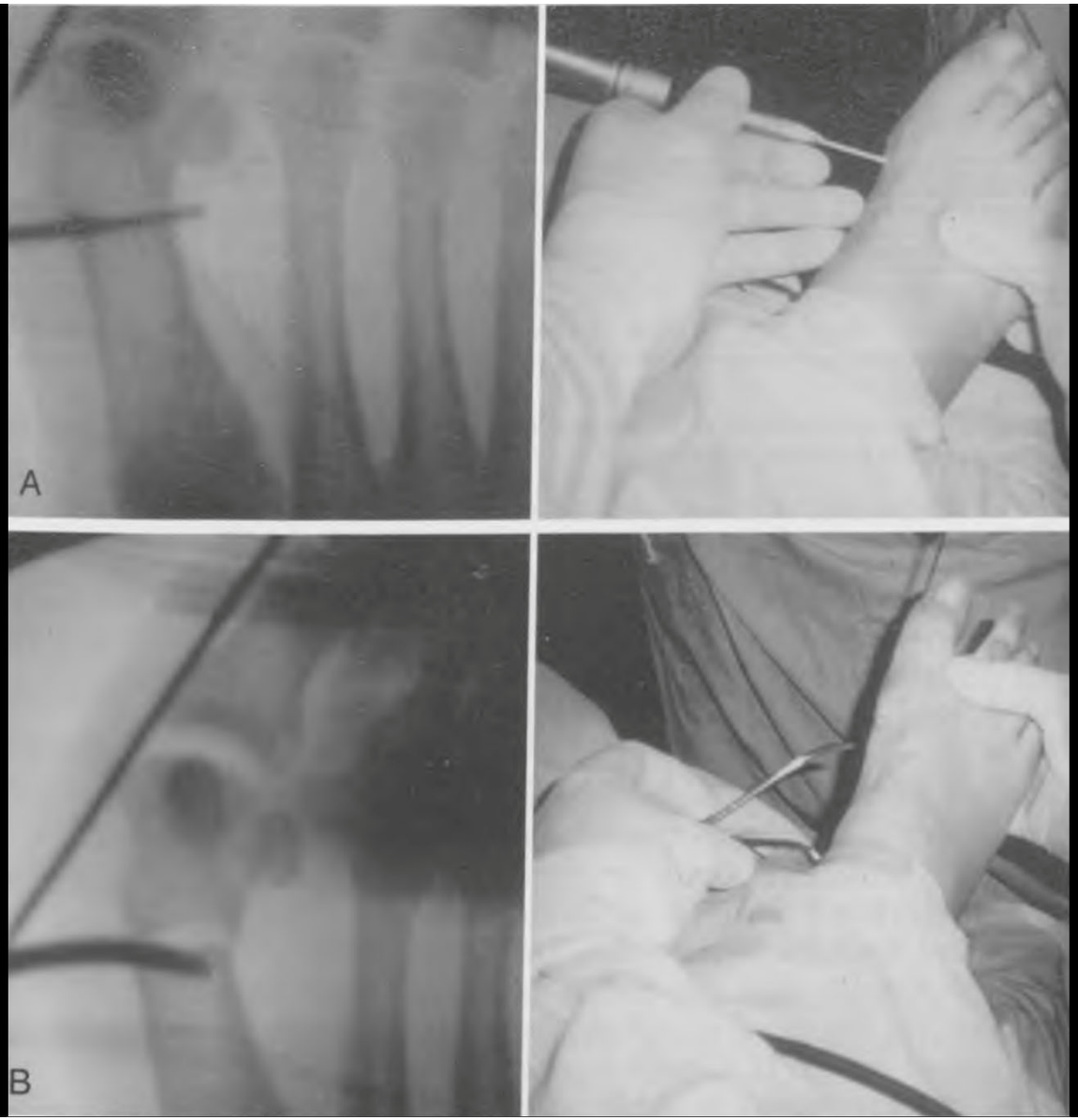

A
B
C

THE HALLUX 1083–7515/00 $15.00 + .00

HALLUX VALGUS CORRECTION BY THE METHOD OF BÖSCH:

A New Technique With a Seven-to-Ten-Year Follow-Up

Peter Bösch, MD, Stefan Wanke, MD, Robert Legenstein, MD


A
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A


B


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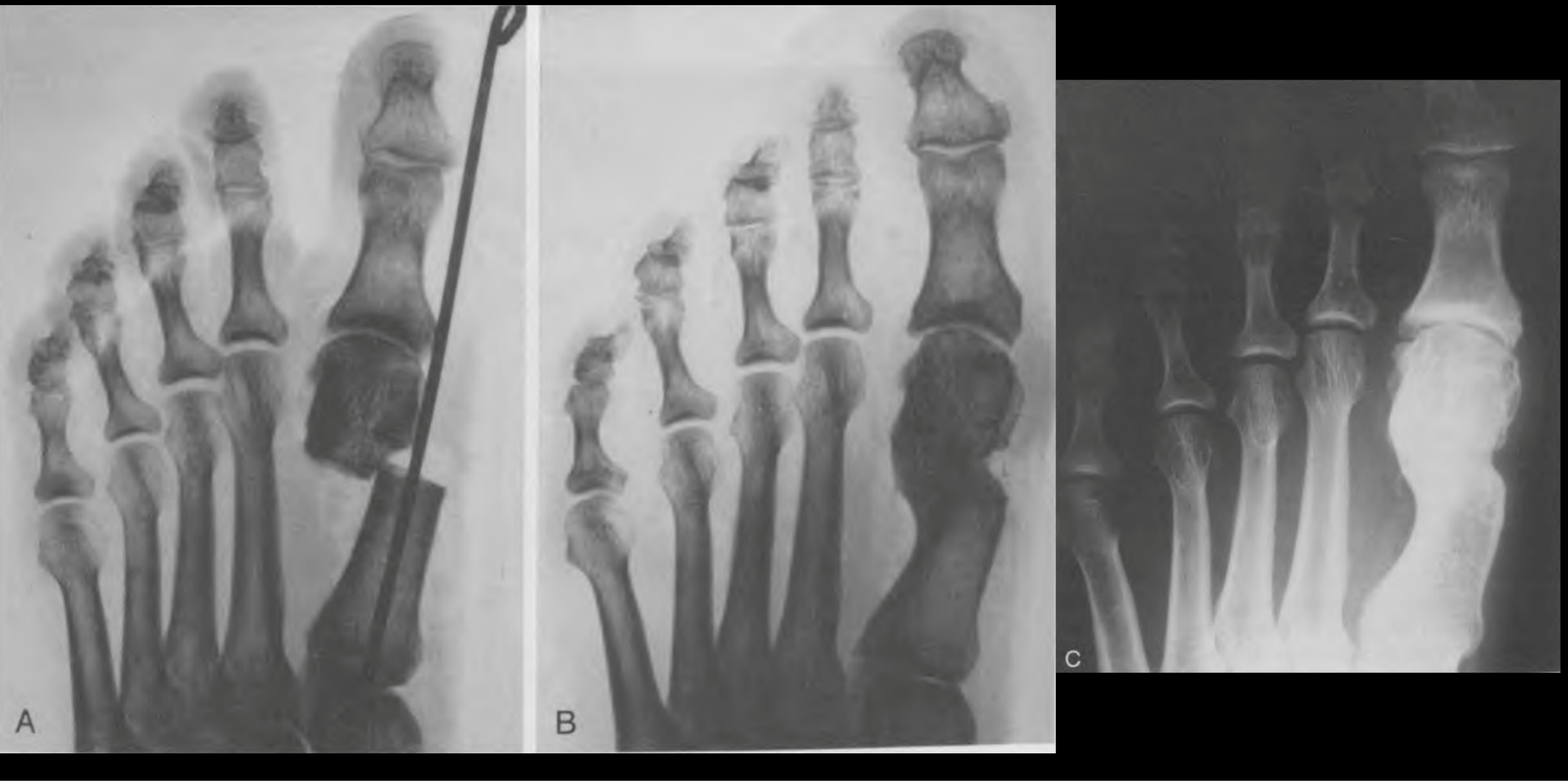

A
B
C

J Foot Ankle Surg. 2016 Nov - Dec;55(6):1336-1342. doi: 10.1053/j.jfas.2016.07.006. Epub 2016 Sep 3.

Modified Percutaneous Hallux Abductovalgus Correction.

Khosroabadi A[1], Lamm BM[2].

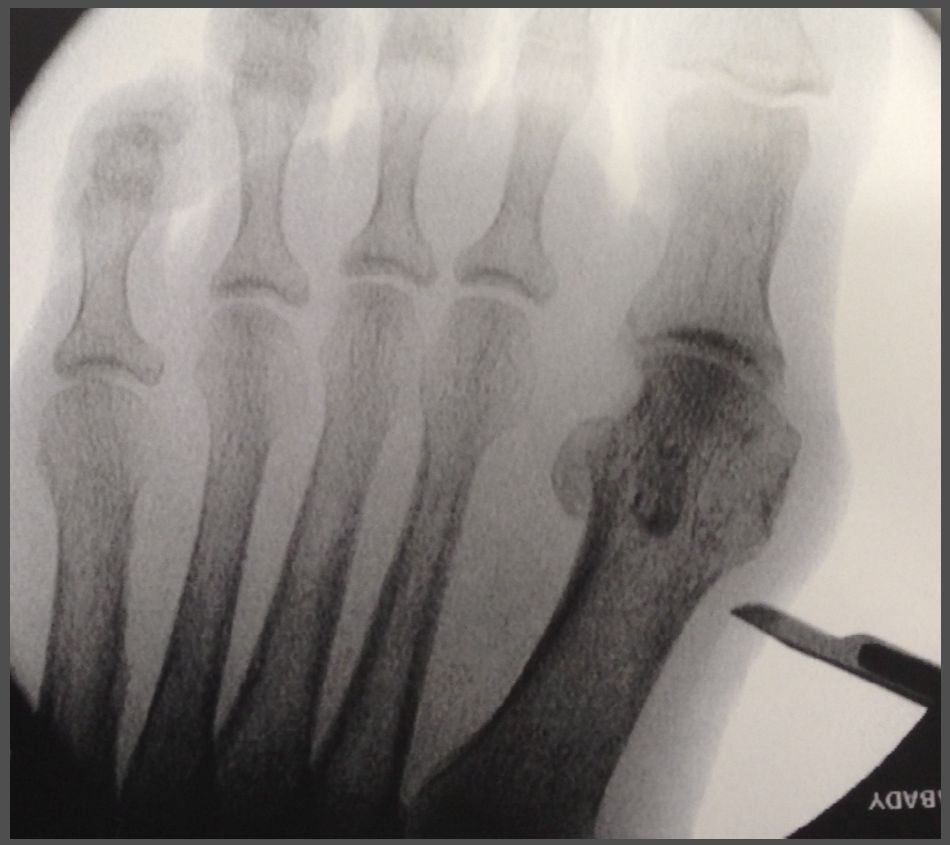
Author information

Abstract

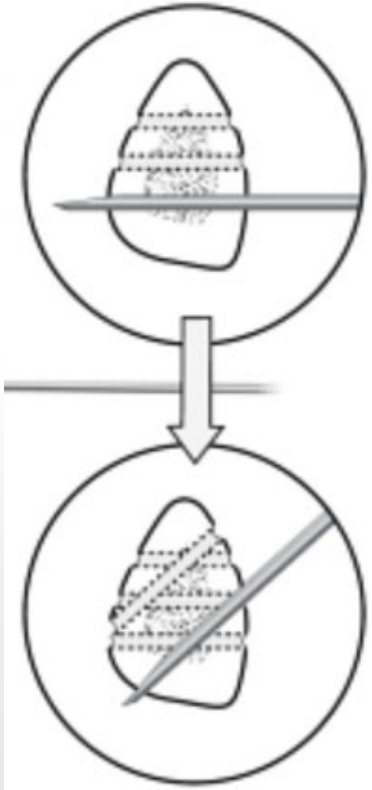
Percutaneous surgical techniques and minimally invasive procedures in foot and ankle surgery are gaining interest for both patients and surgeons. Percutaneous surgery is defined by a soft tissue or osseous procedure performed through the smallest possible incision without direct visualization of the underlying target structures. Percutaneous surgery has many potential advantages, including quicker operative times, multiplanar osteotomy correction, smaller incisions, decreased scarring, lower complication rates, and faster recovery times. The potential disadvantages include the need for specific equipment, that it cannot be used for large deformities, and that it requires an extensive learning curve. A commonly attempted percutaneous procedure is first metatarsal osteotomy for correction of hallux abductovalgus or bunion. We present our preoperative planning and intraoperative techniques for percutaneous hallux abductovalgus correction.

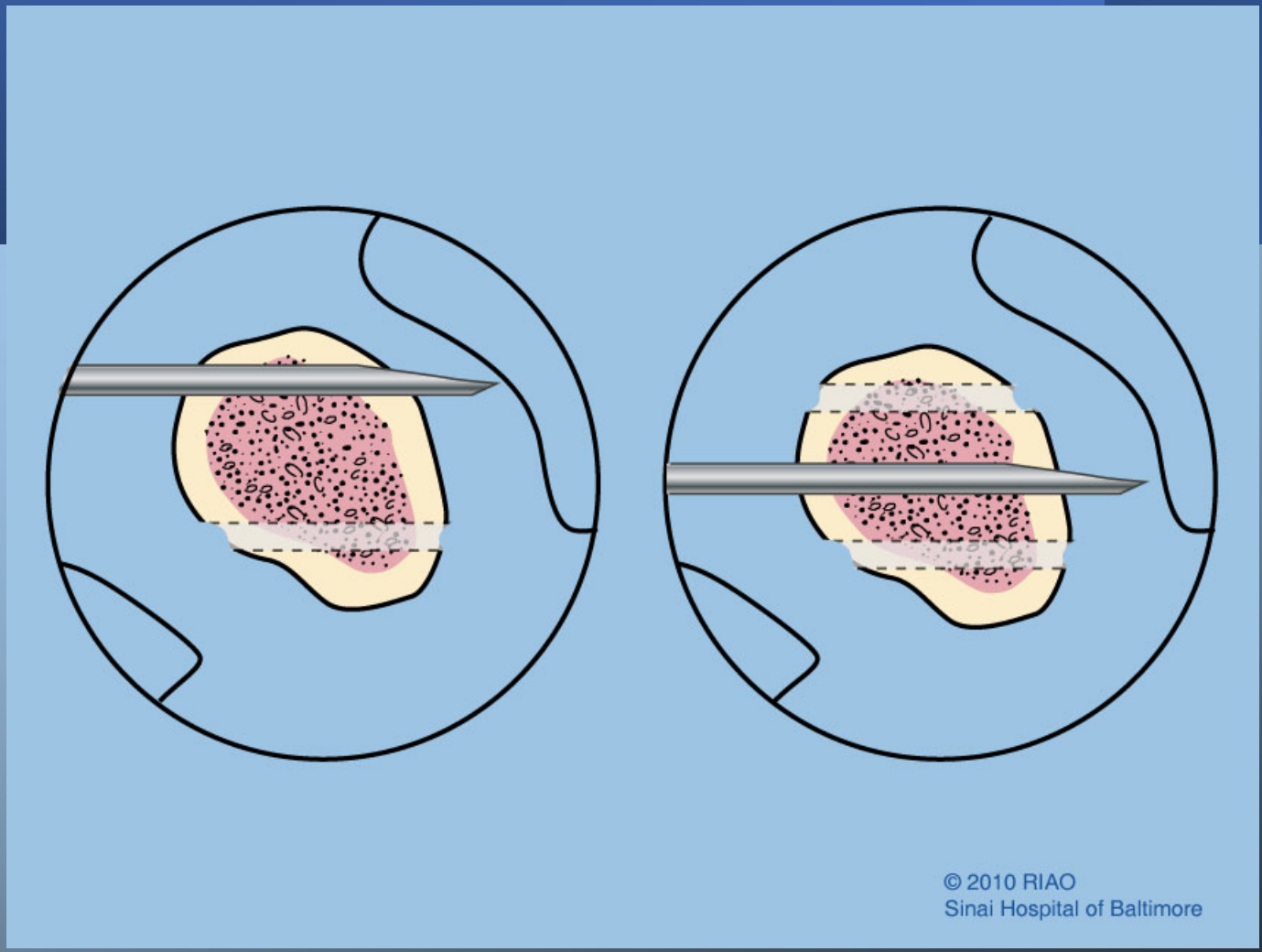
KEYWORDS: bunion; first metatarsal osteotomy; hallux abductovalgus; minimally invasive surgery; percutaneous surgery

PMID: 27600486 DOI: 10.1053/j.jfas.2016.07.006




Stryker

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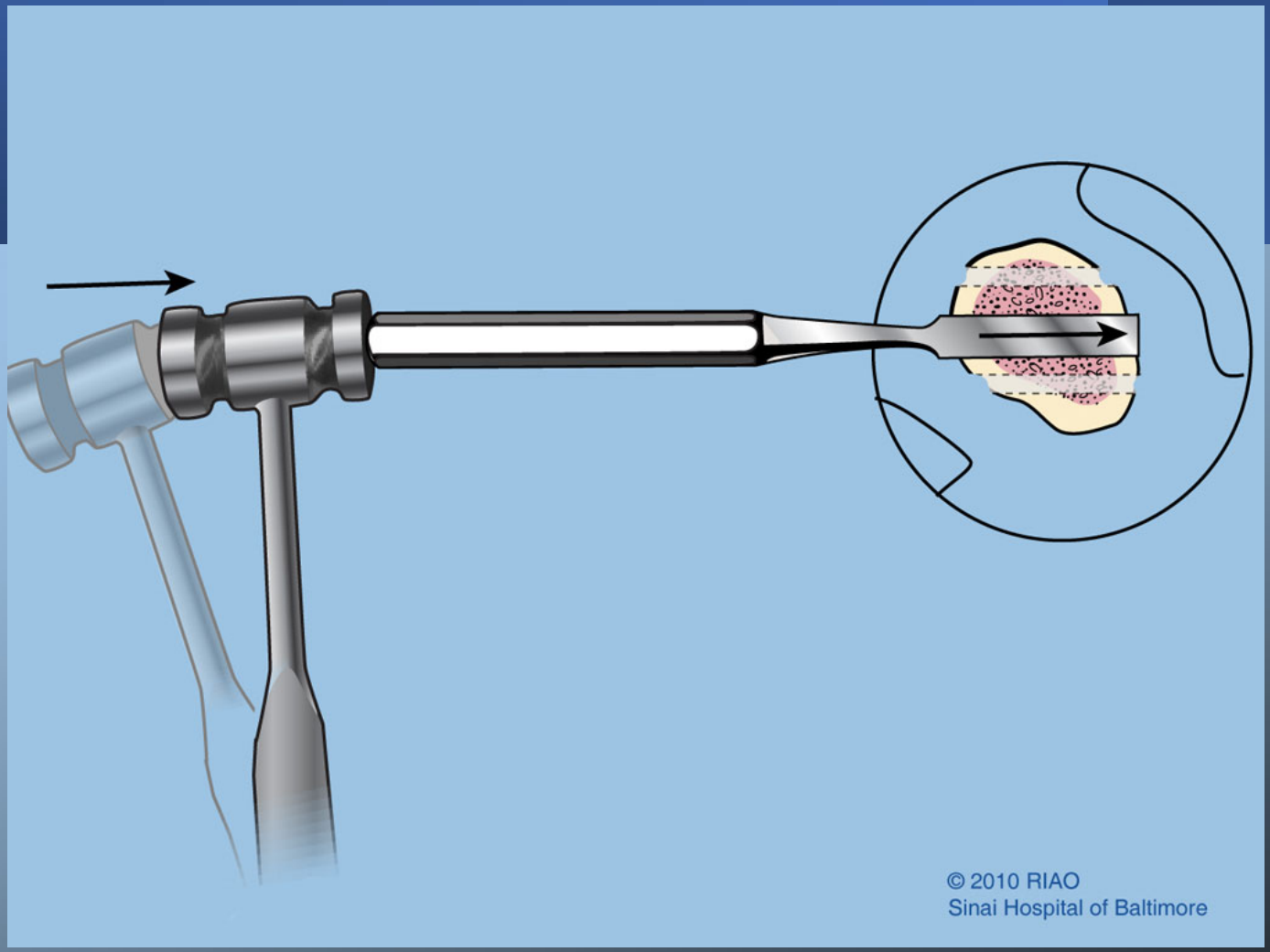
Sinai Hospital of Baltimore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COMPLICATIONS
AHEAD

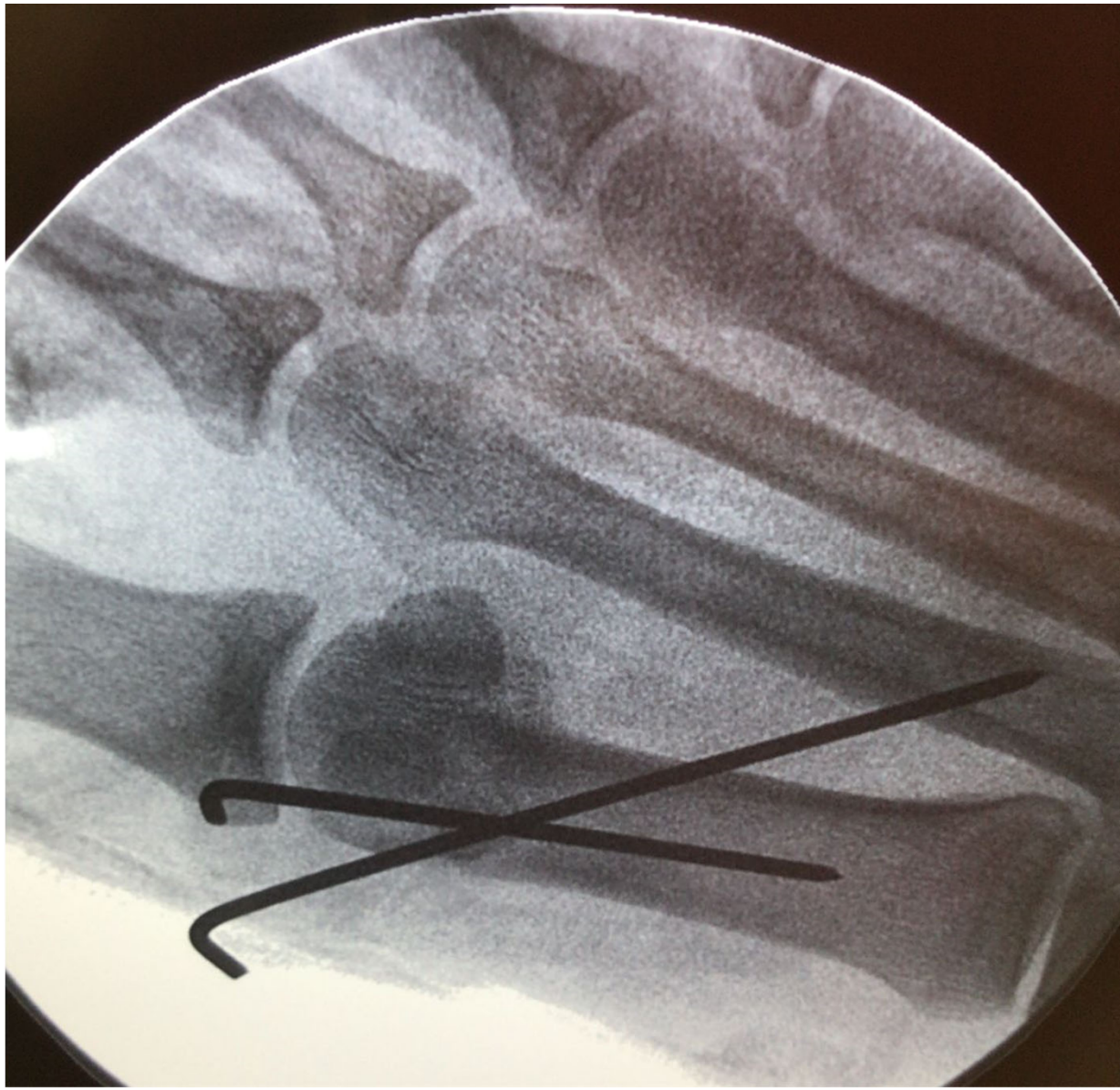
Distal Osteotomy

- COMPLICATIONS

1. Recurrent deformity
2. Delayed or Nonunion
3. Limited joint motion
4. Avascular necrosis
5. Incisional neuritis

COMPLICATIONS

- Overcorrection
- Under correction



Incomplete Translation

COMPLICATIONS

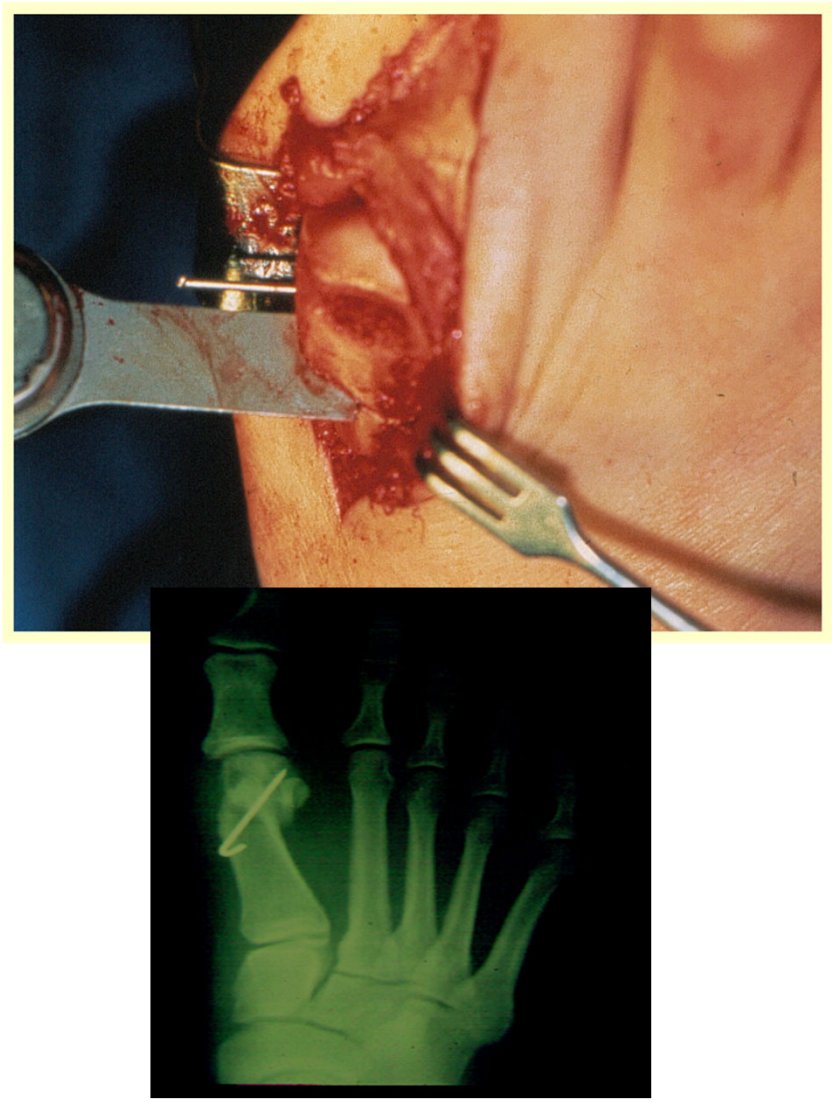
- Plantar or dorsal malalignment


ELT

Distal Osteotomy

- COMPLICATIONS

1. Recurrent deformity
2. Delayed or Nonunion
3. Limited joint motion
4. Avascular necrosis
5. Incisional neuritis



Distal Osteotomy

- COMPLICATIONS

1. Recurrent deformity
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Distal Osteotomy

- COMPLICATIONS

1. Recurrent deformity
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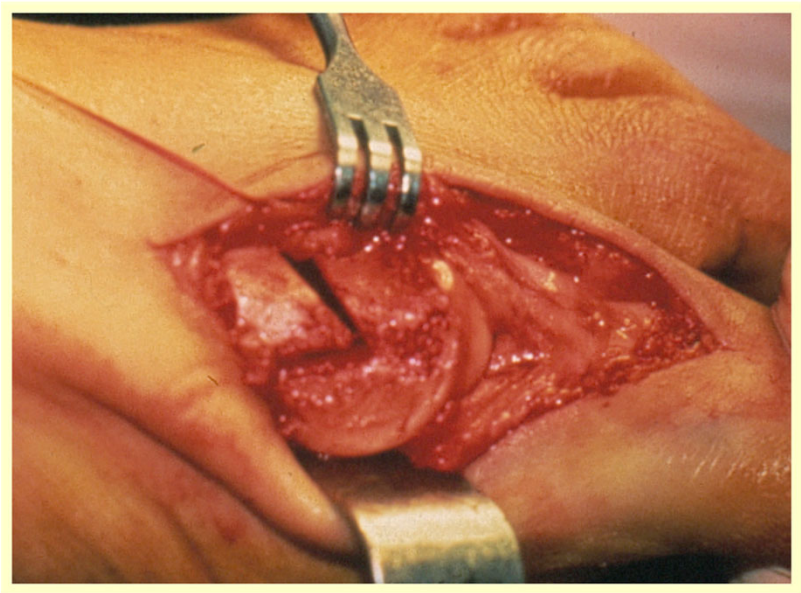

Original Article

Effect of minimally invasive distal first metatarsal osteotomy on blood flow of the metatarsal head

So Minokawa*, Ichiro Yoshimura, Kazuki Kanazawa, T

Department of Orthopaedic Surgery, Fukuoka University School of Medicine, 7-45-1 Nanak

ARTICLE INFO

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15 June 2018
Accepted 18 November 2018
Available online xxx

ABSTRACT

Background: Distal first met
hallux valgus (HV) deformiti
good outcomes without ava
described the *in vivo* blood f
formed to evaluate the *in vi*
with HV using laser Dopple
metatarsal osteotomy on the
Methods: From April 2015 to
men, 8 women). Blood flow
feet were performed by laser
postoperative follow-up.
Results: The median pre- an
ml/min/100 g, respectively
rate of change in the blood fl
patients (23.1%) showed a
pressure was 90 (84.5–97) a
0.00; 95% CI, −3.0–2.0; *P* =
CI, −3.1%–2.2%; range, −9.
follow-up.
Conclusions: No significant difference was found in the rate of change in blood flow pre- and post-osteotomy, suggesting that minimally invasive distal first metatarsal osteotomy does not influence blood flow of the metatarsal head.

Contents lists available at ScienceDirect

Journal of Orthopaedic Science

journal homepage: http://www.elsevier.com/locate/jos

Original Article

Effect of minimally invasive distal first metatarsal osteotomy on blood flow of the metatarsal head

So Minokawa*, Ichiro Yoshimura, Kazuki Kanazawa, Tomonobu Hagio, Takuaki Yamamoto

Department of Orthopaedic Surgery, Fukuoka University School of Medicine, 7-45-1 Nanakuma, Jonan-ku, Fukuoka 814-0180, Japan

AVN of the 1st met head reported at a range of 0% to 20%

Incidence of AVN 1st met head after MIS ranges from 0.0% to 3.5%

Bosch et al reported 0% AVN

Angthong et al reported 0% AVN with MIS

Ianno et al reported 3.5% AVN

Distal Osteotomy

- COMPLICATIONS

1. Recurrent deformity
2. Delayed or Nonunion
3. Limited joint motion
4. Avascular necrosis
5. Incisional neuritis

MIS bunion examples

Percutaneous Chevron Akin Implant System

Indications:
PECA implants are indicated for small bone fragment osteosynthesis for extremity surgeries. Examples of use: Hallux Valgus with Percutaneous Chevron and Akin osteotomies.

Fully threaded, constant pitch: Facilitates purchase for stable fixation.

40 Degree Chamfer Cut Head: Anatomically contours to the medial cortex of the first metatarsal.

Exact-T® recess:
Allows Exact driver positioning and provides optimal torque.

Self-tapping Self-drilling

Proximal cutting flutes: Eases insertion.

PECA Bunion Instrumentation

Simple | Effective | Precise | Innovative

Sterile Percutaneous Burrs

Intelligently designed cutting flutes offer precision bone resection and removal without violating soft tissue structures.

Reduction Wire

The single use reduction wire offers the simplicity of a flexible stem with a rigid and sharpened tip for hands free metatarsal translation (CKW03001).

Exact-T® – Patent Pending:

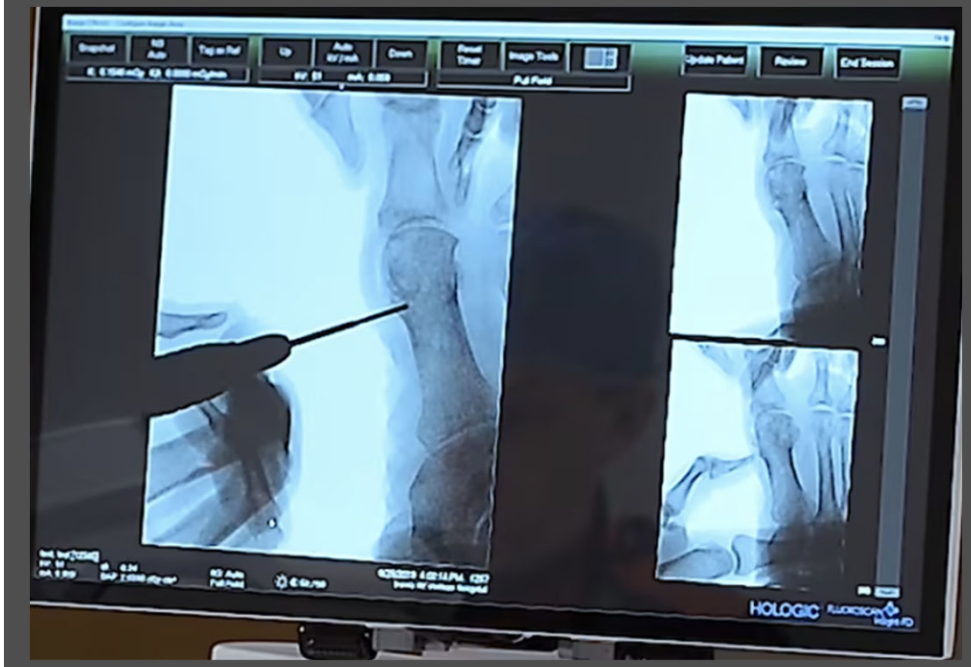
Facilitates correct placement of implant upon insertion.

Exact-T® Recess:
Keyed recess connection. Ensures driver inserts implant in only one direction.

QuickStep Reamers

Reamers designed for immediate setup on a wire-driver to maximize Operating Room efficiency.

Visual Guideline:
The black laser marking aligns with the chamfer head of the implant, identifying the medial cortex of the first metatarsal, ensuring proper placement when implanted.


HOLOGIC


Full Field

Pre-Op

Post-Op

MINI MAXLOCK™ EXTREME™

ISO PLATE

Key Benefits

- Provides surgeon the ability to address more severe hallux valgus deformities with a distal Chevron/Austin osteotomy
- ISO (Intraosseous Sliding Osteotomy) Plate with POCKETLOCK™ Technology combines bending strength and rotational control of a plate with the compression generation of an inter-fragmentary screw
- This technique uses the pocket of the plates to direct the interfragmentary fixation screw into the proximal metatarsal.

System Surgical Technique Animation_ISO Small Plate and Screw (video)

Total Bunion Correction Portfolio

novastep
Your foot & ankle company

peca
Percutaneous Osteotomy

Percutaneous Precision Bunion Correction

- Distal percutaneous approach
- Less pain, less stiffness, faster recovery
- Non capsule violating technique
- Promotes percutaneous forefoot techniques

centroLock
Guided Transverse Osteotomy System

Guided Transverse Osteotomy System

- Distal minivasive approach
- 3 plane correction
- Hybrid intramedullary design
- Facilitates 100% translation

MINIBunion™

MINIMALLY INVASIVE BUNION SYSTEM

BUILD YOUR M.I.S. PRACTICE

The CrossRoads MiniBunion® System provides surgeons with a refined subtle surgical technique, minimally invasive surgery (M.I.S.) instrumentation, and stable implant fixation. With an approximately 1.5 cm incision, surgeons may minimize soft tissue damage and reduce pain for patients.*

PRODUCT FEATURES

- Stable Implant Fixation
- Small Incision (~15mm)
- Simple Instrumentation
- Efficient Procedure
- Sterile, Reusable Instrumentation with ScanMAP®

CrossRoads

TRILLIANT SURGICAL

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M.I.B.

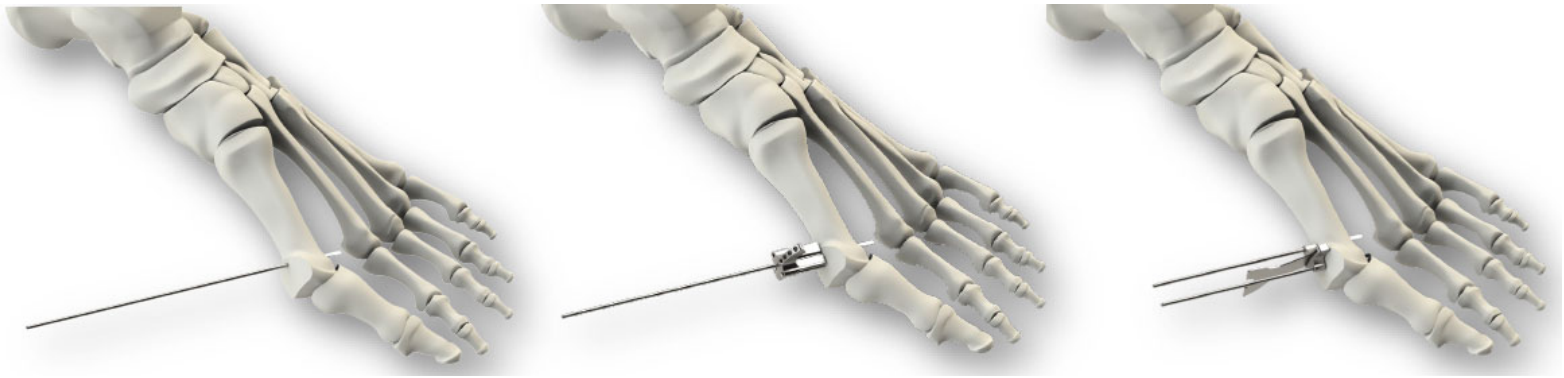
(Minimally Invasive Bunion) Plating System

The Minimally Invasive Bunion (M.I.B.) Plating System is a unique approach to tripl hallux valgus correction. The M.I.B. plate minimizes soft tissue disruption by requiring a small incision site, and provides a quick, solid construct.

MINI Bunion Technique

Tradional Surgery Incision

MIS Incision

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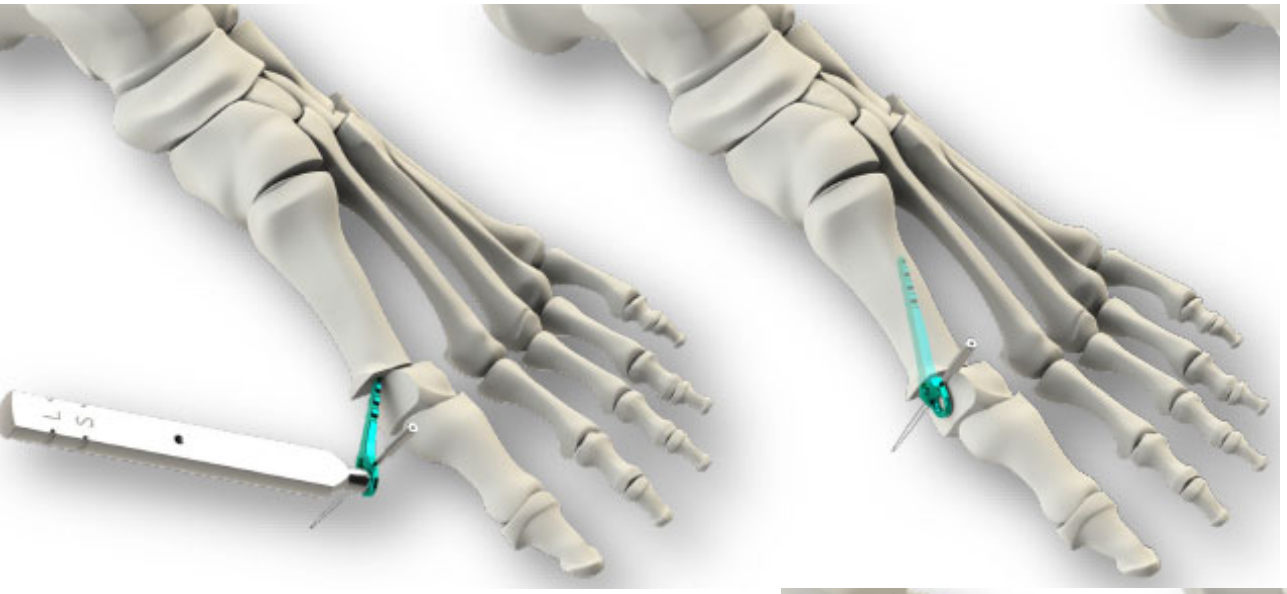



40
31
0.1 min
0.00 mGy/min
0.24 mGy
OEC


HLF


ST MARY'S MEDICAL CENTER
07/31/202
10:33:51 A
40
26
0.1
0.00 mGy
0.20
OEC

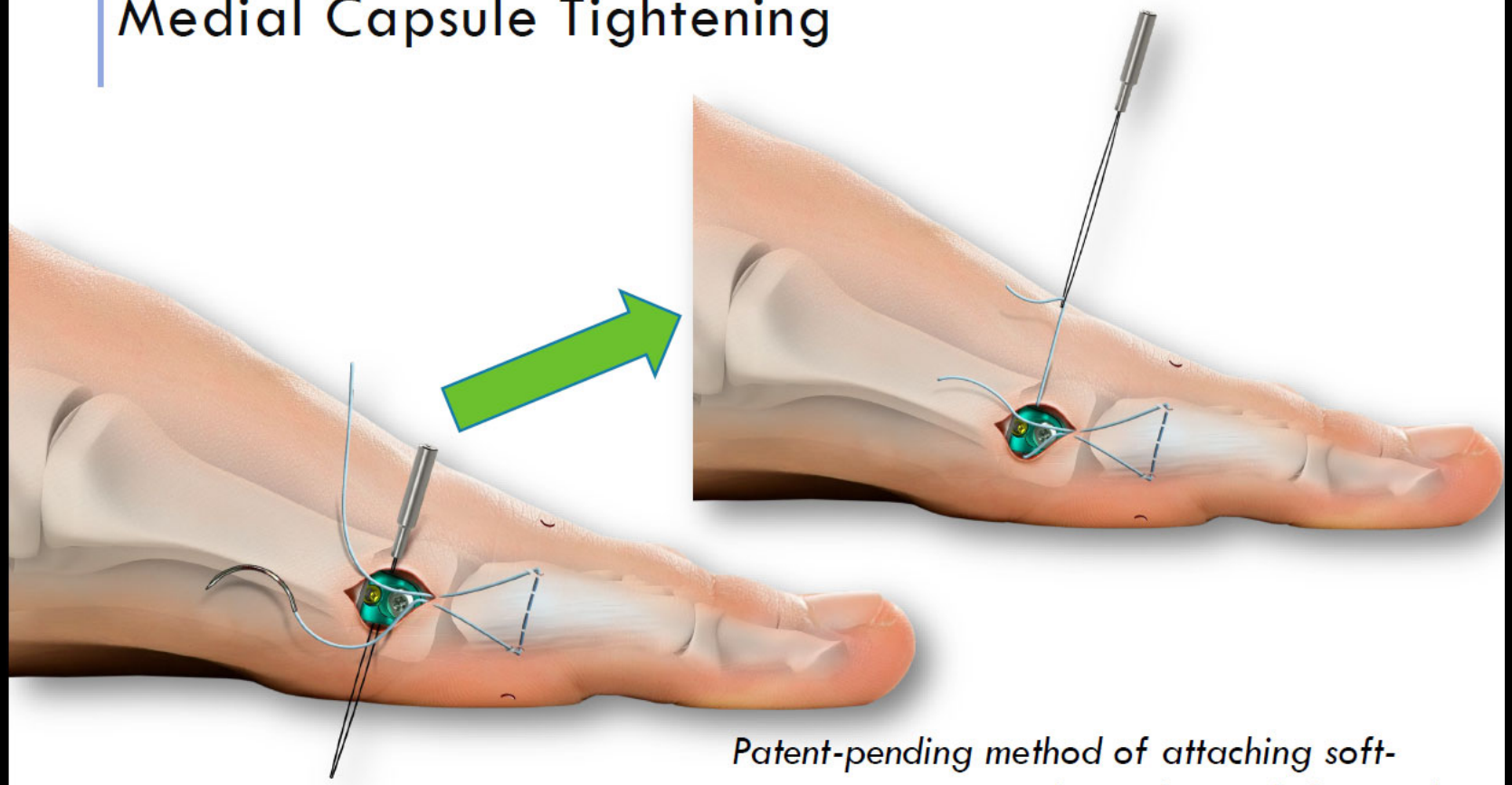
Frontal Plane Rotation


E
246452
50
57 kVp


OEC

CrossRoads Extremity Systems

Medial Capsule Tightening



Patent-pending method of attaching soft-tissue correction to the implant to help avoid recurrence

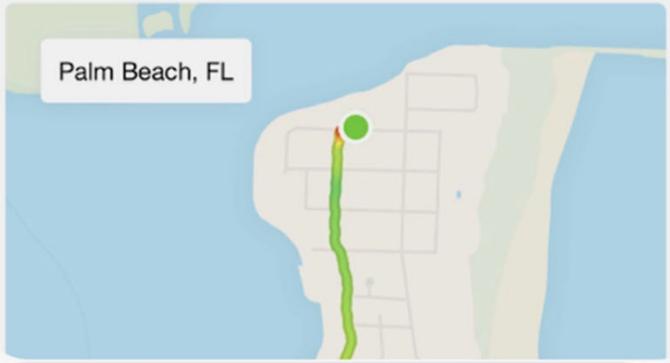
CASE #1


18°
120 mm
100 m

1.00

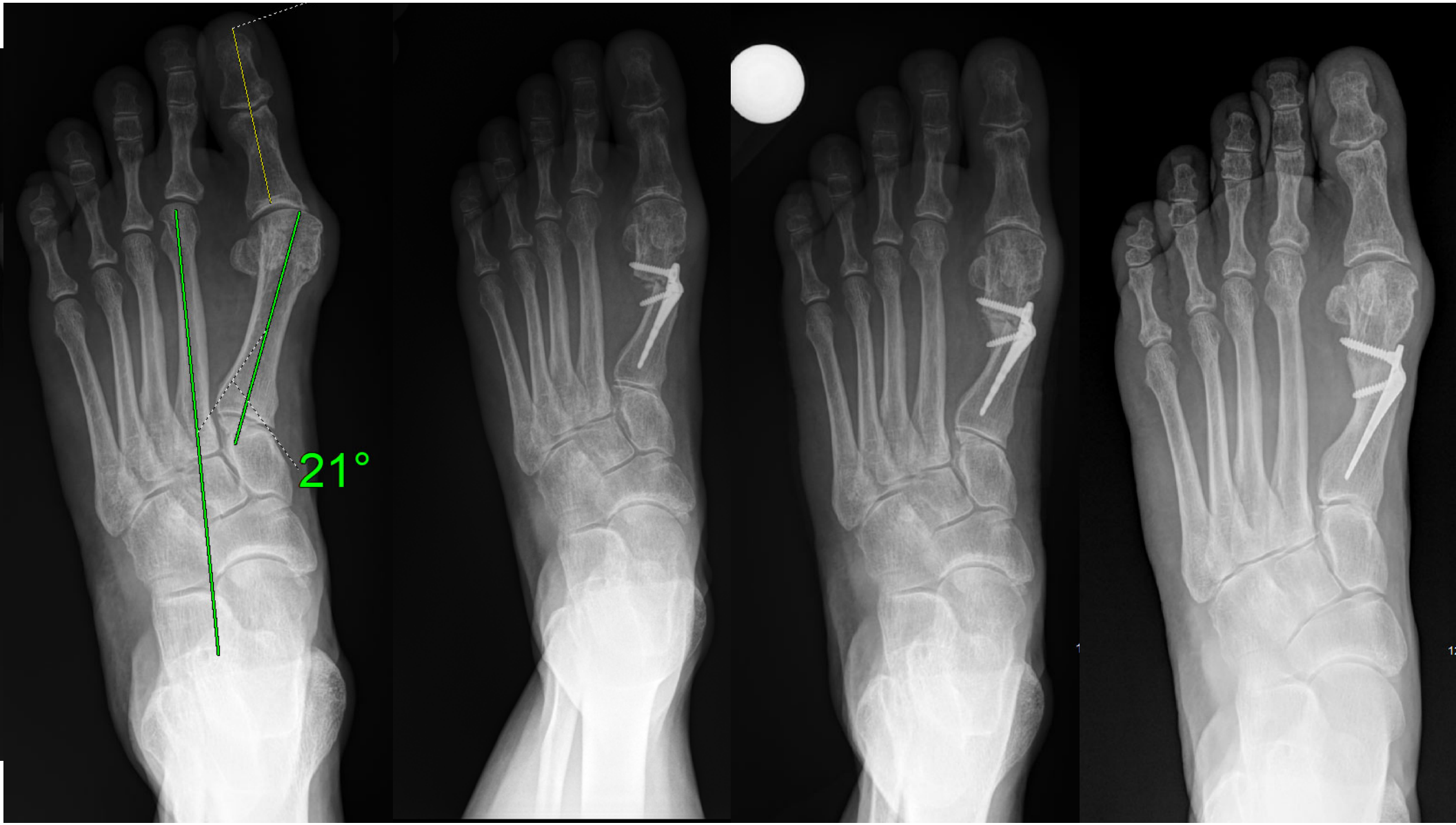
Miles

10'20'' Avg. Pace	10:20 Time	89 Calories
20 ft Elevation Gain	0 ♡ Avg. Heart Rate	166 Cadence



My first one mile run since my surgery!!!!

CASE #2


21°

Case #3


Series: 1
L
Series: 1
L
L

Post Operative Course

Immediate WB in a surgical shoe

Week 1: Wound check, no x-rays

Week 4-6: Return to compression sock and sneaker, x-rays

Week 8-10: Return to activity

Week 12: Return to sport, no restrictions

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Hallux Valgus Surgery in the Athlete: Current Evidence

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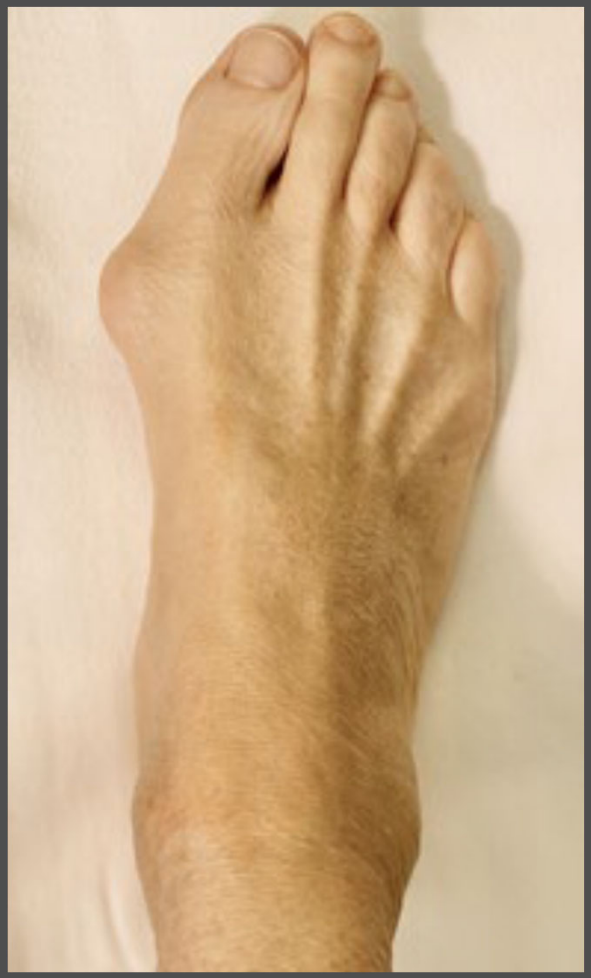
1st MTPJ demand >4 times body weight (400%) during running & jumping

Increase in range of motion is required for certain sports (ballet)

Must correct the deformity and restore function in athletes

Average RTA 12 weeks (mild to moderate deformity)



Summary

- Very low risk of AVN
- No removal of bump
- Immediate postoperative weight bearing
- Decreased OR time (<20 min) & limited surgical dissection
- No significant ROM reduction, improved function (extra-articular)
- Less post op pain, edema, and scar tissue (no dissection)
- No tourniquet needed

Summary

- Improved cosmesis
- Improved and stable instrumentation
- Ability to rebalance soft tissues
- Low energy osteotomy (faster healing)
- Zero nonunions
- Ability to correct frontal plane

Conclusion

High learning curve

Know the anatomy

Be comfortable with using c-arm, must get the right x-ray

Have the appropriate instrumentation

Preparation is Key


PLAN
PREPARE
PERFORM