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)
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

Figure 6

- Hematoma Inflammation
- Soft Callus
- Hard Callus
- Remodeling

6 Week Pin Pull
MIS: Principles of Fracture Healing

Principles of Fracture Healing
MIS: Bone remodeling

Remodelling

- Influenced by Wolff's law

Bunion preop/ post op
MIS: Bunion Anatomy
MIS: Anatomy

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


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

N: 20 patients, chevron bunionectomy without tourniquet control by two surgeons. Blood flow recordings: Periflux PF3 laser Doppler probe

Baseline ➔ medial capsulotomy ➔ adductor tenotomy ➔ lateral release ➔ chevron
(45%) (13%) (13%) (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
MIS: Intra-operative set up
1st drill hole = “Osteotomy Guide Wire”

2nd drill hole
Kelly hemostat guides K-wire into the proximal fragment
K-wire is advanced into the medial cuneiform bone.

Fragment is properly displaced.
Pre-Op and Immediate Post-op
3 Months Post-op
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


• 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

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

<table>
<thead>
<tr>
<th>Study</th>
<th>Year of Publication</th>
<th>Type of Study</th>
<th>Level of evidence</th>
<th>No. of patients</th>
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# MIS: Literature Review

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<th>Authors</th>
<th>Year</th>
<th>Study Design</th>
<th>Procedure Description</th>
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<td>Magnan et al.</td>
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<td>Martinez-Nova et al.</td>
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<td>Roth et al.</td>
<td>1996</td>
<td>Retrospective study</td>
<td>Mini-incision versus Kramer osteotomy</td>
<td>105 (124): subcutaneous group, 88 ft; open group, 36 ft</td>
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<td>Sanna and Ruid</td>
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<td>Mini-incision and arthroscopy</td>
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MIS: Literature Review

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<th>Post-OP</th>
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<td>DMMA</td>
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<td>6.45°</td>
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  – 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!