Evaluation of A Novel Approach to Hallux Valgus Treatment: Triplanar Deformity Classification, Non-Compression Fixation & Immediate Weight-Bearing

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Statement of Purpose

The objective of this study was twofold:

1. Develop a triplanar classification system to characterize the 3D hallux valgus (HV) deformity
2. Perform an early evaluation of a novel procedure that allows for triplanar correction and immediate weight-bearing (WB) after Lapidus arthrodesis

Literature Review

Current Hallux Valgus Treatment Paradigm

- Current HV classifications primarily severity-based, relying on 2D transverse-plane measures in AP x-rays
- Most HV procedures are transverse-plane osteotomies
  - Demonstrating 30-78% radiographic recurrence[1,2]
- Recent CT studies indicate 87% bunions are 3-plane deformities, with metatarsal frontal-plane rotation[3]
- Failure to correct metatarsal frontal-plane rotation associated with increased recurrence rates:
  - 10.0X if sesamoids not corrected[4]
  - 12.7X if rotation uncorrected ("lateral round sign")[5]

➔ Need for a triplanar HV classification

Triplanar 1st TMT Fusion & Immediate Weight-Bearing

- TMT is convenient site for 3-plane anatomic correction at apex of deformity (anatomic CORA)
- Traditional limitation is inability to WB early
  - Recent studies challenge WB standards following Lapidus, with limited WB at 2-3 wks[6,7]
- Recently developed multiplanar plating constructs rely on relative stability & secondary ("biologic") healing[8,9]

➔ New constructs may allow for immediate WB

Triplanar Hallux Valgus Classification[10]

Class	Anatomic Findings	MTP Joint Status	Treatment Recommendation
1	• Increased HVA and IMA • **No 1st metatarsal pronation** evident on AP and sesamoid axial radiograph • Sesamoids may be subluxed	• No clinical or radiographic evidence of DJD	• Transverse plane corrective procedure • +/- Distal soft tissue procedures
2A	• Increased HVA and IMA • **1st metatarsal pronation** evident on AP and sesamoid axial radiograph • **No sesamoid subluxation**	• No clinical or radiographic evidence of DJD	• Triplane correction with 1st met. supination
2B	• Increased HVA and IMA • **1st metatarsal pronation** evident on AP and sesamoid axial radiograph • **With sesamoid subluxation**	• No clinical or radiographic evidence of DJD	• Triplane correction with 1st met. supination • + Distal soft tissue procedures
3	• Increased HVA and IMA • **>20 degrees metatarsus adductus (MTA)**	• No clinical or radiographic evidence of DJD	• Met. 2 & 3 transverse plane correction. • Followed by 1st met. correction (per class 1 & 2 recommendations)
4	• Increased HVA and IMA • +/- 1st metatarsal pronation	• **Clinical and/or radiographic evidence of DJD**	• First MTP Arthrodesis. • Resectional/implant arthroplasty may be utilized

Methods

- Design: Retrospective, multi-center consecutive series
- Surgical Procedure: **Instrumented 3-plane, 1st TMT correction** with **2 mini-plate** multiplanar fixation (without interfragmentary compression)
- Exclusion: Class 3 & 4 HV patients
- Post-op Regimen: **Immediate WB** as tolerated in post-op boot
- HV Cohort: 49 patients, **4.3±1.0 mo follow up** (min 3 mo)
- Data Analysis: Radiographic measures (IMA, HVA, TSP, Lateral Round Sign) and reported complications

Results

Triplanar Classification (pre-op):
6% Class 1, 43% Class 2A, and 51% Class 2B HV patients
(note: Class 3 & 4 excluded)

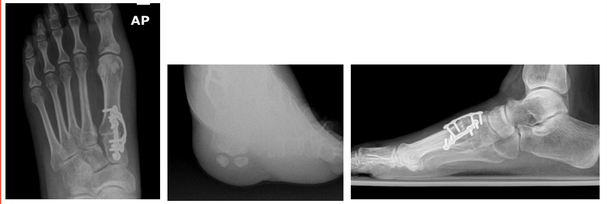

Fig. 1 Post-op 3-plane x-rays after triplanar correction.

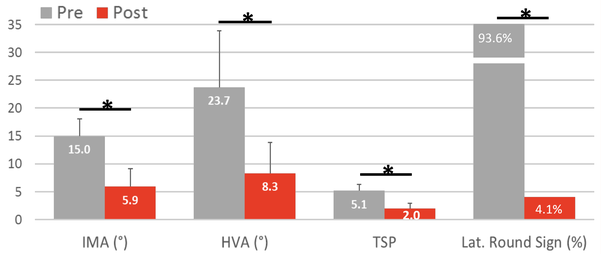

*Fig 2. Anatomic 3-plane radiographic measures. *p<0.001*

Delayed wound healing/swelling	2 (4%)
Broken screw in fixation construct	1 (2%)
Hardware removal for soft-tissue irritation	1 (2%)
Undercorrection (IMA>10° or HVA>20°)	2 (4%)
Non-union	0 (0%)

Table 1. Complication rates.

Discussion

This study presented a novel triplanar approach to the classification and treatment of the HV deformity

- Results demonstrate that triplanar HV deformity consistently corrected with triplanar 1st TMTJ fusion
  - Elimination of lateral round sign (met. frontal-plane rotation) in 95.9% patients
  - Three-plane correction maintained at 4 mo

➔ Triplanar classification provides framework for 3-plane assessment and treatment

Immediate WB is possible after 1st TMT fusion

- Minimal complications observed, no non-unions
  - Consistent with previous studies showing excellent results with early (2-4 wk) WB[6,7]
- 2 mini-plate 90-90 construct provides multiplanar, relative stability
  - Allows WB to stimulate biological healing process[9]
  - Prior biomechanical results demonstrate superior to anatomic plate & compression screw[8]

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