CONCOMITANT PROXIMAL INTERPHALANGEAL AND DISTAL INTERPHALANGEAL ARTHRODESIS FOR REPAIR OF LESSER TOE DEFORMITIES

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Background

Hammertoes, claw toes, and mallet toes are common deformities of the lesser toes. These arise from excessive extension across the metatarsophalangeal (MTP) joint, leading to contracture of the proximal interphalangeal (PIP) and/or distal interphalangeal (DIP) joints.

Arthrodesis is the mainstay of surgical management and can be accomplished via internal fixation (i.e., permanent implants) or external fixation (i.e., temporary K-wires).

Arthrodesis may be performed at:
- The PIP joint alone
- Both PIP and DIP joints concurrently

Concurrent PIP-and-DIP fixation:
- Proposed to reduce recurrence and yield a straighter construct
- May increase complication risks due to additional implant sites

Study Purpose: Compare surgical outcomes, complication rates, and patient-reported measures among PIP-only arthrodesis versus concurrent PIP-and-DIP arthrodesis techniques– further distinguishing these outcomes between internal versus external fixation in PIP-only arthrodesis.

Methods

Design: Retrospective chart review of all lesser toe surgeries at a single academic orthopedic department (4-year period).

Patient Data: Preoperative demographics and comorbidities relevant to orthopedic healing collected.

Surgical Comparison Groups – see Figure 1a

Outcomes:
- **Case-level:** Complications
  - Minor complications
  - Major complications
- **Toe-level (when available*)**
  **available defined as the presence of both preoperative and post-operative (at ≥6 months follow-up) PROs*
  - Patient Reported Outcomes (PROs):
    - Pain Interference (PI)
    - Foot and Ankle Outcome Scores (FAOS)
  - Radiographic Outcomes (Figure 1b):
    - Medial-lateral (ML) angulation
    - Dorsal-plantar (DP) angulation
    - Level of bony union (total, partial, none)

Analysis: Statistical comparisons across groups for complications, PROs, and radiographic outcomes.

Figure 1a) Surgical Comparison Groups

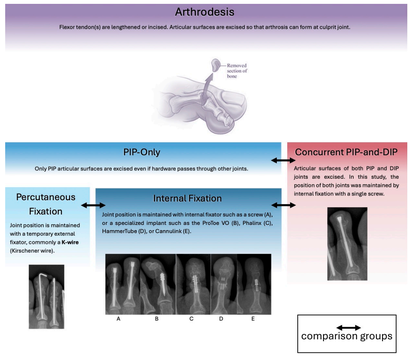
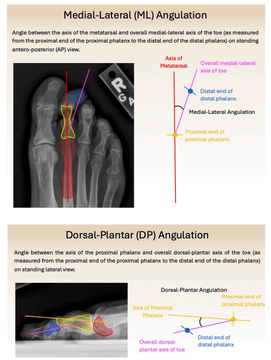


Figure 1b) Radiographic Measures



Demographics

Demographic	PIP-Only N=79		Concurrent PIP-and-DIP N=49	P value
	Internal N=47	External N=32		
Age	62.1 (±11.0)		61.3 (±14.2)	0.73
	62.3 (±12.3)	61.8 (±8.88)		0.124
Female	50 (63%)		33 (67%)	0.705
	32 (38%)	18 (56%)		0.92
BMI	28.9 (±6.46)		28.3 (±5.64)	0.563
	29.0 (±6.91)	28.7 (±5.85)		0.831
Pre-Existing Comorbidities				
Chronic Deformity	5 (6%)		4 (8%)	0.719
	2 (4%)	3 (9%)		0.748
Neuropathy	21 (27%)		22 (45%)	0.0335*
	10 (21%)	11 (34%)		0.0435*
Diabetes Mellitus	16 (20%)		8 (16%)	0.655
	8 (17%)	8 (25%)		0.621
Pre-DM	22 (28%)		8 (16%)	0.204
	12 (26%)	10 (31%)		0.288
Osteoporosis	10 (13%)		6 (12%)	1
	6 (13%)	4 (12%)		1
Osteopenia or Prior Non-Union	32 (41%)		15 (31%)	0.34
	23 (49%)	9 (28%)		0.0985
Immunocompromised	14 (18%)		14 (29%)	0.186
	9 (19%)	5 (16%)		0.345

Results

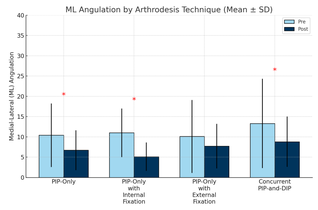
Complications

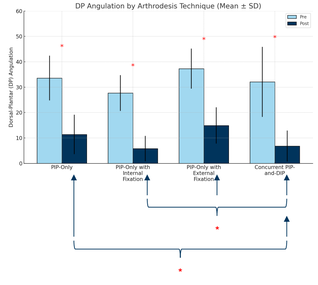
	PIP-Only N=79		Concurrent PIP-and-DIP N=49	P value
	Internal N=47	External N=32		
Any Minor Complication	28 (35%)		11 (22%)	0.155
	14 (30%)	14 (44%)		0.124
Any Major Complication	8 (10%)		8 (10%)	0.103
	5 (11%)	3 (9%)		0.262

Any Minor Complication	28 (35%)	11 (22%)	0.155
	14 (30%)	14 (44%)	0.124
Infection Requiring Oral Antibiotics	6 (8%)	5 (10%)	0.749
	4 (9%)	2 (6%)	0.92
Malunion or New Deformity	8 (10%)	2 (4%)	0.326
	6 (13%)	2 (6%)	0.276
Nonunion / Recurrence	14 (18%)	1 (2%)	0.0055*
	8 (17%)	6 (19%)	0.0315*
Hardware Failure (no revision req'd)	10 (13%)	3 (6%)	0.365
	5 (11%)	5 (16%)	0.378
Other Minor Complication	1 (<1%)	2 (4%)	0.159
	0	1 (3%)	0.121

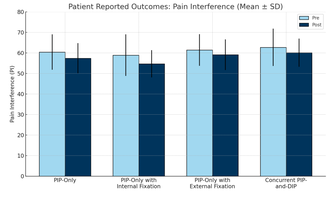
Any Major Complication	8 (10%)	8 (10%)	0.103
	5 (11%)	3 (9%)	0.262
Infection Requiring IV Antibiotics	2 (3%)	3 (6%)	0.366
	0	2 (6%)	0.321
Irrigation & Debridement	2 (3%)	3 (6%)	0.386
	0	2 (6%)	0.294
Hardware Removal	4 (5%)	8 (16%)	0.0565
	3 (6%)	1 (3%)	0.123
Revision Surgery	6 (8%)	2 (4%)	0.499
	5 (11%)	1 (3%)	0.341

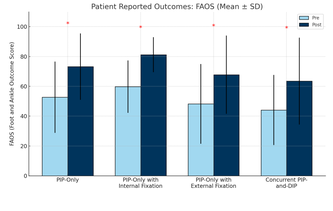
Radiographic Outcomes





Patient Reported Outcomes (PROs)





Conclusions

Overall complications rates:
- Roughly 1 in 3 patients experienced a minor complication and 1 in 6 a major complication, regardless of technique — showing that lesser toe surgery carries a meaningful but expected risk profile.
- Major complications occurred significantly later than minor complications (~12 months vs ~4 months post-op), though timing did not differ between arthrodesis techniques.
- Neither the number of toes treated per case nor concurrent foot/ankle procedures increased complication risk — suggesting outcomes are more influenced by fixation technique than surgical complexity.
- Diabetes was the only comorbidity associated with higher complication risk.

Patient-reported outcomes (PROs):
- All techniques equally improved FAOS, but none significantly improved PI, suggesting that structural correction improves function more than pain burden.

Fixation Type (Internal vs. External in PIP-only Arthrodesis)
- Internal and external fixation showed similar complication rates and correction outcomes.

Concurrent PIP + DIP Arthrodesis vs PIP-only Arthrodesis
- Lowest recurrence rates and best dorsal–plantar alignment
- Achieved despite theoretically higher complication risk.

Takeaways

- **All surgical methods improve function, but concurrent PIP + DIP arthrodesis offers the most durable and structurally optimal correction.**
- **Technique choice matters:** Concurrent PIP + DIP arthrodesis showed the most durable correction with lower recurrence compared to isolated PIP fixation.
- **Function > pain relief:** All techniques improved function (FAOS) but not pain (PI) — outcomes should be framed as functional gains rather than pain elimination.
- **Comorbidities matter:** Diabetes was the only comorbidity linked to higher complication risk, emphasizing patient optimization and long-term follow-up.

No disclosures to report.