Ascension St. Vincent

upperline HEALTH

Juvenile Hallux Valgus: Evidence, Evolution, and Emerging Surgical Strategies

By Patrick A. DeHeer, DPM FACFAS, FFPM RCPS (Glasg)

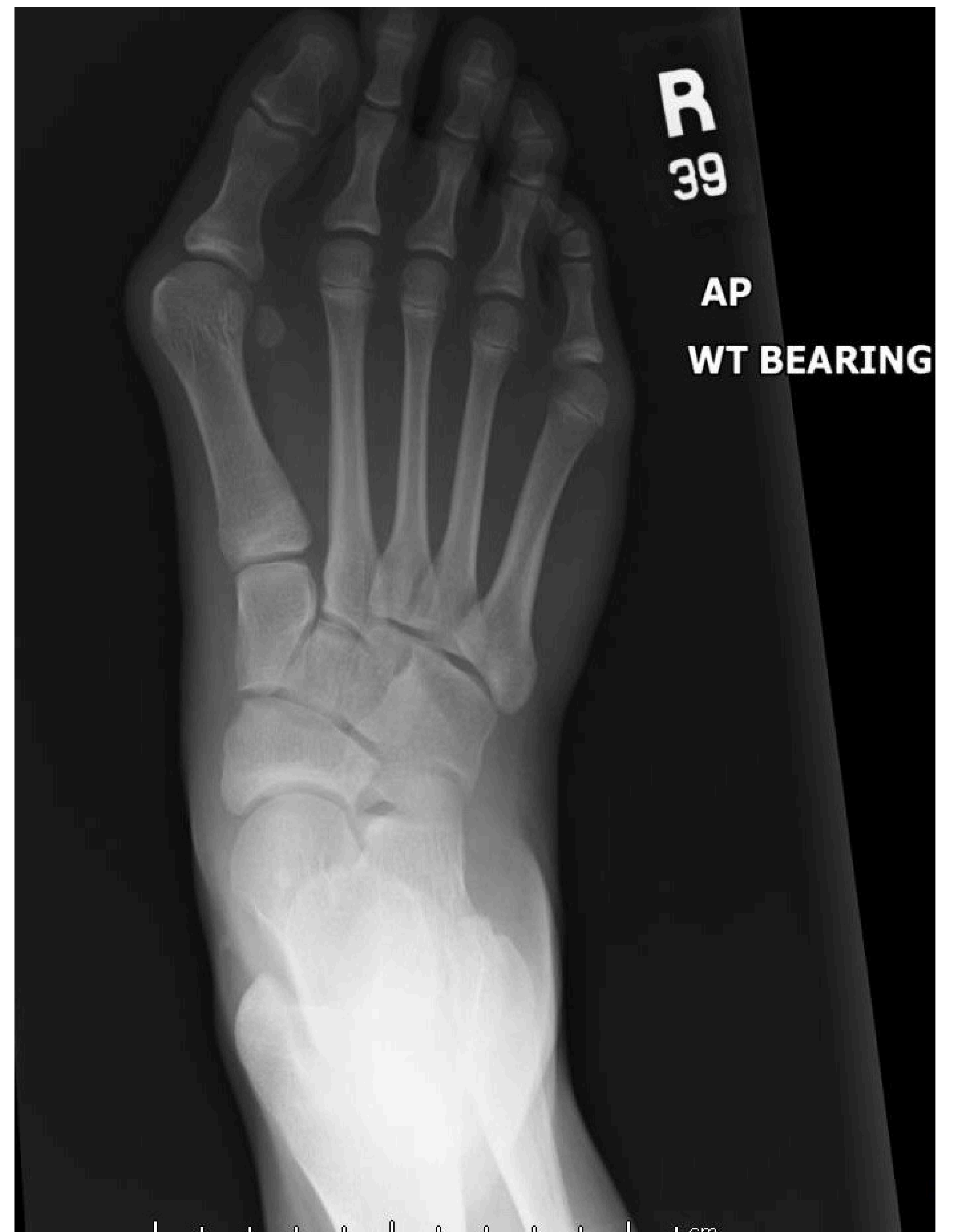
Disclosures

1. *Inventor The Equinus Brace®* **& Principle IQ Medical**
2. **Consultant Nvision Biomedical Technologies**
3. *Speaker & Consultant Paragon 28*
4. *Speaker Medline*

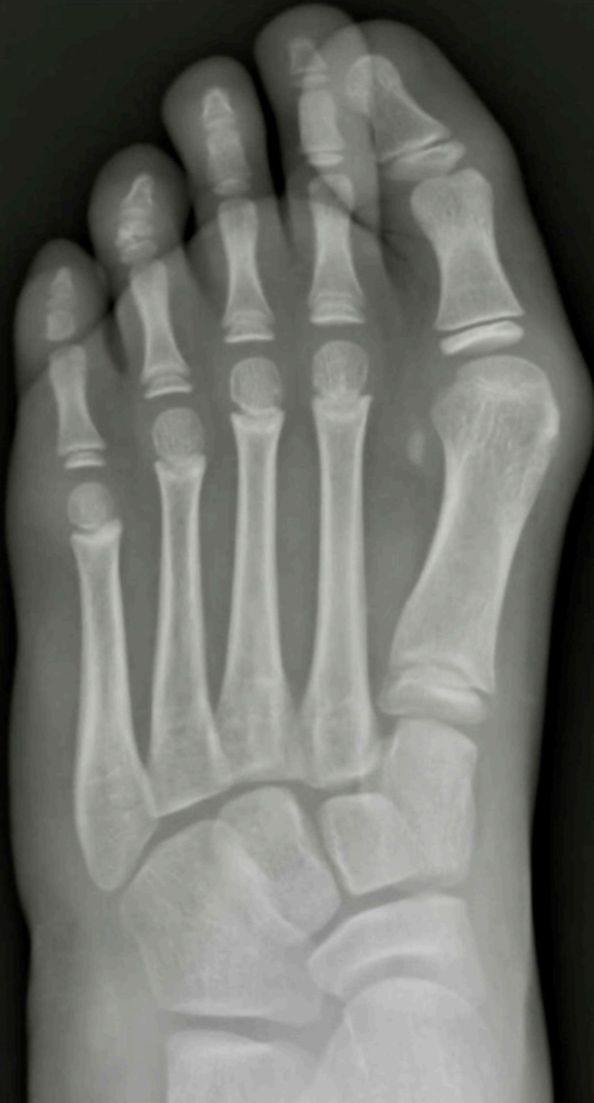
Disclosures

1. *Inventor The Baumann Gastroc Recession System*
2. *Shareholder/Consultant, SUTUREGARD Medical Inc.*
3. *Consultant CTM Biomedical*
4. *Principle DeHeer Orthopedics*

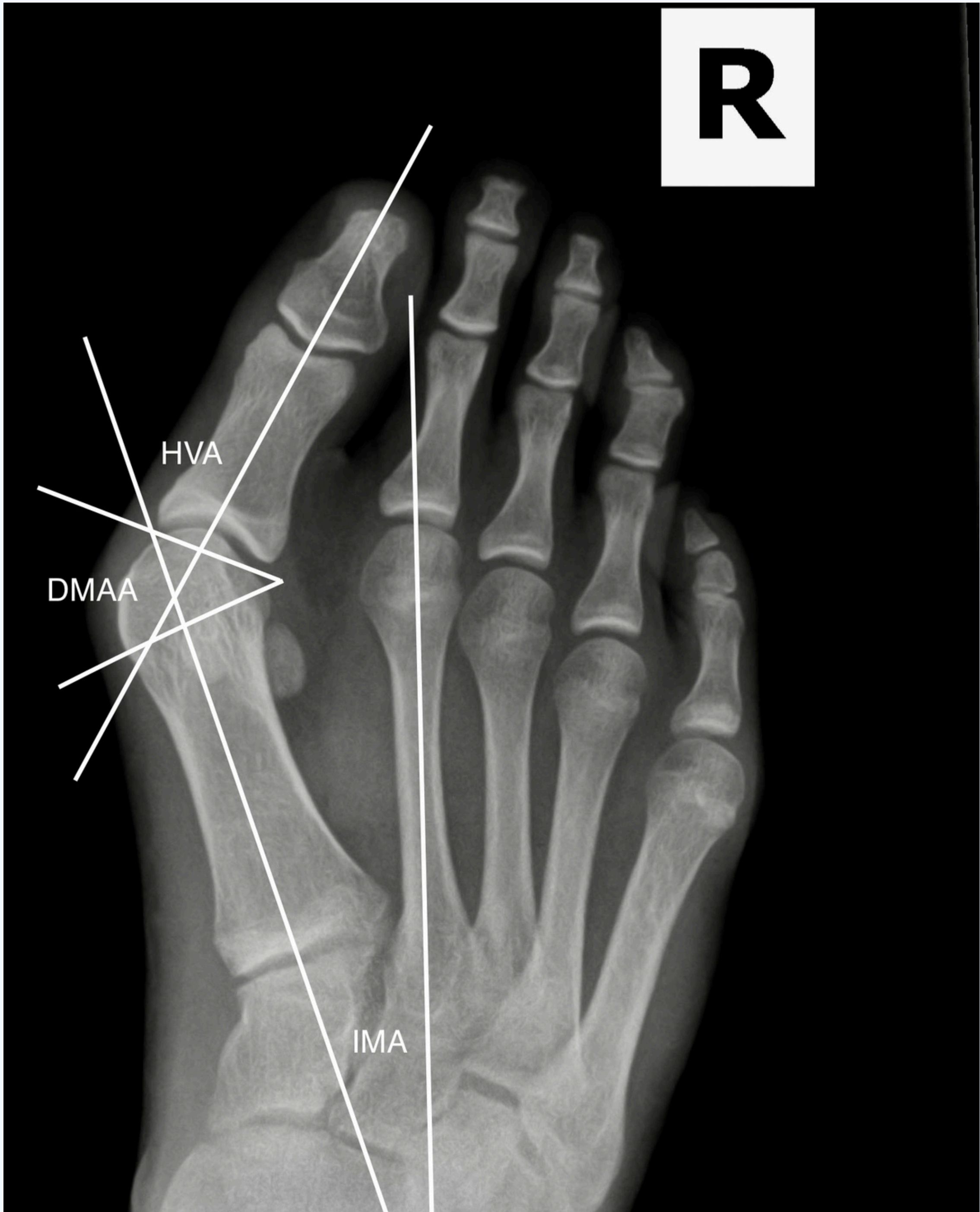
How does this happen?



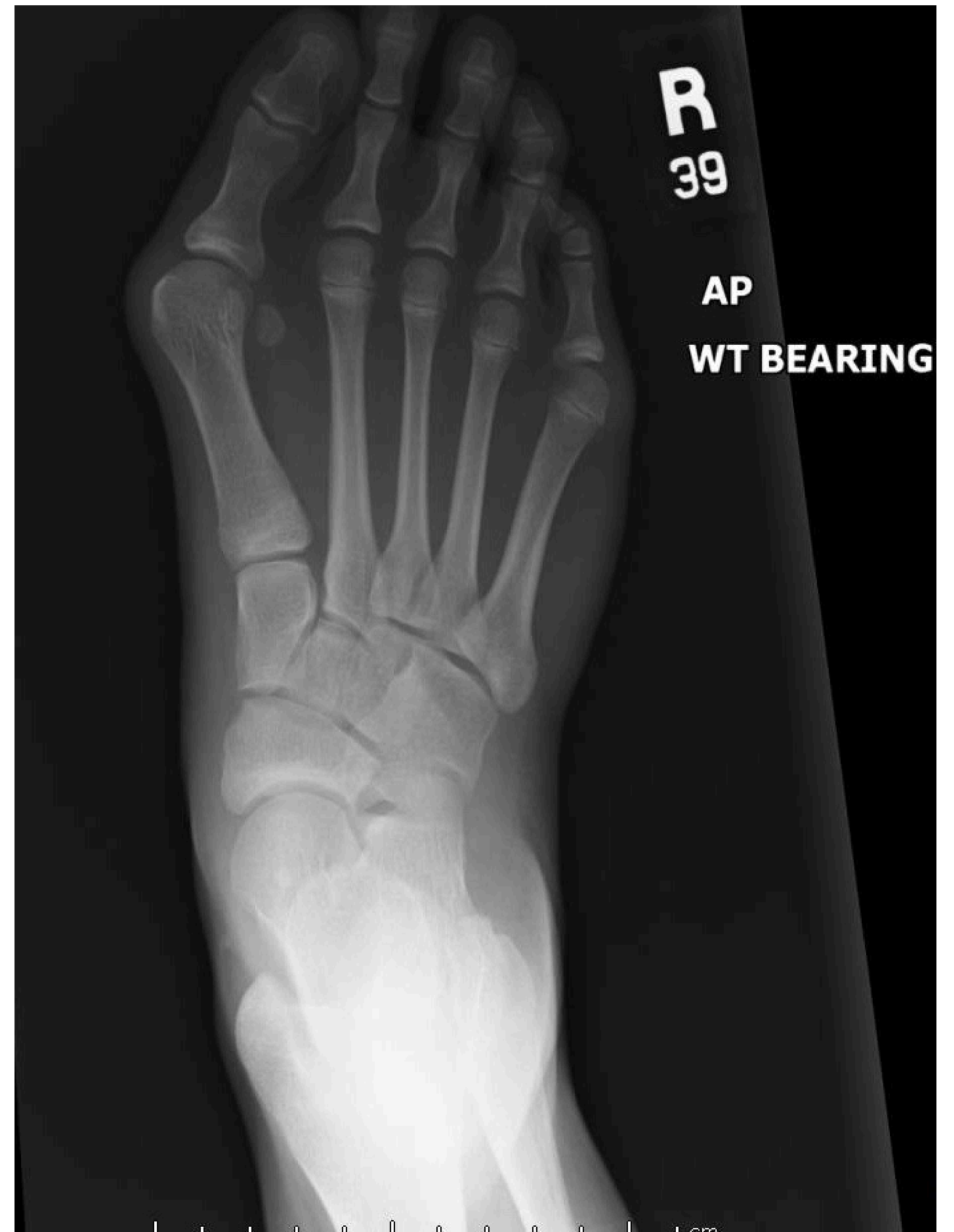
9 y/o M with HAV &
overlapping 2nd digit B/L
(left worse)



9 y/o M with HAV and
overlapping 2nd digit, mildly
pronated foot structure


R
HVA
DMAA
IMA

Incidence
&
Inheritance.



Nix et al.

J Foot Ankle Res 2010

Prevalence of hallux valgus in the general population: a systematic review and meta-analysis

1. Study Results
   a. A total of 78 papers reporting results of 76 surveys (**total 496,957 participants**) were included and grouped by study population for meta-analysis.

Table 1 Pooled random effects estimates for HV prevalence by age subgroup expressed as % (95% CI)

	Overall	Male	Female
Juvenile			
Pooled prevalence estimate	7.8 (6.2 to 9.5)	5.7 (3.7 to 7.6)	15.0 (7.7 to 22.3)
Number of studies	16	5	6
Adult			
Pooled prevalence estimate	23.0 (16.3 to 29.6)	8.5 (1.4 to 15.6)	26.3 (16.5 to 36.2)
Number of studies	15	8	9
Elderly			
Pooled prevalence estimate	35.7 (29.5 to 42.0)	16.0 (10.6 to 21.3)	36.0 (26.9 to 45.1)
Number of studies	37	16	16

Piqué-Vidal et al.

JFAS 2007

Hallux Valgus Inheritance: Pedigree Research in 350 Patients With Bunion Deformity

1. Study Results

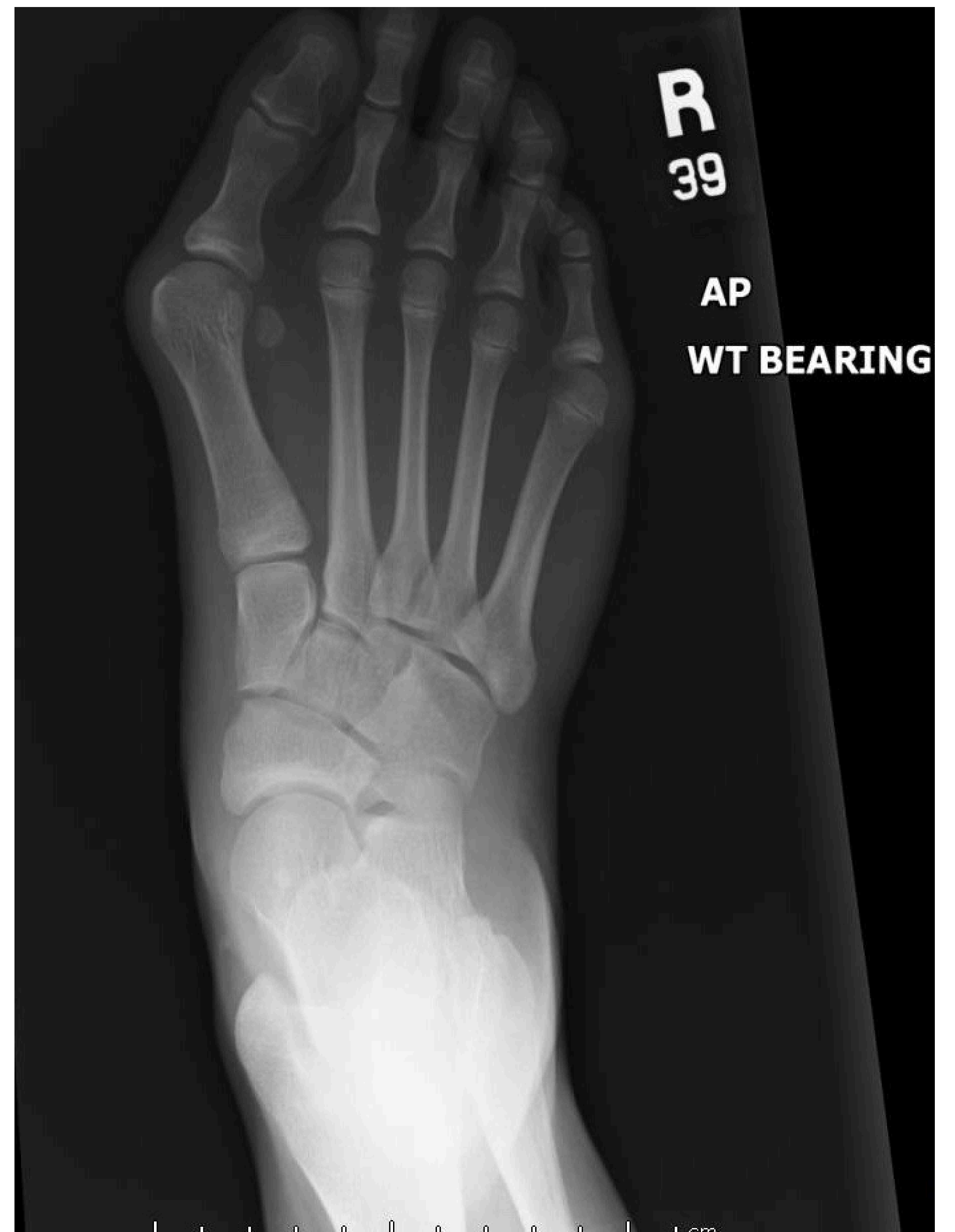
   a. Family history of bunion deformity was present in 90% of probands, with vertical transmission affecting some family members across 3 generations, which is compatible with **autosomal dominant inheritance with incomplete penetrance**.

TABLE 1 Demographic characteristics of the study population

Data	No. Patients (%)
Total patients	350
Sex	
Men	22 (6.3)
Women	328 (93.7)
Age, years, mean ± SD (range)	47.8 ± 14.8 (7–86)
Unilateral bunion deformity	27 (7.7)
Bilateral bunion deformity	323 (92.3)
Juvenile hallux valgus	15 (4.3)
Sex	
Men	4 (26.7)
Women	11 (73.3)
Age, years, mean ± SD (range)	15.4 ± 4.4 (7–20)
Adult hallux valgus	335 (95.7)
Sex	
Men	18 (5.4)
Women	321 (91.7)
Age, years, mean ± SD (range)	49.3 ± 13.5 (21–86)
No. affected members per pedigree	
One	35 (10)
Mean pedigree (range)	11.1 (8–21)
Two	71 (20.3)
Mean pedigree (range)	10.6 (7–19)
Three or more	244 (69.7)
Mean pedigree (range)	13.2 (9–34)

Abbreviation: SD, standard deviation.

HAV
Quaility of Life.



Yamamoto et al.

FAI 2016

Quality of Life in Patients With Untreated and Symptomatic Hallux Valgus

1. All subscales and physical component summary scores of the SF-36 for untreated HV patients were **significantly lower** than those of the general population.
    a. Surgical decision making should not be based on the severity of the deformity alone, but rather the patient's QOL should also be carefully assessed.
2. Investigated the QOL of HV patients undergoing corrective surgery using the SF-36. The authors showed that the mental subscale scores, such as vitality, social function, role-emotional, mental health, and general health, were equal to or higher than those of the general American population.
    a. Thordarson et al. FAI 2005

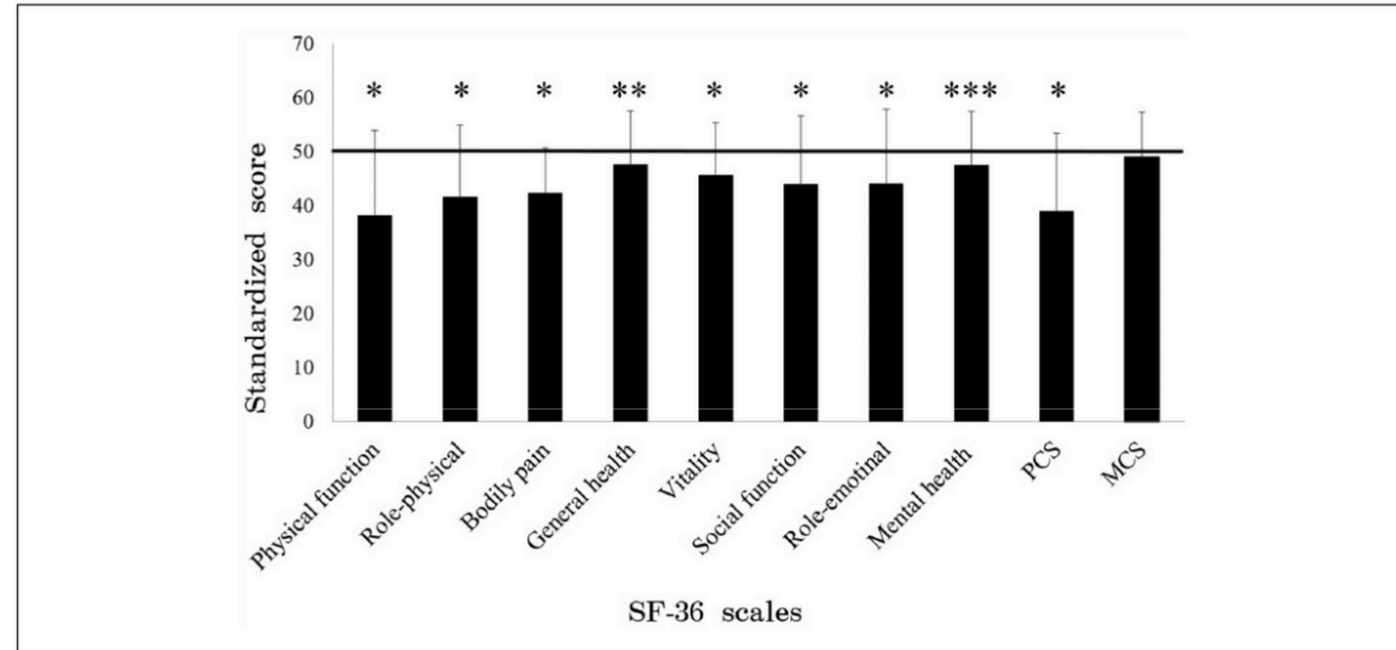
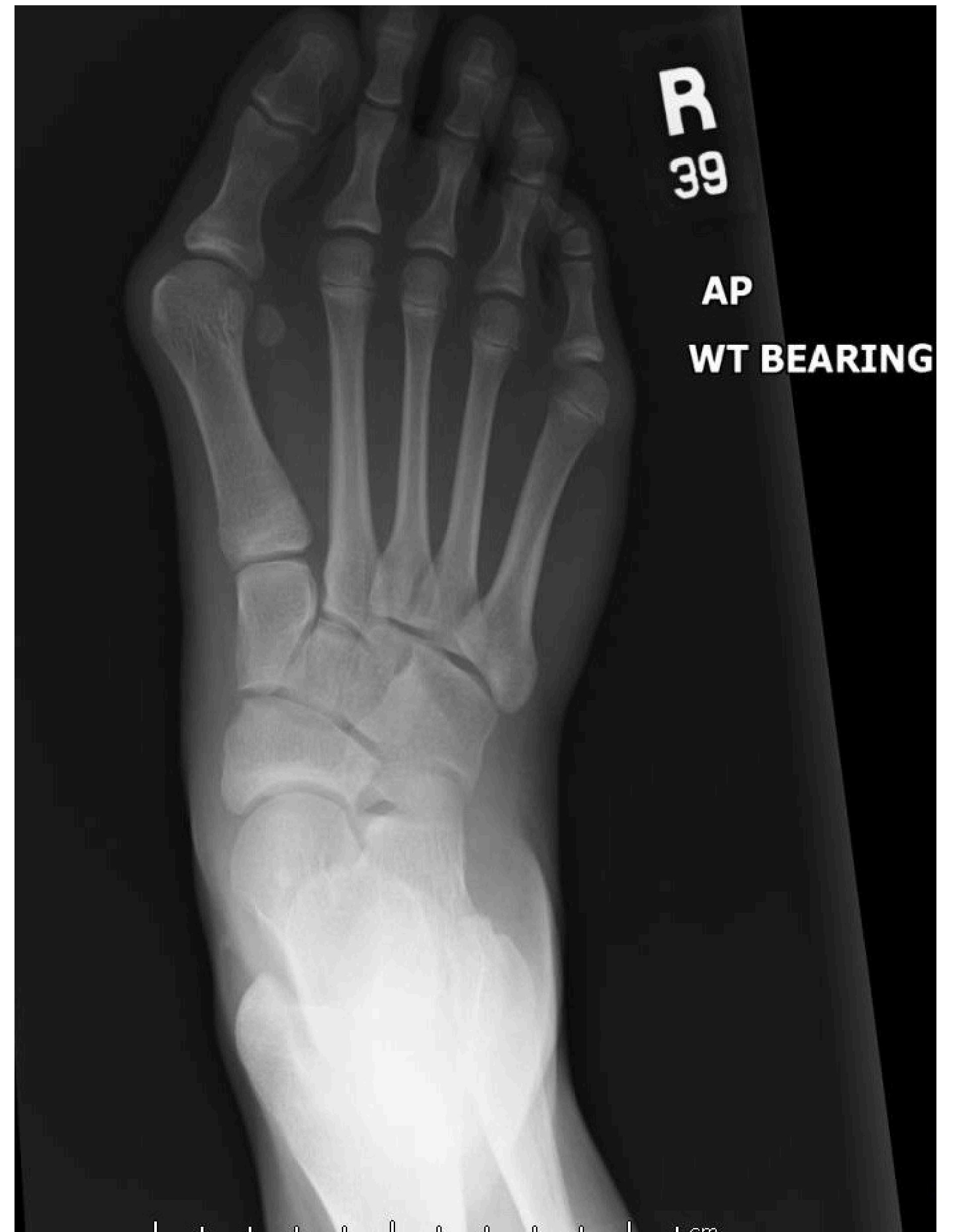


Figure 1. Standardized SF-36 values for symptomatic HV subjects. All SF-36 subscales and physical component summary scores for symptomatic HV subjects were significantly lower than those of the general population. Error bars represent standard deviations. The mean scores for the general population are 50.
$*P < .001$, $**P = .015$, $***P = .009$.
SF-36, 36-item Short Form Health Survey; HV, hallux valgus; PCS, physical component summary score; MCS, mental component summary score.

Landmark JHAV Article.



Coughlin

FAI 1995

Juvenile Hallux Valgus: Etiology and Treatment

1. 719 HAV repairs between 1-1983 to 1-1994 with **65 Juvenile cases (9%)** – 45 patients (60 feet) met inclusion criteria
2. 40 F (52 feet) **88%** : 5 M (8 feet) **12%**
3. 33 L : 27 R
4. Average F/U 60 months (12-126 months)
5. **Average age onset 11.8 years** (2-18 years) - 24 feet onset prior to 10 years (40%)
6. 52 of 60 **(82%) related pre-op pain** & symptoms with standard footwear 11 patients (24%) related history of constricting footwear
7. 58 of 60 **(96%) related deformity progression**
8. **Average DMAA 11.4°**
9. Family Hx HAV – DMAA & HVA significantly higher

Surgical Procedures

Procedure	No. of cases	DMAA (lateral slope)	Hallux valgus avg correction	Remaining hallux valgus (noncorrection)	Correction ratio (HV correction/ noncorrection)	Congruency ratio (DMAA/ noncorrection)	1–2 IM angle correction	Forefoot narrowing
McBride	4	9.3	10	16.5	10/15.6 = .6	9.3/16.5 = .6	4.8	+2
Double osteotomy	7	18.9	22.9	7.1	22.9/7.1 = 3.3	18.9/7.1 = 2.7	8.3	−5.4
Chevron	16	9.1	8.3	12.1	8.3/12.1 = .7	9.1/12.1 = .8	2.3	−2.8
DSTP with osteotomy	33	11.6	23	8	23/8 = 2.9	11.6/8.0 = 1.5	8.4	−5.5

Metatarsus Adductus

	No. of cases	DMAA (avg)	Hallux valgus			1–2 IM angle		
			Avg preop	Avg postop	Avg correction	Avg preop	Avg postop	Avg correction
Normal (0–15°)	29	10.9	26	7.5	18.5	12.6	5.7	6.9
Mild (16–20°)	18	12.9	29.6	7.8	21.8	12.1	5	7.1
Moderate/severe (>21°)	13	10.5	29.4	10.9	18.5	11.5	6.1	5.4

Length of First and Second Metatarsals

	No. of cases	DMAA	Hallux valgus avg correction	1–2 IM angle avg correction
Short first metatarsal <−1 mm	17	6	19.1	7.3
Equal second metatarsal >−1 mm to <+1 mm	25	11.9	18.1	4.9
Long first metatarsal >1 mm	18	15.8	21	8.4

Coughlin

FAI 1995

Juvenile Hallux Valgus: Etiology and Treatment

1. **Family Hx of HAV** – 31 of 43 (**72%**, 28 F & 3 M), 2 patients were adopted
2. 29/31 patients pattern consistent with maternal transmission
3. **Average age at surgery 15.9 years** (10-21 years) – 7 feet operated with open physis
4. Subjective outcomes – 51 excellent / 6 good / 3 fair
5. Subjective/objective outcomes using duPont scoring system – **43 excellent (72%) / 12 good (20%)** / 3 fair (5%) / 2 poor (3%)
6. **Complications – hallux varus 6 feet / recurrence 6 patients (10%)**
7. Pes planus was found to have no significant association with the preoperative deformity or with postoperative failure of surgery including under or over correction.
8. Sarrafin's Anatomy of Foot and Ankle – average appearance & closure of ossification centers 1st MTB (1.6 years F / 2.3 years M & **13.7 years F / 15.6 years M**) & 1st MTH which is ~~present in 95% of children by~~ age 4-5 years (2-3 years & 10-11 years)

Pes Planus

	No. of cases	Hallux valgus			1–2 IM angle		
		Avg preop	Avg postop	Avg correction	Avg preop	Avg postop	Avg correction
Normal	39						
		27.4	9.3	18.2	12.2	6	6.2
Mild	11						
Moderate/severe	10	29.8	3.9	25.9	12.4	8.9	5.4

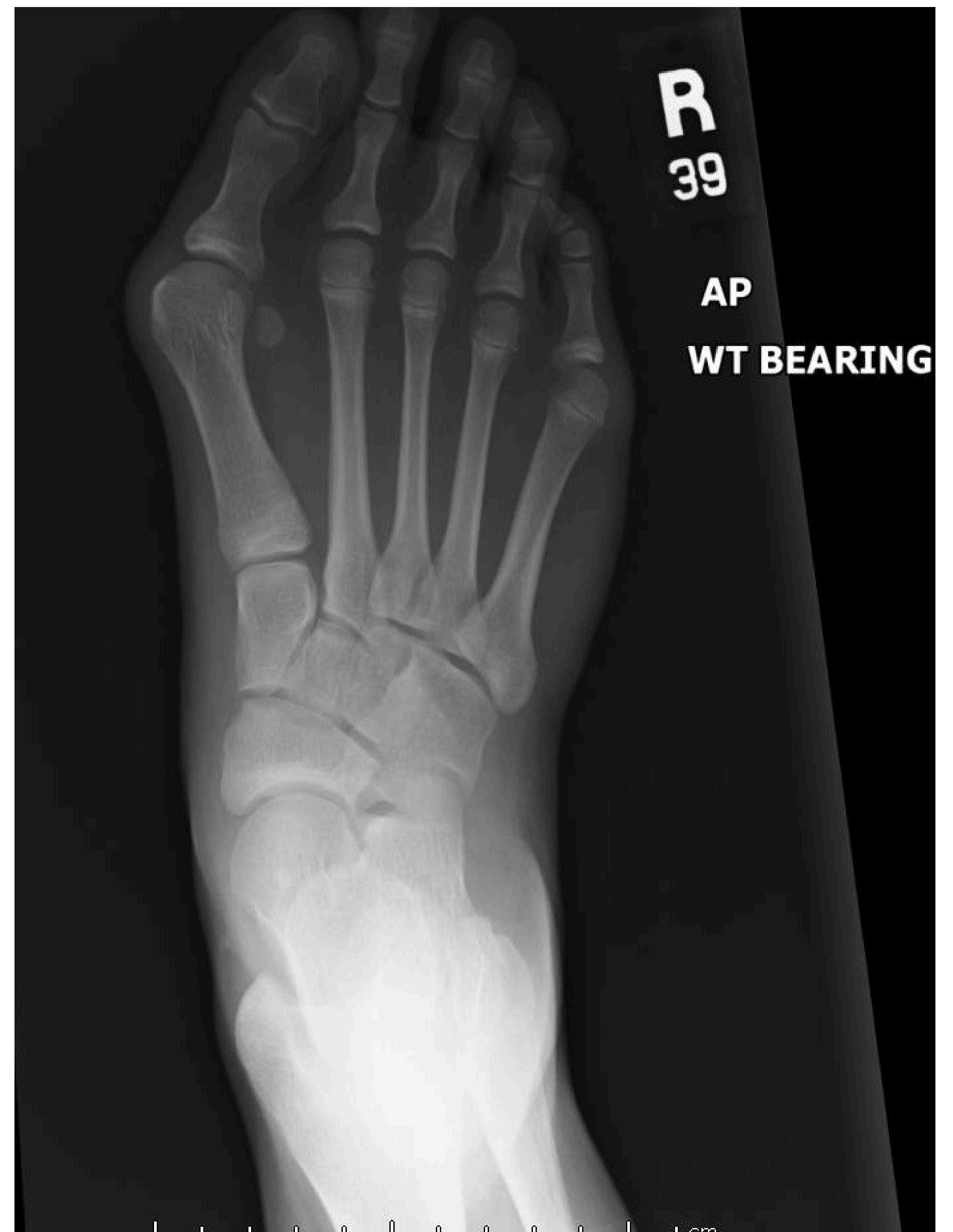
Surgery with Open or Closed Epiphysis

	No. of cases	Avg DMAA	Hallux valgus			1–2 IM angle			Complications
			Avg preop	Avg postop	Avg correction	Avg preop	Avg postop	Avg correction	
Open epiphysis	7	21.1	32.7	4.3	25.4	12.6	2.6	10	2 varus
Closed epiphysis	53	10	27.2	8.9	18.3	12.1	5.9	6.2	2 varus

Early vs. Late Onset of Juvenile Hallux Valgus

	No. of cases	Hallux valgus		Avg DMAA
		Avg preop	Avg correction	
Younger patients (<10 years)	24	31.5	23.9	14.9
Older patients (>10 years)	36	25.4	14.5	8.9

JHAV
&
Pes Planus.



Kim et al.

FAI 2019

Radiographic Assessment of Foot Alignment in Juvenile Hallux Valgus and Its Relationship to Flatfoot

1. There was **no significant difference in hindfoot alignment of patients with JHV and controls**. Naviculocuboid overlap (P <.001), lateral talo–first metatarsal angle (P = .002), and metatarsus adductus angle (P = .004) were significantly greater in patients with JHV than in controls, whereas the anteroposterior talo–first metatarsal angle (P = .026) was significantly less.

Table 1. Comparison of Radiographic Indices Between the Control Group and the JHV Group.[a]

	Control Group (n = 55)	JHV Group (n = 163)	*P* Value
Age, y, mean (range)	11.4 (8-14)	11.8 (8-14)	.083
Sex, n (%)			.130
Male	15 (27.2)	29 (17.8)	
Female	40 (72.8)	134 (82.2)	
Radiographic indices			
Hindfoot			
Calcaneal pitch angle, degrees	17.3 ± 6.1	16.9 ± 5.8	.656
Tibiocalcaneal angle, degrees	66.8 ± 7.4	66.5 ± 7.0	.797
Talocalcaneal angle, degrees	50.2 ± 7.7	51.8 ± 5.6	.090
Midfoot			
Naviculocuboid overlap, %	51.0 ± 16.5	60.3 ± 14.7	<.001
Talonavicular coverage angle, degrees	22.0 ± 7.2	23.4 ± 8.5	.282
Forefoot			
Lateral talo–first metatarsal angle, degrees	12.7 ± 7.3	16.6 ± 8.5	.002
AP talo–first metatarsal angle, degrees	9.7 ± 6.1	7.5 ± 6.6	.026
Metatarsus adductus angle, degrees	15.3 ± 3.8	17.2 ± 4.2	.004
Hallux valgus angle, degrees	9.6 ± 3.1	28.5 ± 5.6	<.001
Intermetatarsal angle, degrees	7.7 ± 1.7	12.7 ± 2.2	<.001
Distal metatarsal articular angle, degrees	8.9 ± 4.1	23.9 ± 7.7	<.001
First metatarsal cuneiform angle, degrees	15.9 ± 4.6	22.3 ± 3.8	<.001

Abbreviations: AP, anteroposterior; JHV, juvenile hallux valgus.
[a]Values are expressed as the means ± standard deviation unless otherwise indicated. *P* values were derived from the independent *t* test.

Kim et al.

FAI 2019

Radiographic Assessment of Foot Alignment in Juvenile Hallux Valgus and Its Relationship to Flatfoot

1. **Symptomatic and asymptomatic JHV patient subsets showed no significant radiologic differences**.

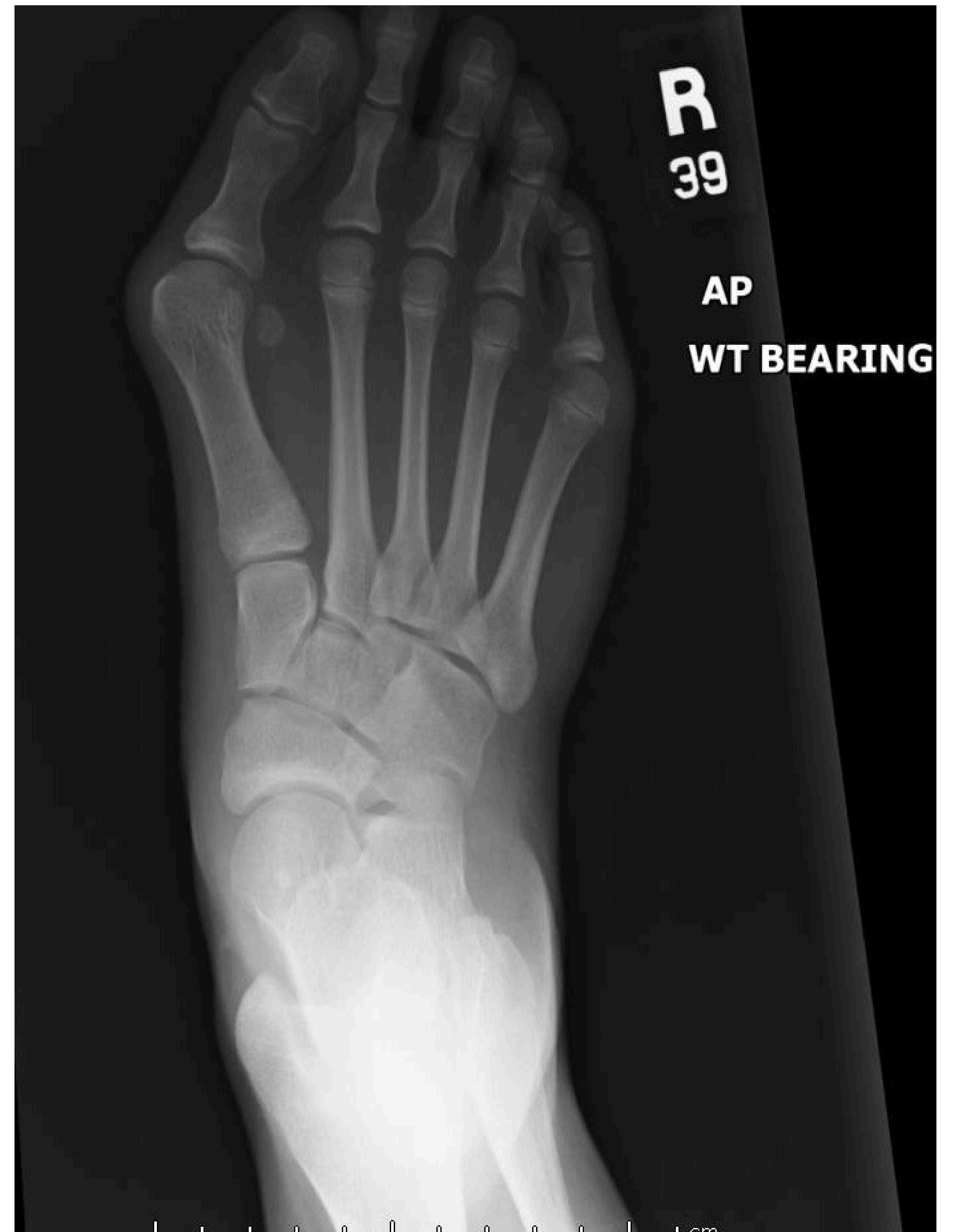
2. Radiographic profiles in patients with JHV were inconsistent with regard to features of flatfoot, and foot alignment was unrelated to the presence of symptoms or degree of deformity in JHV.

Table 2. Comparison of Radiographic Indices Among Groups.[a]

	Control Group (n = 55)	JHV Group (n = 163) Group 1: Asymptomatic (n = 130)	JHV Group (n = 163) Group 2: Symptomatic (n = 33)	*P* Value
Age, y, mean (range)	11.4 (8-14)	11.6 (8-14)	13.0 (9-14)	<.001
Sex, n (%)				.290
Male	15 (27.2)	24 (18.5)	5 (15.2)	
Female	40 (72.8)	106 (81.5)	28 (74.8)	
Radiographic indices				
Hindfoot				
Calcaneal pitch angle, degrees	17.3 ± 6.1	16.7 ± 5.7	17.8 ± 6.1	.577
Tibiocalcaneal angle, degrees	66.8 ± 7.4	66.6 ± 7.1	66.2 ± 6.6	.932
Talocalcaneal angle, degrees	50.2 ± 7.7	51.7 ± 5.8	52.5 ± 5.1	.191
Midfoot				
Naviculocuboid overlap, %	51.0 ± 16.5	59.6 ± 13.5	63.0 ± 18.8	<.001
Talonavicular coverage angle, degrees	22.0 ± 7.2	23.7 ± 7.9	22.4 ± 10.4	.410
Forefoot				
Lateral talo–first metatarsal angle, degrees	12.7 ± 7.3	16.6 ± 7.9	16.9 ± 10.7	.009
AP talo–first metatarsal angle, degrees	9.7 ± 6.1	7.8 ± 5.9	6.6 ± 8.7	.066
Metatarsus adductus angle, degrees	15.3 ± 3.8	17.2 ± 4.5	17.5 ± 2.9	.013
Hallux valgus angle, degrees	9.6 ± 3.1	28.4 ± 5.4	29.1 ± 6.3	<.001
Intermetatarsal angle, degrees	7.7 ± 1.7	12.9 ± 2.1	11.9 ± 2.3	<.001
Distal metatarsal articular angle, degrees	8.9 ± 4.1	23.5 ± 7.7	25.4 ± 7.5	<.001
First metatarsal cuneiform angle, degrees	15.9 ± 4.6	22.1 ± 3.9	22.7 ± 3.5	<.001

Abbreviations: AP, anteroposterior; JHV, juvenile hallux valgus.
[a]Data are expressed as the means ± standard deviation unless otherwise indicated. *P* values were derived from the one-way analysis of variance.

JHAV
Radiology.



Iliou et al.

Acta Orthop Traumatol Turc 2015

Relationship between pedographic analysis and the Manchester scale in hallux valgus

Table 1. Distribution of the deformities according to the Manchester scale grading system.

Deformity grade	Number of feet	Incidence
None	391	72.1%
Mild	70	12.9%
Moderate	58	10.7%
Severe	24	4.4%

Table 2. Mean hallux valgus angle (HVA), first intermetatarsal angle (IMA) and standard deviation values in all four Manchester grades.

Deformity grade	HVA	IMA
	Mean±SD	Mean±SD
None	11.69±1.79	6.95±1.67
Mild	23.39±4.09	11.21±2.21
Moderate	33.09±3.26	14.07±2.58
Severe	44.96±4.04	16.88±4.47

Table 4. Mean pressure values under the hallux (T1), second to fifth toes (T2, 3, 4, 5), first metatarsal head (M1), second metatarsal head (M2), third metatarsal head (M3), fourth metatarsal head (M4), fifth metatarsal head (M5), middle foot (MF), lateral heel (LH) and medial heel (MH) based on the Manchester scale.

Deformity grade	T1	T2, 3, 4, 5	M1	M2	M3	M4	M5	MF	MH	LH
None	7.54	5.24	55.18	73.10	64.21	59.35	39.50	61.41	99.39	89.70
Mild	41.39	7.31	64.30	74.33	49.08	63.56	48.01	35.63	78.31	70.43
Moderate	60.41	4.60	84.22	91.55	59.10	61.76	41.91	28.50	80.03	70.66
Severe	75.67	6.58	110.67	124.67	61.29	54.79	41.58	34.88	75.50	69.08

Kaiser et al.

FAI 2018

Radiographic Evaluation of First Metatarsal and Medial Cuneiform Morphology in Juvenile Hallux Valgus

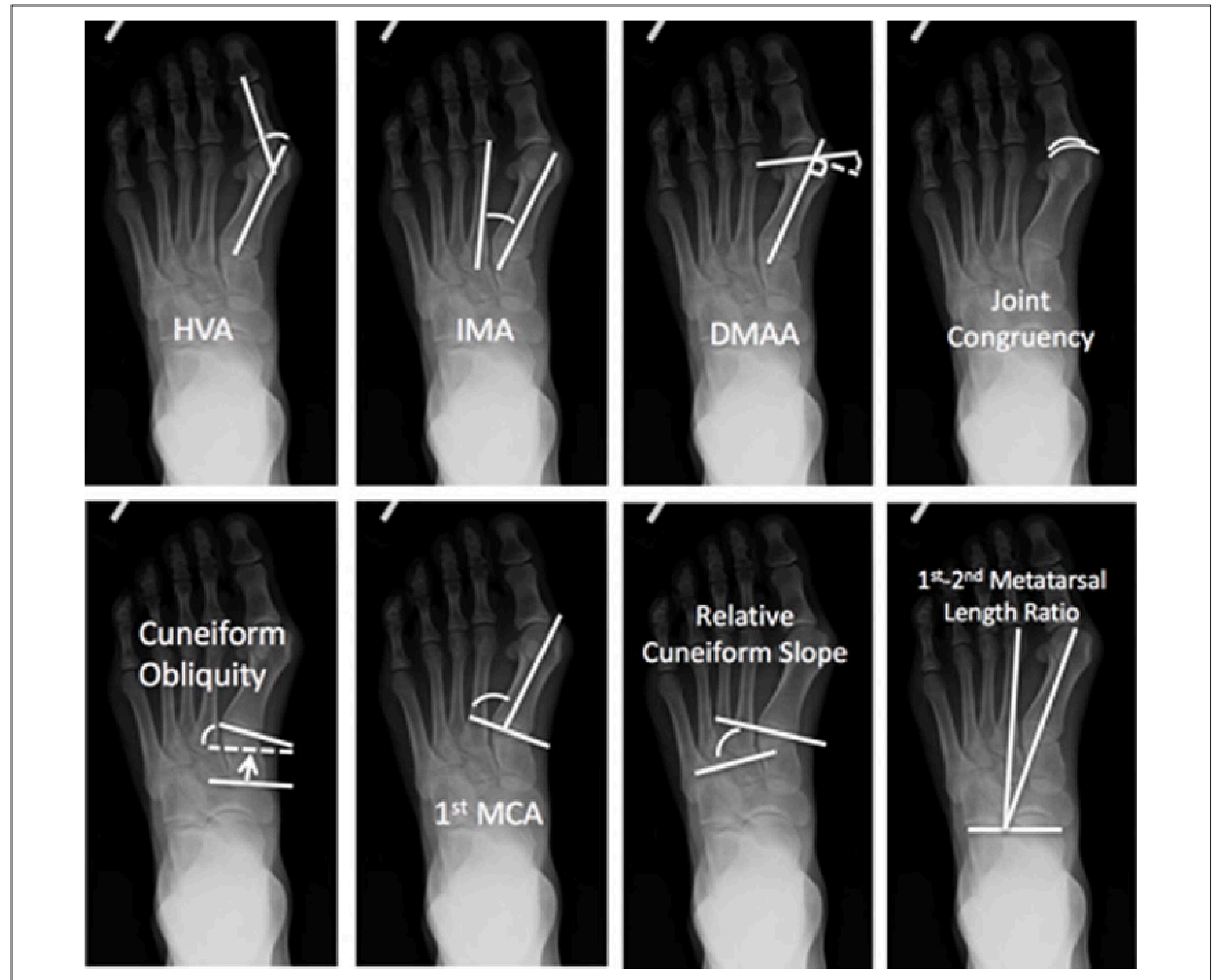


Figure 1. Measurements of JVH are illustrated and include hallux valgus angle (HVA), intermetatarsal angle (IMA), distal metatarsal articular angle (DMAA), metatarsal cuneiform angle (MCA), relative first to second metatarsal length ratio (1:2 MT ratio), Meary's angle, MTPJ congruency, which have been described and reported previously in the literature. Two novel measurements to characterize the bony morphology of the medial cuneiform–first metatarsal that we described are cuneiform obliquity (CO) and relative cuneiform slope (RCS).

Kaiser et al.

FAI 2018

Radiographic Evaluation of First Metatarsal and Medial Cuneiform Morphology in Juvenile Hallux Valgus

Table 1. Patient and Condition Characteristics for Controls and JHV Subjects.

Measure or Characteristic	Normal (n=50 Feet in 36 Patients) Mean ± SD, or n (%)	JHV (n=93 Feet in 57 Patients) Mean ± SD, or n (%)	P*
Age, y	13.2 ± 2.5	14.1 ± 2.1	.06
Sex, male. n (%)	15 (30)	23 (25)	.47
Physis, open, n (%)	32 (64)	34 (37)	.004
HVA	7.5 ± 4.1	30.1 ± 8.7	
DMAA	1 ± 2.9	15.2 ± 7.8	<.001
MCA	90 ± 2.7	94 ± 4.6	<.001
IMA	9.2 ± 2.3	13.1 ± 2.9	<.001
1:2 MT ratio	1.003 ± 0.0	1.019 ± 0.0	.004
MTP congruency, n (%)	50 (100)	83 (89)	.99
Cuneiform obliquity	8.7 ± 3.8	12.6 ± 6.00	<.001
Relative cuneiform slope	31.8 ± 7.7	34.1 ± 8.00	.08
Meary's angle	2 ± 7.3	2 ± 9.6	.97

Abbreviations: DMAA, distal metatarsal articular angle; HVA, hallux valgus angle; IMA, intermetatarsal angle; JHV, juvenile hallux valgus; MCA, medial cuneiform angle; MT, metatarsal; MTP, metatarsophalangeal.

*All *P* values were adjusted using Holm-Bonferroni correction for multiple comparisons.

Kaiser et al.

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Radiographic Evaluation of First Metatarsal and Medial Cuneiform Morphology in Juvenile Hallux Valgus

Table 2. Post Hoc Comparisons by JHV Group (N=143 Feet in 93 Patients).[a]

	Normal (n=50 Feet in 36 Patients)		Mild-Moderate (n=70 in 45 Patients)		Severe (n=23 Feet in 12 Patients)	
Measure or Characteristic	Mean ± SD, or n (%)	P*	Mean ± SD	P**	Mean ± SD	P***
Age, y	13.2 ± 2.5	.10	14.2 ± 2.1	.77	13.7 ± 1.9	.77
Sex, male, n (%)	15 (30)	.06	13 (19)	.30	10 (44)	.30
Physis open, n (%)	32 (64)	.006	24 (34)	.43	10 (44)	.21
HVA	7.5 ± 4.1		26.2 ± 5.6		41.9 ± 5.3	
DMAA	1 ± 2.9	<.001	13.8 ± 7.4	.01	19.3 ± 7.5	.08
MCA	90 ± 2.7	<.001	93.6 ± 4.5	.16	95.2 ± 4.9	<.001
IMA	9.2 ± 2.3	<.001	12.7 ± 2.7	.01	14.5 ± 2.9	<.001
1:2 MT ratio	1.003 ± 0.0	.05	1.014 ± 0.0	.02	1.033 ± 0.0	.003
MTP congruency, n (%)	50 (100)	1.00	66 (94)	.03	17 (74)	1.00
Cuneiform obliquity	8.7 ± 3.8	<.001	12.6 ± 6.2	.80	12.9 ± 5.3	.002
Relative cuneiform slope	31.8 ± 7.7	.40	33.5 ± 8.2	.40	36 ± 7.2	.12
Meary's angle	2 ± 7.3	1.00	1.3 ± 8.7	1.00	4 ± 11.7	1.00

Abbreviations: DMAA, distal metatarsal articular angle; HVA, hallux valgus angle; IMA, intermetatarsal angle; JHV, juvenile hallux valgus; MCA, medial cuneiform angle; MT, metatarsal; MTP, metatarsophalangeal.

[a]All *P* values were adjusted using Holm-Bonferroni correction for multiple comparisons.

**P* values are based on comparisons between normal and mild-moderate JHV subjects.

***P* values are based on comparisons between mild-moderate and severe JHV subjects.

****P* values are based on comparisons between normal and severe JHV subjects.

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Radiographic Evaluation of First Metatarsal and Medial Cuneiform Morphology in Juvenile Hallux Valgus

Table 3. Correlations Between Radiographic Measurements and HVA.

Measure	Correlation Coefficient (*r*) (95% CI)	*P*
DMAA	0.75 (0.67, 0.82)	<.001
IMA	0.63 (0.52, 0.72)	<.001
First MCA	0.43 (0.29, 0.56)	<.001
1:2 MT ratio	0.39 (0.24, 0.52)	<.001
Cuneiform obliquity	0.37 (0.22, 0.51)	<.001
Cuneiform slope	0.24 (0.08, 0.39)	.03
Meary's angle	0.07 (-0.13, 0.27)	.50

Abbreviations: DMAA, distal metatarsal articular angle; HVA, hallux valgus angle; IMA, intermetatarsal angle; MCA, medial cuneiform angle; MT, metatarsal.

Table 4. Correlations Between Radiographic Measurements and IMA.

Measure	Correlation Coefficient (*r*) (95% CI)	*P*
DMAA	0.49 (0.35, 0.6)	<.001
First MCA	0.43 (0.29, 0.56)	<.001
1:2 MT ratio	0.20 (0.04, 0.35)	.02
Cuneiform obliquity	0.48 (0.34, 0.6)	<.001
Cuneiform slope	0.20 (0.04, 0.35)	.02
Meary's angle	0.02 (-0.18, 0.22)	.87

Abbreviations: CI, confidence interval; DMAA, distal metatarsal articular angle; IMA, intermetatarsal angle; MCA, medial cuneiform angle; MT, metatarsal.

Kaiser et al.

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Radiographic Evaluation of First Metatarsal and Medial Cuneiform Morphology in Juvenile Hallux Valgus

Table 5. Multivariable Results From Ordinal Logistic Regression for JHV Outcome (Normal, Mild-Moderate, Severe).

	OR (95% CI)	*P*
DMAA	1.35 (1.25, 1.50)	<.001
MCA	1.12 (1.00, 1.25)	.04
MTP congruence	0.005 (0.001, 0.034)	<.001
Cuneiform obliquity	1.04 (0.96, 1.13)	.37
Male	0.64 (0.23, 1.70)	.38
Open physis	0.74 (0.31, 1.79)	.51

Abbreviations: CI, confidence interval; DMAA, distal metatarsal articular angle; JHV, juvenile hallux valgus; MCA, medial cuneiform angle; MTP, metatarsophalangeal; OR, odds ratio; HVA, hallux valgus angle; IMA, intermetatarsal angle; MT, metatarsal.

"Deformity in JHV was highly correlated with both the proximal and distal morphology of the first metatarsal and medial cuneiform. Severe JHV was associated with increased bony deformity and increased incongruity of the MTPJ. Treatment should be individualized, but JHV treatment algorithms can take this information into account."

Ota et al.

J Foot Ankle Res 2018

Etiological factors in hallux valgus, a three-dimensional analysis of the first metatarsal

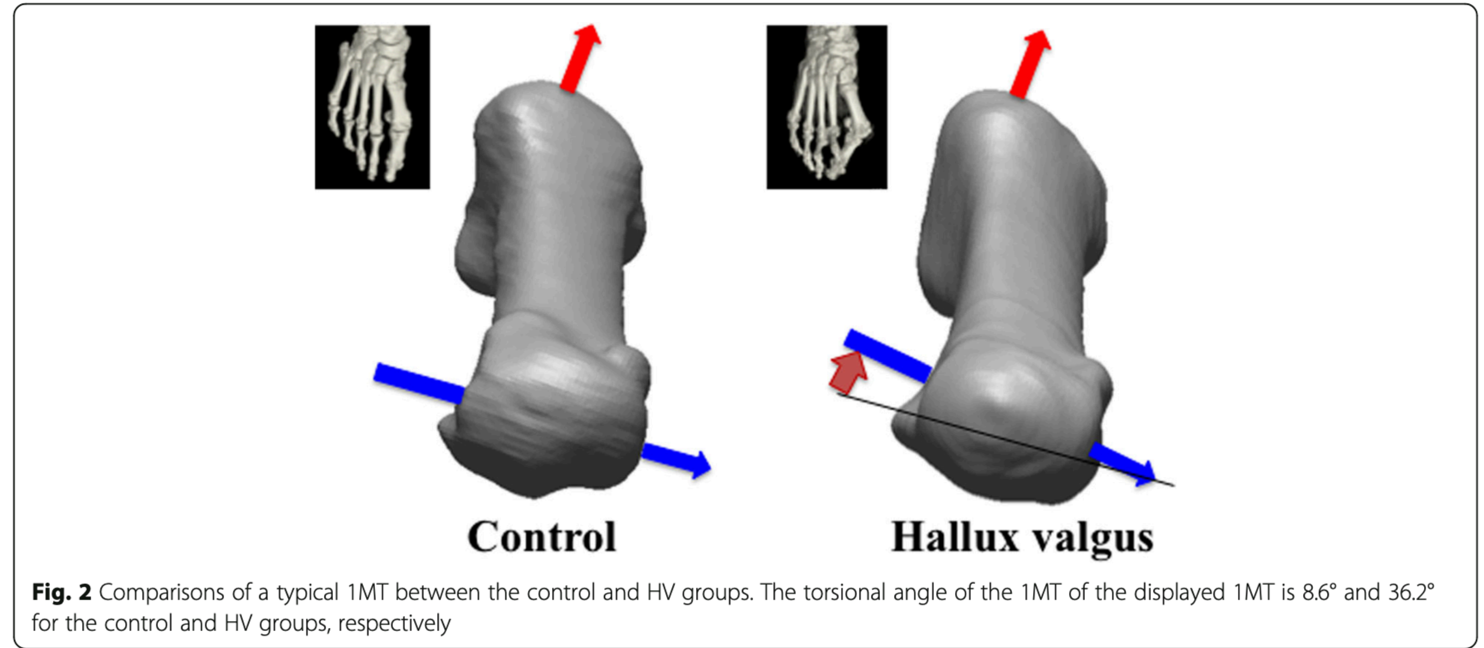


Fig. 2 Comparisons of a typical 1MT between the control and HV groups. The torsional angle of the 1MT of the displayed 1MT is 8.6° and 36.2° for the control and HV groups, respectively

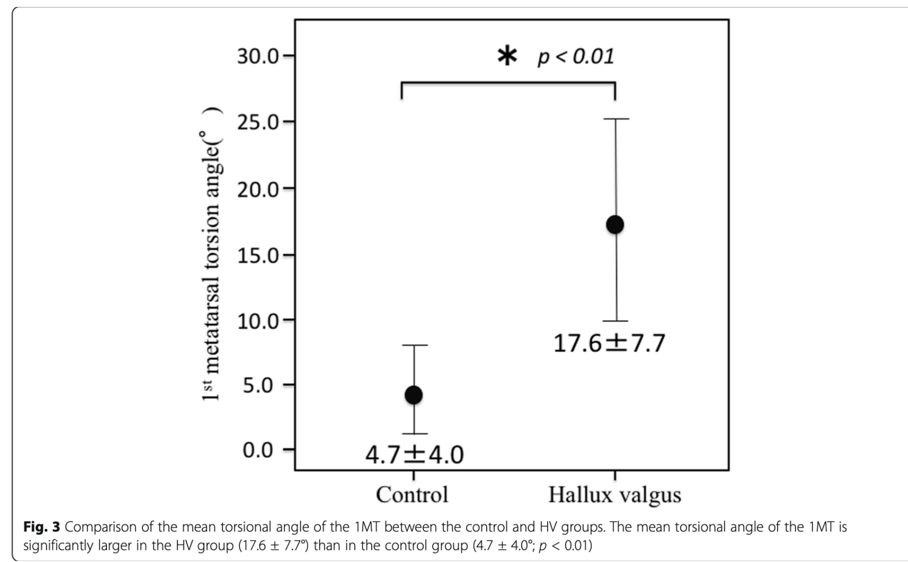


Fig. 3 Comparison of the mean torsional angle of the 1MT between the control and HV groups. The mean torsional angle of the 1MT is significantly larger in the HV group (17.6 ± 7.7°) than in the control group (4.7 ± 4.0°; $p < 0.01$)

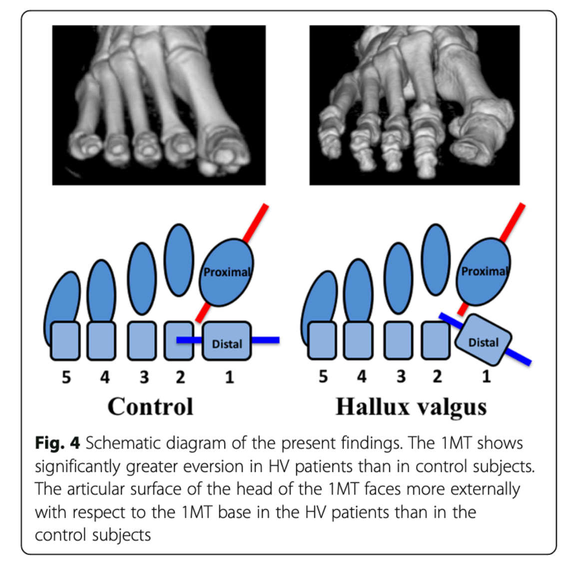


Fig. 4 Schematic diagram of the present findings. The 1MT shows significantly greater eversion in HV patients than in control subjects. The articular surface of the head of the 1MT faces more externally with respect to the 1MT base in the HV patients than in the control subjects

Ota et al.

J Foot Ankle Res 2018

Etiological factors in hallux valgus, a three-dimensional analysis of the first metatarsal

“The 1MT showed significant eversion in hallux valgus patients compared to control group patients. Previous studies using radiography have suggested that the 1MT is rotated in the pronated direction. However, the present study clarified that the 1MT is not only rotated, but also twisted, in the HV group.”

“Since the present study only compared the torsion of the 1MT between the HV and control groups, it is difficult to assess possible mechanisms underlying the morphological change of the 1MT due to HV. However, such a change in morphology could possibly emerge both congenitally and developmentally.”

Schmidt et al. Iowa Orthopaedic Journal 2021

The Rotational Positioning of the Bones in the Medial Column of the Foot: A Weightbearing CT Analysis

- While the proximal first metatarsal was found to be pronated with an average of 33.9º, the distal metatarsal demonstrated an average pronation of only 18.5º, with an overall significant difference of **15.6º**, consistent with intrinsic torsion of the bone from proximal to distal
- Ota et al. - torsional angle of the first metatarsal from proximal to distal to be on average **17.6º** in HV patients and 4.7º in controls
- Rotational profile of the distal metatarsal and proximal phalanx was similar, which would be consistent with the proximal phalanx of the first toe following the alignment/malalignment of the distal metatarsal or vice-versa.

Table 2. Measured Rotational Profiles of the Medial Column Bones

Medial Column Bone	Rotational Profile Mean Value (Degrees)	Lower 95% CI	Upper 95% CI
Navicular	43.2º	41.1	45.3
Medial Cuneiform	6.1º	4.0	8.3
Proximal First Metatarsal	33.9º	31.8	36.0
Distal First Metatarsal	18.5º	16.4	20.6
Proximal Phalanx Rotation	21.6º	19.5	23.7

Mean values (degrees and 95% Confidence Intervals (95% CI)

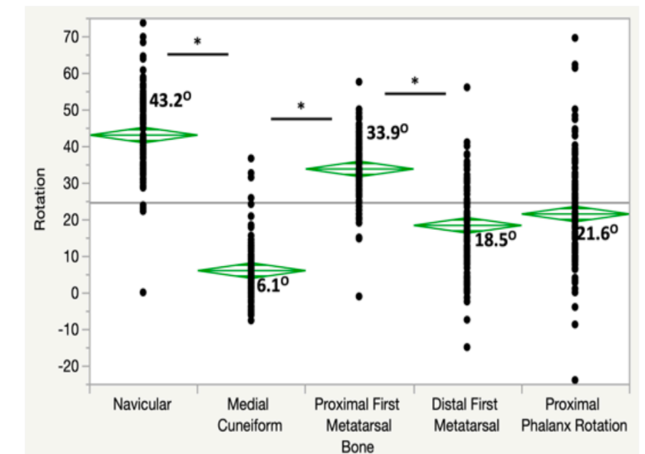
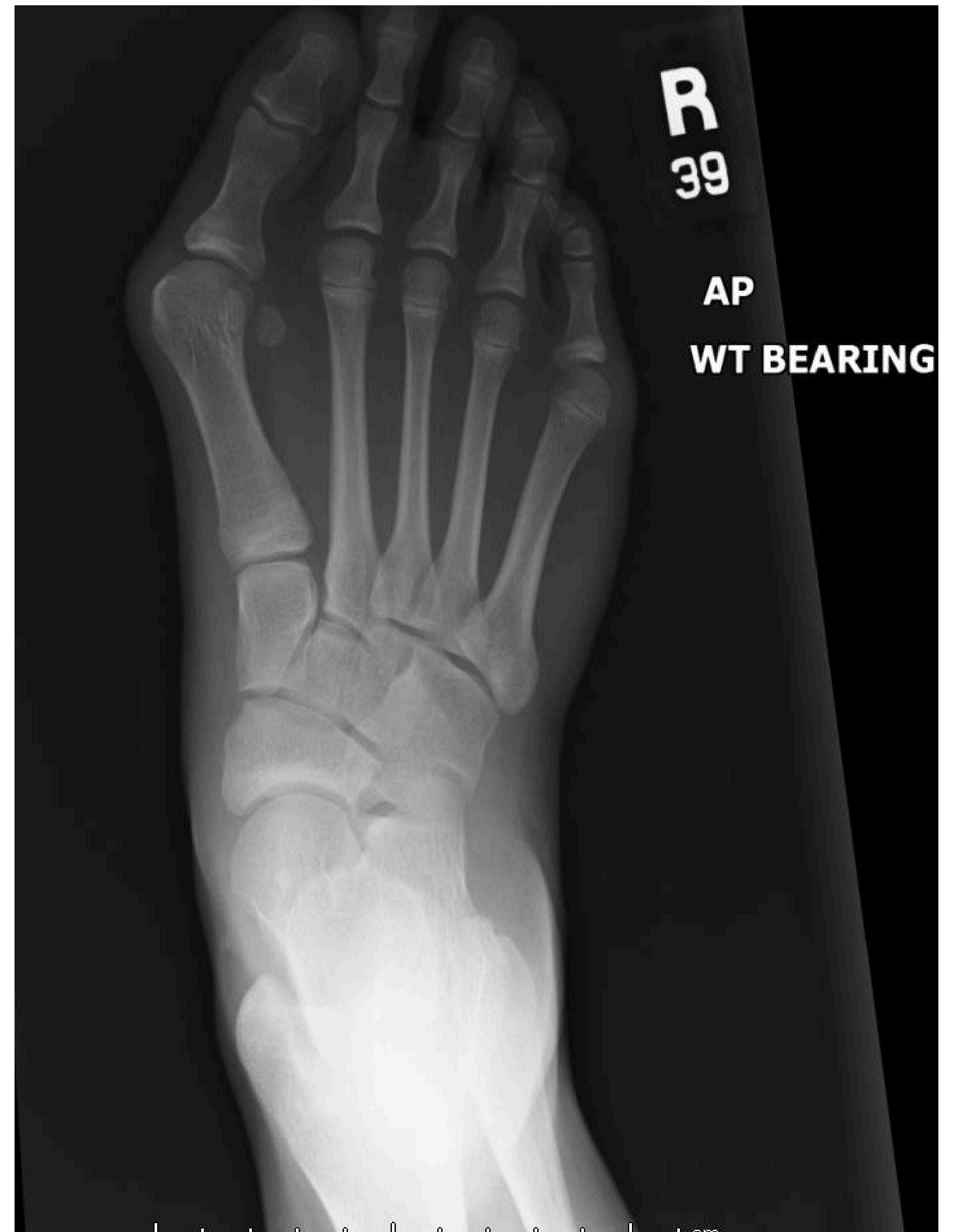


Figure 2. Mean rotation values for medial column bones, all in pronation.

JHAV Conservative Treatment.



Kilmartin et al JBJS Br 1994

A Controlled Prospective Trial of a Foot Orthosis for Juvenile Hallux Valgus

1. Screening of 6000 children between 9 and 10 years of age
2. 122 children had radiographic confirmation HAV (2%)
3. Randomized treatment – functional custom orthotic vs. no treatment
4. F/U every 6 months for 3 to 4 years

Table I. The differences in the metatarsophalangeal joint and intermetatarsal angles before and after the trial, in children with bilateral hallux valgus

	Study group (n=24)		Control group (n=22)	
	Left	Right	Left	Right
MTP angle before trial in degrees (mean±SD)	21±4.18	21.07±5.0	18.22±3.6	18±2.3
MTP angle after trial in degrees (mean±SD)	23.5±6.0	22.8±6.0	19.13±4.3	19.85±4.6
p value of difference	NS	NS	NS	NS
95% confidence interval	2 to 5.3	0.48 to 2.9	−0.31 to 2	0.5 to 4
IM angle before trial in degrees (mean±SD)	10.44±2.2	10.9±1.9	10.27±1.68	10.63±1.98
IM angle after trial in degrees (mean±SD)	10.73±3.1	10.79±2.2	10.28±2.2	10.44±2.1
p value of difference	NS	NS	NS	NS
95% confidence interval	−0.56 to 1.2	−1 to 0.93	−0.73 to 0.75	−0.8 to 0.4

Kilmartin et al JBJS Br 1994

A Controlled Prospective Trial of a Foot Orthosis for Juvenile Hallux Valgus

1. Radiographic parameters - HV & IM angles
2. 29 children lost to F/U – 12 treatment group : 17 control group
3. Unable to standardize footwear but authors did not consider this as a cofounder
4. 3 years after initial exam, children were x-rayed again

Table II. The differences in metatarsophalangeal joint and intermetatarsal angles before and after the trial, in children with unilateral hallux valgus

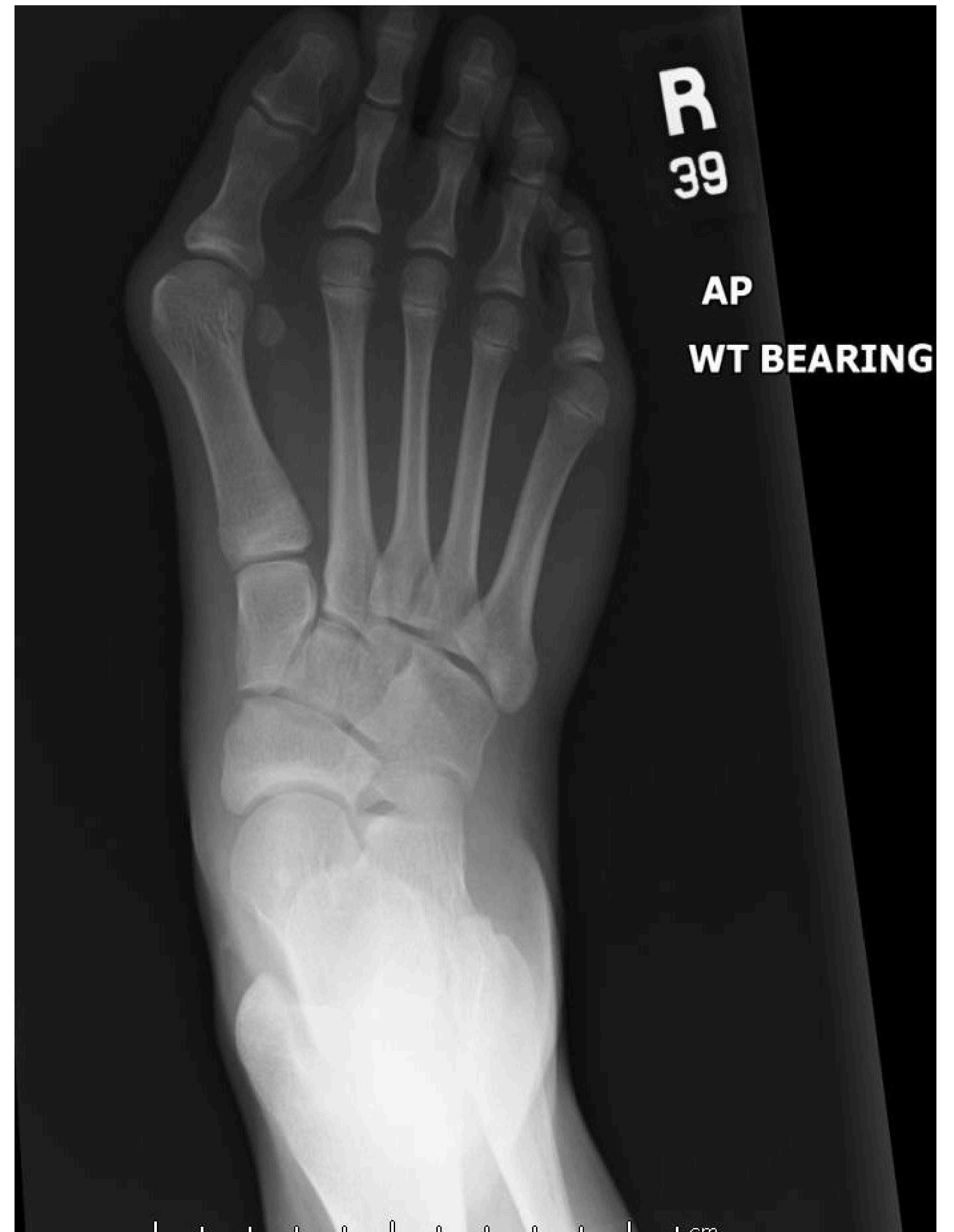
	Study group (n=26)		Control group (n=21)	
	Affected	Unaffected	Affected	Unaffected
MTP angle before trial in degrees (mean±SD)	18.96±3.7	10.9±4.9	17.88±2.0	11.85±1.97
MTP angle after trial in degrees (mean±SD)	21.84±5.64	15.7±6.9	20.35±4.6	15.85±4.7
p value of difference	NS	<0.05	NS	<0.001
95% confidence interval	0.66 to 5.0	2 to 6.6	0.42 to 4.5	1.82 to 5
IM angle before trial in degrees (mean±SD)	9.74±1.87	8.78±1.58	10.25±1.96	9.64±1.89
IM angle after trial in degrees (mean±SD)	10.8±2.0	9.72±2.2	10.98±2.3	9.89±1.96
p value of difference	NS	NS	NS	NS
95% confidence interval	0.46 to 1.66	0.17 to 1.62	0.11 to 1.35	–0.66 to 1.2

Kilmartin et al JBJS Br 1994

A Controlled Prospective Trial of a Foot Orthosis for Juvenile Hallux Valgus

> “Biomechanical orthoses of the type we used should not be used to treat juvenile hallux valgus; they appear to increase the rate at which the condition progresses. In children with unilateral hallux valgus the orthoses do not halt the development of hallux valgus in the clinically normal foot.”

JHAV
Progression of Deformity.



Hyuk Sung et al.

Foot Ankle Surg 2019

Natural progression of radiographic indices in juvenile hallux valgus deformity

Table 1
Patient demographics.

Parameter	Value
No. subjects (male/female)	69 (23/46)
No. of radiographs	594
Laterality (right/left)	68/67
Age at first visit (years)	10.2 ± 4.0
Follow-up duration (years)	2.8 ± 2.4 (1.0–9.6)
No. of follow-up	2 (2–12)

Radiographic parameter	Value
Hallux valgus angle	18.4 ± 8.0
Hallux interphalangeal angle	14.9 ± 6.6
Intermetatarsal angle	10.1 ± 3.2
Metatarsus adductus angle	17.6 ± 5.4
Distal metatarsal articular angle	14.4 ± 12.8
AP talo-1st metatarsal angle	8.7 ± 6.9
AP talo-2nd metatarsal angle	12.8 ± 8.3
Lateral talo-1st metatarsal angle	4.6 ± 3.7

Age at first visit, follow-up duration, follow-up interval, and radiographic parameters; mean ± standard deviation (range).
No. of follow-up; mode (range).
Age = decimal years.
AP = anteroposterior.

Hyuk Sung et al.

Foot Ankle Surg 2019

Natural progression of radiographic indices in juvenile hallux valgus deformity

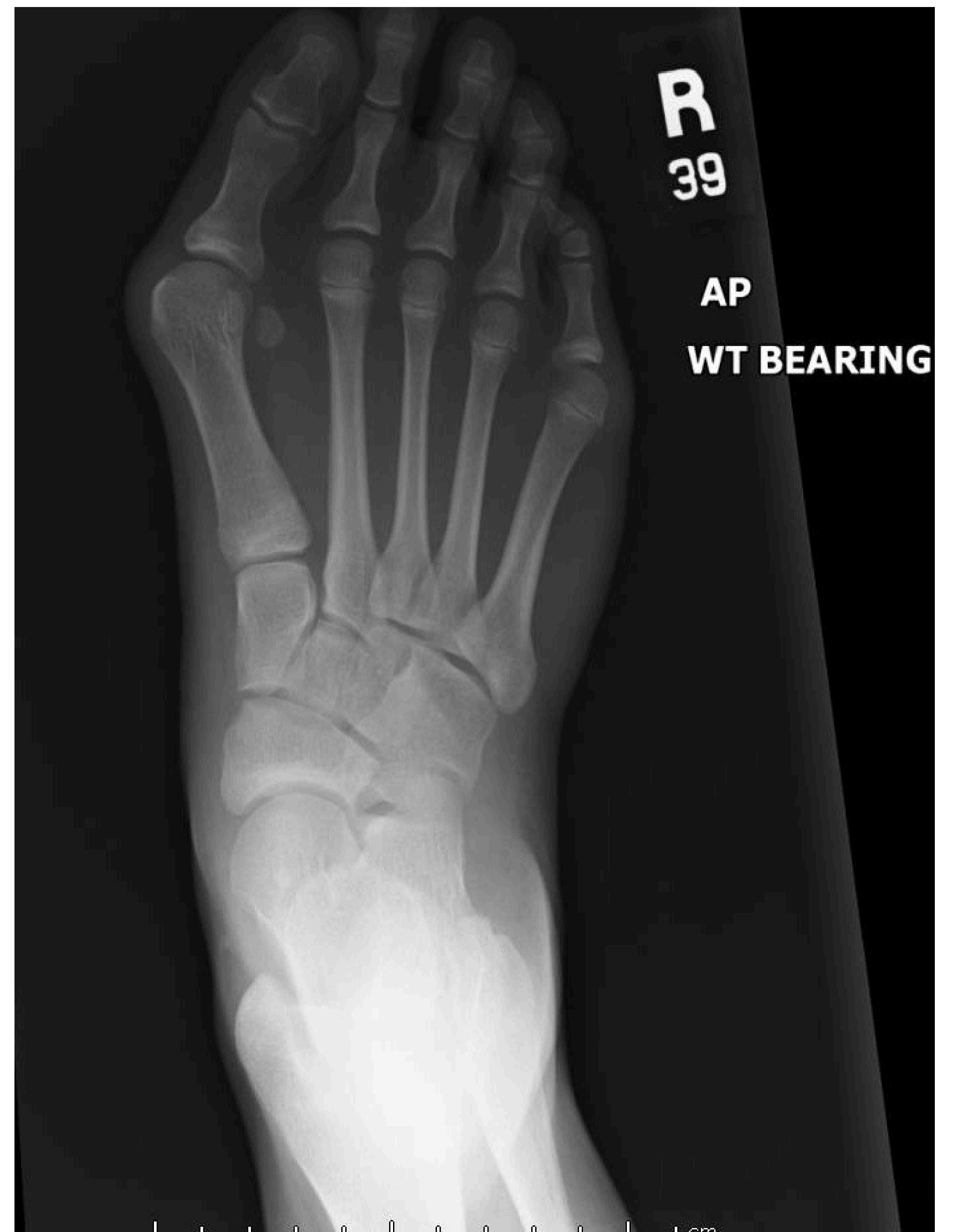
Table 4
The estimation and fixed effects of radiographic indices using a linear mixed model.

	HVA			HIA			IMA			MAA			DMAA		
	Estimate	SE	p-Value	Estimate	SE	p-Value	Estimate	SE	p-Value	Estimate	SE	p-Value	Estimate	SE	p-Value
Age	0.8	0.1	<0.001	−0.3	0.1	0.019	0.0	0.1	0.543	0.0	0.1	0.791	0.8	0.3	0.003
Sex (male)	−7.4	1.7	<0.001	5.9	1.6	<0.001	−0.5	0.7	0.520	1.0	1.4	0.494	−2.6	3.5	0.449
Laterality	−0.398	1.7		−0.481	1.4		−0.3	0.6		0.7	1.2		−3.4	3.0	
AP talo-1st MTA	0.0	0.1	0.970	0.0	0.1	0.736	0.0	0.0	0.883	0.0	0.1	0.564	0.0	0.1	0.773
Lat talo-1st MTA	0.0	0.1	0.971	0.1	0.1	0.314	0.1	0.0	0.018	0.2	0.1	0.042	0.0	0.2	0.829

HVA = hallux valgus angle; HIA = hallux interphalangeal angle; IMA = intermetatarsal angle; MAA = metatarsus adductus angle; DMAA = distal metatarsal articular angle; AP talo-1st MTA = anteroposterior talo-first metatarsal angle; Lat talo-1st MTA = lateral talo-first metatarsal angle.
SE = standard error.

- JHV deformity could progress with aging - both **HVA and DMAA increased by 0.8° per year** ($p < 0.001$ and $p = 0.003$, respectively).
- **HVA increased by 1.5° per year in patients age <10 years, whereas no significant change in the HVA was noted in patients age ≥10 years**
- HVA increased by 0.8° per year ($p < 0.001$) in patients who had both HVA <15° and IMA≥ 10° at the initial examination
- HVA of ≥15° regardless of the IMA at the initial examination, HVA increased by 0.5° per year ($p = 0.001$)
- Increased lateral talo-first metatarsal angle toward flatfoot deformity was associated with increased IMA and MAA

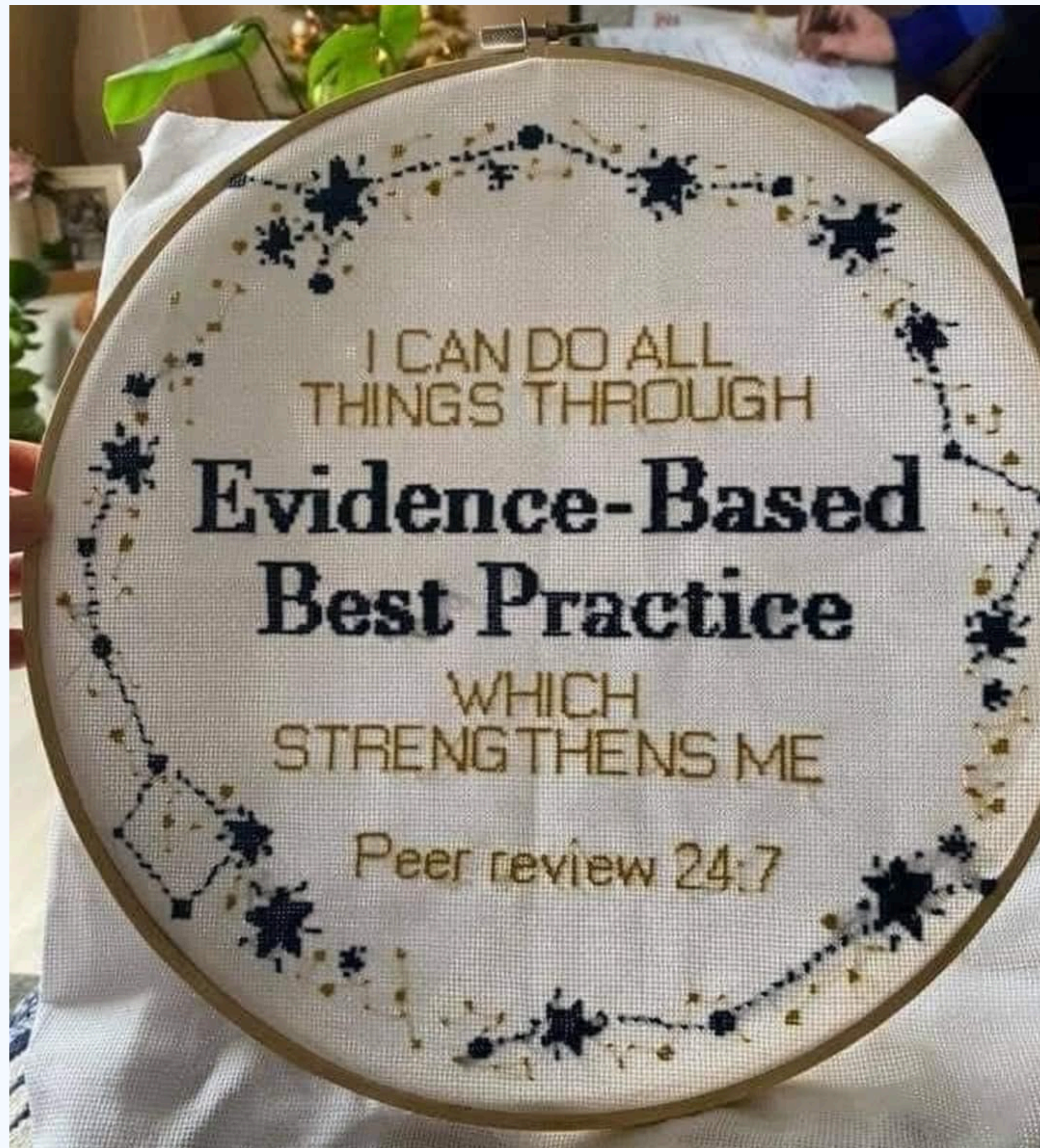
JHAV
Sx Treatment.



Mahan & Cidambi Foot Ankle Clin N Am 2021

Juvenile Hallux Valgus

"Conservative care should be used first before any invasive procedures. Significant deformity can occur without any pain, and invasive treatment should not be initiated for deformity alone, except in the instance of severe deformity causing skin compromise (more common in developmentally delayed or neuromuscular patients who may not be able to express discomfort). Shoe and activity modifications are usually the first line of treatment. Night splints, bunion pads, and other commercial devices can be used to help relieve symptoms. Surgical treatment should be reserved for bunions that are persistently painful despite failure of conservative measures, typically in a patient who has reached skeletal maturity."


I CAN DO ALL
THINGS THROUGH
Evidence-Based
Best Practice
WHICH
STRENGTHENS ME
Peer review 24:7

Kaiser et al. FAI 2018

Radiographic Evaluation of First Metatarsal and Medial Cuneiform Morphology in Juvenile Hallux Valgus

“JHV remains a difficult problem with an unsatisfactorily high recurrence rate after corrective surgery.”

- Coughlin FAI 1995
- Helal Clin Orthop Relat Res 1985

Grace et al.

JFAS 1999

Modified Lapidus Arthrodesis for Adolescent Hallux Abducto Valgus

1. 23 patients (30 feet) with
2. Average age of 16.5 years
3. Average F/U of 61 months
4. 21 F : 2 M
5. Average Pre-Op IM < = 13.3°
6. 2nd MT hypertrophy noted 60% patients
7. 25 excellent / 3 good / 2 fair
8. 2 recurrences 1 nonunion
9. Post-Op IM < = 5.4° (8° average in reduction of IM)

Grace et al.

JFAS 1999

Modified Lapidus Arthrodesis for Adolescent Hallux Abducto Valgus

"The modified Lapidus arthrodesis accomplishes two major goals not attainable with metatarsal osteotomies. This procedure **will restore stability to the first ray and eliminate disturbances in weight bearing patterns of the forefoot**. Additionally, the modified Lapidus arthrodesis will address the apex of the deformity, stabilizing the articulation and thereby preventing recurrent deformity, eliminating hypermobility of the first ray, and eliminating multiplanar instability associated with an increased tendency for the metatarsal to shift in both the sagittal and transverse planes."

Mahan & Cidambi Foot Ankle Clin N Am 2021

Juvenile Hallux Valgus

> "The Lapidus procedure also includes an acute correction of the 1 to 2 IMA. This does not address the elevated DMAA often seen in JHV, which would need to be addressed separately."

Del Vecchio & Dalmau-Pasto Foot Ankle Clin N Am 2020

Percutaneous Lateral Release in Hallux Valgus Anatomic Basis and Indications

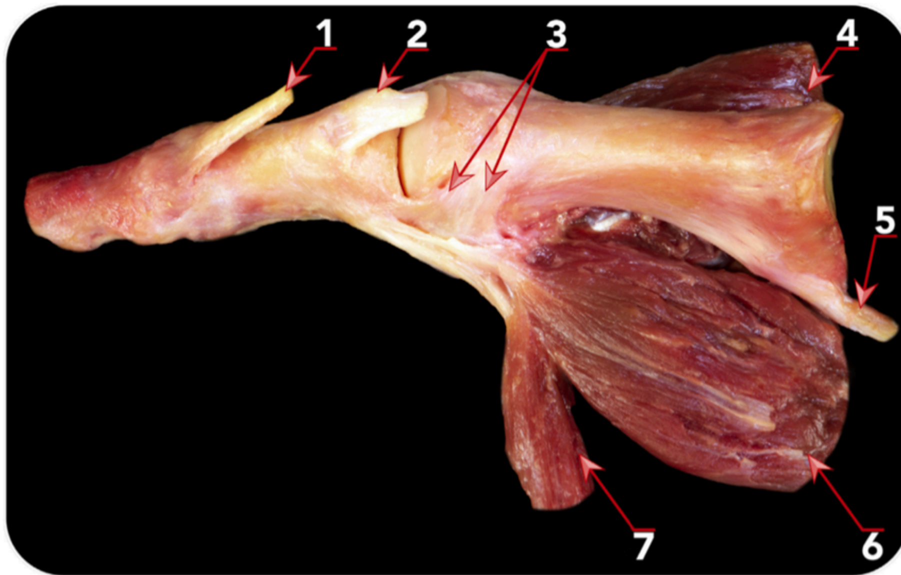


Fig. 4. Lateral view of a dissection of the first MTP joint. The joint capsule has been resected to allow visualization of the lateral collateral ligament and adductor hallucis tendon insertion. (1) Extensor hallucis longus; (2) extensor hallucis brevis; (3) lateral collateral ligament (MTP and metatarsosesamoid fascicles); (4) lateral head of flexor hallucis brevis; (5) peroneus longus tendon; (6); oblique head of adductor hallucis muscle; (7) transverse head of adductor hallucis muscle.

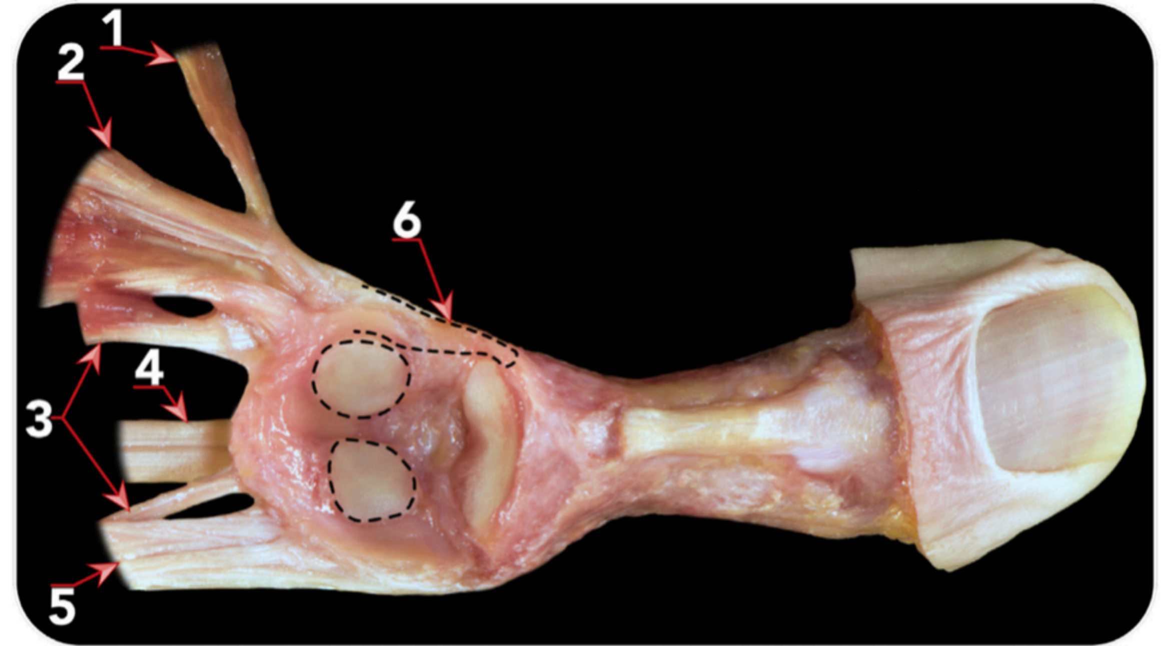


Fig. 5. Dorsal view of a dissection of the first MTP joint plantar plate. The first metatarsal has been resected. (1) Transverse head of adductor hallucis muscle; (2) oblique head of adductor hallucis muscle; (3) medial and lateral heads of flexor hallucis brevis; (4) flexor hallucis longus tendon; (5) abductor hallucis tendon; (6) area lateral to the lateral sesamoid where the percutaneous lateral release is performed.

Yammine & Assi

Foot Ankle Srug 2018

A meta-analysis of comparative clinical studies of isolated osteotomy versus osteotomy with lateral soft tissue release in treating hallux valgus

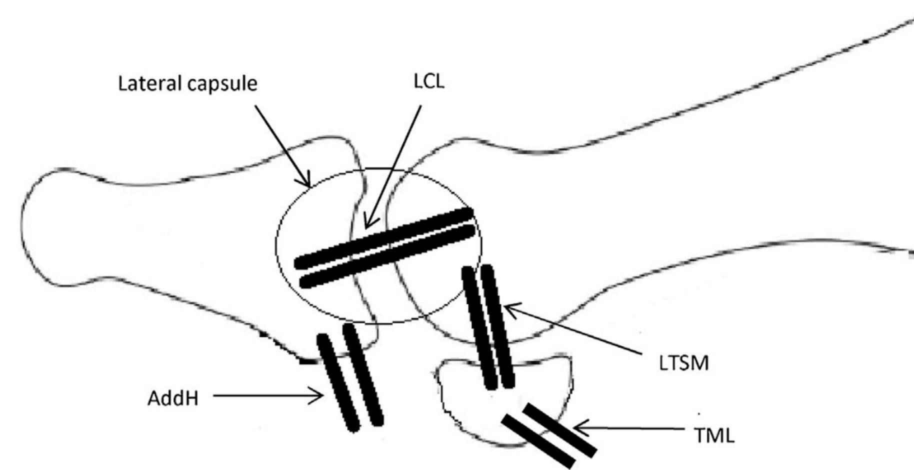


Fig. 1. Anatomical structures involved in lateral release. LCL: lateral collateral ligament, AddH: auctor halluces, LTSM: lateral sesamoido-metatarsal ligament, TML: transverse metatarsal ligament.

Table 1
Characteristics of included studies.

Studies	Study design	Sample size (patients/feet)	Age (years)	Follow-up (months)	Type of osteotomy	Released structures of LSTR	Osteotomy only (feet)	Osteotomy + LSTR (feet)
Resch et al. [8]	Randomized	87/106	47 (15–74)	36 (12–48)	Chevron	AddHT	62	44
Trnka et al. [7]	Retrospective comparative	45/48	51.7 (20–82)	17 (12–26)	Chevron	AddHT, lateral capsule, TML	20	28
Lee et al. [14]	Quasi-randomized	86/144	43 (18–48)	22.8 (12–37.2)	Chevron	AddHT, lateral capsule, TML, LSMT	70	74
Woo et al. [17]	Retrospective comparative	90/119	53 (19–81)	9.6 (3.6–22.2)	Chevron +Akin (92.4%) Chevron only (7.6%)	AddHT, lateral capsule, LSMT	68	51
Shi et al. [15]	Retrospective comparative	76 patients/feet	50.4 (18–70)	12	Chevron	AddHT, perforation lateral capsule, TML	35	41
Grle et al. [6]	Retrospective comparative	41/48	57 (43–77)	24 (6–40.8)	Chevron	AddHT, lateral capsule, TML	25	23

AddHT: adductor hallucis tendon (both heads), TML: transverse metatarsal Ligament, LSMT: lateral sesamoid metatarsal ligament.

Yammine & Assi

Foot Ankle Srug 2018

A meta-analysis of comparative clinical studies of isolated osteotomy versus osteotomy with lateral soft tissue release in treating hallux valgus

Table 2
Outcomes.

Studies	HVA Correction w/out LSTR	HVA Correction with LSTR	IMA correction w/out LSTR	IMA correction with LSTR	Post-operative TSP w/out LSTR	Post-operative TSP with LSTR	Diff AOFAS w/ out LSTR	Diff AOFAS with LSTR
Resch et al. [8]	7.5 ± 2.27	9.8 ± 2.3°	3°	3°	–	–	–	–
Trnka et al. [7]	16 ± 5°	21 ± 4.5°	8 ± 3°	9 ± 3°	1.1 ± 0.3	0.6 ± 0.2	95 (post-op)	95 (post-op)
Lee et al. [14]	23 ± 4°	20 ± 5°	3 ± 2.5°	4 + 1.25°	–	–	47	43
Woo et al. [17]	8.9 ± 6.5°	3.8 ± 8.7°	6.3 ± 2.9°	5.4 ± 3.1°	4.1 ± 1.25	3.7 ± 1	22.1	28
Shi et al. [15]	12.9 ± 7.9°	15.7 ± 7.1°	5.3 ± 2.6°	5.4 ± 2.0°	3.1 ± 0.9	2.7 ± 1	–	–
Grle et al. [6]	26.84 ± 7.7	23.44 ± 5.4	7.36 ± 3.2°	7.39 ± 1.6°	1.8 ± 0.8	0.8 ± 0.15	92.8 (post-op)	96 (post-op)

LSTR: lateral soft tissue release, LSMT: lateral sesamoid metatarsal ligament, TSP: tibial sesamoid position.

Table 4
Subgroup meta-analyses.

Variable	Subgroups			
	Type of design		Type of release	
	RCT [studies]	Retrospective comparative [studies]	Including LSMT [studies]	Excluding LSMT [studies]
HVA	d = 0.11 (95% CI = –0.922 to 1.149) I^2 = 95.7% P = 0.8	d = –0.29 (95% CI = –1.110 to 0.513) I^2 = 85 P = 0.8	d+ = 0.66 (95% CI = 0.415 to 0.914) I^2 = 0% P < 0.0001	d = –0.48 (95% CI = –1.149 to 0.178) I^2 = 85.6% P = 0.15
IMA	d = –0.10 (95% CI = –0.898 to 0.682) I^2 = 90.3% P = 0.8	d = –0.11 (95% CI = –0.412 to 0.189) I^2 = 0% P = 0.4	d = –0.10 (95% CI = –0.898 to 0.682) I^2 = 90.3% P = 0.8	d = –0.11 (95% CI = –0.412 to 0.189) I^2 = 0% P = 0.4

LSMT: lateral sesamoid metatarsal ligament.

Yammine & Assi

Foot Ankle Srug 2018

A meta-analysis of comparative clinical studies of isolated osteotomy versus osteotomy with lateral soft tissue release in treating hallux valgus

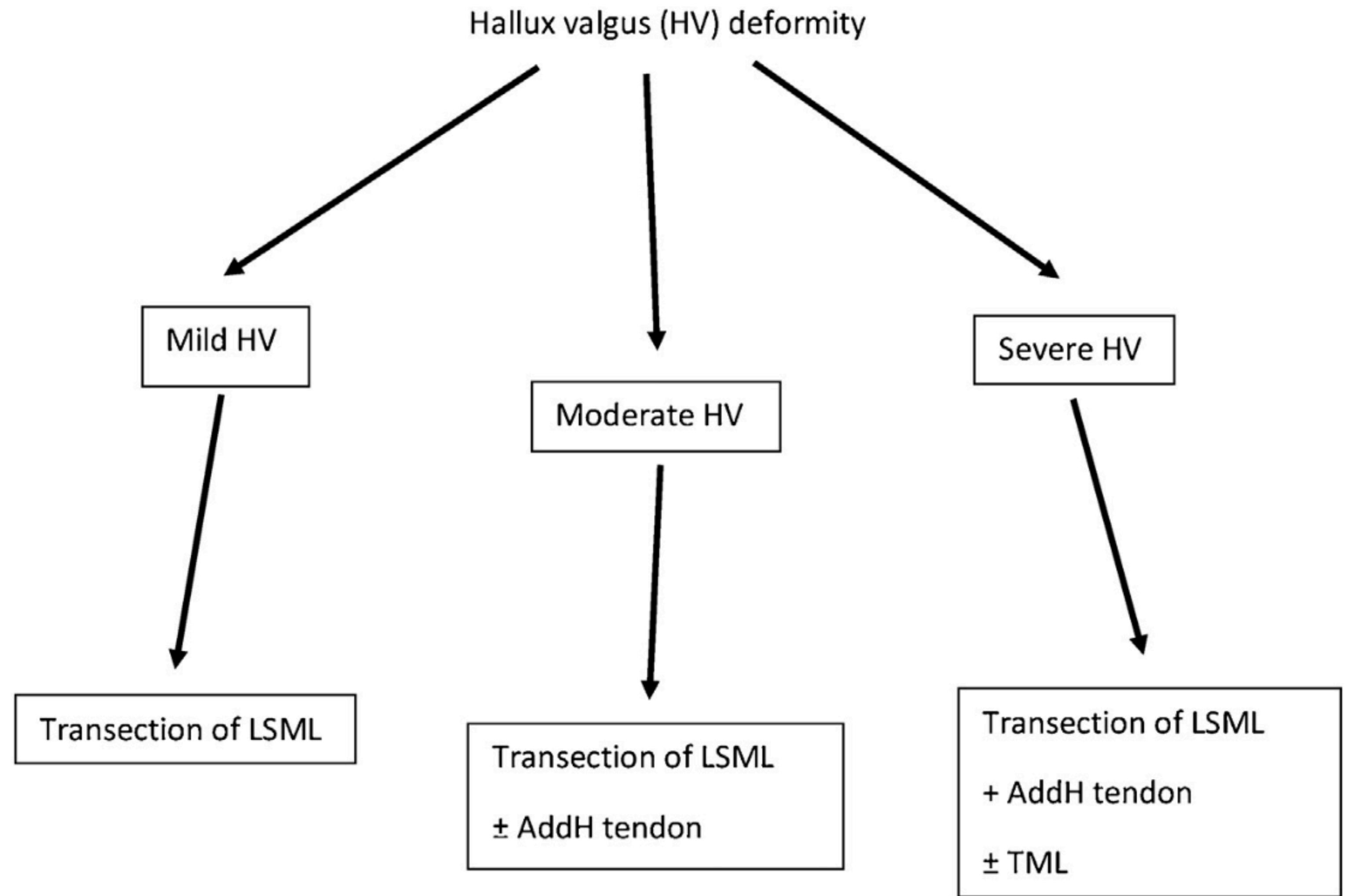


Fig. 3. Decisional tree for lateral soft tissue release.

Kotlarsky et al.

Foot Ankle Specialist 2021

Treatment of Adolescent Hallux Valgus With Percutaneous Distal Metatarsal Osteotomy

Table 2.

Changes in the Different AOFAS Criteria Before and After Surgery.

AOFAS Criteria	Improvement, Number of Feet (%)	No Change, Number of Feet (%)	Deterioration, Number of Feet (%)
Pain	29 (91%)	3 (9%)	0
Function activity limitations	29 (91%)	3 (9%)	0
Footwear requirements	26 (81%)	6 (19%)	0
MTPJ ROM	28 (88%)	4 (12%)	0
IPJ ROM	0	32 (100%)	0
MTPJ-IPJ stability	0	32 (100%)	0
Callus related to hallux MTPJ-IPJ	15 (47%)	16 (50%)	1 (3%)
Alignment	32 (100%)	0	0

Abbreviations: AOFAS, American Orthopedic Foot and Ankle Society; MTPJ ROM, metatarsophalangeal joint range of motion (dorsiflexion plus plantarflexion); IPJ ROM, interphalangeal joint range of motion (plantarflexion); MTPJ-IPJ stability, metatarsophalangeal joint-interphalangeal joint stability in all planes.

- 32 feet (27 patients)
- All patients were <18 years of age
- 10 male patients (12 feet) and 17 female patients (20 feet)
- **Average age at surgery was 15.8 years**, with a SD of 1.6 (median = 16 years; range = 13-18 years)
- Average follow-up time was 43 months, with a SD of 22 months (median = 30 months; range = 24-94 months)
- Average pre-op AOFAS = 66 (median = 64; SD = 11), and post-op at last follow-up, the average score = 96 (median = 100; SD = 6) ($P < .0001$)

Kotlarsky et al.

Foot Ankle Specialist 2021

Treatment of Adolescent Hallux Valgus With Percutaneous Distal Metatarsal Osteotomy

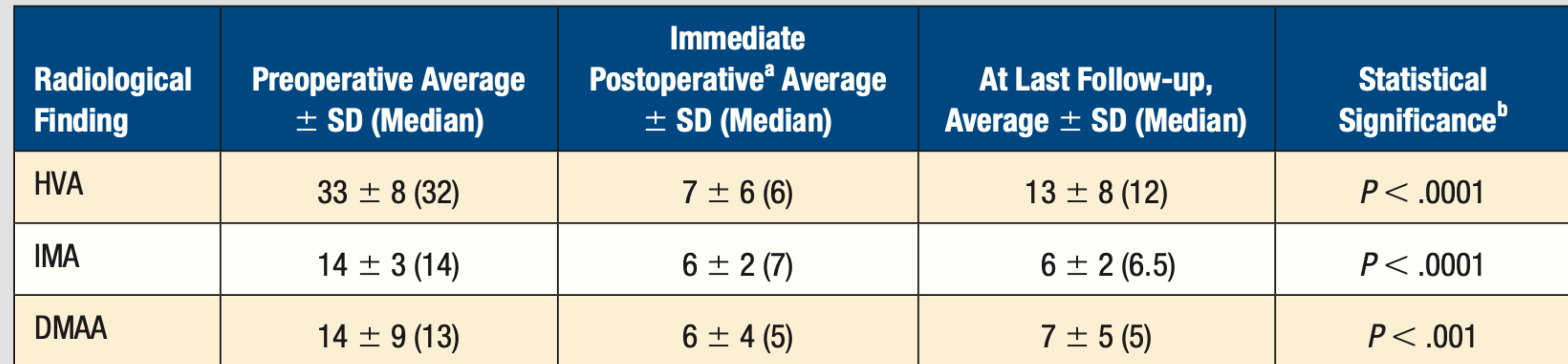


Table 3.

Comparison Between Radiological Values Before and After Surgery.

Radiological Finding	Preoperative Average ± SD (Median)	Immediate Postoperative[a] Average ± SD (Median)	At Last Follow-up, Average ± SD (Median)	Statistical Significance[b]
HVA	33 ± 8 (32)	7 ± 6 (6)	13 ± 8 (12)	$P < .0001$
IMA	14 ± 3 (14)	6 ± 2 (7)	6 ± 2 (6.5)	$P < .0001$
DMAA	14 ± 9 (13)	6 ± 4 (5)	7 ± 5 (5)	$P < .001$

Abbreviations: HVA, hallux valgus angle; IMA, intermetatarsal angle; DMAA, distal metatarsal articular angle.
[a]Radiological values within 2 weeks from Kirschner wire removal (2 months after surgery).
[b]Statistical significance between the preoperative and last follow-up measures. There was no statistically significant difference between the early and late postoperative IMA and DMAA values. The difference between the early and late postoperative HVA was statistically significant ($P < .05$).

Lee et al.

Journal of the Pediatric Orthopaedic Society of North America 2025

Treatment of Adolescent Hallux Valgus With Percutaneous Distal Metatarsal Osteotomy

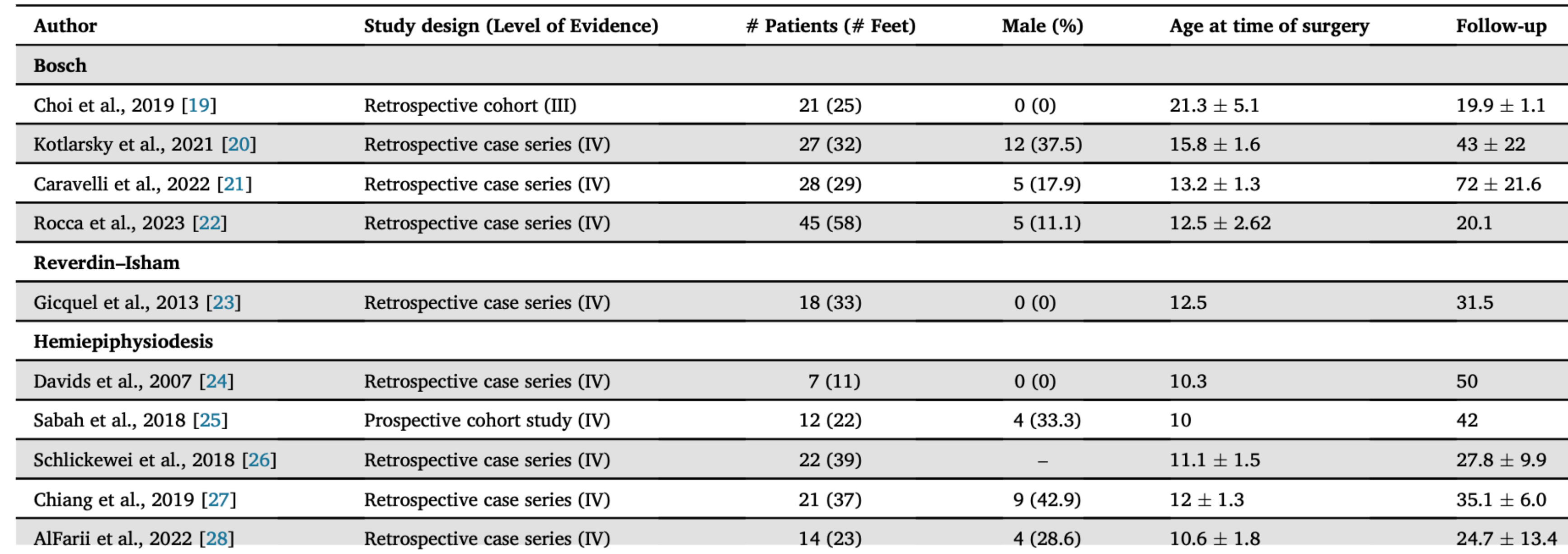


Table 1.
Summary of studies on juvenile hallux valgus.

Author	Study design (Level of Evidence)	# Patients (# Feet)	Male (%)	Age at time of surgery	Follow-up
Bosch					
Choi et al., 2019 [19]	Retrospective cohort (III)	21 (25)	0 (0)	21.3 ± 5.1	19.9 ± 1.1
Kotlarsky et al., 2021 [20]	Retrospective case series (IV)	27 (32)	12 (37.5)	15.8 ± 1.6	43 ± 22
Caravelli et al., 2022 [21]	Retrospective case series (IV)	28 (29)	5 (17.9)	13.2 ± 1.3	72 ± 21.6
Rocca et al., 2023 [22]	Retrospective case series (IV)	45 (58)	5 (11.1)	12.5 ± 2.62	20.1
Reverdin–Isham					
Gicquel et al., 2013 [23]	Retrospective case series (IV)	18 (33)	0 (0)	12.5	31.5
Hemiepiphysiodesis					
Davids et al., 2007 [24]	Retrospective case series (IV)	7 (11)	0 (0)	10.3	50
Sabah et al., 2018 [25]	Prospective cohort study (IV)	12 (22)	4 (33.3)	10	42
Schlickewei et al., 2018 [26]	Retrospective case series (IV)	22 (39)	–	11.1 ± 1.5	27.8 ± 9.9
Chiang et al., 2019 [27]	Retrospective case series (IV)	21 (37)	9 (42.9)	12 ± 1.3	35.1 ± 6.0
AlFarii et al., 2022 [28]	Retrospective case series (IV)	14 (23)	4 (28.6)	10.6 ± 1.8	24.7 ± 13.4

Lee et al.

Journal of the Pediatric Orthopaedic Society of North America 2025

Treatment of Adolescent Hallux Valgus With Percutaneous Distal Metatarsal Osteotomy

Table 2.
Radiographic and clinical outcomes.

Author	HVA			IMA			AOFAS		
Bosch	**Pre**	**Post**	**Diff**	**Pre**	**Post**	**Diff**	**Pre**	**Post**	**Diff**
Choi et al., 2019 [19]	25.3 ± 3.4	12.4 ± 4.6	−12.9	14.4 ± 0.8	4.9 ± 2.2	−9.5	58.6 ± 8.6	88.9 ± 6.4	30.3
Kotlarsky et al., 2021 [20]	33 ± 8	13 ± 8	−20	14 ± 3	6 ± 2	−8	66 ± 11	96 ± 6	30
Caravelli et al., 2022 [21]	22.8 ± 4.6	9.1 ± 2.5	−13.7	13.4 ± 2.5	6.7 ± 2.1	−6.7	59.7 ± 6.8	90.7 ± 6.2	31
Rocca et al., 2023 [22]	28.4 ± 5.7	13.2 ± 2.4	−15.2	15.2 ± 3.2	9.5 ± 1.9	−5.7	68.1 ± 6.8	96.3 ± 3.2	28.2
Reverdin–Isham									
Gicquel et al., 2013 [23]	28.1 ± 6.3	19.5 ± 8.5	−8.6	13.6 ± 2.6	12.7 ± 2.7	−0.9	–	80.7	–
Hemiepiphysiodesis									
Davids et al., 2007 [24]	34.6 ± 6.3	31.2 ± 7.2	−3.4	15.5 ± 1.8	13.1 ± 2.8	−2.4	–	–	–
Sabah et al., 2018 [25]	26	22	−4	13	11	−2	–	–	–
Schlickewei et al., 2018 [26]	26.5 ± 6.6	20.2 ± 6.2	−6.3	14.1 ± 5.4	10.5 ± 2.9	−3.6	–	–	–
Chiang et al., 2019 [27]	25.1 ± 4.8	20.4 ± 6.3	−4.7	12.3 ± 2.4	10.0 ± 2.7	−2.3	68.7 ± 10.1	85.2 ± 12.3	16.5
AlFarii et al., 2022 [28]	30.9 ± 6.7	27.6 ± 8.2	−3.2	14.6 ± 2.3	12.5 ± 3.0	−2	–	–	–

AOFAS, American Orthopaedic Foot and Ankle Society; HVA, hallux valgus angle; IMA, intermetatarsal angle.

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Treatment of Adolescent Hallux Valgus With Percutaneous Distal Metatarsal Osteotomy

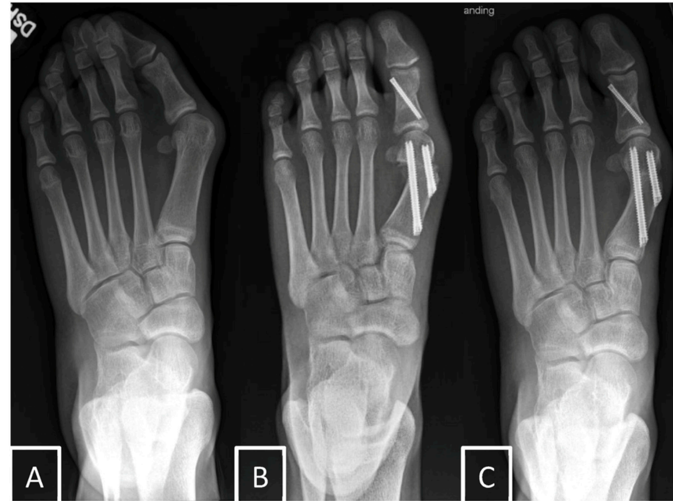

Figure 3. (A) Preoperative anteroposterior (AP) view of the right foot of a 13-year-old girl with juvenile hallux valgus. (B) AP view of the right foot at 5 weeks post-operation following third generation minimally invasive surgery with screw fixation. (C) AP view of the right foot at 8 months post-operation, showing a well-healed osteotomy.

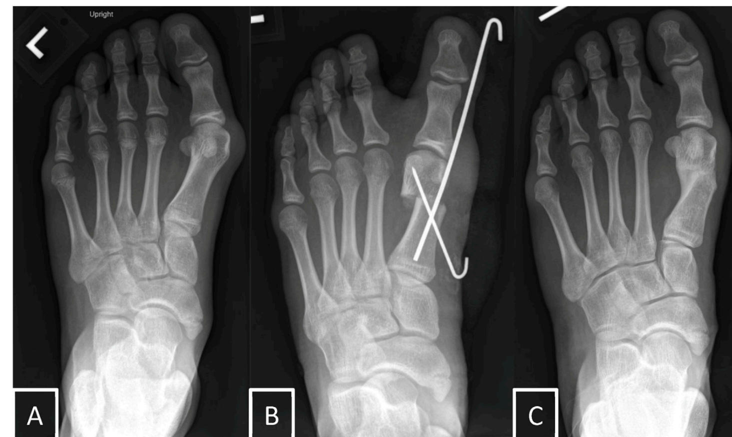

Figure 2. (A) Preoperative anteroposterior (AP) view of the left foot of a 16-year-old female with juvenile hallux valgus. (B) AP view of the left foot 2 weeks post-op from the SERI procedure. (C) AP view of the left foot 5 months post-op, showing a well-healed osteotomy with interval hardware removal. SERI, Simple, Effective, Rapid, and Inexpensive.

Table 3.
Complications.

Author	# Feet	Major* (%)	Minor (%)	Total (%)
Bosch				
Choi et al., 2019 [19]	25	2 (8)	0 (0)	2 (8)
Kotlarsky et al., 2021 [20]	32	1 (3.1)	2 (6.3)	3 (9.4)
Caravelli et al., 2022 [21]	29	0 (0)	3 (10.3)	3 (10.3)
Rocca et al., 2023 [22]	58	0 (0)	0 (0)	0 (0)
Reverdin–Isham				
Gicquel et al., 2013 [23]	33	0 (0)	12 (36.4)	12 (36.4)
Hemiepiphysiodesis				
Davids et al., 2007 [24]	11	0 (0)	1 (9.1)	1 (9.1)
Sabah et al., 2018 [25]	22	0 (0)	0 (0)	0 (0)
Schlickewei et al., 2018 [26]	39	3 (7.7)	3 (7.7)	6 (15.4)
Chiang et al., 2019 [27]	37	0 (0)	0 (0)	0 (0)
AlFarii et al., 2022 [28]	23	5 (21.7)	6 (26.1)	11 (47.8)

* Complications considered major complications by the authors or requiring revision surgery.

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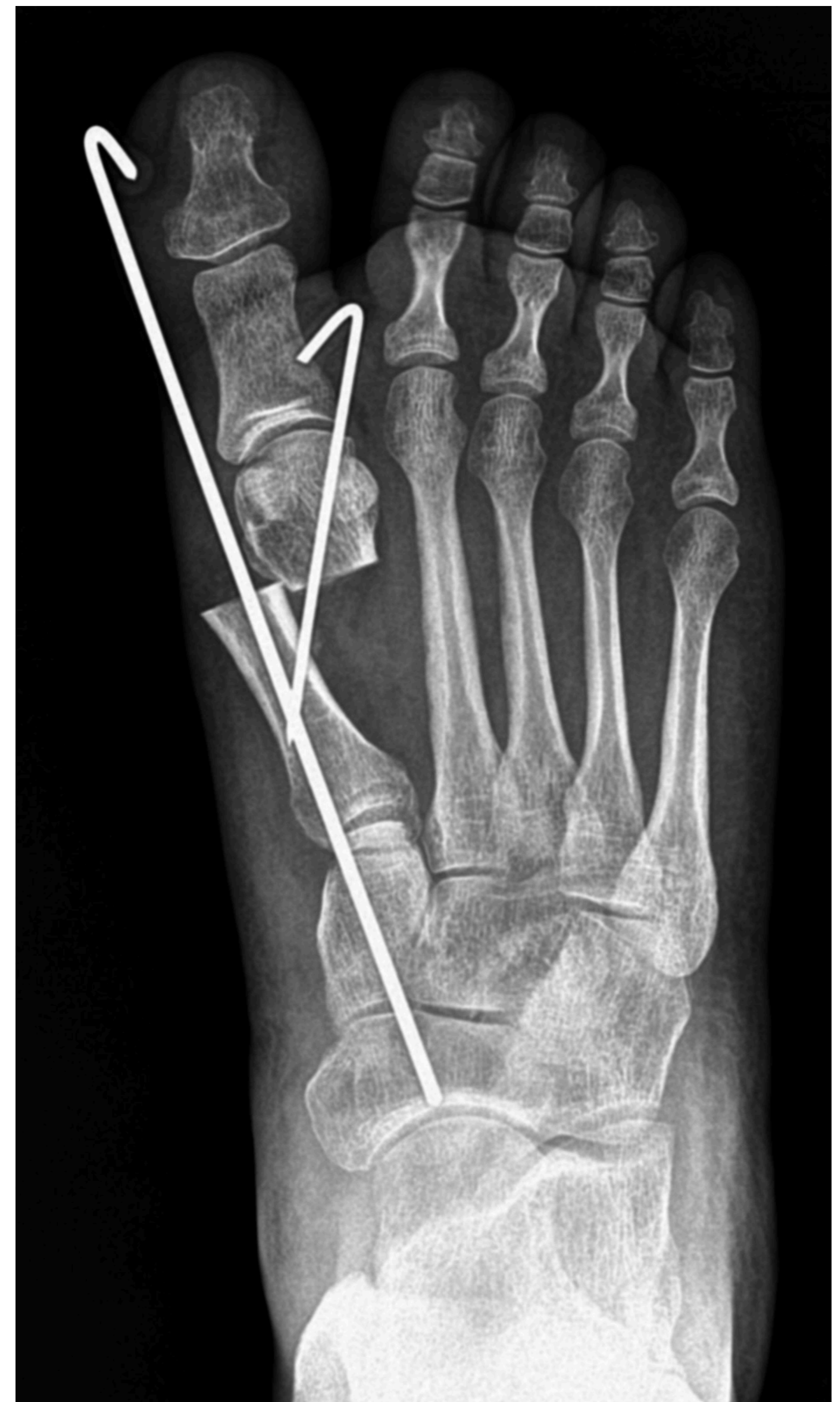
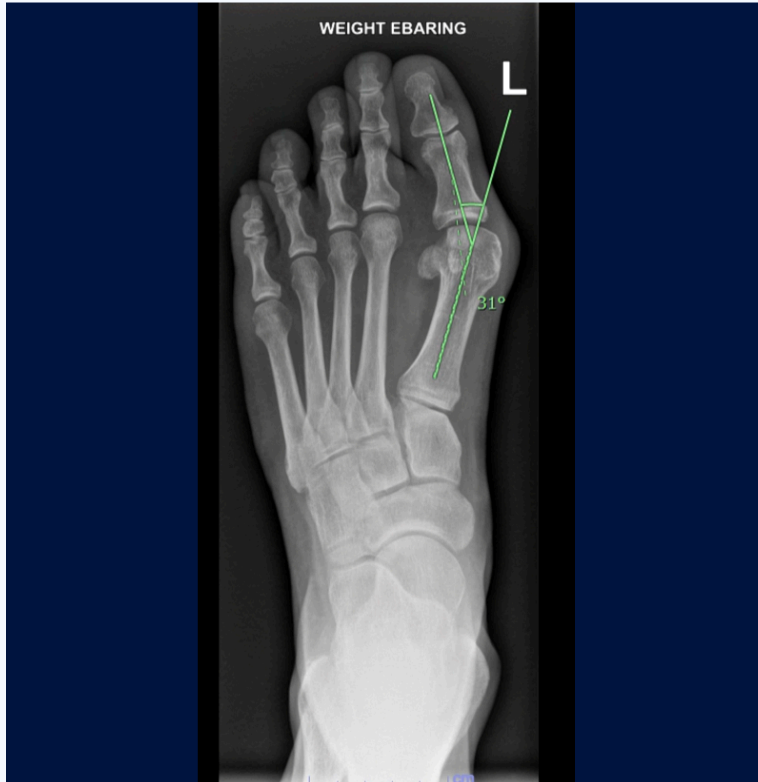
"The current review is limited by the heterogeneity of available studies, and these studies are limited in several ways. Large-scale retrospective and prospective studies are few and long-term follow-up studies are deficient. Longer term studies are needed to fully assess the clinical, functional, and radiographic outcome over time and accurately evaluate recurrence and complication rates. Studies that compare MIS with open techniques for JHV are rare, with only one prospective study [19] and one retrospective study [25] identied in the literature. Furthermore, studies are complicated because standardized assessments are lacking in evaluating clinical and radiological outcomes. Although the AOFAS score is commonly used to report clinical outcomes, it is not recommended as a sole outcome measure [34]."

Tension Band Lateral Release.

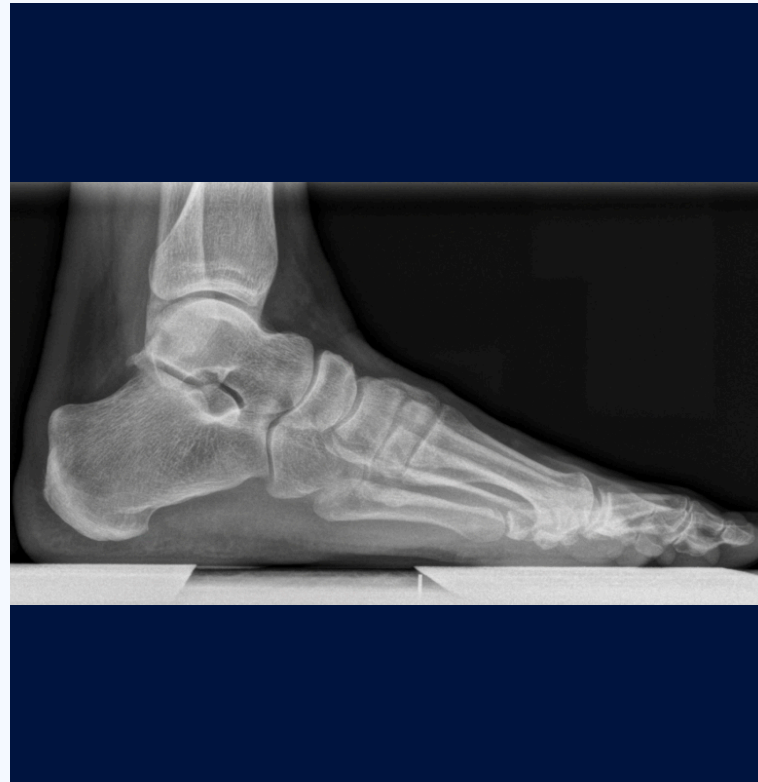


SERI Procedure



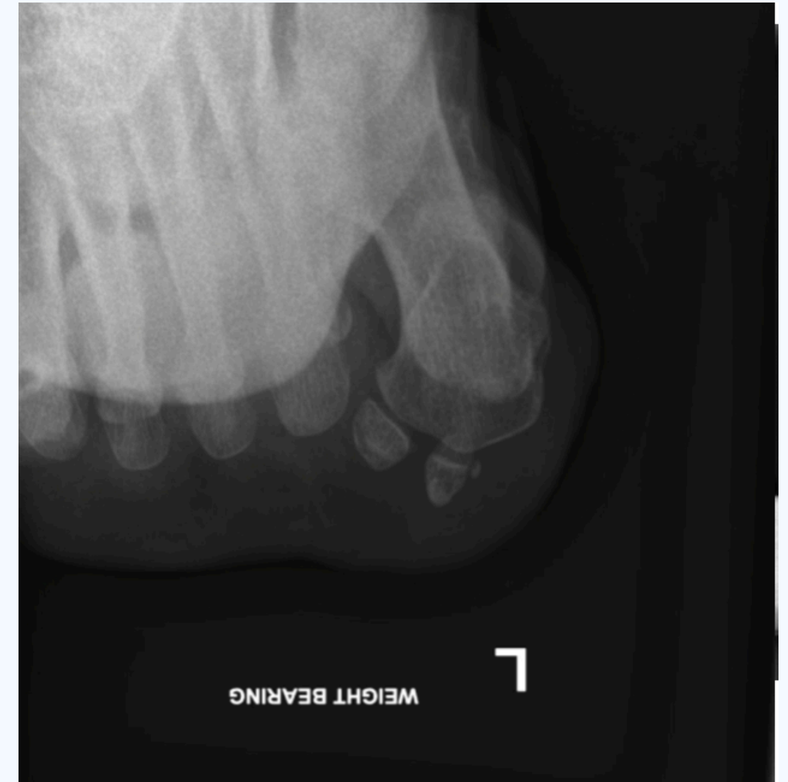
Pre-Op

WB AP



Pre-Op

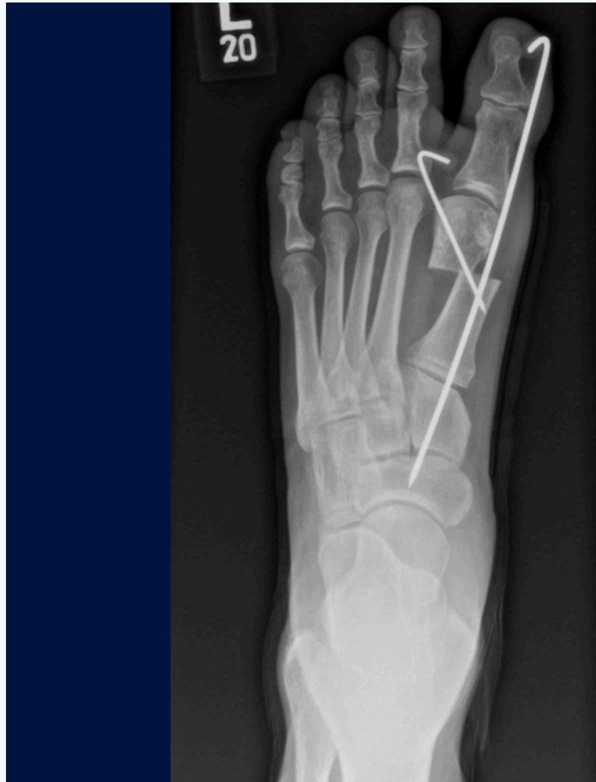
WB Lateral



Pre-Op

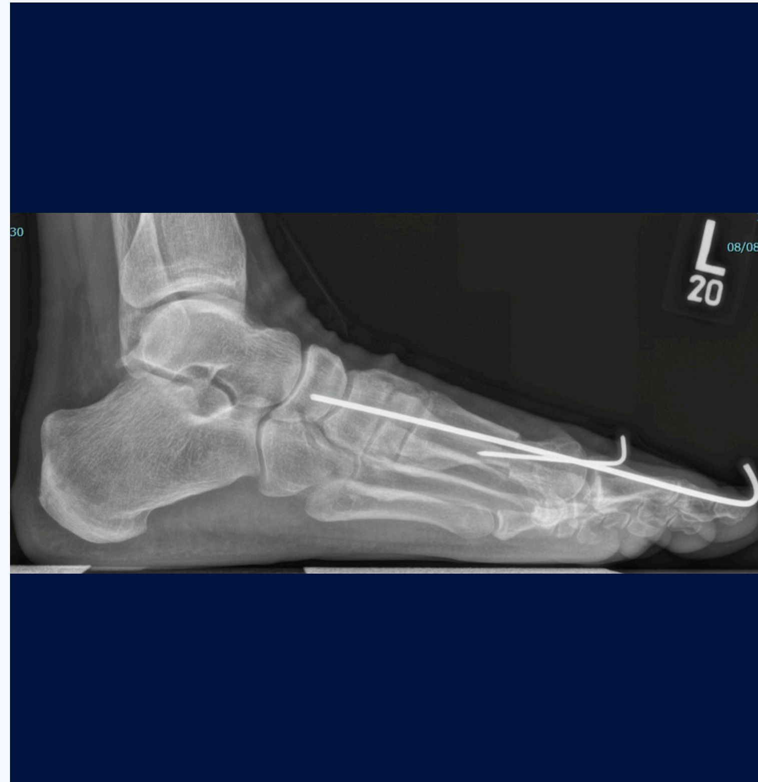
Axial Sesamoid

SERI Procedure



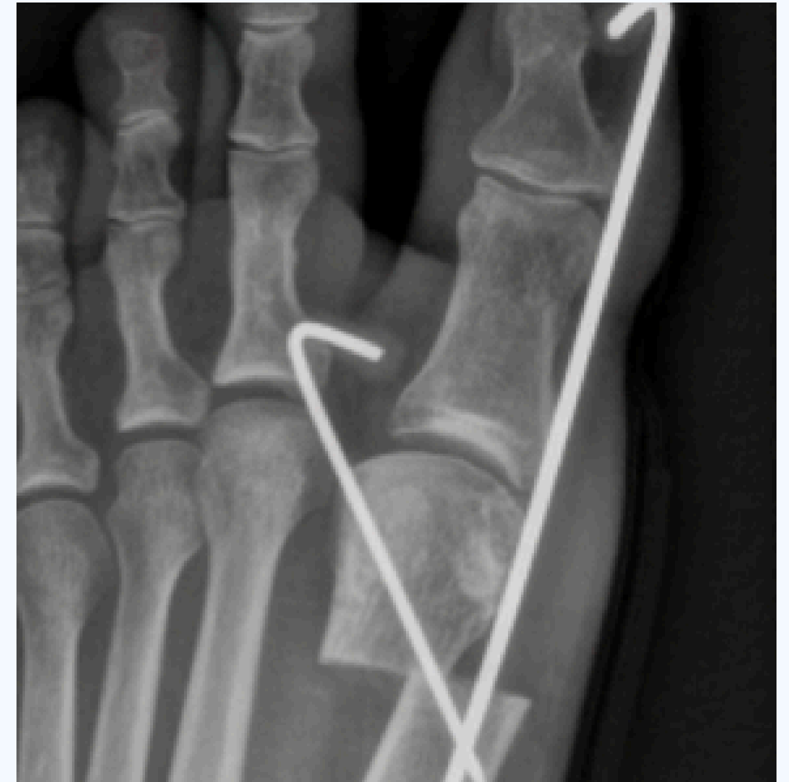
Post-Op

WB AP



Post-Op

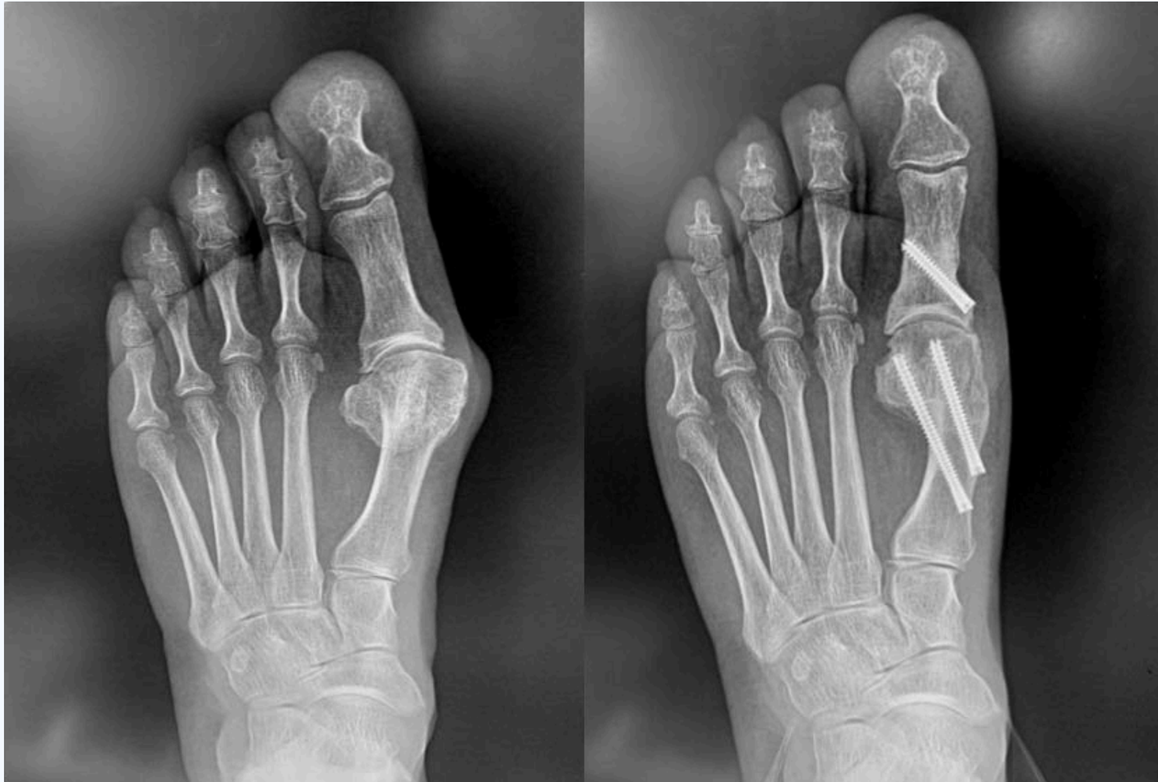
WB Lateral



Post-Op zoomed on 1st MPJ

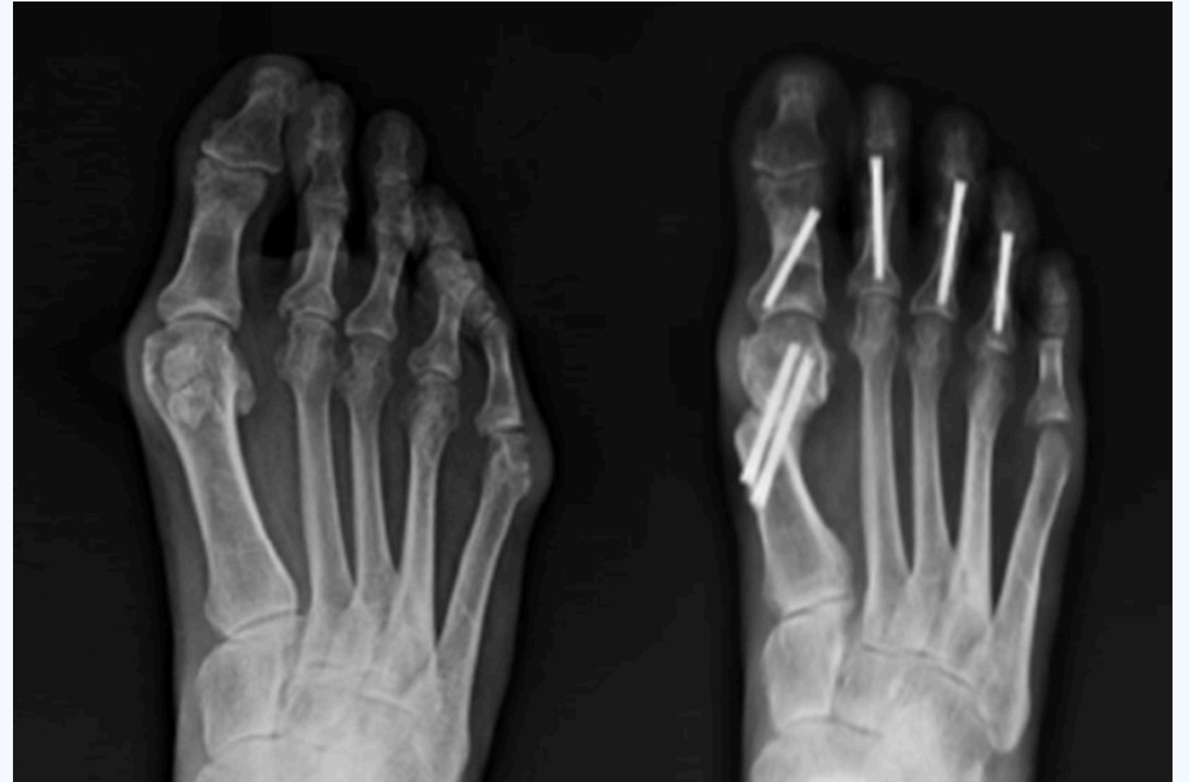
WB AP

SERI Procedure With Screws



Pre & Post-Op

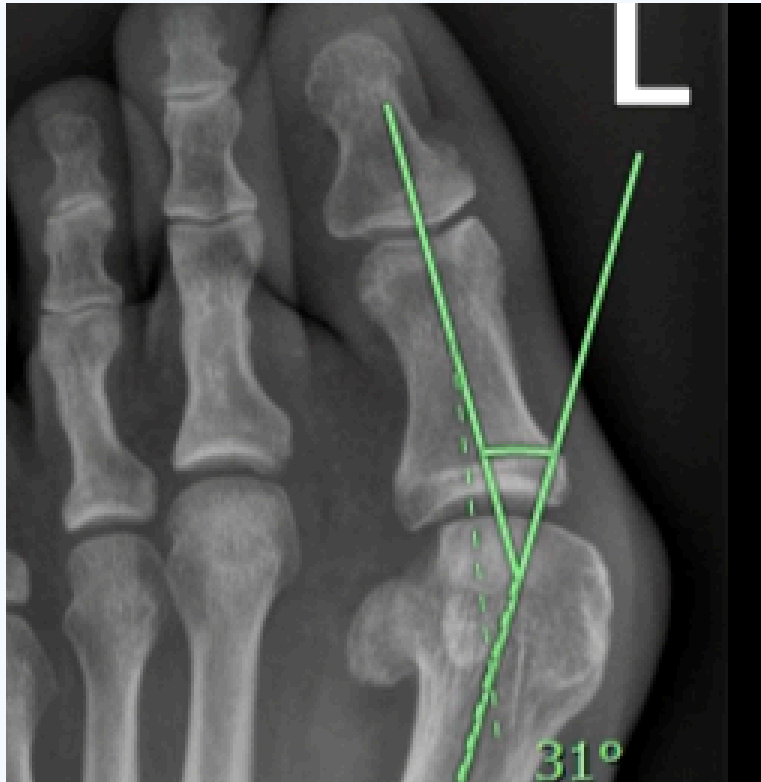
WB AP



Pre & Post-Op

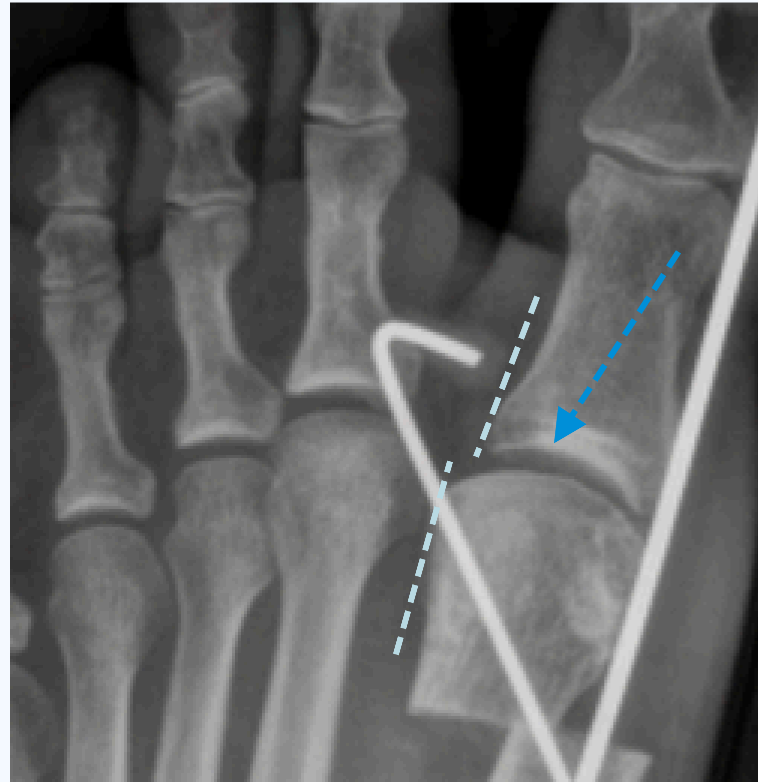
WB AP

Tension Band Lateral Release



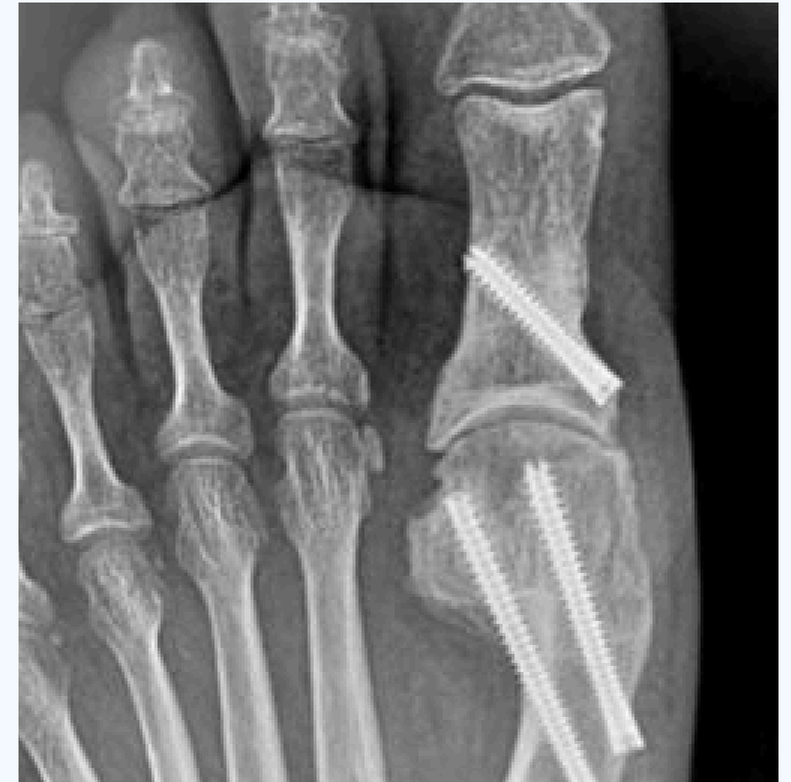
Pre-Op

WB AP



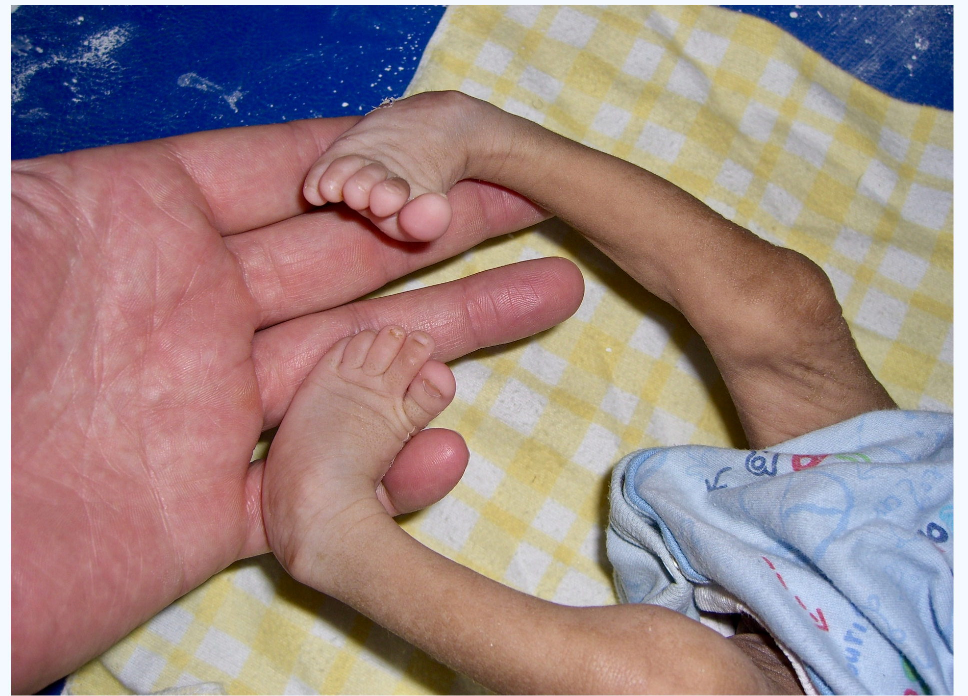
Post-Op with pins

WB AP

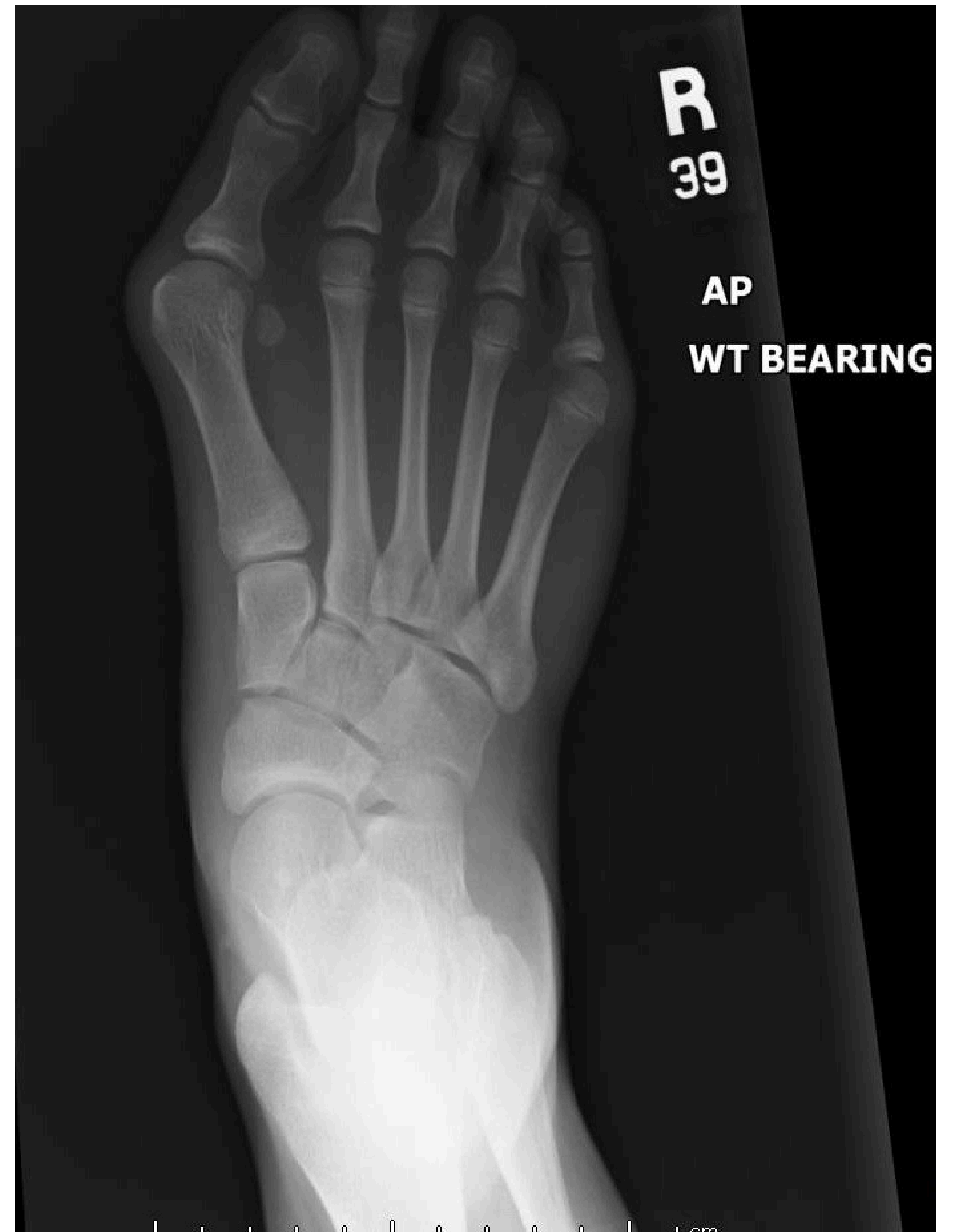


Post-Op with screws

WB AP



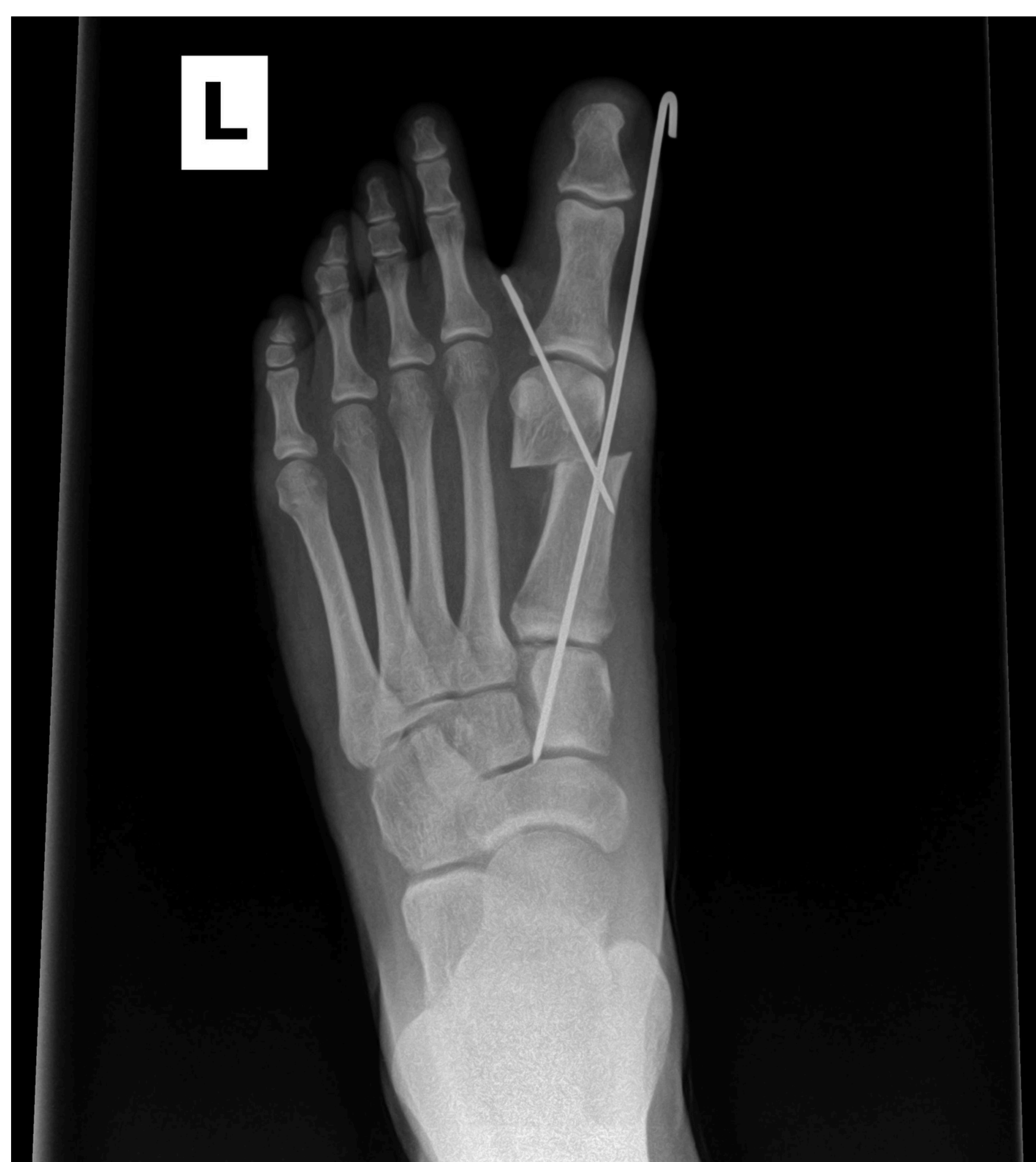
JHAV
Surgical Cases.



SERI
Case #1.

14 y/o F with HAV, PCFD, Equinus

Procedures - Gastroc recession, Evans, Lapidus



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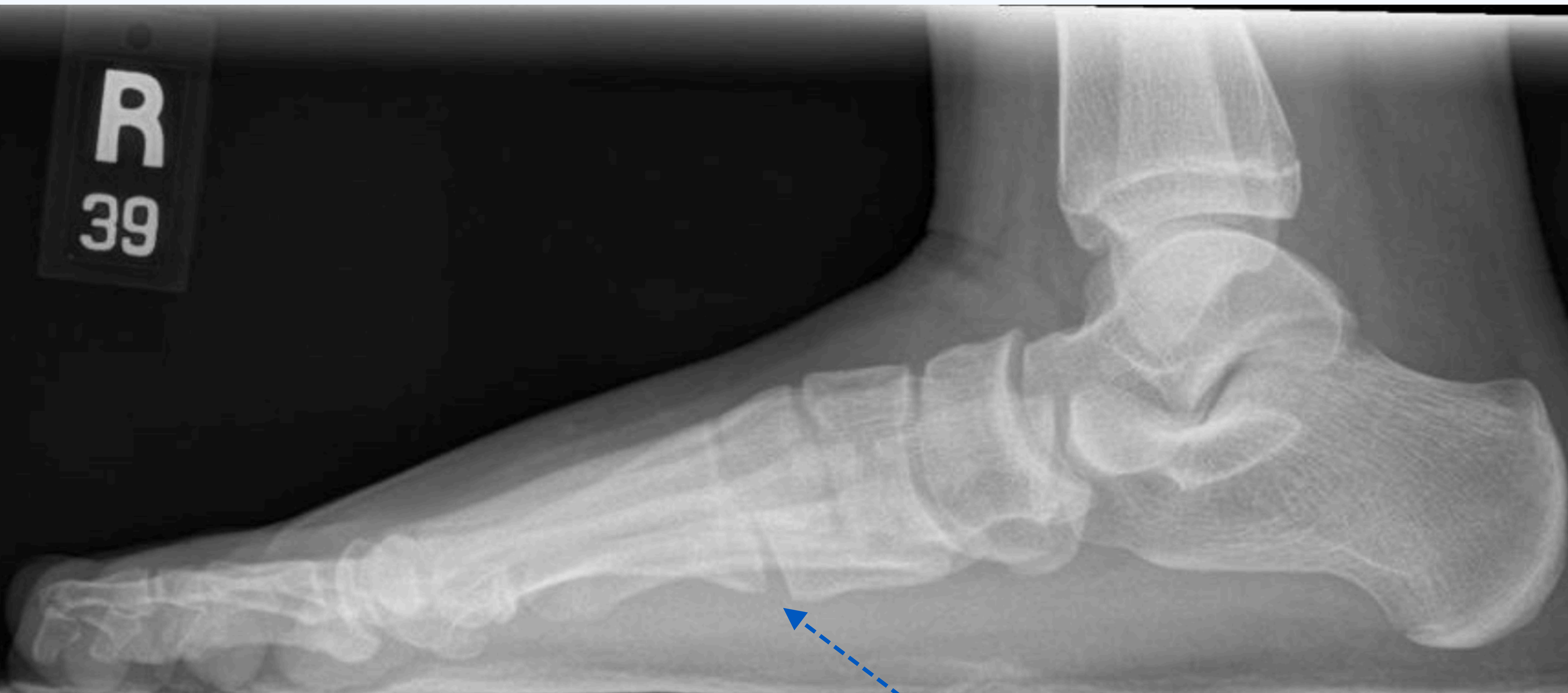
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WT BEARING

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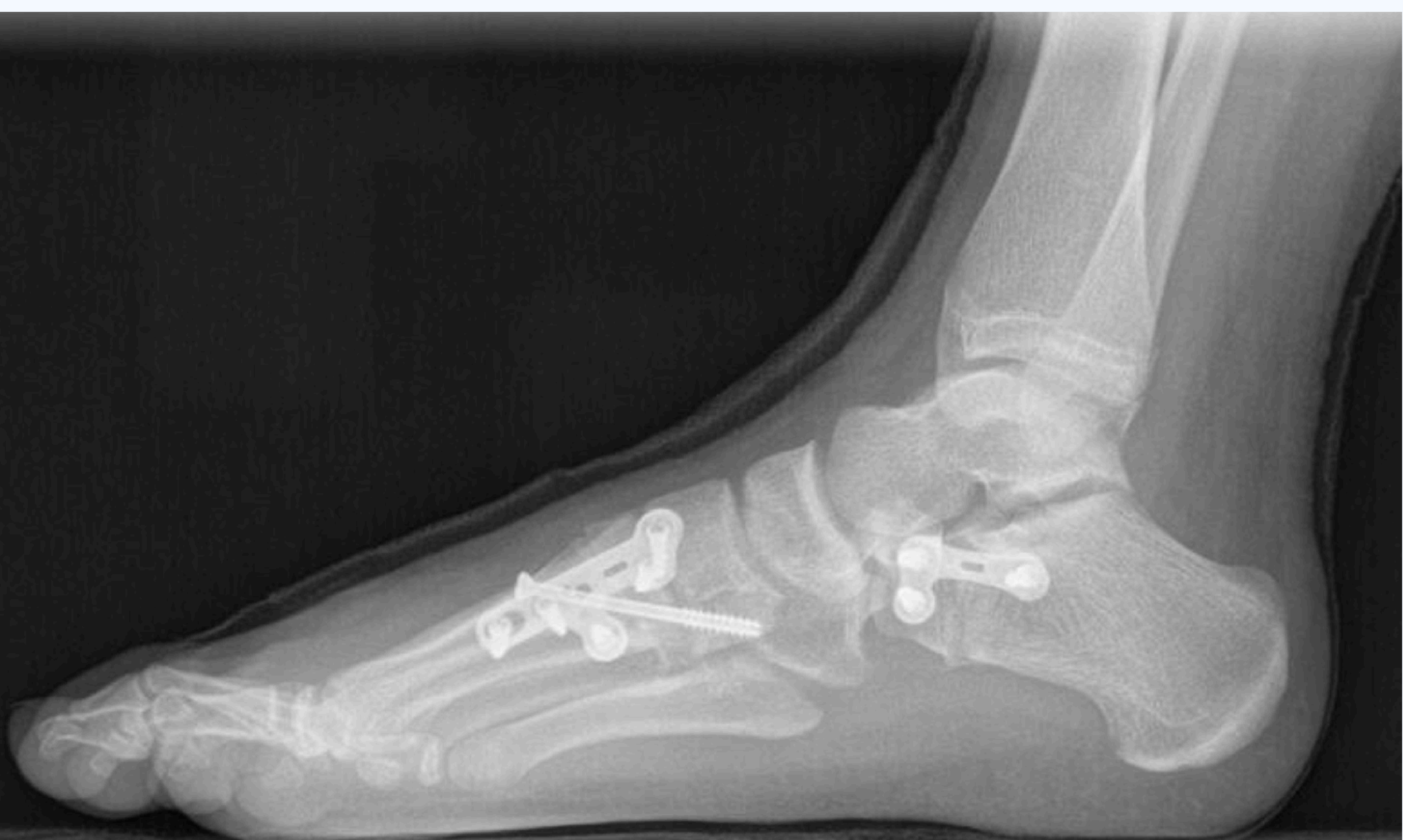
WT BEARING

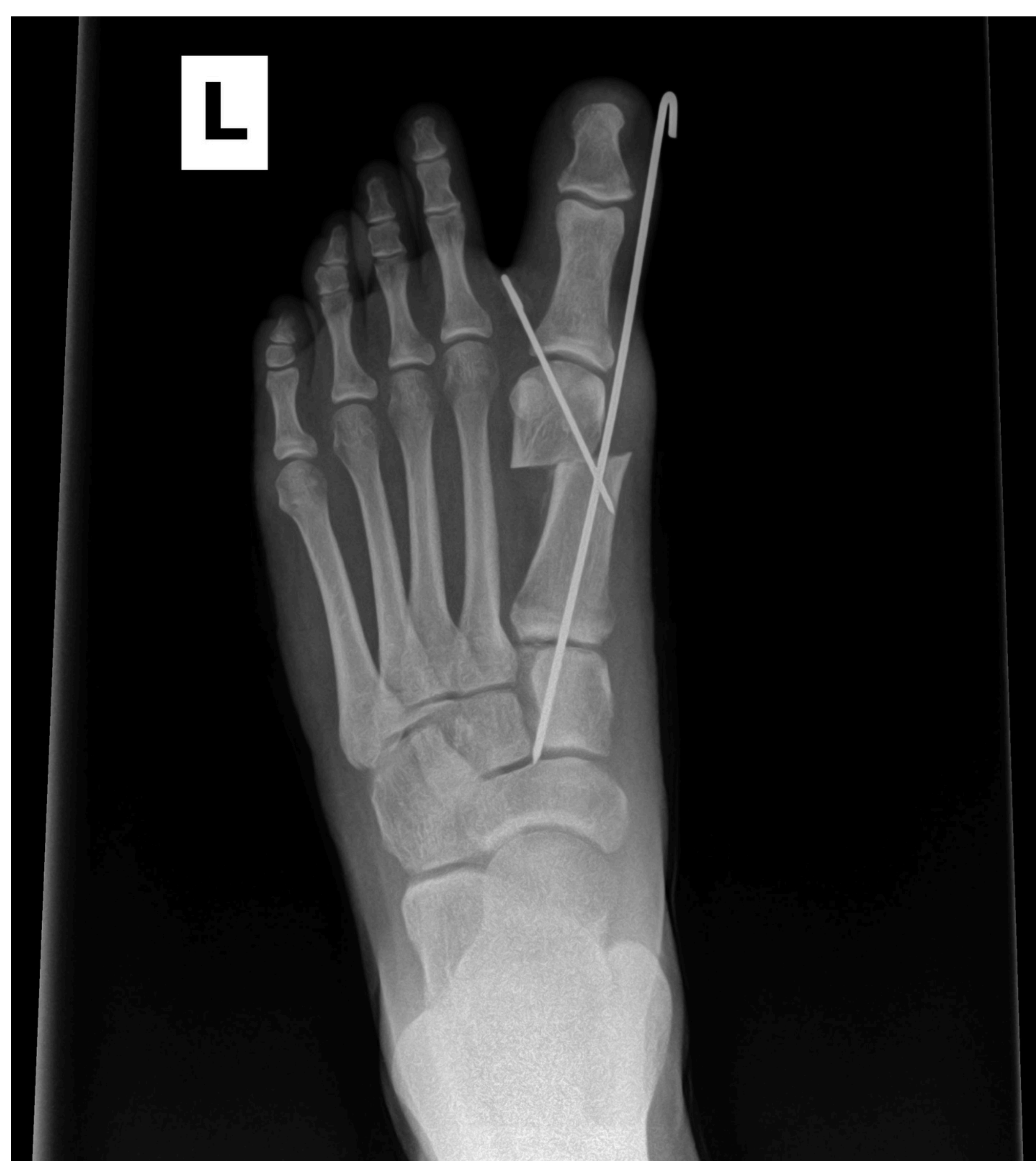


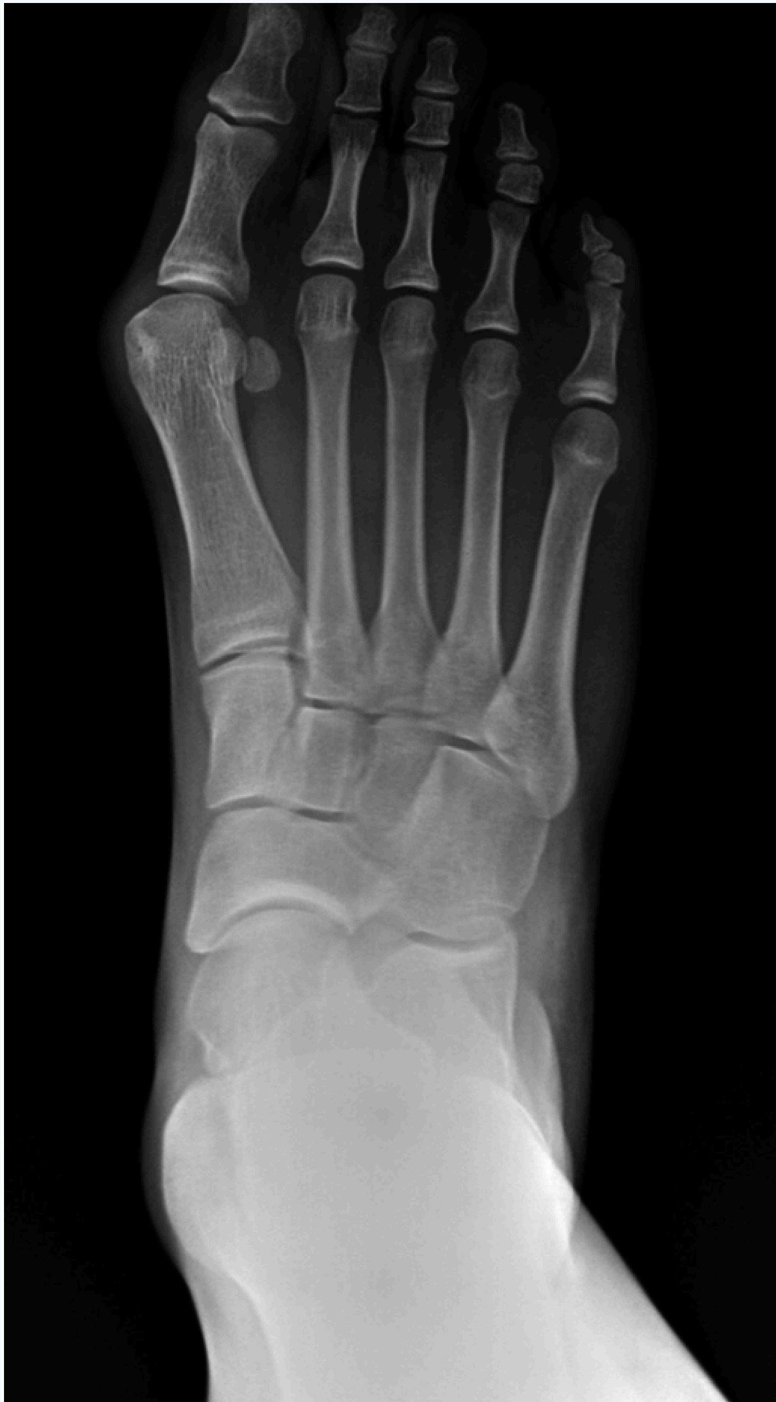
SERI
Case #2.

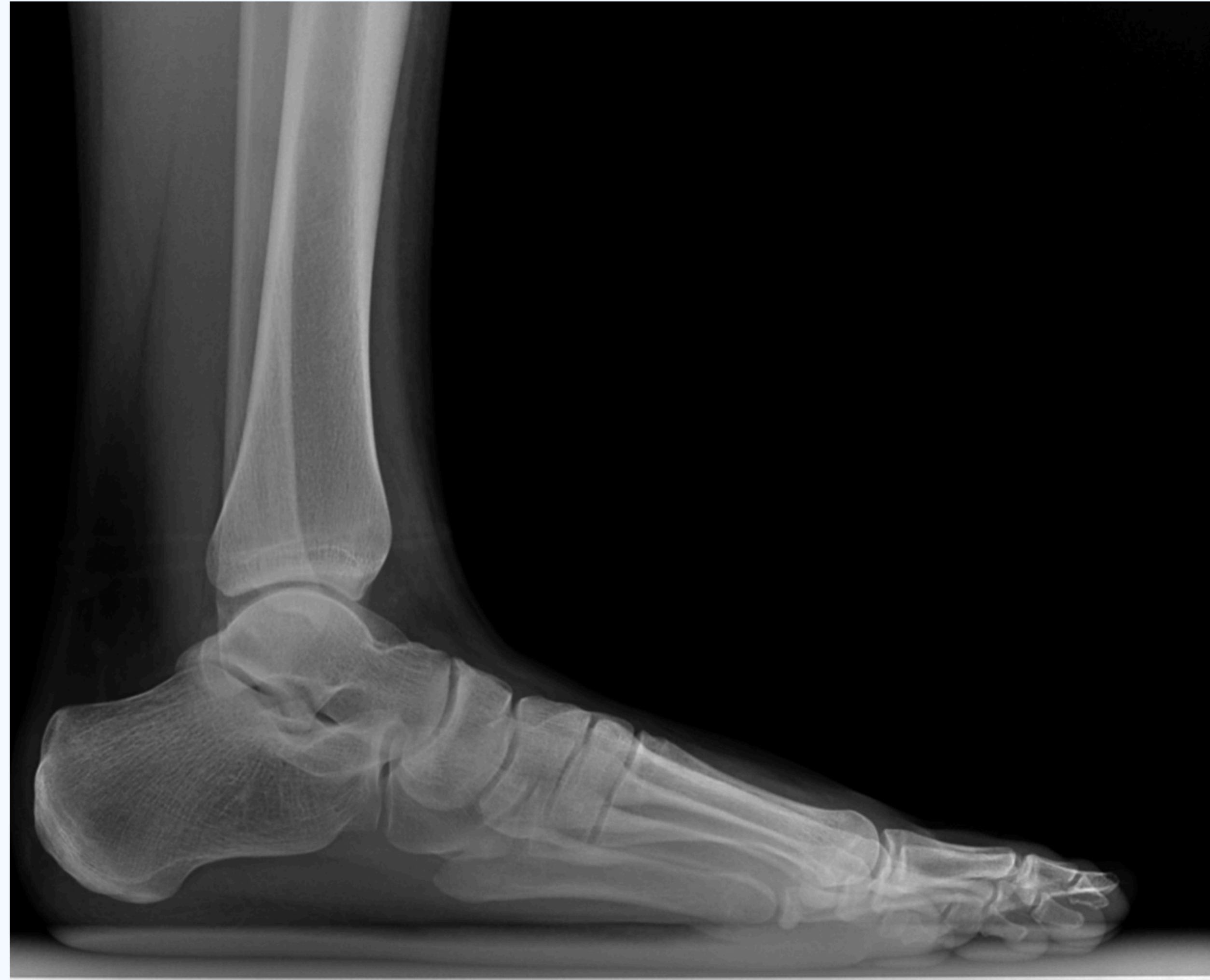
15 y/o F with HAV, PCFD, Equinus

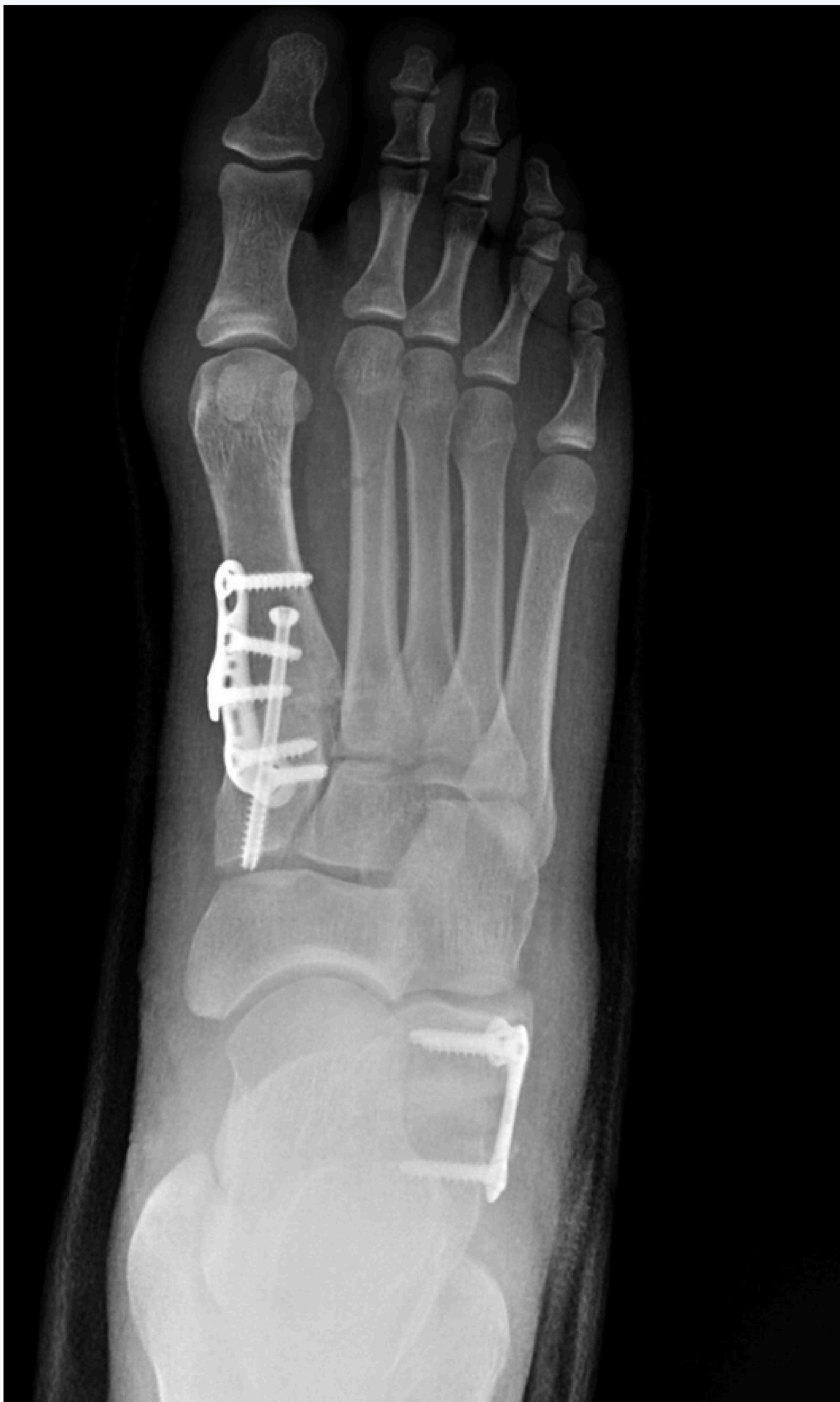
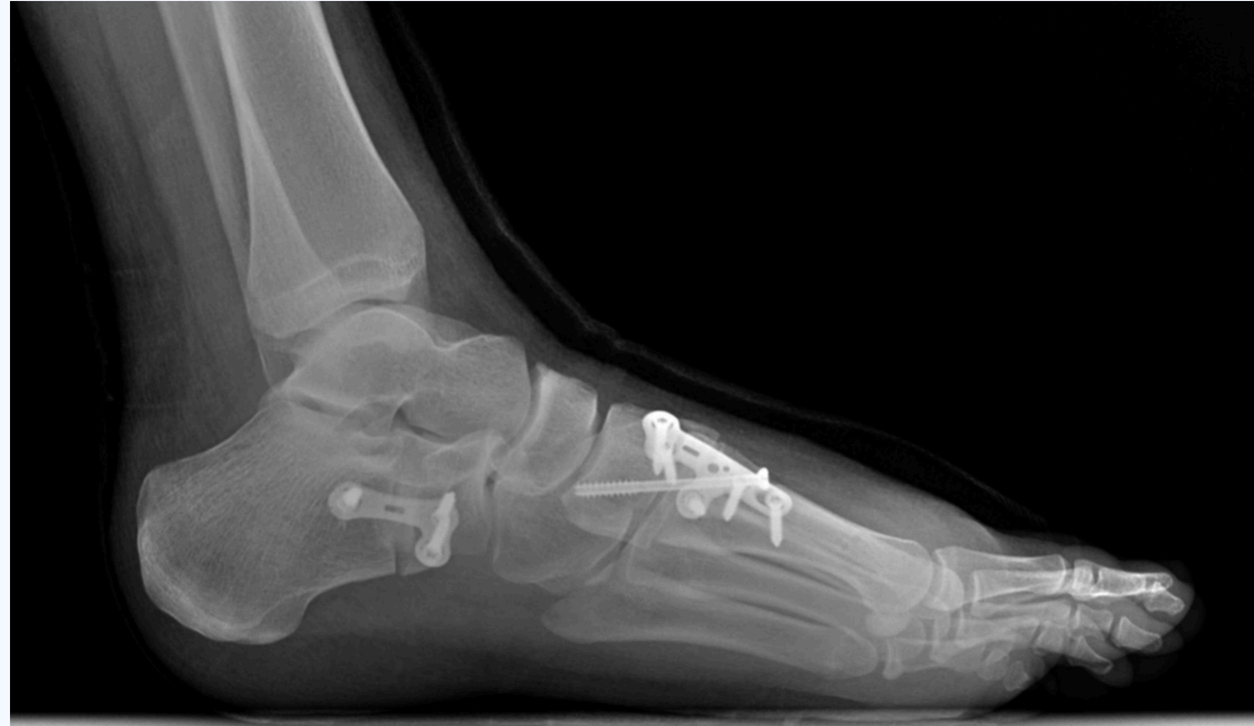
Procedures - Gastroc recession, Evans, Lapidus

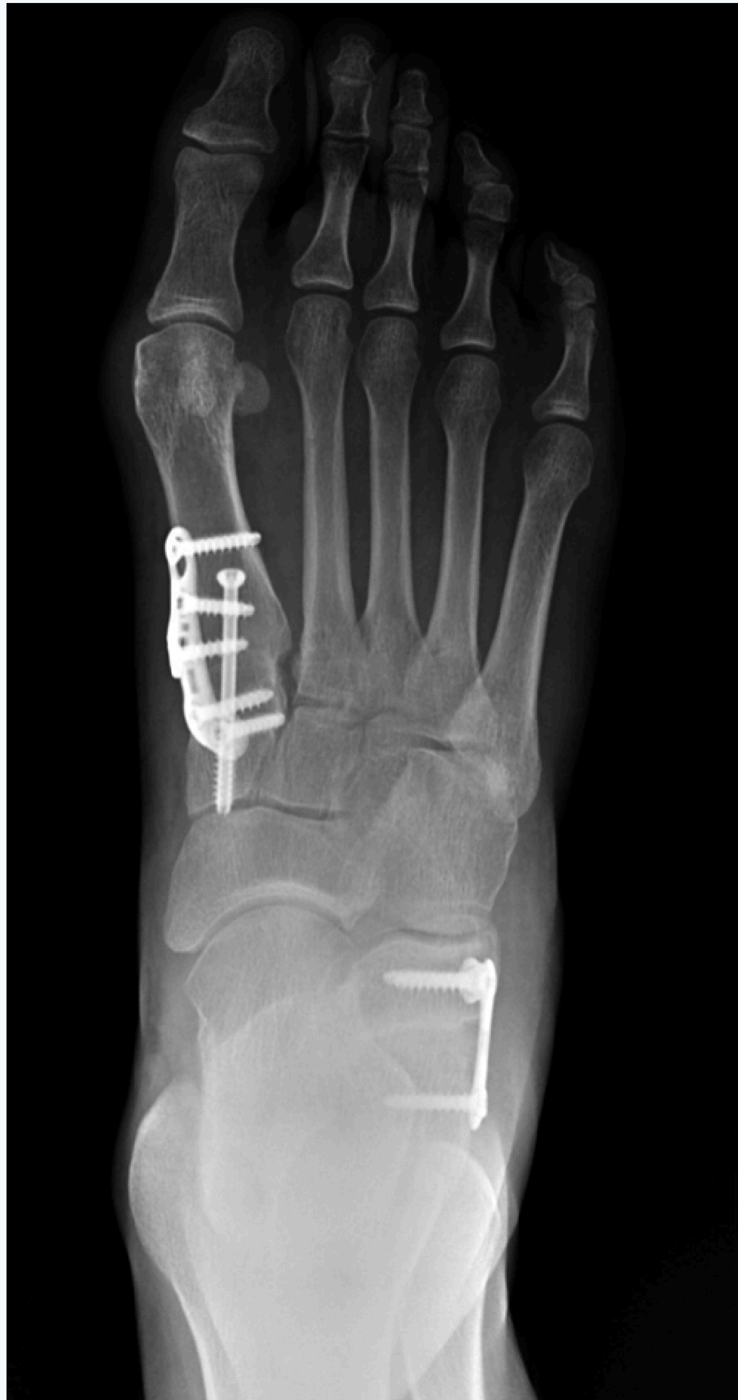
Follow-Up Procedures - HWR, SERI

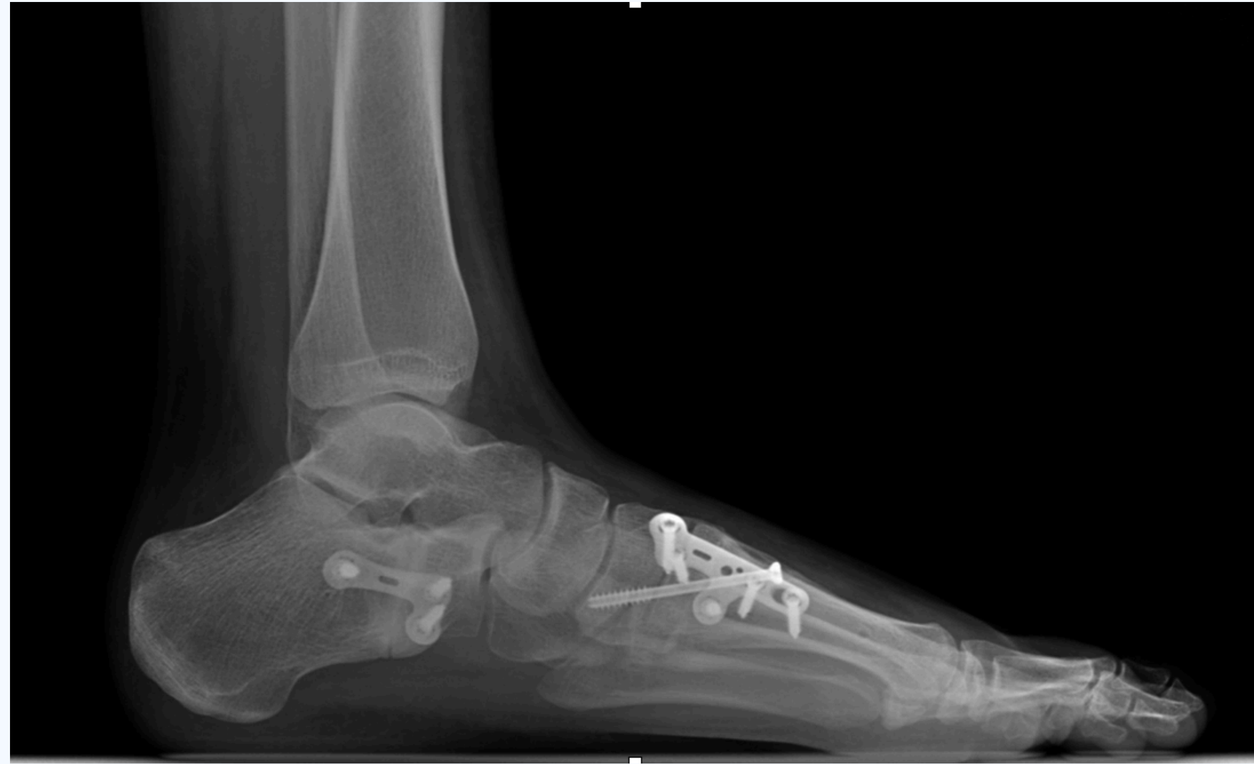


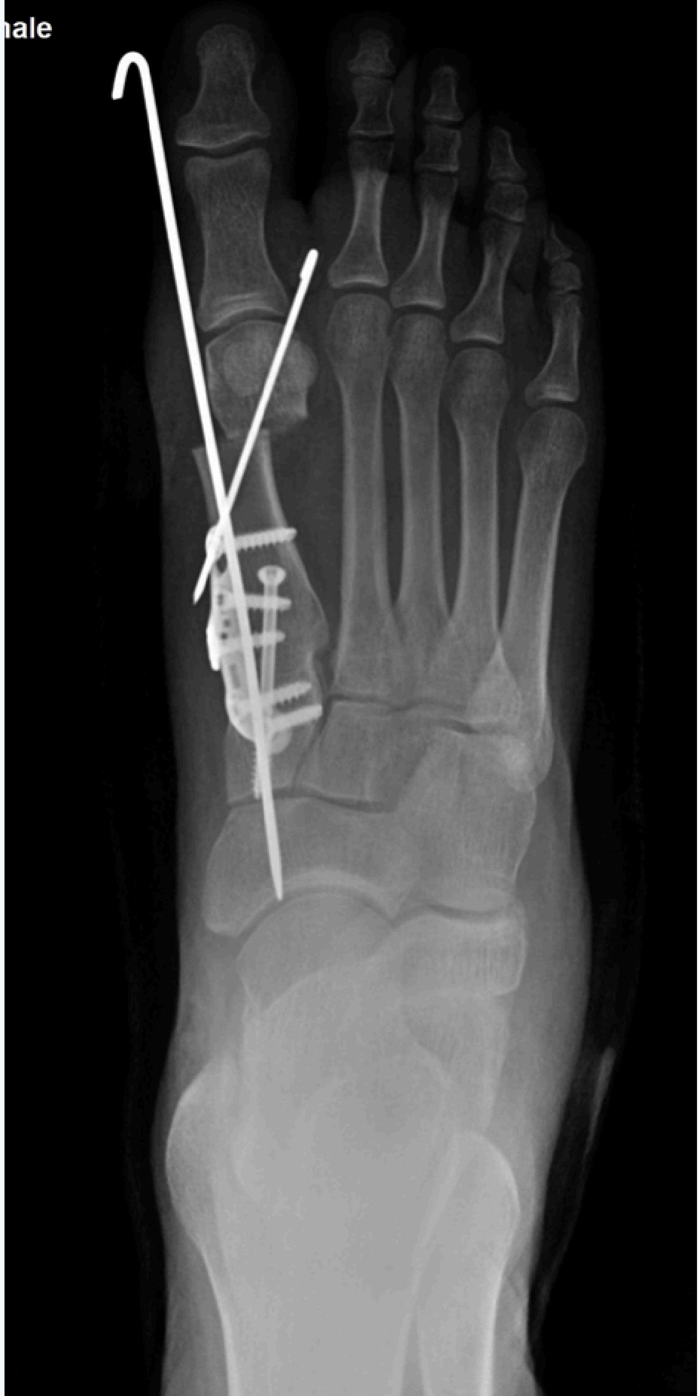


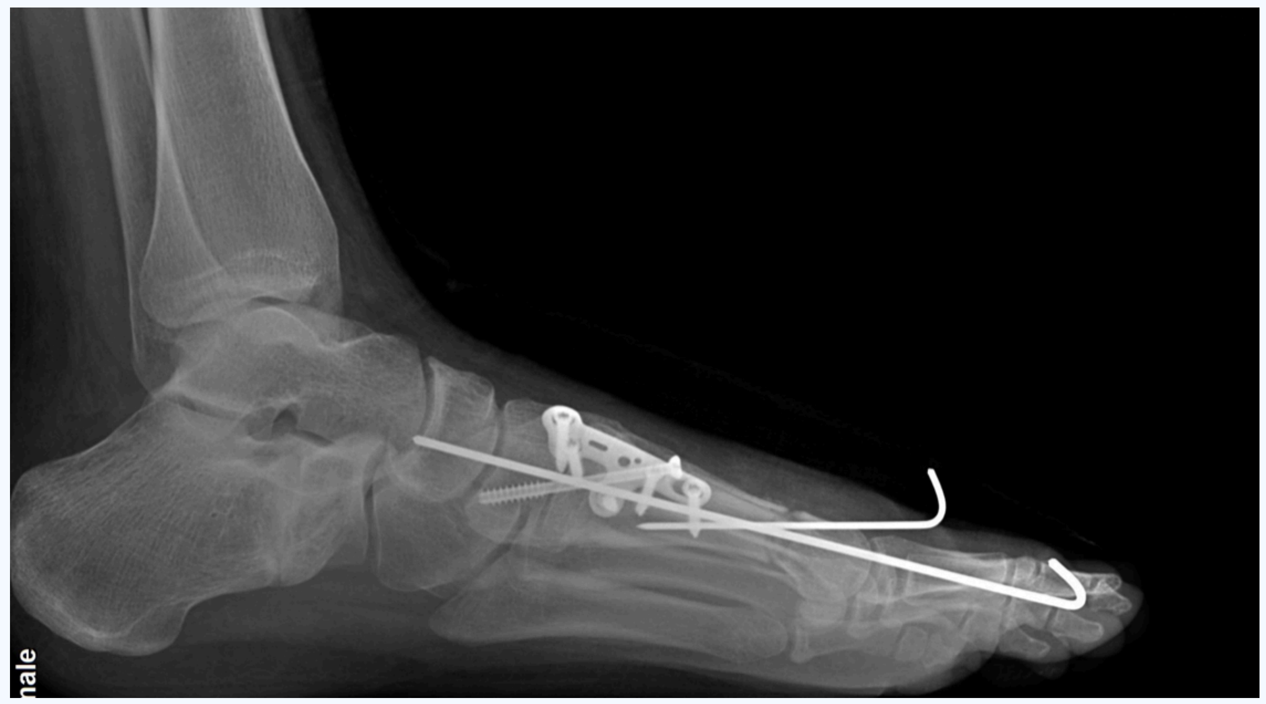


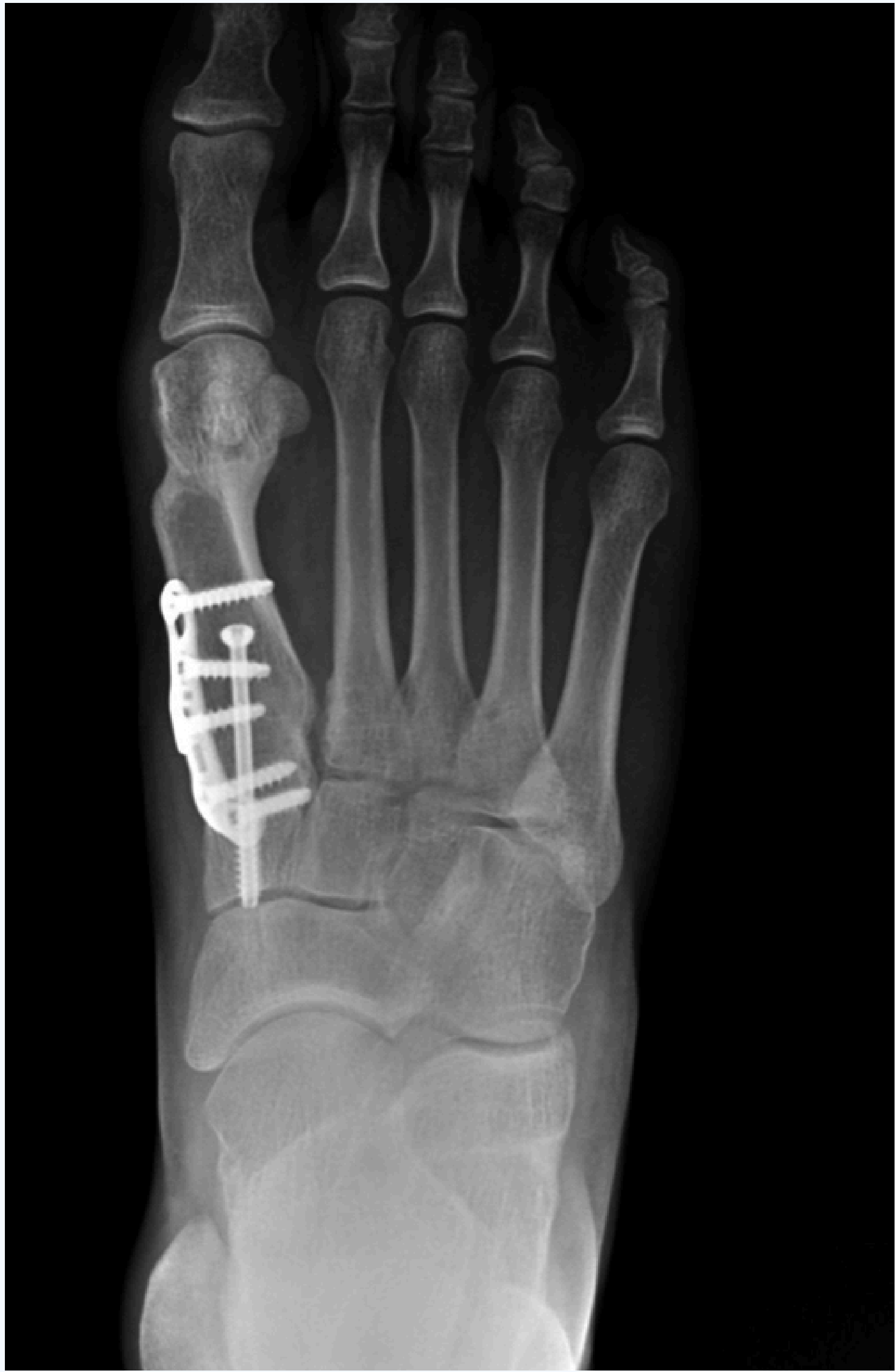



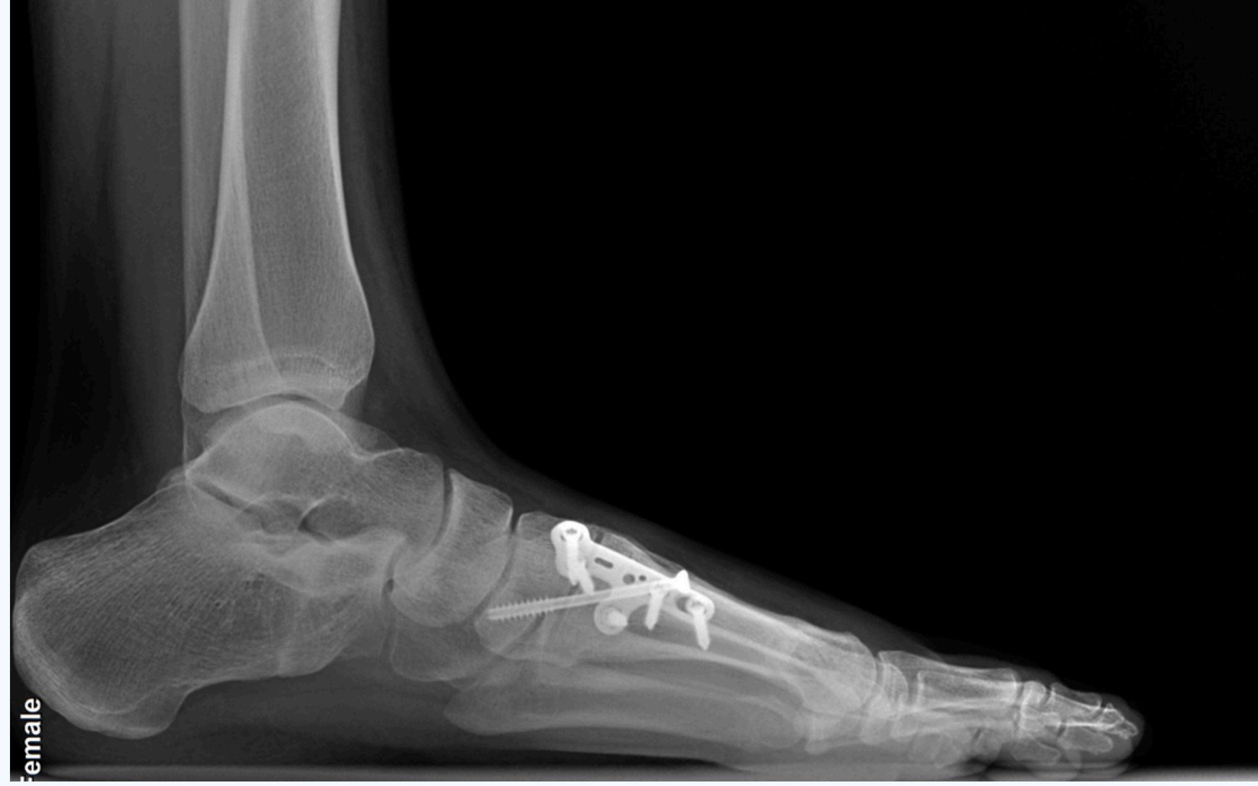








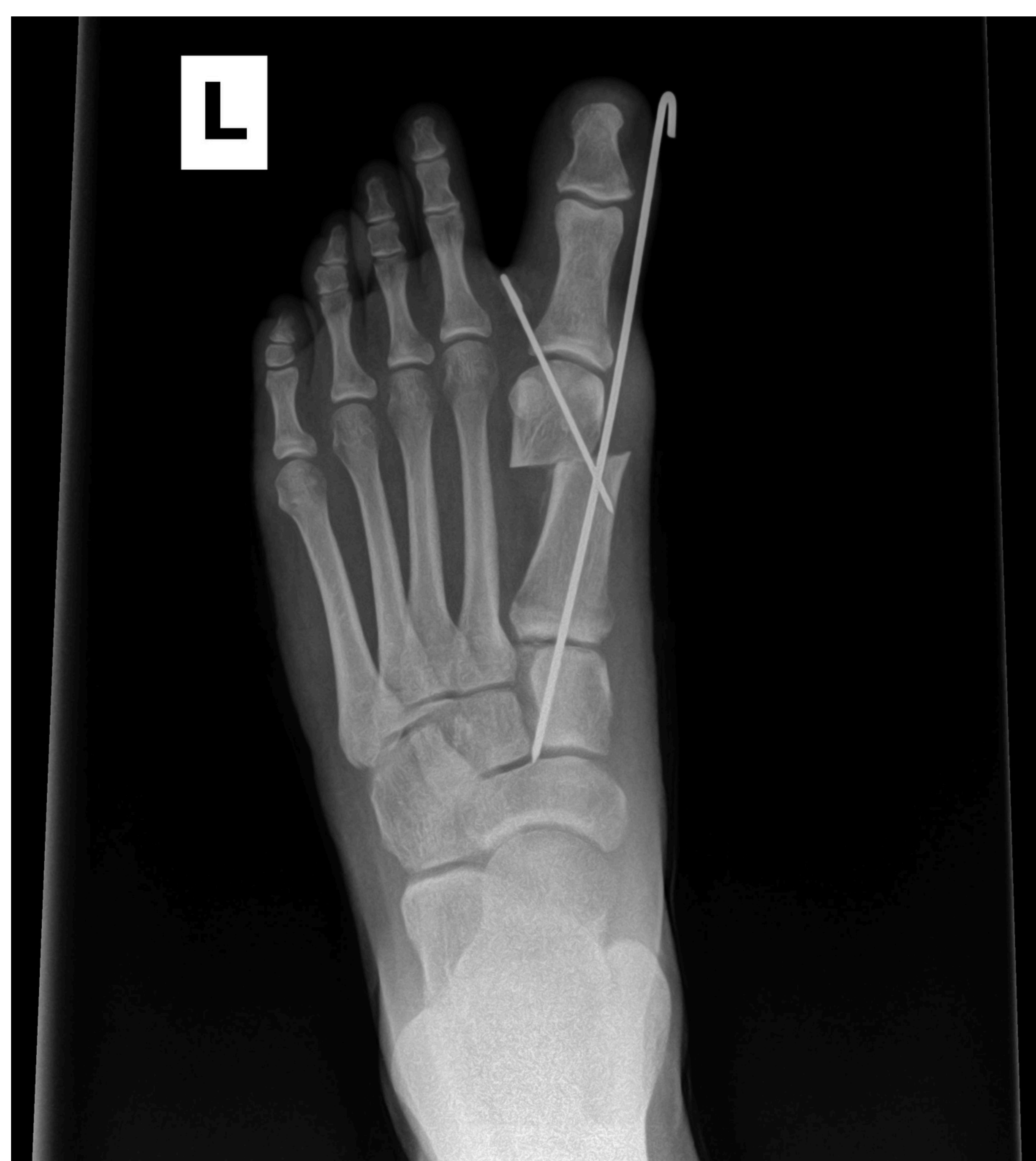


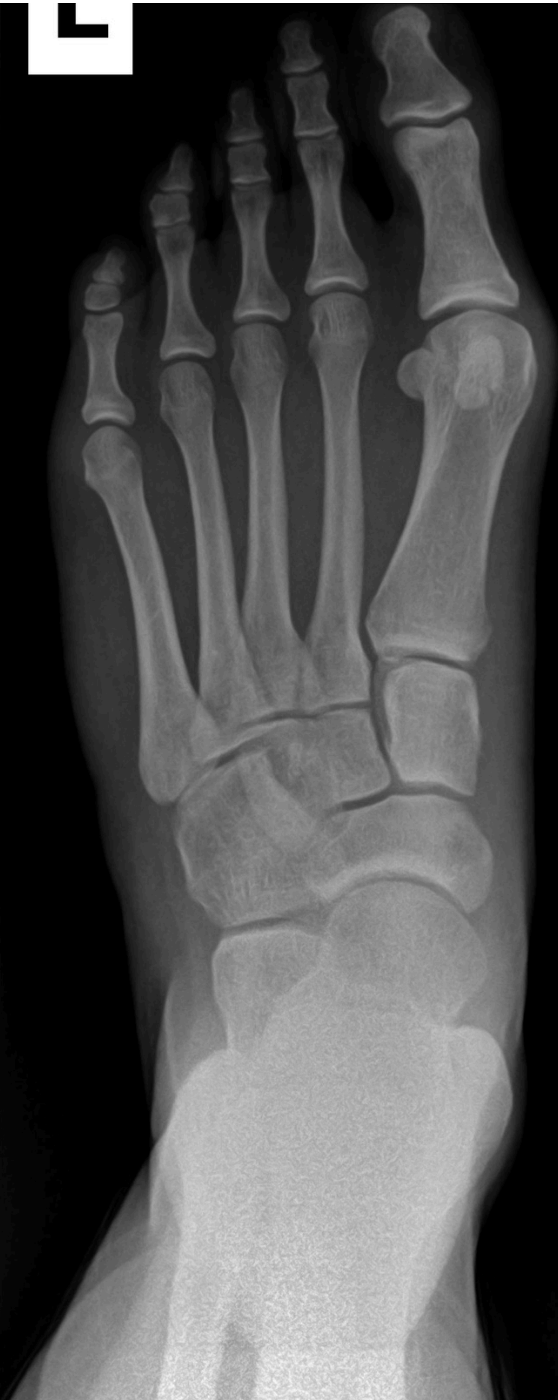


SERI
Case #3.

17 y/o F with HAV (elite tennis player, had to both feet simultaneously due to college recruitment and upcoming season)

Procedures - SERI B/L

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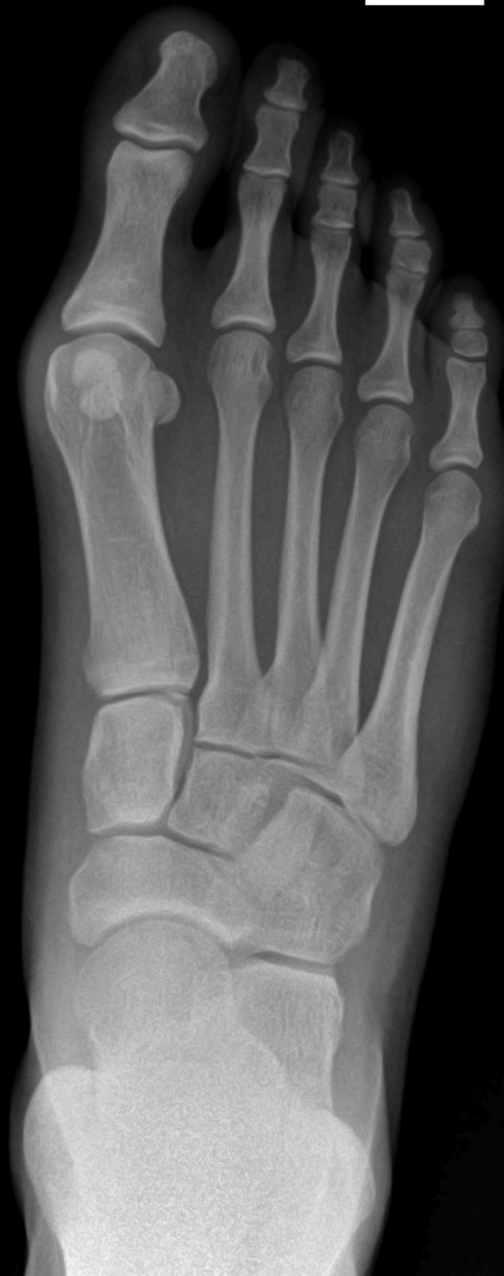
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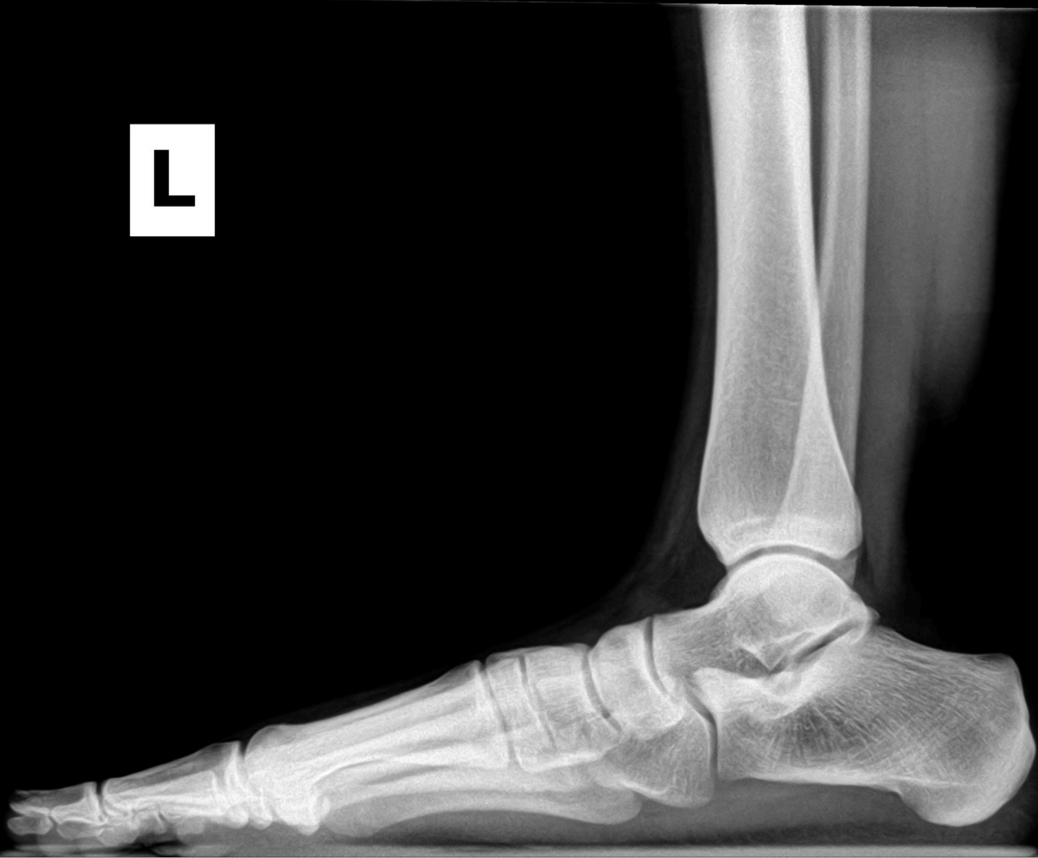
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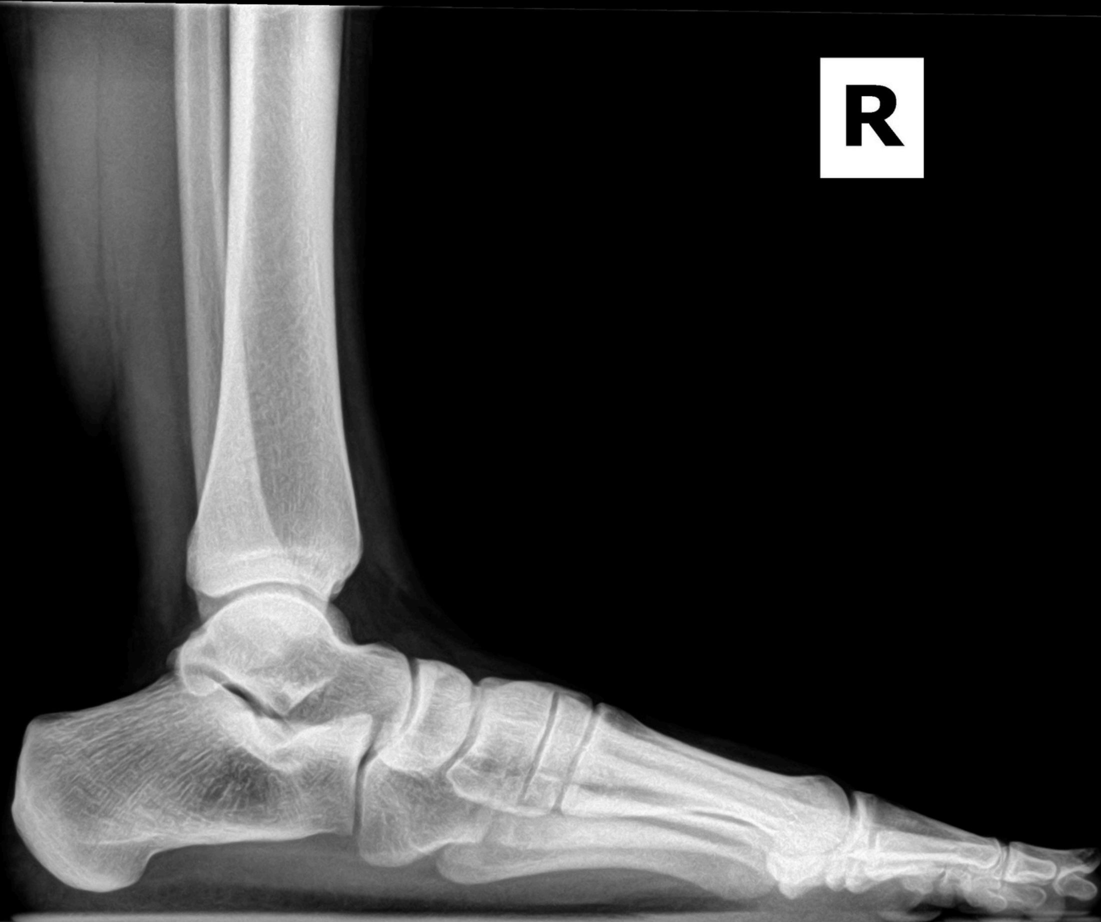
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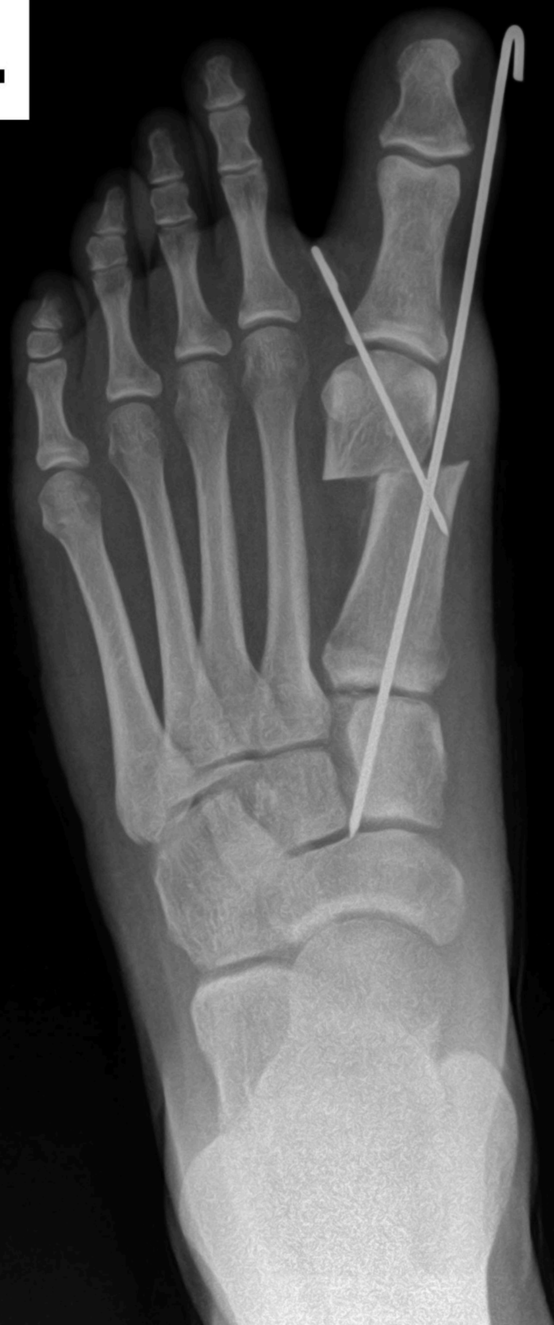
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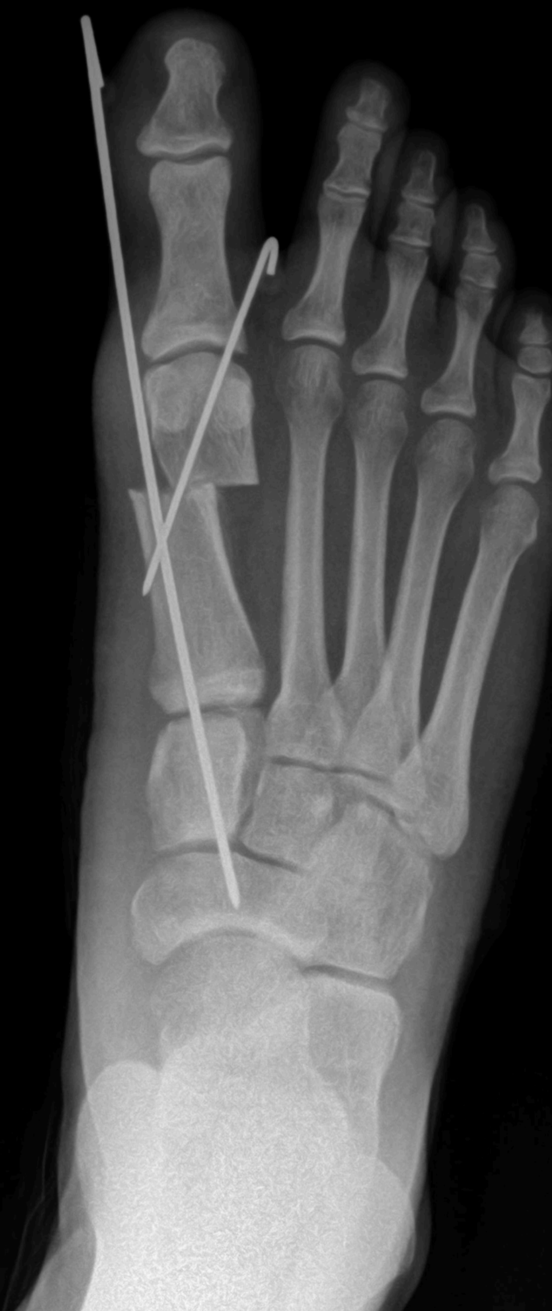
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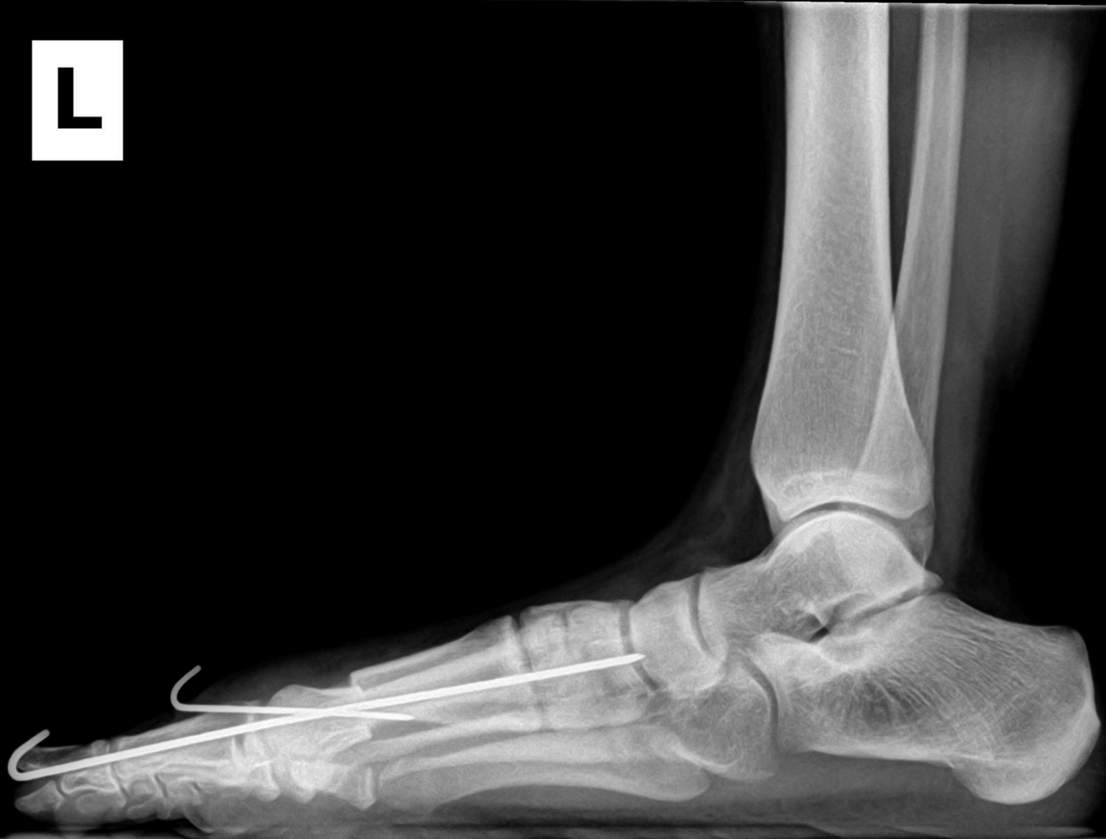
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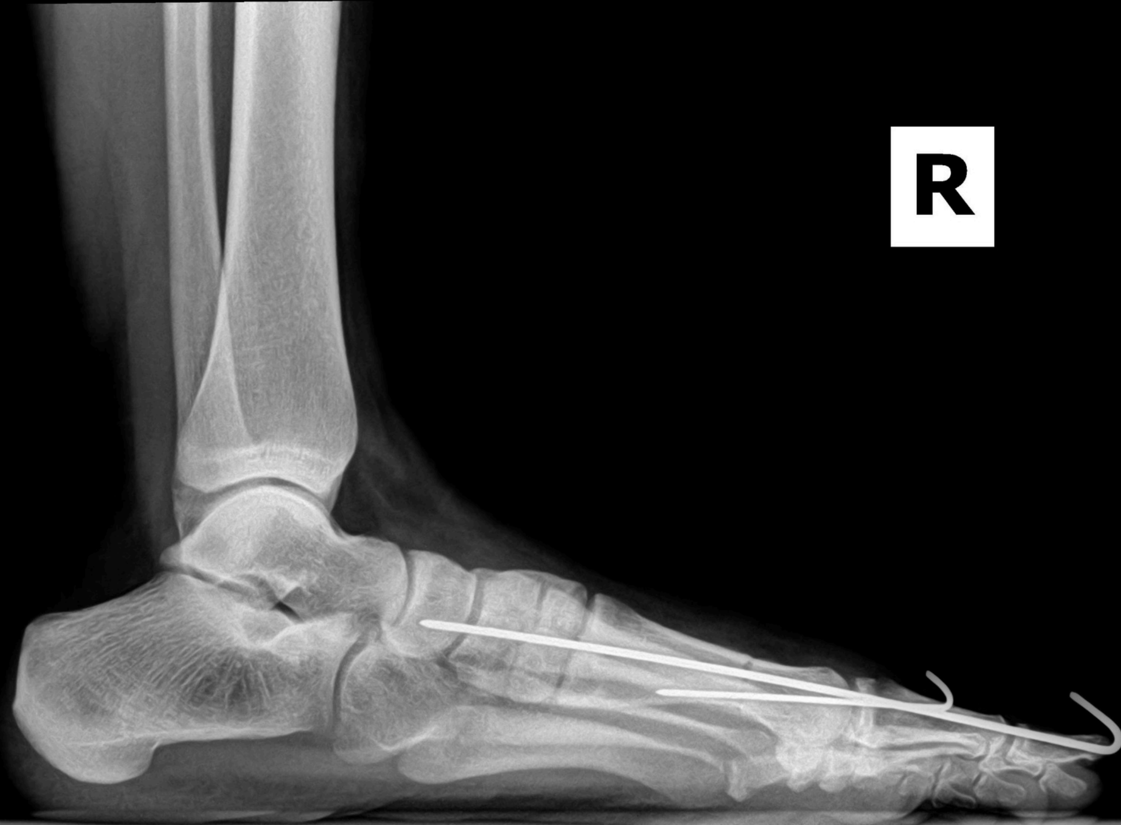
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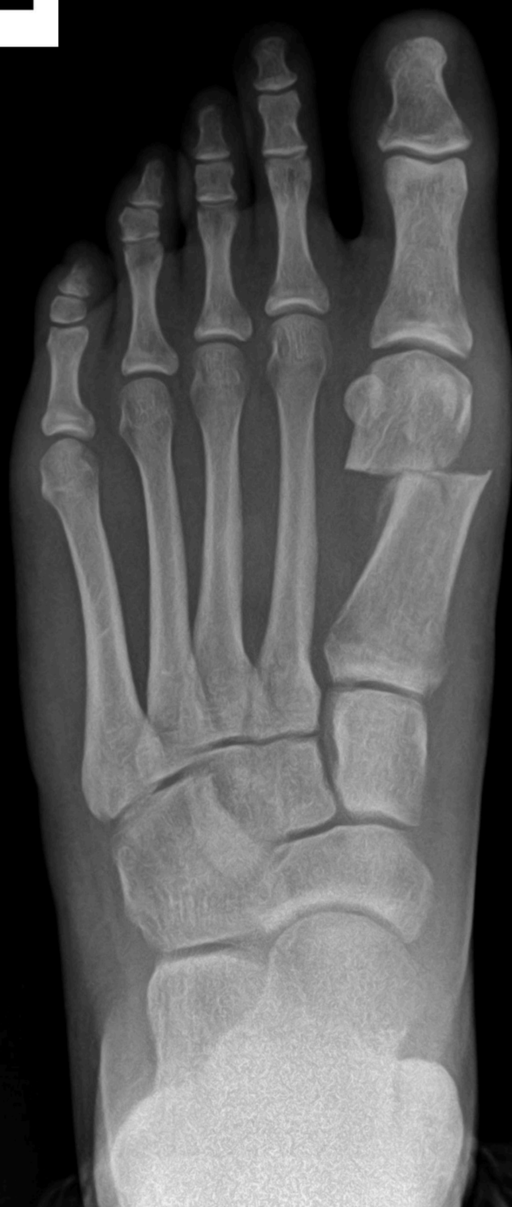
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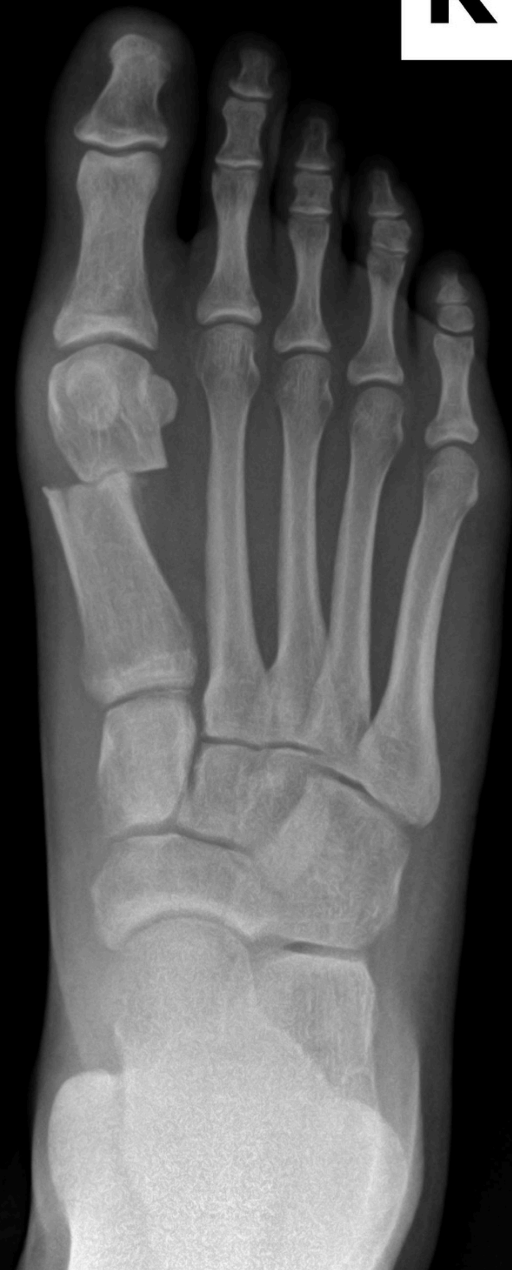
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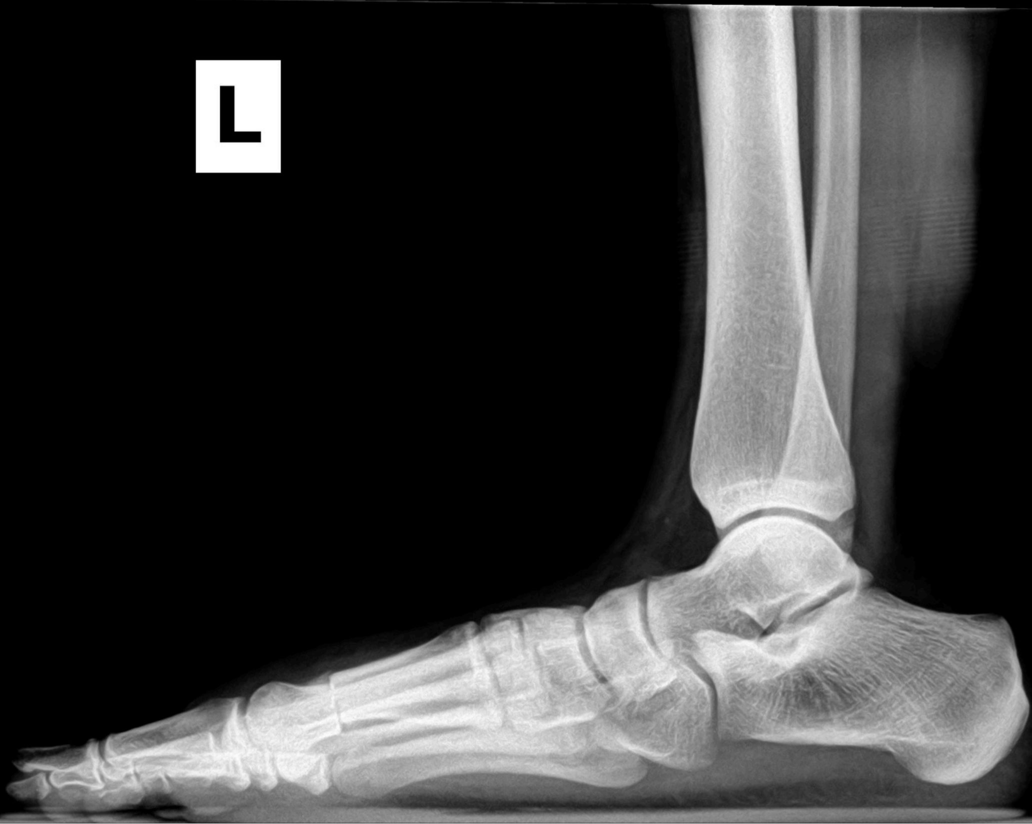
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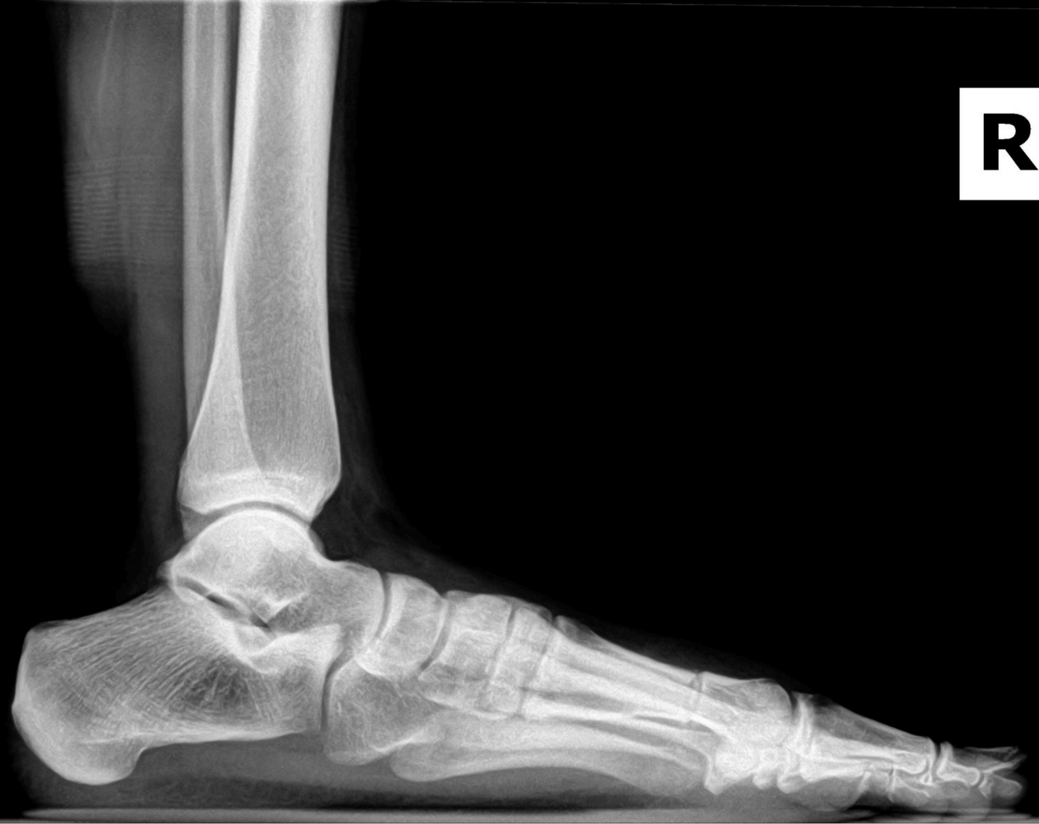
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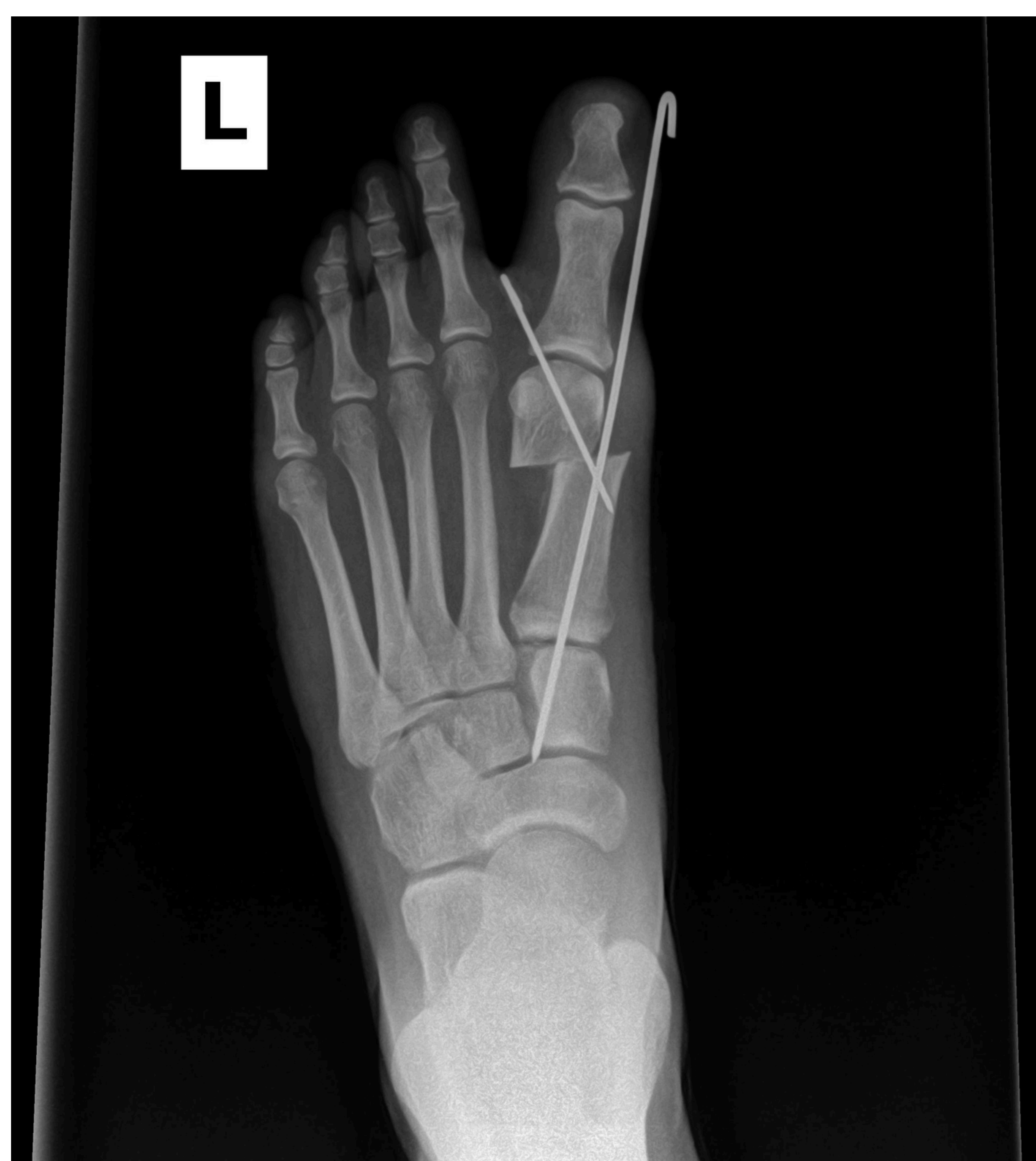
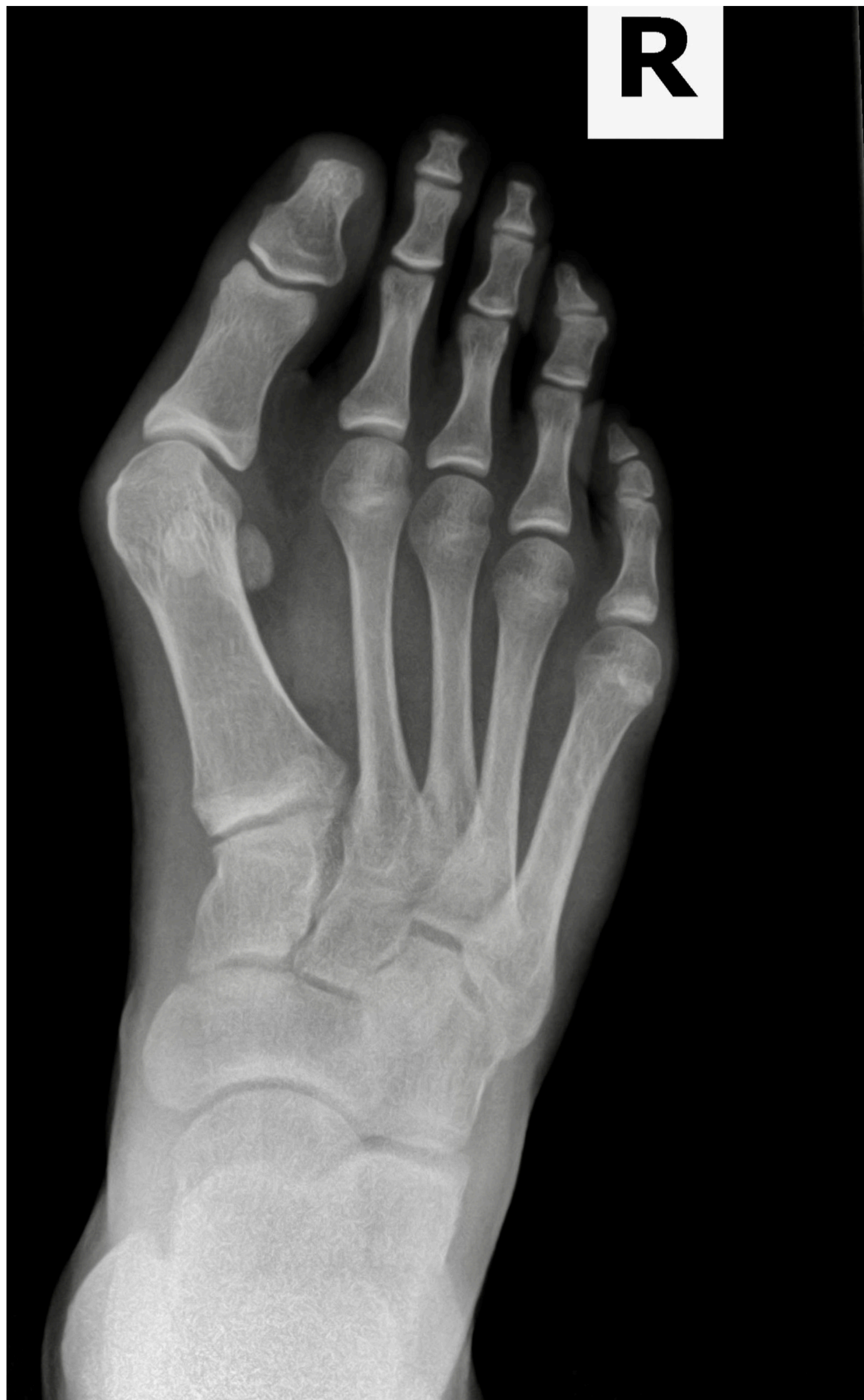
SERI
Case #4.

16 y/o M with HAV

Procedures Right - Lapidus, SERI

Procedure Left - SERI

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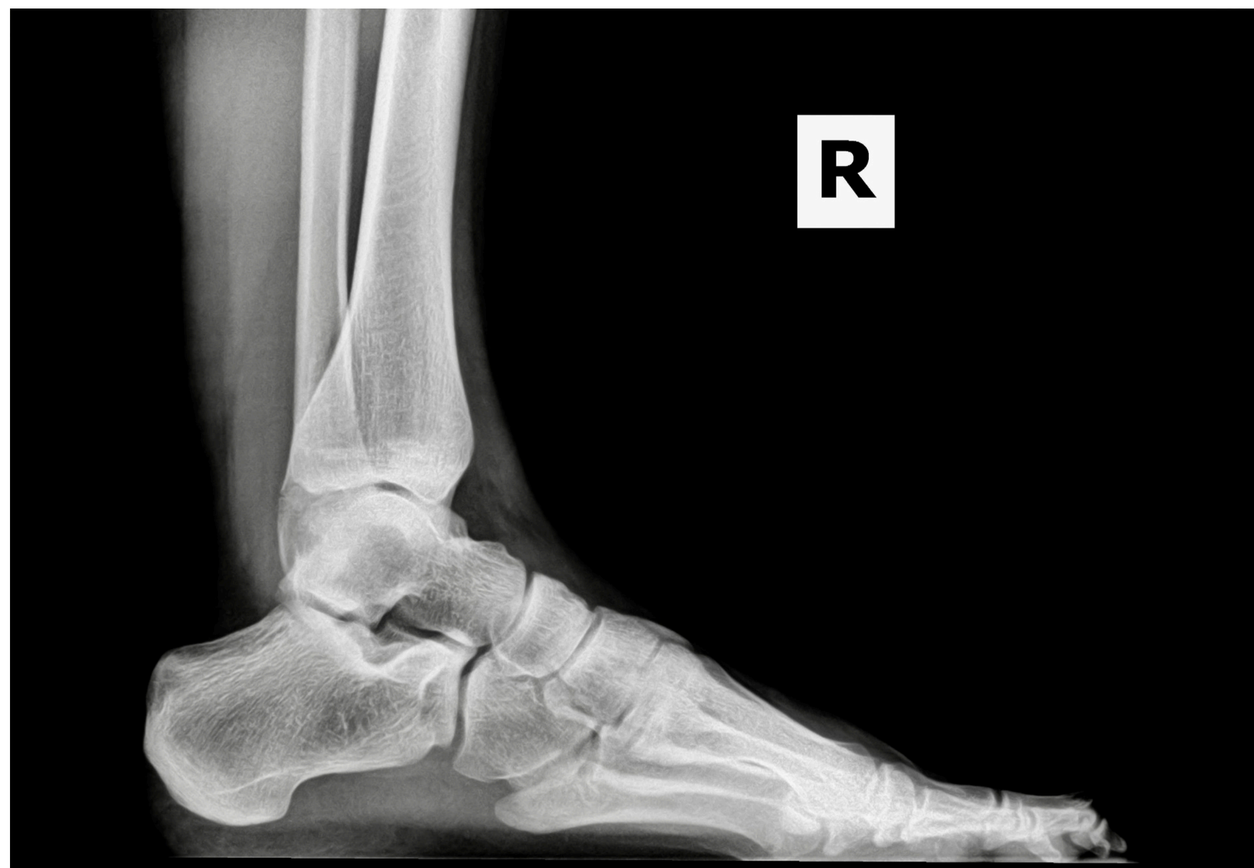
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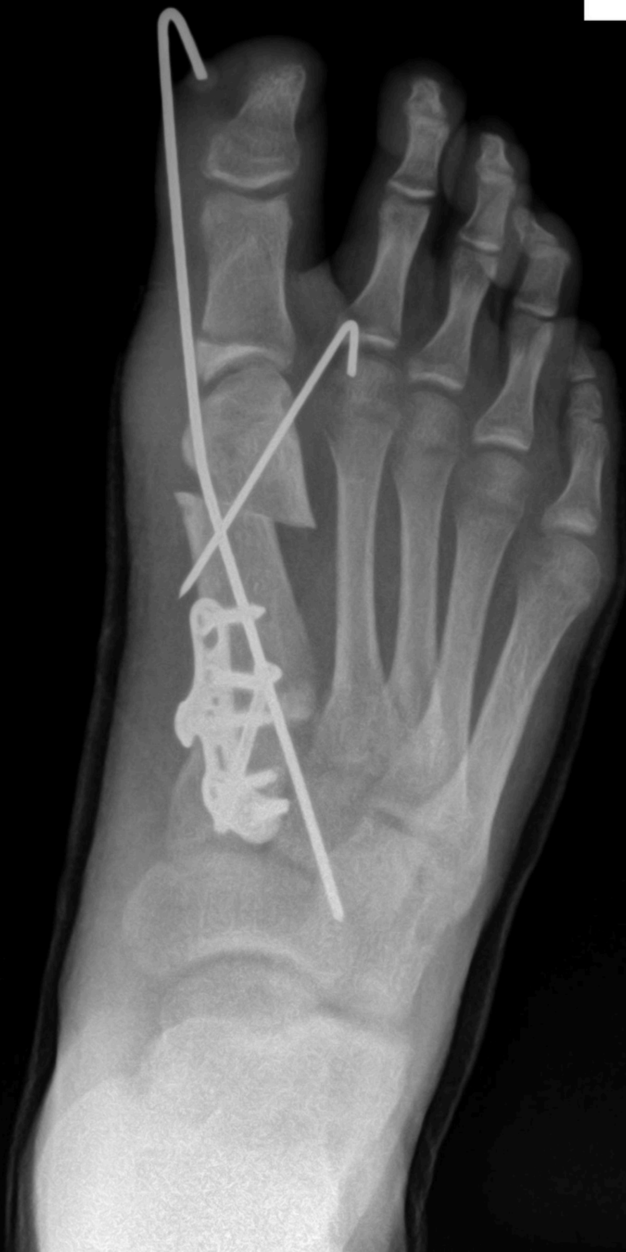
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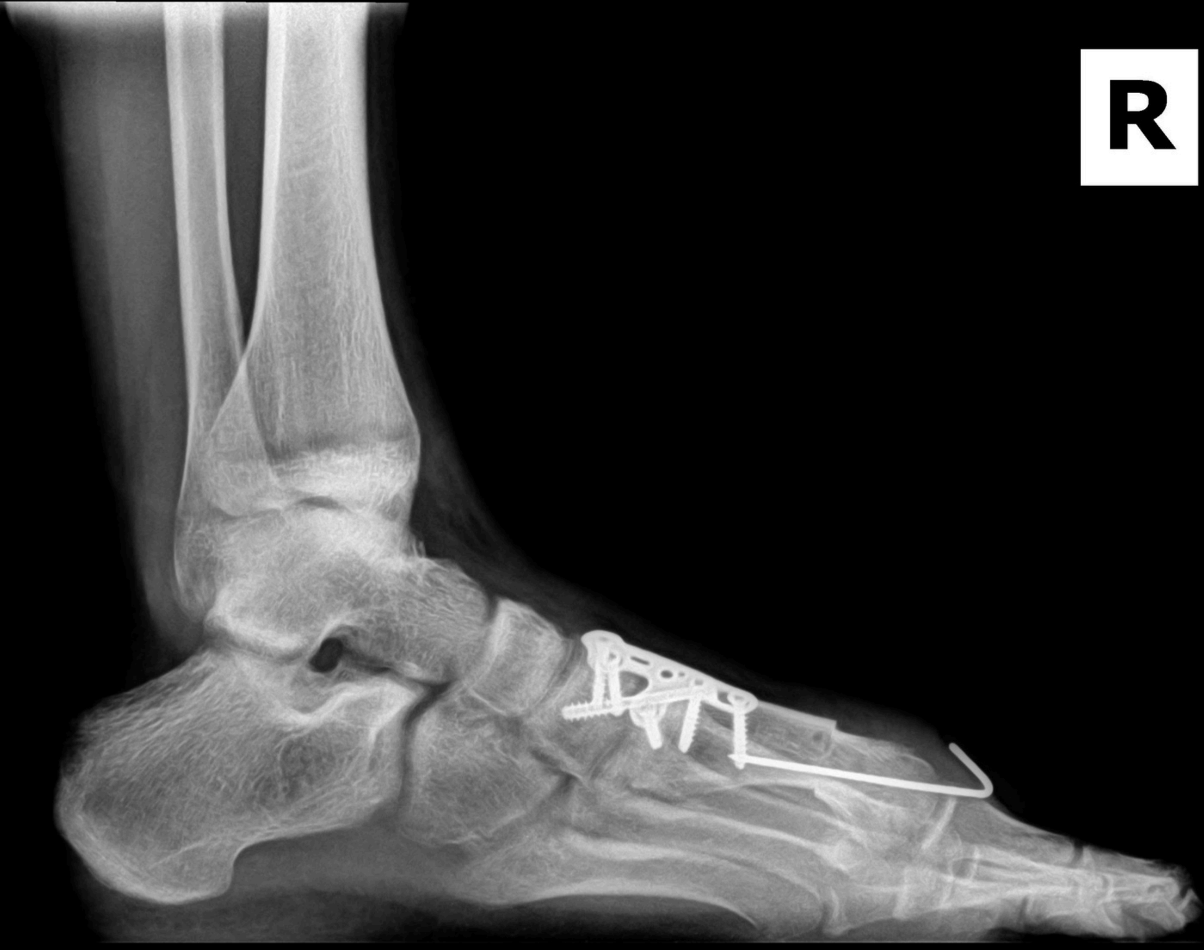
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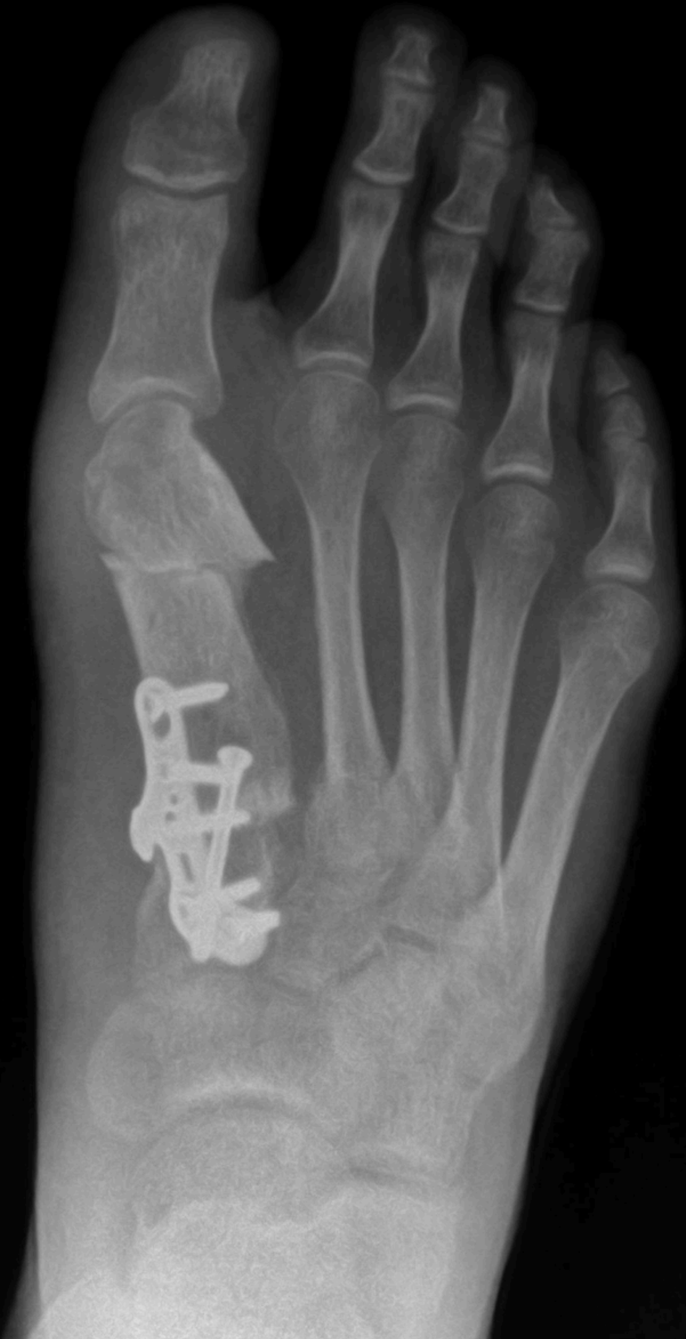
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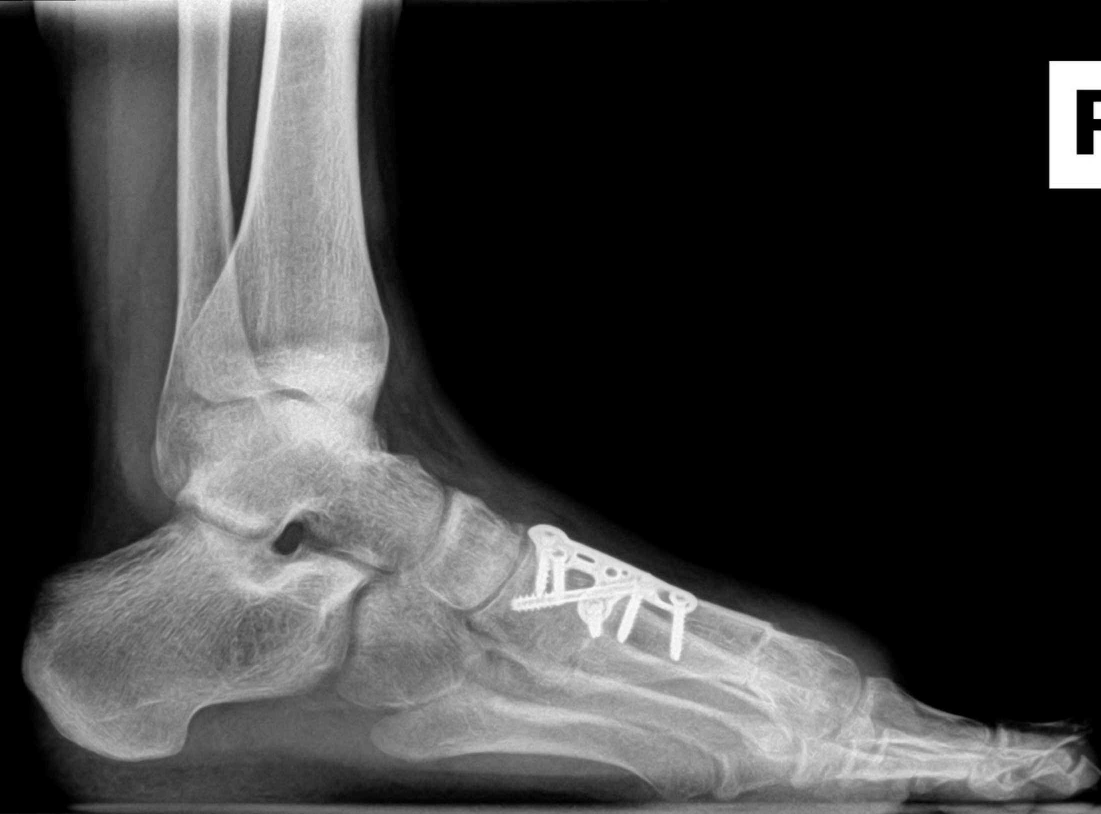
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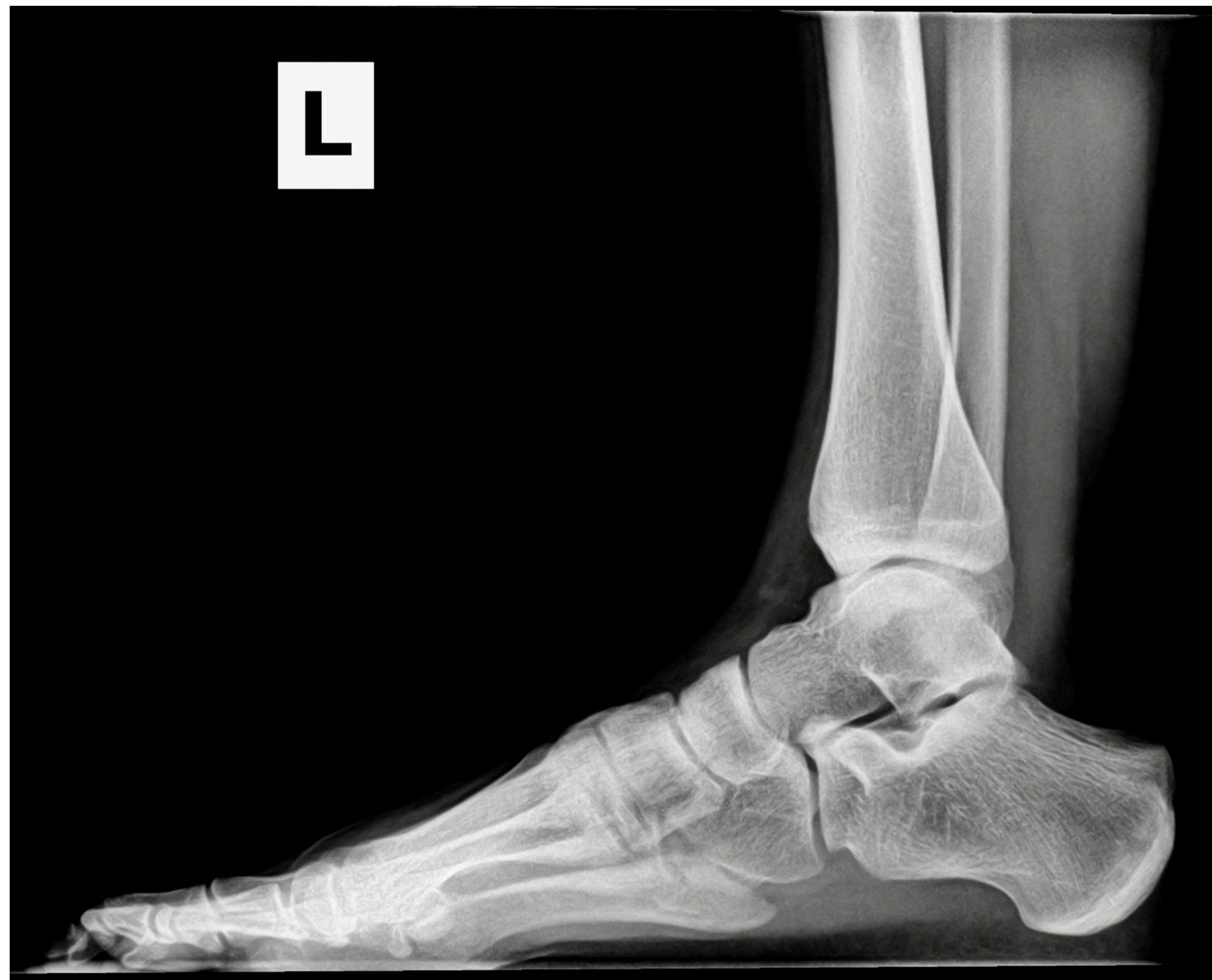
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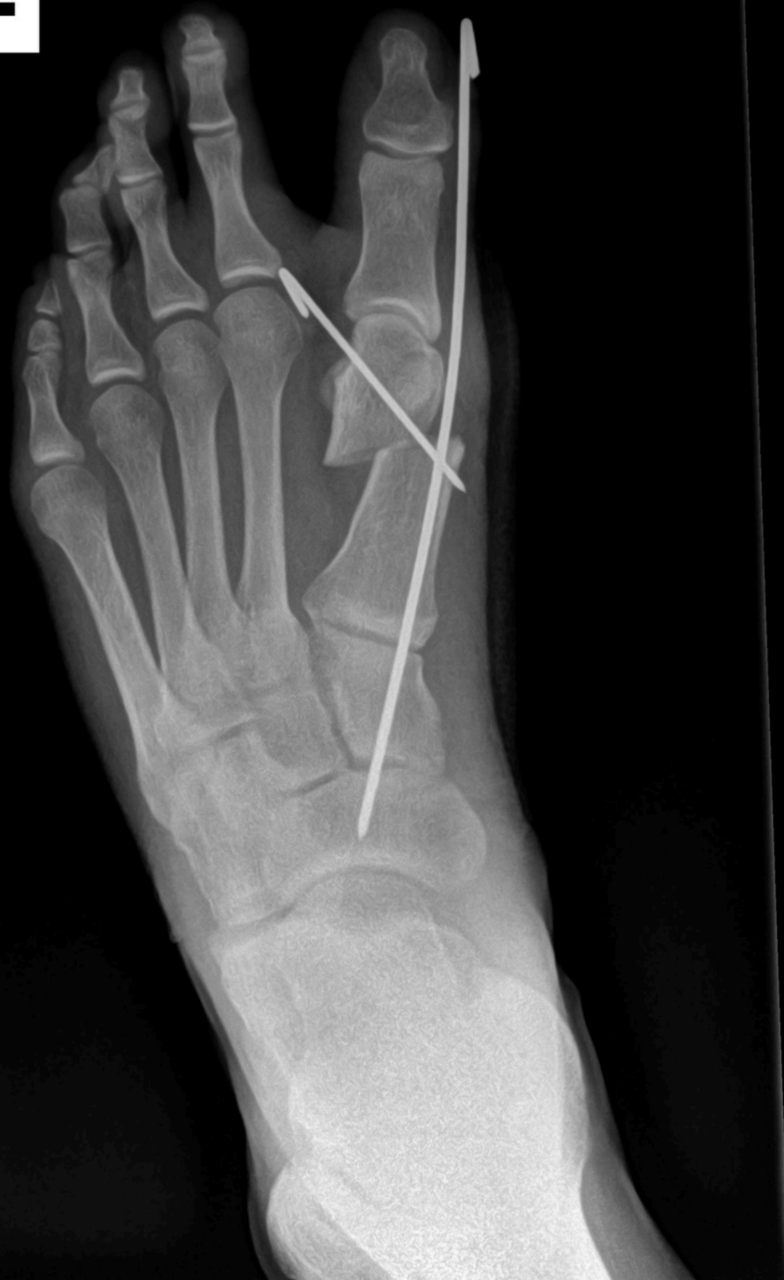
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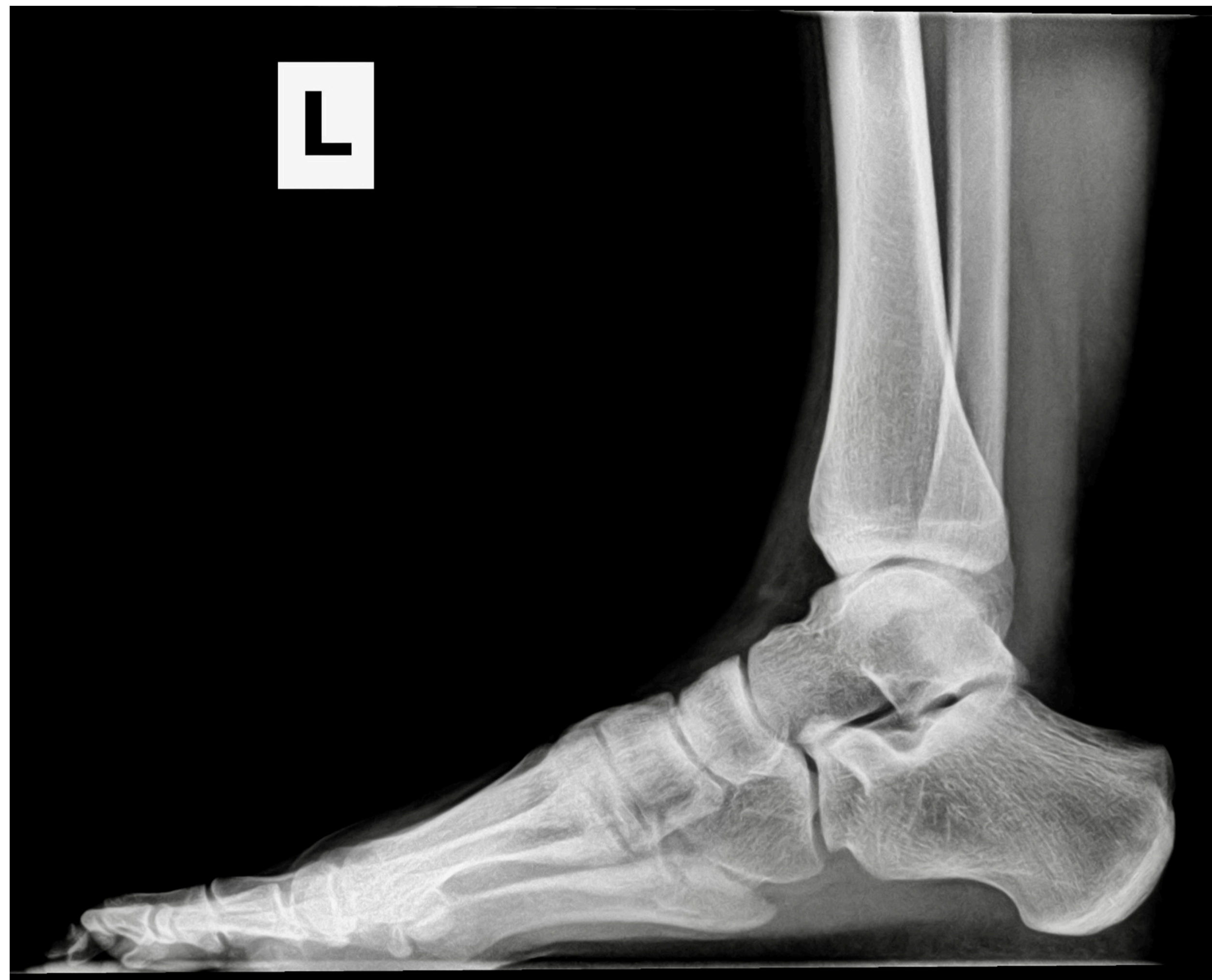
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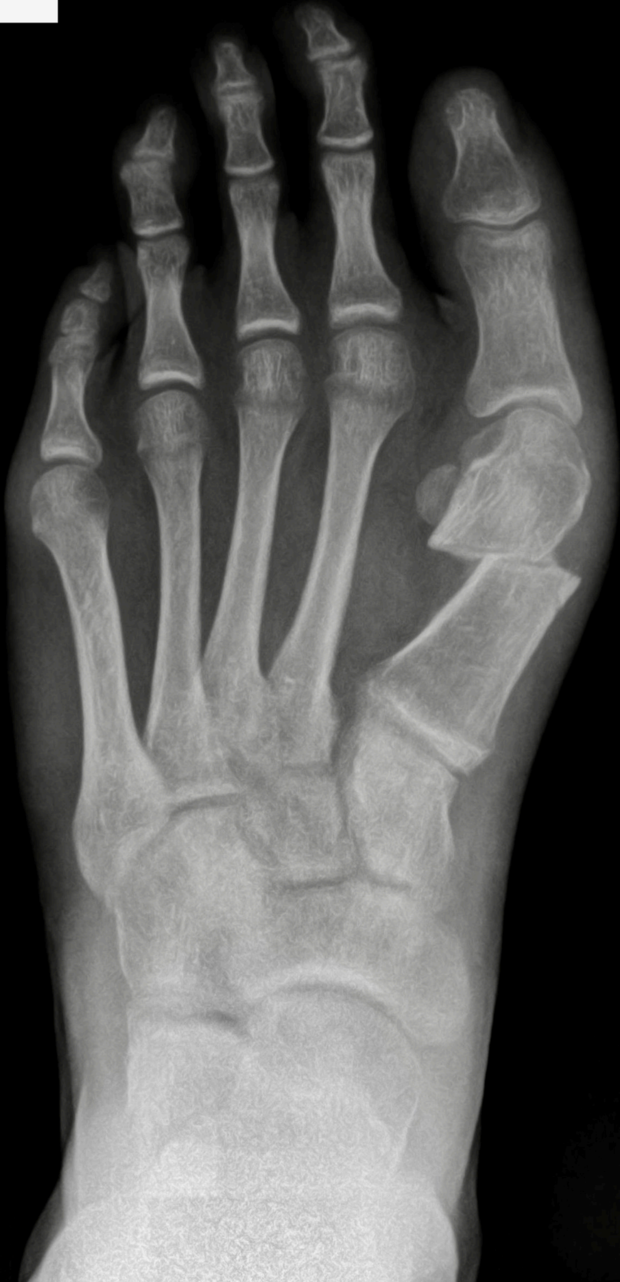
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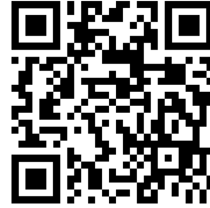

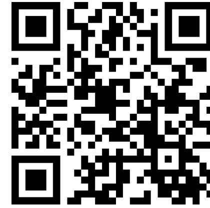

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