

Diagnosis and Treatment of First Metatarsophalangeal Joint Disorders.

Section 1: Hallux Valgus

Clinical Practice Guideline First Metatarsophalangeal Joint Disorders Panel:
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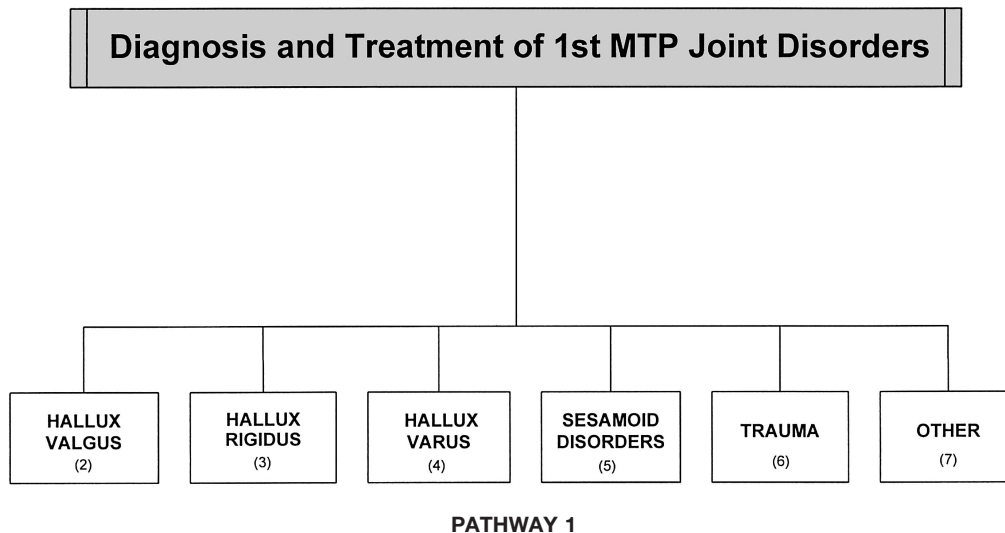
This clinical practice guideline (CPG) is based upon consensus of current clinical practice and review of the clinical literature. The guideline was developed by the Clinical Practice Guideline First Metatarsophalangeal (MTP) Joint Disorders Panel of the American College of Foot and Ankle Surgeons. The guideline and references annotate each node of the corresponding pathways.

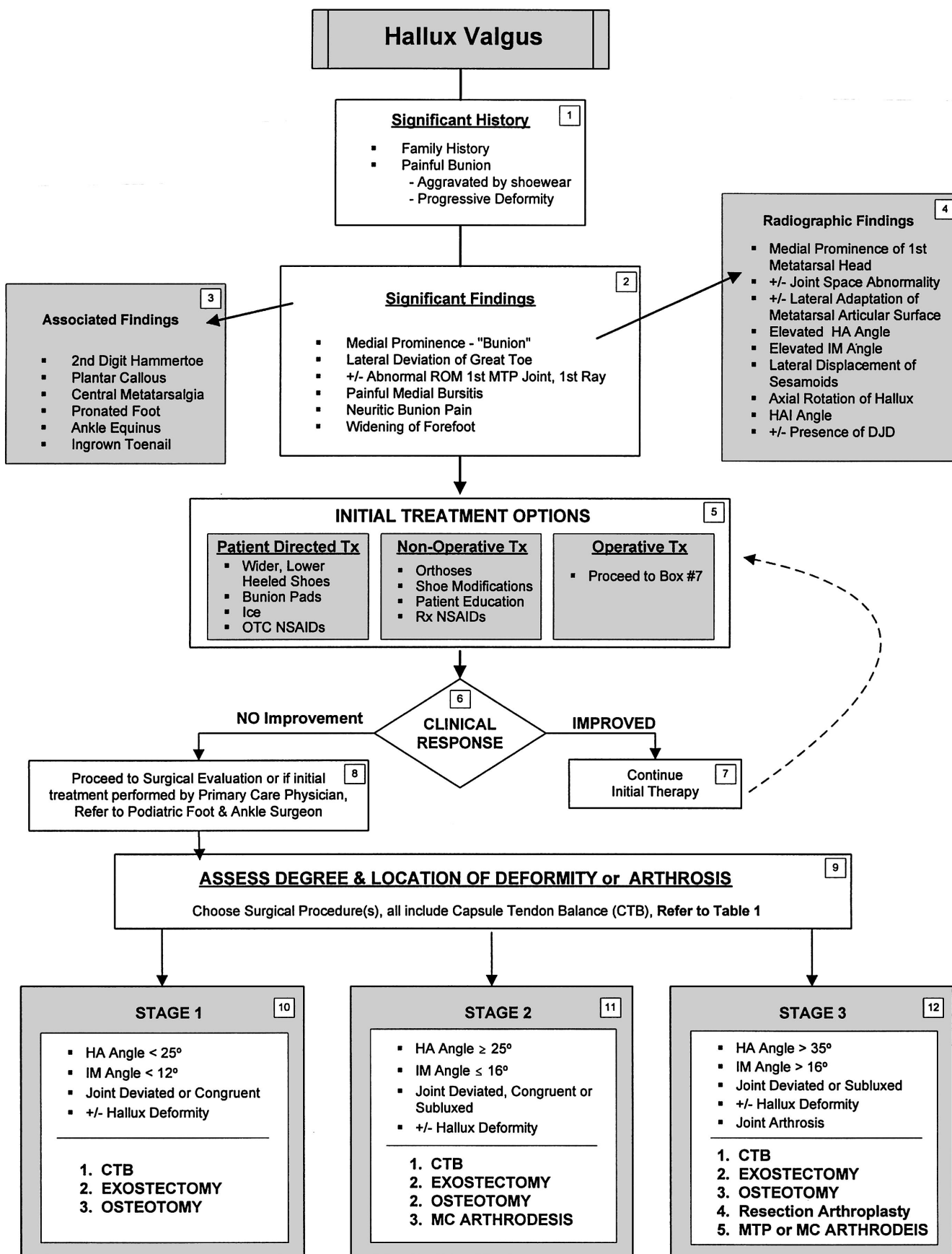
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Diagnosis and Treatment of First MTP Joint Disorders (Pathway 1)

Pathology of the first MTP joint encompasses a variety of disorders from acquired orthopedic deformities and traumatic injuries to overuse problems and systemic disorders. These clinical problems typically involve the first MTP joint and are encountered daily by the foot and ankle surgeon. This document will review current practice guidelines for the diagnosis and treatment of: hallux valgus (Pathway 2), hallux rigidus (Pathway 3), hallux varus (Pathway 4), sesamoid disorders (Pathway 5), trauma (Pathway 6), and other disorders of the first MTP joint (Pathway 7).





PATHWAY 2

Hallux Valgus (Pathway 2)

Hallux valgus deformity is one of the most common foot problems seen today by foot and ankle specialists. Hallux valgus is a deformity at the first MTP joint with abduction and valgus rotation of the great toe combined with a medially prominent first metatarsal head. A complete spectrum of pathology and symptoms is seen with this condition. A vast array of surgical procedures has been described for the symptomatic patient. The treatment may be more challenging than one may initially expect, because the deformity may range from benign and asymptomatic to severe and disabling.

Significant History (Node 1)

Patients presenting with this deformity often have a significant family history of bunion deformity (1,2). The deformity may be noted in adolescence, although it is more prevalent in women older than 30 years (2–6). Symptoms may occur early or they may not manifest until later in life. Pain is generally associated with irritation at the medial subcutaneous bunion, although even significant deformities may be asymptomatic. The condition may be aggravated by short or tight footwear, particularly with regard to women's shoe gear. Hallux valgus is considered to be a progressive condition and patients present with varied degrees of deformity from mild enlargement of the metatarsal head to severe dislocation of the first MTP joint.

Significant Findings (Node 2)

Hallux valgus is readily apparent with clinical inspection of the patient. Significant findings may include a subcutaneous bony prominence or medial bump. The great toe is abducted or deviated laterally, often with a degree of axial or valgus rotation (7,8). Shoe irritation may result in a painful medial bursitis with inflammation surrounding the first MTP joint or neuritis of the adjacent medial dorsal cutaneous nerve (6). Patients note widening of the forefoot; this contributes to difficulty wearing shoes comfortably.

First MTP joint range of motion should occur completely within the sagittal plane, but with hallux valgus, the motion may be in an oblique manner with abduction and eversion during dorsiflexion (9–11). Adaptation occurs at the metatarsal articular surface with lateral deviation, and joint motion may become track-bound laterally (12–14). An assessment of the patient standing and limited gait analysis is undertaken. First ray hypermobility secondary to rear-foot pronation is generally considered responsible for elevation of the intermetatarsal (IM) angle (15–19). Hallux valgus

may also occur with a lesser degree of transverse plane deformity with limitation of joint movement and degenerative changes. This is referred to as hallux valgus rigidus.

Associated Findings (Node 3)

Hallux valgus can present with numerous associated findings (8) that are part of a syndrome of forefoot derangement and may include:

- Hammertoe deformity of the second toe—Lateral deviation of the great toe may cause instability of the second toe and the second MTP joint. The second toe may overlap (dislocation syndrome) or under lap the hallux, or the toes may abut each other. Interdigital lesions are not uncommon.
- Plantar callus—Hyperkeratotic lesions may vary from a diffuse callus subsecond, -third, and -fourth metatarsal heads to a localized or nucleated lesion usually under the second metatarsal head. Formation of these lesions is believed to be caused by abnormal metatarsal pressures during gait (20,21).
- Central metatarsalgia—Generally, bunion formation is associated with first ray insufficiency, leading to lateral weight transfer and symptoms that may include metatarsalgia or a localized capsulitis of the second MTP joint (22–25).
- Pronated foot type—Pronation may be responsible for the weak foot characteristics, leading to forefoot deformities such as bunions and hammertoes (10,11).
- Ankle equinus—Ankle or gastrosoleus equinus is defined clinically as a limitation of ankle dorsiflexion. Ankle equinus is a detrimental force leading to pronation of the foot and development of foot deformities (26).
- Ingrown toenail—Ingrown toenails may occur on either nail border and are caused by the valgus and abducted position of the great toe or from abutment with the second toe (11).

Radiographic Findings (Node 4)

Radiographic evaluation should include assessment of general radiographic parameters and angular relationships of the osseous segments involved in this deformity (2,5,13, 27–29).

These parameters allow assessment of the severity of deformity and provide a basis for surgical procedural selection (Node 9). Radiographs should be weightbearing views of the feet and taken with the patient standing in the angle and base of gait (30).

- Medial prominence of the first metatarsal head—The

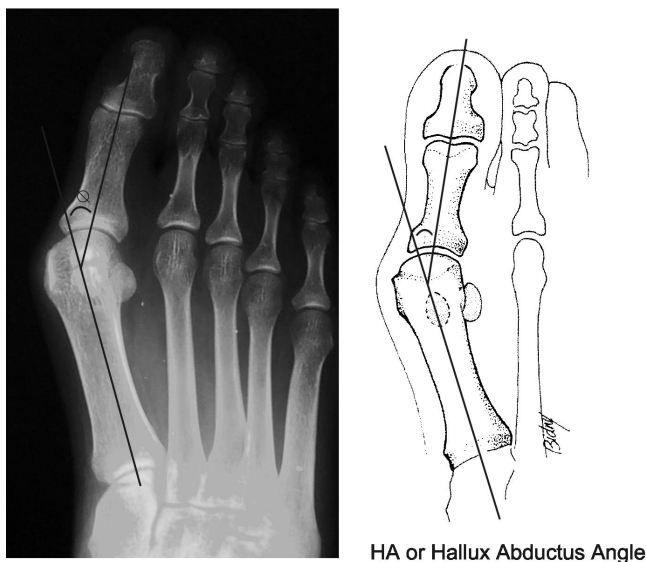


FIGURE 1 The HA angle is formed by the angle between the longitudinal axis of the hallux and first metatarsal; it is a reliable indicator of the severity of a bunion or a hallux valgus deformity.

medial prominence may be caused by the increased IM angle and/or hypertrophy of the medial epicondyle. The metatarsal head may square off or present with erosions (2,7,31).

- Joint space—The joint space may be normal or show narrowing with or without degenerative changes. End-stage deformities may show dislocation of the joint (13).
- Hallux abductus (HA) angle—This angle is defined by the longitudinal bisections of the hallucal proximal phalanx and the first metatarsal, and is measured on the dorsoplantar radiograph (Fig. 1). Values greater than 20° are often pathologic and correlate with severity of deformity (32).
- Proximal articular set angle—Lateral adaptation of the distal first metatarsal articular surface occurs with long-standing HA, and this can be assessed radiographically. This angular value is described by a perpendicular line drawn to the longitudinal bisection of the first metatarsal at a point intersecting a line drawn to the functional articular surface of the metatarsal head. This has also been described as the distal metatarsal articular angle. Normal values are 0° to 8° , but interobserver variability exists and the value may not correlate with intraoperative observations (29,33).
- IM angle—The IM angle, formed by the longitudinal bisections of the first and second metatarsals, increases with severity of deformity (Fig. 2). Abnormal values are greater than 10° . Metatarsus adductus may alter the significance of this measurement (5,34).
- Lateral displacement of the sesamoids—Displacement of the sesamoids occurs with hallux valgus and correlates

with increases in the IM angle. The relationship of the tibial sesamoid to the first metatarsal bisection is determined (7,35).

- Axial rotation of the hallux—Valgus rotation of the great toe occurs with advanced hallux valgus deformity. This is a qualitative determination and is assessed by the symmetry of the proximal phalanx on the dorsoplantar radiograph (13).
- Hallux abductus interphalangeus angle—This angle is defined by the longitudinal bisections of the hallucal proximal and distal phalanges. Normal values are considered less than 10° (28).
- Degenerative joint disease—With long-standing or severe hallux valgus, degenerative joint disease may develop.

Initial Treatment Options (Node 5)

When symptoms begin to interfere with a patient's lifestyle, initial treatment (eg, wider, lower-heeled shoes; bunion pads; ice; and over-the-counter analgesics) is often self-directed. Patients who are unresponsive to the initial treatment or unable to fulfill the self-directed regimen should be directed to a podiatric foot and ankle surgeon for evaluation.

Nonsurgical care involves patient education, including a discussion of the natural history of the disorder, evaluation of footwear, and prior treatment. Prescription anti-inflammatory nonsteroidal drugs may be indicated for symptomatic arthralgias or bursitis. Nonsurgical alternatives include shoe modifications, with pocketing of the medial shoe contour or wider causal shoes. Although there is no scientific

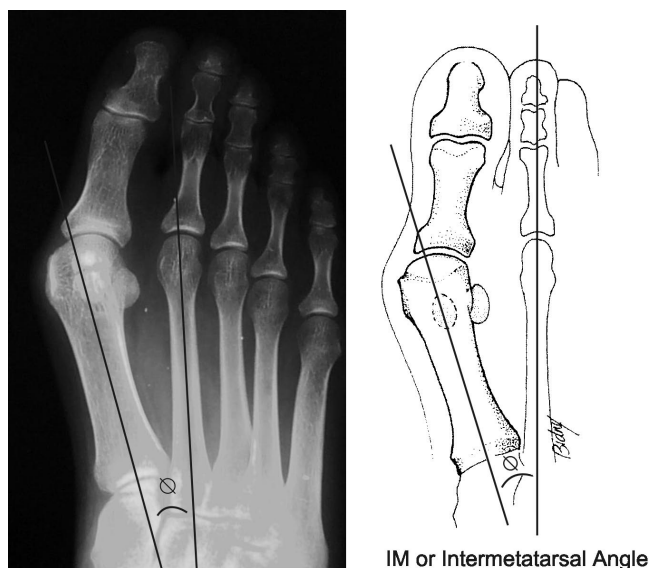


FIGURE 2 The IM angle is formed by the longitudinal axis of the first and second metatarsals, respectively; this angle is also generally elevated in more severe deformities.

TABLE 1 Relative corrective ability of hallux valgus procedures

Surgical Procedure	IM	Type of Correction Able to Be Achieved				Postoperative Care
		Sagittal Plane Deformity	Linear Metatarsal Deformity	PASA	Frontal Plane Deformity	
Capsule tendon balance	+	○	○	○	+ ^a	WB
Green-Reverdin	+	○	○	++++	○	WB
Hohmann	++	+	++	++++	++	PWB
Chevron	++	+	++	++++	○	WB
Long arm V	+++	+	++	++	○	PWB/WB
SCARF	+++	++	+++	++	○	WB
CAWO (intact hinge)	++++	+	+	○	○	NWB
Crescentic	++++	+	+	○	○	PWB/NWB
Proximal chevron	+++	+	+	○	○	PWB/NWB
Lapidus	++++	++++	++++	○	+	NWB
Keller	++	○	○	○	++ ^a	WB
MTP arthrodesis	+++	○	+++	○	+++ ^a	PWB

NOTE. ○, no corrective value/no effect; + to +++++, relative value scale indicative of potential to correct type of deformity.

Abbreviations: CAWO, closing abductory wedge osteotomy; NWB, nonweightbearing; PASA, proximal articular set angle; PWB, partial weightbearing; WB, weightbearing.

^aFrontal plane correction at first MTP joint.

evidence to support the efficacy of orthotic devices in the treatment of hallux valgus, symptomatic relief may be realized by some patients (36,37).

Surgical recommendations might be considered on the initial evaluation of hallux valgus deformity. Because hallux valgus is a progressive disorder and is often evaluated in the second or third stage, surgical consideration can be undertaken early in the course of treatment.

Clinical Response (Nodes 6, 7, and 8)

When nonsurgical care is rendered, the clinical response is assessed (Node 6). If the patient is doing well, initial treatment may be continued (Node 7). If there has been little or no improvement or if initial improvement deteriorates, surgical treatment is appropriate. If a primary care physician performed the initial evaluation and treatment, referral to a podiatric foot and ankle surgeon is indicated (Node 8).

Assessment of Deformity and Arthrosis (Node 9)

Hallux valgus deformity may be classified into stages 1, 2, and 3 (Nodes 10, 11, and 12). These stages are based on the progression and degree of deformity of HA and the IM angle.

In each stage, surgical intervention includes a capsule-tendon balancing procedure (which may include medial exostectomy), a lateral release, and a medial capsulorrhaphy.

Surgical Treatment: Stage 1 (Node 10)

Stage 1 hallux valgus deformity is defined as an IM angle $<12^\circ$ and an HA angle $<25^\circ$. Although the appearance of the deformity may not be significant, there is often deviation of the joint and medial enlargement of the first metatarsal head. Typically, soft tissue tendon balance (38–45) and exostectomy with/without a distal osteotomy are performed to correct the deformity (46–77). If hallux abductus interphalangeus is present, a phalangeal osteotomy may be indicated (28,78–91) (Table 1; Figs. 3 and 4).

Surgical Treatment: Stage 2 (Node 11)

Stage 2 deformities are more significant and have an IM angle $\leq 16^\circ$ with an HA angle of $\geq 25^\circ$. The joint congruency must be evaluated. Capsule-tendon balancing is performed with or without osteotomy of the first metatarsal and/or proximal phalanx (92–99). When hypermobility of the first ray is encountered or is in the presence of severe deformity, a metatarsal cuneiform arthrodesis may be considered (17,25,34,100–106). If hallux abductus interphalangeus is present, a phalangeal osteotomy may be indicated (Table 1; Figs. 5 and 6).

Surgical Treatment: Stage 3 (Node 12)

Stage 3 deformities are considered severe and generally more disabling. These deformities have an IM angle that is

FIGURE 3 Distal metatarsal osteotomy is a common procedural alternative and may be performed with a variety of techniques including the Austin or chevron osteotomy. (A) Preoperative anteroposterior (AP) radiograph, (B) postoperative radiograph.

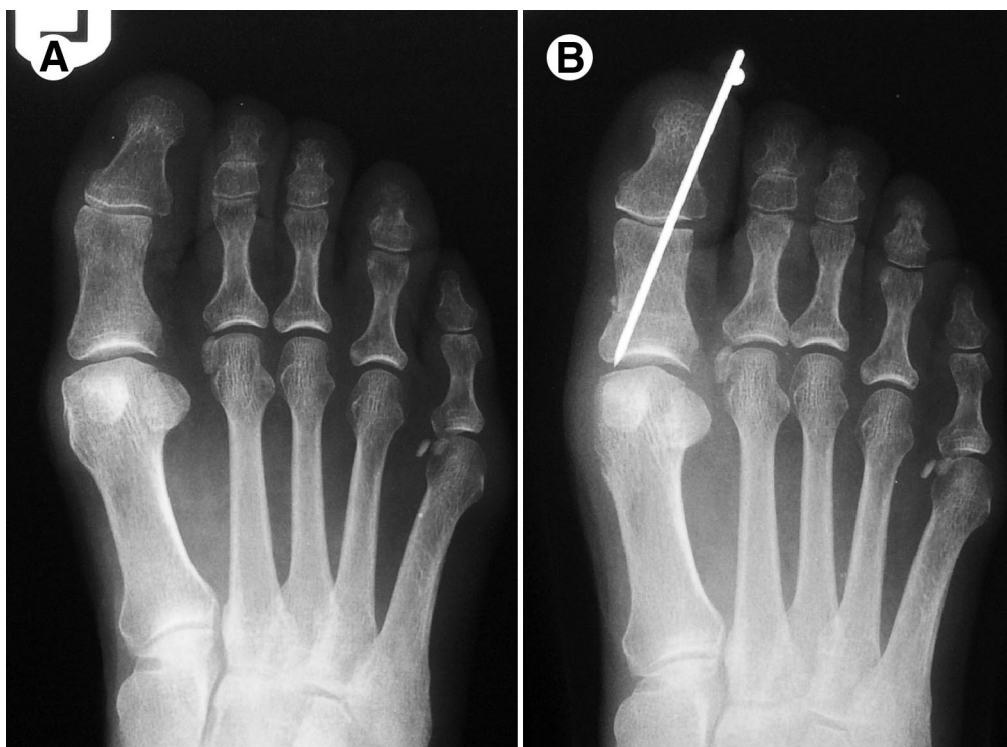


FIGURE 4 Phalangeal osteotomy has been performed as variations of the Akin osteotomy. (A) Preoperative and (B) postoperative oblique Akin osteotomy with Kirschner wire fixation.

FIGURE 5 Proximal first metatarsal osteotomy is selected for cases of significant elevation of the first intermetatarsal angle. (A) Preoperative AP radiograph and (B) postoperative AP radiograph.

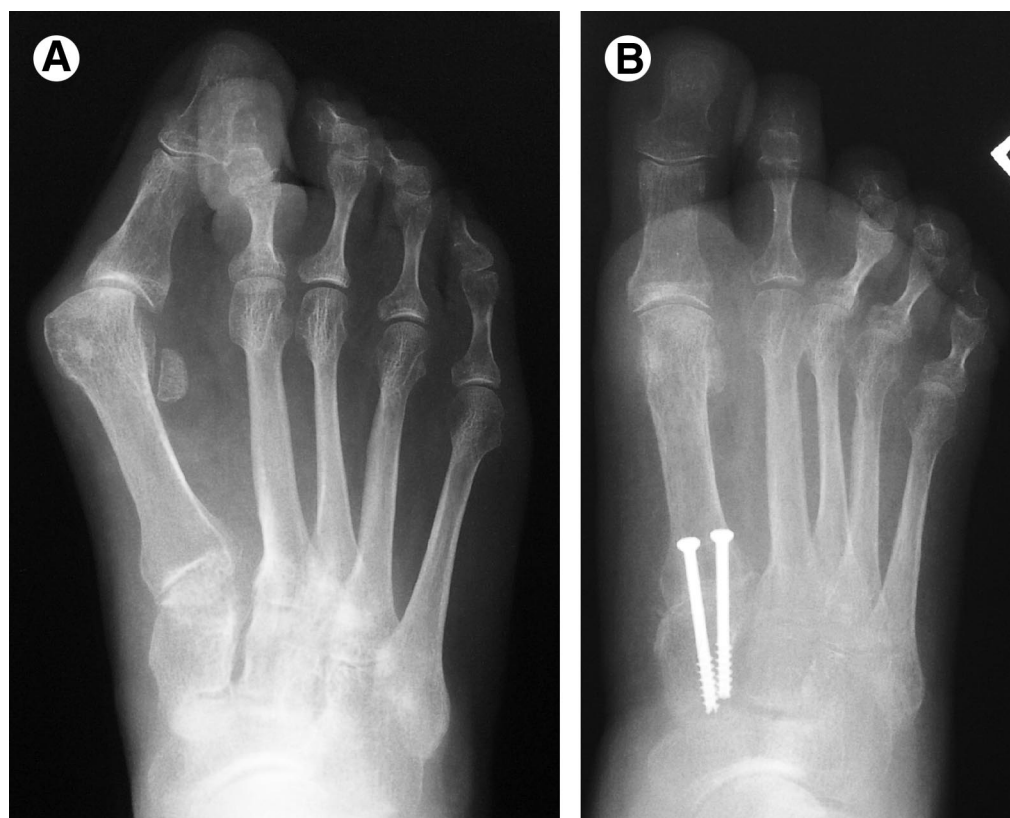
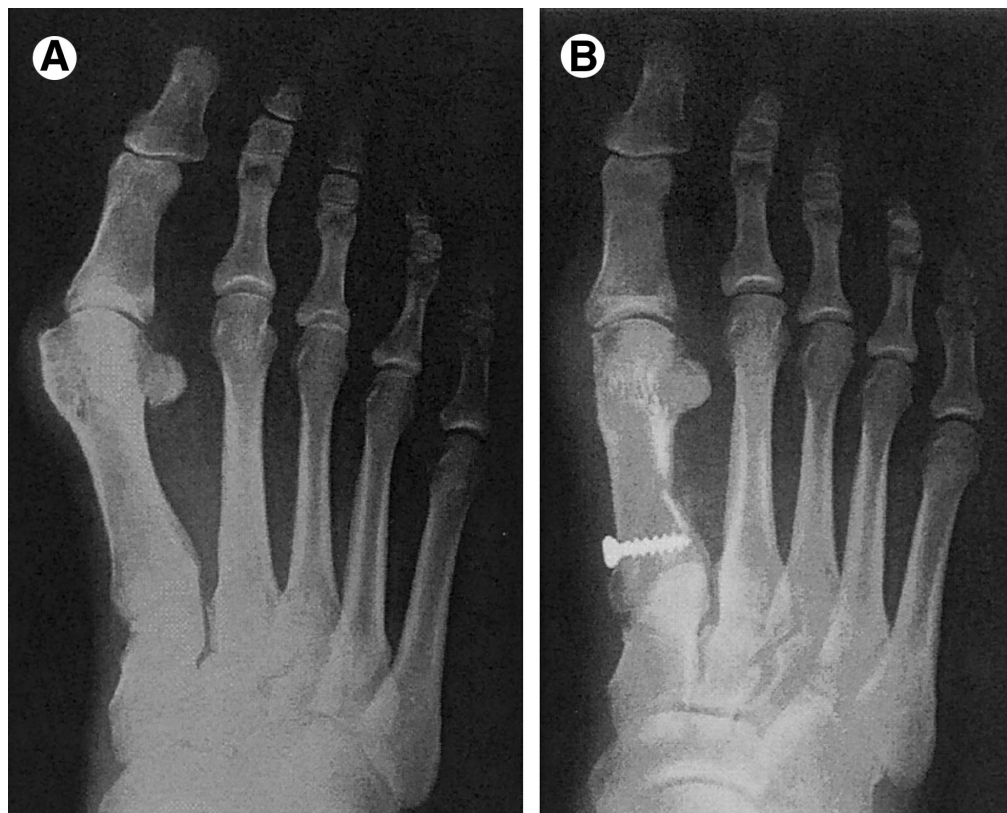


FIGURE 6 The Lapidus or first metatarsal cuneiform joint fusion is useful in cases of hallux valgus with large IM angles or first ray hypermobility. (A) Preoperative AP radiograph and (B) postoperative AP radiograph.

FIGURE 7 The Keller bunionectomy with resection of the proximal phalangeal base still is a useful procedure for hallux valgus deformities. (A) Preoperative and (B) postoperative AP views.

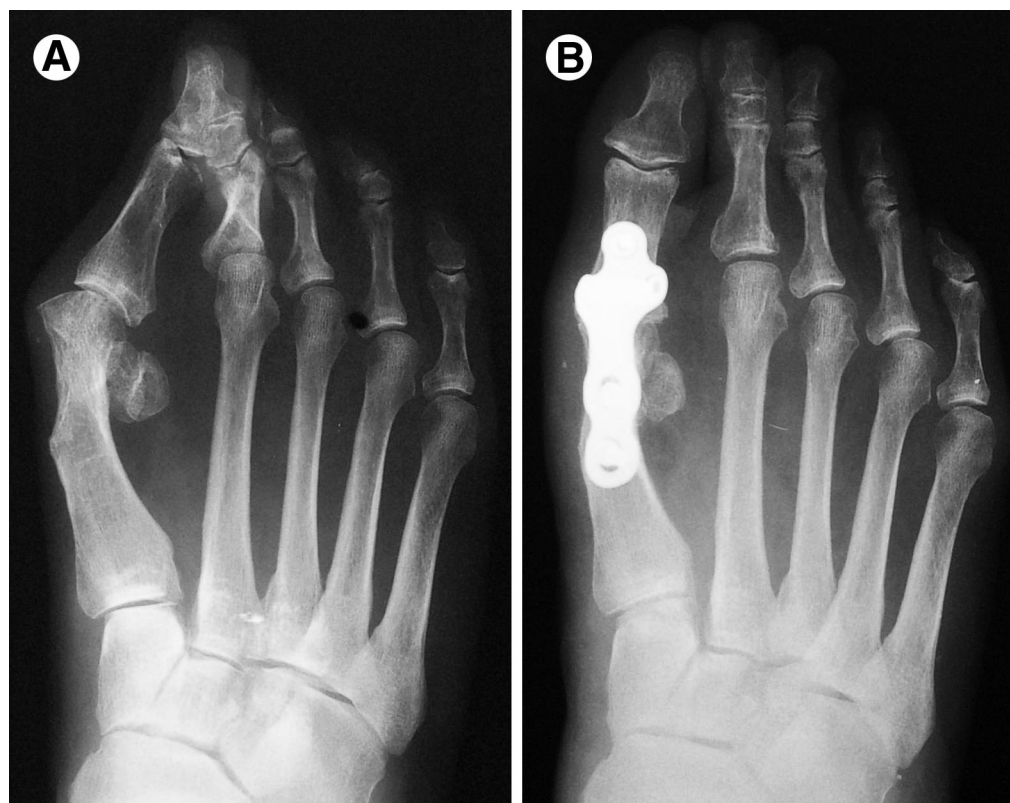
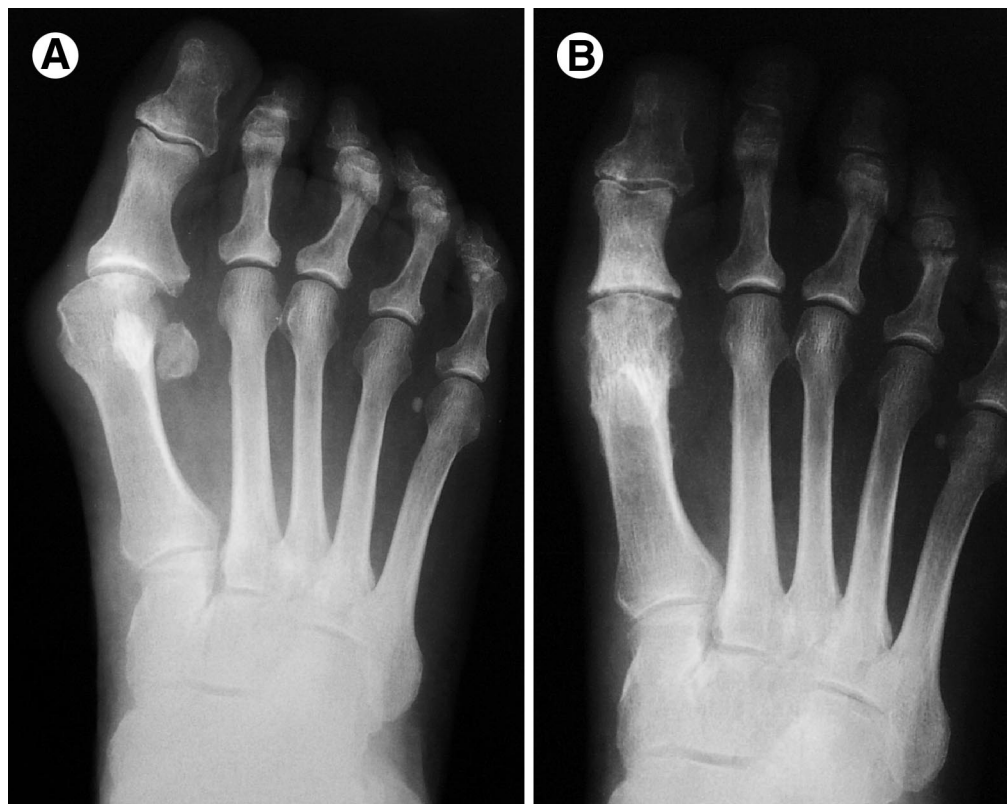


FIGURE 8 First MTP joint fusion is not only a useful salvage technique for recurrent (A) preoperative, (B) postoperative, or arthritic deformities but also useful as a primary procedure for the correction of hallux valgus.

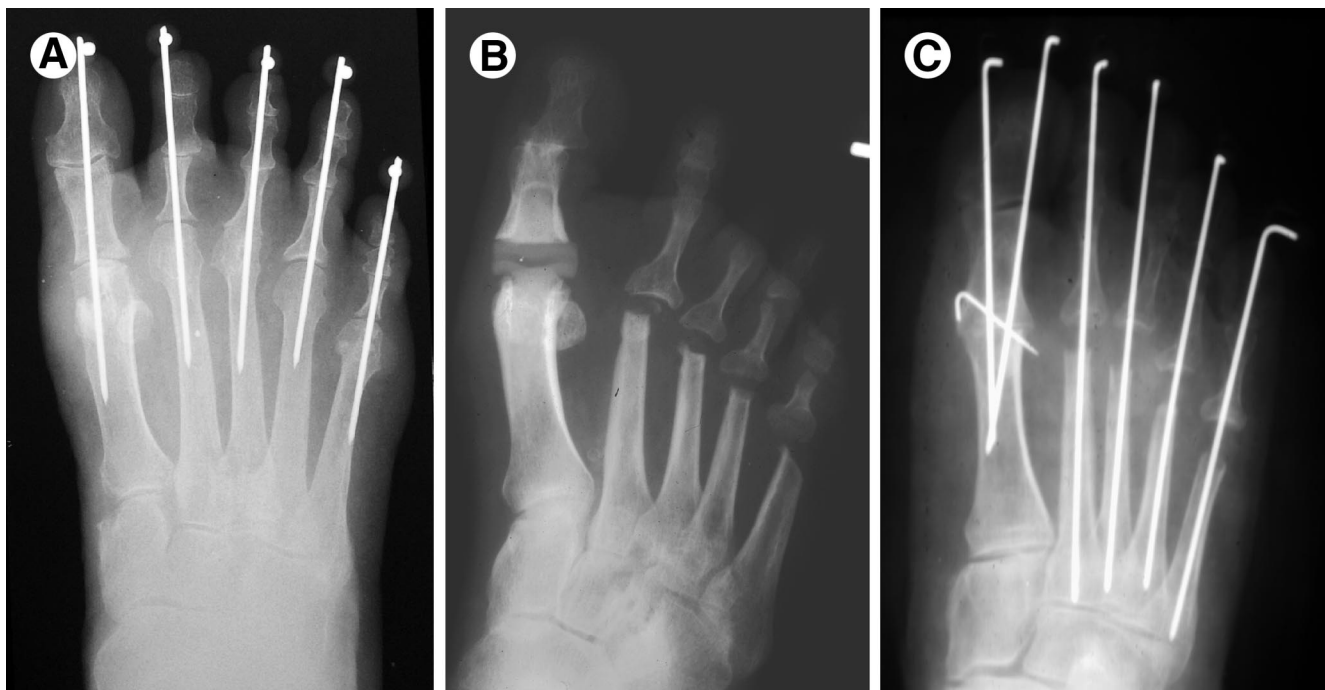


FIGURE 9 Reconstruction of the rheumatoid forefoot may be described as a forefoot arthroplasty combining (A) resection arthroplasty (Keller), (B) first MTP joint implant, or (C) first MTP joint fusion with lesser metatarsal procedures.

usually $>16^\circ$ and an HA angle $\geq 35^\circ$. The MTP joint may be deviated or subluxed. Severe deformities often present with associated findings (Node 3) in addition to hallux valgus.

Deformities in this stage may be corrected through capsule-tendon balancing with an osteotomy of the first metatarsal and/or proximal phalanx. Double osteotomy of the first metatarsal provides an additional option (56,107–113). Determination of location of the osteotomy is influenced by the degree of deformity and/or the presence of associated degenerative arthritis. Metatarsal cuneiform arthrodesis may also be considered.

If hallux abductus interphalangeus is present, a phalangeal osteotomy may be indicated. In certain situations, first MTP joint resection arthroplasty (114–120), with or without a joint implant (121–132), or arthrodesis (133–139) may be performed, as in the case of patients with rheumatoid arthritis or degenerative joint disease or in patients requiring revision surgery (123–125,140–157) (Table 1; Figs. 7–9).

In summary, hallux valgus deformity is an inherited, progressive deformity often associated with certain foot types, with symptoms aggravated by shoe wear. Although conservative measures may be used initially to reduce the symptomatology associated with this deformity, surgical repair is often necessary to correct the hallux valgus and its associated deformities.

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