

# 12

## Austin Procedure and Modified Austin Procedures

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The Austin procedure is primarily a transpositional V osteotomy of the head of the first metatarsal for the management of hallux valgus. The procedure was first reported in the podiatric literature and attributed to Dr. Austin by Miller and Croce.<sup>1</sup> The procedure was presented initially by Dr. Dale Austin in his 1981 publication.<sup>2</sup> The procedure as described is a horizontally directed V osteotomy performed in the metaphyseal bone of the first metatarsal, with the arms of the V at an angle of 60°. Transposition of the head of the metatarsal laterally from one-fourth to one-half the width of the metatarsal shaft addresses the increase in intermetatarsal angle (Fig. 12-1). Redirection by rotation of the metatarsal head is performed to address abnormal transverse plane alignment of the articular surface of the metatarsal head. The osteotomy is fixated by impaction via manual pressure and the protruding portion of the metatarsal shaft is then resected. The osteotomy is combined with soft tissue balancing medially and laterally with tenotomy of the adductor hallucis. This procedure has also been referred to in the literature as the Austin osteotomy, chevron procedure, or Chevron osteotomy. Subsequent modifications have been described to address components of deformity associated with hallux valgus and first metatarsophalangeal joint deformity. These modifications include a bicorrectional technique for treatment of an associated abnormal proximal articular set angle (PASA) or transverse plane deformity of the head of the first metatarsal,<sup>3</sup> to incorporate shortening or lengthening of the metatarsal, as well as plantar flexion and dorsiflexion of the metatarsal head<sup>4,5</sup> and the correction of metatarsus primus elevatus.<sup>6</sup> The bicor-

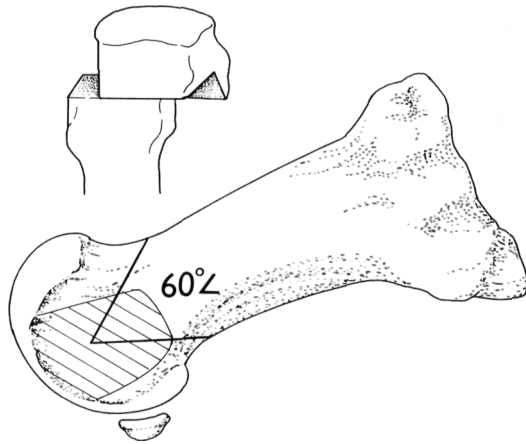
rectional technique as described by Gerbert et al.<sup>3</sup> requires the performance of a second bone cut that extends 80 percent through the metatarsal to remove a medial wedge of bone head<sup>3</sup> (Fig. 12-2A).

Duke and Kaplan<sup>4</sup> reported that by angulating the osteotomy from distal-medial to proximal-lateral shortening of the bone will result, and that plantar flexion will accompany an osteotomy that is directed from dorsomedial to plantar-lateral. Combining the techniques described it is possible to effect triplane correction to varying degrees with the osteotomy<sup>5</sup> (Fig. 12-3A and B).

Youngswick<sup>6</sup> performed a second osteotomy paralleling the dorsal arm of the V osteotomy to enable plantar flexion for the management of a metatarsus primus elevatus associated with a hallux limitus (see Fig. 12-2B).

Vogler<sup>7</sup> modified the Austin osteotomy to incorporate an extended dorsal arm of the osteotomy, the so-called offset V osteoplasty (see Fig. 12-2C). The angle of the V reduces from 60° to 40°. The advantages to this modification, according to Vogler, are greater stability of the osteotomy and the ease with which screw fixation in an interfragmentary mode can be applied. Again, modification of the osteotomy allows multiplanar correction. A similar osteotomy has been described by Kalish et al.<sup>8</sup> Modification of the Kalish osteotomy to address an abnormal proximal articular set angle has also been described.<sup>9</sup>

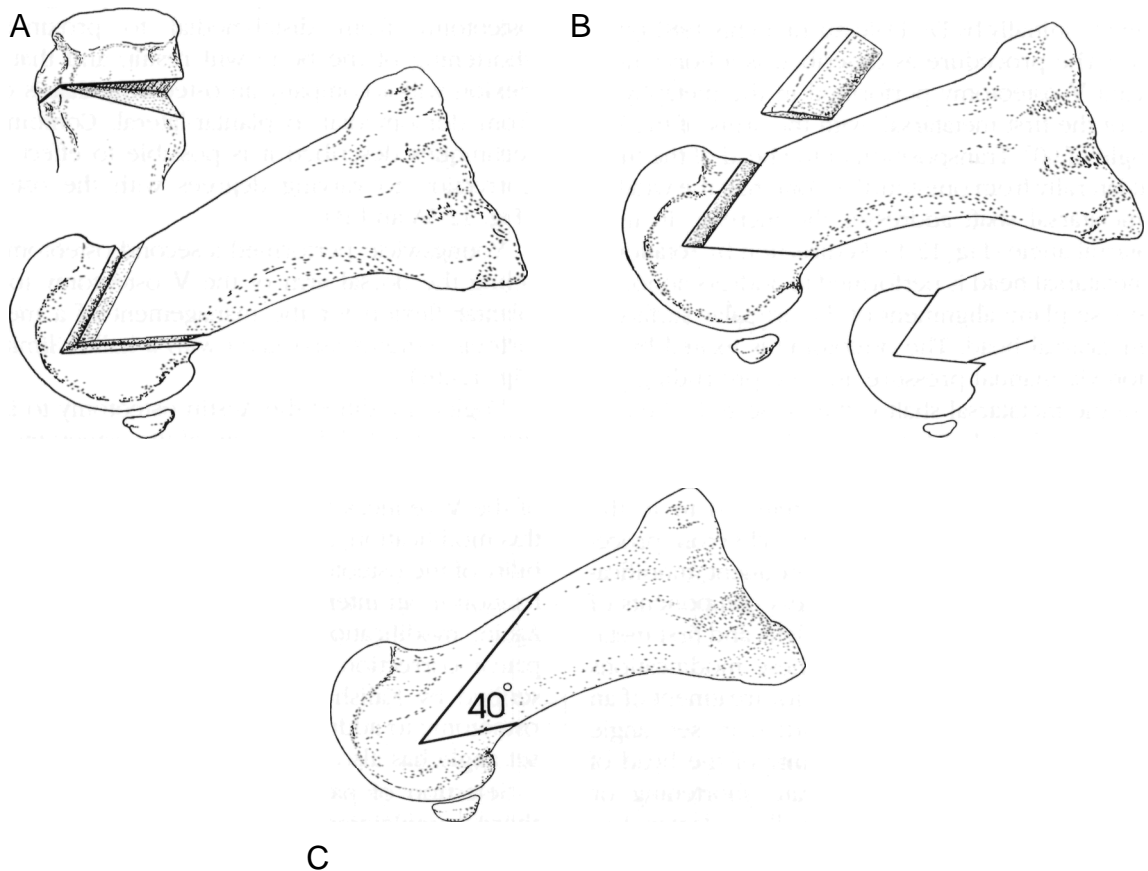
Selection of patients for this procedure includes those complaining of pain associated with a hallux valgus deformity with inability to function comfortably in normal or conventional shoe wear. There should be



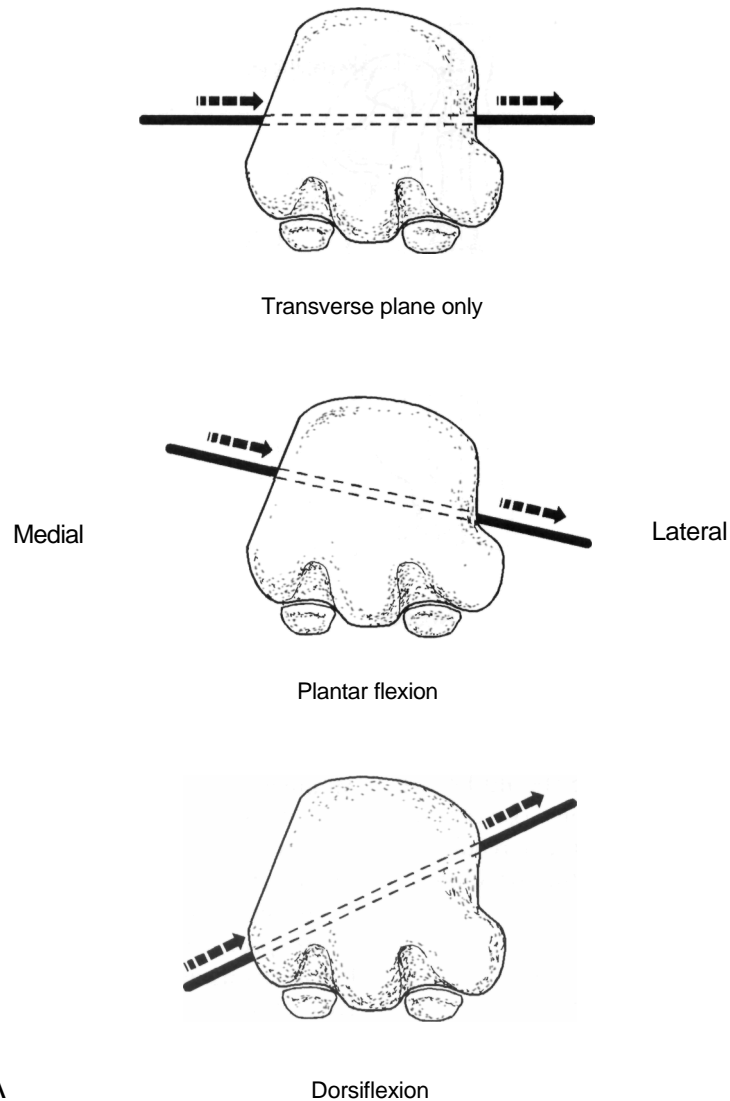
**Fig. 12-1.** Traditional Austin osteotomy.

no pain associated with range of motion with the first metatarsal phalangeal joint. Preoperative examination should reveal a bunion deformity with hallux abductus; a moderate degree of valgus rotation of the great toe is acceptable.

Preoperative radiographic evaluation or criteria include a hallux abductus angle of greater than  $16^\circ$  but less than  $40^\circ$  and a congruous to deviated first metatarsal phalangeal joint, normal or abnormal proximal articular set angle, and an elevation of intermetatarsal angle as great as approximately  $16^\circ$ . The metatarsal width should be assessed because a narrow first metatarsal limits the amount of correction that can be obtained as the potential for transposition is limited. Bone stock in the distal metaphysis of the first metatarsal should be determined radiographically to be healthy and free of cystic changes. A metatarsal index



**Fig. 12-2.** (A) Bicorrectional Austin osteotomy (Gerbert). (B) Youngswick modification for metatarsus primus elevatus. (C) Offset V osteotomy of Vogler.



**Fig. 12-3.** (A) Apex orientation to incorporate dorsiflexion or plantar flexion of the capital fragment. (*Figure continues.*)

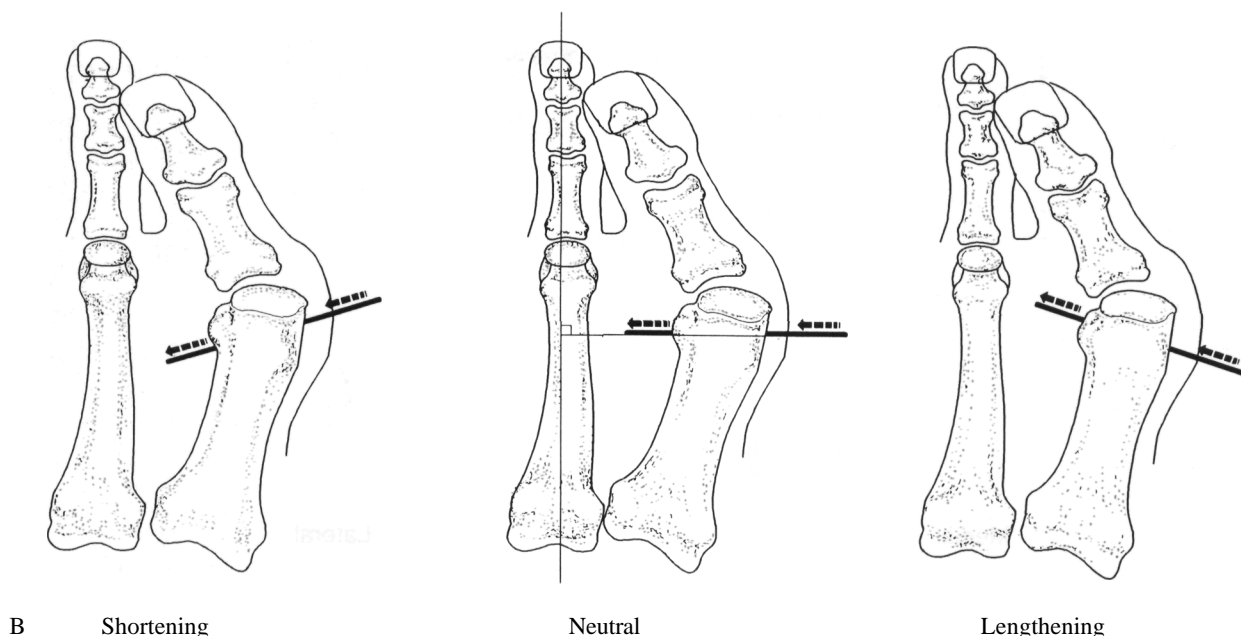
that is positive, neutral, or negative are all acceptable, provided that they are recognized preoperatively and that the osteotomy is performed in such a manner to address these conditions. Relative guideline to contraindications for the Austin procedure are listed in Table 12-1; each patient should be considered individually. The use of templates may be useful in preoperative assessment of the potential for using the Austin procedure in patients.<sup>10</sup>

The objective of this procedure is to provide patients with postoperative reduction of deformity com-

bined with a pain-free range of motion of the first metatarsal phalangeal joint, reduction of the intermetatarsal angle to less than 10°, and an hallux

**Table 12-1.** Contraindications for Austin Procedure

Limited range of motion in first metatarsophalangeal joint
Radiographic signs of osteoarthritis
Hallux abductus angle greater than 40°
Intermetatarsal angle greater than 16°
Poor quality of bone or cystic metatarsal head changes
Narrow first metatarsal
Geriatric patients



**Fig. 12-3 (Continued). (B)** Apex orientation to incorporate shortening or lengthening.

abductus angle of less than  $20^\circ$ . There should be no resultant metatarsalgia following this osteotomy, which should be associated with a cosmetic result acceptable to the patient and no shoe-fitting problems.

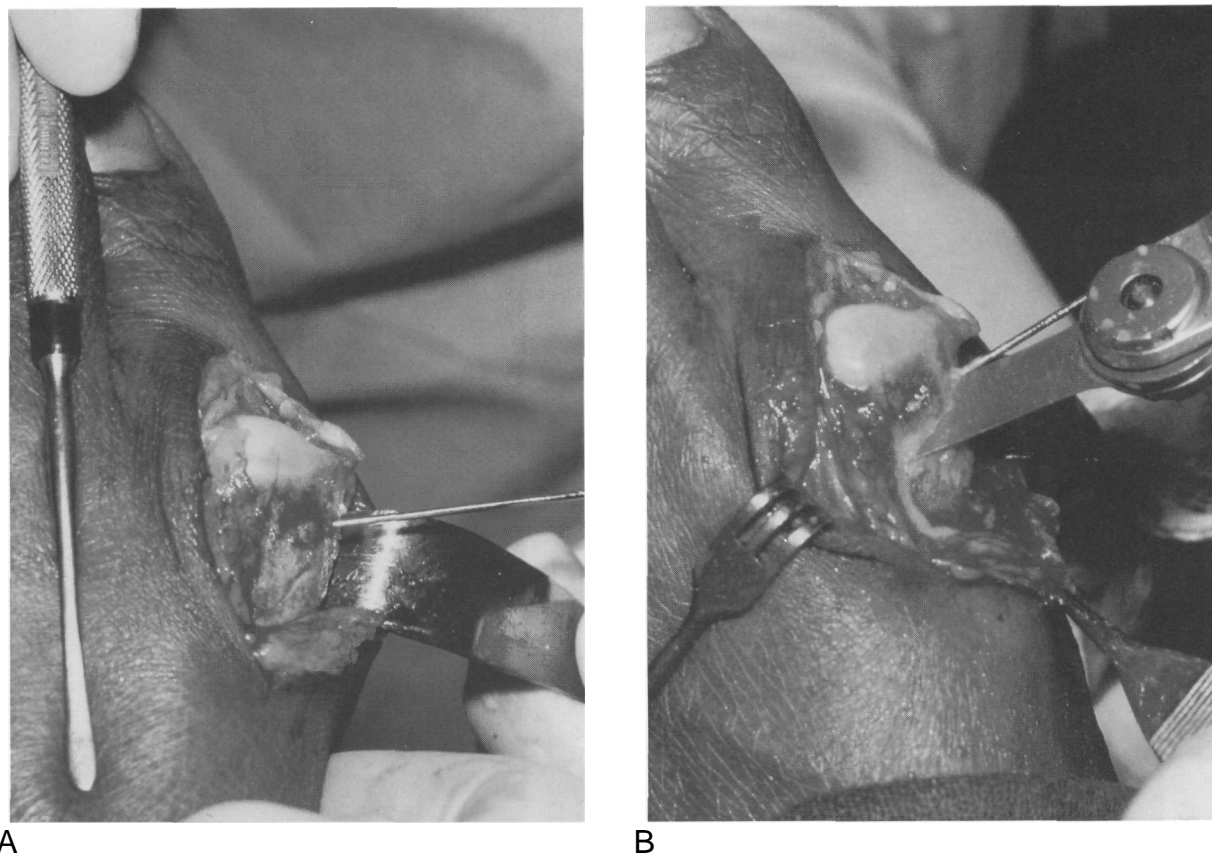
## THE PROCEDURE

The approaches to the first metatarsophalangeal joint for the Austin procedure may be through several initial incisions. These include a dorsomedial linear incision that is placed medial to the extensor hallucis longus tendon, a medial approach, and a plantar-medial approach. The dorsomedial linear incision provides the greatest exposure to the medial aspect of the metatarsal head as well as to the intermetatarsal space. To expose the joint medially, several capsulotomies that can be used include a straight linear incision, one that is T or U shaped with the flap based distally, as described by Austin,<sup>2</sup> or as the author prefers, an inverted L-type capsulotomy. After reflection of the capsule flap and exposure of the metatarsal, remodeling of the exostosis of the metatarsal head is performed using an osteotome and mallet or power equipment.

Minimal resection is required, and aggressive resection of the exostosis is to be avoided; as with all bunion procedures, the exostosis is resected in a dorso-medial attitude.

The attention is next directed to the first intermetatarsal space where the adductor tendon is identified before its insertion in the base of the proximal phalanx and is tenotomized. A linear incision is performed over the fibular sesamoid transecting the fibular sesamoidal ligament, and a vertical capsulotomy of the joint is performed. This lateral T-shaped capsulotomy allows reduction of the fibular sesamoid, facilitating effective transposition of the head. This type of approach minimizes the amount of lateral dissection and therefore disruption of the soft tissues. Aggressive dissection should be avoided in the first intermetatarsal space to avoid potential osteonecrosis of the metatarsal head. It is important that anatomic reduction of the sesamoids be performed to ensure favorable long-term results and restore dynamic balance to the first metatarsophalangeal joint.<sup>2</sup>

After the soft tissue procedures have been completed, the osteotomy is performed. The basic osteotomy as described previously is a cut of approximately  $60^\circ$ . The apex of the V should rest in the center of the

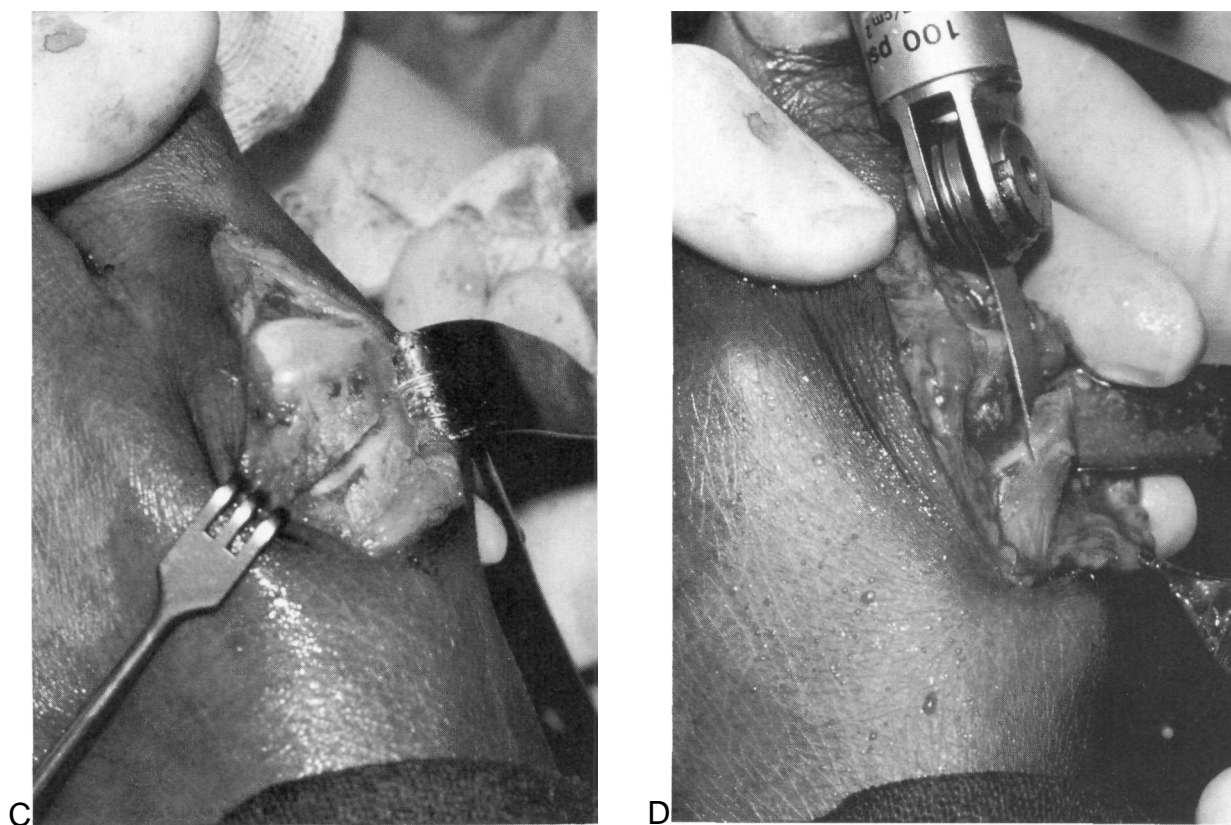


**Fig. 12-4.** (A) Apex wire inserted to delineate axis position. (B) Wire utilized as guide to direct performance of osteotomy. (*Figure continues.*)

metatarsal head. The center of the osteotomy is marked with a 0.045-in. Kirschner wire<sup>2</sup> (Fig. 12-4) that will then become the apex of the V osteotomy. By manipulation of the apex of the osteotomy through the body planes one may obtain, in addition to correction of the intermetatarsal angle, modification to allow lengthening, shortening, plantar flexion or dorsiflexion, or combinations resulting in multidimensional corrections, depending on the position of the apex.<sup>4,5</sup> An apex that approaches the perpendicular relative to the second metatarsal will be neutral, thereby incorporating neither lengthening or shortening (see Fig. 12-3B). If the apex is placed perpendicular to the surface left after resection of the medial eminence (resected primarily dorsomedially), it will incorporate plantar flexion of the metatarsal head (see Fig. 12-3A). If plantar flexion is not desired, of course, the apex

must be corrected before performance of the osteotomy. To ensure proper alignment of the arms of the V, the Kirschner wire (K-wire) is kept in place while cutting the osteotomy, attempting to keep the blade and therefore the plane of the osteotomy maintained in alignment with the apex wire. This simple template, referred to as the apical axis guide,<sup>11</sup> will help ensure performance of the desired osteotomy as well as prevent diversion or conversion of the osteotomy cuts. Before cutting the osteotomy it is useful to score the metatarsal head using the osteotome and mallet in the appropriate 60° angle. The plantar arm should extend proximal to the articular surface for the sesamoids.

Following the osteotomy, the capital fragment is manipulated along the apex for approximately one-quarter to one-half the width of the bone. On completion of the osteotomy and transposition, fixation of the os-



**Fig. 12-4** (Continued). (C) Completed osteotomy. (D) Resection of metatarsal shaft after transposition of the osteotomy.

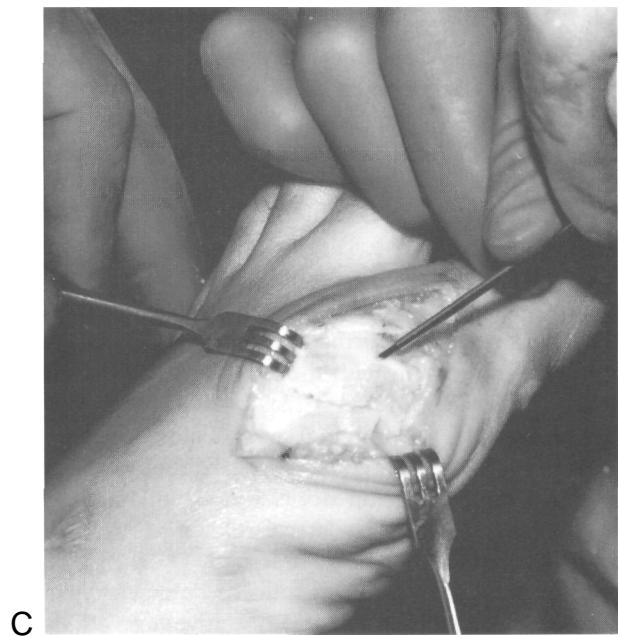
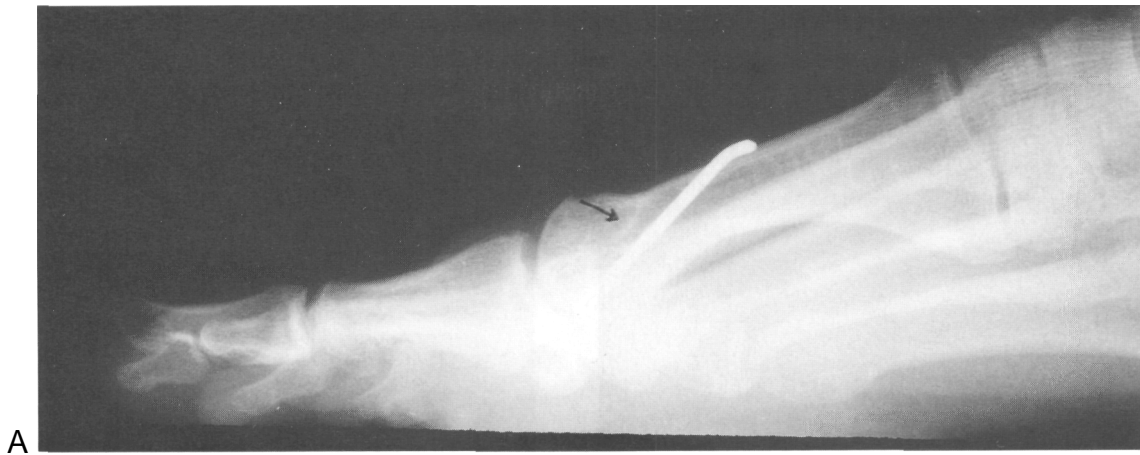
teotomy may occur by a variety of methods (Fig. 12-5). These methods include impaction of the head of the metatarsal on the shaft of the metatarsal,<sup>2</sup> simple K-wire fixation,<sup>12</sup> buried K-wire technique,<sup>13</sup> monofilament stainless steel fixation,<sup>14</sup> screw fixation<sup>15,16</sup> including the Herbert bone screw,<sup>17,18</sup> staples,<sup>19,20</sup> and absorbable fixation.<sup>21-25</sup> Modification of the osteotomy to accommodate certain types of fixation may be necessary; for example, screw fixation requires elongation of the long dorsal arm. Capsular closure is performed maintaining the toe in correct alignment. Excessive plication of the capsule is not desirable.

Postoperative care may include initially management that is weight-bearing or partially weight-bearing; a cast or postoperative shoes may also be used according to the surgeon's preference. The patient is encouraged to begin range-of-motion exercises in the

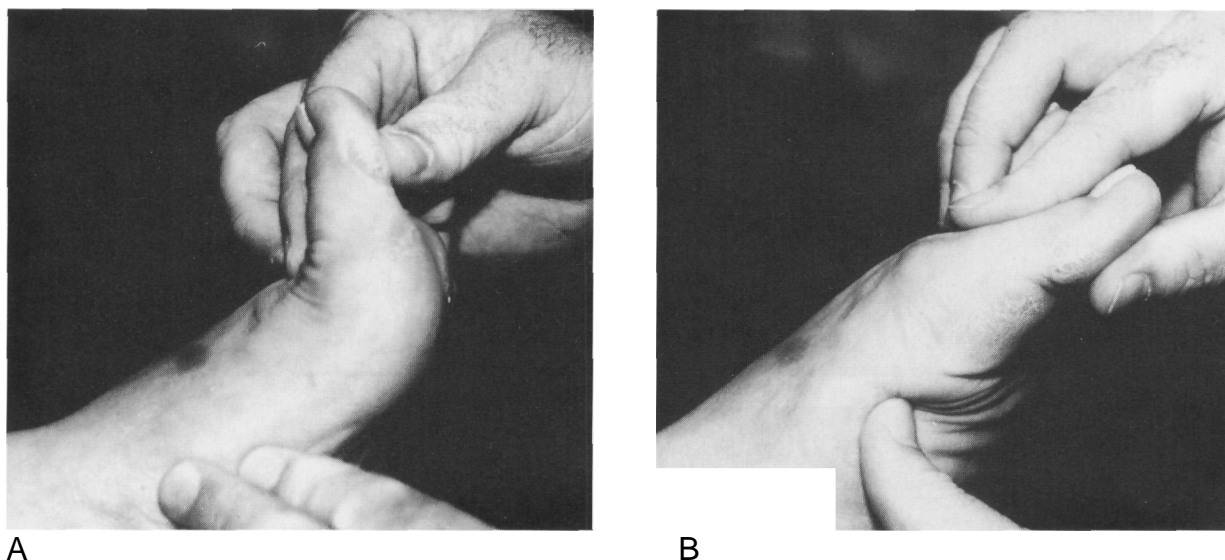
early postoperative period and gradual return to conventional shoe gear may occur at approximately 4-6 weeks (Fig. 12-6).

It is important to consider the potential three-dimensional effects of this osteotomy to use these to advantage in correcting the deformity and preventing an undesired result from incorrect osteotomy performance. The key in this procedure lies in the careful evaluation, design, and performance of the osteotomy (Fig. 12-7).

Potential intraoperative problems include an incorrect osteotomy angle that results in an unstable osteotomy or one that extends undesirably and unnecessarily into diaphyseal bone. Incorrect direction of the osteotomy in the transverse plane may cause undesirable shortening, and in the frontal plane may result in undesirable plantar flexion or dorsiflexion (Fig. 12-8).



**Fig. 12-5.** Examples of internal fixation of the austin osteotomy utilizing (A) Kirschner wire fixation; (B) bone staples; (C) insertion of 1.3-mm Orthosorb pin fixation (Johnson and Johnson, Raynham, MA).



**Fig. 12-6.** Clinical range of motion 4 years after Austin procedure. (A) Dorsiflexion; (B) plantar flexion.

Care must be taken to not transpose the capital fragment too far laterally, causing instability; conversely, inadequate transposition can result in undercorrection.

The Austin procedure has also been combined with other procedures to address different components of a hallux valgus deformity. Reports on its conjunction with the Akin procedure are favorable when the Akin procedure is used to address structural deformity of the hallux.<sup>26,27</sup> The Austin osteotomy may be performed with simultaneous fibular sesamoidectomy; however, I do not do this on a routine basis, and recommend it be performed only with degenerative changes of the fibular sesamoid and not as a means to extend the correction of the Austin procedure in cases of excessive high intermetatarsal angles.

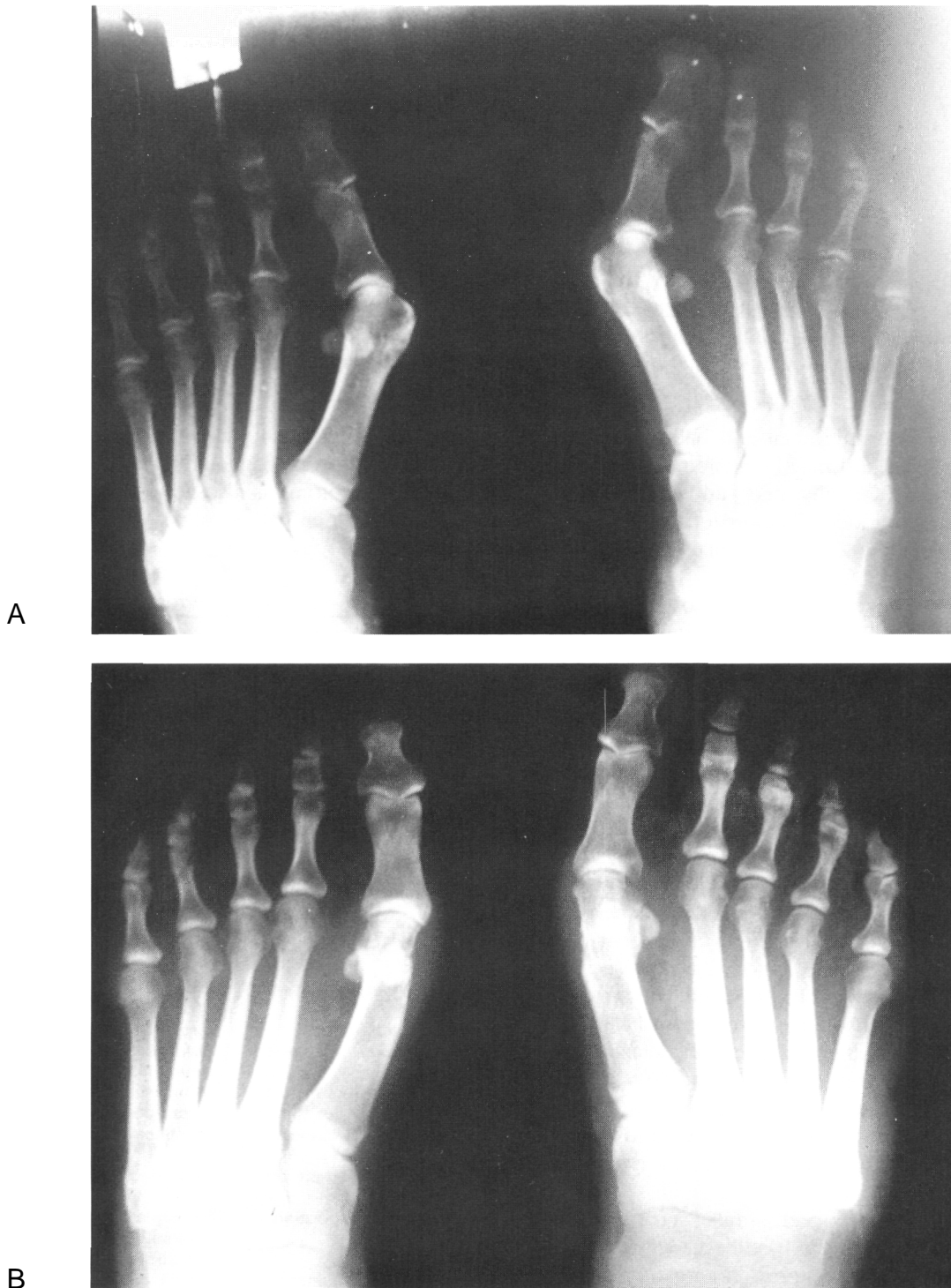
Lateral dissection with the Austin procedure, advocated by several authors, has been discouraged by others because of potential avascular necrosis of the metatarsal head. The concern regarding avascular necrosis following lateral dissection is still unclear. In those cases utilizing no lateral release, no occurrence of osteonecrosis has been reported.<sup>29-32</sup> A 13 percent incidence of osteonecrosis followed transarticular lateral capsular release but did not adversely effect the final clinical result.<sup>34</sup> Others have reported no osteonecrosis to be associated with lateral dissec-

tions.<sup>35-37</sup> Meier and Kensora<sup>38</sup> reported osteonecrosis in 12 of 60 (20 percent) Chevron osteotomies; of 10 patients who underwent an osteotomy plus lateral adductor release, 4 (or 40 percent) developed avascular necrosis. The authors did however conclude that osteonecrosis, even in advanced stages, is not incompatible with satisfactory results. Resch et al.<sup>39</sup> using <sup>99m</sup>Tc bone scans discovered that adductor tenotomy performed through a separate first webspace incision does not increase the risk of osteonecrosis following osteotomy when compared to osteotomy alone.

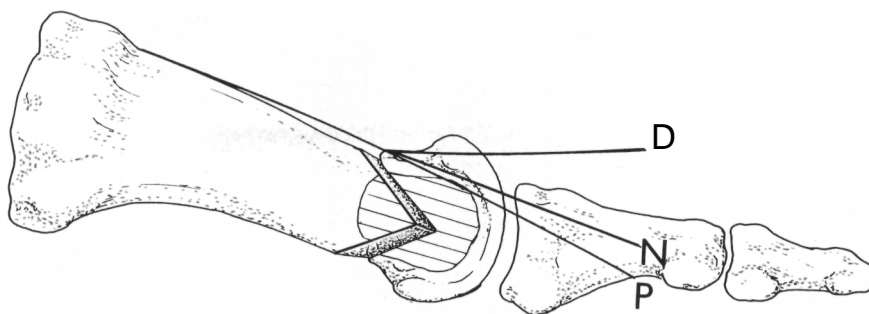
The advantages of the Austin bunionectomy are that (1) it is a joint-preserving procedure; (2) it is biomechanically sound in that it addresses deformities associated with hallux valgus, although the correction of the intermetatarsal angle is relative as opposed to a direct correction that may be accompanied by a more proximal osteotomy; (3) compensation for structural deformity in three planes is possible; (4) performance of osteotomy in the metaphyseal bone provides good bone healing; and (5) it is accessible to a variety of means of fixation.

Several authors have reported success in the management of hallux valgus using the Austin-type osteotomy.<sup>4,5,11-15,19,21,24,29,37</sup> Variations in technique especially with regards to the performance of any lateral dissection are noted. Various degrees of correction





**Fig. 12-7.** (A) Preoperative radiograph. (B) Postoperative radiograph.



**Fig. 12-8.** Postoperative sagittal plane alignment of the osteotomy. In the author's experience, the neutral (**N**) and plantarflexed, (**P**) alignment did not result in metatarsalgia or limitation of first metatarsal phalangeal joint range of motion. The dorsiflexed attitude (**D**) is associated with metatarsalgia and limited joint motion.

with regards to intermetatarsal and hallux abductus angles are reported and may be attributed in part to individual surgeon's preferences and radiographic measurement techniques. Fixation techniques, postoperative management, and incidences of complications also vary among authors.

In comparisons between the Austin osteotomy and Mitchell osteotomy, Kinnard and Gordon<sup>40</sup> reported the results to be satisfactory both clinically and subjectively and equivalent with regards to outcome, but raised concern about a high, "nearly 40 percent" incidence of metatarsalgia for both groups. They also reported greater correction of the intermetatarsal angle with the Mitchell osteotomy and a tendency to lose correction in the immediate postoperative period for the Austin osteotomy. Meier and Kenzora<sup>38</sup> also reported good to excellent results with both osteotomies in about 90 percent of the cases. Osteonecrosis was reported to occur in 12 of 60 (20 percent) feet operated on by the Austin osteotomy, as opposed to 1 of 12 (8 percent) feet with the Mitchell osteotomy.

When the Austin procedure was compared with Basilar osteotomies, for patients with a intermetatarsal angle of 13° to 16° and a hallux abductus angle of 30°, the V osteotomy provided better subjective findings as well as a lower incidence of metatarsalgia and a better postoperative range of motion of the first metatarsophalangeal joint.<sup>44</sup>

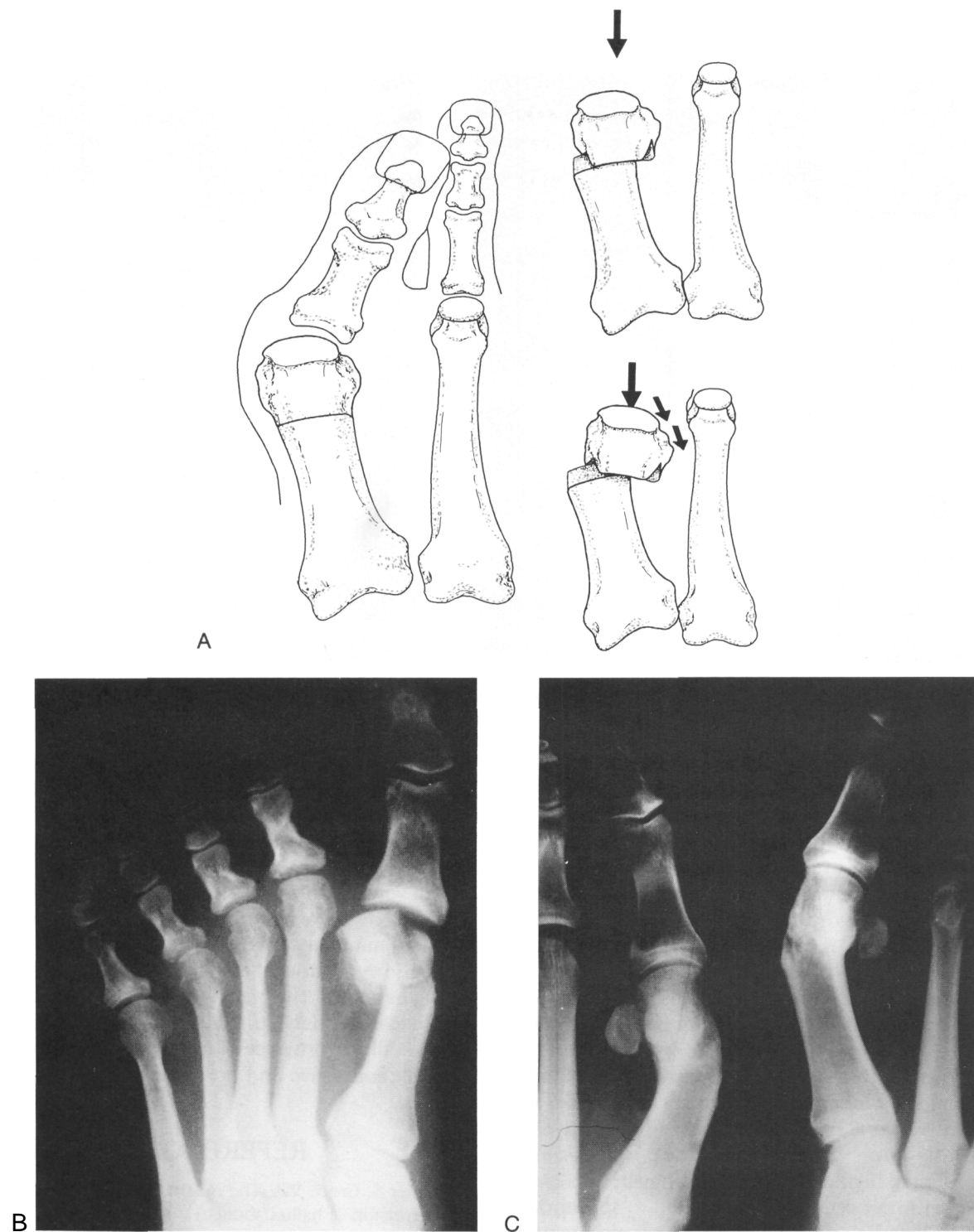
Johnson et al.<sup>42</sup> reported similar postoperative results when comparing a modified McBride bunionectomy with a V osteotomy, noting that greater correction of the intermetatarsal angle and hallux adductus angle resulted with the osteotomy. The

Austin osteotomy applied in a reverse manner has been used for the management of hallux adductus.<sup>43</sup> The Austin osteotomy is also advocated for the management of juvenile hallux valgus.<sup>35,44</sup>

**Table 12-2.** Austin Bunionectomy Complications

Insufficient lateral release	Lateral transposition difficult
Angle of osteotomy too large <sup>46</sup>	Rotation versus transposition
Angle of osteotomy too small <sup>46</sup>	Instability
	Osteotomy into diaphyseal bone
Apex of osteotomy too distal <sup>32,36</sup>	Lateral transposition difficult
Incorrect direction of osteotomy <sup>47</sup>	Danger of fracture of distal fragment (intra-articular)
Loss of bone substance by saw <sup>36</sup>	Deviation resulting in unwanted shortening, plantar flexion, or dorsiflexion
	Converging and diverging of osteotomy surfaces
	Instability
	Inadvertent PASA overcorrection <sup>46,48</sup>
	Malunion <sup>42</sup>
Excessive lateral transposition <sup>46</sup>	Instability, displacement, overcorrection
Insufficient impaction <sup>47</sup>	Instability, displacement
Excessive or poor soft tissue dissection	Osteonecrosis
Excessive excision of medial eminence <sup>46</sup>	Neural injury <sup>33,35,37</sup>
Incorrect resection of metatarsal shaft <sup>47</sup>	Insufficient bone contact after transposition
Failure to correctly transpose head <sup>36</sup>	Prominent medial bone
Difficulty with transposition	Undesired rotation
Joint pain <sup>37</sup>	Incomplete osteotomy; sesamoid blocks transposition
Excessive capsular tightening <sup>12,37</sup>	Preexisting osteoarthritis
	Hallux varus
	Joint stiffness

Abbreviation: PASA, proximal articular set angle.



**Fig. 12-9.** Complications following the Austin procedure. (A) Dislocation of capital fragment resulting from instability and excessive lateral displacement. (B) Radiograph shows dislocation and displacement. (C) Radiograph reveals that rotation rather than transposition has occurred. (*Figure continues.*)



**Fig. 12-9 (Continued).** (D) Hallux varus. (E) Osteonecrosis of first metatarsal head.

Like other procedures for the management of hallux valgus, the Austin procedure is not without complications. A review of complications associated with the osteotomy was published by Gerbert.<sup>46</sup> Complications are outlined in Table 12-2 and illustrated in Fig. 12-9. The primary cause of failure to achieve and maintain correction or recurrence of the deformity is the use of this osteotomy in cases that do not fit the preoperative criteria for its use. Hattrup and Johnson<sup>47</sup> reported an increasing rate of dissatisfaction with increasing age of patients, especially patients in their sixties.

The Austin procedure is an effective means of managing mild to moderate hallux valgus deformities using the outlined criteria for both adults and children.<sup>35-37</sup> My experiences have consistently demonstrated high patient satisfaction with the results of the Austin procedure when applied to appropriate patients. Objective clinical evaluation has also demonstrated good clinical results; however, patient subjective evaluations exceeded the clinical ratings. Relative reductions in the intermetatarsal angle have ap-

proached 7° to 8°, with a corresponding reduction of the hallux abductus angle of 15° to 17°. The tibial sesamoid position can be reduced in the immediate postoperative period to position 1 but in long-term evaluation a position of 3 was observed.<sup>36, 37</sup>

The versatility of the osteotomy allows multiplanar, multidirectional correction with high patient satisfaction and minimal complications. The procedure is effective in reduction of the intermetatarsal and hallux abductus angles. The results of the procedure are reliable and reproducible. Careful attention to detail in the overall performance of the osteotomy will prevent both intraoperative and postoperative complications.

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## SUGGESTED READINGS

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