

HALLUX VARUS

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Hallux varus is often a severe, moderately disabling and embarrassing complication of hallux abductovalgus surgery. Traditional treatment has been extremely variable in approach and results. This chapter examines many of the etiological factors of the acquired or postoperative hallux varus and offers a systematic logical approach to correction.

The deformity of hallux varus occurs at the first metatarsophalangeal joint and affects the entire foot structure and function. It may exist as the subtle transverse plane deformity of hallux adductus or it may present with the classic malleus, adductus and varus rotational deformity (Fig. 1). Previous authors (1-12) have identified the following factors as contributing to development of hallux varus:

1. excision of the fibular sesamoid
2. excessive resection of the medial eminence with disruption of the sagittal groove
3. overzealous osseous correction of the intermetatarsal angle or proximal articular set angle
4. creation of a muscular imbalance through disruption of both the adductor hallucis and lateral head of the flexor hallucis brevis
5. excessive medial capsulorrhaphy
6. creation of a rectus hallux in the face of unrecognized high proximal articular set angle or distal articular set angle
7. medial malposition of the sesamoid apparatus after adductor tendon transfer
8. medially subluxed tibial sesamoid
9. excessive or aggressive postoperative bandaging and splinting.

Historical Etiology

Hawkins (5) felt that there were two types of acquired hallux varus. The first, *static or non-dynamic*, followed hallux valgus correction involving either a joint destructive type procedure or distal metatarsal shaft osteotomy in which the muscle balance was not disturbed. He believed that gradual realignment could be anticipated even though the great toe had been placed in an overcorrected position.

The second was considered to be a dynamic deformity. It represented the creation of a muscular imbalance. This

could occur with any operation involving disruption or destruction of the lateral capsule of the joint. Miller (11) believed that there were both rotational and linear forces responsible for the development, maintenance, and accentuation of the deformity.

Johnson (8) stated that muscular imbalance occurred as a result of a weakened hallux adductor and lateral head of the flexor hallucis brevis being overpowered by the abductor hallucis muscle and medial head of the flexor hallucis brevis. He further stated that development of the classic clawed hallux was a result of the extensor hallucis longus overpowering the flexor hallucis brevis.

Other Considerations

Previously the majority of hallux varus occurred following McBride-type procedures. This may have been a result of the surgeon attempting to achieve maximum correction through a soft tissue procedure to avoid a needed metatarsal osteotomy. In the last decade, numerous first metatarsal osteotomies have been performed in combination with the McBride-type procedure further contributing to hallux varus. We shall examine a few of these factors.

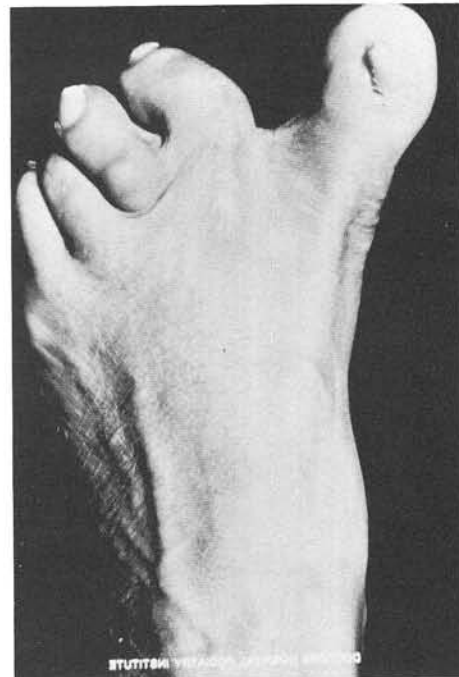


Fig. 1. Clinical demonstration of severe hallux varus deformity.

Recall that when the first metatarsophalangeal joint is properly aligned, the medial rim of the base of the hallux is locked in the sagittal groove of the first metatarsal head. The resultant vectors of force exerted by the abductor hallucis and medial head of the flexor hallucis brevis should not exceed the osseous restraints. So the loss of the adductor function alone should not produce in a hallux varus (Fig. 2).

Excision of the fibular sesamoid does compromise the lateral joint structure to some degree. This may be a predisposing factor to the development of hallux varus. However, as an isolated procedure it should not produce a hallux varus.

Medial capsular repair if performed too vigorously may effectively alter the direction of the force vectors of the first metatarsophalangeal joint. Creating a medially directed force vector can indeed lead to hallux varus (Fig. 3). The medial sesamoid groove is a great stabilizer of the first metatarsophalangeal joint. Resection of the medial condyle and staking of the metatarsal head allows the tibial sesamoid to ride medially. This also leads to an alteration of force vectors. The production of hallux varus can almost be predicted if the metatarsal head is staked in combination with fibular sesamoidectomy and excessive medial capsular tightening.

The stabilizing influence of the sagittal groove can be appreciated during surgery. If the hallux is adducted upon the metatarsal head, the medial rim of the base of the hallux will lock into the sagittal groove. So the loss of the sagittal groove could result in excessive medial displacement of the hallux predisposing the joint to the development of hallux varus (Fig. 4).

It becomes obvious then that resection of the dorsomedial exostosis must be done with a cut angulated to preserve the sagittal groove. Fig. 5). This is logical because the majority of patient complaints are related to the bump or dorsomedial eminence of the first metatarsal, rather than at the plantar medial aspect.

If the tibial sesamoid has been displaced medially it may influence the development of hallux varus much the same as fibular sesamoid influences the development of hallux valgus. If the sesamoid is markedly displaced a classic hallux varus with flexion deformity at the interphalangeal joint of the hallux will result. Shift of the balance of power to the medial side of the joint will close the first intermetatarsal angle by reverse buckling of the metatarsophalangeal joint (Fig. 6).

Often the correction of hallux valgus is evaluated by the hallux position. A rectus hallux signifies a very satisfactory result. Occasionally the hallux may be placed in a rectus position and the surgeon may be overlooking a proximal articular set angle deformity (Fig. 7). This may lead to a mild hallux varus or adductus deformity of the hallux which with time results in destructive changes.

Implant arthroplasties are subjected to the same forces at the first metatarsophalangeal joint as in other procedures. If enough deforming factors are present hallux varus may result.

Adductor Tendon Transfer

In many instances the adductor tendon will be dissected free from its distal attachments and transferred in a sub-

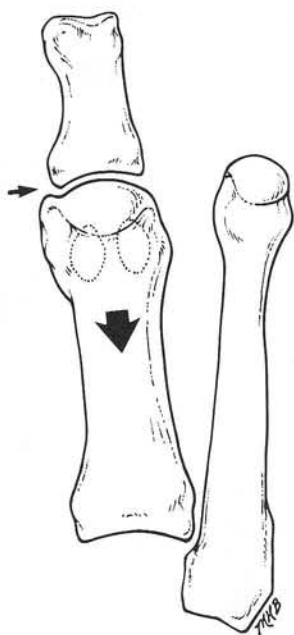


Fig. 2. Proper alignment of first metatarsophalangeal joint; medial rim of base of hallux locked into sagittal groove of first metatarsal head.

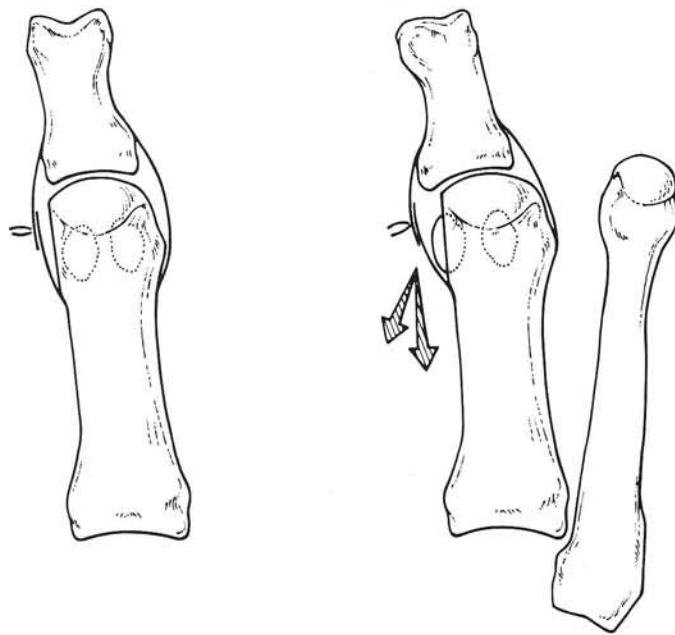


Fig. 3. Altered force vectors with excessive medial capsular repair.

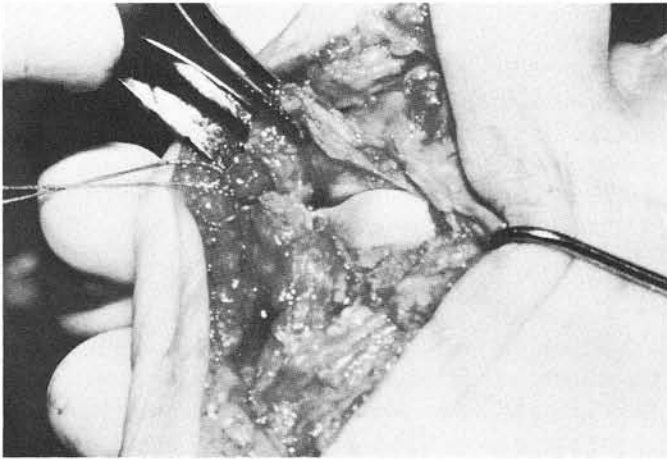


Fig. 4. Medial rim of hallux abutting sagittal groove.

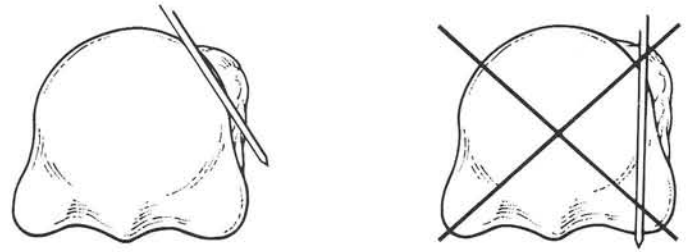


Fig. 5. Demonstration of angulated resection of dorsomedial eminence rather than resection through sagittal groove.

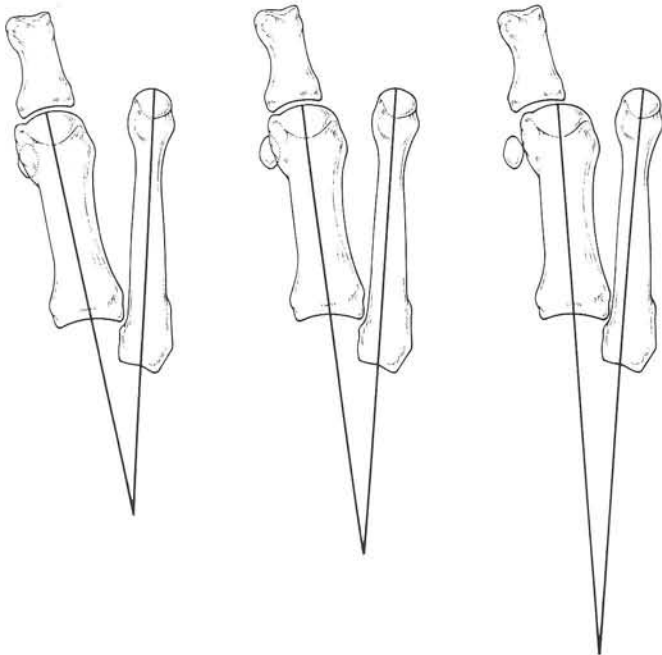


Fig. 6. Displaced tibial sesamoid can create reverse buckling phenomena and close intermetatarsal angle.



Fig. 7. Unrecognized hallux valgus interphalangeus deformity can contribute to overcorrection of the first metatarsophalangeal joint.

capsular fashion to be anchored to the medial capsular flap. If this maneuver is performed too vigorously it may excessively derotate the sesamoid apparatus so that the tibial sesamoid is displaced medially. The effect of the adductor transfer can vary according to the amount of tension applied to the suture as well as its level of attachment to the medial capsular flap. If the attachment is more proximal on the joint capsule it will exert less force than when attached more distally (Fig. 8).

Surgical Approaches

Attempts at conservative therapy, such as bandaging and splinting have met with little success. Surgical approaches

to hallux varus vary considerably. Simple procedures such as medial capsulotomy and tendon lengthening have met with disappointing results. More complex procedures such as total soft tissue release of the first metatarsophalangeal joint, and first metatarsal osteotomies have had more success. Implant arthroplasties and first metatarsophalangeal joint fusions have produced mixed results.

Hallux varus creates a powerful muscular imbalance that cannot be ignored. The disruption of antagonistic intrinsic musculature in turn alters the influence and effect of the extrinsic muscle groups. As a result, simple procedures such as capsulotomy or extensor tendon lengthening will fail.

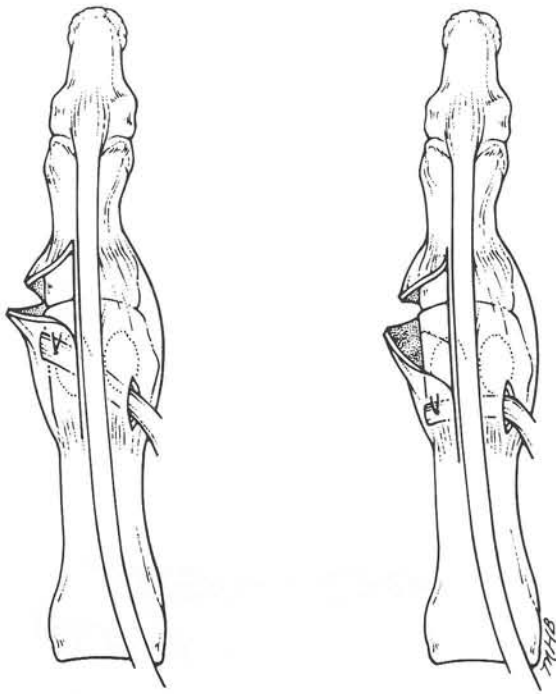


Fig. 8. Varied position and tension applied to suture of adductor hallucis transfer may influence creation of hallux varus. Distal transfer can create greater force than transfer more proximally.

Correction of hallux varus will require a well thought out plan of action. Several circumstances require further consideration.

1. skin incision and or scar revision
2. dissection process
3. total soft tissue release
4. medial capsular incision
5. tibial sesamoid positioning
6. periodic evaluation of the procedure
7. osseous correction
8. implant or Keller arthroplasty
9. timing of repair
10. expectation of physician and patient

Timing of hallux varus repair and expectations of the patient and physician are most important. If the complication is recognized soon enough non-operative treatment such as bandaging, splinting, or taping of the hallux into a valgus attitude may be beneficial. If the deformity has been in existence for some time, conservative methods will no doubt fail. It must be recognized that severe destructive changes can take place at the first metatarsophalangeal joint in the presence of hallux varus (Fig. 9).

The expectations of the physician and the patient should be clearly defined and understood before any corrective treatment is instituted.

Skin Incision

The previous scar should be evaluated to determine if it contributes to the deformity. If it is a contributing factor, scar revision rather than reincision should be considered. Otherwise, a dorsomedial curvilinear incision will provide ample access to the structures of the first metatarsophalangeal joint.

Dissection Process

Anatomic dissection has proven of great benefit in joint reconstruction. The establishment of tissue planes in revisional surgery often requires more delicate dissection. Tissue plane identification may have to be initiated more proximally along the first ray. The repair process involves the manipulation of scarred tissue on the superficial and deep level. The tissues do not possess normal characteristics and so the predictability of the healing process less certain. Inventory and functional assessment of all the structures comprising the first metatarsophalangeal joint is required. Dissection of the intermetatarsal space may be most challenging.

Total Joint Release, Capsular Incision and Repair

Arthrotomy of the first metatarsophalangeal joint is approached similar to a dislocated lesser metatarsophalangeal joint or total joint implant. All soft tissue structures are released from the metatarsal head to fully evaluate their influence on the deformity (Fig. 10).

The capsular incision is a most important step in the surgical repair process. The presence of medial capsular contraction or shortening from previous surgery greatly influences the final outcome. The surgeon must visualize the final positioning of the metatarsophalangeal joint. Repositioning the hallux from its varus position to a more abducted

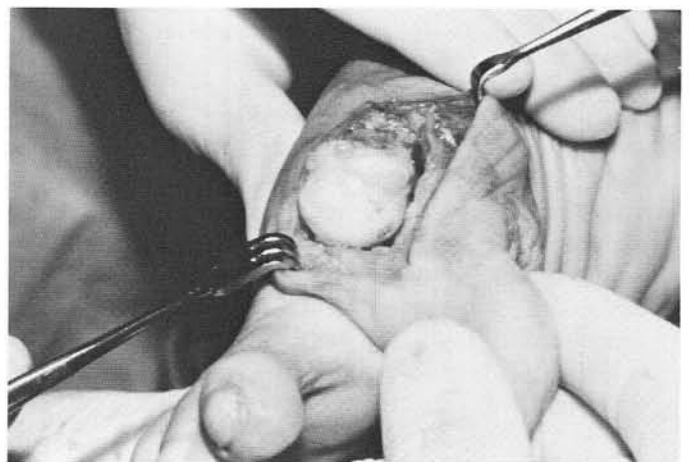


Fig. 9. Destructive changes of metatarsal head secondary to hallux varus deformity.

position will involve a relative lengthening of the medial capsular structures.

The goal of the capsular repair is lengthening of the dorsal and medial capsule for coverage of the metatarsophalangeal joint. Capsular incisions to consider are: U-shaped, pennant shaped, "V" shaped, tongue and grooved shaped (Fig. 11). Each of these capsular incisions allows for coverage of the joint surfaces with repositioning of the hallux.

Tibial Sesamoid

A medially displaced tibial sesamoid usually requires division of the conjoined tendons of abductor hallucis and flexor hallucis brevis. Realignment and derotation of the capsule has a direct effect on the tibial sesamoid position. If adequate sesamoid positioning is achieved, it may be desirable to convert the abductor hallucis muscle into a plantarflexor of the joint by transferring it plantarly. If satisfactory repositioning of the sesamoid cannot be achieved, it should be excised. After excision of the sesamoid the interphalangeal joint should usually be arthrodesed.

Abductor Hallucis

This muscle has been found to insert into the medial aspect of the proximal phalanx of the hallux 5% of the time. Nineteen per cent of the time it was not attached to the tibial sesamoid at all (12). If this is a contributing factor to the deformity it may need to be tenotomized or transferred. It has been useful to transfer the tendon to the lateral plantar aspect of the first metatarsophalangeal joint.

The goal in transferring the abductor tendon is to convert its deforming influence to a stabilizing and corrective force. It may be routed either dorsally or plantarly to the metatarsal neck. The tendon is generally attached to the plantar lateral capsular structures. This provides a good anchor point and may also exert a derotating effect on the

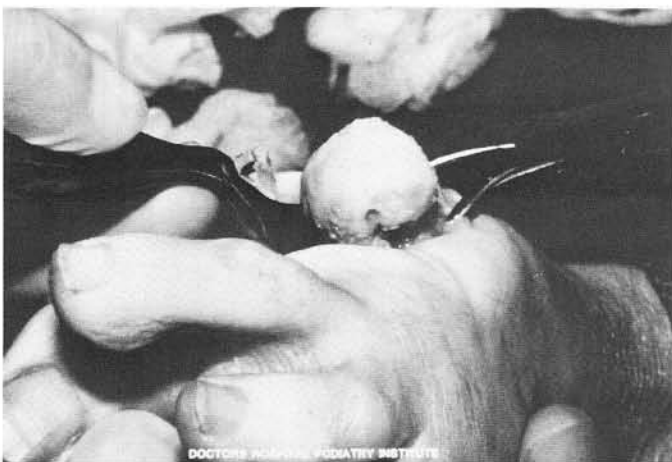


Fig. 10. Degloving of first metatarsophalangeal joint also considered as total joint release.

capsule. In several cases in which the tendon was transferred dorsal to the first metatarsal its effect was only marginal. This may have been due to the intrinsic instability that exists in the capsule after a total soft tissue release of the joint. When the abductor tendon is routed beneath the first metatarsal a greater stabilizing effect has been noted (Fig. 12).

Periodic Assessment

The first metatarsophalangeal joint should be examined at regular intervals during the surgical procedure. This is done to determine position and functional direction. Unfortunately, patients cannot get off the operating table and be evaluated with the foot in a weight-bearing position. Evaluation of the foot in a loaded position will be only an estimate of weightbearing. Should residual varus deformity remain after total joint release, osseous alteration must be considered.

Addressing The first Ray

All osseous deformities require thorough clinical and radiographic examination. A negative intermetatarsal angle is often due to overzealous correction. Such findings may necessitate osseous correction of the first ray. Numerous first metatarsal osteotomies may provide adequate correction. Various modifications of the Austin osteotomy have been successful in realigning the first ray. Occasionally bone grafting of the first ray with more complex fixation methods may be required.

A staked first metatarsal head with hallux varus deformity presents a greater challenge. Thorough evaluation of the articular surface and assessment of function is necessary. A negative proximal articular set angle may also be present. Revisional osteotomy of the distal metaphyseal region may be needed. The use of an implant may be warranted due to loss of articular cartilage.

In some instances varus deformity may be secondary to an Akin type procedure done in combination with a soft tissue bunionectomy. If osseous deformity is present at the level of the hallux it also must be addressed by a reverse Akin osteotomy.

A common misconception is that an implant arthroplasty will restore normal position to the joint and solve the problem. Implants are not a panacea for hallux varus. If an implant arthroplasty is selected as the procedure of choice all deforming forces must be removed from the soft tissue and bone or the implant will fail.

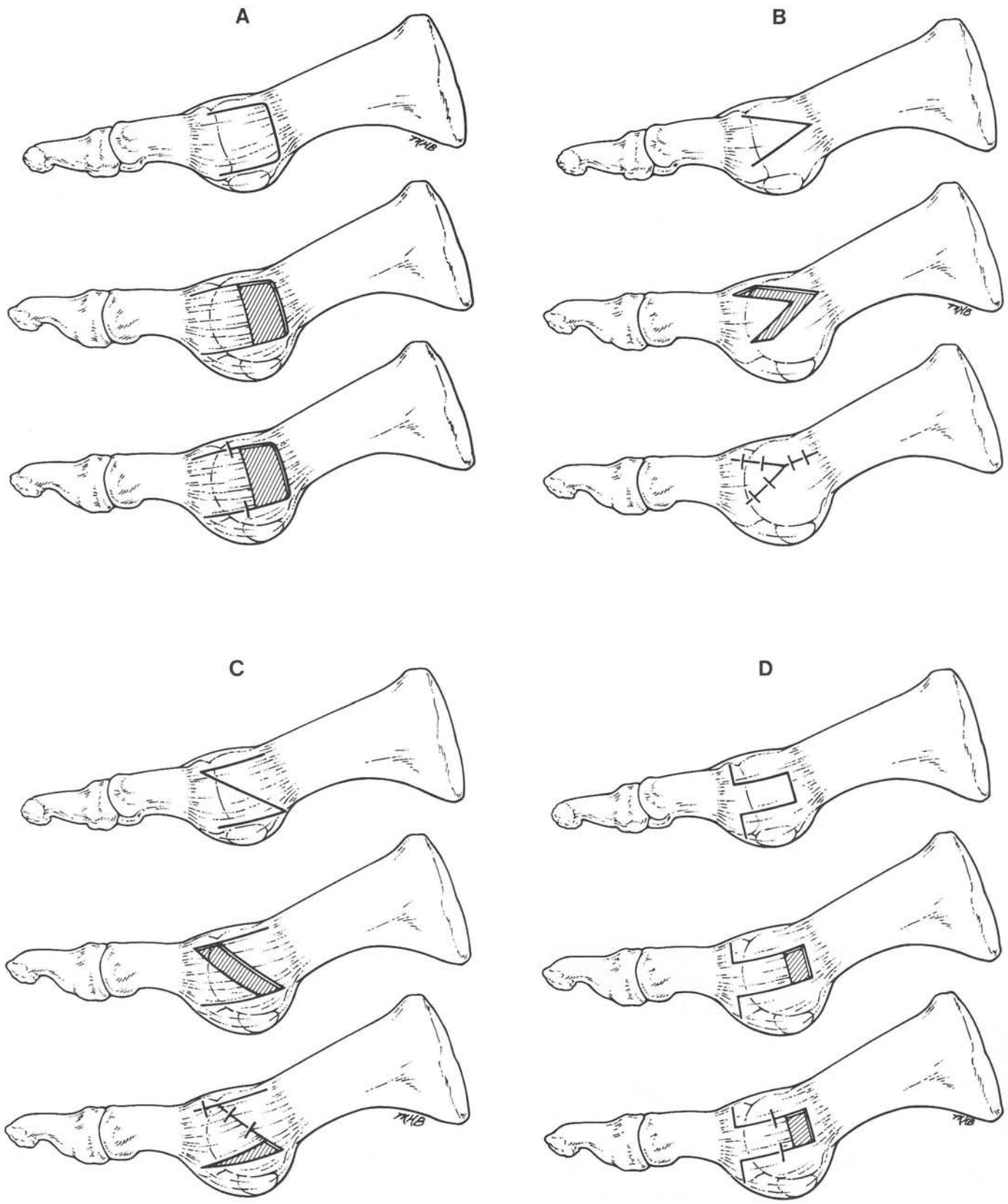


Fig. 11. Various approaches to medial capsular repair.

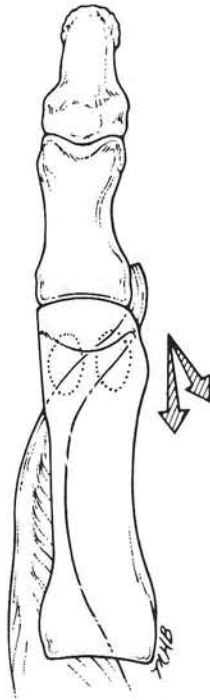


Fig. 12. Transfer of abductor hallucis plantar to first metatarsal creates greater force vectors in proximal and plantar directions.

An alternative procedure that must be included for completeness, is first metatarsophalangeal joint arthrodesis. Most podiatrists view this as a last resort but it is a predictable method of treatment in the appropriate patient population.

Summary

Successful treatment of hallux varus requires thorough evaluation and identification of all deforming influences. A well thought out operative plan must be developed which reverses the deforming forces. Total soft tissue release and

appropriate attention to the muscle-tendon balance principles should be a logical initial step. If other deforming influences are present such as first ray malalignment, the appropriate reconstructive procedures should be undertaken.

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