ANATOMIC DISSECTION OF THE HAMMERTOE

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The hammertoe deformity is commonly treated by the podiatric surgeon. Pathology of the digits at various levels as well as considerations in conservative and surgical care have been discussed extensively in the literature.[1] This paper will provide a surgical guide to anatomic dissection of the digit by addressing all of its components in a logical step-wise fashion.

Digital deformity has been classically attributed to three distinct mechanisms; flexor substitution, flexor stabilization and extensor substitution. These biomechanical mechanisms induce deformity at varying levels of the digit. A careful evaluation of foot function is important to surgical correction of the hammertoe deformity. A thorough knowledge of functional anatomy is necessary for long term reduction of digital pathology.

This approach to digital surgery is based upon surgical principles which are fundamentally similar to anatomic dissection in other areas of the lower extremity. A logical progression of the dissection technique allows preservation of the vital neurovascular structures of the digit, an organized reduction of the deformity, and a timely return to function.

CLINICALLY ILLUSTRATED TECHNIQUE

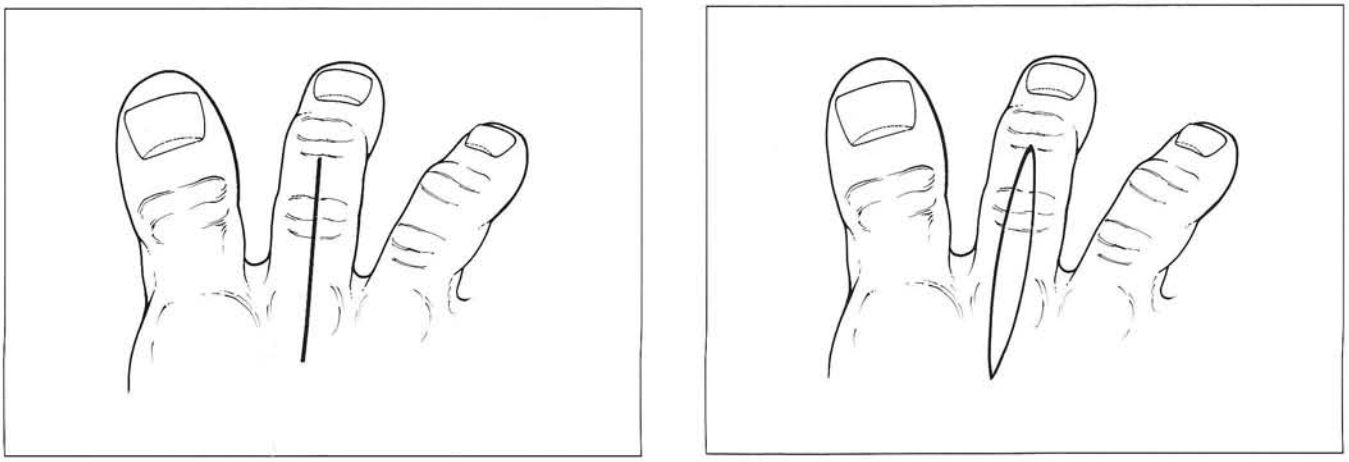

Figure 1. The skin incision is midline over the dorsal aspect of the digit for exposure of the proximal interphalangeal joint and can be extended proximally to the metatarsophalangeal joint region. Several incisional approaches can be used including an elliptical, transverse, or lazy "s" technique.

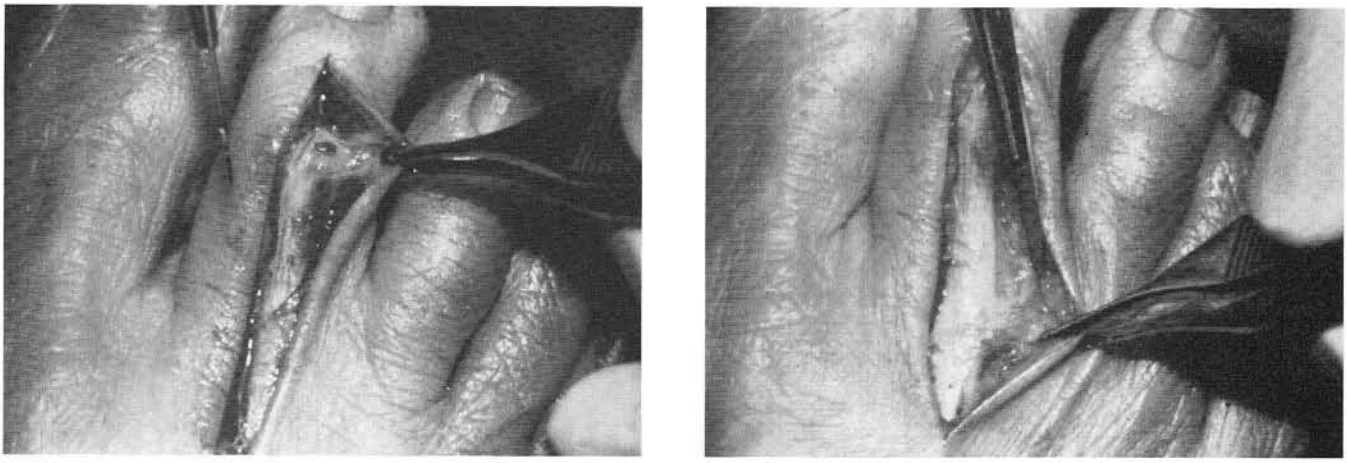

Figure 2. Once the integument is incised along the entire length of the proposed incision, the superficial fascia is identified. This layer is delicately gleaned from the medial and lateral aspects of the proximal phalanx. Care is taken to reflect this subcutaneous layer while preserving the longitudinally oriented neurovascular bundles.

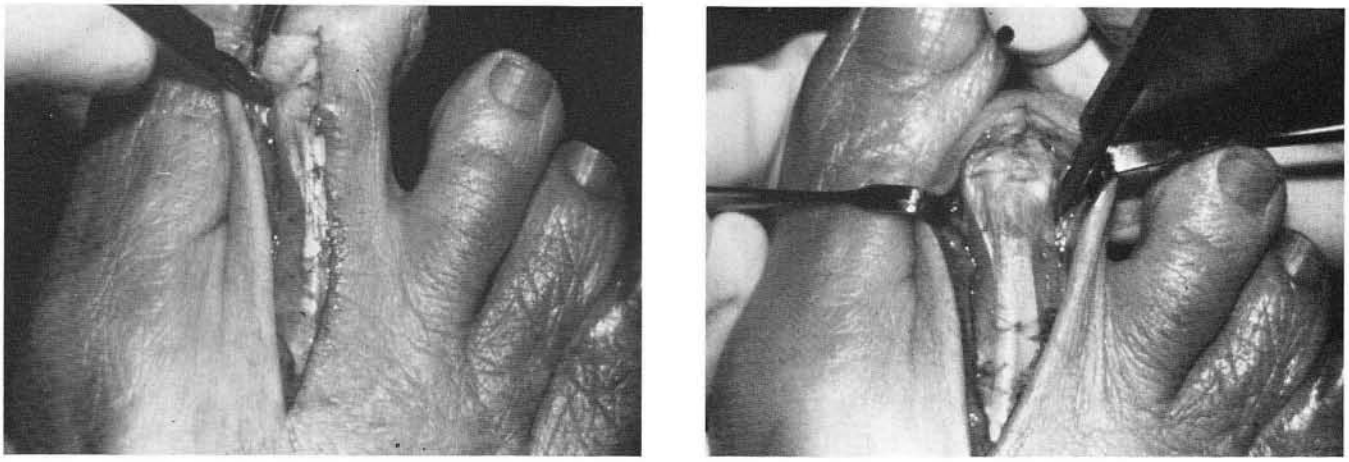

Figure 3. After the subcutaneous layer has been reflected medially and laterally, attention is directed to exposing the proximal phalangeal head. The medial and lateral collateral ligaments are identified at their respective plantar positions and resected cleanly at the joint level. The collateral ligaments can be primarily sutured at the time of reapproximation of the extensor tendon.

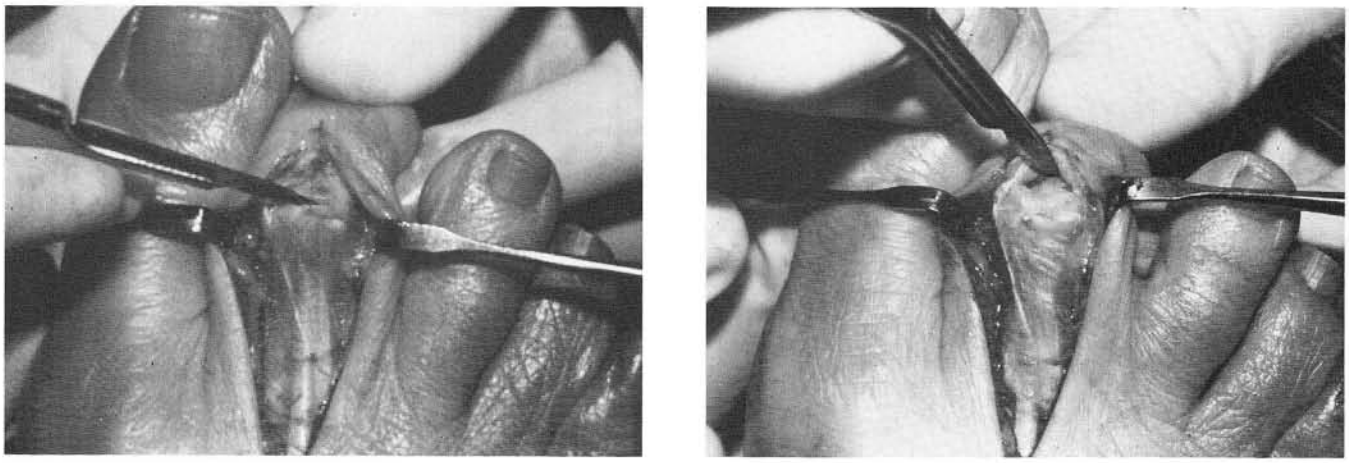

Figure 4. The extensor tendon is transversely incised just distal to the head of the proximal phalanx and the head of the proximal phalanx is exposed.

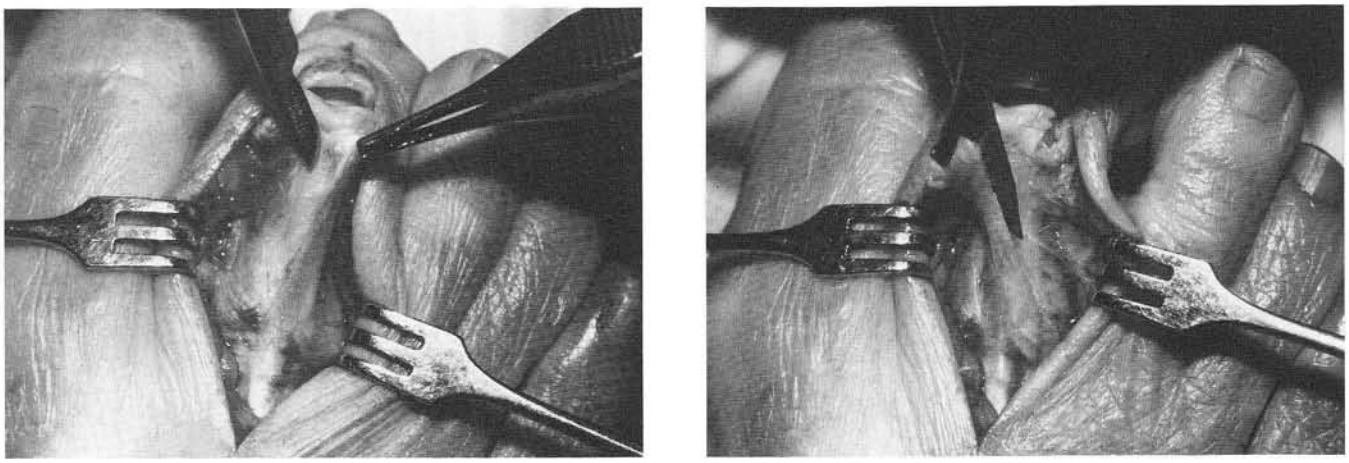

Figure 5. The extensor tendon is freed from the dorsal aspect of the proximal phalanx by an angulated stroke of the blade at the medial and lateral margins of the tendon. The extensor hood expansion, denoted as a thin fascial layer, is cleanly reflected at this level, freeing the extensor tendon.

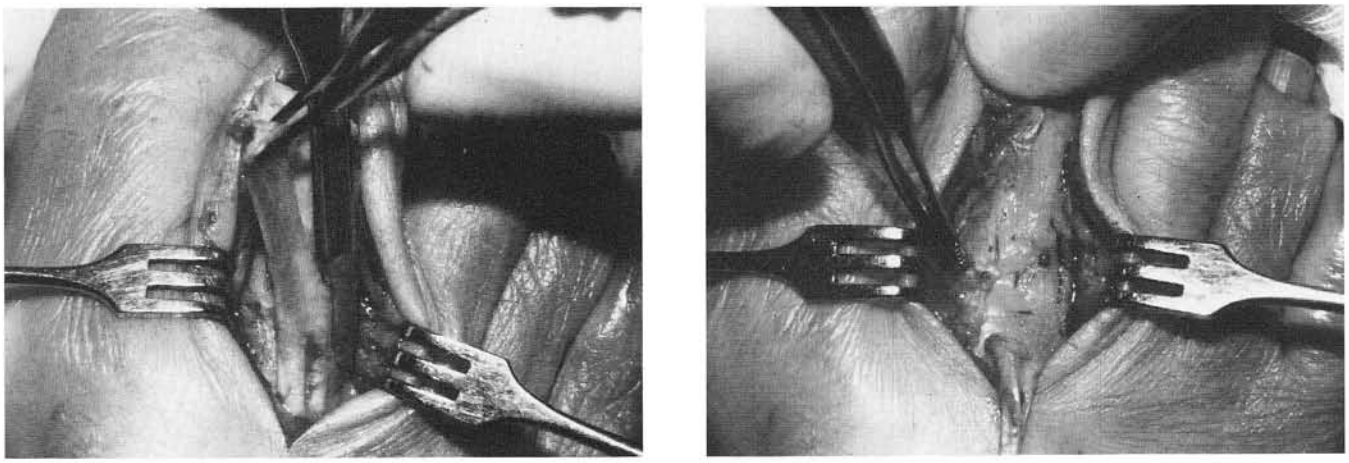

Figure 6. The extensor tendon is reflected proximally to the level of the metatarsophalangeal joint so that the capsular structures can be adequately exposed.

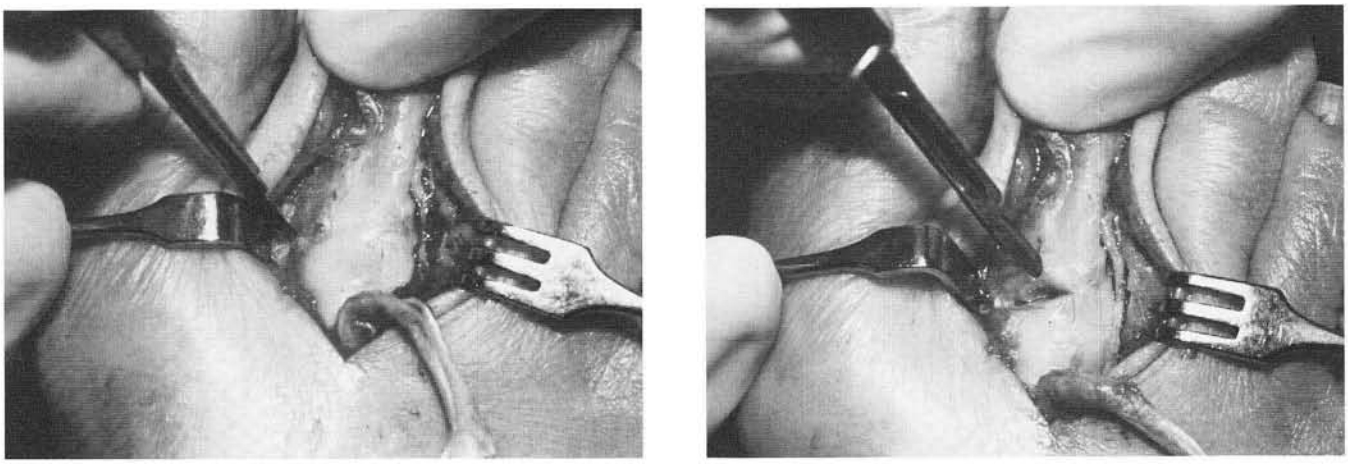

Figure 7. The capsular tissues are incised and released as necessary to allow complete reduction of the contracture at this level. A step-wise approach would include a dorsal capsulotomy followed by a medial or lateral release, depending on the transverse plane position of the deformity. A plantar release of the capsule and plantar plate would be performed to ensure total reduction of a severely dislocated digit.

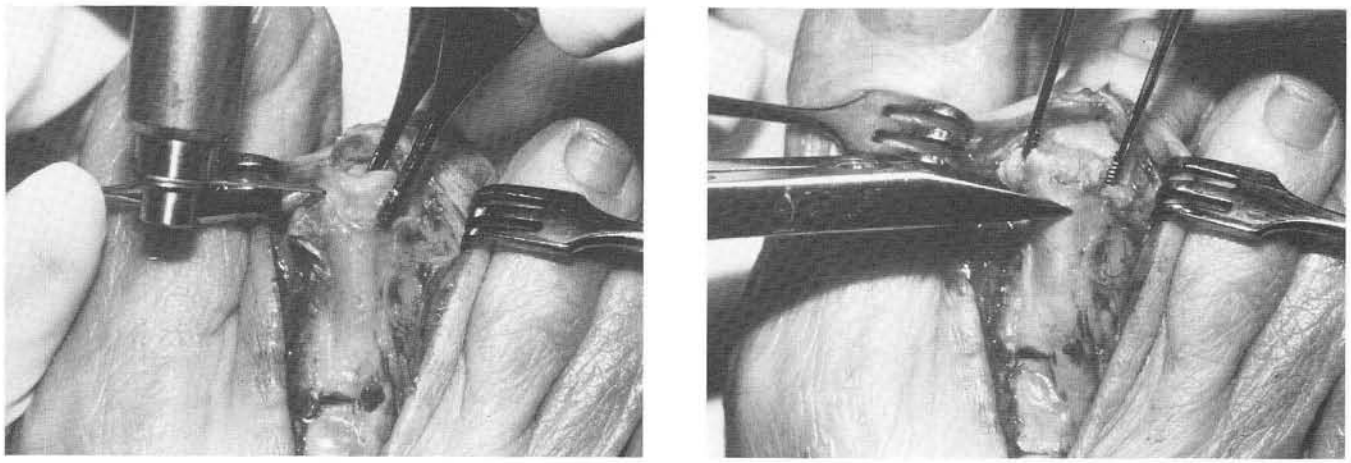

Figure 8. Following capsular dissection, attention is redirected to the head of the proximal phalanx. The head of the phalanx is resected with either power or hand instrumentation. Care is taken to provide adequate resection of bone to the level of the metaphyseal flare of the head, as well as a transverse orientation of resection to ensure a perpendicular relationship with the base of the middle phalanx.

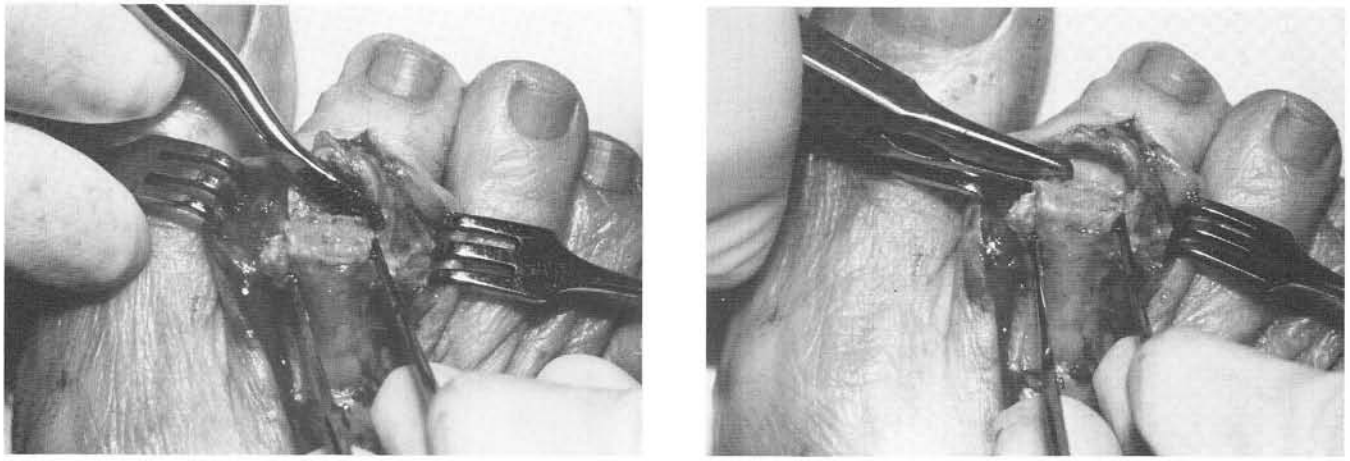

Figure 9. A rasp or rongeur is used to create a clean margin of bone, devoid of spurring and rough contours.

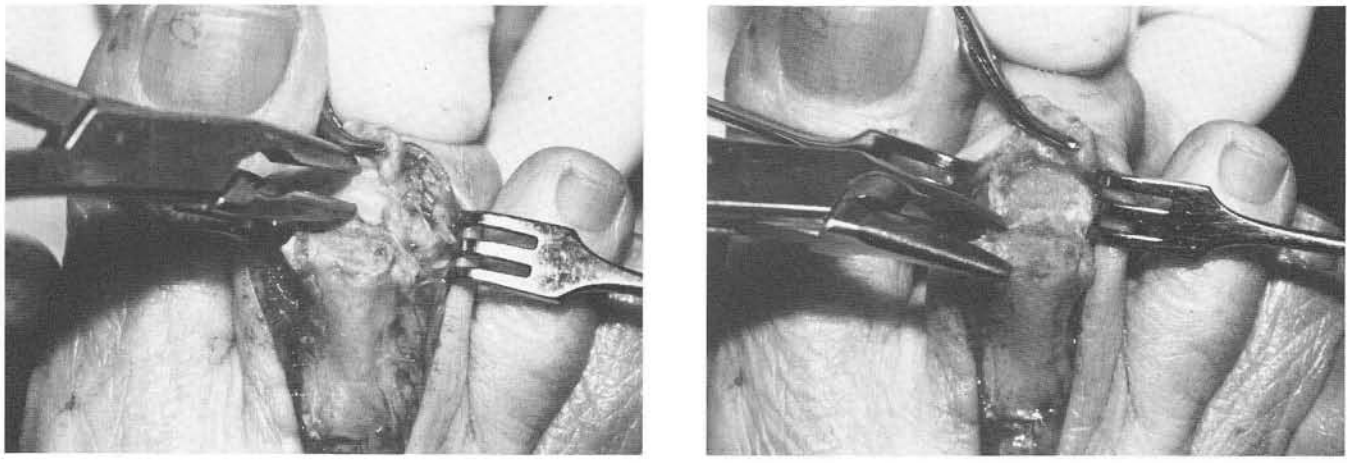

Figure 10. A rongeur is used to resect the cartilaginous surface of the middle phalanx. Care is taken to resect articular cartilage without excessive bone loss. A perpendicular plane of the base of the middle phalanx is important so that it will line up congruently with the resected portion of the head of the proximal phalanx.

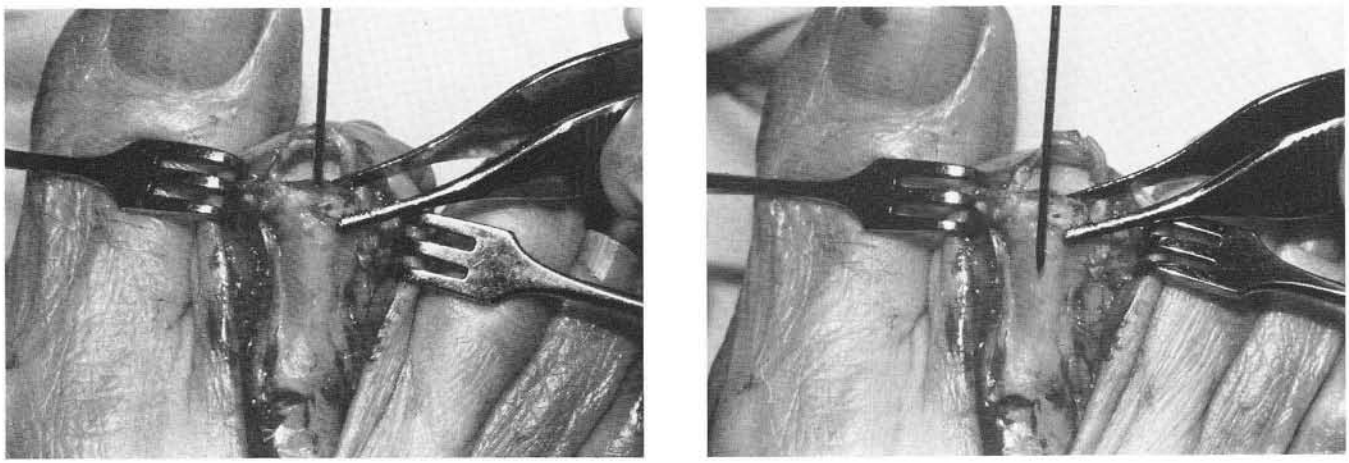

Figure 11. The intramedullary canal of the proximal phalanx is identified with a 0.045 K-wire. This will expedite the advancement of the K-wire as it enters the proximal phalanx.

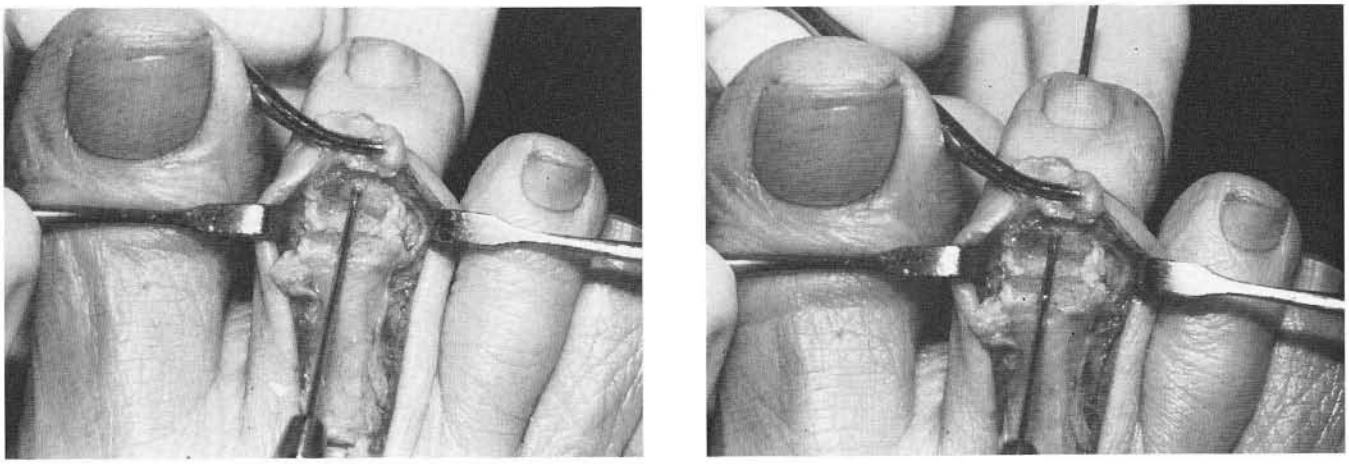

Figure 12. The 0.045 K-wire is now directed into the base of middle phalanx and the central portion of the bone. Care is taken to hold the tip of the toe in slight dorsiflexion. This technique ensures an accurate exit point at the distal aspect of the toe. The wire should be driven through the distal phalanx and exit centrally in line with the nail plate.

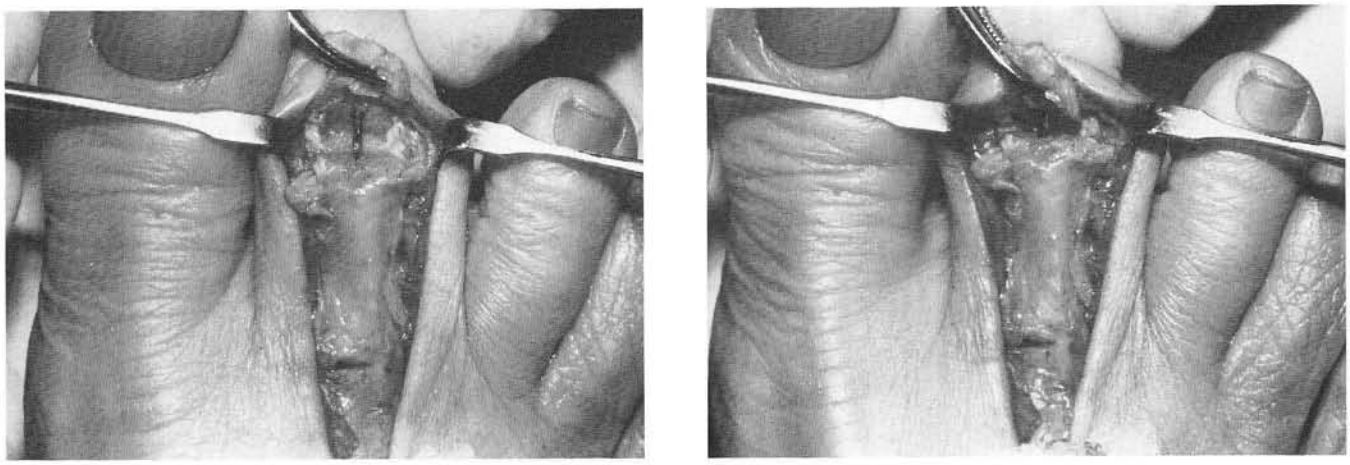

Figure 13. The wire is retrograded back into the proximal phalanx. Under direct visualization the wire is placed into the prepared "pilot hole" corresponding to the intramedullary canal of the proximal phalanx.

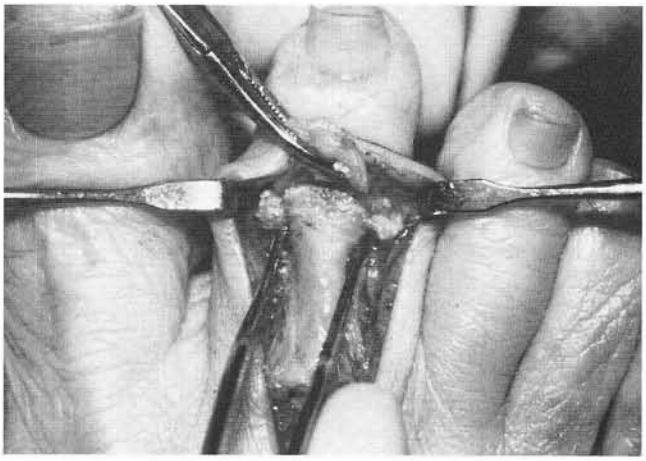
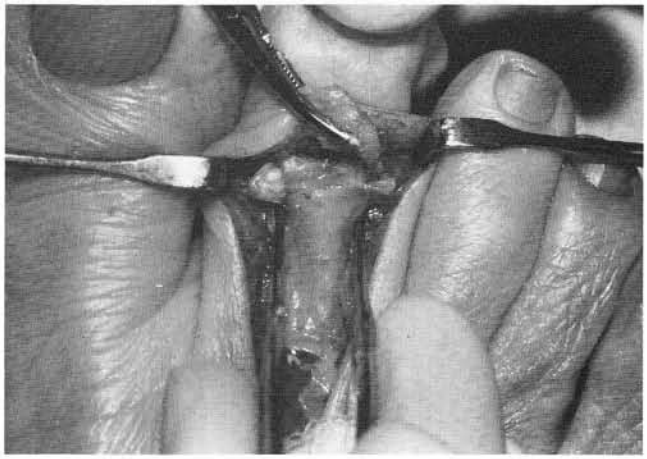

Figure 14. The proximal phalanx is stabilized at its surgical neck, and the distal aspect of the toe is aligned so that the middle and proximal phalangeal surfaces are congruent. The wire is advanced to the level of the subchondral bone plate of the base of the proximal phalanx and then advanced if necessary, to exit into the metatarsophalangeal joint area.

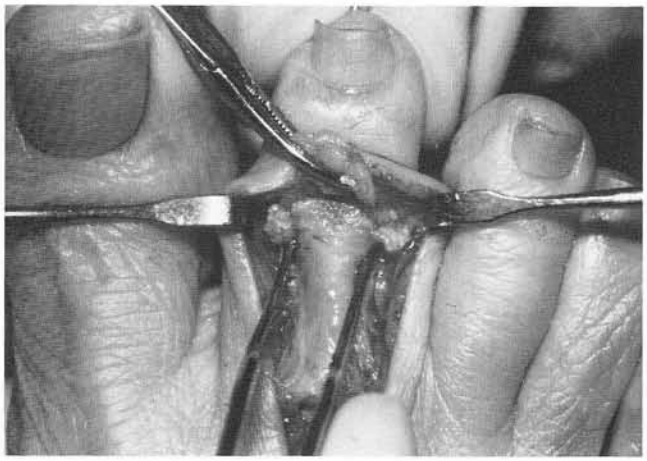
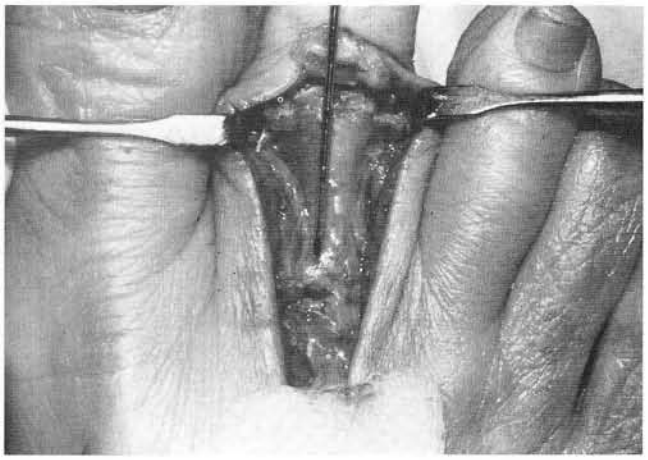

Figure 15. The arthrodesis site is examined for a flush bone-to-bone contact. Any step-defect or angulation at this level is unacceptable and should be corrected prior to advancement of the wire across the metatarsophalangeal joint level. An additional K-wire of equal length can be used as a measuring guide for proper position.


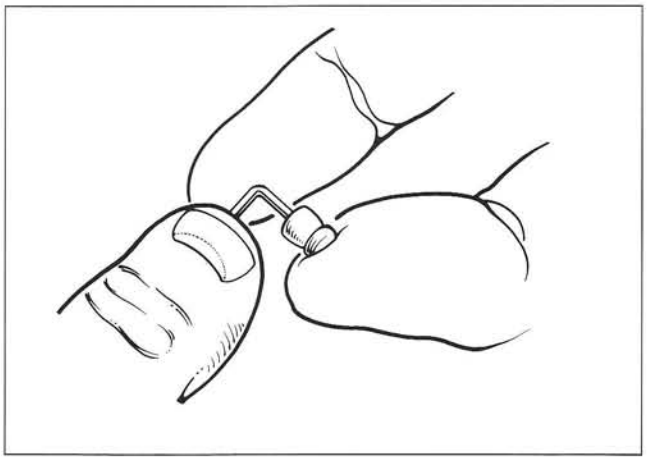

Figure 16. The distal wire is then bent, cut and capped. The arthrodesis site is inspected for any positional change prior to closure.

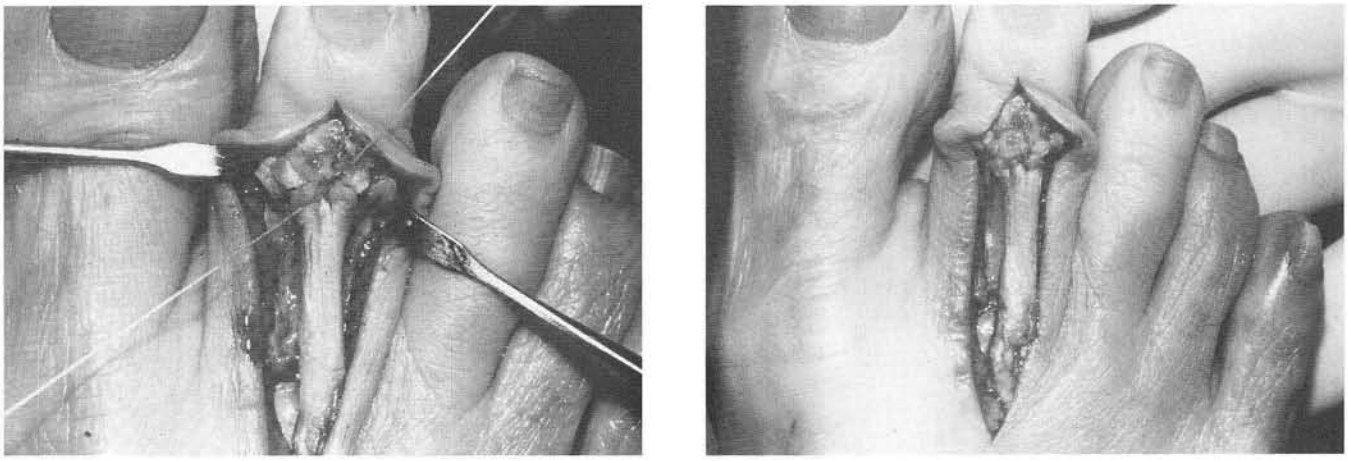

Figure 17. Closure begins with the reapproximation of the extensor tendon. A horizontal or simple interrupted technique is used.

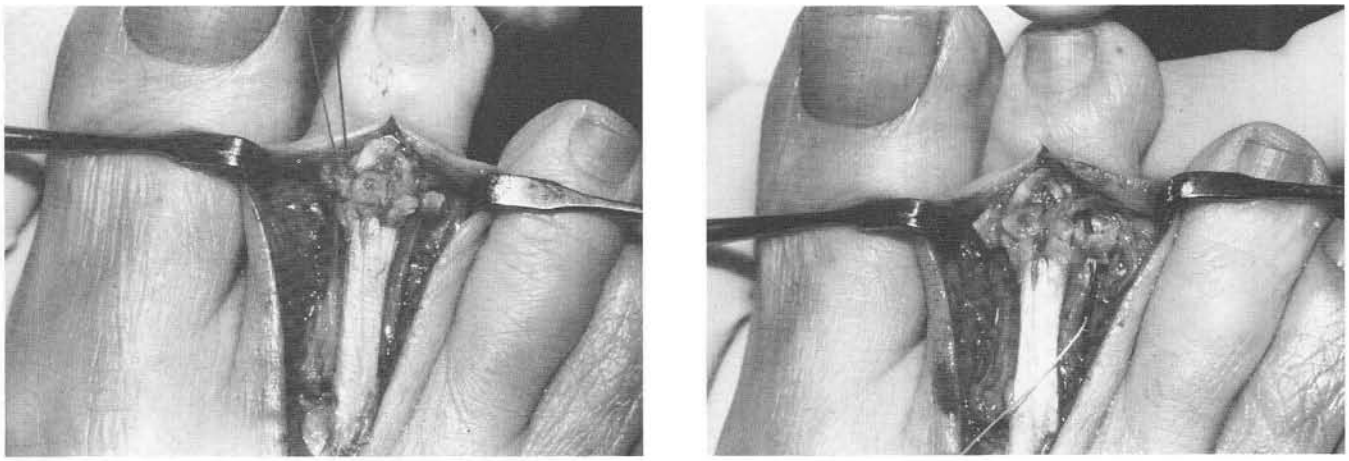

Figure 18. The medial and lateral collateral ligaments are identified and repaired with a simple interrupted technique. This step is useful when performing an arthroplasty, because the repair of the collateral ligaments maintains stability to the region.

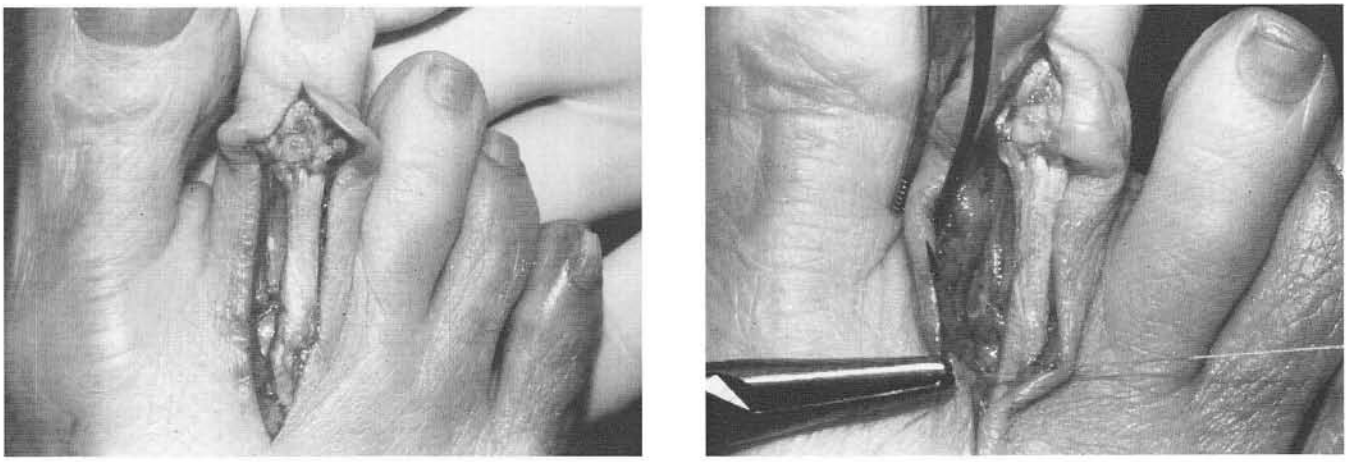

Figure 19. The subcutaneous tissue is identified and sutured in a continuous running fashion with an absorbable material.

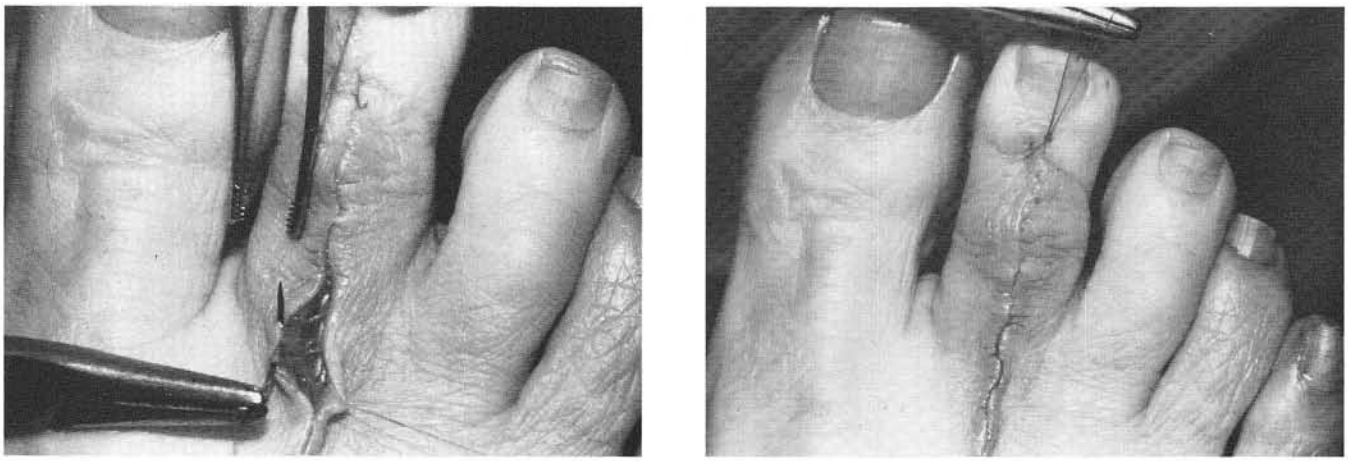

Figure 20. The integument is repaired using an intradermal continuous suture technique with an absorbable material. Varying suture techniques and materials can be employed.

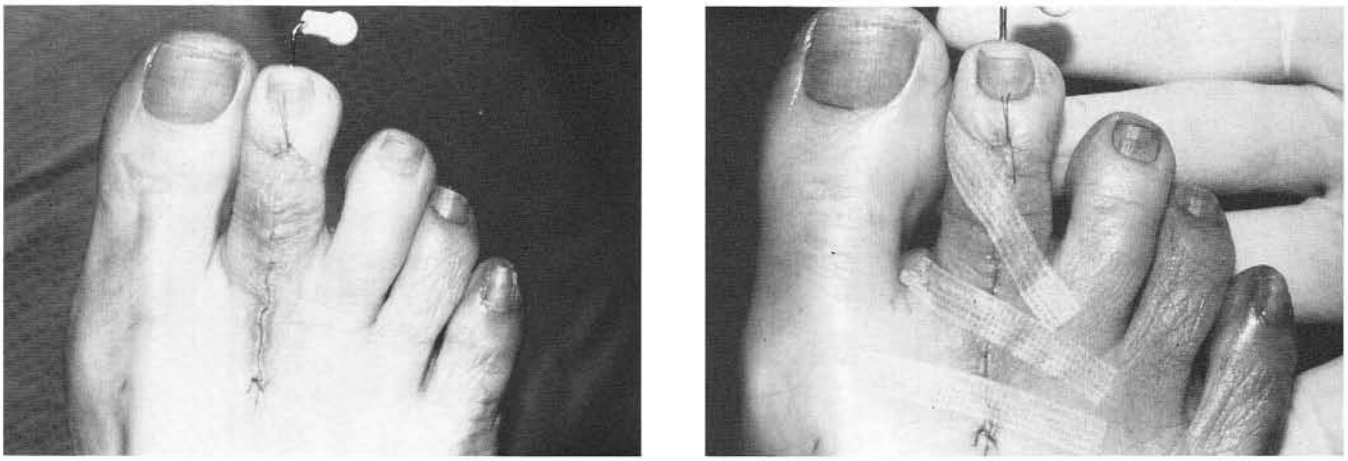

Figure 21. Final postoperative result.

SUMMARY

An anatomically sound method of surgically correcting a hammertoe deformity has been presented. Many variations to this particular series are possible when the principles of anatomic dissection are appreciated. An understanding of the dynamics of the deformity and knowledge of surgical anatomy and technique should provide consistent and reproducible results in digital surgery.

REFERENCE

1. McGlamry Ed, Banks AS, Downey MS (eds): *Comprehensive Textbook of Foot Surgery* 2nd ed, Baltimore, Williams & Wilkins, 1992.