

# COMPLICATIONS IN DIGITAL SURGERY

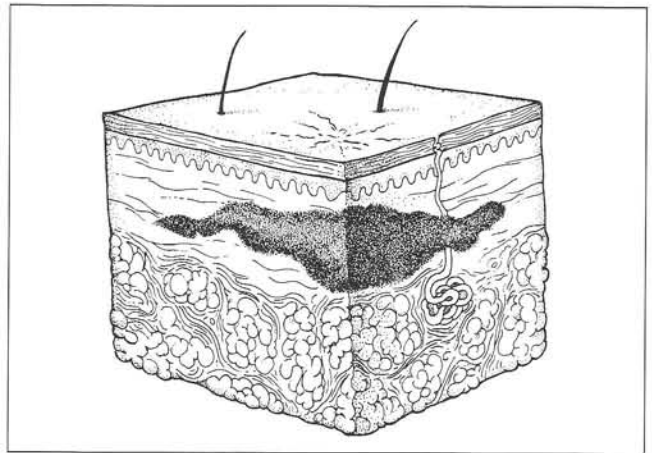
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Infection, excessive scarring, and delayed healing are potential complications of any surgery. Digital surgery, the most common type of podiatric surgery, is still fraught with a multitude of complications, many of which can be minimized by enhanced surgical technique and a thorough understanding of the etiology of these complications.

Vascular complications, although rarely encountered, are of special concern. Compromise in arterial circulation occurs in only the rarest of circumstances, however, a dissecting hematoma is more frequently encountered. This results from excessive bleeding which separates the dermis from the subcutaneous tissues. This will result in dermal devascularization and skin slough. It is important to recognize, since unnecessary amputations have been performed where this condition mimics gangrene. (Figure 1)

Other atypical effects of digital surgery are bone accretion, or more commonly, bone atrophy, which may take years to develop. Bony proliferation has been attributed to a periosteal reaction which occurs as a result of surgical trauma to the bone. This trauma is magnified by splintering of the phalanx when hand instrumentation is used.

It is the author's opinion that long term bony changes are in part the result of Wolff's law. Bone is a dynamic, living, tissue which responds in form and function to applied stresses. An arthroplasty of a proximal phalanx in which inadequate bone is resected will have significant retrograde forces place upon it by the middle phalanx. These stresses will result in bone accretion. It is also possible that excessive shoe pressure may have the same effect. (Figure 2) Bone which is not stressed, such as following significant



**Figure 1.** Dissecting hematoma. Blood separates the dermis from its vascular supply in the subcutaneous tissue.



**Figure 2.** Bone accretion is observed in the 2nd and 5th toes. Inadequate bone removal results in significant retrograde pressure on the remaining phalanx.

resection of the phalangeal head, will diminish in size and density. (Figure 3) These complications will lead to either the formation of a new point of pressure, or further instability within the joint.

The majority of digital complications, however, result from an inadequate evaluation of the etiology of the deformity, or from an inappropriate method of treatment. The majority of digital deformities are the result of a dynamic muscle imbalance. This can result from overpowering of the long extensors or flexors, or weakness of the intrinsic musculature. Since the intrinsic muscles primarily stabilize the MPJ's, any surgery to the metatarsal head, neck, or joint, may further de-stabilize the digit. (Figure 4)

It is important to recognize the etiology of the deformity, so that the appropriate procedure can be performed. Flexor stabilization hammertoes are easily recognizable. During the stance phase of the gait cycle, the digits appear to grip the ground. All of the lesser digits are involved, and the 4th and 5th toes display increasing degrees of varus rotation. (Figure 5) The most common cause of flexor stabilization hammertoes is pronation. The long flexor tendons, which are supinators of the rearfoot, overcompensate to stabilize the subtalar and midtarsal joints. Unless this deforming influence is removed, re-deformity will

occur if an arthroplasty is performed. Arthroplasty can be successful, if the effects of the pronation are removed by orthotic therapy or flatfoot surgery. Flexor tenotomy or tendon transfer will also remove the deforming force.

Extensor substitution hammertoes result from overpowering of the long extensor tendons, as typically seen in the cavus foot. The extensors fire early to provide ground clearance for the plantar-grade forefoot. These deformities are seen only in the swing phase of gait, and produce hammertoes which are drawn straight back onto the dorsum of the foot. (Figure 6) Again, arthroplasty is prone to failure unless corrective measures are taken. A Hibb's tendon transfer, cavus foot reconstruction, or extensor tenotomy, can effectively remove the deforming force.

In the surgical planning of a digital deformity, arthrodesis is the procedure of choice, unless the etiology is eliminated. Once the IPJ has been arthrodesed, the digit can no longer buckle. As the flexor then contracts, the digit will plantarflex at the MPJ until ground resistance is encountered. Extensor overpowering, on the other hand, is resisted by the passive tension of the long flexor tendon, which now has a long lever arm at the MPJ.



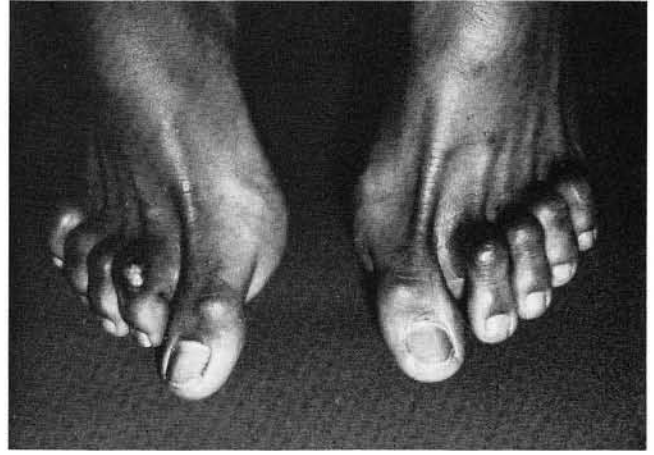
**Figure 3.** Atrophy of the proximal phalanges when normal stresses are removed.



**Figure 4.** Multiple surgeries have de-stabilized the MPJ's, resulting in digital deformities.



**Figure 5.** Dynamic muscle imbalance produced by the long flexors tendons. Note the varus rotation of the 5th toe.



**Figure 6.** Dynamic muscle imbalance produced by the long extensors. All of the lesser digits are dorsally subluxed.