The Index Finger - A Unique Creature of Habit

Robert W. Crow

The forefinger serves to exemplify the precise movements of the human hand. It distinguishes itself as the first of four digits with its independence of flexion and unique ability to extend alone. When active it is the initiator of grasp and a complement to the thumb in pinch. When disturbed, in contrast, it can impede hand motion and serve as a barrier to the same functions that it helps when intact.

It shall be the purpose of this paper to discuss the anatomy of this digit and then allude to the more common problems found with it, accompanied by a brief discussion of the accepted methods of restoration for each of these insults.

Range of Motion

The index finger is capable of a full range of motion. It can flex and extend at the distal and proximal interphalangeal joints as well as at the metacarpophalangeal joint. In addition, it has the ability to abduct and adduct at the latter joint which makes it a "diarthrodial multi-axial joint." The metacarpal of this finger is usually the longest of all the metacarpals in the hand. Its base is forked and opens in the central portion for articulation with the lesser multangular. The two sides of this fork articulate radially with the greater multangular and ulnarly with the styloid process at the base of the third metacarpal. The dorsal aspect of the radial articulation serves as the site of insertion of the extensor carpi radialis longus tendon. This unit with its companion, the extensor carpi radialis brevis, which inserts into a similar site on the adjacent third metacarpal, serves as a stabilizing element of the wrist. In severe injuries to the index finger requiring ray amputation, this insertion serves as the proximal line of division of the metacarpal in order to preserve the transverse arch of the hand as well as the stability of the wrist. The ulnar side of the base of this metacarpal is the site of insertion of the interosseous ligament which joins the bases of the second and third metacarpals. The radial volar aspect of the base is also the site of part of the origin of the adductor pollicis muscle, sharing in this capacity with the third metacarpal and the greater and lesser multangular as well as the capitate.

The shaft of the second metacarpal is somewhat flattened, especially on the dorsal surface, but in most other respects is not unlike the remaining metacarpals. The head is large and somewhat irregular while the articular surface is longer on the volar than on the dorsal surface. This latter plateau is a site for the beginning of the capsule of the metacarpal phalangeal joint.

Phalanges

Phalanges do not differ markedly from those of adjacent digits and, therefore, will not be discussed in detail except for their connection with the overlying flexor and extensor mechanisms as well as the surrounding soft tissue which will be alluded to in detail below.
Extensor Mechanism

The extensor mechanism is somewhat unique in this finger. The common extensor tendon, the extensor digitorum communis, sends limbs to all four digits of the hand. It arises from the lateral humeral epicondyle as well as the intermuscular septum and then passes through the hood of the fourth dorsal compartment ulnar to Lister's tubercle to insert into the dorsum of the proximal phalanx. This pattern is essentially duplicated in all digits but, uniquely to the index finger, the extensor indicis proprius, originating from the posterior surface of the ulnar as well as the interosseous membrane, runs distally with this common extensor and passes anteriorly to it as it extends through the synovial sheath. It then deviates medially to insert on the ulnar side of the slip of the common extensor into the proximal phalanx. This unique characteristic provides the index finger with the ability to extend itself independently of the adjacent fingers. It also provides an excellent tendon to be used for transfer when thumb extension is deficient or absent and cannot itself be repaired. From the proximal phalanx distally the extensor mechanism of the index finger is not unlike that of the other fingers and divides into a central slip which inserts into the middle phalanx and then extends via two lateral bands which join the lumbrical and interosseous muscle to run distally to terminate at the proximal end of the terminal phalanx. The insertion here is just proximal to the matrix of the nail and this structure is frequently injured concurrently with the tendon in disruptions of this distal insertion.

Intrinsic Muscles

The intrinsic muscles which aid the extensor tendons are somewhat different in the index finger than in adjacent digits. One limb of the muscle inserts into the lateral tubercle of the proximal phalanx and the second inserts into the dorsal hood without contribution to the lateral slip of the first lumbrical. This difference allows the first dorsal interosseous to flex the proximal phalanx more effectively in grasp, especially in the thenar web. Because of the absence of the first dorsal interosseous to join the tendinous insertion of the first lumbrical, it does not help in extension of the middle and distal phalanges, as is the case in the other three adjacent digits. This function is supplied fully by the lumbrical muscle and the volar interosseous muscle, which inserts into the dorsum of the middle and proximal phalanges and then joins the terminal phalanx through the lateral band as previously described.

Flexor Mechanism

The flexor mechanism of the index finger is not unlike those of the adjacent fingers. The position of the superficial tendon at the wrist is almost always dorsal to those of the third and fourth fingers and usually shares this position with the superficial tendon to the fifth finger. The flexor digitorum profundus runs with the long tendons to the other digits and its function and mode of action are common to each of them.

Blood Supply

Blood supply is furnished by branches of both the radial and ulnar vessels. Distal to the pisiform the ulnar artery divides into two branches. The larger remains superficial and joins a smaller branch of the radial artery to form the superficial palmar arch. This arch then
gives rise to the common volar digital vessels which then give origin to the proper digital artery on the ulnar aspect of the index finger.

The smaller branch of the ulnar artery joins the deep branch of the radial artery and proceeds to pass between the heads of the first interosseous to supply the first metacarpal. The proper radial digital vessel most often arises from this branch, and in amputations of the index finger this vessel must be divided distal to the metacarpal artery or the digital vessel to the thumb which also arises at this site may be jeopardized.

The venous drainage is supplied by both a superficial and a deep system. The superficial veins provide the majority of the drainage of the finger. The dorsal digital vessels pass along the sides of the finger and join one another by communicating vessels. The digital vessel on the radial side of the index finger and the venous channels from the thumb provide the radial portion of the dorsal venous drainage on the thenar aspect of the hand as they merge to form the cephalic vein which then proceeds proximally. The volar digital veins accompanying the corresponding arteries on each side of the finger arise from the deep system and connect to the superficial vessels by oblique intercapitular veins. In neurovascular island transfers these venous components should be protected and transferred, as well as the accompanying arteries, to provide adequate drainage for the pedicle.

The lymphatic supply to the index finger largely follows the venous supply and is thus composed of both a superficial and a deep component. The lymph drainage from the finger follows the course of the cephalic vein along the radial aspect of the forearm and empties into the thoracic duct. This is important in cases of infection or tumor involving the index finger, as often the first sign of distal involvement is the presence of a node in the deltopectoral triangle in contrast to nodes in the epitrochlear region which appear much sooner in diseases on the hypothenar aspect of the hand.

**Innervation**

Sensation of the index finger is supplied by components of the radial, ulnar, and median nerves. Innervation of the volar aspect is provided by the digital branches of the median nerve. These also extend to the dorsum to provide sensation to the distal one and one-half phalanges on that surface. Because of this circumferential and almost constant pattern, the index finger is an excellent site to determine interruption of sensation supplied by the median nerve. The dorsal sensation for the proximal portion of the mid and proximal phalanges is supplied by the superficial branch of the radial nerve and its accompanying digital branches.

Motor innervation is supplied by components of each of the three nerves as well. The long flexor tendons are both median innervated while the intrinsic musculature is supplied by both median and ulnar nerves. The latter is important in isolated ulnar nerve injury at the wrist for only the interosseous muscles are denervated while the lumbricals remain intact in the index and midfinger, providing a means of preserving metacarpophalangeal flexion and interphalangeal extension, a function which is usually lost in the ulnar two digits in the same kind of injury. The common extensor tendon and indices proprius are supplied by the radial nerve as are the other finger and thumb extensors.
Summary

The index finger has now been described in its anatomic relationship to the hand as well as in its unique capacity as the "digit of individualization." It is an essential part of the fine precise motion of pinch and grasp when it is intact and can substitute for the thumb when needed in cases of severe injury or amputation. When injured, however, the index finger is a significant barrier in the same capacity that it functionally aids, and despite reconstructive attempts is sometimes subjected by mutual decision of both the physician and the patient to amputation. The index finger is truly "a unique creature of habit".