The hand is a mechanical and sensory tool. Many of the features of the upper limb are designed to facilitate positioning the hand in space.

The Skin of the Hand

The skin of the palm is thick and hairless and contains large numbers of sweat glands with no sebaceous glands. It is bound down to the underlying deep fascia by numerous fibrous bands. The skin shows many flexure creases at the sites of skin movement, which are not necessarily placed at the site of joints (Fig. 1). The skin on the dorsum of the hand is thin, hairy, and freely mobile on the underlying tendons and bones.

Deep Fascia of the Hand

- **Palmar Aponeurosis** is a triangular condensation of deep fascia that covers the palm and is anchored to the skin in distal regions (Fig. 2).
  The apex of the triangle is continuous with the palmaris longus tendon "when present" otherwise, it is anchored to the flexor retinaculum. From this point, fibers radiate to extensions at the bases of the digits that project into each of the index, middle, ring, and little fingers and, to a lesser extent, the thumb. Transverse fibers interconnect the more longitudinally arranged bundles that continue into the digits.
  Vessels, nerves, and long flexor tendons lie deep to the palmar aponeurosis in the palm.
- **The palmaris brevis** is a small muscle that arises from the flexor retinaculum and palmar aponeurosis and is inserted into the skin of the palm (Fig. 2). It is supplied by the superficial branch of the ulnar nerve. Its function is to corrugate the skin at the base of the hypothenar eminence and so improve the grip of the palm in holding a rounded object.

Dupuytren's contracture

The palmar fascia can become abnormally thickened in certain individuals, causing the fingers to progressively develop a fixed flexion position (Fig. 4). This results in loss of dexterity and function, and in severe cases requires surgical removal of the abnormal tissue.

- **Fibrous Digital (Fibrous Flexor) Sheaths**
  After exiting the carpal tunnel, the tendons of the flexor digitorum superficialis and profundus muscles cross the palm and enter fibrous sheaths on the palmar aspect of the digits (Fig. 3).
  The sheaths contain thickened areas – known as the annular pulleys and cruciform pulleys.
  The annular pulleys (or annular ligaments) represent five areas where the fibrous flexor sheaths are reinforced by circular fibres. It is thought that annular pulleys are most important in preventing bowstringing of the flexor tendons.
  The cruciate pulleys refer to areas where the fibrous flexor sheaths are reinforced by cruciform fibres.

Dr. Mohammed Hussein Assi
MBChB-MSc-PhD-MRCPCH-DCH (UK)

- **Synovial Flexor Sheaths**

  In the hand, the tendons of the flexor digitorum superficialis and profundus muscles invaginate a common synovial sheath from the lateral side (Fig. 3).

  The medial part of this common sheath extends distally without interruption on the tendons of the little finger. The lateral part of the sheath stops abruptly on the middle of the palm, and the distal ends of the long flexor tendons of the index, the middle, and the ring fingers acquire digital synovial sheaths as they enter the fingers.

  The flexor pollicis longus tendon has its own synovial sheath that passes into the thumb.

  These sheaths allow the tendons to move smoothly, with a minimum of friction, beneath the flexor retinaculum and the fibrous flexor sheaths.

  The synovial sheath of the flexor pollicis longus (the **radial bursa**) communicates with the common synovial sheath of the superficialis and profundus tendons (the **ulnar bursa**) at the level of the wrist in about 50% of subjects.

- ✓ The **vincula longa** and **brevia** are small vascular folds of synovial membrane that connect the tendons to the anterior surface of the phalanges (Fig. 6). They resemble a mesentery and convey blood vessels to the tendons.

Tenosynovitis of the Flexor Tendons

It is an infection of a synovial sheath, most commonly resulting from the introduction of bacteria into a sheath through a small penetrating wound, such as that made by the point of a needle or thorn. The infection results in distention of the sheath with pus; the finger is held semiflexed and is swollen. Any attempt to extend the finger is accompanied by extreme pain because the distended sheath is stretched. As the inflammatory process continues, the pressure within the sheath rises and may compress the blood supply to the tendons that travel in the vincula longa and brevia. Rupture or later severe scarring of the tendons may follow.

A further increase in pressure can cause the sheath to rupture at its proximal end. Anatomically, the digital sheath of the index finger is related to the thenar space, whereas that of the ring finger is related to the midpalmar space. The sheath for the middle finger is related to both the thenar and midpalmar spaces (see p.4 & fig.11). These relationships explain how infection can extend from the digital synovial sheaths and involve the palmar fascial spaces.

In the case of infection of the digital sheaths of the little finger and thumb, the ulnar and radial bursae are quickly involved. Should such an infection be neglected, pus may burst through the proximal ends of these bursae and enter the subtendinous space of the forearm between the flexor digitorum profundus anteriorly and the pronator quadratus and the interosseous membrane posteriorly. This fascial space is commonly referred to clinically as the **space of Parona.**

Trigger Finger (Stenosing Tenosynovitis)

In the trigger finger, there is a palpable and even audible snapping when a patient is asked to flex and extend the fingers. It is caused by the presence of a localized swelling of one of the long flexor tendons that catches on a narrowing of the fibrous flexor sheath anterior to the metacarpophalangeal joint (Fig. 5). It may take place either in flexion or in extension. The situation can be relieved surgically by incising the fibrous flexor sheath.

- **Insertion of the Long Flexor Tendons**

  Each tendon of the flexor digitorum superficialis enters the fibrous flexor sheath; opposite the proximal phalanx it divides into two halves, which pass around the profundus tendon and meet on its deep or posterior surface, where partial decussation of the fibers takes place (Figs. 6&8). The superficialis tendon, having united again, divides almost at once into two further slips, which are attached to the borders of the middle phalanx. Each tendon of the flexor digitorum profundus, having passed through the division of the superficialis tendon, continues downward, to be inserted into the anterior surface of the base of the distal phalanx.

- **Insertion of the Long Extensor Tendons**

  The four tendons of the extensor digitorum emerge from under the extensor retinaculum and fan out over the dorsum of the hand. They are embedded in the deep fascia.

  Strong oblique fibrous bands connect the tendons to the little, ring, and middle fingers, proximal to the heads of the metacarpal bones (Figs. 7).

  The tendon to the index is joined on its medial side by the tendon of extensor indicis, and the tendon to the little finger is joined on its medial side by two tendons of extensor digiti minimi. On the posterior surface of each finger, the extensor tendon joins the fascial expansion called the **extensor hoods** or **dorsal extensor (digital) expansions** (Figs. 8&9).

  Near the proximal interphalangeal joint, the extensor hood splits into three parts: a central part, which is inserted into the base of the middle phalanx, and two lateral parts, which converge to be inserted into the base of the distal phalanx.

  The extensor hood receives the tendon of insertion of the corresponding interosseous muscle on each side and farther distally receives the tendon of the lumbrical muscle on the lateral side.

Mallet Finger

Avulsion of the insertion of one of the extensor tendons into the distal phalanges can occur if the distal phalanx is forcibly flexed when the extensor tendon is taut. The last 20° of active extension is lost, resulting in a condition known as mallet finger (Fig. 10).

Boutonnière (Buttonhole) Deformity

Avulsion of the central slip of the extensor tendon proximal to its insertion into the base of the middle phalanx results in a characteristic deformity (Fig. 10). The deformity results from flexing of the proximal interphalangeal joint and hyperextension of the distal interphalangeal joint. This injury can result from direct end-on trauma to the finger, direct trauma over the back of the proximal interphalangeal joint, or laceration of the dorsum of the finger.

❖ **Fascial Spaces of the Palm (Fig. 11)**

Normally, the fascial spaces of the palm are potential spaces filled with loose connective tissue. Their boundaries are important clinically as they may limit the spread of infection in the palm. The triangular palmar aponeurosis fans out from the lower border of the flexor retinaculum. From its medial border, the medial fibrous septum passes backward and is attached to the anterior border of the 5th metacarpal bone. Medial to this septum is a fascial compartment containing the three hypothenar muscles; this compartment is unimportant clinically.

From the lateral border of the palmar aponeurosis, a second fibrous septum (the oblique fibrous septum) passes obliquely backward to the anterior border of the third metacarpal bone, usually, this septum passes between the long flexor tendons of the index and middle fingers and it divides the palm into the **thenar space**, which lies lateral to the septum (and must not be confused with the fascial compartment containing the thenar muscles), and the **midpalmar space**, which lies medial to the septum.

Proximally, the thenar and midpalmar spaces are closed off from the forearm by the walls of the carpal tunnel. Distally, they are continuous with the appropriate lumbrical canals.

The thenar space contains the first lumbrical muscle and lies posterior to the long flexor tendons to the index finger and in front of the adductor pollicis muscle.

The midpalmar space contains the 2nd, 3rd, and 4th lumbrical muscles and lies posterior to the long flexor tendons to the middle, ring, and little fingers. It lies in front of the interossei and the third, fourth, and fifth metacarpal bones.

The **lumbrical canal** is a potential space surrounding the tendon of each lumbrical and is filled with connective tissue. Proximally, it is continuous with one of the palmar spaces.

❖ **Pulp Space of the Fingers**

The deep fascia of the pulp of each finger fuses with the periosteum of the terminal phalanx just distal to the insertion of the long flexor tendons and closes off a fascial compartment known as the **pulp space**. Each pulp space is subdivided by the presence of numerous septa, which pass from the deep fascia to the periosteum.

Through the pulp space, which is filled with fat, runs the terminal branch of the digital artery that supplies the diaphysis of the terminal phalanx. The epiphysis of the distal phalanx receives its blood supply proximal to the pulp space.

Pulp-Space Infection (Felon)

Infection of pulp space is common and serious, occurring most often in the thumb and index finger. Bacteria are usually introduced into the space by pinpricks or sewing needles.

The accumulation of inflammatory exudate within these spaces causes the pressure in the pulp space to quickly rise. If the infection is left without decompression, infection of the terminal phalanx can occur. In children, the blood supply to the diaphysis of the phalanx passes through the pulp space, and pressure on the blood vessels could result in necrosis of the diaphysis. The proximally located epiphysis of this bone is saved because it receives its arterial supply just proximal to the pulp space.

The close relationship of the proximal end of the pulp space to the digital synovial sheath accounts for the involvement of the sheath in the infectious process when the pulp space infection has been neglected.

Intrinsic Muscles of the Hand

Unlike the extrinsic muscles that originate in the forearm, insert in the hand, and function in forcefully gripping ("power grip") with the hand, the intrinsic muscles occur entirely in the hand and mainly execute precision movements ("precision grip") with the fingers and thumb. All of the intrinsic muscles of the hand are innervated by the deep branch of the ulnar nerve except for the three thenar and two lateral lumbrical muscles, which are innervated by the median nerve. The intrinsic muscles are predominantly innervated by spinal cord segment T1 with a contribution from C8.

➢ Short Muscles of the Thumb

The short muscles of the thumb are the Abductor Pollicis Brevis, the Flexor Pollicis Brevis, the Opponens Pollicis, and the Adductor Pollicis. The first three of these muscles (the thenar muscles) form the thenar eminence (Figs. 12&13).

Short Muscles of the Thumb

Opponens pollicis	Tubercle of trapezium and flexor retinaculum	Lateral margin and adjacent palmar surface of metacarpal I	Recurrent branch of median nerve (C8, T1)	Medially rotates thumb
Abductor pollicis brevis	Tubercles of scaphoid and trapezium and adjacent flexor retinaculum	Proximal phalanx and extensor hood of thumb	Recurrent branch of median nerve (C8, T1)	Abducts thumb at metacarpophalangeal joint
Flexor pollicis brevis	Tubercle of the trapezium and flexor retinaculum	Proximal phalanx of the thumb	Recurrent branch of median nerve (C8, T1)	Flexes thumb at metacarpophalangeal joint
Adductor pollicis	Transverse head—metacarpal III; oblique head—capitate and bases of metacarpals II and III	Base of the proximal phalanx and extensor hood of thumb	Deep branch of ulnar nerve (C8, T1)	Adducts thumb

The **adductor pollicis** is a large triangular muscle anterior to the plane of the interossei that crosses the palm. It originates as two heads. The two heads converge laterally to form a tendon, which often contains a sesamoid bone, that inserts into both the medial side of the base of the proximal phalanx of the thumb and into the extensor hood (Fig. 13).

The radial artery passes anteriorly and medially between the two heads of the muscle to enter the deep plane of the palm and form the deep palmar arch.

➢ Short Muscles of the Little Finger

The short muscles of the little finger (the hypothenar muscles) are the Abductor Digiti Minimi, the Flexor Digiti Minimi Brevis, and the Opponens Digiti Minimi, which together form the hypothenar eminence (Fig. 12).

Short Muscles of the Little Finger

Opponens digiti minimi	Hook of hamate and flexor retinaculum	Medial aspect of metacarpal V	Deep branch of ulnar nerve (C8, T1)	Laterally rotates metacarpal V
Abductor digiti minimi	Pisiform, the pisohamate ligament, and tendon of flexor carpi ulnaris	Proximal phalanx of little finger	Deep branch of ulnar nerve (C8, T1)	Abducts little finger at metacarpophalangeal joint
Flexor digiti minimi brevis	Hook of the hamate and flexor retinaculum	Proximal phalanx of little finger	Deep branch of ulnar nerve (C8, T1)	Flexes little finger at metacarpophalangeal joint

➢ The interossei

They are muscles between and attached to the metacarpals. They are inserted into the proximal phalanx of each digit and into the extensor hood and are divided into two groups (Fig. 15):

A. Dorsal interossei

Are the most dorsally situated of all of the intrinsic muscles and can be palpated through the skin on the dorsal aspect of the hand. There are four bipennate dorsal interosseous muscles between, and attached to, the shafts of adjacent metacarpal bones. Each muscle inserts both into the base of the proximal phalanx and into the extensor hood of its related digit.

The tendons of the dorsal interossei pass dorsal to the deep transverse metacarpal ligaments:

The first dorsal interosseous muscle is the largest and inserts into the lateral side of the index.

The second dorsal interossei inserts into the lateral sides of the middle finger.

The third dorsal interosseous muscle inserts into the medial side of the middle finger.

The fourth dorsal interosseous muscle inserts into the medial side of the ring finger.

In addition to generating flexion and extension movements of the fingers through their attachments to the extensor hoods (Fig.16), the dorsal interossei are the major abductors of the index, middle, and ring fingers, at the metacarpophalangeal joints.

The middle finger can abduct medially and laterally with respect to the long axis of the middle finger and consequently has a dorsal interosseous muscle on each side.

The thumb and little finger have their own abductors in the thenar and hypothenar muscle groups, respectively, and therefore do not have dorsal interossei.

The radial artery passes between the two heads of the first dorsal interosseous as it passes from the anatomical snuffbox on the posterolateral side of the wrist into the deep aspect of the palm.

B. Palmar interossei

The three (or four) palmar interossei are anterior to the dorsal interossei and are unipennate muscles originating from the metacarpals of the digits with which each is associated.

The first palmar interosseous muscle is rudimentary and often considered part of either the adductor pollicis or the flexor pollicis brevis. When present, it originates from the medial side of the palmar surface of metacarpal I and inserts into both the base of the proximal phalanx of the thumb and into the extensor hood. A sesamoid bone often occurs in the tendon attached to the base of the phalanx.

The second palmar interosseous muscle originates from the medial surface of metacarpal II and is inserted into the medial side of the extensor hood of the index finger.

The third and fourth palmar interossei originate from the lateral surfaces of metacarpals IV and V and are inserted into the lateral sides of the respective extensor hoods.

Like the tendons of the dorsal interossei, the tendons of the palmar interossei pass dorsal to the deep transverse metacarpal ligaments.

The palmar interossei adduct the thumb, index, ring, and little fingers with respect to a long axis through the middle finger. The movements occur at the metacarpophalangeal joints. Because the muscles insert into the extensor hoods, they also produce complex flexion and extension movements of the digits.

➢ Lumbrical muscles

There are four lumbrical (worm-like) muscles, each of which is associated with one of the fingers (Fig. 14).

The muscles originate from the tendons of the flexor digitorum profundus in the palm:

- The medial two lumbricals are bipennate and originate from the flexor digitorum profundus tendons associated with the middle and ring fingers and the ring and little fingers, respectively.
- The lateral two lumbricals are unipennate muscles, originating from the flexor digitorum profundus tendons associated with the index and middle fingers, respectively.

The lumbricals pass dorsally around the lateral side of each finger and insert into the extensor hood.

The tendons of the muscles are anterior to the deep transverse metacarpal ligaments.

The lumbricals are unique because they link flexor tendons with extensor tendons. Through their insertion into the extensor hoods, they participate in flexing the metacarpophalangeal joints and extending the interphalangeal joints.

The medial two lumbricals are innervated by the deep branch of the ulnar nerve; the lateral two lumbricals are innervated by digital branches of the median nerve.

Muscle	Origin	Insertion	Innervation	Function
Dorsal interossei	Adjacent sides of metacarpals	Extensor hood and base of proximal phalanges of index, middle, and ring fingers	Deep branch of ulnar nerve (C8, T1)	Abduction of index, middle, and ring fingers at the metacarpophalangeal joints
Palmar interossei	Sides of metacarpals	Extensor hoods of the thumb, index, ring, and little fingers and the proximal phalanx of the thumb	Deep branch of ulnar nerve (C8, T1)	Adduction of the thumb, index, ring, and little fingers at the metacarpophalangeal joints. Both palmar and dorsal flex metacarpophalangeal joints and extend interphalangeal joints.
Lumbricals	Tendons of flexor digitorum profundus	Extensor hoods of the index, ring, middle, and little fingers	Medial two by the deep branch of the ulnar nerve; lateral two by digital branches of the median nerve	Flex metacarpophalangeal joints while extending interphalangeal joints

Veins of the Hand

The hand contains interconnected networks of deep and superficial veins.

The deep veins follow the arteries; the superficial veins drain into a dorsal venous network on the back of the hand over the metacarpal bones (Fig. 18).

The cephalic vein originates from the lateral side of the dorsal venous network and passes over the anatomical snuffbox into the forearm.

The basilic vein originates from the medial side of the dorsal venous network and passes into the dorsomedial aspect of the forearm.

Arteries of the Hand

The blood supply to the hand is by the radial and ulnar arteries, which form two interconnected vascular arches (superficial and deep) in the palm (Fig. 17).

- The radial artery contributes to the supply of the thumb and the lateral side of the index.
- The remaining digits and the medial side of the index are supplied by the ulnar artery.

Ulnar artery and superficial palmar arch

The ulnar artery and ulnar nerve enter the hand on the medial side of the wrist (Fig. 19).

The artery lies between the palmaris brevis and the flexor retinaculum and is lateral to the ulnar nerve and the pisiform bone. Distally, the artery is medial to the hook of the hamate and then swings laterally, forming the **superficial palmar arch**, which is superficial to the long flexor tendons of the digits and just deep to the palmar aponeurosis. On the lateral side of the palm, the arch communicates with a palmar branch of the radial artery.

The **deep palmar branch** arises from the ulnar artery, just distal to the pisiform, and penetrates the origin of the hypothenar muscles. It curves medially around the hook of the hamate to access the deep plane of the palm and anastomose with the deep palmar arch.

Branches from the superficial arch include: a **palmar digital artery** to the medial side of the little finger, and three, **common palmar digital arteries**, which ultimately provide the principal blood supply to the lateral side of the little finger, both sides of the ring and middle, and the medial side of the index; they are joined by **palmar metacarpal arteries** from the deep arch before bifurcating into the **proper palmar digital arteries**, which enter the fingers.

Radial artery and deep palmar arch

The radial artery curves around the lateral side of the wrist and passes over the floor of the anatomical snuffbox and penetrating anteriorly through the back of the hand (Fig. 20). It passes between the two heads of the first dorsal interosseous muscle and then between the two heads of the adductor pollicis to access the deep plane of the palm and form the **deep palmar arch**.

The deep palmar arch passes medially through the palm deep to the long flexor tendons. On the medial side of the palm, it communicates with the deep palmar branch of the ulnar artery.

Before penetrating the back of the hand, the radial artery gives rise to two vessels: a **dorsal carpal branch,** which passes medially as the **dorsal carpal arch**, across the wrist and gives rise to three **dorsal metacarpal arteries**, which subsequently divide to become small **dorsal digital arteries**, which enter the fingers; and the **first dorsal metacarpal artery**, which supplies adjacent sides of the index finger and thumb.

Two vessels, the **princeps pollicis artery** and the **radialis indicis artery**, arise from the radial artery in the plane between the first dorsal interosseous and adductor pollicis. The princeps pollicis artery is the major blood supply to the thumb and the radialis indicis artery supplies the lateral side of the index finger.

The deep palmar arch gives rise to three **palmar metacarpal arteries**, which join the common palmar digital arteries from the superficial palmar arch; and three **perforating branches**, which pass posteriorly between the heads of origin of the dorsal interossei to anastomose with the dorsal metacarpal arteries from the dorsal carpal arch.

Allen's test: p. 805

Nerves of the Hand

The hand is supplied by the ulnar, median, and radial nerves. All contribute to cutaneous or general sensory innervation. The ulnar nerve innervates all intrinsic muscles of the hand except for the three thenar muscles and the two lateral lumbricals, which are innervated by the median nerve. The radial nerve only innervates skin on the dorsolateral side of the hand.

Ulnar nerve

The ulnar nerve enters the hand lateral to the pisiform and posteromedial to the ulnar artery. Immediately distal to the pisiform, it divides into a deep branch, which is mainly motor, and a **superficial branch**, which is mainly sensory (Fig. 21).

The deep branch of the ulnar nerve passes with the deep branch of the ulnar artery. It penetrates and supplies the hypothenar muscles to reach the deep aspect of the palm, arches laterally across the palm, deep to the long flexors of the digits, and supplies the interossei, the adductor pollicis, and the two medial lumbricals. In addition, the deep branch of the ulnar nerve contributes small articular branches to the wrist joint.

As the deep branch of the ulnar nerve passes across the palm, it lies in a fibro-osseous tunnel (**Guyon's canal**) between the hook of the hamate and the flexor tendons.

The superficial branch of the ulnar nerve innervates the palmaris brevis and continues across the palm to supply skin on the palmar surface of the little and the medial half of the ring fingers.

Median nerve

The median nerve is the most important sensory nerve in the hand because it innervates skin on the thumb, index and middle fingers, and lateral side of the ring finger (Fig. 22).

The median nerve enters the hand by passing through the carpal tunnel and divides into a **recurrent branch** and **palmar digital branches**.

The recurrent branch innervates the three thenar muscles. Originating from the lateral side of the median nerve near the distal margin of the flexor retinaculum, it curves around the margin of the retinaculum and passes proximally over the flexor pollicis brevis muscle. It then passes between the flexor pollicis brevis and abductor pollicis brevis to end in the opponens pollicis.

The palmar digital nerves cross the palm deep to the palmar aponeurosis and the superficial palmar arch and enter the digits. They innervate skin on the palmar surfaces of the lateral three-and-one-half digits and cutaneous regions over the dorsal aspects of the distal phalanges (nail beds) of the same digits. Additionally, the digital nerves supply the lateral two lumbricals.

Superficial branch of the radial nerve

It enters the hand by passing over the anatomical snuffbox on the dorsolateral side of the wrist. Terminal branches of the nerve can be palpated or "rolled" against the tendon of the extensor pollicis longus as they cross the anatomical snuffbox. The superficial branch of the radial nerve innervates the skin over the dorsolateral aspect of the palm and the dorsal aspects of the lateral three-and-one-half digits distally to approximately the terminal interphalangeal joints (Fig. 23).

The Hand as a Functional Unit

The upper limb is a multijointed lever freely movable on the trunk at the shoulder joint. At the distal end of the upper limb is the important prehensile organ "the hand".

Much of the hand's importance depends on the pincer action of the thumb, which enables one to grasp objects between the thumb and index finger. The extreme mobility of the first metacarpal bone makes the thumb functionally as important as all the remaining fingers combined.

Position of the Hand

For the hand to be able to perform delicate movements (such as those used in the holding of small instruments in watch repair) the forearm is placed in the semiprone position, and the wrist joint is partially extended, because the forearm bones are most stable in the midprone position when the interosseous membrane is taut; in other positions of the forearm bones, the interosseous membrane is lax, and with the wrist partially extended, the long flexor and extensor tendons of the fingers are working to their best mechanical advantage; at the same time, the flexors and extensors of the carpus can exert a balanced fixator action on the wrist joint, ensuring a stable base for the movements of the fingers.

- **The position of rest** is the posture adopted by the hand when the fingers are at rest and the hand is relaxed (Fig. 24). The forearm is in the semiprone position; the wrist joint is slightly extended; the second, third, fourth, and fifth fingers are partially flexed, although the index finger is not flexed as much as the others; and the plane of the thumbnail lies at a right angle to the plane of the other fingernails.
- **The position of function** is the posture adopted by the hand when it is about to grasp an object between the thumb and index finger (Fig. 24). The forearm is in the semiprone position, the wrist joint is partially extended (more so than in the position of rest), and the fingers are partially flexed, the index finger being flexed as much as the others. The metacarpal bone of the thumb is rotated in such a manner that the plane of the thumbnail lies parallel with that of the index finger, and the pulp of the thumb and index finger are in contact.

Making a Fist

Making a fist is accomplished by flexing the metacarpophalangeal joints and the interphalangeal joints of the fingers and thumb. It is performed by the contraction of the long flexor muscles of the fingers and thumb.

For this movement to be carried out efficiently, a synergic contraction of the extensor carpi radialis longus and brevis and the extensor carpi ulnaris muscles must occur to extend the wrist joint. (Try to make a "strong fist" with the wrist joint flexed—it is very difficult.)

References:
Gray's Anatomy for Students - 4th Edition
Snell Clinical Anatomy by Regions - 9th Edition

Dr. Mohammed Hussein Assi
MBChB-MSc-PhD-MRCPCH-DCH (UK)