

HUMAN FUNCTIONAL ANATOMY 213

Finger Movements

Outcomes

1. To know the joints and movements of fingers
2. To understand the mechanism of extensor expansion
3. To appreciate the contributions of the lumbricals and interossei to finger control
4. To be able to explain the result of an ulnar nerve lesion

In this lecture:

Joints of the hand
Extrinsic flexors and extensors
Lumbricals and interossei

Readings

1. Stern – Core concepts – sections 84 and 85 (plus appendices)
 2. Faiz and Moffat – Anatomy at a Glance – Sections 37, 38 and 39
 3. Grants method – The Hand, and Joints of the upper limb
- Other good anatomy texts – sections on the hand

HAND FUNCTION AND THE PROXIMAL JOINTS

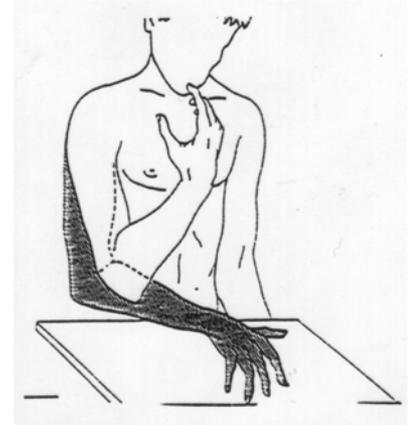
The Shoulder (Flexion and Extension, adduction and abduction, plus rotations) can direct the arm in any direction

The Elbow (Flexion and Extension) is important for lengthening and shortening the arm

Just imagine the difficulties you'd have eating or scratching yourself

The Forearm (Supination and Pronation) is vital for orientating the hand

1. The hand can be made to face away from, or towards the body.
2. Pronation and supination can also be used to impart rotary forces.
3. Occurs in the proximal and distal radio ulnar joints



The Wrist (Flexion and extension, plus Adduction and abduction) optimises the position of the hand for action

1. Usually extended when away from the body but flexed when close to the body.
2. Adduction (ulnar deviation) is used to grasp an object and hold it in the forearm axis.
3. Extension of the wrist increases the strength of the digital flexors.

MUSCLES OF THE PROXIMAL JOINTS

ELBOW Flexion and extension

Triceps
Biceps
Brachialis
Brachioradialis
Plus Pronator teres (PT), extensor carpi radialis longus (ECRL) and brevis (ECRB), flexor digitorum superficialis (FDS)

FOREARM Pronation and supination (all insert on the radius)

Supinator
Biceps
Brachioradialis
Pronator teres
Pronator quadratus.

WRIST Flexion and extension plus adduction and abduction (All insert on metacarpals)

Flexor carpi ulnaris (FCU)
Flexor carpi radialis (FCR)
Extensor carpi radialis longus (ECRL)
Extensor carpi radialis brevis (ECRB)
Extensor carpi ulnaris (ECU)

Adduction involves the use of ulna side carpal muscles
Abduction involves radial side carpal muscles

NERVE SUPPLY

Muscles in posterior compartments and extensors and are supplied by the radial nerve (dorsal)

Muscles in anterior compartments are flexors and pronators and are supplied by the median and ulna nerves (ventral)

JOINTS OF THE HAND

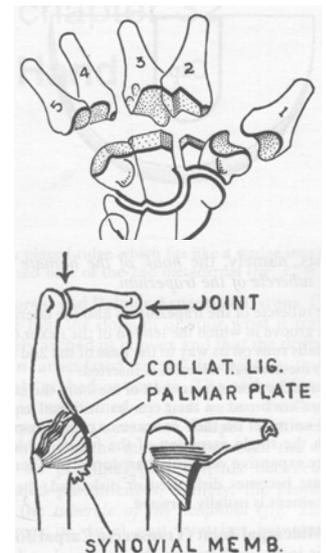
Carpometacarpal (CMC) joints

Digit 1 (thumb or pollex) has a freely movable saddle joint
Digits 2 & 3 (Index and long fingers) have fixed CMC joints
Digits 4 & 5 (ring and little fingers) have more flexible CMC joints

Metacarpophalangeal (MP) joints.

Digit 1 has a bicondylar (uniaxial) joint (flex - extend)
Digits 2 to 5 have condylar (biaxial) joints (flex - extend, adduct - abduct)

Palmar plate
Collateral ligaments
Tight in flexion
Loose in extension



Interphalangeal (IP) joints (proximal and distal PIP & DIP)

Same as MP joints but bicondylar (only flexion - extension)
The thumb has only one IP joint

DIGITAL FLEXORS AND EXTENSORS

Extrinsic muscles

Flexor digitorum superficialis (FDS) inserts on the middle phalanx

Flexor digitorum profundus (FDP) inserts on the distal phalanx

Tendons are bound to the bones by a flexor sheath.

They tend to move their most distal joint first

Palmaris longus (PL) inserts on the proximal phalanx and act on the MP joint but it is very weak in humans. Its broad tendon is the palmar aponeurosis.

Extensor digitorum (ED) inserts into all the phalanges via the extensor expansion. Strongest connection is to the proximal phalanx, and act primarily on the MP joint.



	DIP	PIP	MP
FDP			
FDS			
PL			
ED			

The extrinsic muscles acting alone (“intrinsic minus hand”)

1. Extension of the MP joints
2. Flexion of the IP joints

The extrinsic muscles are mostly supplied by the radial (ED) and Median nerves (PL, FDS and FDP). The ulnar nerve supplies part of FDP.

THE EXTENSOR EXPANSION

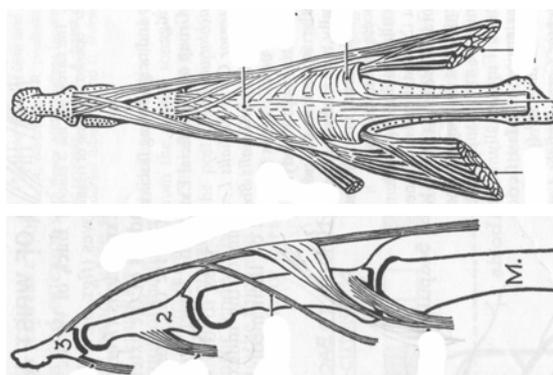
Balancing the action of the extrinsic muscles

LUMBRICALS and INTEROSSEI

Cross the palmar side of the MP joints- - **cause flexion of MP joints**

They join the lateral bands of the extensor expansion over the proximal phalanx

They pull on the extensor expansion as it crosses the dorsal side of the IP joints- - **cause extension of IP joints**



	DIP	PIP	MP
FDP			
FDS			
ED			
Interossei and Lumbricals			

The Lumbrical and interossei are supplied by the **ulnar nerve** (except for the first 2 lumbricals – median nerve) – so the **ulnar nerve** is very important for finger movements.

Co-ordination of MP and IP movements

The lateral bands of the extensor expansion link the MP and IP joints

1. If you passively extend the MP joint, that pulls on the lateral bands and extends the IP joints.
2. If you passively flex the IP joint, that pulls on the lateral bands and flexes the IP joints
3. This relies on the resistance to stretch of the lumbricals and interossei.

OBLIQUE RETINACULAR LIGAMENT

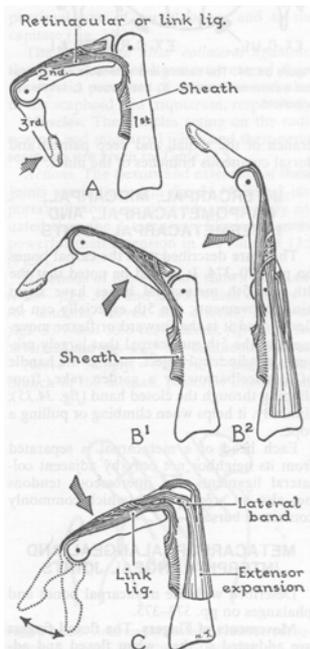
Co-ordination of DIP and PIP movements

It is difficult to flex the DIP and leave the PIP extended. (or extend the PIP and leave the DIP flexed)

The oblique retinacular ligament links these joint so that:

1. When the DIP joint flexes it pulls on the ligament and flexes the PIP joint.
2. When the PIP joint extends it pulls on the ligament and extends the DIP joint
3. If you hold the PIP in flexion, you cant voluntarily extend the DIP but it is very loose if you move it passively.

This ligament and the lateral bands of the extensor expansion. Act to co-ordinate the movements of the 3 finger joints – and produce a smooth digital sweep



DIGITAL ADDUCTION AND ABDUCTION

Every digit has an adductor and an abductor

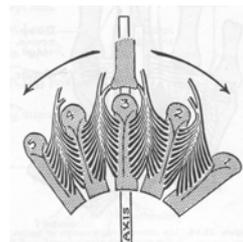
Adduction and abduction is relative to the middle finger

Palmar interossei

Adduct digits 2, 4 & 5

Digit 3 can only abduct

Digit 1 has **adductor pollicis**

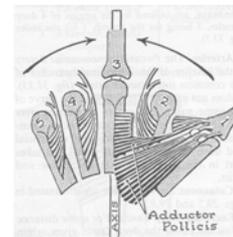


Dorsal interossei

Abduct digits 2, 3 & 4

Digits 1 and 5 have special abductors

1. Abductor pollicis longus and brevis
2. Abductor digiti minimi



Lumbricals attach to the radial side of each extensor expansion so can abduct or adduct the fingers (digits 2 to 5)

The primary function of the lumbricals and interossei is to co-ordinate and control flexion and extension of the fingers

In the foot the lumbricals and interossei have the same arrangement except that adduction and abduction in the foot are relative to the 2nd toe.

Palmar interossei adduct toes 3, 4 & 5

Dorsal interossei abduct toes 2, 3, 4



THENAR AND HYPOTHENAR MUSCLES

Opposition, flexion and abduction of digits 1 & 5

Opposition is a **Carpometacarpal joint motion** so opponens muscles attach to metacarpals.

The other muscles attach to phalanges.

Thenar muscles

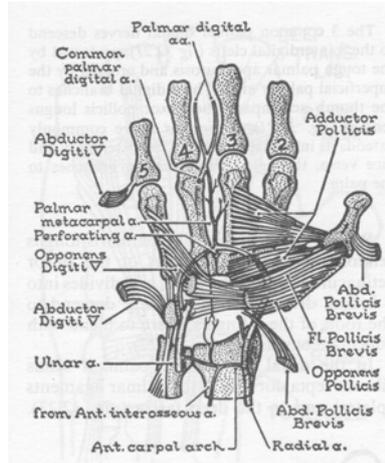
1. Opponens pollicis -
2. Flexor pollicis brevis
3. Abductor pollicis

All supplied by the median nerve

Hypothenar muscles

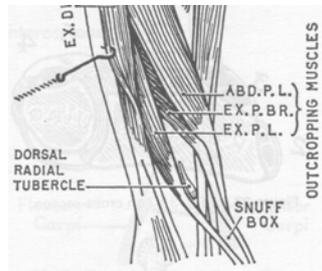
1. Opponens digiti minimi
2. Flexor digiti minimi
3. Abductor digiti minimi

All supplied by the ulnar nerve



The anatomical snuff-box. Three tendons that cross the wrist at the base of the thumb

1. Extensor pollicis longus
2. Extensor pollicis brevis
3. Abductor pollicis longus



Other muscles of the hand (extrinsic)

Flexor pollicis longus
Extensor indicis
Extensor digiti minimi

Most muscle of the hand have corresponding muscles in the foot.