Phalanges

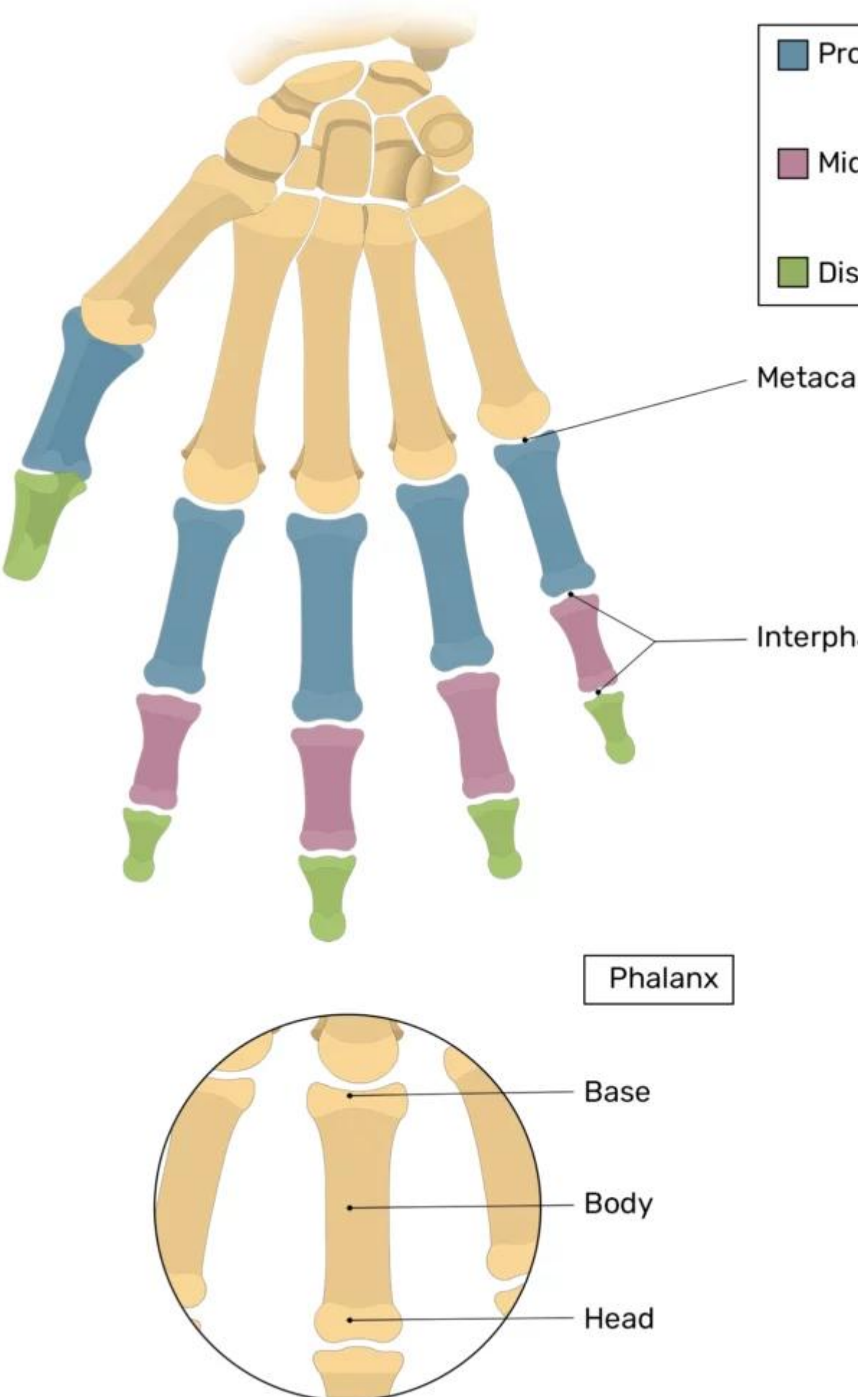
PHALANGES OF THE HAND

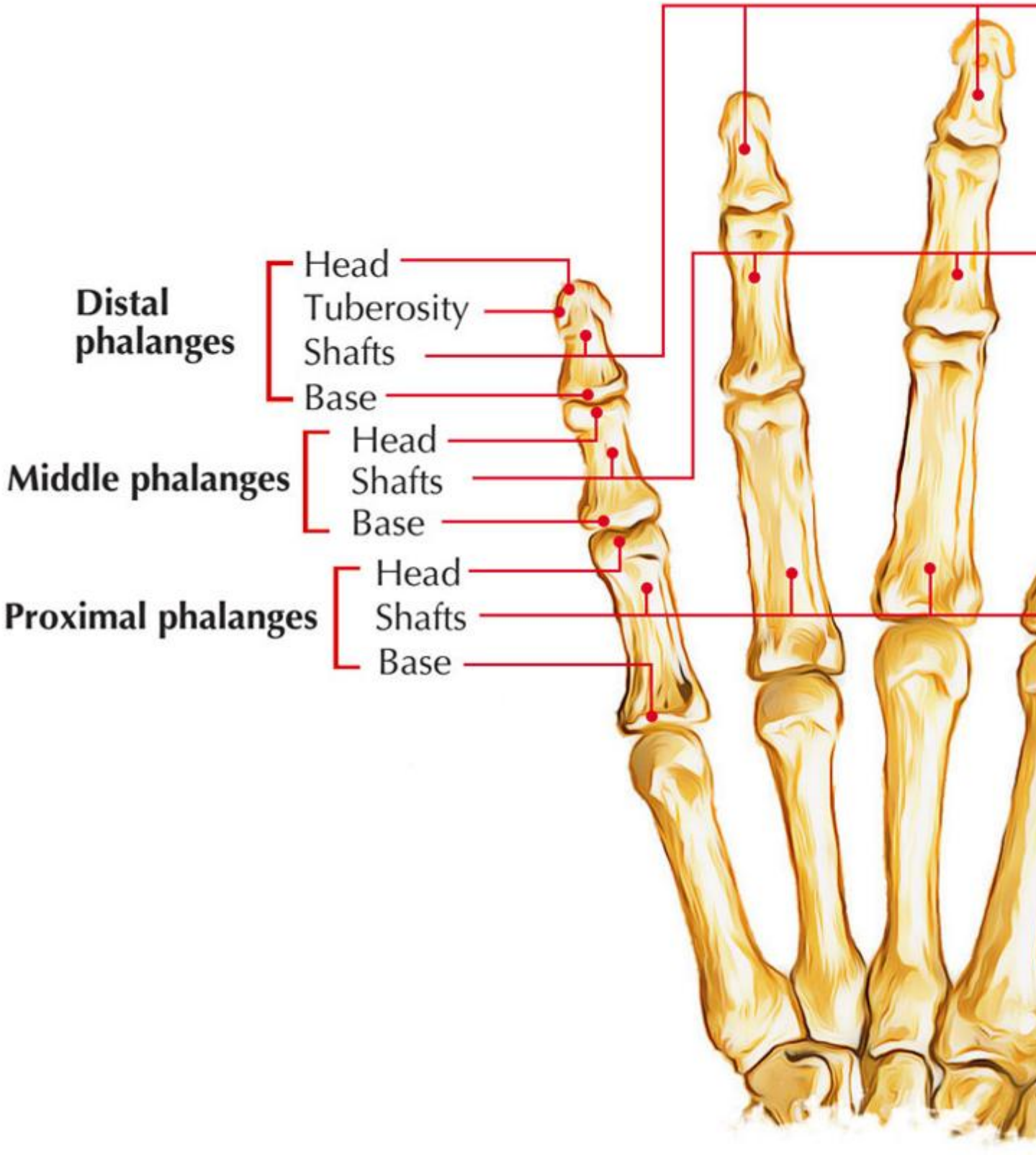
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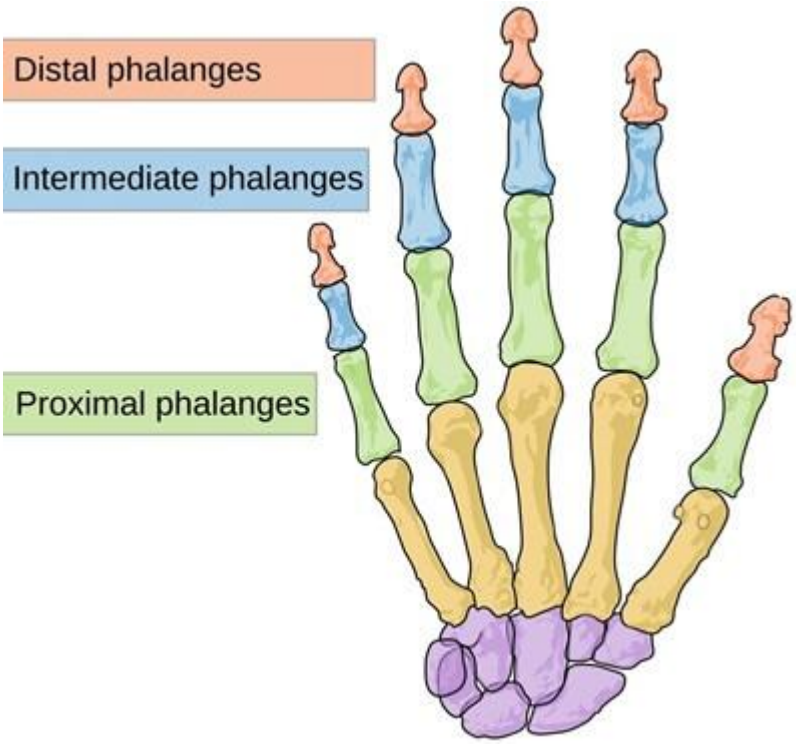
1. General Features

- The phalanges are miniature long bones forming the skeleton of the digits (fingers and thumb).
- Each of the four fingers has three phalanges: proximal, middle and distal.
- The thumb has only two phalanges: proximal and distal.
- Thus, there are 14 phalanges in one hand and 28 in both hands.
- Phalanges provide the skeletal framework for grasping, precision grip, finger movements and fine motor activities.
- Each phalanx consists of a base, shaft and head, although the distal phalanx terminates in an expanded ungual tuberosity (tuft) rather than a typical rounded articular head.

Notes downloaded from **Medmentoredu**


Pro
Mid
Dis
Metaca
Interph
Phalanx
Base
Body
Head


Distal phalanges
Head
Tuberosity
Shafts
Base
Middle phalanges
Head
Shafts
Base
Proximal phalanges
Head
Shafts
Base



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2. Arrangement of Phalanges

DIGIT	PROXIMAL	MIDDLE	DISTAL	TOTAL
Thumb (I)	1	—	1	2
Index finger (II)	1	1	1	3
Middle finger (III)	1	1	1	3
Ring finger (IV)	1	1	1	3

Little finger (V)	1	1	1	3
Total	5	4	5	14

Must know: The thumb lacks a middle phalanx.

3. Parts of a Typical Phalanx

A. Base (proximal end)

- Expanded proximal part of the bone.
- In a proximal phalanx, the base has a concave articular surface for the corresponding metacarpal head.
- In a middle or distal phalanx, the base typically has two shallow articular concavities separated by a ridge, corresponding to the trochlear head of the preceding phalanx.
- Provides attachment to ligaments, joint capsules and tendons.

B. Shaft (body)

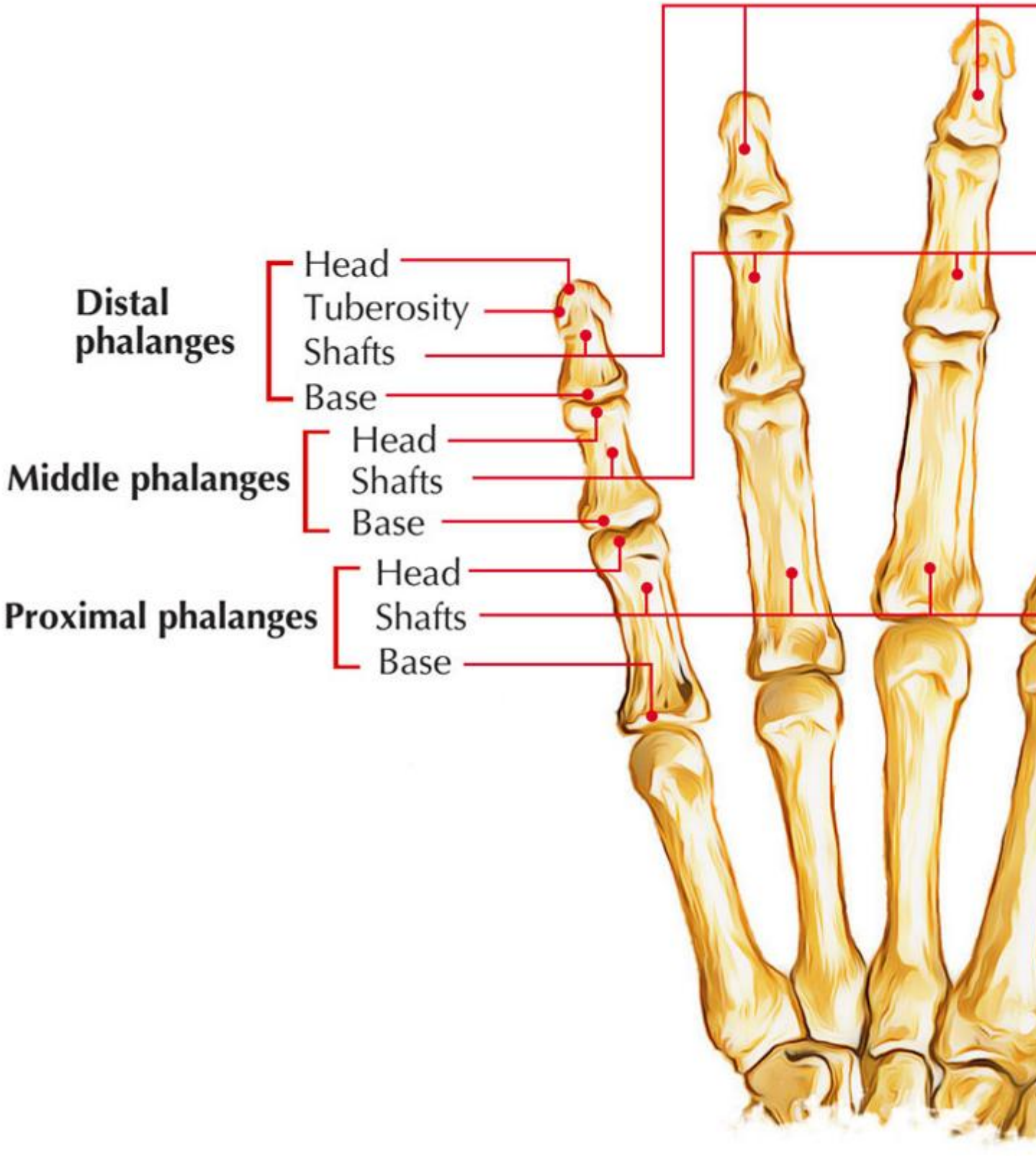
- Elongated, slightly curved and narrower than the base.
- Generally convex dorsally and concave palmarly.
- The palmar surface is related to flexor tendons and their fibrous sheaths.
- The dorsal surface is related to the extensor expansion and extensor tendons.
- The sides give attachment to fibrous digital sheaths and supporting structures.

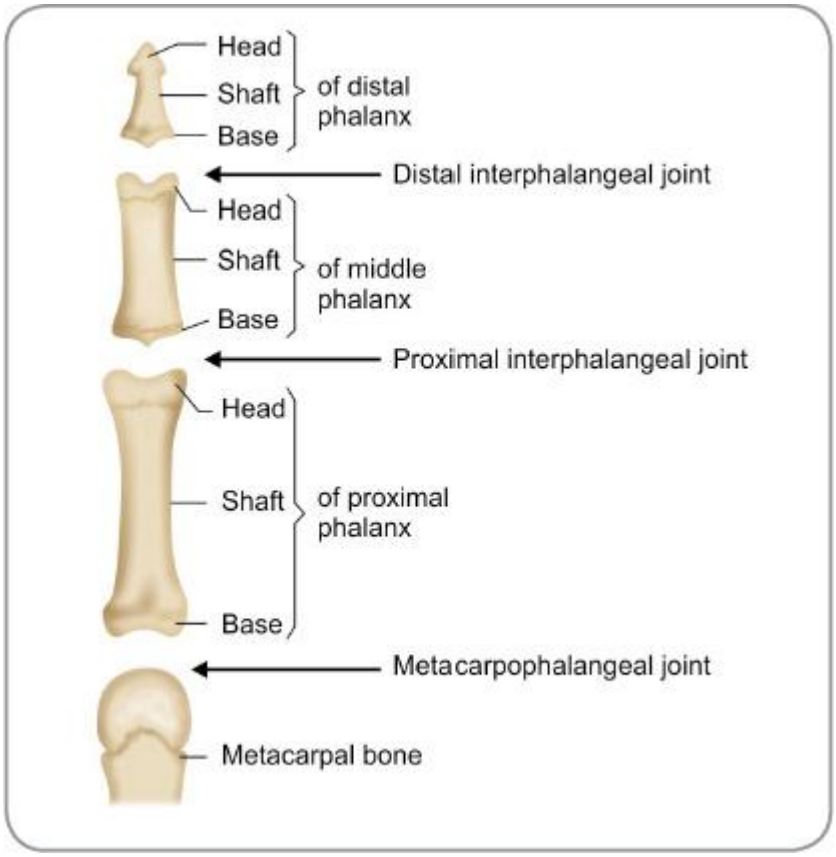
C. Head (distal end)

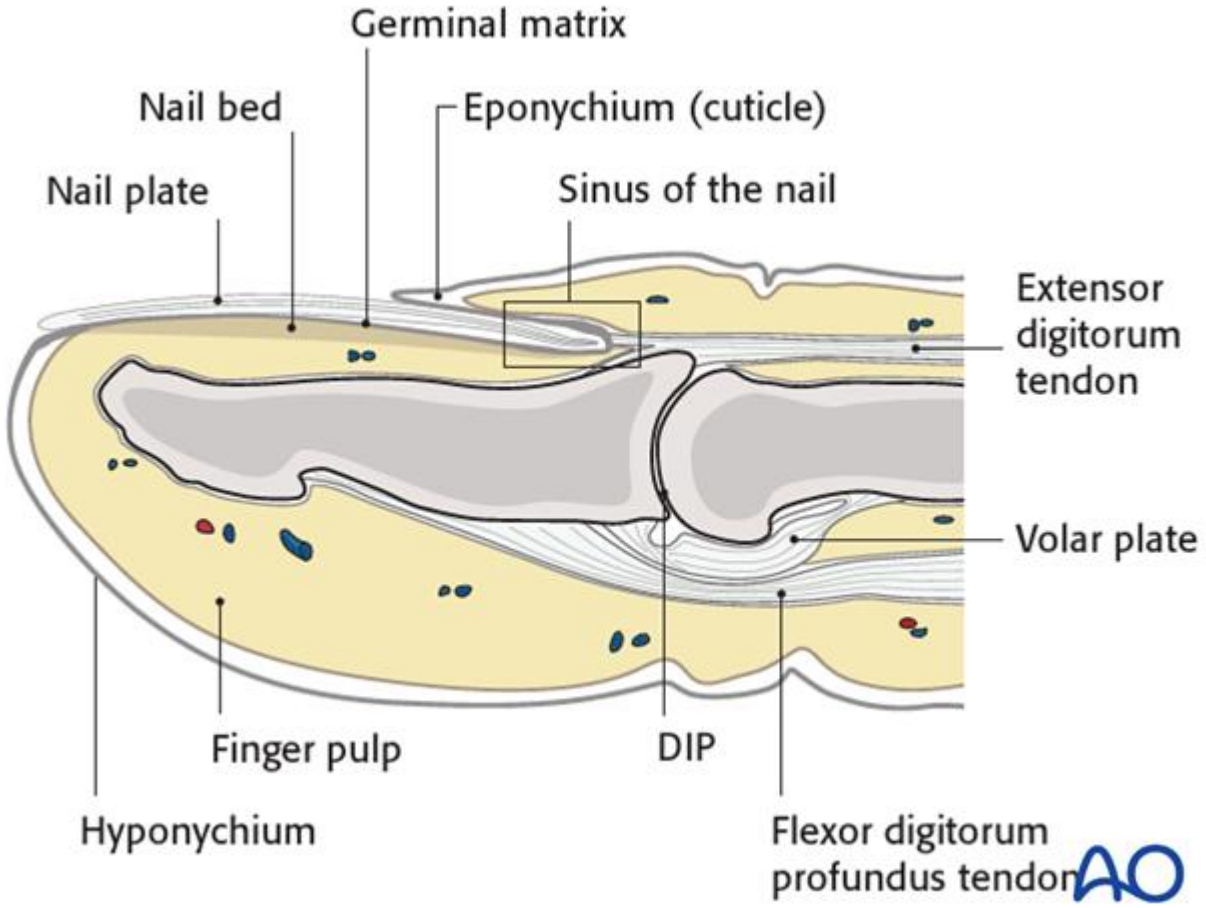
- In the proximal and middle phalanges, the distal end is pulley-shaped (trochlear).
- Articulates with the base of the next phalanx.
- Allows predominantly flexion and extension at interphalangeal joints.

D. Distal phalangeal tuft

- The distal phalanx ends in a broad, roughened ungual tuberosity (tuft).
- Supports the fingertip pulp and distal nail apparatus.
- Important for fine touch, precision grip and fingertip protection.


Distal phalanges
Head
Tuberosity
Shafts
Base
Middle phalanges
Head
Shafts
Base
Proximal phalanges
Head
Shafts
Base


Head
Shaft
Base
of distal phalanx
Distal interphalangeal joint
Head
Shaft
Base
of middle phalanx
Proximal interphalangeal joint
Head
Shaft
Base
of proximal phalanx
Metacarpophalangeal joint
Metacarpal bone



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4. Special Features of Different Phalanges

FEATURE	PROXIMAL PHALANX	MIDDLE PHALANX	DISTAL PHALANX
Number per hand	5	4	5
Relative length	Generally longest in each finger	Intermediate	Shortest

Proximal articulation	Metacarpal head	Proximal phalanx	Middle phalanx (or proximal phalanx in thumb)
Distal end	Trochlear head	Trochlear head	Ungual tuft
Important tendon relationship	Extensor mechanism; flexor tendons	Flexor digitorum superficialis insertion	Flexor digitorum profundus and terminal extensor tendon insertions
Main function	Supports MCP and PIP movements	Supports PIP and DIP movements	Fingertip function and precision grip

5. Important Muscular and Tendon Attachments

Flexor tendons

MUSCLE	INSERTION	PRINCIPAL ACTION
Flexor digitorum superficialis (FDS)	Sides of middle phalanges of digits II–V	Flexion of proximal interphalangeal (PIP) joints
Flexor digitorum profundus (FDP)	Palmar bases of distal phalanges of digits II–V	Flexion of distal interphalangeal (DIP) joints
Flexor pollicis longus (FPL)	Palmar base of distal phalanx of thumb	Flexion of thumb interphalangeal joint

Extensor tendons

- Extensor digitorum: Contributes to the dorsal extensor expansions of fingers II–V.

- Central slip: Inserts onto the dorsal base of the middle phalanx.
- Terminal extensor tendon: Inserts onto the dorsal base of the distal phalanx.
- Lumbricals and interossei: Contribute to the extensor expansion, assisting MCP flexion and interphalangeal extension.
- Extensor pollicis longus: Inserts onto the dorsal base of the distal phalanx of the thumb.

High-yield concept: FDS flexes the PIP joint, FDP flexes the DIP joint, and the terminal extensor tendon extends the DIP joint.

6. Joints of the Phalanges

JOINT	ARTICULATING BONES	TYPE	PRINCIPAL MOVEMENT
Metacarpophalangeal (MCP)	Metacarpal head and proximal phalanx	Condyloid synovial	Flexion, extension, abduction, adduction
Proximal interphalangeal (PIP)	Proximal and middle phalanges	Hinge synovial	Flexion and extension
Distal interphalangeal (DIP)	Middle and distal phalanges	Hinge synovial	Flexion and extension
Thumb interphalangeal (IP)	Proximal and distal thumb phalanges	Hinge synovial	Flexion and extension

Important stabilising structures

- Collateral ligaments: Provide lateral stability.
- Volar plates: Resist excessive hyperextension.

- Extensor mechanism: Coordinates finger extension.
- Fibrous digital sheaths and annular pulleys: Hold flexor tendons close to the bones and prevent bowstringing.

CLINICAL ANATOMY OF PHALANGES

7. Fractures of Phalanges

- Phalangeal fractures are common injuries of the hand.
- Usually result from crushing injuries, direct blows, falls or twisting trauma.
- May involve the base, shaft, neck or distal tuft.
- Injuries may be associated with tendon, ligament, nail-bed or neurovascular damage.

Important complications

- Finger stiffness and reduced range of motion.
- Malunion and rotational deformity.
- Tendon adhesions.
- Joint contracture.
- Post-traumatic arthritis following intra-articular fractures.

Clinical pearl: Even a small rotational deformity of a phalanx may cause overlapping or scissoring of fingers during flexion.

8. Mallet Finger



- Injury to the terminal extensor tendon at its insertion on the dorsal base of the distal phalanx.
- Commonly caused by sudden forced flexion of an extended fingertip.
- May be a pure tendon rupture or an avulsion fracture involving the dorsal base of the distal phalanx.

- Produces a characteristic drooping fingertip.

Clinical features

- Inability to actively extend the DIP joint.
- Fingertip remains in flexion.
- Passive extension is generally possible.
- Pain and swelling may be present over the dorsal DIP joint.

Treatment principle

- Stable injuries are commonly treated with continuous DIP extension splinting for an appropriate period, generally around 6–8 weeks.
- Unstable fractures, substantial joint involvement or volar subluxation may require surgical assessment.

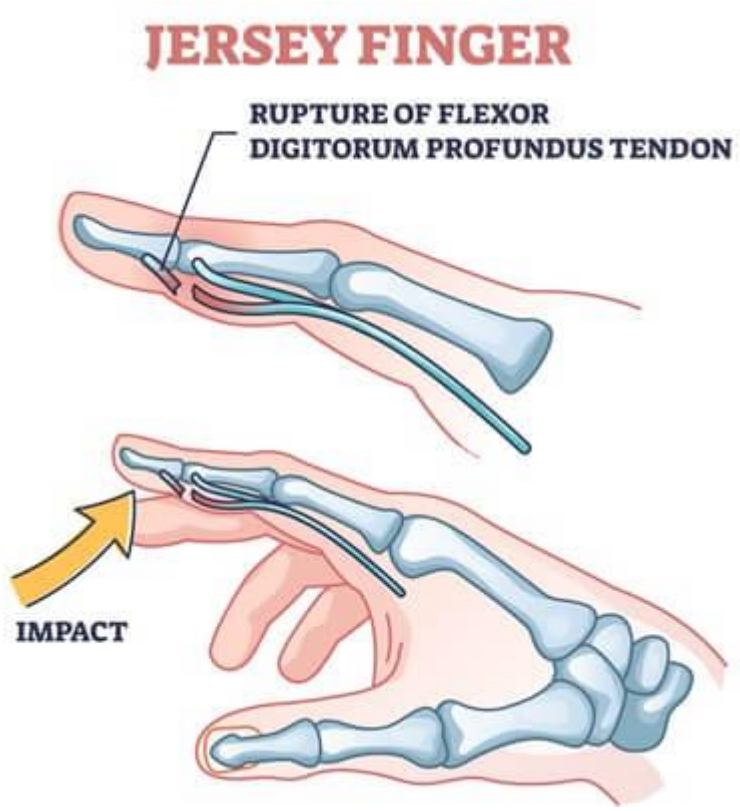


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Must know: Mallet finger = loss of active DIP extension.

9. Jersey Finger



- Avulsion of the flexor digitorum profundus (FDP) tendon from the palmar base of the distal phalanx.
- Typically occurs when a flexed finger is suddenly forced into extension.
- Classically seen when a player grabs an opponent's jersey and the finger is forcibly pulled straight.
- The ring finger is commonly involved.

Clinical features

- Inability to actively flex the DIP joint.
- Pain and tenderness over the palmar aspect of the distal finger.
- The affected finger may rest in relative extension.

- An avulsed bony fragment may be visible on radiographs.

Clinical importance

- Requires prompt hand-surgery assessment, as tendon retraction can complicate delayed repair.



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Mallet finger versus Jersey finger

FEATURE	MALLET FINGER	JERSEY FINGER
Injured tendon	Terminal extensor tendon	FDP tendon
Attachment	Dorsal base of distal phalanx	Palmar base of distal phalanx
Mechanism	Forced DIP flexion	Forced DIP extension
Lost movement	Active DIP extension	Active DIP flexion
Typical appearance	Drooping fingertip	Finger rests relatively extended
Usual management	Often extension splinting	Usually surgical repair

10. Tuft Fractures

- Fractures involving the terminal tuft of the distal phalanx.
- Usually result from crushing injuries, such as a finger being caught in a door or struck by a heavy object.
- May be comminuted due to the cancellous structure of the tuft.

Clinical features

- Localised fingertip pain and swelling.
- Subungual haematoma.
- Nail-bed laceration.
- Occasionally, open fracture with associated soft-tissue injury.

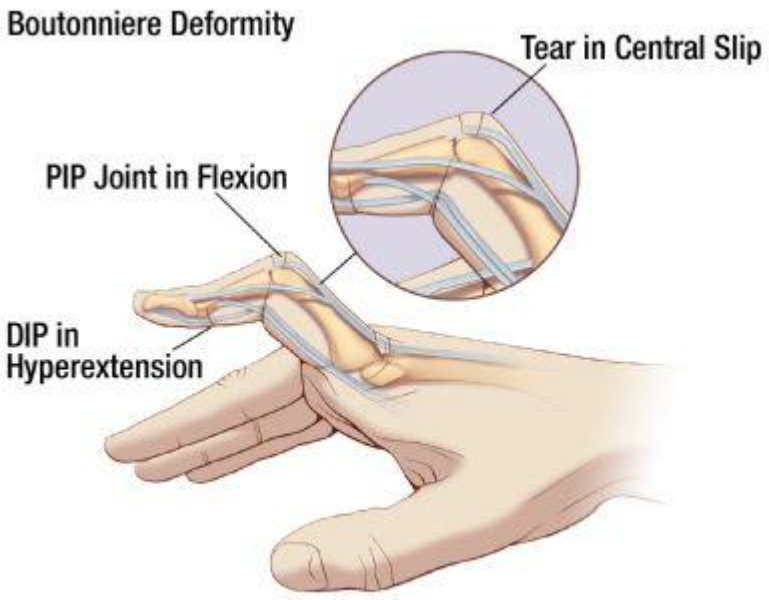
Clinical importance

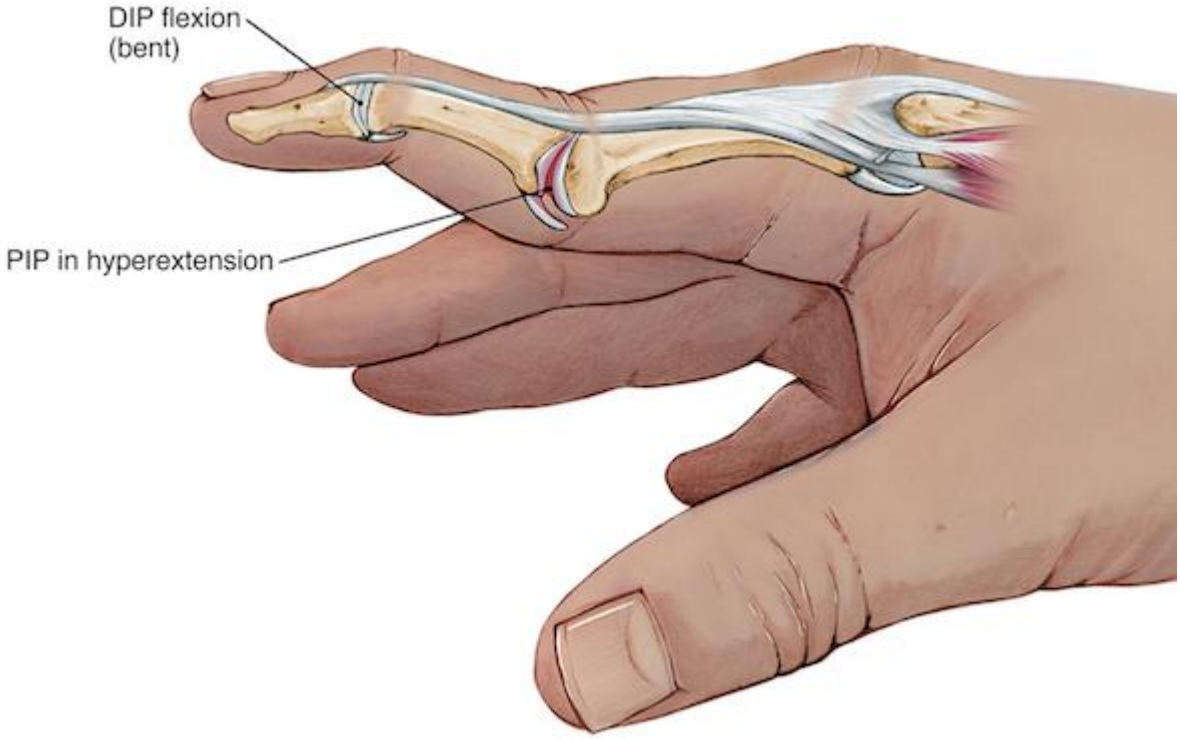
- Nail-bed injuries require careful examination.
- Many stable tuft fractures are treated conservatively with protection and splinting.
- Open fractures or complex nail-bed injuries may require additional wound management.

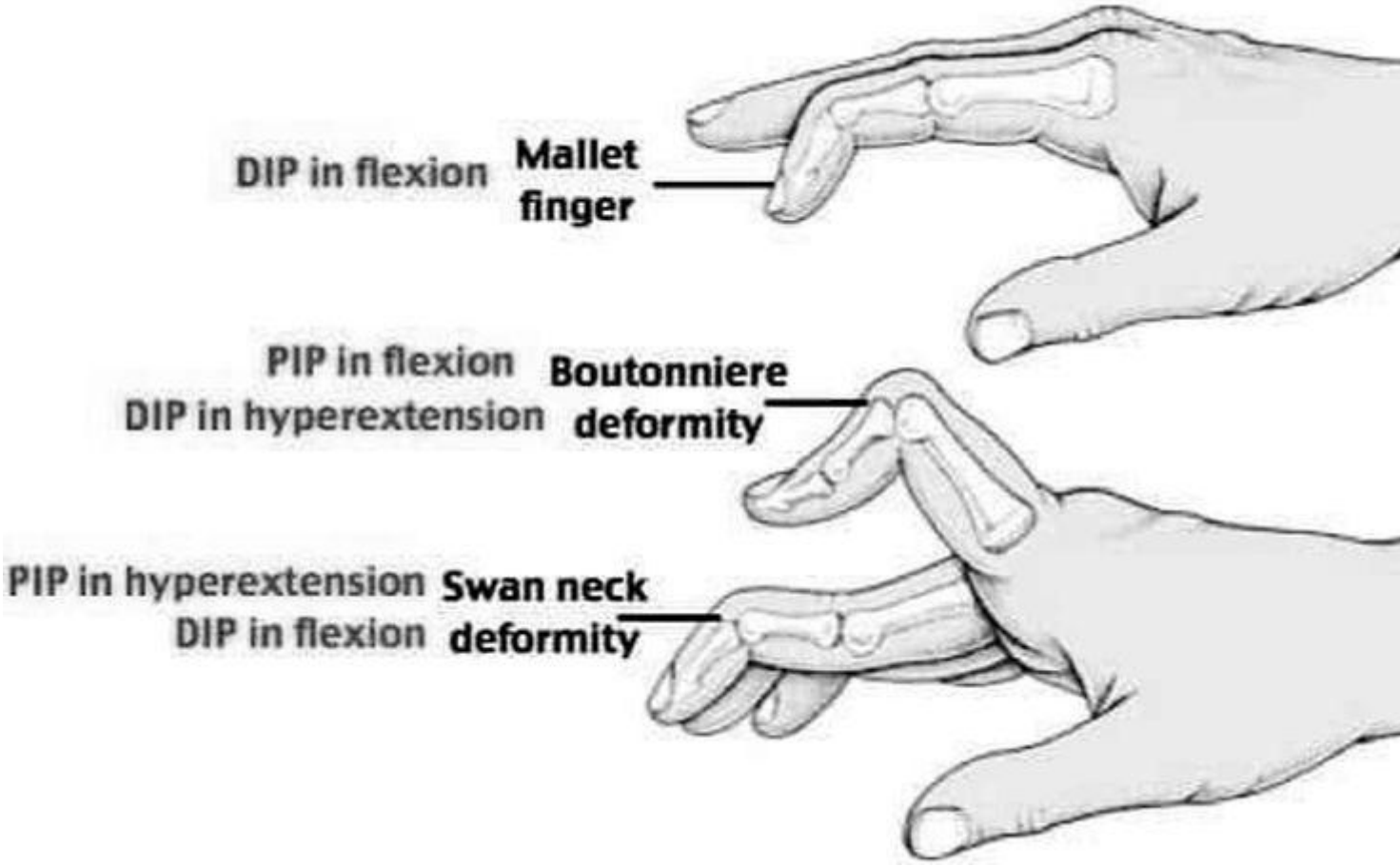
11. Other Important Deformities

CONDITION	ANATOMICAL ABNORMALITY	CHARACTERISTIC FEATURE

Boutonnière deformity	Central slip injury	PIP flexion with DIP hyperextension
Swan-neck deformity	Imbalance of extensor mechanism and joint stabilisers	PIP hyperextension with DIP flexion
Clinodactyly	Congenital angular deviation, often involving an abnormal middle phalanx	Sideways curvature of a finger
Brachydactyly	Abnormal shortening of phalanges, metacarpals or both	Short digits
Camptodactyly	Flexion contracture, commonly of PIP joint	Persistent finger flexion




DIP flexion
(bent)
PIP in hyperextension


DIP in flexion
Mallet
finger
PIP in flexion
DIP in hyperextension
Boutonniere
deformity
PIP in hyperextension
DIP in flexion
Swan neck
deformity

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Additional clinical point — Seymour fracture

- Paediatric fracture involving the distal phalangeal physis with associated nail-bed injury.
- Often appears clinically similar to a mallet deformity.
- Represents a potentially open physeal fracture, requiring prompt recognition and management.

OSSIFICATION OF PHALANGES

12. General Features of Ossification

- Each phalanx normally ossifies from two centres: one primary and one secondary centre.
- The primary centre forms the shaft (diaphysis).
- The secondary centre forms the base (proximal epiphysis).
- Primary ossification begins during intrauterine life.
- Secondary centres appear during early childhood and fuse during adolescence.

Primary ossification centres

An important feature is that distal phalanges begin ossifying before proximal and middle phalanges.

PHALANX	APPROXIMATE APPEARANCE OF PRIMARY CENTRE
Distal phalanx	8th week intrauterine life
Proximal phalanx	10th week intrauterine life

Middle phalanx	11th–12th week intrauterine life



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Secondary ossification centres

- A single secondary centre appears at the base of each phalanx.
- Usually appears during the 2nd–4th year, with some centres developing earlier.
- The secondary centre fuses with the shaft during adolescence, commonly between 16 and 18 years in conventional anatomy teaching.
- The timing varies with sex and skeletal maturity.

13. Important Ossification Sequence

Primary Ossification: Distal ? Proximal ? Middle

1

Distal

8 weeks

2

Proximal

10 weeks

3

Middle

11–12 weeks

Conventional sequence of appearance of the primary ossification centres.

Important examination points

- First phalanges to begin ossification: Distal phalanges.
- Last in the usual primary ossification sequence: Middle phalanges.
- Site of secondary ossification centre: Base.
- Growing end of a phalanx: Proximal end.
- Total ossification centres per phalanx: Usually 2.
- Total centres in the phalanges of one hand: 28 (14 primary and 14 secondary).

Memory aid: D–P–M = 8–10–12 weeks (Distal ? Proximal ? Middle).

14. Clinical Importance of Phalangeal Ossification

A. Growth plate injuries

- Children and adolescents may sustain fractures involving the phalangeal growth plates.
- Growth plate injury may result in premature fusion, shortening or angular deformity.
- Injuries are commonly classified using the Salter–Harris classification.

B. Skeletal age estimation

- Appearance and fusion of the secondary centres contribute to assessment of skeletal maturity.

- Hand and wrist radiographs are commonly used for bone age determination.
- Interpretation must consider chronological age, sex and population variation.

C. Developmental anomalies

- Abnormal formation or growth of phalanges may result in:

- Brachydactyly: Short digits.
- Clinodactyly: Angular deviation of a digit.
- Symphalangism: Congenital fusion or absence of an interphalangeal joint.
- Triphalangeal thumb: Presence of three phalanges in the thumb instead of two.

15. High-Yield Quick Revision

EXAMINATION POINT	ANSWER
Total phalanges in one hand	14
Total phalanges in both hands	28
Number in each finger	3
Number in thumb	2
Growing end	Base (proximal end)

Site of primary centre	Shaft
Site of secondary centre	Base
First primary ossification	Distal phalanges
Primary centre of distal phalanges	8th week IUL
Primary centre of proximal phalanges	10th week IUL
Primary centre of middle phalanges	11th–12th week IUL
Mallet finger	Terminal extensor tendon injury
Jersey finger	FDP tendon avulsion
Mallet finger deficit	Loss of active DIP extension
Jersey finger deficit	Loss of active DIP flexion
Distal phalangeal crush injury	Tuft fracture
PIP flexion + DIP hyperextension	Boutonnière deformity
PIP hyperextension + DIP flexion	Swan-neck deformity

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16. Exam Focus

University long-answer / diagram question

Describe the general anatomy of the phalanges, including their arrangement, characteristic features, tendon attachments, ossification and clinical anatomy.

Short-note questions

- Mallet finger.
- Jersey finger.
- Tuft fractures.
- Ossification of phalanges.
- Boutonnière and swan-neck deformities.
- Congenital abnormalities of phalanges.

Viva questions

1. How many phalanges are present in one hand? — Fourteen.
2. Which digit has only two phalanges? — Thumb.
3. Which phalanges ossify first? — Distal phalanges.
4. Where is the secondary ossification centre of a phalanx? — Base.
5. Which tendon is injured in mallet finger? — Terminal extensor tendon.
6. Which tendon is injured in jersey finger? — Flexor digitorum profundus.
7. Which deformity produces PIP flexion and DIP hyperextension? — Boutonnière deformity.

8. What is a tuft fracture? — Fracture of the terminal ungual tuberosity of the distal phalanx.

NEET PG / INI-CET Clinical Pearls

- Drooping fingertip + inability to actively extend DIP ? Mallet finger.
- Forced extension of a flexed finger + inability to actively flex DIP ? Jersey finger.
- Crush injury with subungual haematoma ? Consider distal phalangeal tuft fracture and nail-bed injury.
- PIP flexion + DIP hyperextension ? Boutonnière deformity.
- PIP hyperextension + DIP flexion ? Swan-neck deformity.
- Open distal phalangeal physeal fracture with nail-bed disruption in a child ? Seymour fracture.
- First primary ossification centre among phalanges ? Distal phalanx, approximately the eighth week of intrauterine life.