



Terms of Movement & the Skeletal System

Anatomical Planes, Angular and Special Movements, the Axial and Appendicular Skeleton, Bone Tissue, and the Language of Bone Surface Markings

Full-day session · 6–7 instructional hours · 58 slides



Session Roadmap

Six modules. Each closes with a practice set. Two breaks and one lunch.

I	Anatomical Planes	<i>The 3D reference system, revisited</i>	45 min
II	Terms of Movement — Angular Motion	<i>Flexion, extension, abduction, adduction, rotation</i>	80 min
III	Special Movements	<i>The movements that belong to one joint</i>	80 min
IV	The Skeletal System	<i>Divisions, functions, cartilage</i>	60 min
V	Bone Tissue and Classification	<i>Compact, spongy, long bone anatomy</i>	60 min
VI	Bone Terminology	<i>Depressions, openings, projections, processes</i>	60 min



Learning Objectives

By the end of this lecture, students will be able to:

Name	the anatomical planes and the movements that occur in each.
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Define	the terms of angular motion and demonstrate each one.
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Distinguish	special movements and name the joint each belongs to.
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Describe	the axial and appendicular divisions, and the functions of the skeletal system.
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Classify	bones by shape, and name the parts of a typical long bone.
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Apply	the descriptive terms for bone surface markings to palpable landmarks.
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Movement Terms Are Assessment Terms

You will not write "the client cannot lift their arm." You will write which movement, in which plane, to how many degrees.

What a movement term buys you

- "AROM shoulder abduction 90°, limited by pain" is measurable and repeatable.
- It tells the next therapist exactly what to re-test.
- It tells a physiotherapist which tissues are implicated.
- It converts a complaint into a baseline.

What bone terminology buys you

- "Tenderness at the greater trochanter" names a structure anyone can find.
- "Sore hip" names nothing at all.
- Bony landmarks are the fixed points from which you navigate soft tissue.
- You cannot palpate what you cannot name.



I

MODULE I

Anatomical Planes

- Imaginary sectioning
- Sagittal
- Frontal / coronal
- Transverse / horizontal
- Oblique
- Planes and axes



Anatomical Planes

These planes are imaginary sectioning of the body for descriptive purposes. Imaginary flat surfaces that pass through the body parts.

Plane	Also called	Divides the body into
Sagittal plane	Median plane	Right and left
Transverse plane	Horizontal plane	Superior and inferior
Coronal plane	Frontal plane	Anterior and posterior

There is no plane inside the body. The plane is a description we impose so that we can speak precisely about position and movement.



Anatomical Planes, Defined

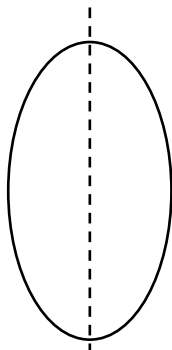
Three cardinal planes, mutually perpendicular, and a fourth that is everything else.

- Sagittal plane (midsagittal, parasagittal)
 - *A vertical plane that divides the body or organ into right and left sides.*
- Frontal or coronal plane
 - *Divides the body or an organ into anterior (front) and posterior (back) portions.*
- Transverse or Horizontal plane
 - *Divides the body or an organ into superior (upper) and inferior (lower) portions.*
- Oblique Plane
 - *This plane passes through the structure at an oblique angle.*
- Midsagittal passes exactly through the midline, producing equal halves. Parasagittal is offset from the midline, producing unequal portions.



The Three Cardinal Planes

Each plane hosts a family of movement. Name the plane and you have narrowed the movement to three or four possibilities.

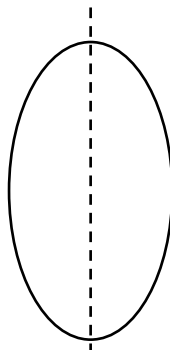


Anterior view

Sagittal

Divides right and left.

Flexion / Extension occur here.

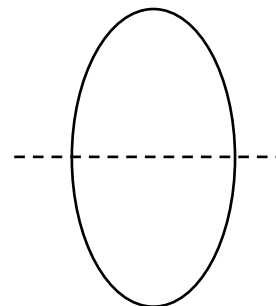


Lateral view

Frontal (Coronal)

Divides anterior and posterior.

Abduction / Adduction occur here.



Anterior view

Transverse

Divides superior and inferior.

Rotation occurs here.

The oblique plane passes through the structure at an oblique angle. Most real human movement is oblique, not cardinal.



Every Plane Has an Axis

Movement occurs in a plane and around an axis. The axis is perpendicular to the plane of movement.

Plane	Axis	Movements	Example
Sagittal	Frontal (side to side)	Flexion, extension	A biceps curl
Frontal	Sagittal (front to back)	Abduction, adduction	A jumping jack
Transverse	Vertical (longitudinal)	Rotation, pronation, supination	Shaking the head "no"
Oblique	Oblique	Combined movements	Reaching across the body

The counterintuitive part: movement in the sagittal plane occurs around a frontal axis. The axis is the pin the movement turns on, not the surface it travels along.



Practice Set 1 — Name the Plane

Perform each movement, then name the plane it occurs in and the axis it turns around.

1. Cervical flexion
2. Shoulder abduction to 90°
3. Cervical rotation to the left
4. Ankle dorsiflexion
5. Lateral flexion of the lumbar spine
6. Forearm supination
7. Circumduction of the shoulder
8. Reaching diagonally across the body

Items 7 and 8 are the interesting ones. Neither occurs in a single cardinal plane.



II

MODULE II

Terms of Movement — Angular Motion

- Flexion and lateral flexion
- Extension and hyperextension
- Abduction and adduction
- Rotation
- Circumduction
- Angular motion at each joint



Terms of Movement

The first family of movement terms. Learn them as opposing pairs; never learn one alone.

- Flexion: Bending the body part or decreasing the angle between the body parts.
- Lateral Flexion: Side bending of the spine laterally.
- Extension: Straightening the body part or increasing the angle between body parts.
- Abduction: Moving away from the median plane.
 - *In reference to the foot, abduction would be toes 3–5 going away from the 2nd toe, and for the hand it would be the 2nd finger going away from the 3rd finger.*
- Adduction: Moving towards the median plane.
 - *In reference to the hand, the 2nd finger is approaching the 3rd finger, and for the foot, toes 3–5 are approaching the 2nd toe.*



Flexion, Extension, Hyperextension, Lateral Flexion

The sagittal-plane family, with one member that bends sideways.

- FLEXION — decreasing the angle. Bringing the forearm toward the arm; bringing the chin toward the chest.
- EXTENSION — increasing the angle. The return from flexion, back to anatomical position.
- HYPEREXTENSION — extension beyond the anatomical position. Looking up at the ceiling; arching the lumbar spine.
- LATERAL FLEXION — side bending of the spine laterally. It occurs in the frontal plane, not the sagittal, despite the word "flexion."
- Exceptions worth knowing: at the ankle, flexion and extension are named dorsiflexion and plantar flexion. At the thumb, the plane is rotated 90°.
- Hyperextension is normal at some joints and pathological at others. The knee does not hyperextend without consequence.

Charting: "AROM cervical extension limited by pain at end range" — name the movement, the range, and the limiting factor.



Abduction and Adduction

The frontal-plane family. Movement away from and toward the median plane.

- ABDUCTION — moving away from the median plane. Raising the arm out to the side; lifting the leg laterally.
- ADDUCTION — moving towards the median plane. Bringing the limb back to the body.
- Memory aid: to ADDuct is to ADD the limb back to the body.
- The hand and the foot do not use the body's midline as their reference. They each have their own reference digit.
- Hand: the reference is the 3rd finger (middle finger). Abduction of the 2nd finger means it moves away from the 3rd.
- Foot: the reference is the 2nd toe. Abduction means toes 3–5 move away from the 2nd toe; adduction means they approach it.

This is why spreading your fingers is abduction, and why spreading your toes is abduction — even though neither hand nor foot is near the body's midline.



Three Different Midlines

"Away from the midline" only makes sense once you know which midline.

Limbs and trunk	<i>Reference: the median (midsagittal) plane</i>	Example	<i>Shoulder abduction moves the arm from the trunk</i>
Hand	<i>Reference: the 3rd finger</i>	Example	<i>The 2nd finger going away from the 3rd is abduction</i>
Foot	<i>Reference: the 2nd toe</i>	Example	<i>Toes 3–5 going away from the 2nd toe is abduction</i>

Note that the thumb is the exception to the exception: thumb abduction moves it anteriorly, away from the palm, because the thumb sits in a rotated plane.



Rotation

Movement around the long axis. It occurs in the transverse plane.

- Rotation: Movement around the long axis.
- Medial / internal rotation — the anterior surface of the limb turns toward the midline.
- Lateral / external rotation — the anterior surface of the limb turns away from the midline.
- At the spine and the head, rotation is named by the direction the face or the anterior surface turns: "cervical rotation to the left."
- At the forearm, rotation has special names: supination and pronation. We meet those in Module III.
- Rotation is the movement most often lost first and noticed last. Assess it deliberately.

Charting: "AROM cervical rotation to the left decreased 30% compared to right." Always state the side and the comparison.



Circumduction

Not a single movement, but a sequence of them performed continuously.

- Circumduction: Combination of movements which includes flexion, extension, adduction and abduction.
- The distal end of the limb traces a circle; the proximal end stays fixed. The limb sweeps a cone.
- It requires a joint that permits movement in at least two planes — ball-and-socket or condyloid.
- The shoulder, hip, wrist, and metacarpophalangeal joints circumduct. The elbow and knee do not.
- Circumduction is not rotation. A limb can circumduct without any rotation around its long axis.
- It crosses the sagittal and frontal planes, and belongs to neither.



Angular Motion

The terms in this module have a collective name, and a clinical use.

- This first group of movements are referred to as 'angular motion.'
- For every joint that we discuss, there will be a specific combination of angular motion found at that joint.
- The combination available at a joint is determined by its shape, its capsule, and its ligaments.
- The knee is a hinge: flexion and extension, plus a small amount of rotation when flexed. It does not abduct.
- The shoulder is a ball-and-socket: flexion, extension, abduction, adduction, rotation, and therefore circumduction.
- When you assess a joint, you assess the angular motions it should have. Absence of an expected motion is a finding.

The reverse is also true: presence of a motion a joint should not have — a knee that abducts — is instability, and a referral.



Angular Motion, Collected

Cover the right-hand column. Define each term before you check.

Movement	Definition	Plane
Flexion	Decreasing the angle between body parts	Sagittal
Extension	Increasing the angle between body parts	Sagittal
Hyperextension	Extension beyond the anatomical position	Sagittal
Lateral flexion	Side bending of the spine laterally	Frontal
Abduction	Moving away from the median plane	Frontal
Adduction	Moving towards the median plane	Frontal
Rotation	Movement around the long axis	Transverse
Circumduction	Flexion, extension, adduction and abduction combined	Sagittal + frontal



Practice Set 2 — Name the Movement

Perform each, then name the movement, the plane, and the joint.

1. Bringing the chin toward the chest
2. Raising the arm laterally to shoulder height
3. Spreading the fingers apart
4. Bringing the toes 3–5 toward the 2nd toe
5. Turning the head to look over the right shoulder
6. Looking up at the ceiling
7. Tracing a large circle in the air with a straight arm
8. Bending sideways at the waist

For each, also state: could this joint perform this movement if it were a hinge joint?



III

MODULE III

Special Movements

- Protraction and retraction
- Elevation and depression
- Lateral deviation
- Supination and pronation
- Deviation, opposition, reposition
- Inversion, eversion, dorsiflexion, plantar flexion



Special Movements

Movements that belong to one joint or one region, and cannot be described by the angular terms alone.

The list

- Elevation
- Depression
- Lateral deviation
- Protraction / Protrusion
- Retraction / Retrusion
- Inversion

Continued

- Eversion
- Dorsiflexion
- Plantar flexion
- Supination
- Pronation
- Opposition

Protraction and Retraction

Movement of a structure anteriorly or posteriorly, in the transverse plane, without rotation.

- Protraction: Moving the structure anteriorly / forward.
- Retraction: Moving the structure posteriorly / backward.
- At the scapula: protraction draws the shoulder blades apart around the thorax; retraction draws them together.
- At the mandible: the same movements are called protrusion and retrusion — pushing the jaw forward and drawing it back.
- Protraction / Protrusion and Retraction / Retrusion name the same movement in two regions.
- Clinical: a habitually protracted scapula lengthens the rhomboids and shortens the pectoralis minor. That pattern predicts what you will palpate.

Charting: "Bilateral scapular protraction with forward head posture noted on standing assessment."

Elevation, Depression, and Lateral Deviation

Movement of a structure superiorly or inferiorly, and — at the jaw alone — from side to side.

- Elevation: Raising the structure superiorly (cephalad).
- Depression: Lowering the structure inferiorly (caudally).
- At the scapula: shrugging is elevation; the return is depression. The upper trapezius elevates; the lower trapezius depresses.
- At the mandible: elevation closes the mouth; depression opens it.
- Lateral deviation: side-to-side movement of the mandible, away from the midline. It occurs at the temporomandibular joint.
- Lateral deviation is assessed in every TMJ examination. Deviation of the jaw to one side on opening is a positive finding.

Note the terminology carried forward from Lecture 4: cephalad means toward the head, caudally means toward the feet.



Supination and Pronation

Rotation of the forearm around its long axis. The radius crosses the ulna, or uncrosses it.

- Supination: The forearm is rotated laterally (palm up).
- Pronation: The forearm is rotated medially (palm down).
- Memory aid: you carry a bowl of soup in a supinated hand.
- In the anatomical position the forearm is supinated. This is why the radius is lateral and the ulna is medial.
- In pronation the radius crosses over the ulna. "Lateral" and "medial" still refer to the anatomical position, not to the crossed bones.
- The movement occurs at the proximal and distal radioulnar joints, not at the wrist and not at the elbow hinge.

Loss of supination is functionally disabling: it prevents carrying, receiving change, and turning a door handle.



Ulnar Deviation, Radial Deviation, Opposition, Reposition

Four movements of the wrist and thumb. Two are abduction and adduction under another name.

- Ulnar deviation: Adduction of the wrist. The hand moves toward the ulnar (medial) side — the little-finger side.
- Radial deviation: Abduction of the wrist. The hand moves toward the radial (lateral) side — the thumb side.
- Opposition: Thumb moves medially to meet the other fingers.
- Reposition: Put the thumb back to a neutral position.
- Opposition is the movement that makes the human hand a grasping hand. It combines abduction, flexion, and medial rotation of the thumb.
- Loss of opposition — as in advanced carpal tunnel syndrome with thenar atrophy — is a major functional loss and a referral.

Note that ulnar and radial deviation are named for the bones, not for direction. The wrist "deviates" toward the named bone.



Inversion, Eversion, Dorsiflexion, Plantar Flexion

Four movements of the foot and ankle. Two describe the sole; two describe the angle at the ankle.

- Eversion: Plantar surface of the foot moves laterally.
- Inversion: Plantar surface of the foot moves medially.
- Dorsiflexion: Bending the ankle towards the shin.
- Plantar flexion: Bending the ankle towards the posterior / back of the body.
- Inversion and eversion occur at the subtalar joint. Dorsiflexion and plantar flexion occur at the talocrural (ankle) joint.
- Clinical: the classic lateral ankle sprain is an inversion injury, damaging the anterior talofibular ligament. Ask the mechanism before you palpate.

Dorsiflexion and plantar flexion are the ankle's names for extension and flexion. The naming is historical, not logical — learn it as given.



Special Movements, Collected

Every special movement belongs to a joint. Name the joint and the definition follows.

Movement	Joint or region	Definition
Elevation / Depression	Scapula, mandible	Raising superiorly / lowering inferiorly
Protraction / Retraction	Scapula	Moving anteriorly / posteriorly
Protrusion / Retrusion	Mandible	Moving anteriorly / posteriorly
Lateral deviation	Mandible (TMJ)	Side-to-side movement away from the midline
Supination / Pronation	Radioulnar joints	Forearm rotated laterally / medially
Ulnar / Radial deviation	Wrist	Adduction / abduction of the wrist
Opposition / Reposition	Thumb (1st CMC)	Thumb to the fingers / back to neutral
Inversion / Eversion	Subtalar joint	Sole moves medially / laterally
Dorsiflexion / Plantar flexion	Talocrural joint	Ankle toward the shin / toward the back



Practice Set 3 — Name the Special Movement

Perform each, then name the movement and the joint at which it occurs.

1. Shrugging the shoulders
2. Turning the palm to face the ceiling
3. Touching the thumb to the little finger
4. Pointing the toes toward the floor
5. Tilting the sole of the foot inward
6. Pushing the lower jaw forward
7. Bending the hand toward the little-finger side
8. Drawing the shoulder blades together

For each, also give the opposing movement.



IV

MODULE IV

The Skeletal System

- Bone and cartilage
- The axial skeleton
- The appendicular skeleton
- Functions of the skeletal system
- Cartilage and its role
- Types of cartilage



The Skeletal System

The skeletal system includes both bone and cartilage, and is made up of 2 basic divisions.

- Axial = Central core of the skeletal system.
- Appendicular = Includes the bones of the upper and lower limbs and bones that attach the limbs to the axial skeleton.
- The division is functional, not arbitrary: the axial skeleton protects and supports; the appendicular skeleton moves.
- The two divisions meet at the shoulder girdle and the pelvic girdle — the bones that attach limb to core.



The Axial Skeleton

Axial = Central core of the skeletal system.

Contents

- 8 cranial bones
- 14 facial bones
- Auditory bones
- Hyoid bone
- Vertebrae of the spinal column
- 12 pairs of ribs
- The sternum

Notes for the RMT

- The hyoid is the only bone in the body that articulates with no other bone. It is suspended by muscle.
- The vertebral column: 7 cervical, 12 thoracic, 5 lumbar, sacrum, coccyx.
- The ribs and sternum form the thoracic cage, which protects the heart and lungs and moves with every breath.
- The auditory bones — malleus, incus, stapes — are the smallest bones in the body.



The Appendicular Skeleton

Appendicular = Includes the bones of the upper and lower limbs and bones that attach the limbs to the axial skeleton.

Upper limb and girdle

- Scapula
- Clavicle
- Humerus
- Radius
- Ulna
- Carpal bones
- Metacarpal bones
- Phalanges of the hand

Lower limb and girdle

- Innominate bones (the hip bones)
- Femur
- Tibia
- Fibula
- Patella
- Tarsal bones
- Metatarsal bones
- Phalanges of the foot



Functions of the Skeletal System

Six functions. Only one of them is the one students name first.

- Protection for vital structures.
 - *The cranium protects the brain; the thoracic cage protects the heart and lungs.*
- Support the body and its vital cavities.
- Movement.
 - *Bones are levers; joints are fulcrums; muscles supply the force.*
- Mineral deposition (storage for salts).
 - *Principally calcium and phosphate, released into the blood as required.*
- Blood element production.
 - *Red marrow produces red cells, white cells, and platelets.*
- Energy storage. Yellow marrow has adipose cells (fat), which can be used for energy.



Cartilage and Its Role

Cartilage and its role (costal and articular).

- The skeletal system is composed of cartilage and bones.
- Cartilage is semi rigid and is found where flexibility is required (i.e. costal cartilage and ribs).
- Articular cartilage covers the ends of bones within a joint, providing a near-frictionless bearing surface.
- Costal cartilage joins the ribs to the sternum, allowing the thoracic cage to expand with each breath.
- Cartilage is avascular. It receives nutrients by diffusion, which is why it heals slowly and poorly.
- That single fact — avascularity — explains chondromalacia, osteoarthritis, and why meniscal tears often require surgery.



Types of Cartilage

Three types, distinguished by the fibres in their matrix and by where they are found.

Type	Where it is found	Property and clinical note
Hyaline	Joints (articular surfaces)	Smooth, low friction; degenerates in osteoarthritis
Elastic	Ear (and epiglottis)	Flexible, springs back to shape
Fibrocartilage	Discs of the spinal column	Tough, resists compression; also the menisci and pubic symphysis

Hyaline is also found in the costal cartilage, the nasal septum, and the growth plate of a developing long bone.



Practice Set 4 — Axial or Appendicular?

Classify each bone, and name which of the six skeletal functions it most obviously serves.

- | | |
|-------------|------------------------|
| 1. Sternum | 5. 5th lumbar vertebra |
| 2. Clavicle | 6. Scapula |
| 3. Hyoid | 7. Innominate |
| 4. Patella | 8. Malleus |

Then: which type of cartilage would you find at the sternocostal junction, in the ear, and between L4 and L5?



V

MODULE V

Bone Tissue and Classification

- Bone as living tissue
- Compact bone
- Spongy bone
- Classification by shape
- Accessory bones
- Parts of a long bone



Bone

Bone is living tissue that is hard and makes up most of the skeleton.

- Bone is subject to constant rebuilding, the same as any other living tissue.
- Osteoblasts build bone. Osteoclasts break it down. The balance between them is remodelling.
- Bone remodels in response to load. Loaded bone thickens; unloaded bone thins.
- This is why immobilisation weakens bone, and why weight-bearing exercise is prescribed for osteoporosis.
- Bone is vascular and innervated. It bleeds, it hurts, and it heals — unlike cartilage.
- Roots to carry forward: oste/o (bone), -blast (former), -clast (breaker), -porosis (porous condition).



Compact and Spongy Bone

2 Types of Bone. The same tissue, arranged two different ways, for two different jobs.

Compact bone	<i>Superficial thin layer; provides the strength to bones for weight bearing</i>	Spongy bone	<i>Also called cancellous or trabecular bone</i>
Where	<i>A larger proportion of compact bone is found at the ends of the bones</i>	Where	<i>Found deep to compact bone and superficial to the marrow cavity if present</i>
Structure	<i>Dense, solid, arranged in concentric lamellae</i>	Structure	<i>Contains many small spaces; a lattice of trabeculae</i>

The trabeculae of spongy bone align along the lines of stress. The architecture is a record of the loads the bone has carried.



The Coverings and Cavities of Bone

Bone is not solid throughout, and it is never bare.

- Periosteum: the tough fibrous membrane covering the outer surface of bone, except at the articular surfaces.
- It is richly innervated. A blow to the shin hurts because you have struck the periosteum, not the bone.
- Tendons and ligaments blend into the periosteum at their attachments. This is where traction injuries occur.
- Endosteum: the thin membrane lining the internal surfaces, including the marrow cavity.
- Medullary (marrow) cavity: the hollow interior of the diaphysis of a long bone, containing marrow.
- Articular cartilage covers the epiphyses where they form a joint. Here there is no periosteum.

Clinical: periostitis — inflammation of the periosteum — presents as exquisite, well-localised bone pain. "Shin splints" is one common form.



Classifications of Bones

Bones are classified by shape. The shape predicts the function.

- Long: Are tubular in shape (i.e. humerus and femur).
- Short: Are cuboidal in shape and found in the wrist (i.e. carpal bones).
- Flat: Protective function (i.e. skull bones, scapula).
- Irregular: Various shapes (i.e. bones of the face, vertebrae).
- Sesamoid: Develop in certain tendons (i.e. patella and sesamoid bones of the 1st toe).
- "Long" refers to shape, not size. The phalanges of the fingers are long bones.



Accessory Bones

Extra bones which are small, irregular in shape and often found in the sutures of the skull bones. These are also commonly seen in the foot.

- In the skull they are called sutural or Wormian bones, sitting within the cranial sutures.
- In the foot, accessory ossicles are common — the os trigonum and the accessory navicular are the ones you will hear named.
- They are normal anatomical variants. Most cause no symptoms and are found incidentally on imaging.
- Occasionally an accessory bone in the foot becomes symptomatic, producing localised pain on palpation and on loading.
- Do not assume every palpable prominence is a pathology. Some people simply have an extra bone.
- Sesamoid bones — patella, and the sesamoids of the 1st toe — are a related idea: bone forming inside a tendon where it crosses a joint.



Parts of a Typical Long Bone

Four named regions, from the end of the bone to its shaft.

Epiphysis

The end of a long bone. Composed largely of spongy bone, covered by articular cartilage where it forms a joint.

Metaphysis

The region between the epiphysis and the diaphysis. In a child, this is where the growth plate sits.

Diaphysis

The shaft of the long bone. A thick collar of compact bone surrounding the medullary cavity.

Epiphyseal line

In adults this is a remnant line where the epiphyseal plate (growth plate) was in the child or developing bone.



The Growth Plate and Why It Matters

The epiphyseal plate is the site of longitudinal bone growth in the child. It is cartilage, and cartilage is the weak link.

- In the growing skeleton, the epiphyseal plate is weaker than the surrounding bone, ligament, and tendon.
- Consequently, a force that would sprain a ligament in an adult may fracture the growth plate in a child.
- A child with a bony tenderness at the end of a long bone after trauma requires imaging, not massage.
- Growth-plate injuries can disturb subsequent growth. This is why paediatric injury is referred, not treated.
- The plate closes at skeletal maturity, leaving the epiphyseal line — a remnant, visible on radiograph.
- Traction apophysitis — Osgood-Schlatter at the tibial tuberosity, Sever's at the calcaneus — is a growth-plate condition of the adolescent athlete.

Bone terminology becomes a safety rule: know whether your client's skeleton is mature before you interpret a bony tenderness.



Practice Set 5 — Bone Tissue and Shape

Answer from memory, then check with a partner.

1. Which type of bone is found at the ends of long bones in larger proportion?
2. Which type of bone contains many small spaces?
3. Name the five classifications of bone by shape.
4. Classify: the patella. The scapula. A carpal bone. A thoracic vertebra. A phalanx.
5. Name the four parts of a typical long bone.
6. What is the epiphyseal line, and what was it before?
7. Where in the body would you find hyaline, elastic, and fibrocartilage?
8. Why does bone heal but articular cartilage largely does not?

The last question is the one that matters most in practice.



VI

MODULE VI

Bone Terminology

- Descriptive terms for surface markings
- Depressions and openings
- Foramen, canal, fissure
- Projections
- Processes
- Palpating landmarks



Bone Terminology

Descriptive terms for bone surface markings. Every bump, hollow, and hole on a bone has a name, and the name tells you what it does.

Depressions and openings

- Allow passage of materials.
- Form joints.
- Named: fossa, sulcus or groove, foramen, fissure, canal, sinus.
- If something needs to pass through or sit within the bone, it is a depression or an opening.

Processes and projections

- Provide attachment for muscles and ligaments.
- Some also form joints.
- Named: trochanter, tuberosity, tubercle, crest, line, spine, head, neck, condyle, trochlea, facet.
- If something pulls on the bone there, it is a projection. If something articulates there, it is a process.



Depressions and Openings

Depressions and Openings allow passage of materials and form joints.

Term	Definition	Example
Fossa	Shallow depression in bone, houses opposing bone during flexion	Olecranon fossa
Sulcus or Groove	Furrow along bone, holds tendon or blood vessel	Intertubercular sulcus
Foramen	Opening in bone, nerves and blood vessels pass through	Foramen magnum
Fissure	Narrow slit between 2 adjacent bones, nerves and blood vessels pass through	Superior orbital fissure
Canal	Large opening in center of bone	Carotid canal
Sinus (or Antrum)	Cavity or chamber within bone	Frontal sinus



Foramen, Canal, and Fissure

Three openings. The distinction is shape and length, not function — all three transmit nerves and vessels.

- FORAMEN — an opening in bone. Nerves and blood vessels pass through. It is a hole: short, and usually round.
- The foramen magnum, in the occipital bone, transmits the spinal cord. The intervertebral foramina transmit the spinal nerve roots.
- CANAL — a large opening in the centre of bone. It is a tunnel: a foramen with length.
- FISSURE — a narrow slit between 2 adjacent bones. Nerves and blood vessels pass through. It is a crack, not a hole.
- Clinical: narrowing of an intervertebral foramen compresses a nerve root, producing radiculopathy. The terminology names the mechanism.
- Plurals: one foramen, two foramina. One fissure, two fissures. One sulcus, two sulci.

The Latin plural rule from Lecture 2 reappears: -men becomes -mina, -us becomes -i.



Bone Terminology — Projections

Projections provide attachment for muscles and ligaments. Six terms, distinguished by size and shape.

Term	Definition	Palpable example
Trochanter	Large projection off bone	Greater trochanter of the femur
Tuberosity	Small projection off bone	Tibial tuberosity; ischial tuberosity
Tubercle	Small rounded projection	Greater tubercle of the humerus
Crest	Prominent ridge or elongated projection	Iliac crest
Line	Long narrow ridge, less prominent than crest	Linea aspera of the femur
Spine	Small pointy projection	Spine of the scapula; ASIS

Every example in the right-hand column is palpable through skin. These are the landmarks from which you navigate soft tissue.



Bone Terminology — Processes

Processes are projections that form part of a joint, or that guide a moving structure.

Term	Definition	Example
Head	Rounded projection at end of bone, articulates with base of adjacent bone	Head of the femur
Neck	Supports head in articulation	Neck of the femur
Condyle	Large rounded protuberance at end of bone	Medial condyle of the femur
Trochlea	Groove at the end of bone — houses moveable tendon	Trochlea of the humerus
Facet	Smooth flat articular surface	Facet joints of the vertebrae

Related term from Lecture 1: the epicondyle sits upon the condyle. Epi- means upon. Lateral epicondylitis is inflammation upon the lateral condyle.



Palpating and Charting Bony Landmarks

Bone terminology is palpation terminology. The landmark is what makes a soft-tissue finding locatable.

Do not write

Write instead

"Sore hip"

"Tenderness at the right greater trochanter"

"Pain at the top of the pelvis"

"Tenderness along the left iliac crest"

"Sore spot on the shoulder blade"

"Tenderness at the medial border of the right scapula"

"Tender bump below the kneecap"

"Tenderness at the tibial tuberosity"

"Pain at the outer elbow"

"Tenderness at the lateral epicondyle of the humerus"

"Sore at the sitting bone"

"Tenderness at the right ischial tuberosity"

The right-hand column can be found again by another therapist, next week, without asking the client to point.



Practice Set 6 — Name the Marking

For each description, name the bone marking term. Then say whether it is a depression, an opening, a projection, or a process.

1. A shallow depression that houses an opposing bone during flexion
2. A furrow that holds a tendon or blood vessel
3. A large projection off bone
4. A narrow slit between two adjacent bones
5. A smooth flat articular surface
6. A prominent ridge or elongated projection
7. A cavity or chamber within bone
8. A rounded projection at the end of a bone that articulates with the adjacent bone

Then palpate three of them on your partner and describe the location using Lecture 4's directional terms.



Terms That Are Confused, and Why

Each pair differs by one idea, and by an entire clinical meaning.

This	Means	Not this	Which means
Rotation	Movement around the long axis	Circumduction	Flexion, extension, abduction, adduction combined
Supination	Forearm rotated laterally, palm up	Pronation	Forearm rotated medially, palm down
Inversion	Sole moves medially	Eversion	Sole moves laterally
Protraction	Structure moves anteriorly	Retraction	Structure moves posteriorly
Compact bone	Superficial, dense, weight bearing	Spongy bone	Deep, many small spaces
Epiphysis	The end of a long bone	Diaphysis	The shaft of a long bone
Tuberosity	Small projection off bone	Trochanter	Large projection off bone
Foramen	An opening in bone	Fissure	A narrow slit between two bones



Key Takeaways

Four ideas carry the whole day.

Movement is named by plane

Flexion and extension in the sagittal, abduction and adduction in the frontal, rotation in the transverse.

Special movements belong to joints

Name the joint and the definition follows: supination to the radioulnar, opposition to the thumb, inversion to the subtalar.

Bone is living tissue

It is subject to constant rebuilding, the same as any other living tissue. Cartilage, being avascular, is not.

Markings are palpation

Holes for passage, bumps for attachment. The name of the landmark is what makes your finding locatable.



Self-Check Before You Leave

Answer these without notes. If you can, you have met today's objectives.

1. Define flexion, extension, abduction, and adduction.
2. What is the reference digit for abduction of the hand? Of the foot?
3. What four movements combine to form circumduction?
4. What is meant by 'angular motion'?
5. Name the six functions of the skeletal system.
6. List the contents of the axial skeleton.
7. Name the two types of bone and where each is found.
8. Define fossa, foramen, fissure, trochanter, tubercle, and facet.

Bring your answers to the next session. We open Lecture 6 with this list.



Levers, hinges, and the names of both.

Every movement you assess occurs in a plane, around an axis, at a joint.

Every landmark you palpate has a name that tells you what it does.

Holes for passage. Bumps for attachment.

Bone is living tissue, subject to constant rebuilding.

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