

* Joints (Arthrology) *

Joint : is a site where two or more bones come together, whether or not movement occurs between them.

Or it's a site of an articulation

The structure of a given joint is directly correlated with it's degree of movement. i.e. function dictates the structure.

* Classification of joints :-

A- Functional classification : based on the degree of movement of the joint :

1. Synarthroses: non-movable j.
2. Amphiarthroses: slightly movable j.
3. Diarthroses: freely movable j.

B- Structural classification : based on the structure of the j. & according to the tissue that lie between the bones into three major kinds :

1. Fibrous joints
2. Cartilaginous joints
3. Synovial joints

[1] Fibrous joints : such j. the articulating surfaces of the bones are joined by fibrous connective tissue, thus very little movement is possible. The degree of movement depends on the length of collagen fibers uniting the bones. This group is further classified into three subtypes :-

a- Sutures :(to saw) these joints situated between the bones of the skull, some of them are completely immovable. These joints are wavy lines, interdigitating & considered as stable j. some times, some j. fused & become ossified & called **Synostosis** (e.g. frontal bone)

b- Syndesmosis : (to fasten or bind) in these joints , the bones are joined by ligaments, some movement may occur & it's flexible j. (e.g. inferior tibiofibular syndesmosis)

c- Gomphosis : these are specialized joints consisting of pegs that fit into socket & are held in place by a fine bundles of irregular collagenous connective tissue. (e.g. the attachment of the roots of the teeth to the bone of the jaw)

i.e. the teeth are pegs & the sockets called alveoli of the mandible & maxilla (alveolar arch). The teeth are united to the socket by a ligament called **periodontal ligament**.

[2] Cartilaginous joints : such j. the bones are united by means of either hyaline or fibrocartilage, it's divided into two types :

a- **Primary cartilaginous joints = Synchondrosis**, is one in which the bones are united by a plate or bar of hyaline cartilage. No movement is possible. It's very strong j.

(e.g.1, the union between the epiphysis & the diaphysis of a growing bone

e.g.2, the union between the first rib & the manubrium sterni)

b- **Secondary cartilaginous joints = Symphysis**, is one in which the bones are united by a plate of fibrocartilage & the articular surfaces of the bones are covered by a thin layer of hyaline cartilage. Small amount of movement is possible.

(e.g.1, intervertebral joints = joint between the vertebral bodies

e.g.2, symphysis pubis)

[3] Synovial joints : these are highly specialized joints designed for the major j. require movement of different ranges & permit a great degree of freedom of movement. It's completely different from the other j

It's characterized by the followings :-

1* The articular surfaces of the bones are covered by a thin layer of hyaline cartilage separated by a joint cavity.

2* The cavity of the joint is called **synovial cavity**, it's lined by **synovial membrane**, which extends from the margins of one articular surface to those of the other.

3* The articular surfaces are lubricated by a viscous fluid called **synovial fluid**, which is produced by the synovial membrane.

4* The synovial membrane is protected on the outside by a tough (strong) fibrous membrane referred to as the **capsule** of the joint.

5* The capsule is strengthened by a ligament which give the support & stabilization of the articulated bones in addition to the surrounding muscles.

6* In certain synovial j., discs or wedges of fibrocartilage are interposed between the articular surfaces of the bones called **articular discs**, which move during certain movement to allow more degree of movement.
(e.g. temporomandibular j. & knee j.).

* Types of synovial joints :

synovial joints divided or classified according to either:

(1) **Axis of movement**, this classification assumed the presence of perpendicular axes (an imaginary lines). Joints that have only one axis of rotation , have one degree of freedom of movement, others have two degrees of freedom & so on.

(2) **Shape of the articular surfaces of bones** which determine the types of movement that are possible & indirectly it determine the range of movement.

* According to both 1&2 there are many types of synovial j., the commonest types:

1. **Plane joints (gliding, non axial j.)** : the apposed articular surfaces are flat or almost flat, this permits the bones to glide or slide on one another.

(e.g. sternoclavicular & acromioclavicular joints).

2. **Hinge joints (ginglymus, uniaxial j.)** : resemble the hinge on the door, it permits movement in only one plane, so that flexion & extension movements are possible. It consist of a convex cylinder of one bone applied to a corresponding concavity of other bone.

(e.g. elbow, knee, & ankle j., interphalangeal j. in fingers).

3. **Pivot joints (trochoid, monoaxial j.)** : this type of j. looks like the uniaxial j. but the axis is vertical & one central bony pivot is surrounded by a bony-ligamenous ring, & rotation is the only possible movement.

(e.g. atlantoaxial j. & superior radioulnar j.).

4. **Condylloid joints** : these j. have two distinct convex surfaces that articulate with two concave surfaces. The movements of flexion, extension, abduction, & adduction are possible with a small amount of rotation.

(e.g. metacarpophalangeal joints of the hand).

5. **Ellipsoid joints (biaxial j.)** : an elliptical convex articular surface fits into an elliptical concave articular surface. It consists of an elongated ball & socket j. with it's circumference looks-like an ellipse. The movements of flexion, extension, abduction, & adduction can take place, but rotation is impossible. (e.g. wrist j.).

6. Saddle joints (sellar, biaxial j.) : they consist of two concavo-convex articular surfaces oriented at the right angle to one another (resemble a saddle on a horse's back). The movements of flexion, extension, abduction, adduction, & rotation can take place.

(e.g. carpometacarpal j. of the thumb).

7. Ball-and-socket joints (spheroidal, multiaxial j.) : a spherical ball-shaped head of one bone fits into a socket-like concavity of the other bone. This arrangement permits a great degree of freedom & range of movements including flexion, extension, abduction, adduction, medial rotation, lateral rotation, & circumduction.

(e.g. shoulder j. & hip j.).

* Stability of joints *

The stability of a joint depends on three main factors:

- 1- The shape, size, & arrangement of articular surfaces.
- 2- The presence of ligaments, wither fibrous or elastic ligaments.
- 3- The tone of the muscles around the joint.

[1] Articular surfaces: the ball & socket arrangement of the hip j. & the hinge j. of the ankle j. are good examples of the role of bone-shape.

[2] Ligaments: a- Fibrous ligaments: prevent excessive movement in a joint.

(e.g.) ligaments of the j. between the bones of feet arches.

b- Elastic ligaments: support the j. & assist the bones to return to their original position after movement & stretching.

(e.g.) elastic ligaments of the auditory ossicles.

[3] Muscle tone: it's the major factor controlling stability of the joints.

(e.g.1) the tone of the short muscles around the shoulder j. keeps the hemispherical head of the humerus in the shallow glenoid cavity of the scapula & not to be easily dislocated.

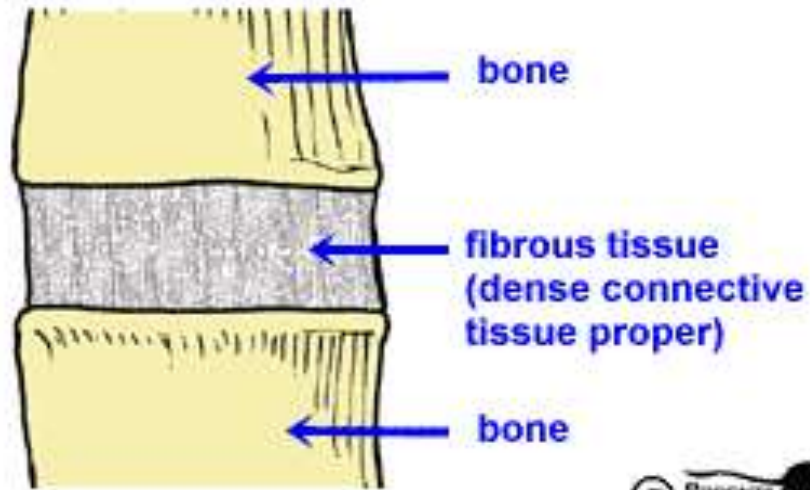
(e.g.2) the tonic activity of the quadriceps femoris muscle on the knee joint.

* Factors affecting the range of movement of joints :

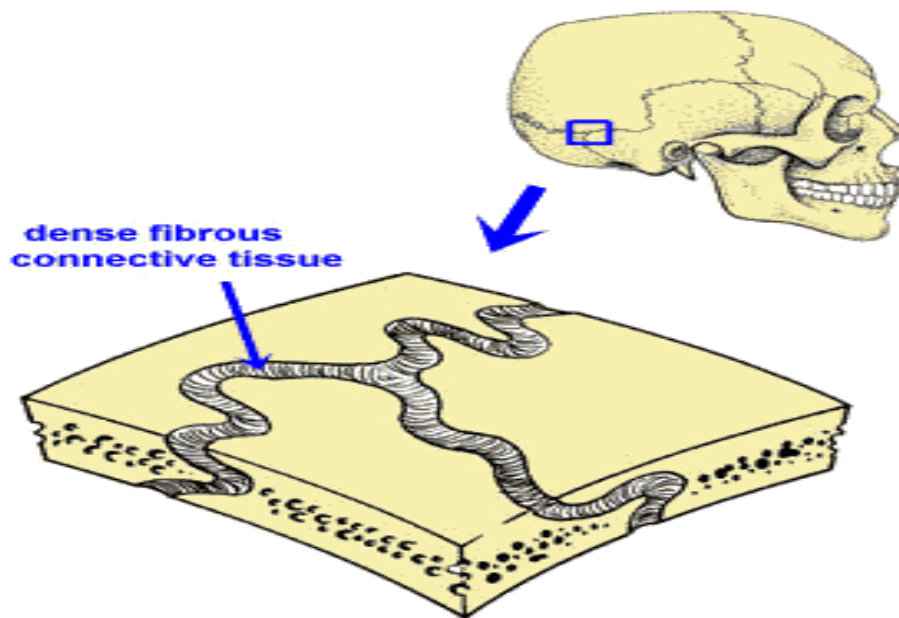
The range of movement is various from one person to another. Generally the range of movement is limited & determined by the following factors:-

1. Muscular (tone of muscles).
2. Ligaments & the capsule of the joints.
3. The shape of the articular surfaces of the bones.
4. The presence of soft tissues accusing the moving parts.

Fibrous joints

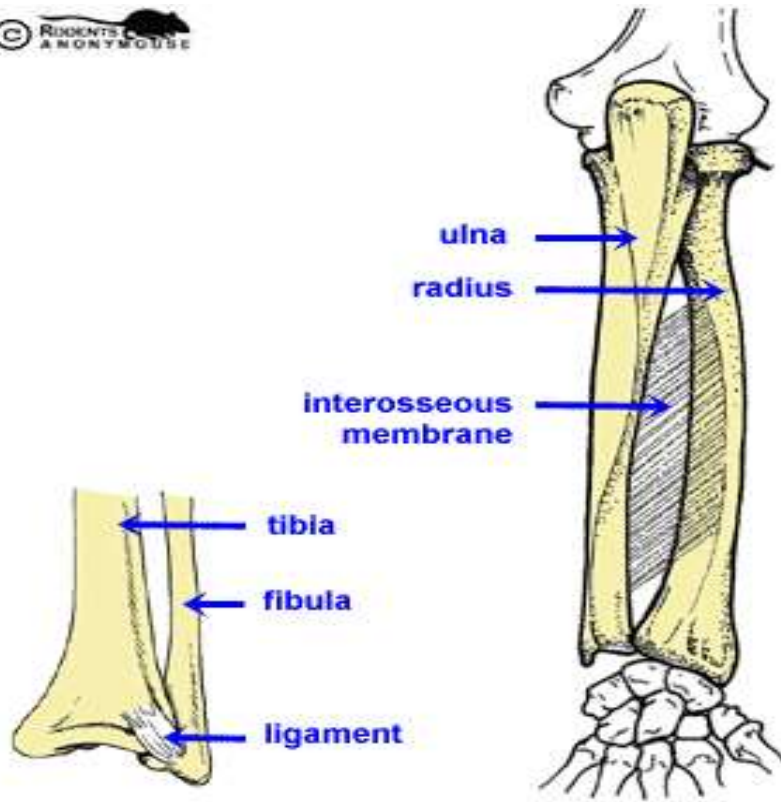


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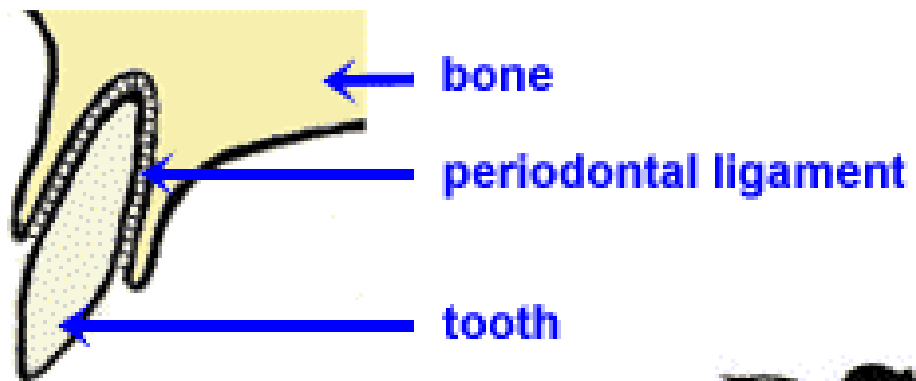
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a- Sutures



(inferior tibiofibular syndesmosis)

b- Syndesmosis



c- Gomphosis