JOINT STRUCTURE & FUNCTION-I

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JOINT

- A joint is the site of junction or union between two or more bones made up of fibrous connective tissue and cartilage
- A joint is used to connect one component of a structure with one or more components
- The design and materials used for a joint depends upon the function and nature of its components
- The joint that serves single function are less complex than joint that serve multiple functions
- The joint mobility is inversely proportional to the stability



MATERIALS USED IN A JOINT

The materials used in human joints is connective tissue in the form of bone, bursae, capsules, cartilages, ligaments, tendons, fat pads, menisci, disks, etc



STRUCTURE OF CONNECTIVE TISSUE

- It is characterised by wide dispersed cells and the presence of large extracellular matrix
- The cellular component are of two types: Resident Cells and Circulating cells
- Resident cells include chondroblasts, fibroblasts, osteoblasts, tenocytes, etc
- Circulating cells include Lymphocytes, macrophages, etc
- Extracellular Matrix is composed of 2 components: Interfibrillar Matrix and Fibrillar Matrix



INTERFRIBILLAR COMPONENT

- It is composed of hydrated networks of proteins such as Proteoglycans and Glycoproteins
- The proteoglycans and glycoproteins form a supporting substance for the fibrillar and cellular component
- The proteoglycans contribute to the strength of the collagen
- Tissue that are subjected to high compressive forces have a large proteoglycan content, where as the tissue that resist tensile forces have a low proteoglycan concentration
- Glycoproteins play an important role in the initiation between the adjacent cells and in the adhesion of these cells to the collagen



FRIBILLAR COMPONENT

- There are two major class of structural proteins namely Collagen and Elastin
- Collagen is the most abundant protein and accounts for about 30% of all body proteins
- It has a tensile strength that approaches that of steel and is responsible for functional integrity of connective tissue structures
- The collagen fibres are made up of tropocollagen molecule which is synthesize in endoplasmic reticulum of the fibroblasts
- The collagen fibres may be arranged in different ways and also vary in size and shape
- Collagen fibres are non-elastic, but due to their arrangement in some structures they provide certain elasticity
- In relaxed state, the collagen assume a wavy configuration called crimp, which disappears when they get stretched



- Elastic is a yellow fibrous tissue
- It provides elasticity to the structures
- They are yellowish in colour and branched
- Generally the percentage of elastin fibres are less compared to collagen
- These are found in all joint structures, skin, tracheobronchial tree and wall of the arteries

STRUCTURE OF LIGAMENTS

It binds one bone to another either at or mean a joint

- Some ligaments are part of, or blend with the joint capsule, while the others are distinguished structures often appearing as dense white bands or cords of connective tissue except ligamentum flavum which is yellow in colour
- Ligaments are named according to their location, shape, bony attachments and relationship to one another, but occasionally may be on the name of identifier
- Example: Anterior longitudinal ligament is an example of a ligament that appears to be named both for location (anterior) and shape(longitudinal), Lateral and medial collateral ligament of knee and elbow on their location, coracohumeral according to their attachment, etc
- The cruciate ligament at the knee because they cross each other



(a) Anterior view

STRUCTURE OF TENDONS

These connect muscle to bone and are usually named for the muscle to which they are attached

Like Biceps tendon for Biceps Brachii



STRUCTURE OF BURSAE

- These are flat sacs of synovial membrane in which inner sides of sacs are separated by a fluid film,
- Bursae are located where moving structures are in tight approximation, i.e., between tendon and bone, bone and skin or muscle and bone or ligament and bone
- Bursae is located between the skin and bone such as found between patella and skin and the olecranon process of ulna and skin are called subcutaneous bursae
- Subtendinous bursae lie between tendon and bone
- Submuscular bursae between muscle and bone



STRUCTURE OF CARTILAGE

It is divided into the following types:

- White Fibrocartilage: It is primarily made up of collagen fibres. It forms the bonding cement in joints that permit little motion. This type of cartilage also forms Intervertebral discs and is found in Glenoid and acetabular labra
- Yellow Elastic Cartilage: It is found in ears and epiglottis and having higher ratio of elastin yellow
- Hyaline Articular Cartilage: It is referred as articular cartilage forms a thin covering of the bones in the majority of joints. It provides a smooth resilient and low friction surface of articulation This cartilaginous surface have capabilities of bearing and distributing weight over a person's life time. However, once it is injured it has limited and important mechanism of repair

