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**Q 1:** Explain “ Biomechanics of Articular cartilage ”

**Answer :**

 Articular cartilage is a thin layer of specialized connective tissue with unique viscoelastic properties .its Principal function is to provide as smooth ,lubricated surface for low friction articulation and to facilities the transmission of loads to the underlying subchondral bone.

**Function of articular cartilage:**

* Distributes joint load over a wide area , decreasing the stresses sustained by the contacting joint surface .
* Allow relative movement of the opposing joint surface with minimal friction and wear.
* Minimize peak stresses on subchondral bone
* Surface roll or side during motion
* Provide a friction reducing weight bearing surface with friction coefficient of 0.0025

Function within a contact pressure range 2- 11 MPa

**Type of cartilage:**

|  |  |  |
| --- | --- | --- |
| Type | Appearance | Location |
| Hyaline  | Glassy , smooth | Covers long bones , growth plates |
| Fibro | Dense  | Inter vertebral disk , meniscus |
| Elastic | Yellow , opaque | Epiglottis, eustachian tube. |

**Biomechanics composition of articular cartilage:**

* Extracellular matrix
* Proteoglycan (5-10℅)
* Collagen (10-20℅) type I
* Water , (68- 85℅)

The Martial properties of articular cartilage depend on its extracellular matrix ,but the existence and maintenance of matrix depend on chondrocytes.

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Q 2 : Explain “ Biomechanics of Tendon and Ligament”

  **Introduction of Tendon and ligament :**

**Tendon :**

* Tendon connect muscle to bone
* Tendon consists of bundle of collagenous fiber arrange in parallel
* Origin at muscle , crosses at least one joint and insert in bone
* Offer greater tensile strength .

**Ligament :**

* Ligament connect bone to bone
* Ligament consist mostly of bundle of elastin molecule formed into elastic fiber with some bundle of collagen .
* Origins and insert into bone
* More elastic and flexible than tendon
* Offer less tensile strength.

**Composition :**

|  |  |  |
| --- | --- | --- |
| Component | Ligament | Tendon |
| Fibroblast | 20℅ | 20℅ |
| water | 60-80℅ | 60-80℅ |
| Solids  | 20-40℅ | 20-40℅ |
| Collagen | 70-80℅ | Slightly higher |
| Type l | 90℅ | 95-99℅ |
| Elastin  | Up to 2x collagen  | Scarce  |
| Ground substance | 20-30℅ | Slightly lesser |

 **Anatomical position of tendon :**

 **Tendon:**

* Tendon contain collagen fibrils Type 1
* Tendon contain a proteoglycan matrix
* Tendon contain fibroblasts that are arranged in parallel rows

**Type 1 collagen :**

* 86℅ of tendon dry weight
* Glycine (33℅ )
* Proline (15 ℅ )
* Hydroxyproline (15℅)

**Anatomical position of ligament :**

* Similar to tendon in hierarchical structure
* Collagen fibrils are slightly less in volume fraction
* Higher percentage of proteoglycan matrix than tendon
* Fibroblasts

**Function:**

**Tendon :**

* Tendon carry tensile force from muscle to bone
* They carry compressive force when wrapped around bone like a pulley.
* They facilities skeletal muscle movement
* Propriception
* Secondary function : storage of energy

**Ligament :**

* It maintain correct bone and join geometry
* Ligament + associated joint capsule combinely functions as passive joint stabilizer
* Secondary function: proprioception.