**Assignment**

**Course Title: Biomechanics And Ergonomics I**

**DPT 2nd semester section B**

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**Q1:** Explain “Biomechanics of Articular cartilage”

And: **ARTICULAR CARTILAGE:**

It is a poroelastic biological material that allows the distribution of mechanical loads and joint movements.

**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 :**

1. Similar to tendon in hierarchical structure
2. Collagen fibrils are slightly less in volume fraction
3. Higher percentage of proteoglycan matrix than tendon
4. Fibroblasts

**Function:**

**Tendon :**

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

**Ligament :**

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

|  |
| --- |
| **Mechanical properties of ligaments in tendons:  Both are viscoelastic tissue Both exhibit the non linear behavior . Strength ( sustain highly load ) . When load is applied enough it cause injury demage , dependent on rate and amount of load .** |