**Grand Assignment**

**Course Title: Biomechanics And Ergonomics I**

**DPT 2nd semester section B**

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**Note:**

**INTERNAL ASSESSMENT MARKS WILL BE GIVEN ON BASIS OF GRAND ASSIGNMENT**

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

**Articulaer cartilage:**

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

**Function of articuler cartilage:**

* Distribute joint load over a wide area decreasing the stress sustained by contacting hoint surface.
* **Allow** the relative movement of the opposing joint surface with minimal fraction and wear.
* Minimize peak stresses on subchondral bone.
* **Surface** roll during motion.
* Provide fraction reducing weight bearing surface with the fraction coefficent of 0.0025.

**Types of cartilages:**

* **Hyline cartilage:**

**Apperance:**

Glassy and smooth.

**Location:**

Cover long bones ,growth plates.

* **Fibro cacartilag:**

**Apperance:**

Dense.

**Location:**

Inter vertebral discs , miniscus.

* **Elastic cartilage:**

**Apperance:**

Yellow ,opaque

**Location:**

Epiglotis ,eustacian tube.

**Biomechanic composition of articulrr cartilage:**

* Extracelluler matrix.
* Protoglycan (5-10%)
* Collagen type 1 (10-20%)
* Water (68-85%).

The material properties of articule cartilage depends on its extra celluler matrix but the existance and and maintance of matrix depends upon chondrocytes.

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**Q2:** Explain “Biomechanics of Tendon and Ligament

 **Introduction:**

**Tendons:**

* They connects muscles to bones.
* They originates at muscles and cross at least one joint and insert in bones.
* They consist of bundles of collagen fobers arrange in parallel.And provide greater tensile strength.

**Ligaments:**

* **It**  connects bone to bone.
* They originates and inserts in bone.
* Offer less tensile strength.
* More elastic and fkexible than tendons.
* They mostly consist of bundles of elastic molecule formed into elastic fibers and some collagen .

**Composition:**

|  |  |  |
| --- | --- | --- |
| **Component** | **Ligament** | **Tendons** |
| Fibroblast | **20%** | **20%** |
| **Water** | **60-80%** | **60-80%** |
| Solids | **20-40%** | **20-40%** |
| Collagen | **70-80%** | Slightely higher |
| Type 1 | **90%** | **95-99%** |
| Elastin | Up to 2x of collagen | **Scarce** |
| Ground substance | **20-30%** | Slightely lesser |

**Anatomical position of tendons:**

**Tendons:**

**Anatomy:**

* **It** contains taype 1 collagen fibrils.
* They contain fibroblast cells that are arranged in parallel.
* **It** contain proteoglycen matrix.

**Type 1 collagen:**

1. **-86% of tendon dry weight.**
2. **-33% glycine.**
3. **-15% proline.**
4. **-15% hydrox proline.**

**Anatomical pisition of ligaments:**

**Anatomy:**

* Similar to tendon in hierarChical structure.
* Fibroblasts.
* Higher percentage of proteo glycen matrix than tendon.
* Collagen fibers are slightely less in volume fraction and organization than tendons.

**Functions:**

**Tendons:**

* It carry tensile force from muscles to bones.
* **They** carry compressive forces when wrapoed around bone like pully.
* They facilitate skeletal muscle movement in joints.
* They has secondry function as a storage of energy.

**Ligamebts:**

* It maintain correct bone ang joint geomatry.
* Ligaments plus associated joints capsules combinely function as a passive joint stabalizers.
* Is secondry function as a proprioception.

**Injuries in tendons and ligaments:**

* Most common injuries of tendons and ligaments occur due to high stress and overuse.
* Tendons which suffer high xhances of injuries are;
1. Rotator cuff tendons(shoulder).
2. Achilles tendon(leg).
3. **Flexor** tendon (hand).
* Ligaments which suffer high chances of injuries;
* Anterior cruciate ligament(knee).
* Ankle ligament (calcinofiboler ,anterior talofibuler,deltoid).
* **Factors which effect the biomechanical properties of tendons and ligament:**
* Agi ng.
* Dibities millitus.
* Renal dieases.
* Connective tissue diorder.
* Pharmachologic agents.