**Grand Assignment**

**Course Title: Biomechanics And Ergonomics I**

**DPT 2nd semester section B**

**Instructor: Dr. M .Shahzeb khan (PT)**

 **Marks: 20 NAME # SHAMA , ID # 16714**

**Note:**

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

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

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

ALL THE STUDENTS ARE REQUESTED TO UPLOAD YOUR ASSINGMENT BEFORE FINAL TERM EXAM.

 QUESTION # 1 ANSWER

**BIOMECHANICS OF ARTICULAR CARTILAGE#**

**IMPORTANCE #**

**>** Structure and mechanical properties of normal cartilage.

> Manner by which biomechanical and structural factors

 Contribute to the material properties of cartilage.

> Manner by which changes in tissue composition affect the

 Mechanical properties of cartilage.

**FUNCTION OF ARTICULAR CARTILAGE#**

> Distribute join loads 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 stess on subchondral bone.

> Surface roll or slide during moton.

> Provide a friction co efficient of 0.0025.

> Function within a contact pressure range of 2.11Mpa

> Despite comman belief doesn't serve as a " shock absorber "

 \* Very thin.

 \* Capacity negligible composed to muscle and bone.



**NORMAL CARTILAGE #**

\*. Avascular

\* Alymphatic

\* Aneural tissue

**TYPE OF CARTILAGE #**

**1.HYALINE #**

 **Appearance #**  Glassy , smooth

 **Location #** be cover long bone , growth plates.

**2 FIBRO #**

 **Appearance #** Dence

 **Location. #** lnterverteberal disk , mensicus .

**3. ElASTIC #**

 **Appearance #** yellow , opaque

 **Location #.** Epiglottis , eustachian tube.



**THICKNESS OF ARTICULAR CARTILAGE #**

**> Varies with the particulars joint ,and the location within the**

 **joint.**

**> Range from 0.5 mm (rabbit knee ) to 10.0 mm ( pf groove of**

 **bovine knee) .**

**> Human over ends of femur and tibia ( range 2\_4 mm ).**



**COMPOSITION AND STRUCTURE OF ARTICULAR CARTILAGE #**

**> CHONDROCYTES #**  10%

**> COLLAGEN #**  ( fibrous ultrastructure , procollagen

 Pollypeptide ) , 10 - 30 % .

**> PROTEOGLYCAN #** large protein polysaccharide molecules

 ( In form of monomer and aggregates 3 - 10%

**> WATER #** inorganic salts , glycoproteins, lipids , za 60- 87%.

.

 QUESTION # 2 ANSWER

**BIOMECHANICS OF TENDONS AND LIGAMENTS #**

**INTRODUCTION #**

**TENDONS #**

Tendon connect muscle to bone.

> Tendon consists of bundle of collagenous fibers arrange in parallel . They

 are arranged this way to form cords which have great tensile strength .

> Origins at muscles , crosses at least one joint and insert in bone.

**LIGAMENT #**

**" Ligament connect bone to bone "**

**> Ligaments consists mostly of bundles of elastic molecules formed into**

 **elastic fiber with some bundle of collagen.**

**> Origins and insert in bone .**

**> More elastic and flexible than tendon .**

**> Offer less tensile strength.**

**COMPOSITION #**



**ANATOMICAL POSITION OF TENDONS #**

**> TENDONS #**

**\* ANATOMY :**

 **1 . Tendons contain collagen fibrils ( type 1 )**

 **2. Tendon contain a proteoglycan matrix .**

 **3. Tendons contain fibroblasts ( biological cell ) that are arranged**

 **In parallel brows.**

**TYPE 1 COLLAGEN #**

 **1 . - 86% of tendon dry weight .**

 **2 . Glycine ( - 33% ) .**

 **3. Proline ( - 15% ) .**

 **4 . Hydroxyproline ( - 15% ) almost unique to**

**collagen , often used to identify.**

**ANATOMICAL POSITION OF LIGAMENTS**

**LIGAMENT #**

**> ANATOMY #**

 **1.**  Similar to tendon in hierarchical structure .

 **2.** Collagen fibrils are slightly less in volume fraction and organization than tendon

 **3.** Higher percentage of proteoglycan matrix than tendon.

 **4.**  Fibroblasts.

 **FUNCTIONS #**

 **> TENDON#**

 **\* Tendon carry tensile force from muscle to bone.**

 **\* They carry compressive forces when wrapped around bone like**

 **a pulley.**

 **\* They facilitate skeletal muscle movement but**

 **\* Proprioception .**

 **\*. Secondary function : storage of energy .**

**> LIGAMENT #**

 **\* It's maintain correct bone and joint geometry .**

 **\* Ligament + associated joint capsule combine**

 **Passive joint stabilizer.**

 **\* Secondary function : Proprioception.**

**MECHANICALLY MEDIATED LIGAMENT AND TENDON #**

 **# In ligaments and tendons there is less likely to occur change in**

 **Mechanical stiffness because of low vascular supply .**

**# But the im mobilization of a joint for a long time leads to severe change in the characteristics of ligament band tendons.**

**# For this an experiment on the rabbits knee was carried out to check the effects.**

**INJURIES IN TENDONS AND LIGAMENTS #**

**\* Most common tendon and ligaments injuries occur by over use and high loads/ stress given to the tendons .**

**\* The tendon which suffer high chances of injuries are :**

 **1. Rotator cuff tendons ( shoulder )**

 **2. Achilles tendon ( leg)**

 **3. Flexor tendons ( hand )**

**\* The ligament which suffer high chances of injuries are :**

 **1. Anterior cruciate ligament ( knee)**

 **2 . Ankle ligament ( calcaneofibolar , Anterior talofibular , Deltoid.)**

**MECHANICAL AFFECTS ON HEALING TENDON/ LIGAMENT #**

**# ligament and repair are very critical area of orthopedic surgery , especially**

 **In the sports medicine.**

**# In case of tendon , which glide within a sheath the introduction of passive**

 **Motion for healing and repaired tendons is believed to be important**

 **Because it prevents the adhesion between the sheath and tendons that**

 **Restrict motion .**

**#. In case of ligament the relation between the mobilization and repair is not**

 **Positive.**

**# Type of hyaline cartilage covers the bone ends and makes smooth movements possible .**

**# It's distribute the load across joint , minimizing the peak stess on subchondral bone.**

 **THE END🙂**

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