

## DPT 2<sup>ND</sup> SEMESTER (SECTION A)

COURSE TITLE: BIOMECHANICS-I

INSTRUCTOR: AHMED HAYAT

NAME: SANA ALI SHAH

STUDENT ID :16286

FINAL TERM ASSIGNMENT

MARKS: 50

---

### QUESTIONS/ANSWERS

#### QUESTION NO 1 :-

#### Enlist functions of the following muscles:

Deltoid, Trapezius, Latissimus dorsi, Rhomboids, Levator scapulae, Serratus anterior

Pectoralis major minor, Tere major?

#### ANSWER :-

##### 1:DELTOID MUSCLE:-

The deltoid is a thick triangular shoulder muscle. The muscles has a wide origin spanning the acromion, clavicle, spine of the Scapula.

##### FUNCTION :-

1. **Acromial part:-**Abduction of the arm beyond the initial 15°.
2. **Clavicular part:-** Flexion and internal rotation of the arm.
3. **Spinal part:-** Extension and external rotation of the arm.

It all assist with Elevation during the process called glenohumeral and it also play a large role in stability and movement of the upper arm and shoulder joint. Deltoid muscles spans from the lateral portion of the clavicle and spine of the Scapula.

##### 2:TRAPEZIUS MUSCLES :-

It is a paired, large, triangular shaped muscle which is located Superficially in the back of the thorax and neck.

##### FUNCTION :-

The different fibers at with synergist muscles to produce different motions of the Scapula. The action of the trapezius muscle is largely dependent on the direction of the fibers that contracting.

There are three type of fibers.

1. Upper
  2. Middle
  3. Lower
- The upper fiber also called the descending fibers based on their direction. It act with the levator of the Scapulae muscle to produce elevation of Scapula.
  - The middle act with the rhomboids produce retraction of Scapula.
  - The lower fiber also called ascending fiber. It is responsible for the depression of the Scapula.

The trapezius muscle can have two effects.

1. Movement of Scapula when the spinal origins are stable.
2. Movement of spine when the Scapulae are stable.

It is the main functions is to stabilization and move the scapula.

### **3:LATISSIMUS DORSI :-**

It is the widest muscles in the human body. It is relatively thin and covers almost all back muscles at the posterior trunk except the trapezius.

### **FUNCTION :-**

The multidirectional alignments of its fibers, the latissimus dorsi muscle exhibits three actions on the shoulder joint.

- It adducts and internally rotates the arm.
- It effectively extends the flexed arm.
- If the humerus is fixed against the scapula, it pulls the pectoral girdle backward as a whole.

These actions determine the complex functional activity of the latissimus dorsi muscle; it is a climbing muscle, rowing muscle, and a swimming muscle.

There are some Supporting functions of the latissimus dorsi:

- It stabilizes the scapula against the thoracic cage during humeral movements on the shoulder joint.
- If the arms are fixed above the head, it can act in synergy with pectoralis major to elevate the trunk upwards.

- This action also causes the lifting of the pelvis. In people with paraplegia, this action enables the movements of the pelvis and trunk.

#### **4:RHOMBOID :-**

The rhomboids are two bilateral, superficial muscles located in the upper back. The rhomboid muscles extend between the nuchal ligament, spinous processes of thoracic vertebrae and scapula.

#### **FUNCTION :-**

The main action of the rhomboid muscles is scapular retraction around the scapulothoracic joint. The retraction of a scapula simultaneous sliding of the scapula superiorly and medially along the trunk. This superomedial movement of the scapula rotates the glenoid cavity inferiorly, dropping the shoulder girdle. The contraction of the rhomboids fixes and stabilizes the scapula into position. This provides an anchor point in space from which various muscles of the upper limb can act and a fulcrum around which the upper limb can move.

#### **5:LEVATOR SCAPULAE :-**

The levator scapulae muscle is a long muscle of the shoulder girdle. It is situated at the back and the side of the neck.

#### **FUNCTION :-**

The main function of the levator scapulae is the elevation of scapula. The levator scapulae functions to elevate the scapula and tilt the glenoid cavity inferiorly by rotating the scapula downward. It simultaneously pulls the entire scapula medially. This movement is helpful when bringing the elevated arm back to the neutral position. The muscle also moves the inferior angle away from the back causing a small upward tilt of the scapula. If the scapula is fixed, a contraction of the levator scapulae leads to the bending of the cervical vertebral column to the side (lateral flexion) and stabilizes the vertebral column during rotation.

#### **6:SERRATUS ANTERIOR :-**

The serratus anterior muscle is a fan-shaped muscle at the lateral wall of the thorax. It is easy to palpate between the pectoralis major and latissimus dorsi muscles.

#### **FUNCTION :-**

The serratus anterior muscle inserts or attaches to the scapula, the main function of this muscle is to move this bone. The contraction of the entire serratus anterior leads to an anterolateral movement of the scapula along the ribs. The pull of the inferior part at the lower scapula, the

shoulder joint is shifted superiorly. The superior part depresses the scapula and thus acts antagonistically. Shifting now enables to lift the arm above 90° (elevation). In a fixed scapula the muscle lifts the ribs and acts as an accessory inspiratory muscle.

### **7:PECTORALIS MAJOR/MINOR:-**

The pectoralis major muscle is a large muscle in the upper chest, fanning across the chest from the shoulder to the breastbone. The two pectoralis major muscles, commonly referred to as the 'pecs,' are the muscles that create the bulk of the chest. Pectoralis minor is a thin, triangular muscle, situated at the upper part of the chest, beneath the pectoralis major in the human body.

### **FUNCTION :-**

The arm is in the anatomical position, the pectoralis major acts as a strong adductor and internal rotator of the humerus at the shoulder joint. The clavicular portion of the muscle flexes the humerus up to 90 degrees in a horizontal plane. This is particularly important during forced breathing in physical distress. The pectoralis minor depresses the point of the shoulder, drawing the scapula superior, towards the thorax, and throwing its inferior angle posteriorly.

### **8:TERES MAJOR:-**

The teres major muscle is one of the six muscles within the scapulohumeral muscle group. It has a flat shape and is supplied with nerves from the lower subscapular nerve. The muscle is located on the underside of the upper arm, in the area between the shoulder and elbow.

### **FUNCTION :-**

The main function of teres major is to produce the movements of the humerus at the glenohumeral joint, it pulls the anterior surface of the humerus medially towards the trunk (inward rotation), it can extend the arm from the flexed position. It contributes to the stabilization of the shoulder joint.

### **QUESTION NO 2:**

**Name all the ligaments of Shoulder joint and their functions?**

### **ANSWER :-**

### **LIGAMENTS :-**

A short band of tough, flexible fibrous connective tissue which connects two bones or cartilages or holds together a joint.

In the shoulder joint, the ligaments play a key role in stabilising the bony structures. There are some ligaments are given below:

- **Glenohumeral ligament**
- **Coraco-acromial ligament**
- **Coraco-clavicular ligament**
- **Transverse humeral ligament**
- **Acromio-clavicular**
- **Anterior and posterior (SC)**
- **Interclavicular**
- **Costo-clavicular**
- **Sternoclavicular mastoid**

### **GLENOHUMERAL LIGAMENTS :-**

(superior, middle and inferior) – the joint capsule is formed by this group of ligaments connecting the humerus to the glenoid fossa. They act to stabilise the anterior aspect of the joint. They are the main source of stability for the shoulder, holding it in place and preventing it from dislocating anteriorly.

### **GLENOHUMERAL FUNCTIONS:-**

During rotation of the arm lateral rotation stretches all three ligaments while medial rotation relaxes them. During abduction of the arm the middle and inferior ligaments become taut while the superior ligament relaxes. The radius of curvature of the head of the humerus is greater superiorly than inferiorly, which further stretches these ligaments so that they keep the articular surfaces of the joint in their close-packed position. During abduction the greater tubercle of the humerus comes in contact with the upper margin of the glenoid cavity, which limits maximum abduction. By rotating the humerus laterally, this contact is delayed because the greater tubercle is pulled back so that the bicipital groove faces the coracoacromial ligament. This slightly slackens the inferior fibres of the glenohumeral ligament, allowing an abduction of 90°. Combining abduction with 30° flexion in the plane of the scapula causes a delay in the tightening of the ligament resulting in a maximum abduction of 110°.

### **CORACO-ACROMIAL LIGAMENT :-**

The coracoacromial ligament is a strong triangular band, extending between the coracoid process and the acromion. Ligaments are bands of tough fibrous connective tissue that connect bones or cartilage. The coracoacromial ligament joins two parts of the shoulder blade (scapula), connecting the acromion to the coracoid process.

### **CORACO-ACROMIAL FUNCTION :**

The coracoacromial ligament (CAL) connects the acromion and coracoid process of the scapula, forming an osseoligamentous static restraint to superior humeral head displacement. Provide stability to shoulder joint.

### **CORACO-CLAVICULAR LIGAMENT:-**

The coracoclavicular ligament serves to connect the clavicle with the coracoid process of the scapula. The coracoclavicular ligament is the strongest stabilizer of the AC joint. This ligament is very important in the transmission of weight of the upper limb to the axial skeleton.

### **CORACO-CLAVICULAR FUNCTION :-**

The coraco-clavicular ligament Serves to connect the clavicle with the coracoid process of the scapula. It does not properly belong to the acromioclavicular (AC) joint articulation, but is usually described with it, since it forms a most efficient means of retaining the clavicle in contact with the acromion.

### **TRANSVERSE HUMERAL:-**

Transverse humeral ligament – spans the distance between the two tubercles of the humerus. It holds the tendon of the long head of the biceps in the intertubercular groove.

### **TRANSVERSE HUMERAL FUNCTION :-**

It functions to hold the long head of the biceps tendon within the bicipital groove. The transverse humeral ligament is a broad band passing from the lesser

to the greater tubercle of the humerus, and always limited to that portion of the bone which lies above the epiphysial line. The transverse humeral ligament is labeled at center left. It converts the intertubercular groove into a canal.

### **ACROMIO-CLAVICULAR LIGAMENT:-**

This ligament is a quadrilateral band, covering the superior part of the articulation, and extending between the upper part of the acromial end of the clavicle and the adjoining part of the upper surface of the acromion.

### **ACROMIO-CLAVICULAR FUNCTION :-**

The acromioclavicular ligament serves to reinforce the joint capsule and serves as the primary restraint to posterior translation and posterior axial rotation at the AC joint.

### **ANTERIOR AND POSTERIOR (STERNOCLAVICULAR) LIGAMENT:-**

The sternoclavicular joint is a synovial saddle joint that connects the sternum with the clavicles. It is the only true joint which connects the appendicular skeleton of the upper limb with the axial skeleton of the trunk.

### **ANTERIOR AND POSTERIOR STERNOCLAVICULAR FUNCTION :-**

The clavicular head and manubrium allows for movement between the clavicle and the disk during elevation and depression of the scapula. Reinforce capsule anteriorly, Limits anterior translation of clavicle. Reinforce Capsule Posteriorly Limits Posterior Translation of Clavicle Checks Posterior Movement of Head of Clavicle

### **INTERCLAVICULAR LIGAMENT:-**

The interclavicular ligament is a flattened band, which varies considerably in form and size in different individuals, it passes in a curved direction from the upper part of the sternal end of one clavicle to that of the other, and is also attached to the upper margin of the sternum

### **INTERCLAVICULAR FUNCTION :-**

This spans the gap between the sternal ends of each clavicle and reinforces the joint capsule superiorly.

### **COSTO-CLAVICULAR LIGAMENTS :-**

The costoclavicular ligament, is a ligament of the shoulder girdle. It is short, flat, and rhomboid in form, relating to a ligament connecting the costal cartilage of the first rib with the clavicle.

### **COSTO-CLAVICULAR FUNCTION :-**

the two parts of this ligament (often separated by a bursa) bind at the 1st rib and cartilage inferiorly and to the anterior and posterior borders of the clavicle superiorly. It is a very strong ligament and is the main stabilising force for the joint, resisting elevation of the pectoral girdle.

### **STERNOCLEIDO MASTOID LIGAMENT:-**

The sternocleidomastoid muscle is one of the largest and most superficial cervical muscles. The sternocleidomastoid is innervated by the accessory nerve. The primary actions of the muscle are rotation of the head to the opposite side and flexion of the neck.

### **STERNOCLEIDO MOSTOID FUNCTION :-**

The function of this muscle is to rotate the head to the opposite side or obliquely rotate the head. It also flexes the neck. A bilateral contraction elevates the head by dorsally extending the upper cervical joints. At the same time, it flexes the lower cervical column causing an overall bending of the neck towards the chest. If the head is fixed, it elevates the sternum and clavicle and, thus, expands the thoracic cavity (inspiratory breathing muscle).



### **QUESTION NO 3:-**

**Write Individual and combine action of Rotater Cuff muscles?**

**ANSWER :-**

#### **ROTATOR CUFF MUSCLES :-**

The rotator cuff is a group of muscles and tendons that surround the shoulder joint, keeping the head of your upper arm bone firmly within the shallow socket of the shoulder. The rotator cuff includes muscles such as

- **the supraspinatus muscle.**
- **the infraspinatus muscle.**
- **the teres minor muscle.**
- **the subscapularis muscle.**

#### **SUPRASPINATUS MUSCLES :-**

The muscle that elevates the arm and moves it away from the body. The tendon of the supraspinatus muscle is one of four tendons that stabilize the shoulder joint and constitute the rotator cuff.

#### **INFRASPINATUS MUSCLES :-**

Is a triangular muscle located at the back of the shoulder. It is one of the four muscles of the rotator cuff and helps the upper arm rotate outward.

#### **TERES MINOR:-**

The teres minor is a narrow, slim, elongated muscle within the rotator cuff, located in the shoulder. It is involved in the external rotation of the shoulder joint. It is muscle that assists the lifting of the arm during outward turning (external rotation).

#### **SUBSCAPULARIS :-**

The subscapularis is a large triangular muscle which fills the subscapular fossa and inserts into the lesser tubercle of the humerus and the front of the capsule of the

shoulder-joint. A muscle that moves the arm by turning it inward (internal rotation). The tendon of the subscapularis muscle is one of four tendons that stabilize the shoulder joint and constitute the rotator Cuff.

### **COMBINE ACTION OF ROTATER CUFF MUSCLES :-**

The rotator cuff muscles are responsible for stabilizing the shoulder joint, by providing the “fine tuning” movements of the head of the humerus within the glenoid fossa. The joint is not protected inferiorly. The head of the humerus is usually dislocated inferiorly. They are deeper muscles and are very active in the neuromuscular control of the shoulder complex during upper extremity movements.

### **QUESTION NO 4:-**

#### **Define Lateral epicondylitis and explain its physiotherapy treatment?**

#### **ANSWER :-**

#### **LATERAL EPICONDYLITIS :-**

Lateral epicondylitis, also known as “Tennis Elbow”, is the most common overuse syndrome in the elbow. These muscles originate on the lateral epicondylar region of the distal humerus. It is a tendinopathy injury involving the extensor muscles of the forearm.

#### **PHYSIOTHERAPY TREATMENT OF LATERAL EPICONDYLITIS :-**

There are different types of therapies to treat lateral epicondylitis, all with the same aim, reduce pain and improve function. The lateral epicondylitis common in people who play sports such as tennis and squash, but most people get it from other activities where you often have to grip and twist, such as turning a screwdriver.

Therapist will start with pain relief, then show you exercises that stretch and strengthen your muscles.

- Tape, straps, or braces for support

- Ice massage
- Muscle stimulation
- Ultrasound

## **EXERCISE**

### **FINGER STRETCH :**

- Slowly open your thumb and fingers all the way, then close them.
- Touch your fingers to your thumb and put a rubber band around them, including your thumb.
- Repeat up to 25 times.

### **BALL SQUEEZE :-**

- Hold a tennis ball or soft rubber ball in your hand
- Squeeze and release up to 25 times.

### **WRIST EXTENSOR STRETCH :-**

- Use your other hand to hold the fingers of your outstretched hand and bend it back toward your body until you can feel it in your outer forearm.
- Hold your arm straight out so your elbow isn't bent and your palm faces down
- Hold for 15 seconds.
- Repeat three to five times.

### **WRIST TURN:-**

- Gently turn your wrist so your palm faces down.
- Bend your elbow at a right angle by your side so it forms an L.
- Hold your hand out palm up..
- Hold for 15 seconds.
- Repeat three to five times.

### **Exercises:-**

Specific exercises that have a goal of stressing the tissue to just beyond its current capability can be used as a pro-inflammatory technique.

### **Manual Therapy:-**

Your Physiotherapist may use hands-on tissue manipulation techniques to create a small amount of micro-trauma to the area to re-start the inflammation process.

### **Shock Wave Therapy:-**

Extracorporeal Shockwave Therapy (ESWT) can be very effective to help stimulate the inflammatory process.

### **QUESTION NO 5:-**

#### **Differentiate between type 1 and type 2 muscle fibers?**

#### **MUSCLES FIBERS:-**

A muscle cell, especially one of the cylindrical, multinucleate cells that make up skeletal muscles and are composed of numerous myofibrils that contract when stimulated.

#### **DIFFERENTIATE BETWEEN TYPE 1 AND TYPE 2 MUSCLE FIBERS :-**

The muscle fibers categorized into two types

- Slow twitch (type 1)
- Fast twitch (type 2)

#### **SLOW TWITCH (TYPE1) :-**

Slow-twitch fibers are also sometimes called type I or red fibers because of their blood supply. Slow-twitch muscle fibers support long distance endurance activities like marathon running. Slow twitch muscle fibers are fatigue resistant. They

contain more mitochondria, and are aerobic in nature compared to fast twitch fibers. Slow twitch muscle fibres rely on a rich supply of oxygenated blood as they use oxygen to produce energy for muscle contraction. Type I fibers produce less force and are slower to produce maximal tension (lower myosin ATPase activity) compared to type II fibers. But they are able to maintain longer-term contractions, key for stabilization and postural control (1,2).

- Fatigues slower than fast-twitch, type II
- Low, slow force
- Long-term contractions
- Supports fatigue resistance for aerobic activities, stabilization and postural control
- Small muscle fibers

### **FAST TWITCH MUSCLES (TYPE 2) :-**

Fast-twitch muscle fibers support quick, powerful movements such as sprinting or weightlifting. fast-twitch muscles fatigue faster but are used in powerful bursts of movements like sprinting. Fast twitch fibers use anaerobic metabolism to create fuel fast twitch fibers can be an asset to a sprinter since she needs to quickly generate a lot of force. Typically, these have lower concentrations of mitochondria, myoglobin, and capillaries compared to our slow-twitch fibers.

- Fatigues faster than slow-twitch type I
- Large muscle fibers
- Short-term contractions
- Supports power activities
- Greater and quicker force.