# Table of Contents

1 **Anatomy**  
   Skeletal system  
2 **Posture**  
3 **Joints**  
   Types of Joints  
4 **Muscular System**  
   Types of Muscle  
   Major Skeletal Muscles and their Location  
5 **Sports Injuries**  
6 **CPR - Cardio Pulmonary Resuscitation**  
   AED- Automatic External Defibrillator  
7 **References**
Preface

The PE 102 course is offered in the 2nd semester of the undergraduate programme. The content of this health education course describes the body structure, the names and location of the important bones and muscles, and their relation to the basic movements in sports activities. Posture, which is considered essential for maintaining a healthy body structure, is explained in detail with the emphasis on the use of correct posture in everyday activities. Injuries are common in the sports arena and a brief outline of the sports injuries, their symptoms, causes, precautions and treatment are listed for the benefit of the students. Another important life-saving aspect, Cardio Pulmonary Resuscitation (CPR) is described in detail with its practical implementation and the safety measures to be adopted while administering it to save the life of a person.
**ANATOMY**

- **Anatomy** - It is the science of understanding body parts.
- **Human Anatomy** - It is the science of structures, components and positions which make up the human body.

*The human body is made of cells, tissues, organs and systems.*

---

**SKELETAL OR BONY SYSTEM**

**Properties**
- Provides a rigid supporting framework of connective tissue.
- Prevents body from collapsing into heap of soft tissue.
- Provides mechanical levers for muscle.
- Affords a protective shell or casing for vital viable organs like; Brain, lungs, heart and pelvic organs.
- Provides factories for manufacture of RBCs (Red Blood Cells) and WBCs (White Blood Cells).
- Stores calcium and phosphorus.
- Is a vital living tissue continuously undergoing changes of building up and tearing down.
DIVISION OF SKELETON: Two parts: Axial & Appendicular

Main types of bones: 4 types

1. Long bones
2. Short bones
3. Flat bones
4. Irregular bones

Structure of bone:
- Compact tissue forms outer shell and is very hard
- Cancellous tissue (spongy) present below compact tissue contains bone marrow
- Yellow bone marrow – vital minerals and calcium stored in spongy area of bone
- Red marrow in the end of bone - manufactures RBC's

Total bones 206.
Axial 80 – Appendicular 126.
IMPORTANT BONES AND THEIR LOCATIONS:

1. Skull
2. Scapula
3. Ribs
4. Humerus
5. Radius
6. Ulna
7. Pelvis
8. Femur
9. Tibia
10. Fibula

Effect of Physical Activity on the skeleton system

1. Condition of bone becomes stronger
2. Density and size of bone increased
3. More mineral salts are deposited and more fibers are produced
4. More resistant to injuries and faster recovery of fractures caused by mechanical stress on bones
5. Regulation of calcium metabolism is maintained between blood and the bone.
6. Helps to overcome osteoporosis in old age

POSTURE

The ability to stand erect: To handle the body easily, gracefully & efficiently under all circumstances. Muscular strength is involved in correct posture and emotional condition is frequently reflected in the movement of the body.

CAUSES OF POOR POSTURE:

- Heredity
- Muscle imbalances
- Poor circulation
- Over-training, poor training methods or exercise regime
- Pressure on joints and chronic stress
- Lack of flexibility
- Continued fatigue
Posture is tested by reference to the rating guides for 13 different segments identified in the posture rating chart.

**POSTURAL DEFORMITIES**

1. **KYPHOSIS**

Exaggeration or increase in the amount of normal convexity of the thoracic region of the spine.

**Causes:**
- Lack of strength or tension of extensors of spine
- Weight of body parts such as forward head or forward position of the arms may cause stretching of the posterior muscles
- Excessive relaxations may allow gravitational forces to flex the spine too much. Eg. tall people – slumping

**CORRECTION:**
- Extensor muscles to be strengthened and tonus improved with specific exercises
- Excess gravitational stress must be removed by realignment of head, arms and shoulder girdle by a variety of occupational positions
2. LORDOSIS

- Exaggeration or increase in the amount of normal concavity of the lumbar region of the spine.

**Causes:**
- Relaxation and poor tonus of abdominals may allow the curve to collapse.
- If the hips are thrust forward the curve increases in order to throw the upper trunk back into balance.

**CORRECTION:**
- Strengthening the abdominal muscles.
- Hip flexor stretches, pelvic tilt, abdominal crunches, knees to chest stretches & heel slide

3. SCOLIOSIS

- This is the lateral curvature of the spine when the bodies of the vertebrae are usually rotated to the convex side and the spinal processes rotated to the concave side and is known as right or left scoliosis.

**Causes:**
- Congenital or acquired
- Lack of postural tone
- One-sided occupations
- Rickets, infantile paralysis
- Unilateral lung diseases
- One leg being shorter than the other.

**Correction:**
Exercises aimed at stretching the strong muscles on the concave side thereby contracting the weak, unstretched muscles on the convex side.
4. BOW LEGS
- This is a deformity in which the legs are bowed outwards with the thighs in normal alignment but often the thigh is arched outwards as well. This throws weight on the inner side of the knee.

**Causes:**
- As children start walking; rickets is a common cause;
- Muscular weakness
- Napkins tightly applied
- Bowing of femur
- Horse riding
- Greater width of hips

**Correction:**
1. Stretching movements to adduct the knee
2. Standing with cushion between the angles and drawing the knees together

5. KNOCK KNEE
- Abnormal curvature of the lower legs, resulting in a large gap between the feet and ankles when the knees are touching. The weight will be on the outer side of knee and inner side of foot

**Causes:**
- Rickets
- Bad posture
- Excessive walking
- Over weight

**Correction:** Passive stretching of over-contracted muscles.

6. FLAT FOOT
This is a condition in which the inner longitudinal arch of the foot is depressed or collapsed from its normal position causing various degrees of pain, swelling and tiredness according to the disability

**Causes:**
1. Congenital – (inherited or at birth) usually not noticed until the infant begins to walk.
Normal foot

Correction:
• Wear more supportive shoes
• Passive movement of inversion, plantar and dorsiflexion.
• Walking on outer border & with feet turned, rolling leg and ankle, balancing in half crook position
• Towel scrunch

Flat foot

JOINTS
Where two or more bones of the skeleton meet one another. The functions of the joint depend upon the joint type and allow efficient transfer of muscular force from muscle to bone.

Types of Joints: THREE TYPES
1. Immovable or fibrous. Eg. Skull bones.
2. Slightly movable or cartilaginous. Eg. vertebral column.
3. Freely movable or synovial. Eg. hip.

FIGURE SHOWING DIFFERENT JOINTS IN THE HUMAN BODY
TYPES OF FREELY MOVABLE JOINTS

Ball and Socket

Ball and Socket: An example is, at the femur-hip joint. This is where the head of the bone fits into the socket of the other bone, allowing a wide range of motion, in a number of axes.

Hinge Joints

- As their name indicates, these joints provide movement in one plane, like a door hinge.
- Found at elbow and knee joints.

Pivot Joints

Pivot joints: These allow rotation of one bone around another- such as where the radius and the ulna meet.

Condyloid Joints

Also known as ellipsoid joints, this is where curved facia meet, offering movement in a number of planes. Found in the fingers.

Gliding joints: Found between two flat parts of bone, and allow a little lateral movement only. Found between the carpels in the hands (Wrist).

Saddle joints: These joints allow a greater range of movement than condyloid joints, yet are similar in shape. The most well known example is at the base of the thumb.
MUSCULAR SYSTEM

The bodily system that is composed of skeletal, smooth, and cardiac muscle tissue and functions in the movement of the body or of materials through the body, and the maintenance of posture, and heat production. There are approximately 650 skeletal muscles in the body which constitute between 40 to 50% of body weight.

PROPERTIES OF MUSCLES

- Contractility - Ability to shorten.
- Excitability – Respond to stimulus.
- Extensibility – Lengthen beyond its normal resting length.
- Elasticity – Return to original length without damage.

TYPES OF MUSCLES

- **Voluntary** – Skeletal – Striated. – form bulk of body’s muscles tissue – gives general shape to body- striped alternating bands of light and dark - conscious of work
- **Involuntary** – Smooth – non striated - lines most of hollow organs – not under voluntary control – regulated by autonomic nervous system – lines blood vessels, hair follicles, digestive tract, urinary tract.
- **Cardiac** - special muscle tissue of the heart. Vaguely striated – involuntary control

TYPES OF SKELETAL MUSCLES

**Type I Fibers**
These fibers are also called slow twitch or slow oxidative fibers. They are red in color, have a slow contraction velocity, are very resistant to fatigue, have a high capacity to generate energy, and are found in the postural muscles associated with endurance. Athletes such as marathon runners have a high number of this type of fiber
Type II A Fibers
These fibers are fast twitch or fast oxidative and red in color. They produce fast, strong muscle contractions, although they are more prone to fatigue than type I fibers.

Type II B Fibers
These fibers are fast twitch or fast glycolytic fibers and white in color. They fatigue easily and have a fast contraction velocity. This results in short, fast bursts of power and are found in large numbers in the muscles of the arms mainly associated with sprints.

MAJOR MUSCLES OF THE BODY

EFFECT OF EXERCISE ON MUSCULAR SYSTEM
- More effective and efficient
- Increased Tone (tension)
- Good posture
- Increase in size (Hypertrophy)
- Efficient metabolism
- Increase in capillary penetration
- Increase in myoglobin
- Increase in energy storage
- Shrinkage due to disuse (Atrophy)
SPORTS INJURIES

- Sports injuries are injuries that occur to anyone taking part in sporting activity.
- Most sports injuries are due to either trauma or overuse of muscles or joints when participating in a certain activity.
- The majority are caused by minor trauma involving muscles, ligaments, or tendons including: sprains, strains, contusions (bruises), fractures and dislocations.

**Sprain:** Sprain refers to the damage or tearing of ligaments or a joint capsule

**Causes:** A sprain can result from a fall, a sudden twist, or a blow to the body that forces a joint out of its normal position. The seriousness depends on how badly the ligaments are torn. Any joint can be sprained, but the most frequently injured joints are the ankle, knee, and finger.

**Signs & Symptoms:** The signs and symptoms include localized pain, swelling, inflammation, bruising, and loss of the ability to move and use the joint (called functional ability).

**Management:** The first modality for a sprain which can be used is R.I.C.E. i.e. 1. Rest 2. Ice 3. Compression 4. Elevation for the first 24 to 48 hours after the injury.

**Strain**

It is an injury to a muscle or tendon in which the muscle fibers tear and are also known as pulled muscles.

**Causes:** Strains are a result of twisting or pulling of muscle or tendon. It can also be caused by overstretching, overstressing, overuse, prolonged, repetitive movement of the muscles and tendons. Strains usually occur at the back and the hamstring muscle (located in the back of the thigh).

**Signs & Symptoms:** The signs and symptoms include pain, muscle spasm, and muscle weakness. They can also have localized swelling, cramping, or inflammation with some loss of muscle function, stiffness, discoloration, and bruising around the strained muscle.

**Management:** The treatment of strain is the same as that of Sprain. The first modality for a strain which can be used is R.I.C.E. i.e. 1. Rest 2. Ice 3. Compression 4. Elevation for the first 24 to 48 hours after the injury.
Fractures

A fracture is a complete or incomplete break in a bone. It is also a condition where the continuity of a bone is lost. **Causes:** A fracture is caused by a strong force, impact, pressure or stress on the bone due to a blow or fall. Most fractures occur in the arms and legs.

**Type:** There are four main categories of fractures: complete, incomplete, compound and simple. In a complete fracture, bone snaps into two or more parts whereas in an incomplete fracture the bone cracks but does not break all the way through. And in a compound fracture, the bone breaks through the skin, recedes back into the wound. In a simple fracture, the bone breaks but there is no open wound in the skin.

**Signs & Symptoms**

Pain, swelling, bleeding, discoloration due to bruising, spasm of surrounding muscles and deformity of the fractured part.

**Management:** Initial treatment includes splinting the affected area, elevation, applying icepack, pain management and immobilization of effected part.

**CONTUSION**

Damaged or broken blood vessels also called bruise.

**Causes:** Contusions occur when a direct blow such as a fall or a kick from a blunt object strikes part of the body, crushing underlying muscle fibers and connective tissue without breaking the skin. A contusion can result from falling or jamming the body against a hard surface.

**Signs & Symptoms:** Contusions cause swelling and pain, and limit joint range of motion near the injury. Torn blood vessels may cause bluish discoloration. The injured muscle may feel weak and stiff.

**Management:** To control pain, bleeding, and inflammation use R.I.C.E. i.e. 1. Rest 2. Ice 3. Compression 4. Elevation for the first 24 to 48 hours after the injury.
Precautions

1. If you play sports, always wear appropriate protective and safety equipment (wrist, ankle guards) during practices and competitions.
2. When it comes to your workouts, always warm up and cool down (including stretching), and do remember to work up to your training program slowly.
3. Suddenly increasing the intensity or duration of your workouts can lead to overuse injuries.
4. Try weigh training to strengthen your muscles and stretching to improve your flexibility because strong, flexible muscles help support and protect joints.
5. Try conditioning and training year-round to maintain coordination and balance. That way you'll be less likely to injure yourself during your competitive season.
6. After an injury or surgery has healed, it is also important to continue a regular stretching or conditioning program to prevent another injury.
7. The way you move can also help you prevent knee injuries. If your sport involves a lot of jumping, make sure to bend your knees when you land, which takes pressure off the knee. Use your joints to crouch and bend at the knees and hips, reducing the possibility of a ligament injury.

Dislocation

When one or two bones that meet at a joint are knocked out of place or get separated.

**Causes:** A dislocation occurs when the joint experiences an unexpected or unbalanced impact through a fall or severe hit. The most commonly dislocated joint is the shoulder.

**Signs & Symptoms:** Intense pain, joint instability, deformity of the joint area, reduced muscle strength, bruising or redness of joint area, difficulty moving joint and stiffness

**Management:** use R.I.C.E. i.e. 1. Rest 2. Ice 3. Compression 4. Elevation along with immobilization of the joint.
CPR- CARDIO-PULMONARY RESUSCITATION

Cardiopulmonary resuscitation (CPR) is an emergency medical procedure for lifesaving following cardiac arrest and other complications like stroke, choking, drowning, electrical shocks, severe bleeding etc.

CPR has three main parts: Compression, Airway and giving breaths

PROCEDURE: THREE STEPS

STEP 1 (C): CHEST COMPRESSION
- Make sure the victim is lying on his back
- Move clothes out of the way
- Find the location of the chest compression site
- Keep the heel of one hand in the chest center (between nipples)
- Place the other hand on top of the hand already on the chest and interlock the fingers
- Use the palm of your hand on the compression site
- Keep fingers off the chest
- Deliver chest compression with shoulders directly over your hands with arms straight by locking elbows
- Keep the force of compression straight down, avoid pushing on the rib cage or lower tip of the breast bone
- With locked elbows allow body weight to deliver compression
- Push hard and fast depressing the breast bone by 1/3 the depth of victim’s chest – at least 5 cm/ 2 inches
- After each compression, release, allowing the chest to return to its normal position and repeat at a rate of one-two-three-four for 30 compressions
- Perform compressions gracefully with a rate of at least 100 compressions per minute
STEP 2 (A): Airway

- Put one hand on the fore head and the fingers of the other hand on the chin
- Tilt the victim's head back and lift the chin to open the airways

STEP 3 (B): BREATHING

- While holding the airway open, pinch the nose closed
➢ Take a breath, cover the person’s mouth with your mouth
➢ Give 2 breaths (blow for 1 second each). Watch for the chest to rise as you give each breath. Breaths can be done with mask if they are available

➢ Continue the combination of rescue breaths and manual chest compression
➢ If the victim has a restored heartbeat continue the rescue breaths.

Continue CPR and monitor the victim’s condition until the arrival of AED or the emergency medical services

**AED- AUTOMATIC EXTERNAL DEFIBRILLATOR**
It is a computerized machine that can give a shock to the heart and help it work properly again. It is safe, accurate and easy to use.

**AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:**
**1. TURN ON AED**

➢ 2. WIPE BARE CHEST DRY AND ATTACH PADS: Place one pad below the collarbone on the upper right side of the victim’s bare chest. The other should be placed below the peck or breast on the left, below his heart, slightly along his side.
3. PLUG IN CONNECTOR

4. STAND CLEAR: Make sure no-one, including you, is touching the person.
   ■ Say, “EVERYONE, STAND CLEAR.”

5. ANALYZE HEART RHYTHM: Push the “analyze” button, if necessary. Let AED analyze the heart rhythm.
6. DELIVER SHOCK: If SHOCK IS ADVISED: ■■ Make sure no one, including you, is touching the person. ■■ Say, “EVERYONE, STAND CLEAR.” ■■ Push the “shock” button, if necessary

* If the person is not responding and not breathing or is only gasping, then you need to give CPR again or a combination of CPR and AED.

References

"Introductory Anatomy: Joints". http://www.leeds.ac.uk/chb/lectures/anatomy 2008


By: PE Department 2016