

**VOCATIONAL HIGHER SECONDARY  
EDUCATION (VHSE)**

**SECOND YEAR**

**PHYSIOTHERAPY**

*Reference Book*



**Government of Kerala  
Department of Education**

**State Council of Educational Research and Training (SCERT),  
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## **Foreword**

Dear Learners,

This book is intended to serve as a ready reference for learners of vocational higher secondary schools. It offers suggested guidelines for the transaction of the concepts highlighted in the course content. It is expected that the learners achieve significant learning outcomes at the end of the course as envisaged in the curriculum if it is followed properly.

In the context of the Right- based approach, quality education has to be ensured for all learners. The learner community of Vocational Higher Secondary Education in Kerala should be empowered by providing them with the best education that strengthens their competences to become innovative entrepreneurs who contribute to the knowledge society. The change of course names, modular approach adopted for the organisation of course content, work-based pedagogy and the outcome focused assessment approach paved the way for achieving the vision of Vocational Higher Secondary Education in Kerala. The revised curriculum helps to equip the learners with multiple skills matching technological advancements and to produce skilled workforce for meeting the demands of the emerging industries and service sectors with national and global orientation. The revised curriculum attempts to enhance knowledge, skills and attitudes by giving higher priority and space for the learners to make discussions in small groups, and activities requiring hands-on experience.

The SCERT appreciates the hard work and sincere co-operation of the contributors of this book that includes subject experts, industrialists and the teachers of Vocational Higher Secondary Schools. The development of this reference book has been a joint venture of the State Council of Educational Research and Training (SCERT) and the Directorate of Vocational Higher Secondary Education.

The SCERT welcomes constructive criticism and creative suggestions for the improvement of the book.

With regards,

**Dr. P. A. Fathima**  
**Director**  
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## ABOUT THE COURSE

Vocational higher secondary education is a project of central government to address the issues of unemployment. In vocational higher secondary students are guided to different work stream after their secondary education. Among the different vocational courses introduced, physiotherapy has great relevance.

In history it has its roots in the after effects of second world war-in the rehabilitation after injuries .It gradually developed in to a separate branch of medicine. In the past, medical and surgical care was directed only towards the treatment of diseases. Now it is well recognized that attention needs to be paid also towards the after effects of diseases. It is widely accepted that by using physiotherapy treatment techniques and facilities recovery of a patient can be accelerated and the period of convalescence can be reduced and in certain cases permanent disability resulting from disease can be prevented or minimized. "A Physician add life to years and a Physiotherapist add years to life"

This new concept has been the key factor to the development of a new branch of medicine i.e. rehabilitation medicine. Today physiotherapy has emerged as a popular branch of Allied Health science. Its progress and rapid expansion had made it a chief component of Rehabilitation medicine.

It has also a major role in sports medicine and physical fitness.

Vocational higher secondary course in Physiotherapy will enable the students to acquire various skills needed to assist a Physiotherapist in the different specialties. It also offers an opportunity for higher studies in various medical, paramedical and allied health science courses.

### Major skills (with Sub-skills)

#### Module - 3

#### Major skill

Learner will be able to assist physiotherapist in electro therapy and exercise therapy clinics

#### Sub skill

The learner:

- Give general instructions to the clients prior to treatment.
- Prepare the patient for treatment
- Arrange the treatment set up

- Checking, cleaning and maintenance of physiotherapy equipments
- Assist the physiotherapist in providing the following treatment
  - Passive movements
  - Resisted exercise
  - Frenkel's exercise
  - Relaxation techniques
  - Stretching exercise
  - Strengthening exercise
  - Gait training
  - Donning and doffing of orthotics.

#### **Module - 4**

##### **Major skills**

Student will achieve basic knowledge about various neurological, orthopaedic, paediatric and geriatric conditions seen in physiotherapy clinic. Learner will be able to assist the physiotherapist in clinical or hospital set up in treatment of various conditions

##### **Sub skill**

The learner:

- Provide assistance in treating patients with various neurological conditions like hemiplegia, paraplegia, parkinsonism etc
- Provide assistance in treating patients with various orthopaedic conditions like fracture, arthritis etc
- Provide assistance in treating children with cerebral palsy
- Positioning of hemiplegic patients
- Transfer of patients from bed to chair and viseversa
- Provide assistance in treating geriatric patients

## SYLLABUS

### Module - 3

Unit No.	Unit Name	Periods
3.1	Introduction to physiotherapy	25
3.2	Exercise therapy	150
3.3	Human locomotion (gait)	25
3.4	Hydro therapy	15
3.5	Suspension therapy	5
3.6	Relaxation	5
3.7	Chest physiotherapy	10
3.8	Electrotherapy	105
	<b>Total</b>	<b>340</b>

### Module - 4

Unit No	Unit Name	Periods
4.1	Introduction to Neurological Physiotherapy	90
4.2	Introduction to orthopaedic Physiotherapy	105
4.3	Introduction of paediatric Conditions and relevance of physiotherapy	40
4.4	Introduction of physiotherapy in surgical condition	40
4.5	Orthotics and prosthetics	25
4.6	Geriatric physiotherapy	40
	<b>Total</b>	<b>340</b>

## MODULE-3

### FUNDAMENTALS OF PHYSIOTHERAPUTICS

#### UNIT-3.1 .Introduction to physiotherapy

- Definition
- Branches of physiotherapy
- Scope of physiotherapy
- General goals of physiotherapy

#### UNIT-3.2. Exercise Therapy

##### UNIT-3.2.1.Introduction to Exercise Therapy

##### UNIT-3. 2.2 Movement and Types of Movements

###### 1. Active movement

- Free exercise
- Assisted exercise
- Assisted-resisted exercise
- Resisted exercise

###### 2. Passive movement

###### 3. Reflex movements

##### UNIT 3.2.3 Fundamental Positions

- Standing
- kneeling,
- sitting
- lying
- hanging

##### UNIT3. 2.4 Derived Positions

- Standing
- kneeling,
- sitting



- lying
- hanging

### **UNIT3. 2.5 Manual Muscle Test of Major Muscle Group**

- Shoulder-flexors ,extensors, abductors and adductors
- Elbow-flexors and extensors
- Hip-flexors ,extensors, abductors and adductors
- Knee-flexors and extensors

### **UNIT 3.2.6 Range of Joint Motion of Major Joints**

- Shoulder-flexion ,extension, abduction and adduction
- Elbow-flexion and extension
- Hip-flexion ,extension, abduction and adduction
- Knee-flexion and extention

### **UNIT 3. 2.7 Posture**

- Definition and Types (Good and Bad posture)

### **UNIT-3. 2.8 Exercise therapy equipments**

- Suspension unit
- Static cycle
- Treadmill
- Quadriceps table
- Shoulder wheel
- Hand exerciser
- Medicine ball,
- Swiss ball
- Abduction ladder.
- Parallel bar
- Tilt table
- Wheelchair
- Crutches

## **UNIT-3.3 Human locomotion (GAIT)**

### **UNIT-3.3.1 Definition and Gait cycle**

### **UNIT-3.3.2 Pathological gait**

- Circumductory gait
- Scissoring gait
- Festinant gait
- Ataxic gait
- High stepping gait
- Antalgic gait

### **UNIT 3.3.3 Gait training**

### **UNIT3. 3.4 Transfer techniques**

- Wheel chair to bed
- Bed to wheelchair

## **UNIT-3.4 Hydrotherapy**

- Pooltherapy
- Contrast bath
- Cryotherapy

## **UNIT-3.5 Suspension therapy**

- Types and indication

## **UNIT-3.6 Relaxation**

- Definition, types and techniques

## **UNIT-3.7 Chest physiotherapy**

- Postural drainage
- Breathing exercise

## **UNIT-3.8 Electrotherapy**

### **UNIT 3.8.1 Introduction of electrotherapy**

### **UNIT 3.8.2 Classification -low frequency, medium frequency and high frequency equipments**

### **UNIT 3.8.3 Preparation and safety measures for patient and equipments**

#### **UNIT3. 8.4 Thermotherapy**

- Physiological and Therapeutic effects of heat.
- Application of heating modality
- Indication and contraindication of the electrotherapy equipments.

#### **UNIT 8.5 Brief descriptions of electrotherapy equipments-**

- IRR-Infra red radiation
- US-Ultra sound
- SWD-Short Wave Diathermy
- IFT-Interferential therapy
- TENS-Transcutaneous Electrical Nerve Stimulator
- Cold pack
- Hot pack
- Wax bath
- Laser

## **PART -B**

### **OVER VIEW OF MODULE 3**

Students have previous ideas about Anatomy and Physiology of Human body. In this module the student will be able to familiarize with commonly used physiotherapy equipments in exercise therapy and electro therapy. This module introduces different types of equipments used in physiotherapy clinics with emphasise on its usage, indications and maintenance. The student also acquires the skills in preparation of the client for treatment and basic physiotherapeutic techniques including basic exercises, posture, gait training and transfer techniques.

After completion of this module, student will be able to assist the physiotherapist in using various electrotherapy and exercise therapy equipments in a clinical setup. Also student will be able to assist the therapist in Suspension therapy, Hydrotherapy and Chest physiotherapy .

## **UNIT - 1**

### **INTRODUCTION TO PHYSIOTHERAPY**

#### **Introduction**

Physiotherapy is a form of treatment carried through the medium of physical forces such as heat, electricity, mechanical pressure and mechanical forces. Thus, in physiotherapy heat, electrical current, water, soft tissue manipulation, and exercises with or without resistance are utilized. Physiotherapy is a health profession whose primary purpose is the promotion of optimal human health by the application of scientific principles to prevent, assess, correct or alleviate acute or prolonged movement dysfunction.

#### **Learning outcomes**

The learner ;

- Achieve basic knowledge about the physiotherapy
- Define physiotherapy
- Understand the branches of physiotherapy
- Understand the scope of physiotherapy
- Identify the the different goals of physiotherapy

## Concepts (Detailing )

### Definition

Physical therapy provides services to individuals and populations to develop maintain and restore maximum movement and functional ability throughout the lifespan. This includes providing services in circumstances where movement and function are threatened by ageing, injury, pain, diseases, disorders, conditions or environmental factors. Functional movement is central to what it means to be healthy.

Physical therapy is concerned with identifying and maximizing quality of life and movement potential within the spheres of promotion, prevention, treatment/intervention, habilitation and rehabilitation. This encompasses physical, psychological, emotional, and social wellbeing. Physical therapy involves the interaction between the physical therapist, patients/clients, other health professionals, families, care givers and communities in a process where movement potential is assessed and goals are agreed upon, using knowledge and skills unique to physical therapists (WCPT)

### Branches of physiotherapy

Physiotherapy is a complex specialty, as it deals with all disciplines of medicine. Development in this field has resulted in a variety of sub-specialization-

#### 1. Musculo-skeletal physiotherapy

The Musculo - Skeletal Physiotherapy is a branch, where application of physiotherapy is involved in the treatment of physical ailments concerned with structures surrounding the joint region such as Bones, Muscles, Ligaments and Bursa. Some of the conditions dealt in this branch are: Muscle pain, strain, Muscle tear Joint stiffness, Fracture, Ligament strain, sprain, tear, Inability to walk, Inflammation of tendons and bursa, Joint pain, poor posture, Joint inflammation in case of osteoarthritis or rheumatoid arthritis etc

#### 2. Cardio-Thoracic Physiotherapy:

Cardio - Thoracic Physiotherapy is concerned with the care of physical fitness of the heart and lungs. This treatment specializes in clearing away any chest secretions so as to enable and help an individual to breathe more normally, and help in adequate oxygen supply to the healing wound and the body. Some of the conditions treated under this branch are: Asthma, Increased chest secretions other respiratory infections etc

### 3. Neurological Physiotherapy

Neurological Physiotherapy is concerned with the treatment arising from the problems in brain, Nerves of the brain, Spinal cord and nerves of the spinal cord and meninges. Some of the conditions which physiotherapy is essential part of treatment are: Stroke, ataxia, cerebral palsy, Spinal cord injury, peripheral nerve injuries, etc.

### 4. Physiotherapy in Rehabilitation

Physiotherapy and Rehabilitation goes hand in hand. Rehabilitation is nothing but bringing back a physically disabled individual to near normal condition by using his maximum existing capacities. Rehabilitation in physiotherapy involves training and retraining of physical activity in a physically disabled individual. Different types of rehabilitations, where physiotherapy is involved: Stroke Rehabilitation, Geriatric/ Old age Rehabilitation, Cardiac Rehabilitation and Amputee (person who has lost the limb) Rehabilitation

### 5. Physiotherapy in Obstetrics

Physiotherapy in obstetrics is concerned with postural care and physical fitness of women during pregnancy and after child birth.

### 6. Sports Physiotherapy

Sports physiotherapy is specialized for sports persons. Guidance in sport activities like techniques of warming up period, cooling down period, guidance in lifting techniques and also treatment of sport injuries are dealt. Some of the conditions under this are: Any Muscle spasm (pain and tightness of muscle), Muscle strain, Ligament sprain, tear, all other sports injuries.

### 7. Physiotherapy in fitness and postural care

This branch is concerned with guidance and care for physical fitness, good postural care and Body muscle built. Some of the conditions dealt are: Obesity/ Overweight, Poor Posture (Hunch back), Good muscle built etc

### 8. Pediatric Physiotherapy

This branch of physiotherapy treatment is for the children born with physical disabilities and also for the children undergoing any surgery, requiring physiotherapy care. Some of the conditions dealt here are: Club foot- before and after a surgery, Respiratory infections, Fractures in children, Cerebral palsy etc.

## Scope of physiotherapy

The scope of physical therapy practice is dynamic and responsive to patient/client and societal health needs. With the development of knowledge and technological advances, periodic review is required to ensure that scope of practice reflects the latest evidence base and continues to be consistent with current health needs. Research is continually providing new evidence upon which future practice will be built.

## The scope of physical therapy services

Physical therapy is an essential part of the health and community/welfare services delivery system. Physical therapists practice independently of other health care/service providers and also within interdisciplinary rehabilitation/habilitation programmes to prevent, gain, maintain or restore optimal function and quality of life in individuals with loss and disorders of movement.

Physical therapists are guided by their own code of ethical principles. Thus, they may be concerned with any of the following purposes:

1. Promoting the health and well-being of individuals and the general public/society-Emphasizing the importance of physical activity and exercise
2. Preventing impairments, activity limitations, participatory restrictions and disabilities in individuals at risk of altered movement behaviors due to health or medically related factors, socio-economic stressors, environmental factors and lifestyle factors
3. Providing interventions/treatment to restore integrity of body systems essential to movement, maximize function and recuperation, minimize incapacity, and enhance the Quality of life, independent living and workability in individuals and groups of individuals with altered movement behaviors resulting from impairments, activity limitations, Participatory restrictions and disabilities modify environmental, home and work access and barriers to ensure full participation in one's normal and expected societal roles .Physical therapists may also contribute to the development of local, national and international Health policies and public health strategies.

## General goals of physiotherapy

The goals of physiotherapy are to improve mobility and strength, to relieve pain and to restore physical function. This enables you to resume your regular activities of daily living including work, school, recreational activities, home-making and/or self-

care. If the injury or disease is severe in nature, the goal is to assist you in returning to your maximal function.

Physiotherapy provides benefits by use of a non-invasive approach. The Goals of Physiotherapy are to facilitate and maximize recovery and functional mobility following a musculoskeletal or neurological injury. Physiotherapy reaches these goals through:

2. Reduction of pain.
3. Acceleration in healing of injured.
4. Maintenance or restoration of normal range of motion in affected joints.
5. Prevention of fibrosis or soft tissue contractures in injured, weak or paralyzed limbs.
6. Prevention of disuse atrophy during healing phases of neurological and musculoskeletal insults.
7. Improvement of strength and function in weak and paralyzed muscles.
8. Improved performance and quality of movement.
9. Positive psychological effects maximizing both pet and owner's well-being.
10. Provision of individualized home care program to maximize functional mobility and prevent injury .

### **Practical detailing**

Visit to a physiotherapy clinic and make a report about the visit

### **Assessment activities**

- Brain storming
- Collection
- Discussion
- Field visit report

### **TE Questions**

1. Identify the role of physiotherapist in rehabilitation team?
2. List out the different branches of physiotherapy



## UNIT 3.2. EXERCISE THERAPY

### Introduction

This unit provides a general idea about the exercise therapy including therapeutic movements, fundamental and derived positions, posture, gait ,gait training and transfer techniques, and different types of equipments used in exercise therapy.

### Learning outcomes

The learner;

- Achieve Basic knowledge about exercise therapy
- Identify the different types of movements
- Demonstrate the fundamental positions
- Demonstrate the derived positions
- Check the muscle strength of major muscle group
- Measure the range of motion of major joints
- Identify good and bad posture
- Identify commonly used exercise therapy equipments

### Concepts (Detailing)

#### EXERCISE THERAPY

Exercise therapy is a means of accelerating the patient's recovery from injuries and diseases which have altered his normal way of living. The aims of exercise therapy

1. To promote activity and minimize the effects of inactivity.
2. To increase the normal range of motion.
3. To strength the weak muscles.
4. To improve the performance in daily activities

### Movement and types of movements

MOVEMENT is a fundamental characteristic of all animal life and the mean by which the organism adapts itself to the demands made up on it by the environment in which it lives.

Movement used in treatment may be classified as follows;

## 1. Active movements

- a. Voluntary: Voluntary movement-movement performed or controlled by the voluntary action of muscle working in opposition to an external force.
- b. Involuntary reflex

### Classification of Active movement

#### i) Assisted exercise

When muscle strength or co ordination is in adequate to perform a movement an external force is applied to compensate for the deficiency. When the force exerted on one of the body livers by muscular action is insufficient for the production or control of movement, an external force may be added to augment it. This external force must be applied in the direction of the muscle action but not necessarily at the same point.

#### ii) Free exercise

The working muscles are subject only to the forces of gravity acting up on the part moved or stabilized. Free exercise are those which are performed by the patient's own muscular efforts without the assistance or resistance of any external force, other than that of gravity.

#### (iii) Assisted-Resisted exercise

This type of exercise constitutes a combination of assistance and resistance during single movement

#### (iv) Resisted exercise

An external force may be applied to the body livers to oppose the force of muscle contraction. Tension is increased within the muscle by the opposing force and the muscle respond by an increase in their power and hypertrophy.

There are five factors which contribute to the development of muscular efficiency- Power, Endurance, Volume, Speed of contraction and Co-ordination

Resistance force: The physiotherapist, patient, Weights, Weight and pulley circuit, Springs and other elastic structures, Substances which are malleable and Water

## 2. Passive movements

### Passive movements

These movements are produced by an external force during muscular inactivity or when muscular activity is voluntarily reduced as much as possible to permit movement.

## Classification of Passive Movement

- 1- Relaxed Passive Movements, including accessory movements.
2. Forced Passive movement.
3. Continuous Passive movement.

### 1. Relaxed Passive Movement

These are movements performed accurately, rhythmical and smoothly by the physiotherapist through available range of motion( according to anatomy of joints) . The movements are performed in the same range and direction as active movements. The joint is moved through the free range and within the limits of pain.

### Principles Of Relaxed Passive Movement

1. **Relaxation:** The selection of a suitable starting position ensures comfort and support, for both patient and physiotherapist through the movement.
2. **Fixation:** Good fixation for the proximal and distal joint by the physiotherapist to ensure that the movement is localized to the movable joint.
3. **Support:** Full and comfortable support is given to the part to be moved, so that the patient has confidence and will remain relaxed.
4. **Traction:** The fixation of the bone proximal to the joint providing an opposing force to a sustained pull on the distal bone. Traction is thought to facilitate the movement by reducing inter- articular friction.
5. **Range of movement :** The range of movement is done in painless range to avoid spasm in the surrounding muscles.
6. **Speed and Duration:** As it is essential that relaxation is maintained throughout the movement, the speed must be slow and rhythmical, with suitable repetitions of the movement.

### Effects And Uses Of Relaxed Passive Movements

1. Maintain range of motion and prevent formation of adhesions.
2. Maintain the physiological properties of the muscle (extensibility, elasticity, etc.) and prevent shortening and contracture.
3. Help in preserving and maintain the memory of the movement pattern by stimulating the kinaesthetic receptors.
4. The mechanical pressure resulted from the stretching of the thin walled vessels which passing across the moved joint will assist the venous and lymphatic return (improving circulation).

5. Can be used in training of relaxation as the rhythmic continuous passive movements can have a soothing effect and induce further relaxation and sleep.
6. Improving sense of position and sense of movement.

### **Indications Of Relaxed Passive Movement**

1. In cases of paralysis, patient who is confined in bed for a long time or complete rest on bed.
2. When there is an inflammatory reaction and active movement is painful.
3. When the patient in coma.
4. In relaxation as a factor helping to reduce spasm in group of muscles.

### **I. Contra-Indications Of Relaxed Passive Movement**

1. Unhealed fracture, recent fracture, at the site of fracture.
2. At site of effusion or swelling.
3. Immediately following surgical procedure to tendon, ligaments, joint capsule.
4. Immediately after recent tear to ligament, tendon.
5. When a bony block limits joint motion e.g. myositis ossificans.
6. Recent injuries
7. Severe muscle weakness.
8. Acute inflammation or infection as arthritis, osteomyelitis etc

### **II. Forced Passive Movement**

An exercise performed on a subject by a partner who exerts an external force not only to produce a passive movement, but also to increase the range of movement of a joint. The partner presses the joint into its end-position (i.e. end of range), while the subject's muscles that normally carry out the movements are completely relaxed. There is a danger of overextension beyond the range of movement and damage to the joint if the exercise is not carried out carefully.

### **III. Continuous Passive Motion (CPM)**

A continuous passive motion device maintains movement of a joint after limb sparing surgery. This device is usually called a CPM. Continuous movement limits stiffness and pain. It is very important to keep joints moving following surgery so that motion will not become limited. The CPM will move the involved leg through its full range of motion. It is only used in bed, but can be used while relaxing, eating, or sleeping.

## Fundamental positions

The postures from which movement is initiated are known as Starting Position and they may be either active or passive in character. There are five basic or fundamental starting position and all the others are derived from them, i.e. standing, kneeling, sitting, lying and hanging. Equilibrium and stability is maintained in these positions by a balance of forces acting upon the body, and when the force of muscular contraction is used for this purpose the contraction is isometric. The strength and distribution of this contraction is normally controlled by a series of reflexes known collectively as the Postural Reflexes but, during the learning process of new patterns of posture, voluntary effort may be required.

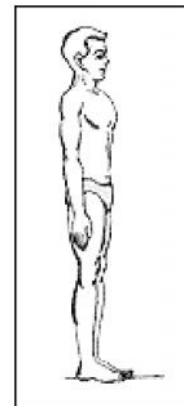
### 1. Standing

This is the most difficult of the fundamental positions to maintain, as the whole body must be balanced and stabilized in correct alignment on a small base by the coordinated work of many muscle groups. The position may be described as follows:

#### Starting Positions

- (i) The heels are together and on the same line, the toes slightly apart (so that the angle between the feet does not exceed  $45^\circ$ ).
- (ii) The knees are together and straight.
- (iii) The hips are extended and laterally rotated slightly.
- (iv) The pelvis is balanced on the femoral heads.
- (v) The spine is stretched to its maximum length.
- (vi) The vertex is thrust upwards, the ears are level and the eyes look straight forwards.
- (vii) The shoulders are down and back.
- (viii) The arms hang loosely to the sides, palms facing inwards towards the body.

It is usually preferable to modify the position of the legs to that in which the heels are slightly apart and the inner borders of the feet are parallel, as this is the natural functional position of the foot when it is used as a lever to propel the body forwards.



## 2. Kneeling

The body is supported on the knees which may be together or slightly apart. The lower leg rests on the floor with the feet plantarflexed or, if a plinth is used, the feet may be in the mid-position over the edge. The rest of the body is held as in standing.



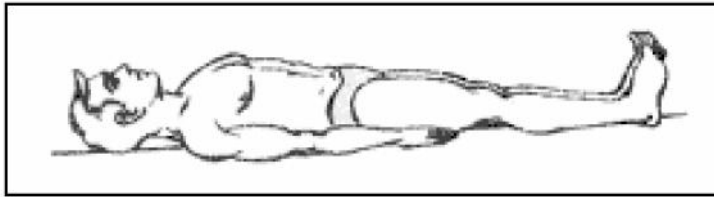
## 3. Sitting

The position is taken on a chair or stool, the height and width of which allow the thighs to be fully supported and the hips and knees to be flexed to a right angle. The knees are apart sufficiently to allow the femora to be parallel and the feet rest on the floor with the heels vertically below the knees.



## 4. Lying

This is the easiest of the fundamental positions as the body can be completely supported in the supine position and is as stable as is possible.



## 5. Hanging (hg.)

The body is suspended by grasping over a horizontal bar, the fore-arms being pronated, the arms straight and at least shoulder width apart. The head is held high and the scapulae are drawn down and together, so that the neck appears as long as possible. The trunk and legs hang straight, with the heels together and the ankles plantar flexed.



## Unit 3.2.4 Derived positions

Derived positions are positions used by modification of the arms, legs or trunk in each of fundamental

position. The aims of derived positions are:

1. To increase or decrease the base of support.
2. To rise or lower the center of gravity (COG).
3. To gain local or general relaxation.
4. To gain fixation and good control of specific area.
5. To increase or decrease the muscle work required to maintain the position.
6. To increase or decrease the leverage.

### Derived position from standing

By alteration of the legs

Achieved by change in the shaper size of the base.

1. Toe standing.
2. Stride standing.
3. Walk standing.
4. Half standing. Standing with trunk alteration
5. Stoop standing.
6. Lax stoop standing

### Position Derived from Kneeling

1. Half Kneeling
2. Kneel Sitting
3. Prone Kneeling

### Positions Derived from Sitting

1. Stride sitting.
2. Ride Sitting.
3. Crook Sitting.
4. Long sitting.

5. Cross Sitting
6. Side sitting.
- 7- High sitting

### Position Derived from Lying

1. Crook Lying
- 2- Crook Lying with Pelvis Lifted
3. Half Lying
4. Prone Lying
5. Leg Prone Lying
6. Side Lying
7. Sit Lying

### Position Derived from Hanging

Full Hanging

#### Manual muscle test of major muscle group

Manual muscle testing is a procedure for the evaluation of the function and strength of individual muscles and muscle groups based on the effective performance of a movement in relation to the forces of gravity and manual resistance.

#### Manual Muscle Test Grades

- Grade 5** (Normal; 100%)- The patient or subject can complete the whole range of motion (movement) against gravity with maximum resistance applied by the therapist at end-of-range.
- Grade 4** (Good; 75%)- The subject can complete the whole range of motion against gravity with moderate resistance applied by the physical therapist (PT) at end-range. Testing the uninvolved limb should always be considered to know whether you are applying too much force on the involved limb or not.
- Grade 3+** (Fair+)- The patient can complete the motion against gravity with minimal resistance applied by the examiner at end-range.
- Grade 3** (Fair; 50%) - The patient can only complete the range of motion against gravity. When external (outside) force is applied by the PT, the patient gives way.



- Grade 2** (Poor;25%) - Your patient cannot perform the movement against gravity. But patient can do complete range of motion when pull of gravity is eliminated. No resistance is applied.
- Grade 1** (Trace)-Patient is not able to move the joint even with gravity eliminated. However, closer examination by the therapist would reveal slight muscle contraction through palpation.
- Grade 0** (Zero; No trace) - No contraction is noticed, even with physical therapist's palpation (touch).

Note: Always tell your client about what procedure you are going to perform and what you are going to obtain from that procedure. Remember to check the uninvolved side first and be consistent on where you apply the resistance. Also, instruct your client not to hold his or her breath as you apply force or resistance

### **Muscle testing procedures of major muscles**

#### **DELTOID**

**Position of Patient:**

With the patient sitting the elbow should be flexed to indicate the neutral position of rotation.

**Position of Therapist:**

The therapist should stand at test side of patient. Place pressure against the dorsal surface of the distal end of the humerus.

**Test:** The patient is to maintain the arm in abduction against gravity.

**Instructions to Patient:** "I am going to push down and I want you to resist me. Keep your arm up as I push down."

#### **BICEPS**

**Position of Patient:**

With the patient sitting the elbow is flexed at a right angle, with forearm in supination.

**Position of Therapist:**

The therapist should stand in front of and at testing side of patient. The hand giving resistance is contoured over the flexor surface of the forearm just proximal to the wrist. The other hand is applied to the humerus to provide a counterforce.

**Test:** Patient flexes elbow against your applied force. If the biceps/brachialis are weak the patient will pronate the forearm before flexing the elbow.

Instructions to Patient: "Bend your elbow, hold it. Don't let me pull it down."

### WRIST EXTENSORS

**Position of Patient:** With the patient sitting with the elbow and forearm supported and forearm is in full pronation with the fingers flexed.

**Position of Therapist:** The therapist should stand or sit at a diagonal in front of the patient.

**Test:** Support the patients forearm under the wrist while the other hand used for resistance is placed over the dorsal surface of the metacarpals. Do not permit full extension of the fingers.

**Sample Instructions to Patient:** “Bring your wrist up, hold it. Don’t let me push it down.”

### QUADRICEPS

**Position of Patient:** With the patient sitting with the trunk approximately perpendicular to the floor, the leg is extended – but not locked – in extension at the knee. Trunk extension is allowed only if significant hamstring tightness precludes assuming the recommended testing position.

**Position of Therapist:** The therapist stands at the side of the tested limb and the testing hand is placed over anterior surface of distal leg just above the ankle. The other hand is placed under the distal thigh.

**Test:** The patient extends the knee through available range of motion but do not allow knee to “lock” into extension during the test.

Instructions to Patient: “Straighten your knee and hold it, don’t let me bend it.”

### ANKLE DORSIFLEXORS

**Position of Patient:** With the patient sitting, the knee is flexed at 90°.

**Position of Therapist:** The therapist sits in front of testing limb and supports the leg just above the posterior aspect of the ankle joint.

**Test:** The patient dorsiflexes the ankle joint without extending the great toe. Pressure is applied on the dorsum of the foot (in the direction of plantar flexion and eversion).

Instructions to Patient: “Pull your foot up to the ceiling.”

### GLUTEUS MEDIUS

**Position of Patient:** With the patient side lying, the test leg is superior to the supporting leg. The test limb is slightly extended beyond midline and pelvis is rotated slightly forward. The supporting leg is flexed for stability.

**Position of Therapist:** The therapist stands behind patient and test hand is placed on lateral surface of knee or at the ankle and the other hand is just proximal to greater trochanter of femur.

**Test:** The patient abducts against the applied resistance without flexing or rotating the hip in either direction. Resistance by examiner is straight and downward.

Instructions to Patient: "I am going to push down on your leg and I want you to resist me."

### GLUTEUS MAXIMUS

**Position of Patient:** With the patient prone the knee is flexed to 90°.

**Position of Therapist:** The therapist stands on the side to be tested and the testing hand is placed over the posterior thigh just above the knee. The other hand may stabilize the pelvis at the upper buttocks.

**Test:** The patient extends the hip through the available range of motion

Instructions to Patient: knee flexion at 90°. Resistance is applied directly downward toward the floor.

Instructions to Patient ; "Lift your leg towards the ceiling and keep your knee bent."

### TRICEPS

**Position of Patient:** Supine or prone

Fixation

Shoulder abducted to 90°, neutral with regard to rotation, & supported between the shoulder & elbow by the table

**Test**

Extension of the elbow joint (to just short of full extension) Pressure against the forearm in the direction of flexion

### Hamstrings

#### Range of Joint Motion of Major Joints

Range of Motion is the measurement of movement around a specific joint or body part. To measure range of motion, physical therapists most commonly use a goniometer, which is an instrument that measures angle at a joint. Goniometers show degrees of an angle from zero to 180 or 360 degrees and are available in different shapes and sizes for the unique joints in the human body, example, when using a goniometer to measure knee flexion, the center of the tool will be at the side view of

the knee joint, and the arms of the goniometer are aligned in the center of the long bones above and below the knee. As the knee is bent or flexed the movable arms provide a measure of the degree of movement.

### Range of motion of different movements of major joints

#### Shoulder joint

Abduction	:	180 degrees
Forward flexion	:	180 degrees
Extension	:	45-60 degrees
Rotation (test with elbow flexed to 90 degrees, see Apley's Scratch Test)		
External Rotation	:	90 degrees
Internal rotation	:	70-90 degrees

#### Elbow joint

Elbow flexion	=	zero to 145 degrees.
Forearm supination	=	zero to 85 degrees.
Forearm pronation	=	zero to 80 degrees.

#### Wrist complex

dorsiflexion (extension)	=	zero to 70 degrees.
palmar flexion	=	zero to 80 degrees.
radial deviation	=	zero to 20 degrees
ulnar deviation	=	zero to 45 degrees.

#### Hip joint

Flexion	=	0 to 125 degrees
Extension	=	0 to 30 degrees.
Adduction	=	0 to 25 degrees.
Abduction	=	0 to 45 degrees.
External rotation	=	0 to 60 degrees.
Internal rotation	=	0 to 40 degrees.

#### Knee joint

Flexion	=	0 to 140 degrees.
Extension	=	zero degrees

### Ankle joint

Neutral position is with foot at 90 degrees to ankle.

Dorsiflexion is 0 to 20 degrees;

Plantar flexion is 0 to 45 degrees.

### Posture

Posture is the position the body adopts in response to the effects of gravity. It is the way you hold yourself in sitting, standing or lying down.

### POSTURE

Posture is a term used to describe a position of the body or the arrangements of body parts relative to one another. Ideal postures are those assumed to perform an activity in the most efficient manner utilizing the least amount of energy. All activity begins with a posture and ends with a posture. The relationships between body parts can be controlled voluntarily but to do this would require too much concentration. During normal functioning one's postures and adjustments to postures are automatic and occur quickly.

**Good posture:** Good posture is the attitude which, is assumed by Body parts to maintain stability and balance with minimum effort and least strain during supportive and non supportive positions.

**CHARACTERISTICS OF GOOD POSTURE (Prerequisites of good posture):**  
For good posture to be maintained the following must be obtained: The ability to maintain 'the body upright in good and erect position with less energy. The ability to maintain balance in upright position via keeping the line of gravity near the center of the base of support.

**Effects of good posture:** Maintaining good posture has its values in different body functions and systems. The effects of good posture include:

1. Helps the muscles in the body to be unloaded and relaxed.
2. Improves respiratory and circulatory efficiency.
3. Prevents unnecessary strain and fatigue.
4. Decreases the incidence of diseases resulting from bad posture.
5. Improves the subject's state; mentally or psychologically.:

**Poor posture:** Poor posture is a position resulting from any deviation from ideally aligned erect posture (good posture).

**Causes of poor posture:** Poor posture may occur due to:

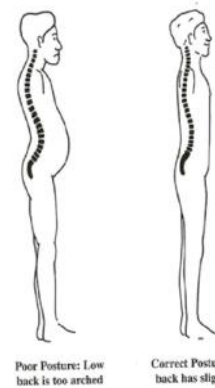
- 1- Defects in: Joints: such as stiffness or immobilization. •Bones: such as shortening or deformity. •Muscles: such as weakness, paralysis or contracture. •Vision or hearing.
- 2- Bad habits: either from early childhood or from occupational positions. Example for that is the workers that perform jobs which require continuous flexed position of the trunk.
- 3- Pain, fatigue or bad psychological state.

**Effects of poor posture:**

Poor posture causes deviations from the normally aligned posture. As a result the body functions are altered and this may lead to dysfunction and diseases.

Poor posture may cause one or more of the following dysfunction:

1. Secondary deformities and compensatory postural defects.
2. Easy fatigability and high energy expenditure.
3. Decrease both respiratory and circulatory efficiency.
4. Pain, bad cosmetic appearance and psychological disturbances.



**Exercise Therapy Equipments**

**Suspension frame**

Tubular steel construction, with welded steel rod-mesh at the top for complete suspension with

slings & ropes. Mesh facilitate suspension at any desired point in relation to the patient and as required in each individual case. Suspension therapy is the treatment given to the patient to improve ROM, and muscle strength.and support body parts by using slings and ropes.



### Static cycle

A static cycle (also known as exercise bicycle, exercise bike, or exercycle) is a device with saddle, pedals, and some form of handlebars arranged as on a bicycle, but used as exercise equipment rather than transportation.



An exercise bicycle is usually a special-purpose exercise machine resembling a bicycle without true wheels, but it is also possible to adapt an ordinary bicycle for stationary exercise by placing it on bicycle rollers or a trainer. Rollers and trainers are often used by racing cyclists to warm up before racing, or to train on their own machines indoors.

### Treadmill



A treadmill is a device generally for walking or running while staying in the same place. One of the most popular types of home exercise equipment is the treadmill, which provides a straightforward, efficient aerobic workout. Treadmills are a good choice to begin a new exercise routine because walking is well tolerated by most individuals regardless of

fitness level and for most back conditions. As strength and endurance are developed, the treadmill can be used for jogging and/or for interval training.

### Quadriceps Table

Designed for effective administration of progressive resistance exercises to the knee joint muscle groups. Both quadriceps and hamstrings can be exercised without changing the position of patient.



Quadriceps Table with back rest

### Shoulder Wheel

The Shoulder Wheel is just such a mechanism – it allows patients to perform resistance exercises to improve range of motion and relieve pain. The Shoulder Wheel is constructed of a 37"-diameter steel tube wheel fitted with a resistance mechanism that revolves smoothly around a drum to provide a varied arc of motion from 10° to 39°. By setting the handle to a specific position, resistance is controlled from 0 to the maximum through a calibrated sensitive resistance mechanism. The Shoulder Wheel is mounted on 3 laminated hardwood boards to easily attach to the wall. The wheel can be adjusted up to a height of 26" to fit all users.



### Hand Exerciser

Hand Exerciser with Spring-Loaded Buttons. Ergonomically engineered to fit comfortably in the palm of the hand, it isolates and develops finger strength, coordination and flexibility using different resistance levels. This versatile hand exerciser can work individual fingers or be compressed as 1 unit to improve hand, wrist and forearm strength as it identifies, tracks and gives immediate positive feedback on the user's progress.



### Medicine ball

A medicine ball workout will add strength to your core, chest and arms and help improve your balance and flexibility. Also, it does not put any pressure on your joints, while you strength train with it and will help give you a good workout without the risk of an injury. See more at: <http://urbanwired.com/health/benefits-of-medicine-ball-exercises/#sthash.frcA74dA.dpuf>





### Swiss ball

An exercise ball, also known as a Swiss Ball, is a ball constructed of soft elastic with a diameter of approximately 35 to 85 centimeters (14 to 34 inches) and filled with air. The air pressure is changed by removing a valve stem and either filling with air or letting the ball deflate. It is most often used in physical therapy, athletic training and exercise. It can also be used for weight training. The ball, while often referred to as a Swiss ball, is also known by a number of different names, including balance ball, birth ball, body ball, ball, fitness ball, gym ball, gymnastic ball, physioball, pilates ball, Pezzi ball, sports ball, stability ball, Swedish ball, therapy ball, or yoga ball.



### Abduction ladder

Shoulder Abduction Ladder - Ladder made of polished hard wood having Thirty numbered steps for shoulder abduction exercises. It is used to increase the range of motion of the shoulder.



### Parallel bar

Parallel bars are used in rehabilitation or therapy centers to help patients regain strength, range of motion, balance and independence as they learn to walk again or regain coordination. Parallel bars can



be used for patients who need to learn how to walk again, increase their range of motion, regain muscle and learn how to walk without the use of a walker, crutches or cane. Parallel bars allow patients to slowly take their first steps with the support of their hands and with the guidance of a physical therapist. As patients are able to regain their mobility, they will be able to transition from using the parallel bars to walking on the ground without the assistance of a person or device.

### Tilt table

Physical therapists use tilt tables to provide early weight bearing experiences for patients too weak to stand on their own. Tilt tables also help patients with orthostatic hypotension—a significant drop in blood pressure that occurs when they move from a prone to a sitting position. To use a tilt table, the patient lies on top of the table on her back. The physical therapist secures the safety straps around the patient, then slowly elevates the table, putting the patient into a standing position, while monitoring her blood pressure and heart rate throughout the treatment. Tilt table treatments can prevent osteoporosis via weight bearing, as well as ankle contractures, blood clots, pulmonary embolism and other bed rest complications for the hospitalized patient.



### Wheelchair

A wheelchair is a chair with wheels. The device comes in variations allowing either manual propulsion by the seated occupant turning the rear wheels by hand, or electric propulsion by motors. There are often handles behind the seat to allow it to be pushed by another person. Wheelchairs are used by people for whom walking is difficult or impossible due to illness, injury, or disability.



### Crutches

A crutch is a mobility aid that transfers weight from the legs to the upper body. It is often used for people who cannot use their legs to support their weight, for reasons ranging from short-term injuries to lifelong disabilities.

Axillary crutches, elbow crutches and forearm crutches



**Practical (Detailing)**

1. Free exercises
  - a. Upper limb
  - b. Lowerlimb
  - c. trunk
2. Resisted exercise
  - a. Shoulder joint
    - i. Flexors and Extensors
    - ii. Adductors abductors
  - b. Elbow joint
    - i. Flexors
    - ii. Extensors
  - c. Wrist
    - i. Flexors
    - ii. Extensors
    - iii. Ulnar and radial deviators
  - d. Hand
    - i. Finger flexors and extensors
  - e. Hip joint
    - i. Flexors and extensors
    - ii. Abductors and adductors
  - f. Knee
    - i. Flexors and extensors
  - g. Ankle
    - i. Dorsi and plantar flexors
3. Passive movement
  - a. Shoulder girdle
  - b. Shoulder joint
  - c. Elbow joint
  - d. Wrist and fingers
  - e. Hip joint

- f. Knee joint
- g. Ankle
- 4. Fundamental position
  - a. Standing
  - b. Sitting
  - c. Kneeling
  - d. Lying
  - e. hanging
- 5. Derived position
  - a. Standing
  - b. Sitting
  - c. Kneeling
  - d. Lying
  - e. Hanging
- 6. Grading of muscle power of major muscles
  - a. Shoulder
    - i. Flexors and Extensors
    - ii. Adductors abductors
  - b. Elbow
    - i. Flexors
    - ii. Extensors
  - c. Wrist
    - i. Flexors
    - ii. Extensors
    - iii. Ulnar and radial deviators
  - d. Hand
    - i. Finger flexors and extensors
  - e. Hip joint
    - i. Flexors and extensors
    - ii. Abductors and adductors
  - f. Knee

- i. Flexors and extensors
- g. Ankle
- i. Dorsi and plantar flexors
- 7. Range of motion of major joints
  - a. Shoulder joint
  - b. Elbow joint
  - c. Wrist and fingers
  - d. Hip joint
  - e. Knee joint
  - f. Ankle
- 8. Good and bad posture.
  - a. Postural analysis of a given modal
- 9. Preparation and maintenance of exercise therapy equipment.
  - a. Static cycle
  - b. Treadmill
  - c. Quadriceps table
  - d. Shoulder wheel
  - e. Hand exerciser
  - f. Medicine ball,
  - g. Swiss ball
  - h. Abduction ladder
  - i. Parallal bar
  - j. Tilt table
  - k. Wheel chair
  - l. crutches

### **Assessment Activities**

- Seminar
- Assignments
- Chart preparation
- Poster Preparation

- Quiz
- Collection of related materials from magazine

### **TE Questions**

1. Differentiate between active and passive movement
2. Write about different types of active movement
3. Write about the fundamental positions.
4. Short note on
  - o Muscle power grading
  - o Ideal posture
  - o Types of suspension
  - o Free exercise
  - o Principles of passive movement

## UNIT 3.3 HUMAN LOCOMOTION (GAIT)

### Introduction

Gait or human locomotion is very important in physiotherapy. This chapter introduces gait cycle, pathological gait patterns and gait training. Also describes about the transfer techniques.

### Learning outcomes

The learner:

- To understand the steps of normal human locomotion and to identify different pathological gait patterns
- To assist the physiotherapist in different types of gait training
- To gain expertise in the transferring of the patients from bed to chair and vice versa.

### Concepts (Detailing)

#### Definition and Gait cycle

Human gait refers to locomotion achieved through the movement of human limbs. Human gait is defined as bipedal, biphasic forward propulsion of center of gravity of the human body, in which there are alternate sinuous movements of different segments of the body with least expenditure of energy.

When walking, One foot is always in contact with the ground. There is a brief period of double support during the gait cycle when both feet are in contact with the ground. The 4 limbs move in a diagonal reciprocal pattern Eg. – the right arm and the left leg move forward simultaneously, followed by the left arm and right leg. When running, There is a brief moment during the gait cycle when both feet are off the ground

Different gait patterns are characterized by differences in limb movement patterns, overall velocity, forces, kinetic and potential energy cycles, and changes in the contact with the surface (ground, floor, etc.). Human gaits are the various ways in which a human can move, either naturally or as a result of specialized training.

#### The Gait Cycle

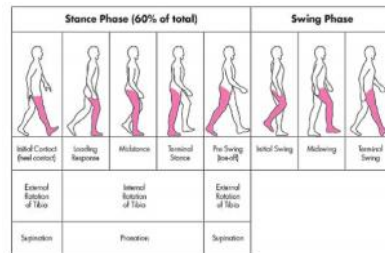
The gait cycle is a repetitive pattern involving steps and strides. A step is one single step, a stride is a whole gait cycle. The step time is the time from one foot hitting the floor to the other foot hitting the floor. Step width can be described as the mediolateral

space between the two feet.

Classification of the gait cycle involves two main phases: the stance phase and the swing phase. The stance phase occupies 60% of the gait cycle while the swing phase occupies only 40% of it. Gait involves a combination of open- and close-chain activities.

**Stance phase** : Begins with the heel strike - this is the moment when the heel begins to touch the ground but the toes do not yet touch. In the midstance phase, we can see settlement of the foot at the lateral border. During the change from mid stance to toe off, the 5 metacarpo phalanges contract. The toe-off phase is also named the propulsive phase.

**Swing phase** : When the stance phase ends, the swing phase begins. This phase is the phase between the toe off phase and the heel strike phase. In the swing phase we can recognize two extra phases - acceleration and declaration. The acceleration phase goes from toe-off to midswing, while declaration goes from midswing to heel strike. In the acceleration phase, the swing leg makes an accelerated forward movement with the goal of propelling the body weight forward. The declaration phase brakes the velocity of this forward body movement in order to place your foot down with control. Between these two phases, the mid-swing phase occurs. In this phase, both feet are under the body, with the heel next to each other



A more detailed classification of gait recognizes six phases:

- Heel Strike
- Foot Flat
- Mid-Stance
- Heel-Off
- Toe-Off
- Mid-Swing

**Heel Strike**-Heel strike, also known as initial contact, is a short period which begins the moment the foot touches the ground and is the first phase of double support.



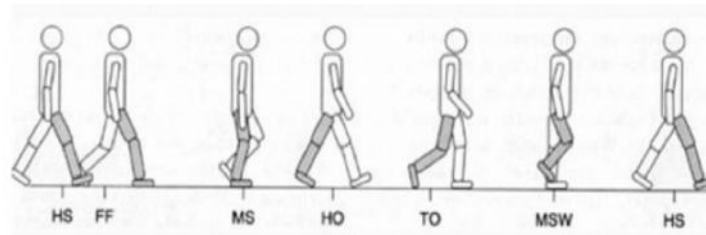
**Foot Flat-** In foot flat, or loading response phase, the body absorbs the impact of the foot by rolling in pronation

**Midstance-**In midstance the hip moves from 10° of flexion to extension by contraction of the gluteus medius muscle.

**Heel Off-**Heel off begins when the heel leaves the floor. In this phase, the body weight is divided over the metatarsal heads.

**Toe Off-**In toe-off, like the name says, the toes leave the ground

**Mid Swing-** In the midswing phase the hip flexes to 30° and the ankle becomes dorsiflexed due to a contraction of the tibialis anterior muscle. The knee flexes 60° but then extends approximately 30° due to contraction of the sartorius muscle. This extension is caused by the quadriceps muscles.



### Pathological gait

Normal walking is the standard against which pathology is measured. Efficiency is often reduced in pathology

**Circumductory gait -Hemiplegic Gait-** often seen as a result of a stroke. The upper limb is in a flexed position, adducted and internally rotated at the shoulder. The lower limb is internally rotated, knee extended and the ankle inverted and plantar flexed. The gait is likely to be slow with circumduction or hip hitching of the affected limb to aid floor clearance

**Scissoring gait-Diplegic Gait.** Spasticity is normally associated with both lower limbs. Contractures of the adductor muscles can create a 'scissor' type gait with a narrowed base of support. Spasticity in the lower half of the legs results in plantarflexed ankles presenting in 'tip toe' walking and often toe dragging. Excessive hip and knee flexion is required to overcome this.

**Festinant gait -Parkinsonian Gait** often seen in Parkinson's disease or associated with conditions which cause parkinsonisms. Rigidity of joints results in reduced arm swing for balance. A stooped posture and flexed knees are a common presentation.

Bradykinesia causes small steps which are shuffling in presentation. There may be occurrences of freezing or short rapid bursts of steps known as 'festination' and turning can be difficult

**Ataxic Gait** is seen as uncoordinated steps with a wide base of support and staggering/variable foot placement. This gait is associated with cerebellar disturbances and can be seen in patients with longstanding alcohol dependency .People with 'Sensory' Disturbances may present with a sensory ataxic gait. Presentation is a wide base of support, high steps and slapping of feet on the floor in order to gain some sensory feedback. They may also need to rely on observation of foot placement and will often look at the floor during mobility due to lack of proprioception.

**High stepping gait -Neuropathic Gaits.** High stepping gait to gain floor clearance often due to foot drop

**Antalgic Gait** Antalgic gait means that the pattern observed is a result of pain. Pain can cause a variety of responses, ranging from a lack of forceful activation up to a full blown flexor withdrawal reaction.

In antalgic gait, the problem is chronic to one degree or another and the patient is attempting to compensate.eg : Degenerative Joint Disease(DJD) /Osteoarthritis(OA), bony or soft tissue trauma, heelspur, etc

### **Gait training**

Gait training is a type of physical therapy that helps people improve their ability to stand and walk. One goal of gait training is preventing falls. Gait training may be recommended after an illness or injury, to help a patient regain independence in walking, even if an adaptive device is needed. Gait training helps strengthen muscles and joints, improves balance, improves posture, develops muscle memory, builds endurance, and retrains the legs for repetitive motion.The secondary benefit of gait training is a reduction of other illness, such as heart disease and osteoporosis, through physical activity and movement. People who choose gait training may become healthier overall than people who choose immobility.

Gait training is usually started as soon as possible after an injury or a health complication. A doctor will prescribe it as part of physical therapy. The patient must be healthy enough for physical activity and movement and have joints that are strong enough to support the therapy.

### Types of weight bearing precautions:

- **Non-weight bearing** : Do not apply any weight through involved leg.
- **Touch down weight bearing**: Allow only the ball of the foot to touch the floor for balance purposes.
- **Partial weight bearing**: Allow a maximum of 50% body weight to be applied to the involved leg.
- **Weight bearing as tolerated**: Allow as much weight as tolerated through the involved leg.

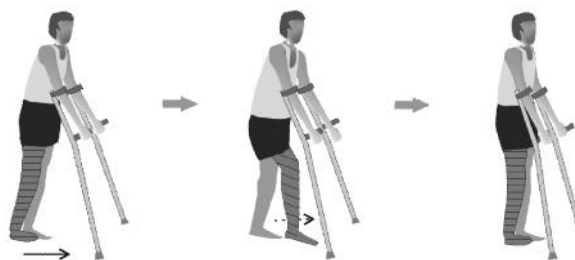
### Use of Crutches

#### Standing up with crutches

- Slide your hips forward to the edge of the chair, bed or toilet seat.
- Keep your injured/healing leg straight and your healthy leg beneath you.
- Place both crutches in the hand of your injured/ healing side, palm down.
- Your injured/healing leg should remain in front of you, bearing no weight.
- Once standing, reach with your free hand for the other crutch and place both crutches under your armpits with your hands firmly grasping the handgrips.

#### Walking with crutches

- At the same time advance both crutches approximately one foot ahead while balancing your weight on your healthy leg.
- Step forward with your injured/healing leg.
- Step forward with your healthy leg, bringing it through the crutches and past the injured/ healing leg.
- Move crutches forward to balance yourself.
- Remember to keep your weight on your hands, not your armpits.
- Keep in mind your crutches take up room on the sides and can get caught on things, so keep a wide space around you.
- Look ahead to where you are walking; don't look at your feet.



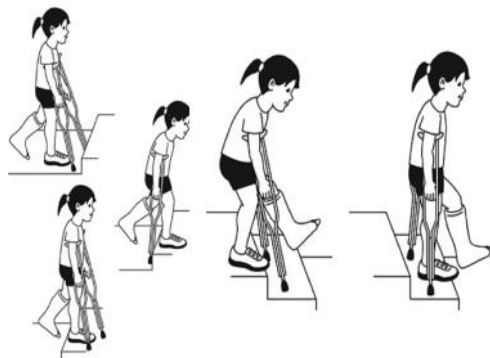
### Climbing stairs with one crutch

- **Ascending:** Walk up the stairs with one crutch if you have a sturdy handrail on one side. Keep one crutch under your arm (opposite side of handrail) while placing the other crutch sideways in the opposite hand. Lift your healthy leg up to the next step, followed by the injured/healing leg, then the crutches
- **Descending:** Walk down the stairs with one crutch if you have a sturdy handrail on one side. Lead with the crutch first, followed by the injured/ healing leg. Then lower your healthy leg.

### Climbing stairs with both crutches

- Do not walk up or down stairs with crutches if you are dizzy or lightheaded or if any steps are wet, icy or snowy.
- In case of emergency, sit down on the step and slide up or down on your bottom, then stand up once you have completed your climb or descent.
- The phrase “**up with the good, down with the bad**” can be used to help you recall which leg to lead with while climbing stairs.
- **Ascending:** Walk up to the bottom step as closely as possible. While putting downward pressure on the crutches with your hands on the handgrips, lift your healthy leg up (“up with the good”) to the first step. Follow with the injured/ healing leg, followed by the crutches.

**Descending:** Bring your feet as close to the edge of the step as possible. Lower both crutches to the next step down and then lower your injured/healing leg (“down with the bad”) to the next step without putting pressure on the leg. Lower your hips while putting pressure on the crutches with your arms. Lower your healthy leg down to the next step.



## Transfer Techniques

Transferring in and out of your wheelchair puts higher stress on arms and shoulders than anything else patients do on a regular basis. Learning the correct way to transfer is extremely important in order to keep the arms functioning and pain-free. Everyone needs individualized transfer training to preserve function and avoid injury. Work with a physical therapist to learn the best transfer technique. Transfer technique may need to be readjusted as years go by. If develop any problems or if living circumstances (e.g. pregnancy) or activities change, go back to your therapist for advice.

### Safe transfer rules and technique

#### Technique

Positioning/setup

Get as close as possible to the surface you want to move to.

Lock your wheels if transferring from a wheelchair.

Put your feet on floor (unless your therapist tells you not to).

Scoot to the edge of your chair.

Get your arm rest out of the way on the side next to the surface you are transferring to.

Lean your trunk forward.

When transferring, your head should move in the opposite direction of your hips. This is known as a head-hips relationship and can help with movement and clearing obstacles. To protect your shoulders, keep your arms as close to your body as possible (about 30-45 degrees away from your body) while you are lifting your weight. To protect your wrists, try to grip an edge or grab bar with your fingers rather than laying your hands flat. Keeping your hands flat and putting your weight on your palms is a dangerous position that can lead to wrist problems such as carpal tunnel syndrome down the road.

#### Lift-off

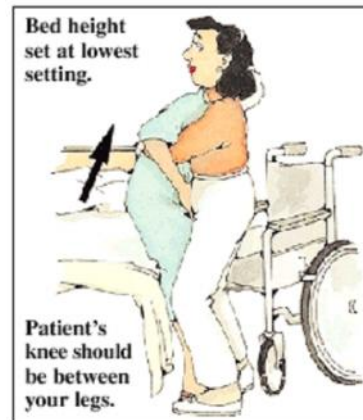
Make sure you are clearing obstacles (not bumping or rubbing) to avoid shearing and pressure sores. If you cannot perform the transfer in one smooth movement while keeping your arms close to your body, move in several small steps and/or use a transfer board. Be careful sliding across the transfer board because the motion can damage your skin. Use a pad or towel on the board when bare skin may come in contact with the board during the transfer. Alternate leading arms and direction of

transfers to keep your arm muscles balanced and reduce strain on one side. Maintain ideal body weight. The more you weigh, the more weight you have to transfer and the more stress you put on your shoulders and arms. If you are unable to perform a transfer safely or are at risk for developing arm pain, you should strongly consider using one of the many kinds of patient lifts available.

### Wheel chair to bed

Steps for transferring from Wheelchair to Bed

1. Have the bed at the lowest level.
2. Park the wheelchair with the person's strongest side next to the bed.
3. Lock the wheelchair brakes and remove feet from foot rests.
4. Swing or remove foot rests from wheelchair.
5. Explain the sequence of lifting and pivoting into the wheelchair (example: on the count of 3, I am going to help you stand up and turn to your strong side; eg right side as in above example; and sit in the wheelchair).
6. Using the bear hug technique, ask the person to place his/her arms on your shoulders as you place your arms around his/her trunk.
7. Bracket their feet with your feet to prevent slipping.
8. Using your leg muscles, stand up and bring the person upward in a slow steady rising motion.
9. Seat the person on the bed
10. Assist in bring the person's legs up onto the bed.
11. Position for comfort.

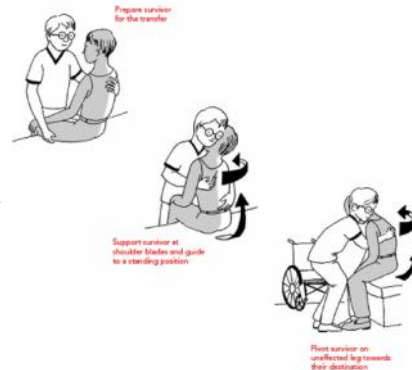


### Bed to wheelchair

Steps for transferring from Bed to Wheelchair

1. Remove clutter from area, including all scatter rugs
2. Discuss with the transferee, the process before and during the transfer
3. The amount of room available for transfer will dictate which side of the bed you will be transferring from.
4. Determine if the transferee has a stronger side, as he/she will be better able to scoot to the edge of the bed on that side prior to transfer.

5. Position wheelchair on the transferee's strongest side (for example if the right side is strongest, you will be transferring from the right side of the bed.)
6. Assist person to be transferred to edge of bed and to sitting position first with feet dangling and then with feet on floor
7. For ease of transfer, position the wheelchair next to the knee on his/her strongest side
8. Pull wheelchair within a foot of the person's knee and lock the wheelchair brakes
9. Explain the sequence of lifting and pivoting into the wheelchair (example: on the count of 3, I am going to help you stand up and turn to your strong side; eg right side as in above example; and sit in the wheelchair)
10. Using the bear hug technique, ask the person to place his/her arms on your shoulders as you place your arms around his/her trunk
11. Bracket their feet with your feet to prevent slipping
12. Using your leg muscles, stand up and bring the person upward in a slow steady rising motion
13. If transferee is capable, have him/her reach for the furthest wheelchair armrest
14. Pivot towards wheelchair seat, and lower slowly
15. Attach or swing foot rests of wheelchair into place
16. Place person's feet onto foot rests of wheelchair.



#### 4. Practical (Detailing)

1. Demonstration of gait and identification of its phases
  - a. Stance
  - b. swing
2. Demonstration of pathological gait
  - a. Cicum ductory

- b. Scissoring
  - c. Festinant
  - d. Ataxic
  - e. High stepping
  - f. Antalgic
3. Crutch walking
    - a. Non Weight Bearing
    - b. Partial Weight Bearing
    - c. Full Weight Bearing
    - d. Ascending
    - e. Descending
  4. Transfer technique
    - a. Wheel chair to bed
    - b. Bed to wheel chair

### **Assessment Activities**

- Chart preparation
- Poster Preparation
- Collection
- Model Preparation
- Practical presentation

### **TE Questions**

1. Define gait
2. Write about the phases of gait cycle
3. Short note on
  - Scissoring gait
  - Cicumdectory gait



## UNIT 3.4 HYDROTHERAPY

### Introduction

Hydrotherapy is the use of water in the treatment of different conditions, including arthritis and related rheumatic complaints. Hydrotherapy differs from swimming because it involves special exercises that do in a warm-water pool. The water temperature is usually 33–36°C, which is warmer than a typical swimming pool.

### Learning Outcomes

The learner:• To gain expertise in the preparation of pool for treatment session and assisting the physiotherapist in the pool during treatment

- To gain expertise in the preparation of contrast bath session and assisting the physiotherapist in treatment.
- To gain expertise in the preparation for cryo therapy treatment session and assisting the physiotherapist in treatment

### Concepts (Detailing)

Hydrotherapy, formerly called hydrotherapy, is a part of medicine and alternative medicine, in particular of naturopathy, occupational therapy and physiotherapy, that involves the use of water for pain relief and treatment. Hydrotherapy is the use of water to treat a disease or to maintain health. The theory behind it is that water has many properties that give it the ability to heal:

1. Water can store and carry heat and energy.
2. Water can dissolve other substances, such as minerals and salts.
3. Water cannot hurt you, even if you are sensitive to your surroundings.
4. Water is found in different forms, such as ice, liquid, or steam. Ice may be used to cool, liquid is used in baths and compresses at varying pressures or temperatures, and steam is used in steam baths or when breathing in.
5. Water can help blood flow.
6. Water has a soothing, calming, and relaxing effect on people, whether in a bath, shower, spray, or compress.
7. Exercise in water takes the weight off a painful joint while also providing resistance.

People use hydrotherapy to treat many illnesses and conditions, including acne; arthritis; colds; depression; headaches; stomach problems; joint, muscle, and nerve

problems; sleep disorders; and stress. People also use it for relaxation and to maintain health. You can also use hydrotherapy to reduce or relieve sudden or long-lasting pain.

### **Pooltherapy**

As the name implies, pool therapy is generally conducted with participants submerged in a swimming pool that is deep enough to reach their shoulders or neck. Pool offers multiple depths and an adjustable current for variable levels of resistance exercise or swimming. Aquatic exercise is especially helpful for rehabilitation of leg injuries or for conditions with limited tolerance for land-based therapy such as fibromyalgia, arthritis, and some types of back pain. Also, a mechanical lift enables most patients to easily enter and exit the pool. Ask your physician if your condition is appropriate for aquatic therapy.

Each facility's approach to water therapy instruction may differ a bit depending on the focus of the class, but participants should look for the following:

- A clean, well lit pool that is comfortably warm but not hot, usually between 90° and 94° f. cooler pools may be safely used as well, but the comfort of the warmer water may be useful
- A knowledgeable instructor who explains and demonstrates exercises
- A set of exercises that works various joints and areas of the body, from the neck, through the back, and down to the feet
- Use of flotation devices, such as belts, barbells, or boards, to provide added resistance or stability.



### **Contrast bath**

Contrast bath also known as “hot/cold immersion therapy is a method of treating muscle soreness, swelling, and inflammation. It was also used for treating joint injuries, mild sprains, symptoms of chronic pain and repetitive strain injuries. Contrast baths can be done at home to treat inflammation and pain. It is also widely used by athletes to speed up muscle recovery after strenuous exercise. Cold water constricts the blood vessels (Vasoconstriction) and hot water opens up the blood vessels (Vasodilation) this creates a “pumping action” that forces circulation. Contrasting is

also much easier and more practical and effective to apply to the limbs, so the best common candidates for contrasting are: plantar fasciitis, shin splints, carpal tunnel syndrome, tennis elbow and Achilles tendinitis. Contrast baths is used as a standard part of many rehab facilities for treating musculoskeletal injuries, especially with repetitive strain or overuse injuries

### **The Process**

Before you start, you will need:

Two containers large enough and having the proper shape to allow the body part to be treated

Water-bath thermometer

Drape sheet

Towels (for drying and to put under the basins)

Cold compress for the head (cold washcloths)

Pitcher to remove and add hot water

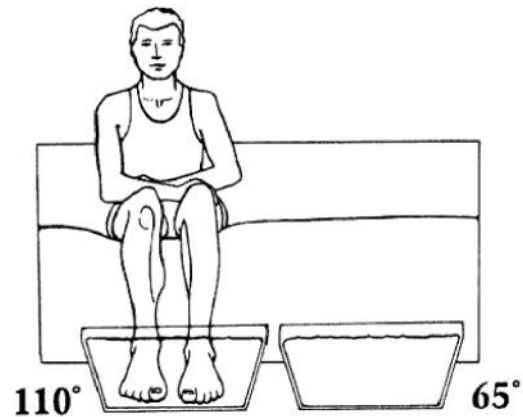
Means for heating water if not near a tub or sink

Ice for cold compress and cold bath

### **Procedure for hot and cold contrast bath**

Place the body part(s) to be treated in hot water 104 degrees F. (40 degrees C.) for 3-4 minutes. Apply a cold compress to the head. Then place the body part in ice water or tap water—45 to 70 degrees F. (7-21C) for 30 seconds to 1 minute). While they are in the cold, increase the temperature of the hot water each time, but do not exceed 110 degrees F (43 degrees C). In other words, after each change, increase the contrast between the hot and cold. Make 6 to 8 changes and always end with cold (except in cases of rheumatoid arthritis, in which case/in which you would end in hot) and dry thoroughly.

As previously mentioned, warm and cool contrast baths are performed for diabetic individuals, but should not be attempted by a layperson. Warm water is defined as 92 degrees F to 100 degrees F. Cool water is between 70 and 80 degrees F. If the person is a diabetic, do not exceed 102 degrees F (give only if the foot pulses are palpable).



### Cryotherapy

Cryotherapy in physical therapy is the application of cold for treatment of symptoms of or problems associated with musculoskeletal conditions, such as strains and sprains. Cryotherapy is also called cold therapy.

Health experts generally agree that cryotherapy should be the initial treatment for acute injuries, such as muscle strains and sprains. Cold can help relieve your pain. In addition, cold helps in vasoconstriction of blood vessels at the site of injury, thereby, limiting bleeding and edema formation.

### Side-effects of cryotherapy

Cold application is relatively safe when appropriately done. Prolonged exposure to a cold modality may lead to frostbite injury. To avoid frostbite injury during physical therapy treatment, the physical therapist should follow the recommended time of cold application. If a commercial cold pack or cold hydrocollator pack is used, it should be wrapped with several layers of towel before application.

### Types of Cryotherapy Application

Cryotherapy may be employed by way of any of the following: Ice massage, Ice packs, Commercial cold gel (hydrocollator) packs, Cold sprays and Cold whirlpool baths.



### **Practical (Detailing)**

1. Application of contrast bath of given subject
2. Application of cryotherapy

### **Assessment Activities**

- Seminar
- Assignments
- Practical performance

### **TE Questions**

1. Short note on
  - Indication of pool therapy
  - Contrast bath
2. Write about the different types of cryotherapy application

## UNIT 3.5 SUSPENSION THERAPY

### Introduction

Therapeutic exercises given to the patients to increase ROM and muscle power while supporting body parts by using ropes, pulleys and slings

### Learning Outcomes

The learner:

- The learner will be able to
- Gain expertise in the preparation and maintenance of the suspension unit and assisting the physiotherapist in
- Treating patients using suspension unit

### Concepts (Detailing)

The technique is used to free a body part from the resistance of friction while it is moving the part. It is suspended in a sling attached to a rope that is fixed to an appropriate point above the body segment. Suspension training is a tool that uses body weight and gravity to challenge the neuromuscular system in ways conventional exercises are unable to accomplish. The suspension trainer provides an alternative to working out with an exercise machine. The system-which uses a device that hangs from the ceiling-was developed by Navy Seals.

Suspension training begins with an upside-down, Y-shaped strap system hanging securely overhead. Exercises involve the user holding on with one or two hands or feet with one or two limbs contacting the ground. The user must always be in contact with the ground, except when performing more advanced plyometric physiotherapy exercises.

### Benefits of Suspension for rom Exercise

- Active participation is required thus the patient learn to use the appropriate muscle for desired movement
- Relaxation is promoted through secure support and smooth rhythmic motion
- Little work is required of stabilizing muscles because the part is supported
- Modification can be made to the system to provide grades of exercise resistance
- After instruction the patient can often work independently of a therapist
- Suspension therapy is a form of assisted exercise

Different types of Ropes, slings, pullies and clips are used to suspend body part

## Types of suspension

### Vertical fixation

The rope is fixed so that it hangs vertically above the centre of gravity of the part to be suspended. The centre of gravity of each part of the body is, at the junction of the upper and middle third. The point of attachment of the rope is over the center of gravity of the moving segment. The part can then move like a pendulum. The movement is small range. This type is used for support.

### Axial fixation

This occurs when all the ropes supporting a part are attached to one 'S' hook which is fixed to a point immediately above the centre of the joint. The point of attachment of the all the rope supporting the part is above the axis of the joint to be moved. The part will move on a flat plan parallel to the floor. This type of fixation allows for maximum movement of the joint.



### *Guthrie smith apparatus*

#### Practical (Detailing)

Preparation and positioning of axial and pendular suspension

#### Assessment Activities

- Practical performance

#### TE Questions

The instrument used for suspension therapy is known as \_\_\_\_\_

## UNIT 3.6 RELAXATION

### Introduction

Planned relaxation calms anxiety and helps body and mind to recover from everyday rush and stress. Music, a long soak in the bath, or a walk in the park do the trick for some people, but for others it's not so easy.

### Learning outcomes

The learner:

- Student will be able to teach the patient the way of attaining good relaxation prior to the treatment

### Concepts(Detailing)

Relaxation techniques

A relaxation technique is any method, process, procedure, or activity that helps a person to relax; to attain a state of increased calmness; or otherwise reduce levels of pain, anxiety, stress or anger. Relaxation techniques are often employed as one element of a wider stress management program and can decrease muscle tension, lower the blood pressure and slower heart rate and breath rates.

Choose a quiet place where you won't be interrupted. Before you start, do a few gentle stretching exercises to relieve muscular tension. Make yourself comfortable, either sitting or lying down. Start to breathe slowly and deeply, in a calm and effortless way. Gently tense, then relax, each part of your body, starting with your feet and working your way up to your face and head. As you focus on each area, think of warmth, heaviness and relaxation. Push any distracting thoughts to the back of your mind; imagine them floating away. Don't try to relax; simply let go of the tension in your muscles and allow them to become relaxed. Let your mind go empty. Some people find it helpful to visualise a calm, beautiful place such as a garden or meadow. Stay like this for about 20 minutes, then take some deep breaths and open your eyes, but stay sitting or lying for a few moments before you get up.

### Contrast Method

Pull your feet up towards you as hard as you can then relax them

Point your toes away from you then relax them

Either push your knees down into the pillow (if you are lying down) or push your feet down into the floor (if you are sitting down) then relax



Tighten your buttocks then relax them

Make a tight fist with both hands then relax them

Stretch both hands out into star shapes then relax them

Tighten the muscles around your elbows and either push down into the bed or onto the arms of the chair then relax them

Pull your shoulders up towards your ears then relax them

Push your head back into the pillow or head rest then relax

Now your muscles are in a better state of relaxation. Stay in the position from your contrast method and begin to focus on your breathing. Try not to change your breathing pattern. With every breath in feel your chest rise, and with every breath out feel your chest fall. As your chest falls feel yourself sink slightly further into the chair or bed. Try to do this for at least 10 minutes.

### **Practical (Detailing)**

Preparation and positioning of the given subject for relaxation

### **Assessment activities**

Attention on practical procedures

### **TE Questions**

Write about definition and technique of relaxation

## UNIT-3.7 CHEST PHYSIOTHERAPY

### Introduction

Chest physiotherapy also known as chest physical therapy (CPT) is a treatment that helps to remove the excess secretions (also called mucus, phlegm, sputum) from inside the lungs, by physical means. It is used to assist a cough, re-educate breathing muscles to improve ventilation of the lungs. For some people, this treatment is only needed for a short time after a lung illness. Others with chronic lung diseases will need to perform this treatment daily because they have a lot of mucus in the upper airways where it can be coughed out. This reduces the chance of lung infection and makes breathing more comfortable.

### Learning Outcomes

The learner:

- understand the importance of breathing exercise
- demonstrate inspiratory and expiratory breathing exercise
- understand the techniques of postural drainage

### Concepts (Detailing)

#### Aims of chest physiotherapy:

1. To prevent accumulation of secretion.
2. Drainage of secretion.
3. To reduce the work done in breathing.
4. To maintain and improve chest wall mobility.
5. To improve breathing pattern.
6. To educate normal and efficient breathing pattern.
7. To develop respiratory muscles endurance.
8. To improve cardiopulmonary exercise tolerance.

Chest physical therapy includes postural drainage (bronchial drainage therapy), active cycle of breathing technique (ACBT), autogenic drainage, positive expiratory pressure technique (PEPT), chest percussion, chest vibration, turning, breathing exercises, forced expiratory techniques (FET) eg. coughing and huffing and incentive spirometry.

#### Postural drainage

Postural drainage technique in which the patient assumes one or more positions that will facilitate the drainage of secretions from the bronchial airways. The procedure uses gravity to move secretions toward the trachea, where they can be coughed up.

more easily. External manipulation of the thorax includes percussion (or "clapping,") and vibration, often done in conjunction with postural drainage

**Percussion** involves rhythmic striking of the chest wall over the area being drained. The manual method is done.

With hands cupped, fingers flexed, and thumbs held tightly against index fingers. If done properly, a hollow sound is heard and there is no discomfort to the patient.

**Vibration** is done immediately after percussion and is directed to the same area. While the patient performs a prolonged exhalation through pursed lips, the therapist presses the flat of the hands or the mechanical device

against the thorax in a downward movement toward the midline of the body. This is repeated four or five times.

The purpose of both activities is to dislodge plugs of mucus, allowing air to penetrate behind them and thus aid in their removal.

### Breathing exercise

Exercise that enhances the respiratory system by improving ventilation, strengthening respiratory muscles, and increasing endurance. It is used in pulmonary rehabilitation

#### Goals

- To strengthen the abdominal muscles and diaphragm.
- To decrease the use of the accessory muscles of respiration.
- To decrease the work of breathing.
- To increase the efficiency of breathing.
- To increase thoracic cage mobility and tidal volume.
- To assist in removal of secretions.
- To increase chest wall compliance.
- To increase exercise tolerance.

**Indications** Breathing exercises are indicated in any pathological state, which causes the patient to use his muscles of respiration inefficiently resulting in an impairment of pulmonary function; generally, any patient with an abnormal pattern of breathing or increased work of breathing. They are done in conjunction with cough effort to assure total lung clearing.

**Contraindications:** Voluntary breathing exercises are contraindicated:

- In acute medical or surgical emergencies.
- In a patient whose level of consciousness does not allow his full cooperation.
- Significant pain or discomfort: although most definitely not a contraindication to therapy, pain or discomfort should be considered by the therapist and all possible steps taken to relieve it if it interferes with the patient's cooperation.

Step	Action
1	Check patient's medical record for physician's orders.
2	Wash hands.
3	Explain purpose/goals of breathing exercise(s) to the patient.
4	Position patient for most efficient breathing pattern
5	Auscultate patient's chest.
6	Instruct patient on specific breathing exercise.
7	Have patient repeat exercise until he/she is performing it adequately without supervision.
8	Have patient cough. Auscultate chest.
9	Therapist may demonstrate by exaggerated pantomime.
10	Document outcome/effectiveness of breathing exercise(s) on RCS treatment card.
11.	Maintains proper medical and departmental records, per RCS Policies 7.1.1 and 7.1.2.

### Pursed-Lip Breathing - Detailed Purpose



Helps to maintain higher and expiratory pressure in the airways. Prevents alveolar collapse and extends alveolar collapse time onset

Step	Action
1	Instruct patient to pucker his/her lips in a whistling position.
2	Ask patient to exhale slowly and completely.
3	Have patient repeat exercise.
4	May be used in conjunction with diaphragmatic breathing.

#### Diaphragmatic Breathing - Detailed Purpose

Used to help strengthen and train the diaphragm and other respiratory abdominal muscles. To increase tidal volume.

Step	Action
1	Position the patient in a 45° relaxed sitting position with the back and head supported.
2	The therapist places hand on the patient's upper abdomen.
3	Have the patient inhale through nose, letting the therapist's hand rise during inspiration.
4	Then have the patient exhale through pursed-lips, while the therapist's hand presses inward on the abdomen.
5	Have the patient perform this exercise with patient's hand on upper abdomen.
6	Have patient repeat exercise until adequate expansion is achieved.
7	The patient should relax upper chest and shoulders.
	Lateral Costal Excursion - Detailed Purpose

**Mobilize the thoracic cage.** Help relieve splinting from incision or abdominal pain.

Step	Action
1	Have the patient sit erect on the edge of the bed or chair.
2	The therapist should place hands over the patient's lower ribs or upper abdomen.
3	Instruct the patient to exhale, while the therapist applies firm pressure against the patient's ribs and abdomen with hands. Have the patient exhale through pursed-lips.
4	Have the patient inhale, pushing the lower ribs outward against the therapist's hands. The therapist should gradually increase resistance to this movement, as much as can be tolerated by the patient.
5	Have the patient perform this exercise using own hands.

#### Undesirable Side Effects :

Patient who is unable to perform exercise easily may increase the work of breathing, by use of accessory muscles.

#### Assessment of Outcome

Breathing exercises shall be considered effective when the patient's pulmonary function improves as measured by one or more of the following means:

##### Subjective:

- The patient's complaint of shortness of breath has resolved or significantly improves.

##### Objective:

- Significant improvement in Arterial Blood Gases.
- Significant improvement in X-rays.
- Significant improvement in tidal volume or forced vital capacity.
- Equal bilateral chest excursion where unequal excursion existed prior to the institution of therapy.
- Decreased work of breathing; decreased respiratory rate.
- Effective voluntary or reflex cough mechanic.

### Patient Teaching

Step	Action
1	The tactile sense is most helpful in instructing a patient to assume a more appropriate breathing pattern. The therapist's hands are placed over the areas where muscular movement is desired and the patient is encouraged to concentrate on expanding the part of the chest under the hands.
2	For segmental breathing instruction, the therapist's hand is placed on the chest area to be expanded. The patient is encouraged to breathe deeply and to preferentially "send air" to that area of the chest where tactile stimulation is being applied by the therapist. On full expiration, moderate compression is applied.
3	It is often helpful to have a patient with obstructive disease exhale through "pursed lips," a maneuver that increases resistance to exhalation at the mouth. This maneuver is Continued believed to transmit an early expiratory backpressure to the bronchial tree and the backpressure is believed to prevent early collapse of small bronchioles and improve exhalation from alveoli (specifically COPD patients).
4	The patient is encouraged to perform pursed-lip breathing while climbing stairs, bathing, getting dressed and lifting.

#### Practical (Detailing)

1. Breathing exercise
  - a. Inspiratory Breathing exercise
  - b. expiratory Breathing exercise

#### Assessment Activities

Attention on practical procedures

Performance in lab

#### TE Questions

1. Write about the common aims of chest physiotherapy.
2. Write short note on
  - Postural drainage
  - Types of breathing exercise

## UNIT-3.8

### ELECTROTHERAPY

#### Introduction

Electrotherapy is a form of medical treatment, which uses small electrical impulses to repair tissue, stimulate muscles and increase sensations and muscle strength. There are several different forms of electrotherapy; these include ultrasound, interferential therapy, transcutaneous electrical nerve stimulation (TENS), laser therapy and muscle stimulation. Ultrasound uses sound waves to speed up the healing process, while interferential therapy and TENS reduce pain by manipulating the nerves which reduces the sensation of pain and produces a tingling feeling. Laser therapy is sometimes used to repair damaged tissue; using lasers means the treatment can be both accurate and intense.

#### Learning Outcomes

The learner:

- Understand the advantages of electrotherapy
- Categorize the electrotherapy equipments
- Prepare the patient and equipments for treatment
- Understand the types and importance of heating modalities
- Understand the Physiological and Therapeutic effects of heat.
- To know the application of modalities
- To know where to use and not to use electrotherapy
- To gain expertise in maintain and checking various electrotherapy equipments and assist the physiotherapist in electrotherapy treatment.

#### Concepts (Detailing)

##### Effects and benefits of electrotherapy

The benefits of electrotherapy are wide-ranging and include a more advanced healing process, a more effective circulatory system and increased muscle tone. The effects of electrotherapy include a reduction in pain, increased strength, increased range of movement, increased speed and strength of muscle contractions and an increased rate of absorption. Classification -low frequency, medium frequency and high frequency equipments



Classification of therapeutic currents according to frequency

### **Low Frequency**

Current in which the direction of electron flow changes periodically with a frequency of 1-1000 Hz. The treatment promotes local blood circulation and muscle build-up, and inhibits inflammation and reduces swellings. Above all, in the event of weakened and partially paralysed musculature, the function of the muscle can be maintained and the weakness can be reduced.

### **High frequency**

Those current of 10,000 Hz or more.

### **Medium Frequency**

Current in which alternate the direction of flow of electrons with a frequency between 1000-10.000 Hz . Depending on the form of application, the primary effect is the alleviation of pain or the stimulating impact with muscle contraction and subsequent muscle relaxation. In the process, circulation improves, swellings are reduced and the musculature is relaxed.

### **I. Low & II-Medium Frequency Modalities**

TENS (transcutaneous Electrical Nerve Stimulation)

High-Voltage pulsed stimulation

Neuromuscular Electrical Stimulation

Galvanic Stimulation

Russian current

Faradic current

Iontophoresis

Interferential Therapy (I.F.T)

### **III. High Frequency Modalities**

Shortwave Diathermy (S.W.D) Microwave Diathermy (M.W.D) Ultra Sound Therapy (U.S) Shockwave therapy

### **IV-Actinotherapy**

Infra - red Radiations (I.R.R) Ultraviolet Radiations (U.V.R) Laser Therapy

### Other Modalities

Continuous Passive Mobilizer (C.P.M) Traction unit (Cervical & Lumbar Traction) Paraffin Wax Bath (P.W.D) Hydrocollator Unit Hydrotherapy – Whirlpool therapy Fluido – Therapy

### Preparation and safety measures for patient and equipments

#### Electrotherapy Patient Preparation

Examine the skin for any wounds and clean the skin. Apply the electrodes to the treatment area. Ensure the electrodes are applied securely to the skin. Ensure good contact between each electrode and the skin. Check the electrode contact regularly during the treatment. Examine the skin again after the treatment. Choose electrodes that fit the anatomy.

**Avoid Water**-A critical precaution when working with electrical equipment is staying out of water.

**Check for Live Wires**-Before beginning work, check to ensure what you're working on is not energized. Use an electrical current tester to check for live or hot wires.

**Prevent Shocks**-Prevent shocks from happening by covering the bare ends of a wire in a service panel with a small plastic cap. If you touch the end by mistake, the cap works as an insulator for the copper and eliminates being shocked.

#### Thermotherapy

The external application of heat is thermotherapy. Heat can be transferred into the body by conduction, convection, and radiation. **Conduction** is the exchange of thermal energy, while the body's surface is in contact with the thermal agent, such as hot packs. **Convection** is a faster process and involves contacting the body's surface with heat energy through a fluid or gaseous method; such as a whirlpool bath or a steam bath.

**Radiation** is the transfer of heat energy in electromagnetic rays through a conducting medium, such as infrared lamps.

**Moist heat** is transferred by conduction and convection. **Dry heat** is transferred by radiation. Moist heat is the best form of heat for enhancing general relaxation. Physiologic responses to heat are superficial. When our bodies encounter heat, we react in several ways.

- Sweating is stimulated and evaporation cools the body.
- Blood vessels near the skin surface begin to dilate and excess heat is lost through the skin. This flushes the skin.

- Our behavior will be altered. Feeling hot makes us uncomfortable and we make environmental adjustments; such as turning on the air conditioner or turning down the thermostat.

### **Benefits of Thermotherapy**

1. Alleviates pain by reducing endorphins when applied.
2. Increases white blood cells, stimulating an immune system response.
3. Soothes, comforts, and sedates as long as inflammation is not present.
4. Reduces muscle spasms.
5. Increases blood volume, oxygenation, and nutrition.
6. Distends and softens superficial fascia.

### **Contraindications of Thermotherapy**

1. Tumor or malignancy
2. Recent injury
3. Recent contusion
4. Phlebitis
5. Diabetes
6. Hypertension
7. Cardiac impairment
8. Recent burn or sunburn
9. Edema
10. Directly over eyes or external genitalia
11. Cerebrovascular accident
12. Fever
13. Open wounds or skin infections
14. Sensory impairment
15. Pregnancy

### **Thermotherapy Applications**

Heat therapy or thermotherapy applications include, but are not limited to the following:

1. Whirlpool baths
2. Warm immersion baths
3. Spas
4. Hydrotherapy tubs
5. Paraffin baths
6. Saunas
7. Spinal packs
8. Steam baths

Warm immersion baths and whirlpool baths are tubs for soaking or contain jets of water.

Both are drained after each use. Hydrotherapy tubs or spas are similar to immersion baths and whirlpool baths, but the water is treated to remain sanitary and available for multiple uses. Soaking can range from fifteen to twenty minutes. If the water is hotter, then shorter treatment time is used. Healthy clients may take one to two per week. Additives such as salt may be used to add to the therapeutic value. Epsom salts can be used.

Whirlpool baths in spa treatments are also known as hydromassage treatments since the jets push water toward the sides of the tank and not on the affected areas. When warm water immersion is combined with light exercise, a Hubbard Tank is used. This is often used in rehabilitation.

### **Brief Description of Electrotherapy Equipments**

#### **Infra Red Lamp**

Infrared heat lamps are a simple and inexpensive, yet incredibly effective treatment for pain, muscle strains, rashes, acne and infections, including hard to reach infections of the nose, ears and sinuses. Infrared heat lamps are red-coloured infrared bulbs that are sold as “heat lamps.”

#### **Benefits**

A single infrared heat lamp directed at an area of the body provides excellent and often surprising benefits.

- Improved circulation.
- Deep penetration, up to several inches inside the body.

- Encourage cells to release toxins.
- Improved oxygenation and hydration of the tissues.
- Killing infections and parasites.
- Disable harmful microorganisms, including those that cause flu, colds, Lyme disease and many other conditions.
- Faster tissue and wound healing.
- Relaxing for muscles and calming for the nervous system.
- Quicker workout recovery.
- Pain. Neck, shoulder, elbow, knee and back pain respond well to the soothing heat of an infrared lamp. The penetrating heat promotes healing and rejuvenation. The frequencies of the light speed healing and recovery.



### Ultrasound therapy

Ultrasound is a therapeutic modality that has been used by physical therapists since the 1940s. Ultrasound is applied using a round-headed wand or probe that is put in direct contact with the patient's skin. Ultrasound gel is used on all surfaces of the head in order to reduce friction and assist in the transmission of the ultrasonic waves. Therapeutic ultrasound is in the frequency range of about 0.8-3.0 MHz.

The waves are generated by a piezoelectric effect caused by the vibration of crystals within the head of the wand/probe. The sound waves that pass through the skin cause a vibration of the local tissues. This vibration or cavitation can cause a deep heating locally though usually no sensation of heat will be felt by the patient. In situations where a heating effect is not desirable, such as a fresh injury with acute inflammation, the ultrasound can be pulsed rather than continuously transmitted.

Ultrasound can produce many effects other than just the potential heating effect. It has been shown to cause increases in tissue relaxation, local blood flow, and scar tissue breakdown. The effect of the increase in local blood flow can be used to help reduce local swelling and chronic inflammation, and, according to some studies, promote bone fracture healing. The intensity or power density of the ultrasound can be adjusted depending on the desired effect. A greater power density (measured in watt/cm<sup>2</sup>) is often used in cases where scar tissue breakdown is the goal.

A typical ultrasound treatment will take from 3-5 minutes depending on the size of the area being treated. In cases where scar tissue breakdown is the goal, this treatment

time can be much longer. During the treatment the head of the ultrasound probe is kept in constant motion. If kept in constant motion, the patient should feel no discomfort at all. If the probe is held in one place for more than just a few seconds, a build up of the sound energy can result which can become uncomfortable.

Some conditions treated with ultrasound include tendinitis, non-acute joint swelling, muscle spasm, and to break down the scar tissue. Contraindications of ultrasound include local malignancy, metal implants below the area being treated, local acute infection, vascular abnormalities, and directly on the abdomen of pregnant women. It is also contraindicated to apply ultrasound directly over active epiphyseal regions (growth plates) in children, over the spinal cord in the area of a laminectomy, or over the eyes, skull, or testes.

### Short wave Diathermy



Short Wave diathermy current is a high frequency alternating current. The heat energy obtained from the wave is used for giving relief to the patient. Its frequency is 27,120,000 cycles per second and the wavelength is 11 metre.

### Types of Applications

- The condenser field method (commonly used)
- Cable method

### Indications

- Inflammation of shoulder joint
- Inflammation of Elbow Joint (Tennis Elbow)
- Degeneration of joints of neck (Cervical Spondylosis)
- Degeneration of joints like knee and hip (Osteoarthritis)
- Ligament Sprains in knee joint

Low Back Ache  
Plantar fasciitis (Heel Pain)  
Sinusitis

**Contraindications -General**

High Fever  
Fluctuating Blood Pressure  
Very sensitive Skin  
Persons with Untreated Fits  
Persons using Cardiac Pace Maker  
Severe kidney and heart problems  
Pregnant Women  
Mentally Retarded Individuals  
Tuberculosis of Bone  
Malignant cancer

**Local**

If the treatment area has:  
Open wounds  
Skin disease  
Unhealed scars  
Recent burns

**Treatment Time**

Initial Stage - 5-10 minutes  
Moderate Stage - 10-20 minutes  
Severe State - 20-30 minutes

**Advantages**

Relaxation of the muscles  
Effective in bacterial infections

Relief of pain

### Disadvantages

Burns

Scalds (Boils)

Overdose

Shock

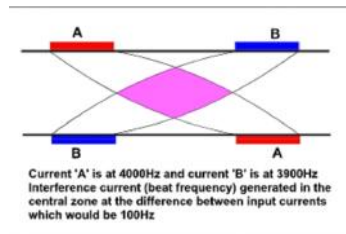
Electric Sparking

Faintness



### Interferential Therapy

Inter Ferential Therapy (IFT) uses a Mid frequency - current for treatment. The basic principle of Interferential Therapy (IFT) is to utilise the significant physiological effects of low frequency (<250pps) electrical stimulation of nerves without the associated painful and somewhat unpleasant side effects sometimes associated with low frequency stimulation



#### The physiological effects include:

1. An increase in localized blood flow which can improve healing by reducing swelling and as a result helps remove damaged tissue and bring nutrients necessary for healing to the injured area



2. The stimulation of local nerve cells that can have a pain reducing/anaesthetic effect due to potentially blocking the transmission of the pain signals (pain gate mechanism) or by stimulating the release of pain reducing endorphins (opioid mechanism)
3. Some degree of muscle stimulation as muscle contraction can be achieved through external application of an electrical current, overcoming some of the muscle inhibition often caused by local injury and swelling

The electrical current is applied to the affected area using four electrodes. The four electrodes are placed in such a way that the two currents produced cross each other in the affected area. For example, if it is a knee injury that is being treated, the two currents can be applied so that they cross deep within the actual knee joint itself. Where the two currents meet, they actually ‘interfere’ with each other; hence the name ‘interferential.’

### Indications

#### Individuals with

- Pain
- Muscles spasm (pain and tightness)
- Swelling
- Muscles strain

#### **Contraindications** -If the Treatment area has:

- Localised wounds
- Unhealed scar
- Recent cuts
- Skin infection

### **Transcutaneous Electrical Nerve Stimulator**

Transcutaneous electrical nerve stimulation (TENS or TNS) is the use of electric current produced by a device to stimulate the nerves for therapeutic purposes. TENS, by definition, covers the complete range of transcutaneously applied currents used for nerve excitation. The unit is usually connected to the skin using two or more electrodes. A typical battery-operated TENS unit is able to modulate pulse width, frequency and intensity. Generally TENS is applied at high frequency (>50 Hz) with

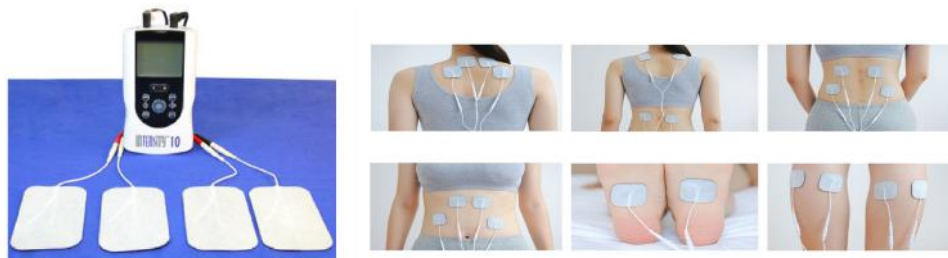
an intensity below motor contraction (sensory intensity) or low frequency (<10 Hz) with an intensity that produces motor contraction. While the use of TENS has proved effective in clinical studies, there is controversy over which conditions the device should be used to treat.

### Transcutaneous Electrical Nerve Stimulation Unit

A transcutaneous electrical nerve stimulation (TENS) unit is a device that sends small electrical currents to targeted body parts. These currents are used to relieve pain. Some TENS units are designed for use in a hospital or healthcare facility. Others are safe to use at home. The pain may be located anywhere on the body.

A transcutaneous electrical nerve stimulation unit sends electrical pulses through the skin. These pulses control pain signals in the body, creating temporary or permanent relief from pain. They can control abnormally excited nerves and release endorphins.

TENS therapy is used for many conditions, including bursitis, arthritis, tendonitis, surgery, migraines, and headaches. It is also used for injuries and wound A transcutaneous electrical nerve stimulation unit sends electrical pulses through the skin. These pulses control pain signals in the body, creating temporary or permanent relief from pain. They can control abnormally excited nerves and release endorphins.



### Cold pack

Ice packs made of plastic or cloth are preferred over commercial ice packs because the commercial ones frequently break spilling chemicals over the body. Place a paper towel or thin cloth over the area prior to the application of ice, to protect the skin. Apply for twenty minutes. Crushed ice in a towel or slushy ice water in a zipped plastic bag may be easily made. A mixture of 2/3 water and 1/3 alcohol will prevent the mixture from freezing solid and will allow the application to conform to the affected area. Double-bagging will prevent leakage. The effects of ice packs include pain relief, prevention of swelling and bruising, and decreased blood flow.



### Hot Pack

Hydrocollator packs, hot compresses, hot dressing, and fomentation packs are all known as hot packs. These packs are moist heat applications used to relieve pain. A hydrocollator holds water between 140 and 160° Fahrenheit. The hydrocollator pack is made of canvas and is filled with silicon granules. The pack will hold heat approximately thirty minutes. Massage therapists use hot packs to prepare an area for massage, since heat will soften fascia and dilate superficial blood vessels. Place a towel or other material on the skin or around the pack to prevent burning the client's skin. Make sure the client is comfortable after the pack is applied. Never allow the client to lie on the hot pack. Check the skin periodically for signs of damage or irritation. Allow the pack to remain on the area for twenty minutes and then proceed with the massage. A cold compress may be placed on the client's forehead or back of the neck if the client perspires.



### Wax bath

Paraffin Baths (122 – 130o Fahrenheit)

Paraffin wax treatments are used to apply heat energy to the tissues and is most useful with injuries to angular bony arches. The petroleum-based waxy mixture is white and odorless and conforms well to wrists, hands, feet, ankles, knees, and

elbows. Paraffin is used for pain relief and softening the skin. Paraffin baths are used for arthritic joints or bursitis, except when joints are hot and swollen.

Paraffin wax is kept at 122 to 130o Fahrenheit. In order to prevent the wax from sticking to the skin, heavy mineral oil is added to the waxy mixture in a five to one solution (five pounds of paraffin wax to one pint mineral oil). This molten wax can be applied as a pack, a dip, or painted on the affected area. The client dips the body part in and out of the mixture quickly, allowing the part to cool and promote drying between dipping. The process may be repeated six to twelve times or until a layer of wax ½ inch thick is opaque. Alcohol or lotion may be applied to the area to remove hardened wax. After dipping, wrap the area with a plastic sheet and then a towel. Allow the client to rest the area up to thirty minutes or until the client reports that he can no longer feel heat. Inform the client to keep the fingers or toes in a relaxed position and to avoid movement to prevent cracks in the paraffin “glove.” Ask the client to remove the wax covering and form a wax ball that the client can use for finger exercise, or replace the paraffin for your next client.

Never use the paraffin bath with open lesions or with peripheral vascular disease.



## Laser

Laser Therapy is a therapeutic modality used in physiotherapy to accelerate tissue healing and for pain relief.

How does Laser Therapy Work?

Laser light is exposed directly over the target tissue. Once the laser light reaches the target tissue, it has several effects that contribute to its ability to accelerate wound healing and relieve pain.

- Increase energy production: Laser can turn on proteins that help speed up your body’s ability to make energy.
- Initiate breakdown of damaged tissue: Laser increases processes within the body that break down damaged and infected tissue.

- Reduce Swelling (Edema): Laser can reduce edema by decreasing production of the substance that triggers the swelling response in the body.
- Increase new tissue formation: Laser signals the production of collagen, which is the backbone of many tissues in the body. The collagen formed following laser therapy is also stronger at each stage of healing than tissues that were not exposed to laser.
- Increases production of natural pain killers and the firing rate of nerves: Laser has shown to reduce pain by increasing endorphins – the body’s natural pain killers –and increasing the firing rate of nerves in the body.



### Indications:

To promote tissue healing and offer pain relief.

- Accelerates both superficial wound and deep tissue healing within the body.
- Reduces pain associated with trigger points or hypersensitive areas of the body and for several musculoskeletal conditions (i.e. carpal tunnel)
- Reduces inflammation (i.e. decreases pain, swelling and stiffness in patient with rheumatoid arthritis)
- Decrease scar tissue

**Contraindications:** Laser is not recommended for treatment over:

- The uterus of pregnant women
- Areas of active cancer
- The eyes
- \* Laser light can cause retinal burns or scarring when viewed directly so it is important not to look directly at the laser at any point during treatment

### Practical (Detailing)

Preparation and positioning of the subject for the treatment by using following electro therapy equipments.

- a. IRR
- b. SWD
- c. ULTRASOUND
- d. IFT
- e. TENS
- f. EMS
- g. Hot pack

### **Assessment Activities**

Practical presentation  
Care of equipments  
Approach to clients  
Record work  
Class test

### **List of practicals**

- 1. Free exercise
- 2. Resisted exercise
- 3. Passive movements
- 4. Fundamental position
- 5. Derived position
- 6. Grading of muscle power of major muscles
- 7. Range of motion of major joints
- 8. Good and bad posture

Preparation and maintenance of exercise therapy equipment

- 9. Static cycle
- 10. Treadmill
- 11. Quadriceps table
- 12. Shoulder wheel
- 13. Hand exerciser
- 14. Medicine ball
- 15. Swiss ball
- 16. Abduction ladder

Demonstration of pathological gait

17. circumductory gait
18. Scissoring gait
19. Festinant gait
20. Ataxic gait
21. High stepping gait

Demonstration of gait training

22. Transfer techniques
23. Cryo therapy
24. Contrast bath
25. Relaxation
26. Breathing exercise

Preparation and application of electro therapy modalities

27. IRR
28. SWD
29. ULTRASOUND
30. IFT
31. TENS
32. EMS

**TE Questions**

1. Classify the electrotherapy equipment based on frequency with suitable example.
2. List out the therapeutic effect of heat
3. Short note on
4. Indication and Contra indication of thermotherapy
5. Indication and contra indications of SWD
6. Expand the term

- SWD
- TENS
- IFT

7. Answer in one word
8. An example of Electro therapy equipments that produces superficial heat.
9. Temperature range of paraffin bath

At the end of module

Extended activities



## Over view of Module 4

Students have already achieved knowledge about basics of physiotherapy. This module enables the students to acquire the knowledge about the various conditions in medical and surgical disciplines like neurology, orthopaedics, paediatrics, and geriatrics. The learner also acquires the concept, types and indications of orthotics and prosthetics.

On successful completion of the fourth module the learner will develop an overall idea of different disease conditions and role of physiotherapist in management of these conditions. The learner will be able to do the preparation of the client, basic physiotherapy techniques based on the condition under physiotherapist's supervision. The learner can also assist physiotherapist in management of various neurological, orthopaedic, paediatric and geriatric conditions in various rehabilitation centres like physiotherapy clinics, old age home, special schools, palliative centres etc.

### UNIT 4.1 INTRODUCTION TO NEUROLOGICAL PHYSIOTHERAPY

#### Introduction

Neurological physiotherapy is the treatment of individuals who have neurological impairments; for example Traumatic Brain Injury or Stroke; Multiple Sclerosis, Spinal Cord Injury and Parkinson's disease. Neuro Physiotherapists specialise in assessing and treating individuals with such neurological impairments to enhance or maximise their functional ability.

Physiotherapy can be carried out within home or clinic. Home based treatment sessions are limited to mat based exercises and walking practise. Clinic based treatment sessions are able to incorporate a larger range of physiotherapy exercises using different machines to enhance strengthening programme.

Neuro Physiotherapy objectives

Neuro Physiotherapy aims to identify and maximise movement potential and quality of life. Treatment programme is specific and based on goals identified during initial assessment session. These may include: education, training, posture awareness, strengthening, stretching, sitting balance, standing balance, and walking practice (if applicable). Address issues proactively to prevent long term problems from developing.

When clients present with progressive neurological conditions such as Parkinson's disease or Multiple Sclerosis, aim to provide advice and treatment during each stage

of the condition. If early intervention can be provided, it can help to prevent the progression of a progressive condition and reduce the degree of secondary complications. In some cases, clients can still make physical gains with improvements in posture, muscle strength and flexibility helping to improve their functional independence and their quality of life.

Neuro Physiotherapists have a special interest in working with clients with neurological impairments. If have a neurological impairment, treatment should be provided by a Specialist Neuro Physiotherapist to ensure that the latest techniques are used within your treatment sessions.

### **Learning Outcomes**

The learner:

- Learner will be able to
- Understand the concept of neurological physiotherapy
- Assist physiotherapist in management of paraplegia, paraparesis, quadripegia and quadriparesis
- Assist physiotherapist in management of Parkinson patient
- Assist physiotherapist in management of hemi paresis and hemiplegia
- Assist physiotherapist in management of ataxic patient
- Identify the conditions like, Epilepsy, Guillianbarre syndrome, Bell's palsy, Multiple sclerosis ,Alzheimer's disease

### **Concepts (Detailing)**

#### **Stroke**

A stroke is a medical emergency, and treatment must be sought as quickly as possible. It is the 5th leading cause of death in the US, with one person dying every 4 minutes as a result. For black people, stroke is the 3rd leading cause of death. Strokes occur due to problems with the blood supply to the brain: either the blood supply is blocked or a blood vessel within the brain ruptures, causing brain tissue to die.

#### **There are three main kinds of stroke.**

Ischemic strokes

Hemorrhagic strokes

Transient ischemic attacks (TIAs), also referred to as mini-strokes

### **Ischemic stroke**

Ischemic stroke is the most common form of stroke, accounting for around 85% of strokes. This type of stroke is caused by blockages or narrowing of the arteries that provide blood to the brain, resulting in ischemia - severely reduced blood flow. These blockages are often caused by blood clots, which can form either in the arteries connecting to the brain, or in other blood vessels before being swept through the bloodstream and into narrower arteries within the brain. Clots can be caused by fatty deposits within the arteries called plaque.

### **Hemorrhagic stroke**

Hemorrhagic stroke are caused by arteries in the brain either leaking blood or bursting open. The leaked blood puts pressure on brain cells and damages them. Blood vessels can burst or spill blood in the middle of the brain or near the surface of the brain, sending blood into the space between the brain and the skull. The ruptures can be caused by conditions such as hypertension, trauma, blood-thinning medications and aneurysms (weaknesses in blood vessel walls).

Intracerebral haemorrhage is the most common type of hemorrhagic stroke and occurs when brain tissue is flooded with blood after an artery in the brain bursts. Subarachnoid haemorrhage is the second type of hemorrhagic stroke and is less common. In this type of stroke, bleeding occurs in the subarachnoid space - the area between the brain and the thin tissues that cover it.

### **Transient ischemic attack (TIA)**

TIAs are different from the aforementioned kinds of stroke because the flow of blood to the brain is only briefly interrupted. TIAs are similar to ischemic strokes in that they are often caused by blood clots or other debris. TIAs should be regarded as medical emergencies just like the other kinds of stroke, even if the blockage of the artery is temporary. They serve as warning signs for future strokes and indicate that there is a partially blocked artery or clot source in the heart. According to the Centers for Disease Control and Prevention (CDC), over a third of people who experience a TIA go on to have a major stroke within a year if they have not received any treatment. Between 10-15% will have a major stroke within 3 months of a TIA.

### **Symptoms of stroke**

Confusion, including trouble with speaking and understanding

Headache, possibly with altered consciousness or vomiting

Numbness of the face, arm or leg, particularly on one side of the body

Trouble with seeing, in one or both eyes

Trouble with walking, including dizziness and lack of co-ordination.

Bladder or bowel control problems

Pain in the hands and feet that gets worse with movement and temperature changes

Paralysis or weakness on one or both sides of the body

Trouble controlling or expressing emotions.

### **Treatments for stroke**

As the two main different kinds of stroke, ischemic and hemorrhagic, are caused by different factors, both require different forms of treatment. It is not only important that the type of stroke is diagnosed quickly to reduce the damage done to the brain, but also because treatment suitable for one kind of stroke can be harmful to someone who has had a different kind.

Ischemic strokes are caused by arteries being blocked or narrowed and so treatment focuses on restoring an adequate flow of blood to the brain. Treatment can begin with drugs to break down clots and prevent further ones from forming. Aspirin can be given, as can an injection of a tissue plasminogen activator (TPA). TPA is very effective at dissolving clots but needs to be injected within 4.5 hours of stroke symptoms manifesting themselves.

Surgeons are able to remove plaque and any other obstructions from the carotid artery through surgery. Emergency procedures include administering TPA via catheter directly into an artery in the brain or using a catheter to physically remove the clot from its obstructive position. There are other procedures that can be carried out to decrease the risk of future strokes or TIAs. A carotid endarterectomy involves a surgeon opening the carotid artery and removing any plaque that might be blocking it. Alternatively, an angioplasty involves a surgeon inflating a small balloon in a narrowed artery via catheter and then inserting a stent (a mesh tube) into the opening in order to prevent the artery from narrowing again.

Hemorrhagic strokes are caused by bleeding into the brain and so treatment focuses on controlling the bleeding and reducing the pressure on the brain that it is causing. Treatment can begin with drugs being given to reduce the pressure in the brain, overall blood pressure, prevent seizures and prevent sudden constrictions of blood vessels. Surgery can be used to repair any problems with blood vessels that have

led or could lead to hemorrhagic strokes. Surgeons can place small clamps at the base of aneurysms or fill them with detachable coils to stop blood flow to them and prevent rupture.

Surgery can also be used to remove small arteriovenous malformations (AVMs) if they are not too big and not too deep within the brain. AVMs are tangled connections between arteries and veins that are weaker and burst more easily than other normal blood vessels.

### Rehabilitation

Strokes are life-changing events that can affect a person both physically and emotionally, temporarily or permanently. After a stroke, successful recovery will often involve specific rehabilitative activities such as:

**Speech therapy** - to help with problems producing or understanding speech. Practice, relaxation and changing communication style, using gestures or different tones for example, all help

**Physical therapy** - to help a person relearn movement and co-ordination. It is important to get out and about, even if it is difficult at first

**Occupational therapy** - to help a person to improve their ability to carry out routine daily activities, such as bathing, cooking, dressing, eating, reading and writing

**Joining a support group** - to help with common mental health problems such as depression that can occur after a stroke. Many find it useful to share common experiences and exchange information

Support from friends and family - to provide practical support and comfort. Letting friends and family know what can be done to help is very important.

### Prevention of stroke

The best way to prevent a stroke is to address the underlying causes. This is best done by living healthily, which means:

Eating a healthy diet

Maintaining a healthy weight

Exercise regularly

Not smoking

Avoiding alcohol or moderating consumption.

Eating a healthy diet means getting plenty of fruits, vegetables and healthy whole

grains, nuts, seeds and legumes; eating little or no red or processed meat; limiting intake of cholesterol and saturated fat (typically found in foods of animal origin); and minimizing salt intake so as to support healthy blood pressure

Other measures taken to help reduce the risk of stroke include: Keeping blood pressure under control, Managing diabetes well and treating obstructive sleep apnoea (if present).

A health care provider can help to reduce the risk of future strokes through prescribing anti-coagulant and anti-platelet medication. In addition to this, the arterial surgery can also be used to lower the risk of repeat strokes.

### **Spinal cord injury (SCI)**

Spinal cord injury (SCI) involves damage to the nerves within the bony protection of the spinal canal. The most common cause of SCI is trauma, although damage can occur from various diseases acquired at birth or later in life. The spinal cord and the brain together make up the central nervous system (CNS). The spinal cord coordinates the body's movement and sensation. Therefore, an injured cord loses the ability to send and receive messages from the brain to the body's systems that control sensory, motor, and autonomic function below the level of injury. Often, this results in some level of paralysis.

Spinal cord trauma is more than a single event. The initial blunt force damages or kills spinal nerve cells. However, in the hours and days after injury a cascade of secondary events, including loss of oxygen and the release of toxic chemicals at the site of injury, further damage the cord.

Acute care following an injury may involve surgery if the spinal cord appears to be compressed by bone, a herniated disk, or a blood clot. Traditionally, surgeons waited for several days to decompress the spinal cord, believing that operating immediately could worsen the outcome. More recently, many surgeons advocate immediate early surgery.

### **Complete vs. incomplete SCI**

Those with an incomplete injury have some sensory or motor function below the level of injury – the spinal cord was not totally damaged or disrupted. In a complete injury, nerve damage obstructs all signals coming from the brain to the body below the injury. People with incomplete injuries have a better chance of getting more return.

The sooner muscles start working again, the better the chances are of additional recovery. When muscles come back later, after the first several weeks, they are

more likely to be in the arms than in the legs.

As long as there is some improvement and additional muscles recover function, the chances are better that more improvement is possible. The longer there is no improvement, the lower the odds it will start to happen on its own.

### **Parkinson's disease**

Parkinson's disease affects the nerve cells in the brain that produce dopamine. Parkinson's disease symptoms include muscle rigidity, tremors, and changes in speech and gait. After diagnosis, treatments can help relieve symptoms, but there is no cure.

Symptoms of Parkinson's disease differ from person to person. They also change as the disease progresses. Symptoms that one person gets in the early stages of the disease, another person may not get until later-or not at all. Symptoms typically begin appearing between the ages of 50 and 60. They develop slowly and often go unnoticed by family, friends, and even the person who has them. The disease causes motor symptoms and non-motor symptoms. Motor symptoms are those that have to do with how you move. The most common one is tremor.

- Tremor, or shaking, often in a hand, arm, or leg, occurs when you're awake and sitting or standing still (resting tremor), and it gets better when you move that body part. Tremor is often the first symptom that people with Parkinson's disease or their family members notice. At first the tremor may appear in just one arm or leg or only on one side of the body. The tremor also may affect the chin, lips, and tongue. As the disease progresses, the tremor may spread to both sides of the body. But in some cases the tremor remains on just one side. Emotional and physical stress tends to make the tremor more noticeable. Sleep, complete relaxation, and intentional movement or action usually reduce or stop the tremor.
- Stiff muscles (rigidity) and aching muscles. One of the most common early signs of Parkinson's is a reduced arm swing on one side when you walk. This is caused by rigid muscles. Rigidity can also affect the muscles of the legs, face, neck, or other parts of the body. It may cause muscles to feel tired and achy.
- Slow, limited movement, especially when you try to move from a resting position. For instance, it may be hard to get out of a chair or turn over in bed.
- Weakness of face and throat muscles. It may get harder to talk and swallow. You may choke, cough, or drool. Speech becomes softer and monotonous. Loss of movement in the muscles in the face can cause a fixed, vacant facial

expression, often called the “Parkinson’s mask.”

- Difficulty with walking and balance. A person with this disease is likely to take small steps and shuffle with his or her feet close together, bend forward slightly at the waist, and have trouble turning around. Balance and posture problems may cause frequent falls. But these problems usually don’t happen until later on.
- Freezing, a sudden, brief inability to move. It most often affects walking.
- A small number of people have symptoms on only one side of the body that never move to the other side.

### **Treatment Overview**

No known treatment can stop or reverse the breakdown of nerve cells that causes Parkinson’s disease. But there are many treatments that can reduce your symptoms and improve your quality of life. Age, work status, family, and living situation can all affect decisions about when to begin treatment, what types of treatment to use, and when to make changes in treatment. As medical condition changes, need regular changes in treatment to balance quality-of-life issues, side effects of treatment, and treatment costs.

### **Treatments for Parkinson’s include:**

Medicines, such as levodopa and dopamine agonists. This is the most common treatment for Parkinson’s disease.

Home treatment. There are many steps you can take at home to make dealing with the symptoms of Parkinson’s disease easier, such as getting regular exercise and eating a healthy diet.

Surgery. Brain surgery, for example deep brain stimulation (DBS), may be considered when medicine fails to control symptoms of Parkinson’s disease or causes severe or disabling side effects.

Speech therapy. Speech therapists use breathing and speech exercises to help you overcome the soft, imprecise speech and monotone voice that develop in advanced Parkinson’s disease.

Physical therapy. Therapists may help you improve your walking and reduce your risk of falling.

Occupational therapy. Therapists can help you learn new ways to do things for yourself so you can stay independent longer.



Treatment for mental problems. Family members may notice that you begin to have problems with memory, problem solving, learning, and other mental functions. When these problems keep you from doing daily activities, it is called dementia. There are medicines that can help treat dementia in people with Parkinson's.

### **Cerebral Palsy**

Cerebral palsy refers to a group of disorders affecting a person's ability to move. It is due to damage to the developing brain either during pregnancy or shortly after birth. Cerebral palsy affects people in different ways and can affect body movement, muscle control, muscle coordination, muscle tone, reflex, posture and balance. Although cerebral palsy is a permanent life-long condition, some of these signs of cerebral palsy can improve or worsen over time. People who have cerebral palsy may also have visual, learning, hearing, speech, epilepsy and intellectual impairments. Cerebral palsy is the result of a combination of events either before, during or after birth that can lead to an injury in a baby's developing brain. There is no single cause of cerebral palsy. For most babies born with cerebral palsy, the cause remains unknown. Researchers now know that only a very small percentage of cases of cerebral palsy are due to complications at birth (e.g. asphyxia or lack of oxygen). It is accepted that cerebral palsy usually arises from a series of causal pathways, i.e. a sequence of events that when combined can cause or accelerate injury to the developing brain.

Stroke is the most common cause in babies who acquire cerebral palsy after 1 month of age. The stroke may occur spontaneously or arise from surgical or heart complications.

#### **Risk factors**

Risk factors do not cause cerebral palsy. However, the presence of some risk factors may lead to an increased chance of a child being born with cerebral palsy.

Premature birth (less than 37 weeks)

Low birth weight (small for gestational age)

Blood clotting problems (thrombophilia)

Inability of the placenta to provide the developing fetus with oxygen and nutrients

RH or A-B-O blood type incompatibility between mother and baby

Infection of the mother with German measles or other viral diseases in early pregnancy

Bacterial infection of the mother, foetus or baby that directly or indirectly attacks the

infant's central nervous system

Prolonged loss of oxygen during the pregnancy or birthing process, or severe jaundice shortly after birth.

### Types of Cerebral Palsy

Cerebral palsy can be described by the way it affects people's movement, the part of the body affected and by how severe the affects are.

**QUADRIPLEGIA:** Both arms and legs are affected. The muscles of the trunk, face and mouth are often also affected.

**DIPLEGIA:** Both legs are affected. The arms may be affected to a lesser extent.

**HEMIPLEGIA:** One side of the body (one arm and one leg) is affected.

Other classifications

**DYSKINETIC:** Characterised by involuntary movements (i.e. out of a person's control)

**ATAXIC:** Characterised by shaky movements. Affects balance and sense of positioning in space

**MIXED:** Although cerebral palsy is a lifelong disability, there are many interventions that can help reduce its impact on the body and the individual's quality of life. An intervention is a service that aims to improve the condition of cerebral palsy and the day-to-day experience of the person living with it.

Children with cerebral palsy may be supported by a team of professionals including health professionals and community-based support services who work together to help the child and family reach their goals.

Through their late teens and early 20s, many young people take increasing responsibility for their own health and wellbeing. Their team may include health professionals and mainstream community providers such as fitness trainers. At present, there is no way to totally prevent or cure cerebral palsy.

### Interventions for movement difficulties

**Medication:** Medical specialists may prescribe medications that assist movement issues. Some medications are taken orally (e.g. diazepam) and others are injected or delivered through surgically implanted pumps (e.g. Baclofen). Many children with cerebral palsy benefit from Botulinum toxin type A injections into muscles affected by spasticity. This intervention is used from about two years of age and is most effective when used in conjunction with therapy.

Surgical procedures : Selective Dorsal Rhizotomy (SDR) is a neurosurgical procedure that is used in a small percentage of children with cerebral palsy to permanently reduce spasticity in their legs.

### Physiotherapy and occupational therapy

Physiotherapists and occupational therapists focus on encouraging a person’s day-to-day movement skills such as sitting, walking, playing, dressing and toileting. They will use a range of specialist interventions such as movement training and equipment, e.g. walking frames, wheelchairs, supportive seating, footwear and orthotics.

### Interventions for muscle, bone and joint difficulties

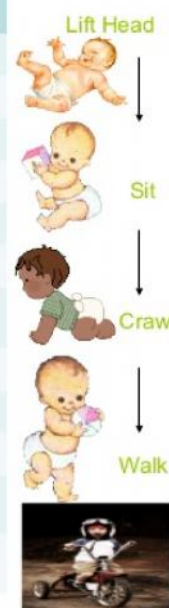
Surgical procedures: Orthopaedic surgeons correct joint deformities and lengthen muscles. Surgery usually takes place in a child’s late primary years or early adolescence to improve walking quality and reduce pain. Paediatric rehabilitation specialists support the management of some of the conditions associated with cerebral palsy, such as spasticity, musculoskeletal issues and growth.

### Casts, splints and muscle strengthening

Physiotherapists and occupational therapists may also focus on preventing impairments that might affect movement. They use casts, orthotics and muscle strengthening exercises.

### Normal mile stones of development

Gross motor developmental milestone	
Age	Milestone
3 months	Neck Holding
5 months	Rolls over
6 months	Sits in tripod fashion
8 months	Sitting without support
9 months	Stands with support
12 Months	Creeps well; walks but falls; stands without support
15 months	Walks alone; creeps upstairs
18 months	Runs; explores drawers
2 years	Walks up and downstairs; jumps
3 years	Rides tricycle; alternate feet going upstairs
4 years	Hops on one foot; alternate feet going downstairs



## Ataxia

Ataxia is a lack of muscle coordination which may affect speech, eye movements, the ability to swallow, walking, picking up objects and other voluntary movements. A person with persistent ataxia may have damage in the part of the brain that controls muscle coordination - the cerebellum. Ataxia may have several causes, including multiple head injury, alcohol abuse, stroke, and cerebral palsy,

### Types of ataxias

The following are some of the more common types of ataxias.

**Cerebellar ataxia** This is ataxia caused by a dysfunction of the cerebellum - a region in the brain which is involved in the assimilation of sensory perception, coordination and motor control. Cerebellar ataxia causes some basic neurological problems, such as:

- Floppiness (hypotonia).
- Lack of co-ordination between organs, muscles, limbs or joints (asynergy).
- Impaired ability to control distance, power, and speed of an arm, hand, leg or eye movement (dysmetria).
- Difficulty in accurately estimating how much time has passed (dyschronometria).
- An inability to perform rapid, alternating movements (dysdiadochokinesia).
- How the patient is affected depends on which parts of the cerebellum are lesioned, and whether lesions occur on one side (unilateral) or both sides (bilateral).

**Sensory ataxia** : This is ataxia due to loss of proprioception. Proprioception is the sense of the relative position of neighbouring parts of the body. It is a sense that indicates whether the body is moving with the required effort, and also where the various parts of the body are located in relation to each other. A patient with sensory ataxia typically has an unsteady stamping gait, with the heel striking hard as it touches the ground with each step. Postural instability becomes worse in poorly lit environments. If a doctor asks the patient to stand with eyes closed and feet together his/her instability will clearly worsen. This is because loss of proprioception makes the patient much more reliant on visual data. The patient may find it hard to perform smoothly coordinated voluntary movements with the limbs, trunk, pharynx, larynx, and eyes.

### Vestibular ataxia

The vestibular system is affected. In acute (sudden) unilateral cases the patient may experience vertigo, nausea, and vomiting. In slow-onset chronic bilateral cases the patient may only experience unsteadiness, giddiness.

### Causes of ataxia

- Vitamin B12 deficiency - as well as other neurological abnormalities, vitamin b12 deficiency can cause overlapping cerebellar and sensory ataxia.
- Inherited ataxia: this means the ataxia is caused by a genetic fault inherited either from the mother or father, or both. a faulty gene that is passed down through generations can cause cerebellar ataxia - in some cases its severity worsens from one generation to the next and the age of onset gets younger. the chances of inheriting ataxia from a parent depends on the type of ataxia that parent has.
- Non-inherited ataxia: even without a family history of ataxia some people may still develop the condition. in some cases, experts never find out what the cause was. the following procedures and circumstances can cause ataxia:
  - Brain surgery.
  - Head injury.
  - Alcohol abuse.
  - Drug abuse.
  - Infections, such as chicken pox (usually goes away after infection has gone).
  - A brain tumour.
  - Exposure to toxic chemicals.
  - Multiple sclerosis, cerebral palsy, and some other neurological conditions.
  - Malformation of the cerebellum while the baby is still in the womb.

### Symptoms of ataxia

Symptoms may vary depending on the severity and type of ataxia. Initial ataxia symptoms usually include:

Poor limb coordination.

Dysarthria - slurred and slow speech that is difficult to produce. The patient may also have difficulties controlling volume, rhythm, and pitch.

If the ataxia advances other symptoms may also appear:

Swallowing difficulties, which may sometimes result in choking or coughing?

Facial expressions become less apparent.

Tremors - parts of the body may shake or tremble unintentionally.

Nystagmus - involuntary rapid rhythmic repetitious eye movement. Movements may be vertical, horizontal, or circular.

Pes cavus - a foot with too high an arch.

Cold feet - because of a lack of muscle activity.

Problems with balance.

Walking difficulties - in severe cases the patient may need a wheelchair.

Vision problems.

Hearing problems.

### **Diagnosis of Ataxia**

A doctor who suspects the patient may have ataxia will refer him/her to a neurologist- a doctor specialized in diagnosis, treatment and prevention of conditions and illnesses related to the nervous system. The specialist will check the patient's medical history for cause factors, such as brain injury, as well as the patient's family history for indications of inheritance. The following tests may also be ordered:

Magnetic resonance imaging (MRI) or Computerized Tomography (CT) scan - to determine whether there is any brain damage.

Genetic tests - to determine whether the patient has inherited ataxia.

Blood tests - some types of ataxia affect the makeup of blood.

Urine tests - urinalysis may suggest specific systemic abnormalities that are linked to some forms of ataxia. If the specialist suspects Wilson's disease the patient may be asked for a 24-hour urine collection to determine how much copper is in the system.

### **Treatments for ataxia**

Although ataxia is not curable, a great deal can be done to ease symptoms and improve the quality of life of the patient. Treatment for coordination and balance problems usually involves the use of adaptive devices which help the patient attain

as much independence as possible. These may include the use of a cane (walking stick), crutches, walker or a wheelchair. Symptoms such as tremor, stiffness, spasticity, sleep disorders, muscle weakness, depression (or frustration, sadness and anger) may be addressed with targeted physical therapy, speech therapy, medications and counselling.

**Occupational therapy** - the occupational therapist can help the patient manage better around the house and work. This may involve some home adaptations, wheelchair assessments, and making the kitchen more practical for the patient.

**Speech therapy** - the speech therapist can help with swallowing, coughing, choking and speech problems. If speech becomes very difficult the speech therapist can help the patient learn how to use speech aids.

**Orthopaedic care** - this can help patients with curvature of the spine (scoliosis).

**Physical therapy (physiotherapy)** - a physical therapist (physiotherapist) can help maintain strength and improve mobility.

**Counselling** - patients with ataxia commonly become frustrated and depressed; this usually results from having to cope with some symptoms which affect physical mobility and coordination. Talking to a well qualified counsellor, such as a psychotherapist can help.

**Supplements and nutrition** - some patients with ataxia have very low levels of vitamin E and require supplements and/or a special diet. As sensitivity to gluten is more common among ataxia patients, a gluten-free diet also helps.

**Medication** - some patients with ataxia telangiectasia are prescribed gamma-globulin injections to boost their immune systems. There are also drugs for muscle spasms and uncontrollable eye movements.

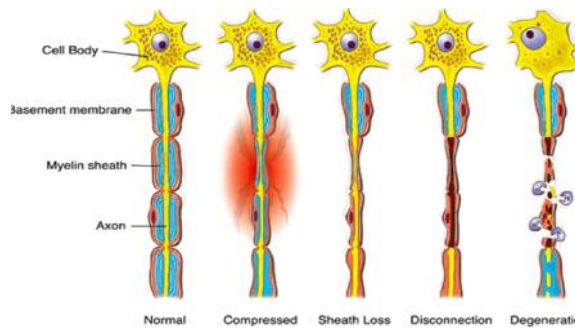
### **Peripheral nerve injury**

Peripheral nerves link brain and spinal cord to the other parts of body, such as your muscles and skin. Peripheral nerves are fragile and easily damaged. A nerve injury can interfere with brain's ability to communicate with muscles and organs. If you feel tingling or numbness in your leg, arm, shoulder or hand, you may have injured one or more nerves when you had an accident or broke a bone. You may also experience numbness or tingling if a nerve is being compressed due to factors such as a narrow passageway, tumour or other diseases. It's important to get medical care for a peripheral nerve injury as soon as possible because nerve tissue can be repaired. Early diagnosis and treatment can prevent complications and permanent injury.

### Classification of peripheral nerve injuries Pathophysiology

Seddon	Sunderland	Pathophysiology
Neuropraxia (compression)	Type 1	Local myelin damage with the nerve still intact
Axonotmesis (crush)	Type 2	The continuity of axons is lost. The endoneurium, perineurium, and epineurium remain intact. Loss of continuity of axons with Wallerian degeneration due to disruption of axoplasmic flow
	Type 3 Type 4	Type 2 with endoneurial injury Type 2 with endoneurial and perineurial injury but an intact epineurium
Neurotmesis (transection)	Type 5	Complete physiological disruption of the entire nerve trunk. Early surgical intervention necessary. Prognosis guarded

### Degeneration Degeneration and Regeneration



Axon degeneration and regeneration of peripheral neurons refers to a series of sequential events that occur following a peripheral nerve injury. Axon degeneration involves the breakdown of axons and myelin distal to an injury site, a requisite for subsequent regeneration, or regrowth of axons.

**Wallerian degeneration** is a process that results when a nerve fiber is cut or crushed, in which the part of the axon separated from the neuron's cell body degenerates distal to the injury.

Wallerian degeneration occurs after axonal injury in both the peripheral nervous



system (PNS) and central nervous system (CNS). It occurs in the axon stump distal to a site of injury and usually begins within 24–36 hours of a lesion. Prior to degeneration, distal axon stumps tend to remain electrically excitable. After injury, the axonal skeleton disintegrates, and the axonal membrane breaks apart. The axonal degeneration is followed by degradation of the myelin sheath and infiltration by macrophages. The macrophages, accompanied by Schwann cells, serve to clear the debris from the degeneration.

Neuroregeneration refers to the regrowth or repair of nervous tissues, cells or cell products. When an axon is damaged, the distal segment undergoes Wallerian degeneration, losing its myelin sheath. The proximal segment can either die by apoptosis or undergo the chromatolytic reaction, which is an attempt at repair. Peripheral nervous system has an intrinsic ability for repair and regeneration, Neuroregeneration in the peripheral nervous system (PNS) occurs to a significant degree. Axonal sprouts form at the proximal stump and grow until they enter the distal stump. The growth of the sprouts is governed by chemotactic factors secreted from Schwann cell. Regeneration is rapid in PNS, allowing for rates of up to 1 millimeter a day of regrowth.

### General Principles of management

The management of a peripheral nerve injury varies depending on the cause, type and degree of the nerve injury. If a nerve is not healing properly surgery may be required to repair the damaged section. Physiotherapy is very important to promote the recovery of peripheral nerve injuries regardless of whether surgery is required to

Maintain range muscle length / joint range of movement

Maintain nerve integrity

Increase muscle strength

Increase sensation

Manage neuropathic pain

### Clinical features and Physiotherapy Management of:

Brachial plexus injury-Erb's palsy and Klumpke's palsy

#### Brachial plexus injury

The brachial plexus is a group of nerves that come from the spinal cord in the neck and travel down the arm. These nerves control the muscles of the shoulder, elbow, wrist and hand, as well as provide feeling in the arm. Some brachial plexus injuries

are minor and will completely recover in several weeks. Other injuries are severe enough and could cause some permanent disability in the arm.

**CAUSES:** These nerves can be damaged by stretching, pressure or cutting. Stretching can occur when the head and neck are forced away from the shoulder, such as during a motorcycle fall or car accident. If severe enough, the nerves can tear out of the spinal cord in the neck. Pressure could occur from the crushing of the brachial plexus between the collarbone and first rib, which can happen during a fracture or dislocation. Swelling in this area from excessive bleeding or injured soft tissues can also cause an injury.

**Signs and symptoms:** Nerve injuries can stop signals to and from the brain, preventing the muscles of the arm and hand from working properly, and causing loss of feeling in the area.

**Treatment:** Many adult injuries will not recover on their own, and early evaluation by physicians who have experience treating these problems is essential. Some injuries can recover with time and therapy. The time for recovery can be weeks or months. When an injury is unlikely to improve, several surgical techniques can be used to improve the recovery. In some cases, when nerve recovery will not happen, a tendon transfer surgery may be performed.

**Recovery:** The patient must do several things to keep up muscle activity and prevent the joints from getting stiff. If the joints become stiff, they will not move even after muscles begin to work again, like a hinge that has rusted.

When a sensory nerve has been injured, the patient must be extra careful not to burn or cut fingers while there is no feeling in the affected area. During nerve recovery, the brain may not interpret the new nerve signals properly, and a procedure called sensory re-education may be needed to optimize muscle control and feeling in the hand or fingers. Factors that may affect results after a brachial plexus injury include patient age and the type, severity and location of the injury. Though these injuries will result in lasting problems for the patient, care by a hand surgeon and proper therapy can maximize function.

### Types of Brachial Plexus Injuries

**Erb's Palsy:** Erb's palsy is caused by damage to the upper C5 and C6 nerves. Children with Erb's palsy have partial or full paralysis of the arm, possibly involving loss of sensation. The affected arm hangs to the side, and cannot be fully raised.

**Klumpke's Palsy:** Klumpke's palsy involves paralysis of the forearm and hand muscles, caused by damage to the lower C8 and T1 nerves. This primarily affects the wrist and fingers, and often appears as a "clawed" hand.

### Diagnosing and Treating a Brachial Plexus Injury

Brachial plexus injuries are usually diagnosed by a baby's paediatrician. If the baby's parents or doctor notices arm weakness, the doctor may order tests, including an MRI, electromyogram (EMG) or a nerve conduction study (NCS). These tests help to determine whether there is any damage to the nerves.

Treatment options fall into two categories. These injuries can be treated surgically—an initial exploratory surgery on the nerves is performed, which may bring back some amount of function. Additional follow-up surgeries may be able to remedy continued weakness. The other option is daily physical therapy, where a therapist and the baby's parents manually move the affected limb to keep it limber and healthy. This physical therapy can begin very soon after birth.

Most brachial plexus injuries resolve within six months. However, about 10% of these injuries cause some degree of permanent impairment. These injuries, affecting the shoulders, arms, wrists or fingers, may cause some loss of sensation, or may cause full paralysis.

Children with brachial plexus injuries require extensive medical treatment, possibly including surgery and physical therapy, to achieve their maximum potential. Some children with brachial plexus injuries have emotional and self-esteem difficulties caused by the injury. Those children can benefit from counseling

### Radial nerve injury - wrist drop

The radial nerve runs down the underside of the arm and controls movement of the triceps (the muscle located at the back of the upper arm). The radial nerve is also responsible for extending the wrist and fingers, and it controls sensation in part of the hand. Injury to the radial nerve may result in radial neuropathy, or radial nerve palsy. Radial nerve injury may be due to physical trauma, infection, or even exposure to toxins. It often causes numbness and tingling or burning pain. It can also be painless. In many cases, this condition will improve if the underlying cause of the injury is treated.

### Causes of Radial Nerve Injury

- Injury to the radial nerve has a variety of possible causes. These include:
- Fracture the humerus
- Sleeping with the upper arm in an awkward position, pressure from leaning the

arm over the back of a chair (called “Saturday night palsy” when caused by consuming too much alcohol and falling asleep in this position)

- using crutches
- falling on or receiving a blow to the arm
- long-term constriction of the wrist (for example, by wearing a tight bracelet or watch)

### Symptoms of an Injury to the Radial Nerve

- Injury to the radial nerve usually causes symptoms in the back of the hand, near the thumb, and in the index and middle fingers. Symptoms may include:
  - Sharp or burning pain
  - Numbness or tingling
  - Trouble straightening the arm
  - Trouble moving the wrist and fingers”drooping” of the wrist and fingers (not being able to extend or straighten the wrist and fingers), also called “wrist drop” and “finger drop”
- Weak hand grip

### Treatment Options

The goal of treatment for radial nerve injury is to relieve symptoms while allowing movement of the wrist and hand. Treatment will depend on the underlying cause. In some cases, symptoms will go away slowly without intervention. The goal of treatment is to allow to use the hand and arm as much as possible.

Surgery to repair the nerve or remove something that is pressing on the nerve may help.

Braces, splints, or other devices to help you use the hand in severe cases

Physical therapy to help maintain muscle strength

Occupational therapy and vocational therapy or counselling to suggest changes at the worksite may be needed.

## II. Ulnar nerve Injury Claw Hand

Ulnar nerve runs all the way from your shoulder to your little finger. The ulnar nerve manages the muscles that allow to make fine movements with fingers. It also controls

some of the muscles of forearm that allow you to grip things tightly. Unlike most of other nerves, the ulnar nerve isn't protected by muscle or bone throughout its course. In some areas, it's near the surface of skin. This means that injuries to the ulnar nerve aren't uncommon.

May lose sensation and have muscle weakness if damage ulnar nerve. This is known as ulnar nerve palsy or ulnar neuropathy. This condition can affect ability to make fine movements and perform many routine tasks. In severe cases, ulnar nerve palsy can cause muscle wasting, or atrophy, that makes the hand look like a claw. Surgery is sometimes necessary to correct this.

### Symptoms of Ulnar Nerve Palsy

Ulnar nerve palsy is typically a progressive condition, meaning it gets worse over time. The symptoms associated with ulnar nerve palsy include:

- A loss of sensation in hand, especially in ring and little fingers
- A loss of coordination in fingers
- A tingling or burning sensation in hand
- Pain
- Hand weakness that may get worse with physical activity
- A loss of grip strength: The lack of strength in hand can affect daily activities, such as gripping a glass and holding a pencil.
- Over time, the lack of control and sensation can cause the muscles in hand to tighten, leading to a claw-like deformity. This usually only occurs in severe cases of ulnar nerve palsy.

### Causes Ulnar Nerve Palsy

The cause of ulnar nerve palsy isn't always known. However, damage to the ulnar nerve can occur due to:

- An illness that damages your nerve
- An injury to the nerve
- Excess pressure on the nerve
- Nerve pressure due to swelling
- An elbow fracture or dislocation

- Damage to the ulnar nerve is like cutting a telephone cord. The messages from your brain can't be properly transmitted to their targets in your hand and arm nor can they be received from the hand.

### **Treatments of Ulnar Nerve Palsy**

Nerve tissues usually heal much more slowly than other types of tissues. However, some ulnar nerve palsy symptoms may get better without treatment.

Medications to reduce nerve spasms, such as gabapentin, carbamazepine, or phenytoin

Corticosteroids to reduce inflammation

A splint to support the hand and reduce painful symptoms

Physical therapy to increase muscle strength and function

Occupational therapy to minimize further injury

Doctor may also recommend surgery if the nerve damage is extensive, extremely painful, or not improving. Surgery is also often necessary if it makes difficult daily life due to the nerve palsy.

One surgical procedure involves tendon transfer. During a tendon transfer surgery, a functioning tendon is moved from its original bone attachment to a new one. This can help restore muscle function, allowing you to perform routine activities once again.

To prevent further injury need to wear a cast, splint, or brace for support.

### **Common peroneal nerve injury- foot drop**

The common peroneal nerve branches from the sciatic nerve. It includes the deep and superficial peroneal branches. These nerves provide sensation to the anterior (front) and lateral (side) parts of the legs and to the top of the feet. They innervate muscles in the legs which lift the ankle and toes upward (dorsi flexion).

A peroneal nerve injury (also called foot drop or drop foot), is a peripheral nerve injury that affects a patient's ability to lift the foot at the ankle. While foot drop injury is a neuromuscular disorder, it can also be a symptom of a more serious injury, such as a nerve compression or herniated disc.

### **Causes of peroneal nerve injury (foot drop)**

Foot drop injury can be caused by an injury to the spinal cord or from other underlying diseases, such as amyotrophic lateral sclerosis (ALS), multiple sclerosis (MS), or

Parkinson's disease. Sometimes, drop foot is a complication from hip replacement surgery, or other injuries (e.g., knee or joint dislocation or fracture, herniated disc).

### **Symptoms of peroneal nerve injury (foot drop)**

- Inability to point toes toward the body (dorsi flexion)
- Pain
- Weakness
- Numbness (on the shin or top of the foot)
- Loss of function of foot
- High-stepping walk (called steppage gait or footdrop gait)

### **Treatment for peroneal nerve injury (foot drop)**

Nonsurgical treatment for peroneal nerve injury (foot drop)

Orthotics, including braces or foot splints, which may be custom-built into the patient's shoe.

Physical therapy, including gait training.

Surgery for peroneal nerve injury (foot drop).

Surgical treatment for drop foot depends on the cause of the injury. A physician may recommend decompression surgery, nerve sutures, nerve grafting, or nerve transfer or tendon transfer.

## **Awareness of the following neurological conditions**

### **1. Epilepsy**

Epilepsy is the fourth most common neurological disorder and affects people of all ages. Epilepsy means the same thing as "seizure disorders". Epilepsy is characterized by unpredictable seizures and can cause other health problems. Epilepsy is a spectrum condition with a wide range of seizure types and control varying from person-to-person. Epilepsy is a chronic disorder, the hallmark of which is recurrent, unprovoked seizures. Many people with epilepsy have more than one type of seizure and may have other symptoms of neurological problems as well.

Although the symptoms of a seizure may affect any part of the body, the electrical events that produce the symptoms occur in the brain. The location of that event, how it spreads and how much of the brain is affected, and how long it lasts all have profound effects. These factors determine the character of a seizure and its impact

on the individual. Having seizures and epilepsy also can affect one's safety, relationships, work, driving and so much more. How epilepsy is perceived or how people are treated (stigma) often is a bigger problem than the seizures.

## 2. Guillain-Barre syndrome

The precise cause of Guillain-Barre is unknown. According to the Centers for Disease Control and Prevention (CDC), about two-thirds of people with Guillain-Barre develop it soon after they've been sick with diarrhoea or a respiratory infection. This suggests that the disorder may be triggered by an improper immune response to the previous illness. Anyone can get Guillain-Barre, but older adults and men are most likely to contract it.

Symptoms of Guillain-Barre Syndrome?

In Guillain-Barre syndrome, immune system attacks peripheral nervous system. The nerves in peripheral nervous system connect brain to the rest of your body and transmit signals to muscles. The muscles won't be able to respond to signals they receive from brain if these nerves are damaged.

The symptoms of Guillain-Barre include:

Tingling or prickly sensations in fingers and toes

Muscle weakness in legs that travels to upper body and gets worse over time

Difficulty walking steadily

Difficulty moving your eyes or face, talking, chewing, or swallowing

Severe lower back pain

Loss of bladder control

Fast heart rate

Difficulty breathing

Paralysis

Treatment

Everybody with Guillain-Barre should be admitted to a hospital for close observation. The symptoms can quickly get worse and can be fatal if they aren't treated. In severe cases, people with Guillain-Barre can develop full-body paralysis. Guillain-Barre can be life-threatening if paralysis affects the diaphragm or chest muscles, preventing proper breathing. Guillain-Barre can't be cured. The goal of treatment is



to lessen the severity of your symptoms and keep your body functioning while your nervous system recovers

### 3. Bell's palsy

Bell's palsy is a paralysis or weakness of the muscles on one side of face. Damage to the facial nerve that controls muscles on one side of the face causes that side of face to droop .The nerve damage may also affect sense of taste. This condition comes on suddenly, often overnight, and usually gets better on its own within a few weeks.

Bell's palsy is not the result of a stroke or a transient ischemic attack (TIA). While stroke and TIA can cause facial paralysis, there is no link between Bell's palsy and either of these conditions. But sudden weakness that occurs on one side of your face should be checked by a doctor right away to rule out these more serious causes.

#### Causes Bell's palsy

The cause of Bell's palsy is not clear. Most cases are thought to be caused by the herpes virus that causes cold sores. In most cases of Bell's palsy, the nerve that controls muscles on one side of the face is damaged by inflammation.

#### Symptoms of Bell's palsy

Sudden weakness or paralysis on one side of your face that causes it to droop. This is the main symptom. It may make it hard for you to close your eye on that side of your face.

Drooling.

Eye problems, such as excessive tearing or a dry eye.

Loss of ability to taste.

Pain in or behind your ear.

Numbness in the affected side of your face.

Increased sensitivity to sound.

#### Treatment Of Bell's Palsy

Steroids have been shown to be effective

Eye protection drops, patch and eye lid weights (available on prescription)

Physiotherapy treatment for Bell's Palsy may consist of facial massage, exercises, acupuncture and electrical stimulation

#### 4. Multiple sclerosis

Multiple sclerosis (MS) is a potentially disabling disease of the brain and spinal cord (central nervous system).

In MS, the immune system attacks the protective sheath (myelin) that covers nerve fibers and causes communication problems between brain and the rest of body. Eventually, the disease can cause the nerves themselves to deteriorate or become permanently damaged.

Signs and symptoms of MS vary widely and depend on the amount of nerve damage and which nerves are affected. Some people with severe MS may lose the ability to walk independently or at all, while others may experience long periods of remission without any new symptoms. There's no cure for multiple sclerosis. However, treatments can help speed recovery from attacks, modify the course of the disease and manage symptoms.

#### 5. Alzheimer's disease

Alzheimer's disease is a progressive disease that destroys memory and other important mental functions. It's the most common cause of dementia — a group of brain disorders that results in the loss of intellectual and social skills. These changes are severe enough to interfere with day-to-day life.

Dementia is a general term for a decline in mental ability severe enough to interfere with daily life. Memory loss is an example. Alzheimer's is the most common type of dementia. Most people with Alzheimer's disease have "late-onset" Alzheimer's, which usually develops after age 60.

##### Signs and symptoms

The degenerative changes that occur with Alzheimer's disease affect the areas of the brain that control thought, memory and language resulting in gradual signs and symptoms related to a person's behaviour and mental function. Often, physical functions such as bowel and bladder control are also affected. With Alzheimer's disease there is great individual variability as to the nature of symptoms experienced and the speed at which deterioration occurs. The types of behaviour change and the length of time symptoms are present are different for each person. The symptoms of Alzheimer's disease typically develop quite slowly. The time between the onset of the disease and death can range from five to 20 years.

Symptoms commonly experienced during the early stages of Alzheimer's disease include:

- Mild forgetfulness – especially short-term memory loss
- Mood changes, including irritability and anxiety
- Difficulty processing new information and learning new things
- Loss of spontaneity and initiative
- Confusion about time and place
- Communication difficulties
- Decline in ability to perform routine tasks.

### Treatment

As there is no known cure for Alzheimer’s disease, treatment focuses on managing symptoms and supporting the person and their family. This may include:

Treating medical conditions that may contribute to confusion or physical decline eg: lung disease or anaemia.

Encouraging stimulating activities in order to encourage the person to continue their normal activities as much as possible.

Providing memory aids and memory triggers such as calendars and written reminders.

Encouraging social interaction to help prevent feelings of loneliness and depression.

Contacting support groups that may be able to offer family/caregivers assistance.

Encouraging regular routine to reduce confusion.

Not smoking.

### Practical (detailing)

1. Positioning of the hemiplegic patient
  - Positioning by using pillows and sand bags.
    - Supine lying
    - Affected side
    - Unaffected side
  - Sitting
2. Passive movements
  - Upper limb
  - Lower limb

3. Positioning of the paraplegic patient

To demonstrate the positioning and passive movement of the spinal cord injury patient.

- Positioning
- Lying position
- Sitting
- Passive movement
- Transfer technique
- Bed to wheel chair
- Wheel chair to beD

4. To demonstrate the exercise in parkinsonism

- Range of motion/flexibility exercise
- 5.To demonstrate the exercise in Ataxia
- Co ordination exercise –frenkal’s exercise
- Upper lib
- Lower limb
- Trunk

6. Demonstration of exercise in cerebral palsy.

- Special care activities for reducing possible complication.
- Child carrying
- Sitting
- Positioning
- Stretching

7. Peripheral nerve injury

- Donning and doffing of following
- Cock op splint
- Afo
- Aero plane splint

8. Preparation and positioning of the subject for electro therapy treatment

Stimulator

TENS

### **Assessment Activities**

Seminar  
Assignments  
Magazine preparation  
Chart preparation  
Poster Preparation  
Quiz  
Collection  
Model Preparation

### **TE Questions**

1. List out the risk factors of stroke
2. Differentiate the stroke and TIA
3. Write about the symptoms of stroke
4. The special type of exercise given in ataxic patient is known as \_\_\_\_\_
5. Classification of peripheral nerve injury.
6. Write short notes on
  - a. Degeneration and regeneration
  - b. Erb's palsy
  - c. Wrist drop
  - d. Bell's palsy

## INTRODUCTION TO ORTHOPAEDIC PHYSIOTHERAPY

### Introduction

Orthopaedics is a branch of medicine focused on the muscular and skeletal systems. The musculoskeletal system is composed of bone, cartilage, ligaments, muscle, tendons, synovium, bursae and fascia. These tissues have evolved to serve two basic functions: structural integrity and stable mobility. The tissues are composite materials made up of cells lying within the extracellular matrix they produce.

Orthopaedic physical therapists diagnose, manage, and treat disorders and injuries of the musculoskeletal system as well as rehabilitate patients post orthopaedic surgery. This specialty of physical therapy is most often found in the out-patient clinical setting. Orthopedic therapists are trained in the treatment of post operative joints, acute sports injuries, arthritis, and amputations just to name a few. Joint mobilizations, strength training, hot/cold packs, and electrical stimulation are modalities often used to expedite recovery in the orthopaedic setting. Those who have suffered injury or disease affecting the muscles, bones, ligaments, or tendons of the body will benefit from assessment and treatment by a physical therapist specialized in orthopaedics

### Learning Outcomes

The learner:

- describes the orthopedic physiotherapy
- lists out the classification, clinical features and complications of fracture.
- explains the management of different types of fracture, Myositis ossificans and management of injury to lateral ligament of Ankle joint as an example
- describes clinical features and general physiotherapy management of Rheumatoid arthritis
- describes clinical features and general physiotherapy management of Osteoarthritis
- describes clinical features and general physiotherapy management of Ankylosing spondylitis
- identifies Cervical and lumbar spondylosis Per arthritis shoulder Tennis elbow

- Golfers elbow
- Plantar fasciitis To explain the indication, types and levels of amputation and care of stump
- Assist physiotherapist in management of amputee patient

### Concepts (Detailing)

## FRACTURE

A fracture is defined as a break in the bone. A significant percentage of bone fractures occur because of high force impact or stress

### Types of bone fracture

- Greenstick fracture - the bone partly fractures on one side, but does not break completely because the rest of the bone can bend. More common among children, whose bones are softer and more elastic
- Closed fracture-A closed fracture is one where the fracture haematoma does not communicate with the outside
- Open fracture(compound fracture) - is one where the fracture haematoma communicates with the outside through an open wound.
- Pathological fracture – It is a fracture occurring after a trivial violence in a bone weakened by some pathological lesion.
- Stress fracture - more common among athletes. A bone breaks because of repeated stresses and strains
- Birth fracture-It is a fracture in the new born child due to injury during delivery

**Anatomical types of fracture**—Various names are given to the fracture according to type of Fracture line-as transverse fracture, Oblique fracture and Spiral fracture

- Comminuted fracture - the bone is shattered into many pieces
- Stellate fracture\_ Occur in flat bones of skull and patella where the fracture line runs in various directions from one point
- Avulsion fracture - a muscle or ligament pulls on the bone, fracturing it
- Compression (crush) fracture - generally occurs in the spongy bone in the spine

- Fracture dislocation - a joint becomes dislocated, and one of the bones of the joint has a fracture

### Clinical features of a bone fracture

Can vary wildly depending on the affected region and severity.

- Pain
- Swelling
- Bruising
- Discoloured skin around the affected area
- Angulations - the affected area may be bent at an unusual angle
- The patient is unable to put weight on the injured area
- The patient cannot move the affected area
- The affected bone or joint may have a grating sensation
- If it is an open fracture there may be bleeding.

### Treatment of bone fracture.

Bone healing is a natural process which in most cases will occur automatically. Fracture treatment is usually aimed at making sure there is the best possible function of the injured part after healing. Treatment also focuses on providing the injured bone with the best circumstances for optimum healing (immobilization). For the natural healing process to begin, the ends of the broken bone need to be lined up - this is known as reducing the fracture. The patient is usually asleep under a general anesthetic when fracture reduction is done. Fracture reduction may be done by manipulation, closed reduction (pulling the bone fragments), or surgery.

**Immobilization** -as soon as the bones are aligned they must stay aligned while they heal. This may include:

Plaster casts or plastic functional braces - these hold the bone in position until it has healed.

**Metal plates and screws** - current procedures use minimally invasive techniques.

**Intra-medullary nails** - Internal steel rods are placed down the center of long bones. Flexible wires may be used in children.

**External fixators**- these may be made of metal or carbon fiber; they have steel pins that go into the bone directly through the skin. They are a type of scaffolding outside the body.



Usually the fractured bone area is immobilized for between two to eight weeks. The duration depends on which bone is affected and whether there are any complications, such as a blood supply problem or an infection.

**Healing** - If a broken bone has been aligned properly and kept immobile the healing process is usually straightforward. Osteoclasts (bone cells) absorb old and damaged bone while osteoblasts (other bone cells) are used to create new bone. Callus is new bone which is formed around a fracture. It forms on either side of the fracture and grows towards each end until the fracture gap is filled. Eventually the excess bone smooths off and the bone is like it used to be before.

**Factors influencing bone healing:** The patient's age, which bone is affected, the type of fracture, as well as the patient's general health is all factors which influence how rapidly the bone heals. If the patient smokes regularly the healing process will take longer.

**Physical therapy** - after the bone has healed it may be necessary to restore muscle strength as well as mobility to the affected area. If the fracture occurred near or through a joint there is a risk of permanent stiffness - the individual may not be able to bend that joint as well as before.

**Surgery** - if there was damage to the skin and soft tissue around the affected bone or joint, plastic surgery may be required.

### Complications of a bone fracture

#### Immediate complication

Shock, injury to vessels, injury to nerves and viscera in the vicinity

#### Delayed complication

These are complications setting in after a few days up to few weeks.

Infection, fat embolism, volkmann's ischemia, delayed nerve injury and myositis ossificans

#### Late complications

These occurs as late results of injury or of its mismanagement. This include

- **Malunion:**-Anatomically malunited with angulation, rotation or over riding of the fragments.
- **Nonunion:**-Failure of the fracture to unite by bony continuity.

- Cross union:- proximal fragment of one bone unite with the distal fragment of the other bone
- Stiffness and contracture of joints
- Myositis ossificans and Volkmann's ischemic contracture

### **Myositis ossificans**

Is a condition where there is new bone formation in soft tissues around joint following trauma. Myositis ossificans is a rare condition that may develop following Contusions that are severe and resulting in a large loss of movement. Treatment is initially conservative, as some patients' calcifications will spontaneously be reabsorbed, and others will have minimal symptoms. In occasional cases, surgical debridement of the abnormal tissue is required, although success of such therapy is limited.

Treatment of myositis ossificans:

- Rest
- Reduction
- Immobilization
- Anti-inflammatory drugs
- Physiotherapy management

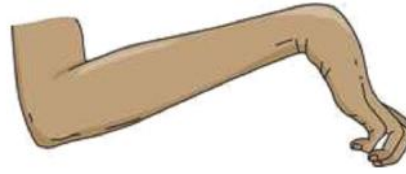
### **Volkmann contracture**

Is a deformity of the hand, fingers, and wrist caused by injury to the muscles of the forearm. Volkmann contracture occurs when there is a lack of blood flow (ischemia) to the forearm. This usually occurs when there is increased pressure due to swelling, a condition called compartment syndrome. Injury to the arm, including a crush injury or fracture, can lead to swelling that presses on blood vessels and can decrease blood flow to the arm. A prolonged decrease in blood flow will injure the nerves and muscles, causing them to become stiff (scarred) and shortened. When the muscle shortens, it pulls on the joint at the end of the muscle just as it would if it were normally contracted. But because it is stiff, the joint remains bent and stuck. This condition is called a contracture. There are three levels of severity in Volkmann contracture:

- Mild — contracture of two or three fingers only, with no or limited loss of feeling
- Moderate — all fingers are bent (flexed) and the thumb is stuck in the palm; the

wrist may be bent stuck, and there is usually loss of some feeling in the hand

- Severe — all muscles in the forearm that both flex and extend the wrist and fingers are involved; this is a severely disabling condition



### Symptoms

The main symptom is pain that does not improve with rest or pain medicines, and continues to get worse with time. If the pressure continues, there will be: Decreased sensation, Paleness of the skin and Weakness

### Treatment

If there is a forearm or elbow fracture, you should use a sling or splint to keep the area still and raise the arm above heart level. This helps prevent further injury and excessive swelling. The best treatment is early surgery to release the pressure in the forearm before permanent injury to the muscles and nerves occurs. Surgery to lengthen and sometimes transfer muscles is necessary to try to regain some hand function. But surgery is not as successful as early diagnosis and treatment.

### Dislocation and subluxation

Dislocation is the total displacement of articular end of bone from the joint cavity. A dislocated joint is a joint that slips out of place. It occurs when the ends of bones are forced from their normal positions. When a joint is dislocated, it no longer functions properly. A severe dislocation can cause tearing of the muscles, ligaments and tendons.

### Classification

- congenital :
- Traumatic: this usually follows a serious violence .types:- acute, old unreduced and recurrent dislocation
- Pathological
- paralytic
- Symptoms of a joint dislocation:
- Swelling
- Intense pain
- Immobility of the affected joint

## Treatment

Treatment of the dislocation depends on the site and severity of injury and may include:

- **Reduction.** During this process, doctor may try some gentle maneuvers to help bones back into position. Depending on the amount of pain and swelling, need a local anesthetic or even a general anesthetic before manipulation of bones.
- **Immobilization.** After bones are back in their right positions, doctor may immobilize joint with a splint or sling for several weeks. Use of the splint or sling depends on the joint involved and the extent of damage to nerves, blood vessels and supporting tissues.
- **Surgery.** May need surgery if doctor can't move dislocated bones back into their correct positions or if the nearby blood vessels, nerves or ligaments have been damaged. Surgery may also be necessary if recurring dislocations, especially of shoulder.
- **Rehabilitation.** After splint or sling is removed, begin a gradual rehabilitation program designed to restore joint's range of motion and strength.

**A subluxation** is a Partial dislocation of a joint. Subluxation is often the result of a traumatic or acute injury. In these cases, a subluxation of a joint can be quite painful. Subluxations may lead to damage of the normal structures that support a joint. For example, when an ACL tear occurs, often the joint is starting to dislocate, and the ligaments that normally support the knee joint are stretched too far, causing the knee joint to sublux.

Some of the common symptoms of a joint subluxation include:

- Pain around the injured joint
- A sensation of wanting to give-out or being unstable
- Swelling of the joint
- Limited mobility of the joint

Subluxations most often occur after an acute injury to the joint. Injuries can include sports injuries, car crashes, falls from a height, or even just simple twisting or reaching movements. Often patients describe hearing a pop or snap of the joint when the injury occurs. Subluxations can also occur as a result of loose joints. In patients with generalized joint laxity, their body may allow for joint subluxations without any trauma or injury.

## Treatment of Joint Subluxation

Early treatment of a joint subluxation should begin by ensuring the joint is in proper position. Once the joint alignment is confirmed, treatment can be focused at reducing inflammation of the affected joint. Steps that can be helpful to reduce inflammation include:

- **Rest:** Resting the joint may require the use of a splint, sling, or crutches. Depending on which joint is injured will determine what devices may help you to rest the joint. Limiting the exertion of the joint and allowing the injured joint to rest will help allow the inflammation to subside.
- **Ice:** Icing an injured joint can be a very helpful step to reduce inflammation. Applying ice packs to the area frequently can help quiet down an injured joint.
- **Elevate:** Elevation is helpful to reduce swelling and pain. Placing the injured joint above the level of the heart, and lying down can help allow the inflammation to subside.
- **Anti-Inflammatory Medications:** Anti-inflammatory medications, often called NSAIDs, are helpful tools to alleviate swelling and inflammation. By limiting the inflammation they can also help to reduce pain.
- **Splints/Supports/Braces:** Braces are often helpful at controlling excessive motion of an unstable joint. Until there can be a more definitive treatment plan, a brace can help to stabilize an unstable joint.
- Once the acute inflammation has subsided, a long-term treatment plan can be pursued. Many joint subluxations are one-time events, and patients will be able to recover full function of the joint. However, some other injuries can cause long-term and recurrent problems. If your symptoms of instability persist, then you should seek medical help to determine a longer-term plan.

## Soft tissue injury

The most common soft tissues injured are muscles, tendons, and ligaments. These injuries often occur during sports and exercise activities, but sometimes simple everyday activities can cause an injury. Sprains, strains, and contusions, as well as tendinitis and bursitis, are common soft-tissue injuries. Even with appropriate treatment, these injuries may require a prolonged amount of time to heal.

## Cause

Soft-tissue injuries fall into two basic categories: acute injuries and overuse injuries.

- Acute injuries are caused by a sudden trauma, such as a fall, twist, or blow to the body. Examples of an acute injury include sprains, strains, and contusions.
- Overuse injuries occur gradually over time, when an athletic or other activity is repeated so often, areas of the body do not have enough time to heal between occurrences. Tendinitis and bursitis are common soft-tissue overuse injuries.

Acute soft-tissue injuries vary in type and severity. When an acute injury occurs, initial treatment with the RICE protocol is usually very effective. RICE stands for Rest, Ice, Compression, and Elevation.

**Rest.** Take a break from the activity that caused the injury. Your doctor may recommend that you use crutches to avoid putting weight on your leg.

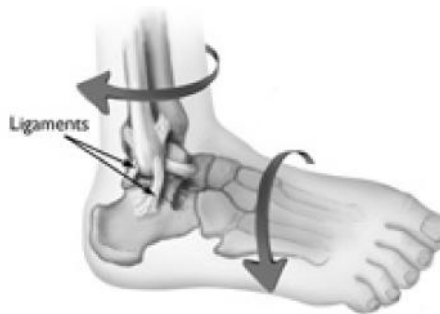
**Ice.** Use cold packs for 20 minutes at a time, several times a day. Do not apply ice directly to the skin.

**Compression.** To prevent additional swelling and blood loss, wear an elastic compression bandage.

**Elevation.** To reduce swelling, elevate the injury higher than your heart while resting.

## Sprains

A sprain is a stretch and/or tear of a ligament, a strong band of connective tissue that connect the end of one bone with another. Ligaments stabilize and support the body's joints. For example, ligaments in the knee connect the thighbone with the shinbone, enabling people to walk and run. The areas of body that are most vulnerable to sprains are ankles, knees, and wrists. A sprained ankle can occur when foot turns inward, placing extreme tension on the ligaments of outer ankle. A sprained knee can be the result of a sudden twist, and a wrist sprain can occur when falling on an outstretched hand.



A twisting force to the lower leg or foot is a common cause of ankle sprains.

Sprains are classified by severity:

**Grade 1 sprain (mild):** Slight stretching and some damage to the fibers (fibrils) of the ligament.

**Grade 2 sprain (moderate):** Partial tearing of the ligament. There is abnormal looseness (laxity) in the joint when it is moved in certain ways.

**Grade 3 sprain (severe):** Complete tear of the ligament. This causes significant instability and makes the joint nonfunctional.

While the intensity varies, pain, bruising, swelling, and inflammation are common to all three categories of sprains. Treatment for mild sprains includes RICE and sometimes physical therapy exercises. Moderate sprains often require a period of bracing. The most severe sprains may require surgery to repair torn ligaments.

### Strains

A strain is an injury to a muscle and/or tendons. Tendons are fibrous cords of tissue that attach muscles to the bone. Strains often occur in your foot, leg (typically the hamstring) or back. Similar to sprains, a strain may be a simple stretch in your muscle or tendon, or it may be a partial or complete tear in the muscle-and-tendon combination. Typical symptoms of a strain include pain, muscle spasm, muscle weakness, swelling, inflammation, and cramping.

The recommended treatment for a strain is the same as for a sprain: rest, ice, compression and elevation. This should be followed by simple exercises to relieve pain and restore mobility. Surgery may be required for a more serious tear.

### PRICE therapy

PRICE stands for:

**Protection** – protect the affected area from further injury by using a support or, in the case of an ankle injury, wearing shoes that enclose and support your feet, such as lace-ups.

**Rest** – stop the activity that caused the injury and rest the affected joint or muscle. Avoid activity for the first 48 to 72 hours after injuring yourself. Your GP may recommend you use crutches.

**Ice** – for the first 48 to 72 hours after the injury; apply ice wrapped in a damp towel to the injured area for 15 to 20 minutes every two to three hours during the day.

Don't leave the ice on while you're asleep, and don't allow the ice to touch your skin directly because it could cause a cold burn.

**Compression** – compress or bandage the injured area to limit any swelling and movement that could damage it further. You can use a simple elastic bandage or an elasticated tubular bandage available from a pharmacy. It should be wrapped snugly around the affected area, but not so tightly that it restricts blood flow. Remove the bandage before you go to sleep.

**Elevation** – keep the injured area raised and supported on a pillow to help reduce swelling. If your leg is injured, avoid long periods of time where your leg isn't raised.

Mechanism, Clinical features and management of injury to lateral ligament of Ankle joint as an example.

The ankle is a hinge joint between the leg and the foot, and allows up and down movement. The bones of the leg (tibia and fibula) form a slot, and the talus bone of the foot fits between them. The talus is held to the tibia and fibula by strong bands of tissue called ligaments. Each ligament is made of many strands or fibres of a material called collagen, which is extremely strong. The ligament on the inside of the ankle (the deltoid ligament) has two layers; the deepest one is most important. This ligament is mainly torn in association with severe fractures of the ankle bones. Sporting injuries of this ligament are rare. The ligament on the outside of the ankle (lateral ligament) is made up of three separate bands: one at the front (anterior talo-fibular ligament), one in the middle (calcaneo-fibular ligament) and one at the back (posterior talo-fibular ligament). The front and middle bands are the ligaments injured in a sprain.

Most ankle ligament injuries are caused when the foot twists inwards. All of the body's weight is then placed on the lateral ankle ligaments. Most ankle sprains are fairly minor injuries, which will get better with simple self-care treatment. The word RICE reminds us of the basic treatment of a sprained joint.

Normally a sprained ankle will recover within 6-8 weeks, although it may tend to swell for a few months longer.

### **Arthritis**

Arthritis is acute or chronic inflammation of a joint, often accompanied by pain and structural changes and having diverse causes, as infection, crystal deposition, or injury. Arthritis is more common among adults aged 65 years or older, but people of all ages (including children) can be affected. There are more than 100 different types of arthritis and related conditions. People of all ages, sexes and races can and do have arthritis, and it is the leading cause of disability



### Causes of arthritis

There is no single cause of all types of arthritis; the cause or causes in any given case vary according to the type or form of arthritis. Potential causes for arthritis may include:

- Injury - leading to degenerative arthritis
- Abnormal metabolism - leading to gout and pseudo gout
- Inheritance - such as in osteoarthritis
- Infections - such as in the arthritis of Lyme disease
- Immune system dysfunction - such as in RA and SLE

Common arthritis joint symptoms include swelling, pain, stiffness and decreased range of motion. Symptoms may come and go. They can be mild, moderate or severe. They may stay about the same for years, but may progress or get worse over time. Severe arthritis can result in chronic pain, inability to do daily activities and make it difficult to walk or climb stairs. Arthritis can cause permanent joint changes.

### Types of arthritis:

- Degenerative Arthritis
- Rheumatoid arthritis
- Inflammatory Arthritis
- Infectious Arthritis
- Metabolic Arthritis

### Clinical features and general management of Rheumatoid arthritis

Rheumatoid arthritis is an autoimmune disease that can cause chronic inflammation of the joints and other areas of the body. Rheumatoid arthritis is characterized by periods of disease flares and remissions. In rheumatoid arthritis, multiple joints are usually, but not always, affected in a symmetrical pattern. Chronic inflammation of rheumatoid arthritis can cause permanent joint destruction and deformity. Damage to joints can occur early and does not always correlate with the severity of RA

Rheumatoid arthritis symptoms and signs include

- Joint pain in the feet, hands, and knees,
- Swollen joints,

- Fever,
- Tender joints,
- Loss of joint function,
- Stiff joints,
- Fatigue,
- Joint redness,
- Rheumatoid nodules,
- Joint warmth
- Joint deformity.

There is no cure for RA. The treatment of rheumatoid arthritis optimally involves a combination of patient education, rest and exercise, joint protection, medications, and occasionally surgery. Medications used in the treatment of rheumatoid arthritis include NSAIDs, DMARDs, TNF alpha inhibitors, IL-6 inhibitors, immune suppressants, and steroids. Early RA treatment results in a better prognosis..

### **Rehabilitation Management for Rheumatoid Arthritis Patients**

**Rest:** Rest and energy conservation can be helpful for locally inflamed joints, but should be avoided long-term due to the potential deleterious side effects

**Exercise :** A structured exercise program can be greatly beneficial to the overall well-being and functioning of the individual with rheumatoid arthritis. Such a program should focus on stretching, strengthening and aerobic conditioning while conserving energy

**Stretching :** Acutely, inflamed joints should be rested to prevent exacerbation of symptoms. For non-inflamed joints, active or active-assisted stretching of all major joints is essential to prevent contracture formation and maintain the current range of motion to perform most activities of daily living.

**Strengthening:** Strengthening exercises should be utilized in non-inflamed joints; while isometric exercises can help maintain strength to prevent injury or facilitate fatigue.

**Aerobic Conditioning:** Several studies have shown the benefit from an aerobic conditioning or aquatic exercise program. in-water exercise would decrease the forces against joints, and the warmth could help decrease joint pain and decrease muscle spasm. They noted an increase in strength and endurance from the water exercise program..

**Superficial Heat:** Superficial heat has its greatest effect on the skin and subcutaneous tissues (Feibel 1976). It is especially useful in circumstances where the goal is to heat joints that are covered by little soft tissue such as those in the hands and feet

**Deep Heat:** Deep heating increases the tissue temperature at a deeper level without overheating skin and subcutaneous fat

**Cryotherapy :** Cold therapy has several physiologic effects that enhance or suppress normal responses to certain stressors. Hemodynamic effects include reflexive vasoconstriction followed by delayed vasodilation. Neuromuscular effects include slowing of nerve conduction velocity, and decreased firing of the muscle spindles, which have been shown by some to reduce spasticity.

**Electrical Nerve Stimulation:** The primary delivery mechanism is via transcutaneous electrical nerve stimulation .

### **Clinical features and general management of Osteoarthritis**

Osteoarthritis is the most common form of arthritis, affecting millions of people worldwide. It occurs when the protective cartilage on the ends of your bones wears down over time. Although osteoarthritis can damage any joint in your body, the disorder most commonly affects joints in your hands, knees, hips and spine. Osteoarthritis often gradually worsens, and no cure exists. But staying active, maintaining a healthy weight and other treatments may slow progression of the disease and help improve pain and joint function.

Osteoarthritis occurs when the cartilage that cushions the ends of bones in your joints gradually deteriorates. Cartilage is a firm, slippery tissue that permits nearly frictionless joint motion. In osteoarthritis, the slick surface of the cartilage becomes rough. Eventually, if the cartilage wears down completely, you may be left with bone rubbing on bone.

Osteoarthritis symptoms often develop slowly and worsen over time. Signs and symptoms of osteoarthritis include:

- **Pain.** Your joint may hurt during or after movement.
- **Tenderness.** Your joint may feel tender when you apply light pressure to it.
- **Stiffness.** Joint stiffness may be most noticeable when you wake up in the morning or after a period of inactivity.
- **Loss of flexibility.** You may not be able to move your joint through its full range of motion.

- Grating sensation. You may hear or feel a grating sensation when you use the joint.
- Bone spurs. These extra bits of bone, which feel like hard lumps, may form around the affected joint.

**Treatments:**

There's no known cure for osteoarthritis, but treatments can help reduce pain and maintain joint movement.

**Physical therapy.** A physical therapist can work to create an individualized exercise program that will strengthen the muscles around joint, increase range of motion and reduce pain.

**Braces or shoe inserts.** Doctor may recommend shoe inserts or other devices that can help reduce pain when stand or walk. These devices can immobilize or support your joint to help take pressure off it.

**Surgical and other procedures:** If conservative treatments don't help, you may want to consider procedures such as: Cortisone shots, Lubrication injections, Realigning bones and Joint replacement.

**Clinical features and general management of Ankylosing spondylitis**

Ankylosing spondylitis is an inflammatory disease that can cause some of the vertebrae in your spine to fuse together. This fusing makes the spine less flexible and can result in a hunched-forward posture. If ribs are affected, it may be difficult to breathe deeply. Ankylosing spondylitis affects men more often than women. Signs and symptoms of ankylosing spondylitis typically begin in early adulthood. There is no cure for ankylosing spondylitis, but treatments can decrease your pain and lessen your symptoms.

**Symptoms:** The most common early symptoms of ankylosing spondylitis include:

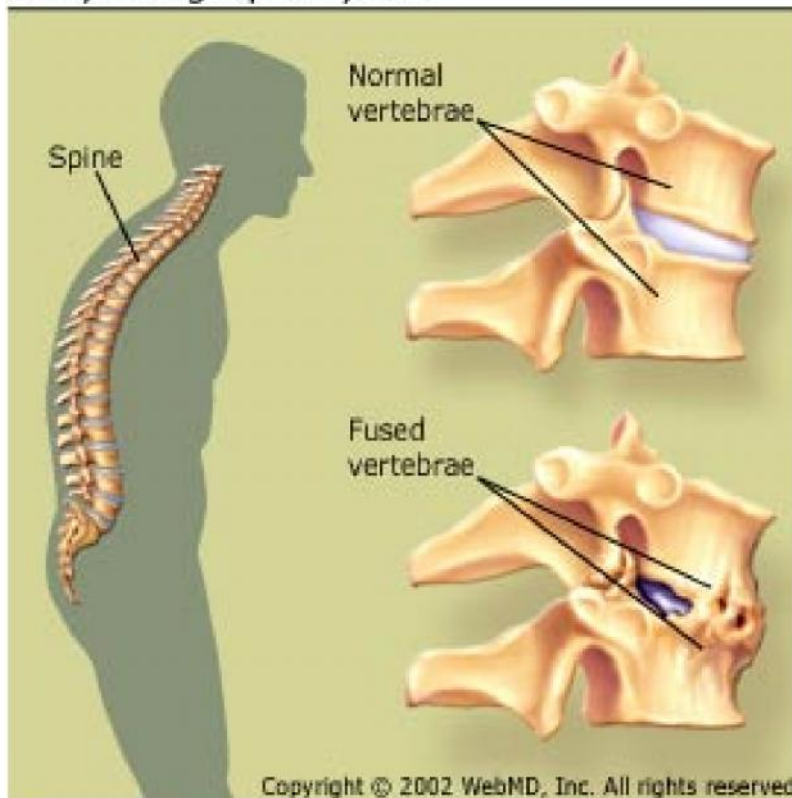
- Pain and stiffness: Constant pain and stiffness in the low back, buttocks, and hips that continue for more than three months. Spondylitis often starts around the sacroiliac joints, where the sacrum (the lowest major part of the spine) joins the ilium bone of the pelvis in the lower back region.
- Bony fusion: Ankylosing spondylitis can cause an overgrowth of the bones, which may lead to abnormal joining of bones, called "bony fusion." Fusion affecting bones of the neck, back, or hips may impair a person's ability to perform routine activities. Fusion of the ribs to the spine or breastbone may limit a person's ability to expand his or her chest when taking a deep breath.

- Pain in ligaments and tendons: Spondylitis also may affect some of the ligaments and tendons that attach to bones. Tendonitis (inflammation of the tendon) may cause pain and stiffness in the area behind or beneath the heel, such as the Achilles tendon at the back of the ankle.

## Management

There is no cure for ankylosing spondylitis, but there are treatments that can reduce discomfort and improve function. The goals of treatment are to reduce pain and stiffness, maintain a good posture, prevent deformity, and preserve the ability to perform normal activities. When properly treated, people with ankylosing spondylitis may lead fairly normal lives. Early intervention with physical and occupational therapy is important to maintain function and minimize deformity. A program of daily exercise helps reduce stiffness, strengthen the muscles around the joints and prevent or minimize the risk of disability. Deep breathing exercises may help keep the chest cage flexible. Swimming is an excellent form of exercise for people with ankylosing spondylitis.

### Ankylosing Spondylitis



## Awareness of the following orthopaedic conditions

### 1. Cervical and lumbar spondylosis

Cervical spondylosis is a general term for age-related wear and tear affecting the spinal disks in your neck. As the disks dehydrate and shrink, signs of osteoarthritis develop, including bony projections along the edges of bones (bone spurs). Cervical spondylosis is very common and worsens with age. More than 85 percent of people older than age 60 are affected by cervical spondylosis. Most people experience no symptoms from these problems. When symptoms do occur, (include pain and stiffness) in the neck nonsurgical treatments often are effective. Sometimes, cervical spondylosis results in a narrowing of the space needed by the spinal cord and the nerve roots that pass through the spine to the rest of your body. If the spinal cord or nerve roots become pinched, you might experience:

- Tingling, numbness and weakness in your arms, hands, legs or feet
- Lack of coordination and difficulty walking
- Loss of bladder or bowel control

#### Causes

As age increases, the bones and cartilage that make up your backbone and neck gradually develop wear and tear. These changes can include: Dehydrated disks, Herniated disks, Bone spurs and Stiff ligaments.

#### Treatment

Treatment for cervical spondylosis depends on the severity of your signs and symptoms. The goal of treatment is to relieve pain, help you maintain your usual activities as much as possible, and prevent permanent injury to the spinal cord and nerves.

A physical therapist can teach exercises to help stretch and strengthen the muscles in neck and shoulders. Some people with cervical spondylosis benefit from the use of traction, which can help provide more space within the spine if nerve roots are being pinched.

#### Acupuncture: Recommend trying acupuncture to reduce pain.

**Surgery:** If conservative treatment fails or if neurological signs and symptoms — such as weakness in your arms or legs — worsen, might need surgery to create more room for spinal cord and nerve roots.

The surgery might involve: Removing a herniated disk or bone spurs, Removing part of a vertebra and Fusing a segment of the neck using bone graft .

## Lumbar spondylosis

Spondylosis is degenerative osteoarthritis of the joints between the spinal vertebrae and/or neural foramina. Lower back spondylosis or osteoarthritis is known as lumbar spondylosis.

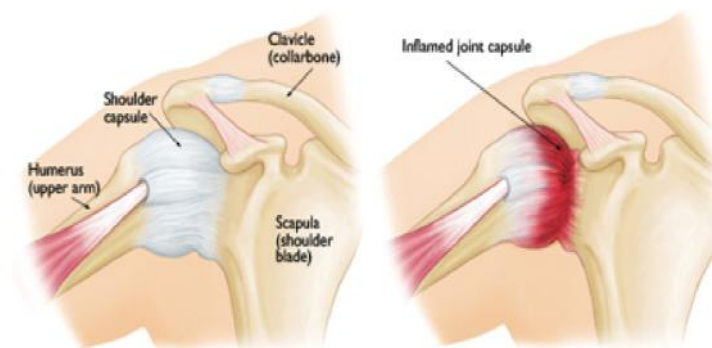
**Lumbar spondylitis symptoms and treatment:** Symptoms of spondylitis vary depending on the individual and the location and severity of the condition. The common symptoms of spondylitis include:

- Stiffness and pain in the neck or back
- Loss of mobility in the spine
- Inability to twist and turn, or to do so without pain
- Chronic pain and discomfort when standing, sitting, or walking
- Deformity or abnormal spine curvature
- There are several conservative treatments to reduce chronic pain, including physical therapy, yoga and medication.

## 2. Periarthritis shoulder

Periarthritis is a condition characterised by pericapsular adhesions following a minor trauma to the degenerated rotator cuff. Patient past middle age, presents with diffuse pain in the shoulder with radiation down to the middle of the upper arm. It is commoner in patients with diabetes and myocardial ischemia. On examination there will be tenderness in the subacromial region and in the anterior joint line. There is marked limitation of abduction and external rotation of the shoulder.

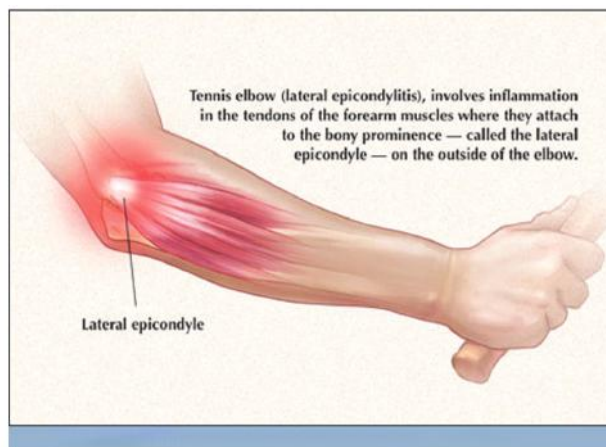
When the condition involves the whole rotator cuff, it results in total restriction of all movements of joint. The condition is then termed as frozen shoulder. Treatment after controlling the pain with analgesics and short wave diathermy is vigorous shoulder mobilization exercises. Resisted cases are treated by local infiltration of hydrocortisone and manipulation under anaesthesia.





### 3. Tennis elbow

Tennis elbow or lateral epicondylitis is a condition in which the outer part of the elbow becomes sore and tender. The forearm muscles and tendons become damaged from overuse — repeating the same strenuous motions again and again. This leads to pain and tenderness on the outside of the elbow. Any activity, including playing tennis, which involves the repetitive use of the extensor muscles of the forearm can cause acute or chronic tendonitis of the tendinous insertion of these muscles at the lateral epicondyle of the elbow. The condition is common in carpenters and other laborers who swing a hammer or other tool with the forearm.



### 4. Golfers elbow

Golfer's elbow is a condition that causes pain where the tendons of forearm muscles attach to the bony bump on the inside of elbow. Golfer's elbow is characterized by.

- Pain and tenderness on the inner side of elbow: Sometimes the pain extends along the inner side of forearm. Pain typically worsens with certain movements.
- Stiffness: Elbow may feel stiff, and it may hurt to make a fist.
- Weakness: May have weakness in hands and wrists.
- Numbness or tingling. These sensations might radiate into one or more fingers — usually the ring and little fingers.

#### Treatment:

The sooner you begin treatment, the sooner you'll be able to return to your usual activities.

Rest.:Put golf game or other repetitive activities on hold until the pain is gone. If return to activity too soon, may make it worse.

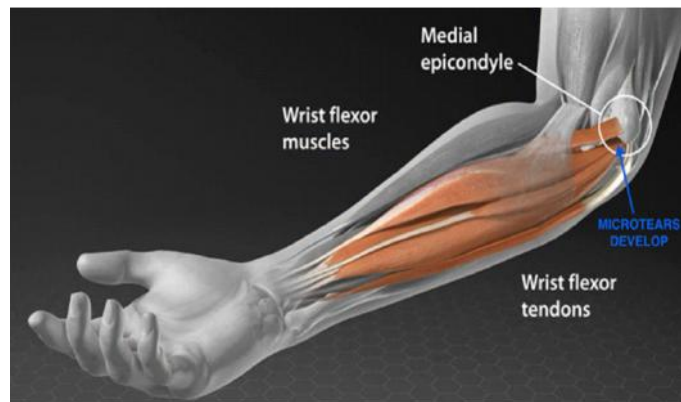


Ice the affected area: Apply ice packs to elbow for 15 to 20 minutes at a time, three to four times a day for several days.

Take an over-the-counter pain reliever: Try ibuprofen (Advil, Motrin IB, others), naproxen sodium (Aleve, others) or acetaminophen (Tylenol, others).

Use a brace: Doctor might recommend to wear a counter force brace on affected arm, which might reduce tendon and muscle strain.

Stretch and strengthen the affected area: A type of strengthening (eccentric) that lengthens the tendon of the wrist extensor muscles has been shown to be particularly effective in treating chronic tendon irritation.



## 5. Plantar fasciitis

Plantar fasciitis is one of the most common causes of heel pain. It involves pain and inflammation of a thick band of tissue, called the plantar fascia, that runs across the bottom of foot and connects heel bone to toes. Plantar fasciitis commonly causes stabbing pain that usually occurs with very first steps in the morning. Once foot limbers up, the pain of plantar fasciitis normally decreases, but it may return after long periods of standing or after getting up from a seated position. Plantar fasciitis is particularly common in runners. In addition, people who are overweight and those who wear shoes with inadequate support are at risk of plantar fasciitis.

### Treatment .

The goals of treatment for plantar fasciitis are to:

Relieve inflammation and pain in the heel.

Allow small tears in the plantar fascia ligament to heal.

Improve strength and flexibility and correct foot problems such as excessive pronation so that don't stress the plantar fascia ligament.

Rest feet. Limit or, if possible, stop daily activities that are causing heel pain. Try to avoid running or walking on hard surfaces, such as concrete.

To reduce inflammation and relieve pain, put ice on heel. Try a nonsteroidal anti-inflammatory drug (NSAID) such as ibuprofen or naproxen. NSAIDs come in pills and in a cream that rub over the sore area.

Wear shoes with good shock absorption and the right arch support for foot. Athletic shoes or shoes with a well-cushioned sole are usually good choices.

Try heel cups or shoe inserts to help cushion heel.

Put on your shoes as soon as you get out of bed. Going barefoot or wearing slippers may make your pain worse.



## Amputation

Amputation is the removal of the whole or part of a limb by cutting through bone or joint.

### Indication of amputation

1. **Traumatic conditions:** Crush injuries to the limb
2. **Vascular conditions:** ischemic condition of the limb-Atherosclerosis, gangrene etc
3. **Neoplastic conditions:** Malignant tumors of bone or soft tissue
4. **Infective conditions:** Leprosy, filarial elephantiasis etc
5. **Congenital conditions:** when the limb is grossly deformed and useless.

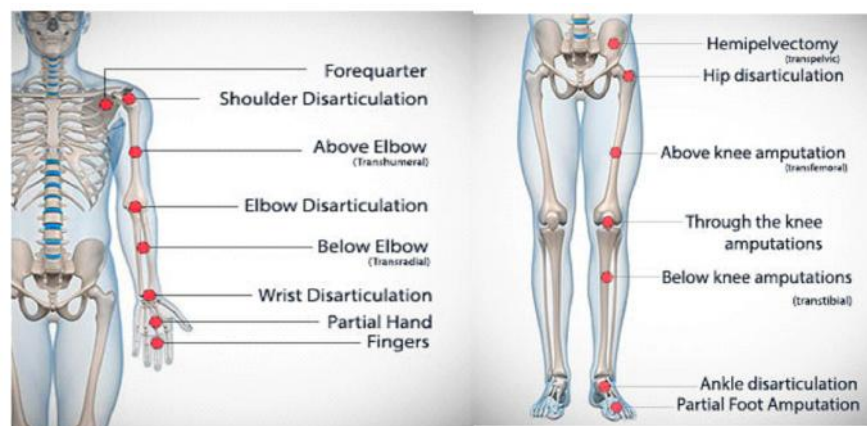
### Types of amputation

Classified according to the surgical technique or the emergency of situation

1. **Guillotine Amputation:** Used when primary healing is unlikely or delayed because of infection, ischemia, or inadequate wound debridement. It is done as an emergency procedure, to save the life of the patient.

2. **Classical Amputation:** These are planned amputation where regular skin flaps are raised and the wound is closed after ablation of limb.
3. **Revision Amputation:** Used after provisional amputation as an elective surgery. In this, level is well- defined & thought out, with the ultimate prosthesis kept in mind.

### Levels of amputation



### Complications of amputation

Immediate complication: Infection, secondary haemorrhage, skin sloughing

Late complication:

Stump neuroma

Contractures

**Phantom limb** : Phantom pain and sensations are defined as perceptions ranging from slight tingling to sharp, throbbing pain or aching that patients perceive relating to an extremity or an organ that is physically no longer a part of the body. Phantom pain is a common problem, affecting between 8% to 10% of patients and is usually reported during the immediate postoperative period but can persist for up to two years. In some cases, phantom pain can be a lifelong experience

Pre and post operative Physiotherapy care

Pre-operative care

Assess the patient Pre-Operatively to know the current status of the patient

Subjective Examination: Current History, Past Medical History, Medications., Social History (-Where the client will likely return to after discharge, eg home, hostel, Who

is at home to assist in ADL's, or could participate / supervise in their rehabilitation etc ) Vocational activities, Premorbid Mobility Levels, Pain etc

Objective Examination: Joint Range of motion, Muscle Lengths, Muscle Strength, Condition of intact limb, Arm Function, Functional Assessments etc

Instructions on Post-Operative Exercises and Positioning

Short term goals include: Maintenance of respiratory function, Maintenance of strength, Maintenance of range of motion & muscle lengths and Maintenance of cardiovascular fitness.

### **Post-operative care**

Maintain function in the remaining leg and stump to maintain peripheral circulation. Maintain respiratory function  
 Mobility Aids: The choice of mobility aids depends on the level of fitness, strength, balance skills of the individual: Walking frame, Axillary crutches, Elbow crutches, Walking stick and For bilateral lower limb amputees a wheelchair is indicated

### **Stump and its Management**

Stump is the residual part of the limb which is left after amputation

Amputees will be taught to care for their stump by either a nurse or a physiotherapist. It is extremely important that to master the techniques of caring stump. If utmost attention is not given to this care then small easily reversible problems may develop into large ones which become difficult to treat.

Care of the Stump – Keep the stump clean, dry, and free from infection at all times.  
 – If fitted with a prosthesis, you should remove it before going to sleep. – Inspect and wash the stump with mild soap and warm water every night, then dry thoroughly and apply talcum powder. – Do not use the prosthesis until the skin has healed. – The stump sock should be changed daily, and the inside of the socket may be cleaned with mild soap.

RESIDUAL LIMB WRAPPING Early wrapping provides a number of positive benefits: Decrease odema & venous stasis , Assist in shaping , Help in counteract contracture , Provide skin protection , Reduce redundant tissue problems, Reduce phantom limb sensation and discomfort and Desensitize the residual limb with local pain.

### **Practical**

1. Application of price therapy in soft tissue injury
2. Application of elastocrepe bandage in lateral ligament injury
3. Demonstration of exercise for rheumatoid arthritis
  - Joint mobility exercise
  - Exercises for knee joint osteoarthritis
  - Isometric
  - Mobility
  - Strengthening
4. Demonstration of exercises for cervical and lumbar exercises
  - Isometric neck exercise
  - Neck mobility exercise
  - Spinal extension /flexion exercise
5. Preparation and positioning of client for electro therapy.
  - IRR for per arthritis
  - US for tennis/golfers/plantar fasciitis

### **Assessment Activities**

Seminar  
Assignments  
Field visit  
Chart preparation  
Quiz  
Collection  
Model Preparation

### TE Questions

1. Write any four differences between RA and OA
2. Briefly explain about stump management
3. List out the complications of fracture
4. Partial displacement of articular surfaces of joint is known as \_\_\_\_\_
5. Differentiate between
  - Dislocation and subluxation
  - Sprain and strain-
6. Short note on
  - Plantar fasciitis
  - Tennis elbow
  - Ankylosing spondylitis
  - Periarthritis shoulder

## INTRODUCTION OF PAEDIATRIC CONDITIONS AND RELEVANCE OF PHYSIOTHERAPY

### Introduction

Paediatric physiotherapists work with people of varying ages from premature babies to adolescents to ensure optimal physical function and development. Like all physiotherapists, they are concerned with movement, co-ordination, posture and the cardiorespiratory system. The aim of the paediatric physiotherapist is to provide a program that the client will enjoy, while encouraging them to participate and become independent.

Paediatric physiotherapists aim to minimise the effects of physical impairment to promote optimum function and musculoskeletal development. Advice on activities and stretches offered by the physiotherapist can assist in maintaining full range of movement and prevention of contracture. Paediatric Physiotherapists treat many conditions similar to those in general physiotherapy practice. However, there are many conditions which are related almost entirely to paediatrics. Some of these are recognised at birth, others may become apparent later in the child's life.

### Learning outcomes

The learner:

- To understand the condition Cerebral palsy
- To assist the physiotherapist in management of cerebral palsy
- To do the corrective movement of CTEV
- To identify and assist in the management of Erb's Palsy ,CDH ,Spina Bifida and Torticollis

### Concepts

#### Cerebral palsy

Cerebral palsy is refers to a group of disorders affecting a person's ability to move. It is due to damage to the developing brain either during pregnancy or shortly after birth.Cerebral palsy affects people in different ways and can affect body movement, muscle control, muscle coordination, muscle tone, reflex, posture and balance. Although cerebral palsy is a permanent life-long condition, some of these signs of cerebral palsy can improve or worsen over time.People who have cerebral

palsy may also have visual, learning, hearing, speech, epilepsy and intellectual impairments. Cerebral palsy is the result of a combination of events either before, during or after birth that can lead to an injury in a baby's developing brain. There is no single cause of cerebral palsy. For most babies born with cerebral palsy, the cause remains unknown. Researchers now know that only a very small percentage of cases of cerebral palsy are due to complications at birth (e.g. asphyxia or lack of oxygen). It is accepted that cerebral palsy usually arises from a series of causal pathways, i.e. a sequence of events that when combined can cause or accelerate injury to the developing brain.

Stroke is the most common cause in babies who acquire cerebral palsy after 1 month of age. The stroke may occur spontaneously or arise from surgical or heart complications

### **CTEV**

Congenital talipes equino varus also known as 'club foot', is a congenital foot deformity present at birth. It is one of the most common congenital deformities. Incidence varies between ethnic groups.

Clinical Presentation : Foot plantar flexed at ankle, Inverted at subtaloid joint, Adducted at forefoot

Foot become smaller than normal, Heel poorly developed, Crease across the medial border, Lateral malleolus prominent. Medial malleolus buried in to depression. Foot cannot be dorsiflexed and everted .Wasting of calf muscle.

### **Principle of treatment**

Correct the deformity-hold the foot in corrected position

Treatment should begin in the first few weeks of life

Different component of deformity should be corrected in the proper sequences,

Fore foot adduction first, Inversion next, equinus last-failure to follow –break the foot—use minimum force

Conservative treatment

1st week-mother is taught to mould the infants foot twice a day, 3 weeks to 3 months-surgeon manipulate once in 2 weeks, maintained by pop, After 4 or 5 manipulation correction is maintained by splint-deni's brown splint



### Surgical treatment

If correction is not achieved by POP, surgery is indicated. Soft tissue operation- postero medial soft tissue release, complete subtaloid release, Tendo achilus lengthening, alligaments and soft tissue release, Bone operation- lateral wedge resection, calcaneo cuboid fusion.

### CDH

Congenital hip dislocation also known as dysplasia of the hip is a condition in which a child is born with a hip problem. Congenital hip dislocation is when the formation of the hip joint is abnormal. The ball at the top of the thighbone which is known as the femoral head is not stable within the socket (which is also known as the acetabulum). This abnormality may cause the ligaments of the hip to be loose or stretched. This condition is usually diagnosed once the baby is born; it mostly affects the left side of the hip in first-born children, girls, and babies born in a breech position. Girls are four times as likely to have hip dysplasia compared to boys. The cause of this condition is still unknown; however, some factors of congenital hip dislocation are through heredity and racial background. It is also thought that the higher incidence in some ethnic groups

The early sign of congenital hip dislocation is when a person is able to hear “clicking” sounds when the legs are moved apart from one another. This condition can be treated if detected early. If this condition goes undetected it can cause one leg to look shorter than its counterpart and the buttock folds are also not symmetrical which causes more creases to be present on the affected side, and skin folds at the thigh are uneven.

### Treatment

Aim-Reduce the hip and maintain it in the reduced position. Treatment is age related and depend on the age at which child is brought.

Below 3 month-von rosen splin,

- 3- 6 month –reduced by gentle manipulation under general anaesthesia.
- 6 - 2 month-preliminary traction and gradual abduction
- 2 - 3 weekplaster spica applied
- 1 - 3 years-surgical open reduction
- 3 - 6 years-open reduction and osteotomy of femur,hip bone

## Spina bifida

Spina bifida is a birth defect where there is incomplete closing of the backbone and membranes around the spinal cord. There are three main types: spina bifida occulta, meningocele, and myelomeningocele. The most common location is the lower back, but in rare cases it may be the middle back or neck.

### Signs and symptoms

- Physical signs of spina bifida may include:
- Leg weakness and paralysis
- Orthopedic abnormalities (i.e., club foot, hip dislocation, scoliosis)]
- Bladder and bowel control problems, including incontinence, urinary tract infections, and poor kidney function
- Pressure sores and skin irritations
- Abnormal eye movement

### Treatment

There is no known cure for nerve damage caused by spina bifida. Standard treatment is surgery after delivery. This surgery aims to prevent further damage of the nervous tissue and to prevent infection

## Torticollis

Torticollis is the Deformity of the neck charecterised by tilting of head to one side, Rotation of the occiput to one side and chin to opposite side. Contracture of sternocledomastoid on one side may be due to myodysplasia of genetic origin, Birth trauma, hematoma,or arterial ischemia

**Clinical feature:** Firm swelling at the junction of midle and distal third of sternomastoid muscle

In left torticollis—the chin is tilted upward to the right side and the occiput is tilted down on the left side

In neglected cases contracture is severe and cannot be stretched passively

### Treatment

Mild deformity: -physiotherapy, Heat modality, Passive movement to cervical spine, Passive stretching of sternocledomastoid.

After correction –maintained by passive hold.

Home treatment-train the mother.

During sleep-positioning by pillows and sand bags

### **Practical**

1. Demonstrate the correction of deformity in the following conditions

CTEV

TORTICOLLIS

### **Assessment Activities**

Seminar

Assignments

Field visit

Chart preparation

Quiz

Collection

Model Preparation

### **TE Questions**

Define cerebral palsy

Write about the position of neck in right side torticollis

Write about the deformity in CTEV

Name the splint used in

CDH

CTEV

## INTRODUCTION OF PHYSIOTHERAPY IN SURGICAL CONDITION

### Introduction

The physiotherapist has an important role to play in assessing which patients being prepared for surgery are at risk of developing complications that she may help to prevent. The physiotherapist must take into consideration the effects of the anesthetic on secretions in the respiratory tract. The physiotherapist will explain to the patient why treatment is necessary and teach the patient the exercises that he will be required to perform post-operatively.

### Learning out comes

- To familiarize the importance of physiotherapy in Head injury
- To familiarize with the importance of physiotherapy in Spinal cord injury
- To familiarize with the importance of physiotherapy in Burns

### Concepts

#### Head injury

A head injury is any sort of injury to brain, skull, or scalp. This can range from a mild bump or bruise to a traumatic brain injury. Common head injuries include concussions, skull fractures, and scalp wounds. The consequences and treatments vary greatly, depending on what caused head injury and how severe it is. Head injuries may be either closed or open. A closed head injury is any injury that doesn't break skull. An open, or penetrating, head injury is one in which something breaks skull and enter brain. It can be hard to assess how serious a head injury is just by looking. Some minor head injuries bleed a lot, while some major injuries don't bleed at all. It's important to treat all head injuries seriously and get them assessed by a surgeon.

#### Causes

In general, head injuries can be divided into two categories based on what causes them. They can either be head injuries due to blows to the head or head injuries due to shaking.

Head injuries caused by shaking are most common in infants and small children, but they can occur any time due to violent shaking.

Head injuries caused by a blow to the head are usually associated with:

motor vehicle accidents

falls

physical assaults

sports-related accidents

## Major Types of Head Injuries

### Hematoma

A hematoma is a collection, or clotting, of blood outside the blood vessels. It can be very serious if a hematoma occurs in the brain. The clotting can cause pressure to build inside skull, which can cause to lose consciousness.

### Hemorrhage

A hemorrhage is uncontrolled bleeding. There can be bleeding in the space around brain, which is a subarachnoid hemorrhage, or bleeding within brain tissue, which is an intracerebral hemorrhage.

Subarachnoid bleeds often cause headaches and vomiting.

### Concussion

A concussion is a brain injury that occurs when brain bounces against the hard walls of skull. Generally speaking, the loss of function associated with concussions is temporary. However, repeated concussions can eventually lead to permanent damage.

### Edema

Any brain injury can lead to edema, or swelling. Many injuries cause swelling of the surrounding tissues, but it's more serious when it occurs in brain. Skull can't stretch to accommodate the swelling, which leads to a buildup of pressure in brain. This can cause brain to press against skull.

### Skull Fracture

Skull doesn't have bone marrow. This makes the skull very strong and difficult to break. A broken skull is unable to absorb the impact, making it more likely that there will also be damage to brain.

### Diffuse Axonal Injury

A diffuse axonal injury, or sheer injury, is an injury to the brain that doesn't cause bleeding but does damage brain cells. Though it isn't as outwardly visible as other forms of brain injury, diffuse axonal injury is one of the most dangerous types of head injuries and can lead to permanent brain damage and even death.

## Symptoms of a Head Injury

Common symptoms of a minor head injury include:

- Headache
- Mild confusion
- Nausea
- Temporary ringing in the ears
- Loss of consciousness
- Seizures
- Vomiting
- Balance or coordination problems
- Abnormal eye movements
- A loss of muscle control
- A persistent or worsening headache
- Memory loss
- Changes in mood

## Treatment

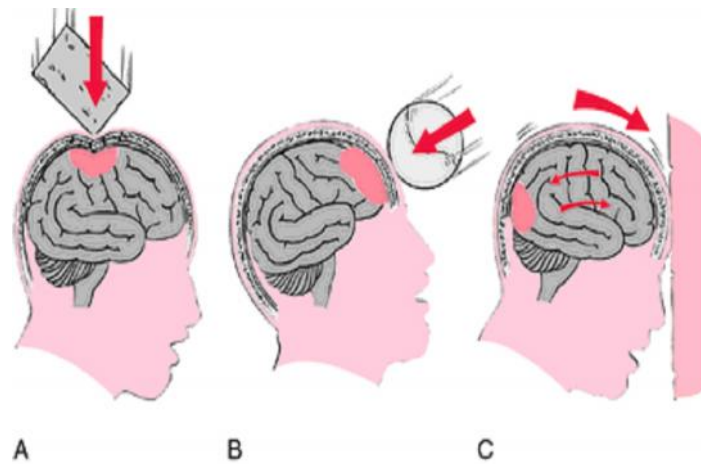
The treatment for head injuries depends on both the type and the severity of the injury. With minor head injuries, there are often no symptoms other than pain at the site of the injury. If have an open cut, may use sutures or staples to close it. Even if injury seems minor, watch condition to make sure it doesn't get worse. May need to be hospitalized if serious head injury occur. The treatment at the hospital will depend on diagnosis.

The treatment for severe head injuries can include: Medication, Surgery and Rehabilitation

## Physiotherapy

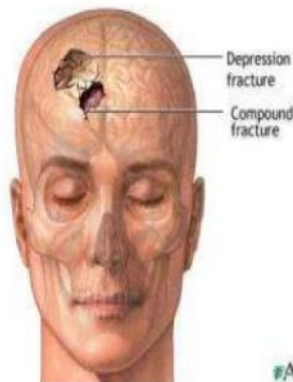
Physiotherapy helps restore movement and function to as near normal as possible when someone is affected by a brain injury. Neuromuscular (brain, nervous system and musculoskeletal system) specialist physiotherapist play an essential role in the multidisciplinary team, working with brain injured persons. The role of a physiotherapist starts right from the acute stage (initial days after the injury) of brain injury through the rehabilitation phase to the long term care.

In the acute stages, the physios work with the injured person to maintain/ improve their respiratory status, commonly known as chest physio. This helps the injured person to clear the secretions from their airways thereby minimizing chances of infections and promoting weaning of tracheostomy tube if appropriate. Physios also deal with maintaining range of motion of the joints in the body by exercises and positioning them. Physiotherapists contribute to the multisensory stimulation program (sometimes called as coma stimulation) along with the other members of the team. Also, early mobilization of the patient from bed to chair/tilt table, standing, walking are also carried out whenever possible.

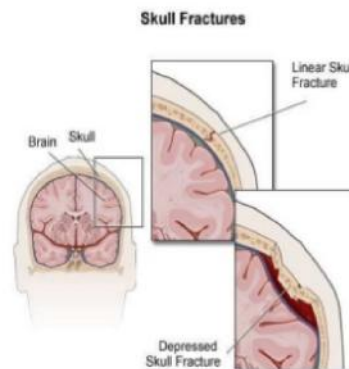


## SKULL INJURIES

### DEPRESSED FRACTURES/COMPOUND DEPRESSED FRACTURES



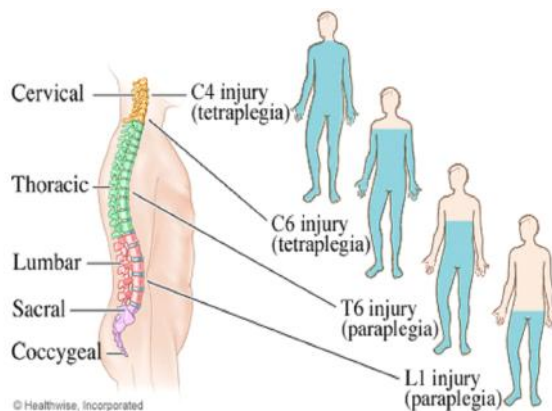
### NON-DEPRESSED LINEAL FRACTURES



## Spinal cord injury

A spinal cord injury (SCI) is damage to the spinal cord that causes changes in its function, either temporary or permanent. These changes translate into loss of muscle function, sensation, or autonomic function in parts of the body served by the spinal cord below the level of the lesion. Injuries can occur at any level of the spinal cord and can be classified as complete injury, a total loss of sensation and muscle function, or incomplete, meaning some nervous signals are able to travel past the injured area of the cord. Depending on the location and severity of damage along the spinal cord, the symptoms can vary widely, from pain or numbness to paralysis to incontinence. The prognosis also ranges widely, from full recovery in rare cases to permanent tetraplegia (also called quadriplegia) in injuries at the level of the neck, and paraplegia in lower injuries. Complications that can occur in the short and long term after injury include muscle atrophy, pressure sores, infections, and respiratory problems.

In the majority of cases the damage results from physical trauma such as car accidents, gunshots, falls, or sports injuries, but it can also result from nontraumatic causes such as infection, insufficient blood flow, and tumors. Efforts to prevent SCI include individual measures such as using safety equipment, societal measures such as safety regulations in sports and traffic, and improvements to equipment. Treatment of spinal cord injuries starts with stabilizing the spine and controlling inflammation to prevent further damage. Other interventions needed can vary widely depending on the location and extent of the injury, from bed rest to surgery. In many cases, spinal cord injuries require substantial, long-term physical and occupational therapy in rehabilitation, especially if they interfere with activities of daily living. Research into new treatments for spinal cord injuries includes stem cell implantation, engineered materials for tissue support, and wearable robotic exoskeletons.





### Rehabilitation in spinal cord injury

SCI patients often require extended treatment in specialized spinal unit or an intensive care unit. The rehabilitation process typically begins in the acute care setting. Usually the inpatient phase lasts 8–12 weeks and then the outpatient rehabilitation phase lasts 3–12 months after that, followed by yearly medical and functional evaluation. Physical therapists, occupational therapists, recreational therapists, nurses, social workers, psychologists and other health care professionals work as a team to decide on goals with the patient and develop a plan of discharge that is appropriate for the person's condition.

In the acute phase physical therapists focus on the patient's respiratory status, prevention of indirect complications (such as pressure ulcers), maintaining range of motion, and keeping available musculature active. For people whose injuries are high enough to interfere with breathing, there is great emphasis on airway clearance during this stage of recovery. Weakness of respiratory muscles impairs the ability to cough effectively, allowing secretions to accumulate within the lungs. As SCI patients suffer from reduced total lung capacity and tidal volume, physical therapists teach them accessory breathing techniques. Physical therapy treatment for airway clearance may include manual percussions and vibrations, postural drainage, respiratory muscle training, and assisted cough techniques. Patients are taught to increase their intra-abdominal pressure by leaning forward to induce cough and clear mild secretions. The amount of functional recovery and independence achieved in terms of activities of daily living, recreational activities, and employment is affected by the level and severity of injury. The Functional Independence Measure (FIM) is an assessment tool that aims to evaluate the function of patients throughout the rehabilitation process following a spinal cord injury or other serious illness or injury. It can track a patient's progress and degree of independence during rehabilitation. People with SCI may need to use specialized devices and to make modifications to their environment in order to handle activities of daily living and to function independently. Weak joints can be stabilized with devices such as ankle-foot orthoses (AFOs) and knee-AFOs, but walking may still require a lot of effort.[98] Increasing activity will increase chances of recovery.[99]

### Burns

Burns are among the most common household injuries, especially in children. Burns are characterized by severe skin damage in which many of the affected cells die. Depending on the cause and degree of injury, most people can recover from burns without serious health consequences. More serious burns require immediate

emergency medical care to prevent complications and death.

### **Burn Levels**

There are three primary types of burns: first-, second-, and third-degree. Each degree is based on the severity of damage to the skin

First -degree burns: red, non-blistered skin

Second -degree burns: blisters and some thickening of the skin

Third -degree burns: widespread thickness with a white, leathery appearance

There is also technically a fourth-degree burn. In this type, the damage of third-degree burns extends beyond the skin into tendons and bones.

### **Causes of Burns**

- Scalding from hot, boiling liquids
- Chemical burns
- Electrical burns
- Fires , including flames from matches, candles, and lighters
- Excessive sun exposure

### **First-Degree Burn**

First-degree burns cause minimal skin damage. They are also called “superficial burns” because they affect the outermost layer of skin. Signs of a first-degree burn include:redness, minor inflammation (swelling),pain,dry, peeling skin (occurs as the burn heals).

First-degree burns are mostly treated with home care. Healing time may be quicker if you treat the burn sooner. To treat this type, you can: soak the wound in cool water for five minutes or longer, take acetaminophen or ibuprofen for pain relief, apply an antibiotic ointment and loose gauze to protect the affected area. Make sure you don't use ice, as this may make the damage worse. Never apply cotton balls to a burn because the small fibers can stick to the injury and increase the risk of infection.



### Second-Degree

Second-degree burns are more serious because the damage extends beyond the top layer of skin. This type of extensive damage causes the skin to blister and become extremely red and sore. Some blisters pop open, giving the burn a wet appearance. Due to the delicate nature of such wounds, frequent bandaging is required to prevent



infection. This also helps the burn heal quicker. Some second-degree burns take longer than three weeks to heal, but most heal within two to three weeks. The worse the blisters are, the longer the burn will take to heal. In some severe cases, skin grafting is required to fix the subsequent damage.

Generally treat a mild second-degree burn by: running the skin under cool water for 15 minutes or longer, taking over-the-counter pain medication (acetaminophen or ibuprofen) and applying antibiotic cream to blisters.

However, seek emergency medical treatment if burns affect a widespread area of the: face, hands, buttocks, groin and feet.

### Third-Degree

Third-degree burns are the worst burns. They cause the most damage, extending through every layer of skin. The damage can even reach the bloodstream, major organs, and bones, which can lead to death.

There is a misconception that third-degree means most painful. With this type of burn, the damage is so extensive that you may not feel pain because your nerves are damaged. Depending on the cause, third-degree burns cause the skin to look: waxy and white, charred, dark brown, raised and leathery



Never attempt to self-treat a third-degree burn. While you're waiting for medical treatment, raise

the injury above your heart. Don't get undressed, but make sure no clothing is stuck to the burn. There is no set healing timeline for third-degree burns.

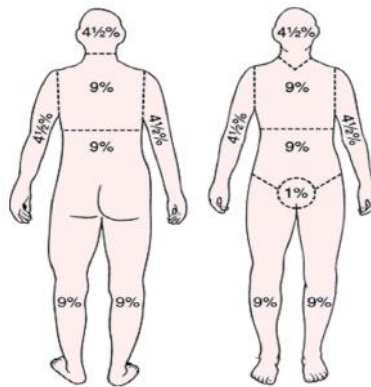
### Treatment

When properly and quickly treated, the outlook for first and second-degree burns is good. These burns are also less prone to scarring. The key is to minimize further damage and infection. Extensive damage from severe second-degree and third-degree burns can lead to problems in deep skin tissues, bones, and organs. Patients may require:

Surgery, physical therapy rehabilitation and lifelong assisted care.

### Rule of nines

A method of estimating the extent of burns, expressed as a percentage of total body



surface. In this method, the body is divided into sections of 9 per cent, or multiples of 9 per cent, each: head and neck, 9 per cent; anterior trunk, 18 per cent; posterior trunk, 18 per cent; upper limbs, 18 per cent; lower limbs, 36 per cent; genitalia and perineum, 1 per cent.

### Burns physiotherapy

The Physiotherapy team provides comprehensive rehabilitation at all stages of a patient's recovery following a burn injury. This includes both inpatient and outpatient care following initial burn injury care through to scar reconstructive surgery. Physiotherapy is an integral component of the burns service and is delivered in accordance with the national standards in the management of burn-injured adults.

Typical inpatient treatment aims include:

- Promoting recovery on intensive care

- Regaining movement, strength and function
- Regaining mobility
- Improving exercise tolerance
- Scar management
- Improving exercise tolerance

Treatment may include positioning, stretching, an exercise programme, and may require a splint(s) to maintain joints in an optimum position during recovery. When a wound is healed, an individualised skin care and scar management programme may be required.

### **Practical**

1. To demonstrate the therapeutic intervention for preventing complications of chronic bed ridden patients
  - Positioning
  - Passive movement
  - Stretching
2. Demonstration of physiotherapy management of burn
  - Positioning
  - Stretching

### **Assessment Activities**

Seminar

Assignments

Field visit

Quiz

Collection

### **TE Questions**

- Types of head injury
- List out the different causes of burning
- Classify the burn according to skin level/thickness
- Write about the main goals of physiotherapy in burn rehabilitation.

## ORTHOTICS AND PROSTHETICS

### Introduction

Orthotics and Prosthetics is an allied health profession that provides evaluation, fabrication and custom fitting of artificial limbs and orthopaedic braces. O&P Professionals are specialists within the rehabilitation or care team for patients with disabling conditions.

### Learning out comes

- To define orthotics and prosthetics and list out the types and indication.

### Concepts

Definition, types and Indications.

Orthotics generally includes devices that correct, improve or support body abnormalities. Musculoskeletal deformities are particularly aided by custom orthotics. Some common conditions corrected or aided by orthotics include fractures, scoliosis, cerebral palsy, spina bifida, and various impairments resulting from a spinal injury or stroke. Orthotic shoes are often prescribed for patients with foot ailments.

There are five main types of orthotics.

**Rigid orthotics** is firm devices that are used to control movement. Created from carbon fiber or plastic, they are used to control movement and reduce pain, particularly with feed.

**Soft orthotics**, made of compressible materials, are often used for conditions such as arthritis or diabetes, in which they relieve pain and pressure.

**Semirigid orthotics**- These help achieve balance while running or performing other physical activities.

**Custom, or calibrated, orthotics**- These use an individual's weight, activity level, and flexibility level to create specific equipment for their personal needs.

**Proprioceptive orthotics**-, is a less expensive means of supporting individuals with conditions such as Morton's Foot Syndrome.

**KAFO-Knee Ankle foot orthosis and AFO-Ankle foot orthosis**

**Spinal Orthotics**



Prosthetics are artificial extensions of the body. They are used to replace body parts that are missing from birth, lost through an injury or disease, or which require removal for medical purposes. It is an artificial device that replaces a missing body part, which may be lost through trauma, disease, or congenital conditions. Prosthesis can also supplement an existing but defective body part. Some prosthetics include artificial lungs, knees, eyes, hearts, hips, limbs, heart valves, ankles, dentures, and gastric bands.

Prosthetic amputee rehabilitation is primarily coordinated by a prosthetist and an inter-disciplinary team of health care professionals including psychiatrists, surgeons, physical therapists, and occupational therapists.

### Types

A person's prosthesis should be designed and assembled according to the patient's appearance and functional needs. The patient's future goals and economical capabilities may help them choose between one or more devices.

Craniofacial prostheses include intra-oral and extra-oral prostheses. Extra-oral prostheses are further divided into hemifacial, auricular (ear), nasal, orbital and ocular. Intra-oral prostheses include dental prostheses such as dentures, obturators, and dental implants.

Limb prostheses include both upper- and lower-extremity prostheses.

Orthotics and prosthetics can be the practice of designing and creating such equipment. People who work in orthotics and prosthetics evaluate patients' needs; fabricate products according to those needs, and custom fit orthopedic braces and

artificial limbs. Careers opportunities in this health profession can include job titles such as direct practitioner, orthotist, fitter, assistant, pedorthist, or technician. Many sciences have contributed to the study of orthotics and prosthetics. These include anatomy and physiology, engineering, psychology, and gait analysis. Orthotics and prosthetics are also part of the biomechanics field of science. This field includes the fusion of mechanical devices with actual human body parts within the nervous, muscular, and skeletal systems. Many people with abnormalities, deformities, or missing body parts can be helped with orthotics and prosthetics. These are pieces of medical equipment that can help replace or improve body parts. They include braces, inserts, artificial limbs, and much other medical equipment fabrication

### Practical

1. Application of orthotics and prosthetics
  - Upper limb
  - Lower limb
  - Neck and trunk

### Assessment Activities

Seminar  
 Assignments  
 Field visit  
 Chart preparation  
 Quiz  
 Collection  
 Model Preparation

### TE Questions

Expand the following term  
 KAFO  
 AFO

Artificial appliances used to replace original body parts is known as \_\_\_\_\_

Write any two examples of internal and external orthotics and prosthetics.

List out the indications of orthotics.

Odd man out                      KAFO                      OSTIN MOOR  
 K WIRE                              BRACES



## GERIATRIC PHYSIOTHERAPY

### Introduction

Geriatric medicine is a specialty that focuses on health care of elderly people. It aims to promote health by preventing and treating diseases and disabilities in older adults. Geriatric physical therapy covers a wide area of issues concerning people as they go through normal adult aging but is usually focused on the older adult. Geriatric physical therapy was defined as a medical specialty in 1989 and covers a broad area of concerns regarding people as they continue the process of aging, although it commonly focuses on older adults. “Physical therapy intervention can prevent life-long disability, restoring the person’s level of functioning to its highest level.”

### Learning outcome

The learner:

- familiarizes with common problems of geriatric patients
- understands the history, concept and methods of geriatric physiotherapy
- understands the role of physiotherapist, exercise, manual therapy and education in geriatric physiotherapy
- familiarizes with Aim of geriatric physiotherapy and different settings
- understands the concept of assessment, goal setting, treatment intervention and re-assessment

### Concepts

Introduction to geriatric Physiotherapy.

Geriatric physical therapy is a proven means for older adults from every level of physical ability to improve their balance and strength, build their confidence, and remain active. A number of people are familiar with physical therapy as a form of treatment to pursue after an accident, or in relation to a condition such as a stroke. Physical therapy is useful for many additional reasons, such as improving balance, strength, mobility, and overall fitness. All of these are factors which older adults may benefit from, contributing to their physical abilities and helping to maintain their independence for longer periods of time. Physical therapy can also help older adults to avoid falls, something that is crucial to this population.

Falling is one of the greatest risks older adults face, often leading to things such as hip fractures which then lead to a downward health spiral. In fact, falling is such an issue among older adults that the Center for Disease Control and Prevention has

reported that one-third of all people over the age of sixty-five fall every year, making falls the leading cause of injury among people from this age group. Hundreds of thousands of older adults experience falls and resulting hip fractures every year, with resulting hospitalizations. Most of the people who experience a hip fracture stay in the hospital for a minimum of one week, with approximately twenty-percent dying within a year due to the injury. Unfortunately, a number of the remaining eighty-percent do not return to their previous level of functioning. Physical therapy can help older adults to remain strong and independent, as well as productive.

### Common condition seen in old age

1. **Musculoskeletal:** Osteoarthritis (inflammation of joints due to wear and tear) and Osteoporosis (bone loss).
2. **Hormonal :** Diabetes (impaired control of blood glucose), Menopause, thyroid dysfunction, high blood cholesterol, Slower overall metabolism.
3. **Neurologic :** Dementia (Alzheimer or other types), Parkinson's disease, Stroke, hearing impairment and balance problem
4. **Visual :** macular degeneration, glaucoma, cataracts and Diabetes and hypertension related eye disease.
5. **Cardiovascular disease:** heart attacks, congestive heart failure, irregular heart rhythm (atrial fibrillation), high blood pressure (hypertension) , atherosclerosis (hardening and narrowing of blood vessels) and Peripheral vascular disease or peripheral artery disease (poor blood flow as a result of narrow blood vessels).
6. **Lungs:** Chronic obstructive pulmonary disease (COPD) and Loss of lung volume.
7. **Kidneys:** Poor kidney function (kidney or renal disease) from long standing diabetes and hypertension.
8. **Skin and Hair:** Hair loss, dry skin, itching, infections.
9. **Cancers:** Prostate, colon, lung, breast, skin, bladder, ovary, brain, pancreas,etc
10. **Bone marrow and immune system:** Inability to produce sufficient blood cells (anemia, myelodysplasia).
11. **Gastrointestinal:** Stomach ulcers, Diverticulitis (small pockets forming in the wall of colon, Swallowing difficulty (dysphagia) , Constipation and Bowel incontinence

12. **Urinary:** Urinary incontinence, urinary urgency, difficulty urinating.
13. **Oral and dental:** gum disease, dry mouth, loss of teeth, poorly fitting dentures.
14. **Infections:** urinary tract infection, pneumonia, skin infection,
15. **Psychiatric:** Depression, anxiety, sleep disturbance, insomnia.
16. **General problems:** Fatigue, general reconditioning, forgetfulness, medication side effects, diminished appetite, weight loss, falls.

### Forms of Geriatric Physical Therapy

#### Physical Therapists

Physical therapists provide people with a variety of services. They work with people individually, evaluating their physical capabilities and designing specific programs of exercise, education and wellness for them. Physical therapists also work with other health care providers to coordinate the person's care. The potential for age-related bodily changes to be misunderstood can lead to limitations of daily activities. The usual process of aging does not need to result in pain, or decreased physical mobility. A physical therapist can be a source of information for understanding changes in the body, they can offer assistance for regaining lost abilities, or for development of new ones. A physical therapist can work with older adults to help them understand the physiological and anatomical changes that occur with the aging process.

Physical therapists help injured or ill people improve their movement and manage their pain. These therapists are often an important part of rehabilitation and treatment of patients with chronic conditions or injuries.

Physical therapist assistants may deliver treatment and physical interventions for patients and clients under a care plan established by and under the supervision of a physical therapist.

Physical therapists evaluate and develop specifically designed, therapeutic exercise programs. Physical therapy intervention can prevent life-long disability, restoring the person's level of functioning to its highest level. A physical therapist uses things such as treatments with modalities, exercises, educational information, and screening programs to accomplish a number of goals with the person they are working with, such as:

- Reduce pain
- Improve sensation, joint proprioception
- Increase overall fitness through exercise programs

- Suggest assistive devices to promote independence
- Recommend adaptations to make the person's home accessible and safe
- Prevent further decline in functional abilities through education, energy conservation techniques, joint protection
- Increase, restore or maintain range of motion, physical strength, flexibility, coordination, balance and endurance
- Teach positioning, transfers, and walking skills to promote maximum function and independence within the person's capability
- There are various common conditions that can be effectively treated through physical therapy. Among the specific diseases and conditions that might affect older adults which can be improved with physical therapy are arthritis, osteoarthritis, stroke, Parkinson's disease, cancer, amputations, urinary and fecal incontinence, and cardiac and pulmonary diseases. Conditions such as Alzheimer's disease, dementia's, coordination and balance disorders, joint replacements, hip fractures, functional limitations related to mobility, orthopedic or sports injuries can also be improved through geriatric physical therapy.

### Exercise

Exercise is defined as any form of physical activity that is beyond what the person does while performing their daily tasks. Exercise is something that is designed to both maintain and improve a person's coordination, muscle strength, flexibility and physical endurance, as well as their balance. It is meant to increase their mobility and lessen their chance of injury through falling. Exercise in relation to geriatric therapy might include activities such as stretching, walking, weight lifting, aquatic therapy, and specific exercises that are geared towards a particular injury or limitation. A physical therapist works with the person, teaching them to exercise on their own, so they may continue their exercise program at home.

### Manual Therapy

Manual therapy is applied with the goals of improving the person's circulation and restoring mobility they may have lost due to an injury or lack of use. This form of therapy is also used to reduce pain. Manual therapy can include manipulation of the person's joints and muscles, as well as massage.

### Education

Education is important to the success and effectiveness of geriatric physical therapy. People are taught ways of performing daily tasks safely. Physical therapists also

teach people how to use assistive devices, as well as how to protect themselves from further injury. Older adults can utilize physical therapy as a means for regaining their independence. Physical therapy can help seniors to feel better, as well as to enjoy a higher quality of life.

## **Principles of Geriatric Physical Therapy**

### **Aims of Geriatric Assessment**

Geriatric physical therapy has been identified as a physical therapy specialization in order to acknowledge the advanced-level skills of physical therapists who seek to address the unique medical and functional problems of older persons. Geriatric physical therapists encounter a wide spectrum of elderly patients, ranging from those who are frail and institutionalized to those who are functionally independent but require attention in outpatient departments.

### **Geriatric physical therapy in different settings**

The role of geriatric physical therapy is important in all care settings. Geriatric physical therapists are providing quality care to patients in multiple settings that include acute care hospitals, skilled nursing facilities, outpatient departments, rehabilitation centres, home health agencies and hospice settings. The over-all condition of a patient will decide the type of care setting.

### **Geriatric Physical Therapy in Acute Care Hospitals**

This is particularly important for the elderly having multiple co morbid conditions. However, a patient with single event like stroke may also need acute care in hospital. The patient is usually monitored by the interdisciplinary team. Physical therapy should be started as early as the elderly is able to tolerate the therapeutic interventions, especially exercises. The early physical therapy intervention can prevent secondary functional loss and promote early restoration of function and thereby reduce the length of hospital stay. The patient should receive therapy for two hrs per day to have significant improvement.

### **Geriatric Physical Therapy in Skilled Nursing Facilities**

A skilled nursing facility has staff and equipment to provide skilled nursing care and other health services. Geriatric physical therapist may provide her specialized services as an employee of a skilled nursing facility or as an independent contractor. Elderly patients who are not suitable for acute care in hospitals may be treated in a skilled nursing facility. The patient should be employed two half-hourly sessions of physical therapy per day. The treatment time may be increased after the reassessment of a patient.

### **Geriatric Physical Therapy at Home**

Many patients prefer to have physical therapy at their home. Physical therapist may visit the patient for once or twice a day. The main advantage of this kind of provision is that it saves the time of caregivers. The caregivers do not have to bother to take a patient to physiotherapy clinic. However, there is a disadvantage in the sense that the necessary equipment cannot be used at home.

### **Geriatric Physical Therapy in Outpatient Departments**

Outpatient department is the best option for the patients having the transport facility. However, it is not the suitable option for the frail elderly. Easy access to equipment and peer interaction are the main advantages for the patients being treated in outpatient departments.

### **Geriatric Physical Therapy Program**

The geriatric population is unique in its wide variation from individual to individual in the effects of both aging and disease processes. The effective administration of Physical Therapy program can make the quality of life better for the patients belonging to this complex group. The important components of this program are:

#### **Assessment**

A comprehensive geriatric assessment is often helpful before the initiation of a physical therapy program to assist with setting realistic goals with each patient. Nevertheless, modification in the assessment may be required in some specific cases. For example, assessment of communication skill is must while working with the older patient with cognitive deficits so as to know the difficulties of patient in problem solving and self-care.

#### **Goal-Setting**

Functional independence is the ultimate goal of physical therapy intervention. This is particularly important in geriatric care, because the presence of acute as well as chronic illness in elderly individuals is often associated with loss of day-to-day function. To achieve this long-term goal, a physical therapist should establish several short-term goals:

- To improve or maintain ROM of different joints. For example, a geriatric patient should  
Have enough ROM at shoulder to dress up or to reach dishes in the cupboard.
- To improve or maintain strength and endurance of muscles. For example, the

patient should have sufficient muscle strength to lift a jug of milk, to make a bed, to make chapatti or to wash clothes.

- To improve or maintain cardiovascular endurance so that a geriatric patient is able to do strenuous activities such as fast walk, cycling or swimming.
- To improve or maintain ambulatory status of a patient so that a patient can go to toilet or for shopping independently.
- To relieve pain. It has been estimated that over 85 percent of older adults have at least one chronic disease that may give rise to the feeling of discomfort or pain.<sup>24</sup> Acute pain following surgery is also becoming quite common in geriatric patients. The most common therapeutic interventions to relieve pain are exercise, orthotics, heat and cold modalities; and electrical stimulating currents.

### Therapeutic Intervention

A number of physical therapy interventions may be employed in order to attain treatment goals:

- Range-of-motion exercise
- Stretching exercise
- Mobilization exercise
- Strengthening exercise
- Aerobic exercises
- Gait training
- Orthotics
- Electrotherapeutic modalities

### Practical

1. To demonstrate the exercise in geriatrics
  - Mobility exercise
  - Recreational activities for geriatrics.

### Assessment activities

- Seminar
- Assignments

### **TE Questions**

1. List out the common geriatric conditions.
2. A medical specialty that focuses on health care of elderly people known as-
3. Explain about the role of physical therapist in a geriatric centre.
4. List out the main goals of physiotherapy in geriatric care

### **At the end of each module**

#### **Extended activities**

- Visit to special school
- Visit to orthotic center
- Visit to old age home

#### **List of practicals**

##### **1. Free exercises**

- a. Upper limb
- b. Lowerlimb
- c. trunk

##### **2. Resisted exercise**

- a. Shoulder joint
  - Flexers and Extensors
  - Adductors abductors
- b. Elbow joint
  - Flexors
  - Extensors
- c. Wrist
  - Flexors
  - Extensors
  - Ulnar and radial deviators
- d. Hand
  - Finger flexors and extensors
- e. Hip joint



- Flexors and extensors
- Abductors and adductors
- f. Knee
  - Flexors and extensors
- g. Ankle
  - Dorsi and plantar flexors
- 3. Passive movement**
  - Shoulder girdle
  - Shoulder joint
  - Elbow joint
  - Wrist and fingers
  - Hip joint
  - Knee joint
  - Ankle
- 4. Fundamental position**
  - Standing
  - Sitting
  - Kneeling
  - Lying
  - hanging
- 5. Derived position**
  - Standing
  - Sitting
  - Kneeling
  - Lying
  - Hanging
- 6. Grading of muscle power of major muscles**
  1. Shouher
    - Flexers and Extensors
    - Adductors abductors

**2. Elbow**

- Flexors
- Extensors

**3. Wrist**

- Flexors
- Extensors
- Ulnar and radial deviators

**4. Hand**

- Finger flexors and extensors

**5. Hip joint**

- Flexors and extensors
- Abductors and adductors

**6. Knee**

- Flexors and extensors
- Ankle
- Dorsi and plantar flexors

**7. Range of motion of major joints**

- a. Shoulder joint
- b. Elbow joint
- c. Wrist and fingers
- d. Hip joint
- e. Knee joint
- f. Ankle

**8. Good and bad posture**

- Postural analysis of a given modal

**9. Preparation and maintenance of exercise therapy equipment.**

- a. Static cycle
- b. Treadmill

- c. Quadriceps table
- d. Shoulder wheel
- e. Hand exerciser
- f. Medicine ball,
- g. Swiss ball
- h. Abduction ladder
- i. Parallal bar
- j. Tilt table
- k. Wheel chair
- l. crutches

**10. Demonstration of gait and identification of its phases**

- a. Stance
- b. swing

**11. Demonstation of pathological gait**

- a. Cicum ductory
- b. Scissoring
- c. Festinant
- d. Ataxic
- e. High stepping
- f. Antalgic

**12. Crutch walking**

- a. Non weight bearing
- b. Partial weight bearing
- c. full weight bearing
- d. ascending
- e. descending

**13. Transfer technique**

- a. wheel chair to bed
- b. bed to wheel chair

**14. Application of contrast bath of given subject**

**15. Application of cryotherapy**

**16. Preparation and positioning of axial and pendular suspension**

**17. Preparation and positioning of the given subject for relaxation**

**18. Breathing exercise**

- a. Inspiratory Breathing exercise
- b. expiratory Breathing exercise

**19. Electrotherapy**

Preparation and positioning of the subject for the treatment by using following electro therapy equipments.

- h. IRR
- i. SWD
- j. ULTRASOUND
- k. IFT
- l. TENS
- m. EMS
- n. Hot pack

**Module- IV**

**20. Positioning of the hemiplegic patient**

Positioning by using pillows and sand bags.

Supine lying

Affected side

Unaffected side

Sitting

**21. Passive movements**

Upper limb

Lower limb

**22. Positioning of the paraplegic patient**

**23. To demonstrate the positioning and passive movement of the spinal cord injury patient.**

Positioning

Lying position

Sitting

Passive movement

**24. Transfer technique**

Bed to wheel chair

Wheel chair to bed

**25. To demonstrate the exercise in parkinsonism**

Range of motion/flexibility exercise

To demonstrate the exercise in Ataxia

Co ordination exercise –frenkal’s exercise

Upper lib

Lower limb

Trunk

**26. Demonstration of exercise in cerebral palsy**

Special care activities for reducing possible complication.

Child carrying

Sitting

Positioning

Stretching

**27. Peripheral Nerve Injury**

Application of splint

Donning and doffing

Cock op splint

Afo

Aero plane splint

**28. Preparation and positioning of the subject for electro therapy treatment**

Stimulator

TENS

**29. Application of price therapy in soft tissue injury**

Application of elastocrepe bandage in lateral ligament injury

**30. Demonstration of exercise for rheumatoid arthritis**

joint mobility exercise

**31. Exercises for knee joint osteoarthritis**

Isometric

Mobility

Strengthening

**32. Demonstration of exercises for cervical and lumbar exercises**

Isometric neck exercise

Neck mobility exercise

Spinal extension e/flexion exercise

**33. Preparation and positioning of client for electro therapy.**

IRR for periarthrits

US for tennis/golfers/plantar fasciitis

**34. Demonstrate the correction of deformity in thre following conditions**

CTEV

TORTICOLLIS

**35. To demonstrate the therapeutic intervention for preventing complications of chronic bed ridden patients**

Positioning

Passive movement

Stretching

**36. Demonstration of physiotherapy management of burn**

Positioning

stretching

**37. Application of orthotics and prosthetics**

upper limb

lower limb

neck and trunk

**38. To demonstrate the exercise in geriatrics**

General Mobility exercise

**List of Standard Equipments and Tools**

◆ White board with marker

◆ Lcd with laptope

- ◆ Stethoscope
- ◆ BP apparatus
- ◆ Bone and skeletal set
- ◆ Goniometer
- ◆ Inclinator
- ◆ Thera band
- ◆ Spirometer
- ◆ Theraputty
- ◆ Exercise mat
- ◆ Thermometer
- ◆ Measuring tape
- ◆ Plinth
- ◆ Dumbbells 2,3,4,5,kg
- ◆ Barbells
- ◆ Free weights
- ◆ Cables
- ◆ Tubing's
- ◆ Weight cuffs
- ◆ Static cycle
- ◆ Treadmill
- ◆ Elliptical trainer
- ◆ Ice packs
- ◆ Wax bath
- ◆ Hydrocollator packs
- ◆ First aid box
- ◆ Slings\Splints
- ◆ Crepe bandage
- ◆ Multi gym

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