WHEELCHAIRS
(Types, Models Available, Parts, & Activities)

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INTRODUCTION

• Wheelchair can be the primary means of ambulation for someone with permanent or progressive disability.

• It substantially influence total body positioning, skin integrity, overall function, and general well-being of the patient.
WHEELCHAIR SELECTION PROCESS

• Assessment of the individual
  – Physical assessment
    • Focuses on neuromuscular status, musculoskeletal status, sensory status and physiologic status
  – Client’s personal profile
    • Age, developmental status, living environment, educational and work history and plans, recreational pursuits and assistive technology used
  – Public accessibility
WHEELCHAIR SELECTION PROCESS

• Be able to determine:
  – Propelling of wheelchair
  – Rental vs. Purchase
  – Frames
    • Rigid (Fixed frame / Non-folding)
    • Folding

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TYPES OF WHEELCHAIR

A. Attendant-propelled chairs

- Designed to be pushed by another individual
- User is unable to propel or operate the chair in a functional and safe manner.
- Consider ease of maneuverability and handling by caregiver.
- Most of manual wheelchairs available in India, serves as attendant-propelled chairs
TO PROPEL A WHEELCHAIR

B. Manual chairs

– Select, if the person is able to propel the wheelchair independently.
– Can have rigid frames / folding frames.
– Refer to the parts listed under *wheelchair components*
– User is seated with elbows extended to 120° and hands rest at the 12 o’clock position on each side.
– Client maneuvers between 11 and 2 o’clock positions.
TYPES OF WHEELCHAIRS

Types:

• Conventional manual wheelchair frame
  – Large rear wheels and small caster wheels in front
  – Highly maneuverable and easy to propel

• Amputee frame
  – Rear axle is offset farther behind the seat back \(\rightarrow\) concentrates a person’s weight farther thus reducing the risk of chair tipping backward

• Indoor frame
  – Large front wheels for propulsion and small casters in the back

• One-arm drive
  – 2 hand-rims on one drive wheel
  – Drive wheels connected by a bar

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MOTORIZED WHEELCHAIR

Power mobility devices / motorized wheelchairs

For individuals

- Who cannot propel a chair using either the hands or feet
- Whom energy expenditure required to walk or propel a manual chair is contraindicated
- Who have musculoskeletal complications such as arthritis in upper limb joints
- Who are prone to repetitive stress injury
- Who have neuromuscular dysfunction that may cause associated reactions in the lower extremities when the upper extremities are used for wheelchair propulsion.
ADVANTAGES/DISADVANTAGES
(Motorized Wheelchair)

– Primary disadvantage
  • Large and heavy
  • Difficult to transport
  • Special lifts are required in public transportation

– 2 types of control options
  • Proportional
    – Joystick
    – Directions and speeds are linked to angle and magnitude of displacement
  • Micro switch
    – Joystick or multiple switch
    – Each switch engages in a single preset speed and direction
WHEELCHAIR MOTORISED (Battery Operated) IMI-1100

- Drive with Joystick fitted on armrest.
- Push the Joystick to the direction you want to move.
- Detachable Armrest and Footrest for easy transfer.
- Operate with rechargeable batteries.
- Can Fold the Chair after removing the Batteries.
Some of the popular models available with “India Medico Instruments”


IMI-720 : Wheelchair, with Meg Wheels - Steel Frame, Folding, with Push Brakes, Chrome-Plated Finish.

IMI-750 : Wheelchair Heavy Duty, with Meg Wheels - Steel Frame, Folding, with Push Brakes, Chrome-Plated Finish.

IMI-790 : Wheelchair with Commode - Steel Frame, Folding, with Push Brakes, Chrome-Plated Finish.

IMI-810 : Steel Manual Wheel Chair detachable Armrest And Footrest.

IMI-820 : Steel Manual Wheel Chair detachable Armrest And Footrest with leg rest.

IMI-850 : Steel Manual Wheel Chair Heavy Duty detachable Armrest And Footrest.

IMI-870 : Wheelchair, DLX, Folding + Recline Back Detachable Armrest for easy transfer.

Detachable & Footrest with Leg support.


IMI-950 : Aluminum Wheelchair with Desk length armrest. Height adjustable Armrests &

Footrest with support straps. Extra cushion for seat & backrest.

IMI-958 : C.P. WheelChair (Pediatric)

IMI-1100 : Wheelchair, MOTORISED (Battery Operated). Drive with Joystick fitted on armrest.

Detachable Armrest and Footrest for easy transfer. Operator with rechargeable batteries.
SPORTS WHEELCHAIR

D. Sports / Recreational wheelchair

– Low profile chair with specific features:

• Low backrest
• Solid and lightweight frames
• Canted (angled) rear wheels
• Lower and narrow seats
SPORTS WHEELCHAIR

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PRICE & DELIVERY

• Cost Price of Wheelchair depends on the facilities required in the Chair.
• The Price range of folding wheelchairs starts from INR. 4000/= to INR. 18000/= each depending on model or facilities required in the Chair.
• Motorized Wheelchair costs INR. 74000/= & above.
• Home Delivery through Courier in India will cost INR. 2000.00 to 3000.00 depending upon destination.

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WHEELCHAIR COMPONENTS/PARTS

- Headrest
- Hand Grip
- Recliner Back Components
- Wheel, Tire
- Handrim
- Axle, Bearing, Hub Cap
- Frame End Cap
- Brake, (wheel lock)
- Crossbrace, Side Frame
- Caster, Axle, Bearing
- Fork, Bearing, Housing, Swivel Cap
- Bumper
- Footplate, Footplate Spring
- Front Slide Post
- Ratchet Assembly
- Calf Pad
- Armrest
- Seat Rail Guide
- Side Panel
- Detachable Arm
- Seat
ARMRESTS

• Armrests
  – Can be fixed, detachable or swing away
  – Detachable or swing away type allow greater ease in sliding board or sideways transfers
LEG RESTS

• Leg Rests
  – Part of the FRONT RIGGING
  – Can be fixed, swing away or detachable
  – Elevating are appropriate for users who have:
    • limited knee flexion
    • lower extremity edema or other medical concerns
    • Adds comfort when wheelchair recline systems are used

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• Footplates
  – Part of the FRONT RIGGING
  – Can be fixed but most of the wheelchairs generally swing up to allow the foot to reach the floor
  – Can be equipped with heel loops, ankle straps or other foot harnessing

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Calf Pads

- Attached to leg rest to keep the foot from colliding with front Wheels

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**Tires**

- **Types**
  - **Pneumatic (air-filled)**
    - Provides a cushioned ride
    - Have a shock absorber function to improve comfort and prolong the life of the chair
    - Require regular maintenance/moderately heavy
  - **Semi-pneumatic (airless foam inserts)**
    - Provides good cushioning and less maintenance
    - Tire may wear
  - **Solid core rubber**
    - Minimal maintenance
    - Light weight
    - Low rolling resistance
    - Mounted on spokes or molded wheels
    - Heavy harsh ride on rough terrain
• Casters
  – Small wheels in front of the wheels
  – Some have anti-rotation locks
  – Size:
    • Small, 4” / 10cm dia.
    • Large, 8” / 20cm dia.
  – Tire Types:
    • Pneumatic
    • Semi-pneumatic
      – Provides shock absorption for outdoor and rough surfaces usage
    • Solid core rubber
      – Best for use indoors and smooth surfaces
• **Rear Wheel Axles**
  
  – Most are fixed but some are adjustable
  
  – Backward placement – increase stability
  
  – Forward placement – decreases stability but increases maneuverability and shortens turning radius
  
  – Type:
    
    • Spokes
    • Mag

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ANTI-TIPPING

• Anti-tipping Extensions
  – Can be used on a wheelchair to prevent the chair from tipping backward & forward
  – Used on the back
  – Provides safety during wheelchair mobility training

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SEATS

• **Seatbelts/Harness/Safety vests**
  
  — For safety and positioning
  
  — Should be considered for individuals with
    
    • Poor judgment
    
    • Severe neuromuscular impairments who need control for posture and safety
  
  — Stabilizes the pelvis
  
  — Anterior support is mounted on the wheelchair frame so that it pulls on the pelvis at a 45° angle to the base of the back seat fitting under the anterior superior iliac spines (ASIS)

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• **Recliner Back**
  - Enables postural changes for rest and pressure relief
  - ≤ 30° semi-reclining option
  - ≤ 90° full reclining option
Hand Rim

- Attached to the outside of the large wheels mostly Chrome-Plated
- Used to propel the wheelchair
- Can be large, small, thick or knobby
• **Hand Grip**
  - Used to push a wheelchair for attendant-propelled wheelchairs

• **Head Rest**
  - For posture and head alignment
  - Adds comfort to the patient
• **Parking Breaks**
  – Restrict wheel turning but are not recommended for slowing or bringing the chair to a stop
  – Types:
    • Toggle
    • Lever/ratchet

• **Hill Climbers/ Grade-aid Devices**
  – Aids in propelling on inclines
  – Restricts counterclockwise movement of wheels
WHEELCHAIR MEASUREMENT PROCEDURE

1. Seat Width
   – Objectives
     • Distribute the patient’s weight over the widest possible surface
     • Keep the overall width of the chair as narrow as possible
       – Wheelchairs should be as narrow as possible to allow comfort and ease of
         repositioning, maneuverability and transfers
   – Measurements:
     • Patient seated on a chair
     • Widest point across the hips and thighs add 2 inches for adequate
       wheelchair clearance on each side
   – Check:
     • Flat palm of hand between the patient’s hip and thigh and wheelchair
       skirt and armrest

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2. Seat Depth

– Objectives
  • To distribute the BW along the sitting surface by bearing weight along the entire length of the thigh to behind the knee
  • Assists to prevent pressure sores on the buttocks
  • For optimal muscle tone normalization throughout the entire body

– Measurements:
  • Measured from the most posterior part of the buttocks, under the thigh, to the popliteal fossa of each knee minus 2 inches

– Check:
  • Clearance behind the knees to prevent contact of front edge of seat upholstery with the popliteal fossa
SEAT-2

– *Consider:*

• For those with leg length discrepancy, the shorter side may be used to determine the seat depth or the front seat edge may be offset to accommodate the length of each side

• May need to be shortened to allow independent propulsion with the LE

• Postural changes throughout the day from fatigue or spasticity

• Power recliner ➔ assume that the patient will slide forward slightly throughout the day; make depth adjustments accordingly
3. Back Height

- **Objective:**
  - To provide back support consistent with physical and functional needs
  - Should be low enough for maximal function
  - Should be high enough for maximal support

- **Measurements:**
  - Measure from seat of the chair to floor of axilla with patient’s shoulder flexed to 90° *minus* 4 inches
  - For those who will self propel
    - Measurement should be 1-2 inches under the tip of scapula
  - For sporting activities
    - Optimal back height is lower

- **Check:**
  - Patient sits upright, Inferior angle 1 finger breadth above the back upholstery

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4. Seat Height from Floor and Foot Adjustment

- **Objectives**
  - To support the patient’s body while maintaining thighs parallel to the floor
  - Elevate foot plates to provide ground clearance over varied surfaces and curb cuts

- **Measurements:**
  - Person’s knees and ankle at 90°
  - Under the distal thigh to the heel of the individual plus 2 inches

- **Check:**
  - 2-3 fingers under thigh from front edge of seat to a depth of approximately 2 inches
  - Foot rest is 2 inches off the ground
5. Armrest Height

- **Objective**
  - Maintain posture and balance
  - Provide support and alignment for UE
  - Allow change in position by pushing down on armrest

- **Measurement**:
  - Shoulder should be neutral, arms hanging at the sides and elbow flexed to 90 °
  - With patient in comfortable position, measure from seat of the chair to olecranon process plus 1 inch

- **Check**:
  - Posture should look correct, shoulders should not slouch forward or forced into elevation when in normal sitting position with flexed elbow on armrest
  - Need to provide forearm support but should not obstruct reach to hand rims for propulsion or to brakes for locking
CONFIRMATION OF FIT

• Fit should be determined with the following:
  – Seated in the wheelchair
  – Wearing usual clothing including shoes
  – Any cushions or components that will affect fit should be in place

• Ill-fitting wheelchair causes:
  – Skin breakdown
  – Fatigue
  – Trunk or extremity deformity
  – Inhibit function
WHEELCHAIR SEATING AND POSITIONING

• Ideal position: sitting with 90° hip, knee and ankle position with the seat fully upright

• Seat back angle
  – Standard frame has 95°

• Angle in space
  – Standard frame also has 3-5°

• Note: Care-giver education is important
  – Pressure relief
  – Look for signs of decreased LE circulation
WHEELCHAIR SAFETY

• Brake should be locked during all transfers

• Foot plates should never be stood on and during most transfers are in the UP position

• In most transfers, it is an advantage to have footrests swung away if possible

• If caregiver is pushing the chair, he should be sure that the patient’s elbows are not protruding from the armrest and the hands are not on the hand rim
WHEELCHAIR MOBILITY
INDEPENDENT PROPULSION

• Bilateral Upper Extremities
  – Forward or Backward movements:
    • grasps the hand rims at 12 o’clock position
    • Pushes or pulls on each wheel with equal force
  – Turning
    • Left: pushes forward on right hand rim, pulls backward on left hand rim simultaneously
    • Right: reverse movement as the previous
DRIVE

• One UE and One LE
  – One hand on the rim pushes or pulls simultaneously with the functional foot
  – Foot serves as the “rudder” while turning

• Bilateral LE
  – Uses heels and soles of feet to propel the wheelchair
ASSISTED FUNCTIONAL ACTIVITIES

• Level-Surface Propulsion
  – Use push handle to move and control the chair
  – Turning: Left
    • Hold the left push handle and push on the right handle
  – Observe safety precautions
ELEVATING CASTER WHEELS TO CROSS THE HURDLE

• Elevation of Caster wheels
  – Stand behind the chair on its rear wheels
  – Push down and forward with one foot on one tipping lever while pushing down and back with both hands on the push handle

• Lowering of Caster wheels
  – Reverse the previous procedure

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ASCENDING AND DESCENDING THE STAIRS

- requires the assistance of 2 people
- Ascending
  - Approach the stairs backward
  - One person stands behind the chair and tips it backward into its balanced position \(\rightarrow\) pulls it up each step in succession
  - Second person stands in front of the chair and holds on to the leg rest upright \(\rightarrow\) lifts and maintains the point of balance
- Descending
  - Approach the stairs forward with the wheelchair in a tipped, balanced position
  - The 2 people reverse the process for ascending stairs
ASCENDING AND DESCENDING A RAMP

• Ascending
  – Caregiver should move the chair in a normal forward direction.

• Descending
  – Tilt the wheelchair backward by pushing the foot down on the tipping levers to its balance position (‘30°).
  – Then the caregiver should ease the wheelchair down the ramp in a forward direction while maintaining the balanced position.
  – If the ramp is steep, the caregiver should move down the ramp backward
ASCENDING AND DESCENDING A RAMP

• Independent
  – Ascending Forward (Both UE)
    • Move hips forward in the chair, lean trunk forward
    • Push equally on the hand rims using smooth forward motion
  – Descending Forward (Both UE)
    • Position hips to the rear of the seat, trunk erect
    • Retard forward motion by applying equal friction on the hand rims using palms of the hand.

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UP AND DOWN A CURB OR A STEP

• Up a curb or a step
  – Helper approaches the curb with the front of the wheelchair and depresses the foot projection on the back of the wheelchair while pulling back on the handles to put the casters over the curb

• Down a curb or a step
  – Helper approaches the curb backward, lets the large back wheels down first then the casters
  – Alternative: tip the w/c back onto the large back wheels to the point of balance where the COG is over the rear axle and then let the large wheels gently down the curb

• Independent going up and down a curb
  – Wheeling - needs good UE strength
  – Same method but the person does a wheelie to clear off the casters over the curb or step

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GUIDELINES FOR PROPER BODY MECHANICS

• Therapist should be aware of the principles of basic body mechanics
• Get close to the patient or move the patient closer to you
• Square off with the patient (face head on)
• Bend knees: use your legs and not your back
• Keep a neutral spine (not bent or arched back)
• Keep a wide base of support
• Keep your heels down
• Don’t tackle more than you can handle; ask for help
• Don’t combine movements. Avoid rotating at the same time as bending forward or backward
MAINTENANCE AND SAFETY INSPECTION

INSPECTION

• Although the Wheelchairs are designed for trouble-free operation, simple daily and monthly inspections should be made of the Wheel’s Bearings, Seat & Back, Folding Mechanism, & Push Breaks to assure patient safety.

• A more comprehensive inspection should be performed every six months to the Frame-work, Wheels, Tires, Brakes, Folding Mechanism, to ensure proper operation and safe applications.

Cleaning

a. As needed, wipe down the frame with a solution of warm water and mild detergent & wipe dry.

b. Hand-wash patient’s Seat, Back & Support Belts, if any, in a sanitizing detergent & wipe dry.

Daily

a. Inspect the free movement of the Castors & Wheels.

Monthly

a. Inspect the Casters & Wheels for uneven wear. Ensure they are attached firmly to the Frame.

b. Check the working of Folding Mechanism & Parking Brakes for its smooth working.

c. Greasing / Oiling of bearings & folding mechanism.