Seating Assessment and Wheelchair Prescription

Rachel Hibbs, DPT
Elizabeth Stanley, DPT
Lynn Worobey, PhD, DPT, ATP

Seating Assessment

• Mat assessment of posture is not the same as a chair assessment of posture
• Optimal assessment should be in chair similar to chair being recommended
• Consider goals of device:
  • Mobility
  • Posture: maintain, accommodate, or improve

Seating Assessment

• Considerations prior to hands-on:
  • Client goals
  • Diagnosis
  • Living situation
  • Transportation
  • Funding source
  • DME vendor
  • Current/previous mobility device
  • Work and Leisure

Seating Assessment

• Considerations/decision making for current mobility device
  • Make and age
  • Condition
  • Supplier and funder
  • Frame type
  • Frame size
  • Functional seat depth
  • Cushion
  • Overall Width
  • Drive Method
  • Fit and Function
  • Backrest
  • Armrests
  • Leg rests
  • Foot plates
  • Rear wheels
  • Casters
  • Belt/harness
  • Accessories
  • Other

Seating Assessment

• Transfers
• Propulsion Technique
• Self Care: ADLs, Bowel and Bladder Management, IADLs
• Perception
• Cognition
• Communication
• Additional Devices (ventilator, communication device)

Physical Assessment

• Positions: supine, unsupported sitting, sitting in seating system
• Pelvis: Rotation, obliquity, lordosis, tilt
• Hips: flexion/extension, external/internal rotation, abduction/adduction
• Knee/hamstrings: contractures vs tightness
• Ankles/feet: inversion/ eversion, plantarflexion/dorsiflexion, rotation
• Trunk: kyphosis, scoliosis, rotation, flexible
• Shoulders: Alignment
• Head/neck: alignment
Physical Assessment

- Hip Width
- Thigh Length
- Lower leg length
- Shoulder width
- Chest width
- Scapula height
- Axilla height
- Back height
- Elbow height
- Overall height
- Weight

Physical Assessment

- Skin integrity
  - Edema
- Sensation
- Skin condition (current and previous)
- Sitting tolerance
- Effective pressure relief
- Pressure mapping

Physical Assessment

- Upper extremity function
  - Hand dominance
- Lower extremity function
- Respiratory status
- Cardiovascular status
- Swallowing/digestion
- Pain
- Seizures
- Tone
- Reflexes
- Tremors
- Ataxia

Ultra-Lightweight Manual Wheelchairs (K0005)

- Very Light (15-25 lbs.)
- Rigid or Folding Frame
- Quick-release axles
- Customizable
- Rule-out other mobility devices

Customization of Manual Wheelchairs

- Seat to floor height
- Seat plane
- Rear axle position
- Width
- Depth
- Camber
- Foot plate angle and seat to leg angle
- Back height and angle
- Backrests
- Angles
- Tension vs rigid back and seat
- Footplates
- Handrims
- Wheels
- Tires
- Wheel locks
- Cushions
- Armrests
Ultra-Lightweight “Specs”

Rigid vs Folding Frame
- Rigid can still “fold”
- Considerations for part-time ambulators
- Durability

Rigid vs Sling vs Tension Backs and Seats

Wheels

Tires

Handrims
Casters

Fit for Function
- Horizontal and vertical wheel alignment
- Seat width and depth
- Tippiness and ease of wheelie, ease of propulsion

Basics of Power
- Groups 1 & 2
- Scooters
- Group 3

Power Wheelchair Options (Group 3)
- Seat functions
- Drive options
- Headrests
- Postural support
- Leg rests, thigh guides, armrests
- Alternative controls
- Expandable controller
- Environmental options

Basics of Power
- Groups 1 & 2
- Scooters
- Group 3

Seat Functions
Postural Support

Alternative Controls

Joysticks

Cushions

Power add-ons

DIY Maintenance

What's Important and How to Teach It.
Learning objectives

- Recognize the importance of completing wheelchair maintenance
- List the appropriate timing for wheelchair maintenance tasks
- Demonstrate methods for maintaining your wheelchair
- Demonstrate how to identify common technical wheelchair problems

Injuries occur more frequently when wheelchairs are not maintained or repaired.

Wheelchair durability found lower than required in laboratory settings and repairs needed increased in the community.

- ANSI/RESNA wheelchair double-drum test
- Percentage of wheelchair users reporting needing repairs in the past 6 months
  - 2009: 40%
  - 2014: 52%
  - 2018: 56%

Direct wheelchair expenditures annually (Veterans Administration)

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repairs and replacement</td>
<td>30%</td>
</tr>
<tr>
<td>Missing work</td>
<td>15%</td>
</tr>
<tr>
<td>Missing medical appointments</td>
<td>10%</td>
</tr>
<tr>
<td>Being stranded</td>
<td>15%</td>
</tr>
<tr>
<td>Being injured</td>
<td>10%</td>
</tr>
</tbody>
</table>

Wheelchair needing repairs has been reported as a cause of adverse consequences for wheelchair users.

Medicare does not cover maintenance but does cover repairs.

- Maintenance such as routine cleaning is not covered.
- Necessary repairs are covered.

Wheelchair check-ups are likely to reduce adverse events related to wheelchair breakdowns.

- Cleaning caster axles
- Patching a flat tire

BE PROACTIVE!!
Maintenance includes both inspection and action items.

Inspection

No problem
Continuing using the wheelchair

Found a problem

Action

Tools – what do you need?

- Crescent wrench
- Lubricant
- Screwdrivers
- Combination wrench
- Allen wrenches
- Tire pump
- Tire patch kit
- Tire lever
- Tire lever

Manual wheelchair maintenance

Rear wheels
- Tyre
- Wheelbase
- Alignment
- Spokes

Casters
- Bearings
- Hub

Cushion
- Cover

Supports
- Foot
- Back
- Lumbar
- Clothing guard

Frame
- Bolts
- Cross-brace suspension

Weekly Inspections

How often should you check different parts of the chair?

- Weekly inspections
- Monthly inspections

How to take care of a manual wheelchair at home.

- Rear wheels
- Caster bearings
- Cushion
- Support frame
- Weekly inspections

- Frame
- Cross-brace suspension

- Weekly inspections
**Pneumatic tires**

- Improperly inflated tires wear quickly and make a wheelchair difficult to maneuver and propel.
- Tire depresses more than 5mm
- Inflate

**Types of valves**

- Presta
- Schrader
- Inflate to recommended pressure

**Wheelchair Maintenance Training: Manual Wheelchair**

**Inspection of the cushion condition may vary depending on the type of cushion.**

- Air cushions
- Gel cushions
- Foam cushions

**ACTION ITEM:**
- Wipe down the wheelchair frame with a clean, damp rag and soap.
- Machine wash
- Do not tumble dry
- Dry cover on towel away from direct sunlight
- When finished, place the cushion back in the correct position

**ACTION ITEM:**
- Clean monthly

**ACTION ITEM:**
- Cushion and cover

**Monthly Inspections**

**Deterioration in the cushion can increase the risk of developing a pressure ulcer.**

- Hole on cushion cover
- Hole on cushion cover
- Inspect cushion cover
- Open the cover and inspect cushion
- Cover foam liner flaking

**ACTION ITEM:**
- Nuts and bolts that are too loose may cause parts to rattle, fall off, and even lead to a malfunction.
- If bolts are visually loose or parts rattle...
- ...Tighten appropriately

**COMMON NUT/BOLT LOCATIONS**

**ACTION ITEM:**
- Inspect weekly

**ACTION ITEM:**
- Inspect monthly

**NUTS AND BOLTS**

**ACTION ITEM:**
- Inspect monthly

**NUTS AND BOLTS**

**ACTION ITEM:**
- Inspect monthly
Worn out tires make the wheelchair more difficult to propel and could lose air and/or burst.

Types of Tires
- Pneumatic
- Solid (no valve)

Checking for wear
- Intact (green) and worn out (red) tread

A damaged inner tube will not hold air and should be replaced or patched.

Types of Tires
- Pneumatic
- Solid (no valve)

Checking for wear
- Intact (green) and worn out (red) tread

A damaged inner tube will not hold air and should be replaced or patched.

Types of Tires
- Pneumatic
- Solid (no valve)

Checking for wear
- Intact (green) and worn out (red) tread

Types of Tires
- Pneumatic
- Solid (no valve)

Checking for wear
- Intact (green) and worn out (red) tread

Types of Tires
- Pneumatic
- Solid (no valve)

Checking for wear
- Intact (green) and worn out (red) tread

Types of Tires
- Pneumatic
- Solid (no valve)

Checking for wear
- Intact (green) and worn out (red) tread

Types of Tires
- Pneumatic
- Solid (no valve)

Checking for wear
- Intact (green) and worn out (red) tread

Types of Tires
- Pneumatic
- Solid (no valve)

Checking for wear
- Intact (green) and worn out (red) tread
If a wheelchair's wheels are not aligned, it will force the wheelchair user to push more often to travel straight.

Testing alignment with water
- Roll through water
- Coast, leaving tracks
- Alignment (top view)
- Alignment (front view)

Wheel axles that are not properly tighten or latched can come off and lead to an accident.

Type of axles
- Fixed axle
- Quick-release axle

ACTION ITEM: Clean the quick-release wheel-axle housing.

Clean and lubricate the axle in the quick-release mechanism
- Clean the axle receiver

Malfunctioning wheel locks can be dangerous during transfers.

Testing wheel locks

Wheel locks should be adjusted if they do not work or interfere with the wheel.

Loose handrims, or handrims that have sharp edges could be hazardous to the user.

Inspect for wear
- Handrim with scratches

Inspect tightness
- Tighten as necessary
Casters that are worn out or caster stems not vertically aligned can make the wheelchair harder to propel.

Example of possible problems:
- Caster assembly not vertically aligned
- Missing caster assembly cap
- Caster float

**ACTION ITEM:** Clean caster axles, hair especially can twist around the bearings and cause breakage.

**Malfunctioning anti-tip casters can increase the risk of a tipping accident.**

- Inspect they latch properly
- Side view
- Turning the caster wheels
- Inspect they are adjusted evenly

Loose foot supports can rattle, fall off, or even malfunction.

- Rigid foot support
- Flip-up foot support
- Rigid foot support with a crack
- Swing away foot support

**Loose arm supports can put the user at risk for falls when using them for support during transfers.**

- Removable arm support
- Flip-up arm support

**INSPECT MONTHLY**
A deteriorated back support can encourage improper back posture.

**Types of back supports**
- Adjustable tension
- Fixed backrest
- Contoured backrest

**Inspect back posts and back support hardware**
- Tightening hardware

**ACTION ITEM:** Lubricate moving parts: increased friction between moving parts can accelerate wear of the parts.

Lubricating the caster stem
Lubricating the folding backrest

**DO NOT lubricate sealed bearings**

**INSPECT MONTHLY**

Malfunctioning foldable back supports can be dangerous during transfers.

**Inspect the folding mechanism**: unlatches properly

**Inspect the folding mechanism**: latches properly

Bent pin that does not latch

**INSPECT MONTHLY**

Seat base must be intact because it provides the stable base to the user.

Inspect upholstery condition
Inspect the fasteners

**INSPECT MONTHLY**

**Clothing guard should not have cracks and properly attached.**

Inspect it can be removed and put back into place tightly

Cracked clothing guard

**INSPECT MONTHLY**

Frames that are cracked, broken or bent can pose a threat to safety and should be tended to immediately.

Inspect the frame
Inspect the weld points

Common weld point
Cracked weld

**INSPECT MONTHLY**
Problems with the folding mechanism may cause the wheelchair to collapse and injury to the user.

Inspect the folding mechanism functions properly

INSPECT MONTHLY

Damaged suspension elements can make the wheelchair harder to drive and less stable when maneuvering obstacles.

Wheelchair with suspension

Suspension elements

Damper
Spring

INSPECT MONTHLY

All wheelchairs should be professionally serviced at least once a year.

In places with inclement weather conditions, wheelchairs should be professionally serviced twice a year.

Power wheelchair maintenance

Before doing any maintenance, turn the power switch to OFF and remove the charger cords

Inspections are done daily, weekly, and monthly.

<table>
<thead>
<tr>
<th>Items</th>
<th>Daily inspections</th>
<th>Weekly inspections</th>
<th>Monthly inspections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frames</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rims</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suspension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross kernels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basket wheels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-tip casters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cushion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others: thigh, trunk, etc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positioning belts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls, indicators, and horn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor sound</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor disengage lever</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contactor box</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuts and bolts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same frequency as manual wheelchair</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Wheelchair Maintenance Training: Manual Wheelchair

Nuts and bolts – same as manual wheelchair.
Some examples:
- Anti-tip wheel
- Head rest
- Missing bolt on lateral thigh support
- Rusted nuts on wheelchair base

Inspect monthly

Wheelchair Maintenance Training: Power Wheelchair Maintenance at Home

Head support
Anti-tip wheel

Inspect Daily

Damage to the plastic covers or shrouds allows moisture and dirt to damage the frame or electronics.

Inspect the shrouds
If present and intact, continue use
If missing or damaged, ask expert

Missing shroud

Inspect Quarterly

Power wheelchairs have suspensions designed to absorb shocks and vibrations.

Springs
Damper

Listen for noise over obstacles

Inspect Monthly

The drive wheel needs appropriate tread for safety and maneuverability.

Front-wheel drive
Mid-wheel drive
Rear-wheel drive

Worn out tire tread

Inspect Monthly

If damaged, the wheelchair frame may fail, resulting in stranding or injury.

Weld points
Cracked frame
Contact a wheelchair maintenance expert

Inspect Monthly

Damage to the plastic covers or shrouds allows moisture and dirt to damage the frame or electronics.

Inspect the shrouds
If present and intact, continue use
If missing or damaged, ask expert

Missing shroud
Good casters are a mobile support for the wheelchair. Damaged casters are less mobile and safe.

- **Inspect Monthly**
  - Listen for bearing noise
  - Check for wear

ACTION ITEM: Clean caster axles, hair especially can twist around the bearings and cause breakage.

**Types of casters**

- More difficult to clean

Caster flutter

Caster cap

ACTION ITEM: Clean caster axles, hair especially can twist around the bearings and cause breakage.

**Types of casters**

- More difficult to clean

Anti-tip casters catch a tipping wheelchair and prevent some tipping accidents.

- **Inspect Monthly**
  - Anti-tip casters
  - Spinning the anti-tip caster
  - Tighten if loose

Cushions and cushion covers – same as manual wheelchair.

ACTION ITEM: Machine wash. Do not tumble dry. Dry cover on towel away from direct sunlight. When finished, place the cushion back in the correct position.

**Inspect Monthly**

Head and neck supports provide stability and prevent the head from extending behind the back support.

ACTION ITEM: Inspect tightness and adjustable hardware. Worn out fabric.

**Inspect Monthly**
Arm support

Arm supports provide good resting posture for the arms and a place for users to grab on for leaning or transfers.

| Flip-up arm support | Inspect Monthly |

- If loose, tighten.
- If it does not adjust easily, lubricate.
- If rough or sharp, ask expert.

Foot support

Foot supports not only support the foot, but also typically absorb most of the impact in frontal collisions.

| Swing away foot supports | Flip-up foot support | Calf support mounting hardware |

- Tighten if loose.
- Worn out coating.

Foot and leg support

Foot supports not only support the foot, but also typically absorb most of the impact in frontal collisions.

| Swing away foot supports | Flip-up foot support | Calf support mounting hardware |

- Tighten if loose.
- Worn out coating.

Back support

Back support must be intact and properly attached.

| Contoured backrest | Upholstery back support | Worn out captain style back support |

- Upholstery back support.
- Worn out captain style back support.

Other supports

Other postural supports improve posture and alignment while maintaining or improving function.

| Swing away trunk supports | Thigh guides with missing bolt |

- Thigh guides with missing bolt.
- Worn away trunk supports.

Pelvic belt

A pelvic belt can correct slouching posture and prevent sliding in the seat.

| Velcro and ring | Inspect hardware |

- Velcro and ring.
- Inspect hardware.

Electrical system
Malfunctioning controls or indicators can leave the user stranded.

When inspecting power seat functions first tilt, then recline and finally elevate the legs.

**ACTION ITEM:** Power seat function(s) malfunction the user can be left in an unsafe position for driving or at risk of pressure sores.

Whenever an error in the wheelchair’s control system occurs, error information appears in the control panel.

Brake failure is a serious problem that can result in severe injury.

**ACTION ITEM:**
- Turn down the speed
- Push the joystick forward
- Release

Motor failure can leave the wheelchair user stranded.

Motor lever failure can leave the wheelchair user stranded as well as injured.
Joystick problems may cause malfunction in wheelchair operation as well as damage to the electronics.

- Wiggle to inspect the controller
- Ensure swing-away mechanisms are tight and functioning
- Inspect the rubber boot and seal of the joystick

A damaged charger can decrease the wheelchair battery life.

- ACTION ITEM: Charge the batteries
- 50% battery charge is the ideal time to charge

Improper insulated wires or loose electrical connections can cause wheelchair malfunction.

- Use zip ties to secure very loose cables

Resources
- [http://www.upmc-sci.pitt.edu/wmtp](http://www.upmc-sci.pitt.edu/wmtp)
  - Clinician Reference Manual Hands-on activity checklists
  - Maintenance cards
  - Power point presentations
  - Manual wheelchair video
  - Power wheelchair video

**Manual and Power Wheelchairs**

Have the wheelchair professionally serviced

All wheelchairs should be professionally serviced at least once a year.

In places with inclement weather conditions, wheelchairs should be professionally serviced twice a year.
Case Study 1

36yo Nepali male
T10 ASIA A x20 years after mudslide crush injury
Has just arrived in the US to live with family

What do we need to consider?
- Strength and ROM
- Sensation
- Transfer skills
- Skin integrity
- Medical Comorbidities
- Additional barriers
- Current equipment

Case Study 2

52yo male with recent h/o cervical epidural abscess, lumbar osteomyelitis resulting in spastic tetraplegia
Now s/p Baclofen pump insertion

What do we need to consider?
- Strength and ROM
- Sensation
- Transfer skills
- Skin integrity
- Medical Comorbidities
- Additional barriers
- Current equipment

Case Study 3

32yo female C2 ASIA B s/p motor vehicle accident
Wife and mom

What do we need to consider?
- Strength and ROM
- Sensation
- Transfer skills
- Skin integrity
- Medical Comorbidities
- Additional barriers
- Current equipment

Handouts
- FMA
- Cushion descriptions/coding
- Maintenance