Environmental and Mobile Device Access for Power Wheelchair Users

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Disclosures

Primary Presenter: Jay Doherty
• Is an employee of Pride Mobility Products Corp.

Co-Presenter: Nancy Shuster
• No conflicts to disclose

Learning Objectives

• Discuss needs assessment process as it relates to determining mobile device and environmental control access and integration into the user’s wheeled mobility device.

• List two features in mobile technologies that address a user’s typical activities of daily living.

• Identify two examples of access and use of a medical device that can be achieved from integrated power wheelchair controls.

• Describe three examples of mounting options for mobile technology.
Global Dependency on Mobile Devices

- For work, school, & interpersonal competence for immediate access to view & respond to text messaging, email, telephone & documents
- Catalyst for how people interact, conduct commerce & learn
- Crucial for individuals who are dependent on powered mobility due to limited volitional control for accessible solutions.
- A vital consideration and ESSENTIAL DIFFERENTIATOR for success & independence across all aspects of person’s life

Why Accessible Solutions are Crucial for Power Wheelchair Users

- Persons with motor & sensory impairment often lack independent mobile technology access
- Although individuals may be able to utilize technology once setup, they often rely on others for technology access
- If technology is not within ease of reach used less frequently or abandoned and impedes person’s success & competency in life domains

Options
- drive to technology location
- technology brought to them & setup for their access (uses time and relies of availability of other people)
- OR integrate it into their power wheelchair system
Why Accessible Solutions are Crucial for Power Wheelchair Users

• (Scherer, M. J., 2000) Nonuse of mobile device(s) may decrease functional abilities, loss of freedom & independence, & risk of injury or disease.
• (Phillips & Zhao 1993) The most significant factor associated with technology abandonment is failure to consider the user’s opinions & preferences since it does not meet the person’s needs or expectations.
• Findings suggest: Technology-related services should emphasize consumer involvement to reduce device desertion, promote consumer satisfaction & functional independence.

Why and How should this be addressed by the Evaluating Team?

Why? Independent access/control of mobile devices can lead to significant control over their life and optimal independence.

Conceptual Model
A power mobility system may function as the “Dashboard” for controlling mobility and environmental control of portable mobility devices, computers (Windows, Android and Macintosh), telephones (cellular), speech generating devices, and environmental appliances.

How can this be done given time & fiscal constraints???
Since most wheeled mobility device evaluations are held outside the person's contextual environments, the evaluating team should inquire about person's typical activities to optimize self-care, work, educational, & interpersonal independence

BEFORE THE ACTUAL ASSESSMENT/TRIAL
of the wheeled mobility device.

Implication
Needs assessment ensures specific features are addressed in comprehensive power mobility system assessment
Assess for Appropriate Device Access Method

- Start with Seating and Positioning
- How does the person currently access their mobile devices and power wheelchair?
- Assess what options can be assessed to promote optimal access for independence.

Needs Assessment: Preparatory Planning saves Time & Improves Quality Outcomes

New wheeled mobility device user:
- difficult to conceptualize all functional & medical needs.

Experienced wheelchair user:
- What is effective in current wheelchair & what needs are not effectively being addressed?
- Although evaluating team’s focus is frequently on medical aspects of person’s motor/sensory limitations, the individual & stakeholders can ascertain what needs not being met.

- Incumbent upon evaluating team to help individual & stakeholders identify needs before on-site evaluation
- Information gathering pre-casing methods
  - emailed or web-based questionnaire
  - telephone interview
  - onsite meeting
- Consequently: When actual wheelchair evaluation occurs, the onsite evaluating team is prepared to include these issues in the evaluation
- “Wish list” development prior to onsite evaluation helps team understand person’s independence & functional goals, while also addressing their bodily & physical needs.
Although this may seem to encumber busy evaluating team, this process helps the team prioritize recommendations:

1. promotes individual's empowerment, "buying in" and involvement in evaluation process
2. allows evaluating team to research technology options prior to assessment
3. allows technology information to be ready or available for assessment/presentation during on-site evaluation

Ultimately: Planning saves time & promotes quality outcomes for a successful wheeled mobility system & decreases the likelihood to rescue less-than-optimal outcomes (cost team $ and time)

Needs Assessment: Current Wheeled Mobility Devices

<table>
<thead>
<tr>
<th>Assistive Technology</th>
<th>Manufacturer and Model</th>
<th>Date of Purchase</th>
<th>Special Features</th>
<th>Location of Use</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Wheelchair</td>
<td></td>
<td></td>
<td>Manual Tilt</td>
<td></td>
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<tr>
<td>Powered Wheelchair</td>
<td></td>
<td></td>
<td>Power Tilt</td>
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<tr>
<td>Medical Stroller</td>
<td></td>
<td></td>
<td>Manual Tilt</td>
<td></td>
<td>In place</td>
</tr>
<tr>
<td>Medical Stroller</td>
<td></td>
<td></td>
<td>Power Tilt</td>
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<td></td>
<td>Power Tilt</td>
<td></td>
<td>In place</td>
</tr>
</tbody>
</table>

Needs Assessment: Current Assistive Technology

<table>
<thead>
<tr>
<th>Assistive Technology</th>
<th>Manufacturer/Model</th>
<th>Operating System</th>
<th>e.g. magnification, voice output, switches, word prediction</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Tablet</td>
<td></td>
<td>Windows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication Device</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Visual Aid</td>
<td></td>
<td></td>
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<tr>
<td>Auditory Aid</td>
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<tr>
<td>Alternative Access</td>
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<tr>
<td>Reading Aid</td>
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<tr>
<td>Environmental Control</td>
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<tr>
<td>Alternative Posture</td>
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<tr>
<td>Environmental Controls</td>
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<tr>
<td>Hygiene Equipment</td>
<td></td>
<td></td>
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<tr>
<td>Lift for Transfers</td>
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</tbody>
</table>
**What barriers impede your ability to complete expected tasks?**

<table>
<thead>
<tr>
<th>Task</th>
<th>Examples</th>
<th>Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Unable to reposition</td>
<td>unable to reposition for comfort &amp; skin integrity</td>
<td></td>
</tr>
<tr>
<td>2) Unable to use telephone</td>
<td>unable to use telephone</td>
<td></td>
</tr>
<tr>
<td>3) Unable to access water bottle to address neurogenic bladder risks</td>
<td>unable to access water bottle to address neurogenic bladder risks</td>
<td></td>
</tr>
</tbody>
</table>

**Are you expected to transition to a new environment?**

<table>
<thead>
<tr>
<th>Transition</th>
<th>When</th>
<th>Demands</th>
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</table>

**Given the above information, what are your functional areas of concern?**

• What do you need/want to be able to do that is currently difficult or impossible to accomplish independently or does not effectively address a medical condition?

**What questions or goals would you like the assistive technology evaluation/consultation to address?**

- Access to computers and tablets
- Access to smart phone technology
- Access to communication devices
- Access to control their environment
  • Lights, Television, thermostat, etc…

**So What are the Things That Technology Offers Today that can Improve Someone’s Independence?**
What do Power Wheelchair manufacturers Offer Today to Allow People with Disabilities to be Connected?

- Bluetooth technology allows the electronics of the wheelchair to access mouse functions and applications on Smart phones, tablets and computers.
- This technology offers?
  - Independence
  - Communication in their immediate environment.
  - Communication outside of the immediate environment.
  - The consumer control over a part or all of their life.

What Smart Phones Provide With Access Through Bluetooth?

**iPhone Switch Control**

- Provides the user with a scanning option for access to the smart phone.
- This access method works adequately for access to applications and can be used to answer incoming calls.
- To access the Switch Control feature on an iPhone with the proper iOS you need to follow these steps.
  - Click on the settings icon
  - Click on the general tab
  - Click on the accessibility tab
  - Click on switch control and turn the function on.
  - You then need to turn on which functions you want activated with a switch command (this will be a directional command with the input device).

Insert Video of iPhone Being Utilized with Switch Control
What Smart Phones Provide With Access Through Bluetooth?

Android Phones
• These phones have a mouse feature available which allows the input device to be utilized as a mouse would control the cursor on the screen.
• With Android products you can use a left mouse click to enter the application and a right mouse click is utilized to close the application.
• There are other options with Android. Assistant allows a user with mobility issues to access many features on the phone that without the assistant feature they would not have easy access.

Adrianna Using Her Bluetooth Mouse to Access Her Android Phone
• Adrianna
  • Cerebral Palsy with mixed tone of athetosis and spasticity
  • Works full time at a catering Service.
  • Technically Savvy
  • Uses a Joust joystick to access her computer at work.
  • Drives her power wheelchair with a proportional chin control.

Tablets
Advantages
• Offer much of what a laptop offers
• Almost as powerful a tool as laptops
• Utilizes a wide range of apps that can provide greater independence
• Most tablets offer Bluetooth capability
• Tablets are more compact and lighter than laptops, so they are easily mounted on power wheelchairs.
• Some tablets can have SIM cards that allow a tablet to function similar to a smart phone for data.
• Windows, Android and Apple Tablets can all be used with Bluetooth on power wheelchairs.
Tablets

Disadvantages

- Can be restrictive with the amount of memory available for apps and storage on the device
- May not always offer the same programs as laptops or computers
- May break easily

Communication devices and Bluetooth access

- The following communication manufacturer devices pair with many Bluetooth chips found in power wheelchair electronics:
  - Dynavox: As long as they are windows based they will pair with power wheelchair Bluetooth capabilities.
  - Prentke Romich: Tech support recommends purchase of a USB mouse adaptor which will allow mouse access to the device.
  - Tobii: Tech support recommends purchase of a USB mouse adaptor which will allow mouse access to the device.
- Remember to always try to device before committing that it will successfully work via Bluetooth with a power wheelchair.
- Manufacturers change functions from time to time.

Bluetooth Can Offer Environmental Access Through Wifi

- Applications can turn a home/apartment into a smart home.
- Applications use a smart phone, tablet or a laptop to have full access to control their home environment.
- A variety of these systems are available, all have pros and cons.
- Educate your consumers that this technology is available.
- Also keep in mind that these systems are hard to get funded if at all and some can be quite expensive.

Which Manufacturers Offer Infrared Control

- Quantum offers infrared through their enhanced display.
- Permobil offers infrared through their Omni display.
- Sunrise Medical offers infrared through their Omni display.
- Invacare offers infrared through a separate module.

What Can Infrared Control? (Environmental)

- Televisions that use infrared remotes
- Stereos that use infrared remotes
- Appliances that use infrared remotes (space heaters, air conditioners, etc...)
- Insteon devices
- Infrared toys
- Cautions with Infrared
  - Infrared washes out in sunlight so infrared door openers work well indoors but not outdoors.
  - Infrared is always line of sight

Environmental Control

There are a variety of ways to control the environment through the wheelchair electronics.

1. Through infrared transmission
2. Through use of WiFi smart home technology which can be controlled through a smart phone, tablet or laptop via Bluetooth connection.

Keep in mind that there is a variety of technology available today and that the possibilities are endless with all of the wireless technology becoming available today.

- Many facilities are putting together smart apartments for individuals to try out technology that is available.
Insteon

- Insteon has replaced X10 which many people were familiar with years ago.
- Insteon has the capability to use the infrared signal sent by a wheelchair to a infrared receiver which can then control modules plugged into wall outlets to turn lights on and off as well as other appliances plugged into wall appliance links.
- In addition, Insteon can be controlled through the use of a smart phone and a hub which gets plugged into your WiFi router.

How Insteon Works

- Insteon uses hubs that receive signals either from a smart device using WiFi or from an infrared receiving module plugged into the wall.
- Insteon then either uses the wiring in the home to transmit the signal to turn on the device or uses a radio frequency to transmit the signal of which the end result is the device turning on.
- Insteon can be integrated with other systems like the nest system that would allow control of a thermostat.

Hardware Mounting Options

- After needs assessment completion for device/technology and input method(s), evaluating team determines how the device(s) will be mounted, based upon the person's functional needs.
- Numerous commercial mounting devices require comprehensive evaluation based upon device type and placement, mount placement, and desired or anticipated task independence:
  - Individual can swing manually into place
  - Require a care-provider to swing into place
  - Motorized mounts controlled by switch or integrated power wheelchair electronics
- Device and mounting should augment independence for optimal visual pursuit and access.
Considerations:
Choosing a mount design and placement

- Is person able to independently move the mount into place and swing it out of the way to power wheelchair?
- How heavy is the device and is independence a realistic objective?
- If person unable to manually swing mount away, is it safe for individual to control power wheelchair with device mounted in place?
- Can motorized mount allow device to be swung away independently?
- What are the functional tasks considerations to allow variable movement of the device toward/away the person at specific times; e.g., eating, drinking, hygiene tasks, specific tabletop tasks?
- Are there considerations to avoid bumping/harming the device or mount; e.g., transfers, doorways, transportation?
- The team can research companies regarding custom mounts in to decide what device is optimal for the individual

http://www.atilange.com/ESW/Files/Wheelchair_Mounting_Systems_Comparison&%20Matrix2.13.pdf  This is a great reference created by Michelle Lange.

Zoe Case Study

- Zoe, is 18-year-old with Tetra-Amelia: congenital lack of all extremities
- Thoracolumbar rotational scoliosis, with spinal fusion corrected non-reducible 54° triplanar dextroscoliosis with pelvic/trunk obliquity
- Restrictive Lung Disease, frequent pneumonias & dehydration

AT Use Prior to recent power wheelchair evaluation

Quantum Q6 Edge with power tilt/seat elevator & seating components
- Independent AMC mini-joystick chin control mounted to right Falcon power boom to control joystick position & 6 Ablenet/Tash Spec switches for drive/tilt/seat elevator, on/off, A/C, & mouse emulation
- Dependent fan control mounted in abductor position
Windows OS laptop with joystick chin control for mouse emulation in Bluetooth mode
- onscreen keyboard/word prediction
- simultaneous Dragon Naturally Speaking speech recognition software for writing & Internet using noise canceling headset microphone
POWER CHAIR DESIGN “WISH LIST” for Independence

• power chair functions for drive, tilt, recline, seat elevator
• cooling systems, call/alert system, electronic/environmental functions for eating, transfers, TV/DVR
• writing, internet use, e-reading
• stylus for tablet use, alert/call system

Overall Strategy

• Configure power chair controls as a DASHBOARD
• using Chin Controlled Joystick, Enhanced Display at midline with Gatlin Swivel Mount, multiple electronics, & mounts

“Wish:” INDEPENDENT CHIN CONTROL position for

• Drive, tilt, recline, seat elevator
• Swing-away for eating, transfers, writing, internet, emails, & reading
• Stylus use for accessing objects
• Alert/call system using speech recognition & stylus:
  ▪ 5 school buildings on water’s edge each accessible by >150 ft. ramps
  ▪ lacks constant adult assistance & expected to perform independently
  ▪ Needs to communicate safety/ADL/medical needs
  ▪ total reliance on power chair functions requires contact method for
    o medical help, mechanical/electronic failure & other emergencies
    o when power wheelchair cannot access a location
    o when stuck on ramp due to wet/icy weather conditions

TEAM DECISION

Two 12V power booms, customized electronics/mounts, & two wire harnesses

Strategy: Right Falcon Power Boom swings in horizontal plane at chin level

• controlled with Ablenet Spec switch mounted right side of headrest
• supports chin control joystick, call alert system (iPhone) with stylus holder, enhanced visual display
• embedded gooseneck InSync microphone [no headset] for writing
• midline control bracket with modified Stealth call alert mount & USB electronic charger port addition
### Strategy: Left Falcon Power Boom moves in direction resembling parasagittal arc

- controlled in Auxiliary/Relay mode
- tablet moves 3-10” distance from face using chin control joystick for mouse emulation & stylus use
- moves to/away for eating, transfers, socialize
- supports Tab Grabber gooseneck mount for ThinkPad Tablet for writing, internet, emails, accessing curriculum, picture/video use; cutout made in seat cushion at distal left corner to allow tablet to lay flat for barrier free transfers

### “Wish:” INDEPENDENT CONSTANT SKIN COOLING & HYDRATION

- Minimize perspiration due to limited skin surface area
- Prevent skin integrity deficits secondary to excessive moisture & heat accumulation
- Use fluid intake to remain hydrated to decrease dehydration risks & minimize pulmonary compromise due to limited skin surface area

*Dehydration reduces blood volume making cardiopulmonary system work harder to pump blood throughout the body & poses medical risk.*

### Strategies: ASL Micro Joystick CHIN CONTROL

- **Fan Operation** in Axillary/Relay mode) attached to power chair’s seat pan in abductor position embedded in ABS shell [Pelonis Fan 12 Volt DC output]
- **Air-Conditioner Control** using ECU/Remote mode allows up to 11 devices to control including other devices Zoe controlled; i.e., TV, Audio, DVD
- **Hydration System with gooseneck:** fluid access
“Wish:” INDEPENDENT use of Mealtime Partner Electronic Feeder

Strategy:
• Not integrated into power chair electronics
• 2 Spec switches strapped to headrest; one for turning the bowl & one for bringing the spoon to her mouth
• Seat elevator: fine adjustments to allow self-feeding using electronic feeder [and to provide appropriate functional transfers height, science lab, social interaction at eye level]

Environmental Control Through Commonly Found Technology

Questions?

Thank you!
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