Powerdrive Wheelchair Features

Introduction
The purpose of this handout is to highlight some of the unique components of powerdrive wheelchairs for people who need a powerdrive wheelchair. It is intended to inform the assessment and prescription process.

Information supplied is based on the experience of the Occupational Therapists (OTs) involved and information available at the time of development.

Features described include:
- Location of drive wheels
- Tyres
- Tilt in Space
- Recline
- Armrests
- Footplates/Hangers
- Headrest
- Control Options
  - Joystick
  - Chin
  - Sip/Puff
  - Head Controls
  - Attendant Controls
  - Scanner & Switch Controls
- Ventilator Attachment

Location of Drive Wheels

Description
Powerdrive wheelchairs are described by the position of the drive wheels, namely front, mid and rear wheel drive. The position of the drive wheels affects the space needed for the chair to turn around, and its manoeuvrability in tight spaces.

Key points to consider:
- Consider where the chair will be used - mainly indoors, outdoors or both.
- Manoeuvrability - mid wheels have the smallest turning circumference, while rear wheels have the largest, so are more difficult to manoeuvre in tight spaces.
- Impact of wheels and caster location on footplate position and subsequent length of chair.
- Mid and front wheel drives are less sensitive to problems caused by weight distribution than rear-wheel drives.
- Smoothness of ride. Different drive wheel locations affect the chair’s suspension
- Ability to traverse obstacles and uneven surfaces
- Weight distribution, stability and ‘tippiness’ on inclined surfaces
- Stability at higher speeds
Type of Tyres

Description
Tyres can be either pneumatic (filled with air) or semi-solid (polyurethane foam filled). Pneumatic tyres and casters provide the smoothest ride, but can be punctured. They require periodic inflating and may go flat if punctured or ruptured in any way. Foam-Filled (flat free) tyres are puncture-proof. They won't rupture or leak air, because there is no air to leak out. They require low-maintenance.

Key points to consider
- Environment where chair is to be used
- If chair is likely to be used outdoors on stones or where there are prickles in the grass, consider solid tyres
- Foam-filled power chair tyres might not deliver as smooth a ride as air-filled ones, but the security of knowing they will not go flat may outweigh any minor discomfort

Power Tilt in Space

Description
Allows the entire seating unit to tilt without opening the “hip” (seat to backrest) angle. The individual can independently control the amount or degree of tilt. The tilt is most commonly operated directly by the main access switch (hand or chin joystick, or sip/puff), once the tilt mode is selected. On some chairs the client may need to operate a separate switch or scan through control options. The chair can be placed in a small amount of fixed tilt ie 5° if client prefers a small degree of tilt to counteract the effect of gravity.

Note: Retrofit of tilt in space may not be possible if a different chair interface is required.

Criteria for Use
Clients with complete injuries of C6 or above may require power tilt. Clients who experience other complications may find power tilt can:
- assist with respiratory function
- reduce care support required
- provide rest position without transfer to bed, assisting with pain and fatigue
- enhance postural stability and balance (including on steep slopes/gutters etc).

Using tilt in space, an individual can independently:
- reposition to assist with pressure relief. A minimum 55° tilt is required to offload pressure off the ischial tuberosities
- promote bladder drainage through repositioning

Features Available
- Greater than 55° requires a centre of gravity weight shift mechanism that works together with the tilt in space
- Variable centre of gravity on chair

Key Points to Consider
Tilt in space may raise the height of the chair by varying amounts, which may influence functional considerations such as:
- Home access - table heights, circulation spaces
- Transport - van access, head clearance required
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- Head support is required when using tilt (see headrest options)
- Funding – currently subsidised by MASS where clinically justified
- Interface with other components - ECU's, power leg rests

Assess:
- Postural changes
- Impact on spasm
- Skin care
- Ability to maintain arm position when in tilt, elbow stops may be needed
- Access to controls to operate chair from all positions
- Clients should not drive in significant tilt unless needing footpath clearance from ground. Most systems have a security stop on tilt position whilst driving

Recline

Description
Allows only the back rest to recline, relative to the seat. The degree of angle of reclined position can be controlled by the client or manually by carer.

Note: Power recline is not recommended for use in isolation for clients with spinal cord injury because of concerns with shear (called weight shift).

Criteria for Use
- When power tilt alone has not achieved desired outcome. Refer to “criteria for use” outlined in power tilt section
- If the individual's hips cannot flex to 90°
- Can assist with positioning
- Can assist with bladder drainage and catheterisation

Features Available
- Manual or power options available
- Weight shift to move seat base to reposition when sitting back into upright position
- Anti-shear back support

Key Points to Consider
- Issues included in tilt-in-space section, with particular emphasis on skin care, hand support, postural changes, and especially arm positioning (arms tend to slide significantly backwards so adequate support needs to be guaranteed)
- When the back is reclined, shearing forces are exerted on the user's sacrum, creating a risk of skin breakdown
- When the back is returned to the upright position, it will push the user forward, compromising the positional support offered by the backrest
- An anti-shear backrest slides up and down the back posts of the wheelchair when the chair is being reclined or returning to upright. The anti-shear back stays in contact with the user's back, eliminating the shearing that would normally occur. It also allows the use of contoured backrests.
- Extensor spasticity may be triggered when recline is used

Armrests

Description
Positioned on sides of wheelchair to ensure shoulders and forearms are supported and to assist with upper body postural stability.

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Criteria for Use
All powerdrive wheelchairs require armrests. The type of armrests will depend on functional ability of the individual and other factors such as type of transfers, access to tables/desks, ease of aligning sling while individual is in chair, etc.

Features Available
- Standard padding recommended to protect forearm
- Gel pads if frequent postural adjustment through forearms
- Height adjustable
- Desk length (half armrests) to allow closer access to tables etc.
- Control arm - quad release or swing away
- Metal outer edge strip to project armrest upholstery (can increase risk of pressure injuries on forearms)
- Side panel (skirt guards) in armrests to assist with thigh position in chair
- Removable or flip up
- Dual post for reinforcement for those who apply pressure for positioning or transferring (heavy duty)
- Waterfall edge for more delicate skin – no metal outer strip

C4 quadriplegia or above
- Arm trough support
- Elbow blocks (to assist with arm support during tilt)
- Modular hand pad
- May need to consider specific hand position
- Strapping into chair not recommended in case of spasm. This should be addressed separately through splinting

Key Points to Consider
- Supportive height for elbows so as to reduce shoulder pain and allow for shoulder depression
- Oedema management for upper limbs enhanced by using supported forearm position
- Cosmetic appearance
- Access to joystick (if appropriate)
- Upper body postural support & stability provided by arm rests
- Access to tables and desks - specify armrest length & width, transfers & whether armrests interfere with these
- Interface between armrest and lap-tray
- Spasm – sheepskin or gel pad may be needed to protect skin in arm trough

Footplates, Hangers and Leg Rests
Description
- Hangers are the bracketry to which the footplates and calf supports/straps are attached.
- Footplates are designed to position and support feet. Their angle can be adjusted to accommodate differing degrees of ankle dorsiflexion while maintaining support along the full length of the foot

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Criteria for Use
- Hangers and footplates are essential for all powerdrive wheelchairs, unless client has lower limb amputation
- Calf pads/straps are required when wheelchair is in reclined or tilted position and to maintain correct positioning of legs in wheelchair. May also assist with positioning during spasm.

Features Available
- Padded
- Detachable and/or swing-away
- Elevating – manual and power
- Lateral or central mounted
- Calf pads/straps to prevent feet from falling off footplates
- Heel loops
- Single piece footplate/footboard
- Lockdown two piece
- Angle adjustable footplates and hangers
- Heavy duty footplates & hangers

Key Points to Consider
- Reclining the wheelchair changes the position of lower limbs so they may require altered type of support
- Central mounted footboard reduces width at front of chair as no footplate hangers necessary, but may interfere with front casters
- Central mounted footboard can prevent feet from being caught between swing-aways. Footboard can flip up but may impact on hoist access to chair
- Spasm will frequently influence positioning devices required and may indicate the need for heavy duty footplates to be supplied
- Heel loop posts may create pressure injury risk on heel – consider calf strap as a safer alternative

Elevating leg rests:
- Oedema – allow for independent raising of lower limbs, used primarily if oedema stockings and or tilt in space is not effective
- Transfers – often protrude above height of seat and need to be avoided during transfer
- Increase length of chair

Headrests
Description
Head rests provide head support on any mobility equipment. Switches for wheelchair and environment controls can be mounted in the head rest.
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Criteria for Use

Individuals with C3/C4 Quadriplegia and above require head support. Other circumstances may include:

- Clients with minimal or no head control
- Clients using tilt in space wheelchairs
- When travelling in a vehicle in the wheelchair, an individual may require additional head support
- Clients with moderate to severe neck pain

Features Available

- Variation in size possible
- Most have three way positioning axis - up/down, forward/back and angled

Key Points to Consider

- Head control
- Muscle imbalance
- Muscle fatigue
- Neck spasm
- Head straps
- Trial of a variety of designs and options is essential
- Ease of set up is important for reliable positioning throughout the day
- Directions for set up should be very clear for carers/families involved
- Compatibility with specialised switches is required

Joystick Controls for Hand/Upper Limb Use

Description
Commonly used controls, designed to drive chair using hand and upper limb movement.

Criteria for Use

- Client has active range and control which allows for controlled movement of chair using joystick
- Switching possible to manage other control functions e.g. tilt-in-space, leg bag opener, power recline, phone and other technology
- Splinting to support wrist and hand position may enhance ability to manage controls

Features Available

- Ball, enlarged ball
- T-bar

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Control Options: General considerations for specialised systems

Key Points to Consider for All Control Options
- Head support and control
- Pain
- Fatigue

May need capacity to access other accessories such as:
- Tilt-in-space and ECU
- Long-term effect on neck joints/chin/jaw and teeth
- On/off switch must be accessible and in suitable position ie raised, carefully positioned, switched separately
- Suspension springs on the powerchair base may facilitate smoother ride
- Aesthetics of control equipment close to face
- Mounting for mouthsticks/drink container
- Maintenance, repair and replacement of customised features. Some control options are not widely available in Australia, therefore must consider trial and maintenance
- Approval from funding source required if later alterations are made
- Training of client and carers
- Programming of all parameters
- Spasm
- Cognition and ability to learn new skills
- Detailed maintenance of controls is essential
- Speed, acceleration and turn rate adjustable through programmer
Chin Controls

Description
Enables powerchair to be driven through chin or jaw movement.

Criteria for Use
- C3 complete level of injury of or above usually indicates a need
- May be considered for clients with a C4 complete injury when pain and fatigue are issues.
- Generally not required for C5 level of injury and below

Features Available
- Joystick with ball, dished knob or other individualized adaptation
- Reversal of directions on joystick configuration may improve function of people with muscle imbalance. In this case, a movement towards body moves the chair forward, away from body for reverse. This is often necessary when attempting to access chin control from tilted position
- Sip/Puff arm allows client to swing chin control arm into position or away. See next section for details
- Latch function can be programmed to enable chair to continue moving for specified period (eg 15 sec - 1 minute) in a straight line once activated. Usually recommended for experienced drivers only
- Mini joystick can be positioned at chin or lip, allowing for movement of chair with small adjustments of joystick (~10mm)
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Sip and Puff

Description
Enables powerchair to be driven using breath control. Can also be used to swing in control arm for chin control mechanism.

Criteria for Use
- Level of injury of C3 complete or above usually indicates a need.
- May be considered for clients with a C4 complete injury when pain and fatigue are issues.
- Used in conjunction with other controls i.e. chin controls, to swing away features whilst managing other tasks.

Features Available
- Latch feature essential (allows for “cruise control” type operation)
- Need kill (emergency stopping) switch for safety
- Ventilator settings and type of tracheotomy valve will need to be assessed to determine if sip/puff is an available option.
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**Head Controls**

**Description**
Enables powerchair to be driven using head and neck movement or positioning on headrest.

**Criteria for Use**
- Level of injury of C4 complete or above usually indicates a need

**Features Available**
- May be operated by applying pressure to a headrest pad, a series of switches (usually 3) or by infra-red detection of head position (Peachtree)
- On/off and forward/reverse may be separate single switches
- Latch function enables chair to continue moving for specified period once activated
- Peachtree has proportional control i.e. further away head is from controller, the faster chair will go
- Autostop function essential for safety
- Use of stand alone attendant control recommended

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**Attendant Controls**

**Description**
Enables powerchair to be driven by attendant.

**Criteria for Use**
- If client is unable to control powerchair independently and safely. This may be in certain environments such as outdoors or in certain situations when fatigue, spasm or positioning is a factor
- May be used in conjunction with other control devices. Overrides these.

**Features Available**
- Usually standard joystick. Frequently, joystick is located behind client. Ventilator placement, recline or tilt of powerchair may necessitate other location.

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**Custom Designed Switch Controls/ Scanning Devices**

**Description**
Enables powerchair to be driven through custom designed switching such as scanner or single switches.

**Criteria for Use**
- If client unable to safely and independently utilise other control options, a custom designed system may be necessary

**Features Available**
- Area currently undergoing expansion
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- Software available to use technology such as I-Phone to interface with powerchair
- Provides client with independent capacity to control environmental features if used with suitable interactive devices eg Progress, Q-Logic, Computer

Ventilator Attachment/Cage

Description
Required to utilise a standard ventilator. Traditionally adds length to chair depending on type of ventilator used. May need to be altered when ventilator changed.

Criteria for Use
Individuals who are ventilator dependent, usually C3 and above.

Features Available
- Fixed attachment to chair
- Swinging attachment designed to accommodate tilting system
- Variation to ventilator cage possible on request to suppliers

Key Points to Consider
- Positioning of, and access to ventilator for carers
- Influence of increased length of chair in terms of access and chair selection
- Set-up to allow for full tilt range
- Change in centre of gravity can affect chair performance