Clinically Speaking

The Power of Seat Function and Base Selection

Power Mobility & Quantum Rehab

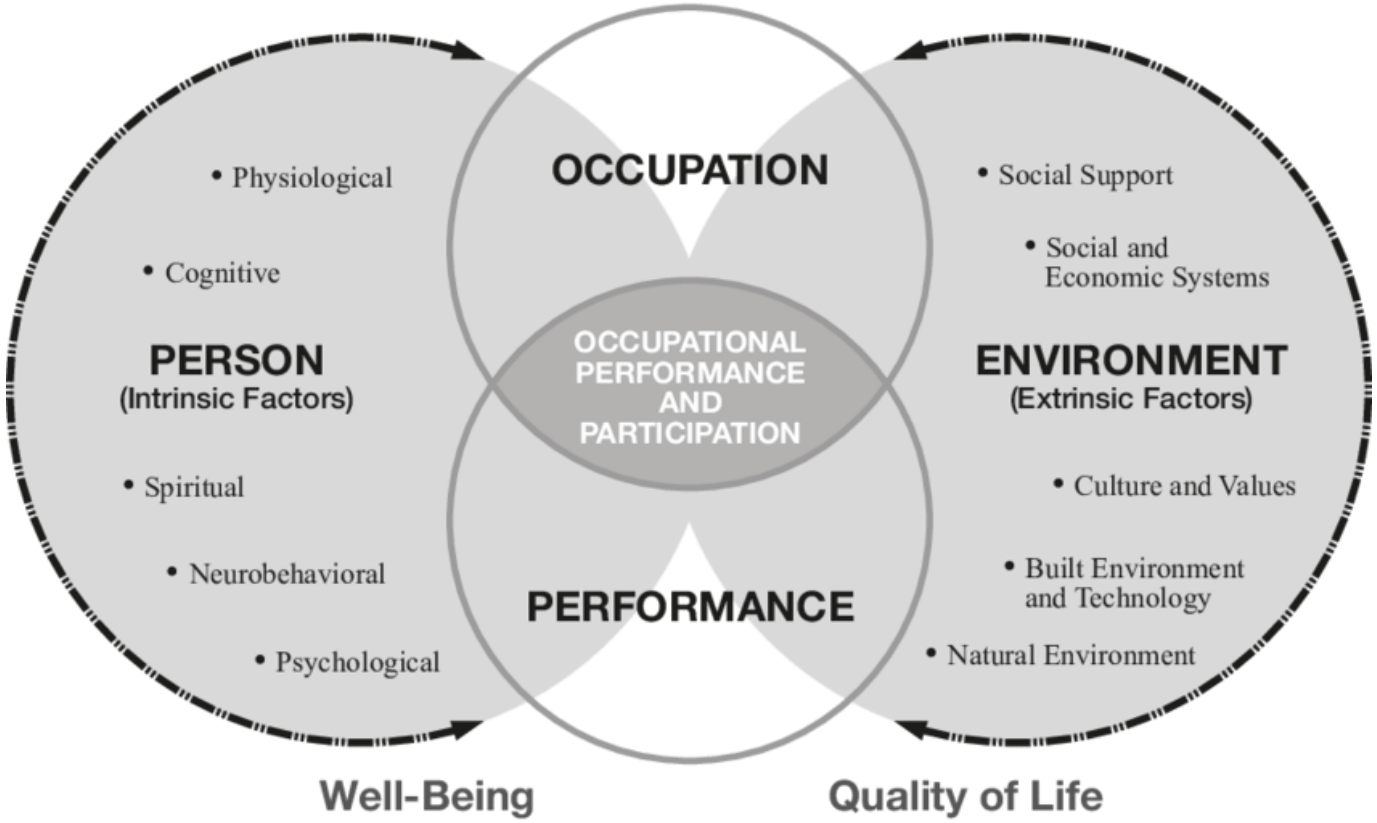
power mobility
The power to move you

QUANTUM®
#1 FOR REHAB POWER

Agenda

- Assessment Process
- Mobility Equipment Algorithm
- Considerations for Power Wheelchair Prescription
- Advantages/Disadvantages of FWD, MWD and RWD
- Powered Seating
- Features of Powered Wheelchairs
- Adjustability and What to Look for

PEOP Model



Baum, C. M., Christiansen, C. H., & Bass, J. D. (2015). The Person-Environment-Occupation- Performance (PEOP) model. In C. H. Christiansen, C. M. Baum, & J. D. Bass (Eds.), *Occupational therapy: Performance, participation, and well-being* (4th ed., pp. 49-56). Thorofare, NJ: SLACK Incorporated.

Resource: Wheelchair Service Provision Guide

Wheelchair Service Provision

- Referral/Intake: Initial Interview
- Assessment/Initial Evaluation
- Equipment Recommendation/Selection
- Funding/Procurement
- Product Preparation (initial set up/programming)
- Fitting, Training, Delivery

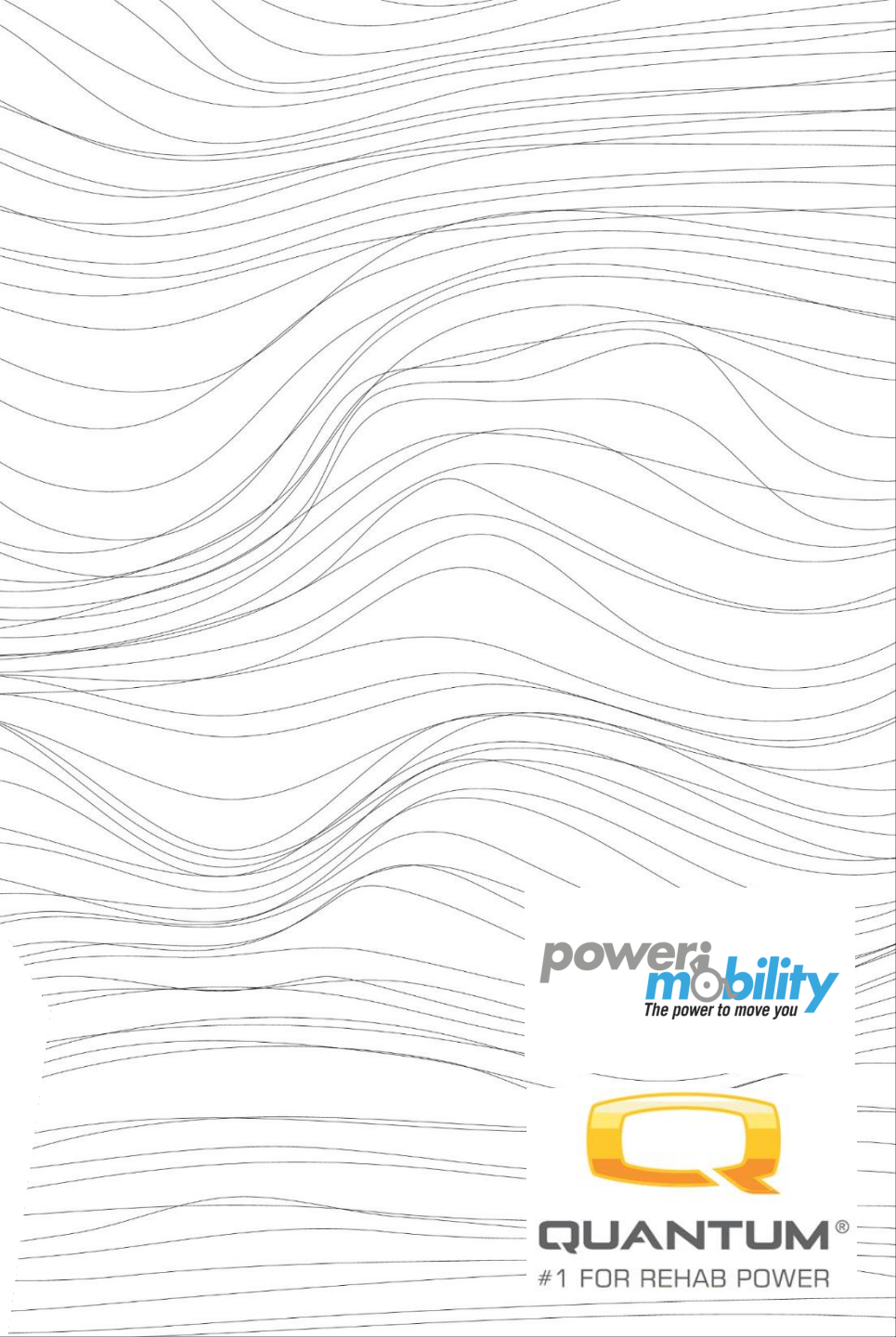
RESNA Rehabilitation Engineering and Assistive Technology Society of North America

Clinical Evaluation:

- Range of motion
- Strength
- Tone/spasticity
- Functional level
- Balance
- vision
- Cognition
- Plan of care and trajectory

https://www.resna.org/Portals/0/Documents/Position%20Papers/RESNAWheelchairServiceProvisionGuide.pdf

Assessment Process



Assessment Process

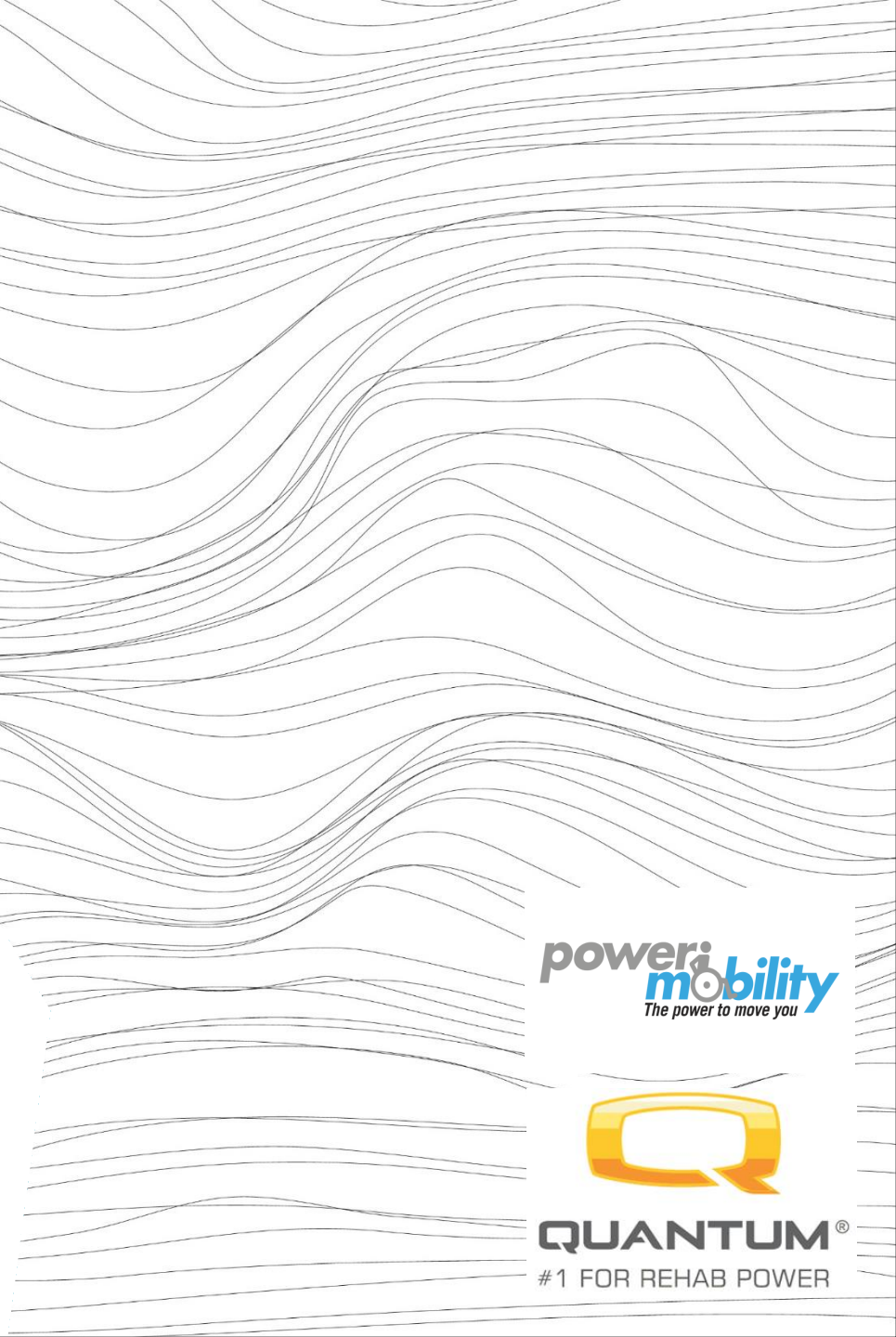
- Initial Assessment / Information Gathering
- Development of Goals
- Physical Assessment / MAT Evaluation
- Environmental Assessment
- Equipment Trial Process
- Clinical Reasoning
- Equipment Considerations and Report Writing
- Delivery and On-Going Training

Assessment Process

- Initial Assessment / Information Gathering
- Development of Goals
- Physical Assessment / MAT Evaluation
- Environmental Assessment
- Equipment Trial Process
- Clinical Reasoning
- Equipment Considerations and Report Writing
- Delivery and On-Going Training

Initial Assessment

Information Gathering
SCI Assessment form



Medical History:

- Primary Diagnosis
- Prognosis
- Medical History/Surgical History
- Other Treatments or Rehab Measures trialed in the past
- Medications and allergies

Current Mobility Skills:

- Safe, Timely, Independent
- Gait (Balance and Safety)
- Manual Propulsion
- Power Mobility Control
- Cardiopulmonary Tolerance (Vital Signs/Subjective Scales)
- Vision, Hearing, Cognition, Motor Control

Neuromuscular:

- Strength
- Motor Control
- Coordination
- Tone/Spasticity
- Balance (sitting and standing)
- Vision and Hearing

Range of Motion and Flexibility

- All body segments (including spine and pelvis)
- Skeletal Deformity Assessment (Reducible vs Non-Reducible
- Linear Measurements

Skin and Pain Assessment:

- Current and Past Skin Integrity issues
- Risk Factors for Pressure Injuries
- Pressure Relief Ability
- Pain - when and where?

Assessment Process

- Initial Assessment / Information Gathering
- **Development of Goals**
- Physical Assessment / MAT Evaluation
- Environmental Assessment
- Equipment Trial Process
- Clinical Reasoning
- Equipment Considerations and Report Writing
- Delivery and On-Going Training

Goal Setting

Goal Setting

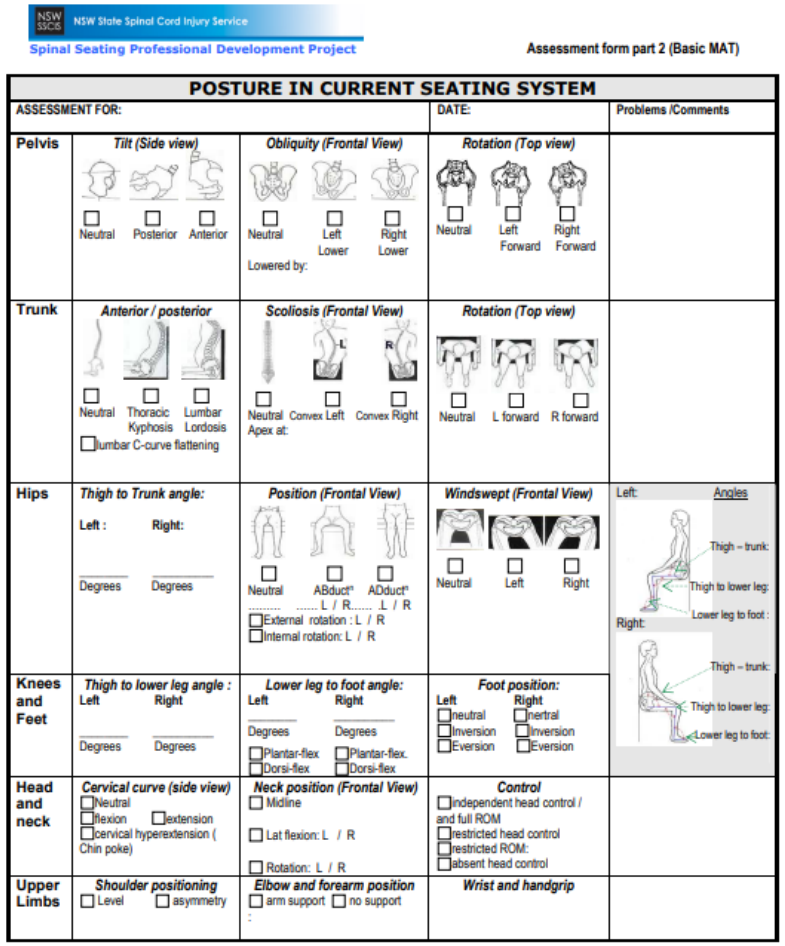
If the need for a wheelchair is identified ask:

- Why?
- What is the purpose of the wheelchair?
- Where will it be used?
- How will this Mobility Device enable the participant to complete their task independently?
- SMART Goals

Assessment Process

- Initial Assessment / Information Gathering
- Development of Goals
- **Physical Assessment / MAT Evaluation**
- Environmental Assessment
- Equipment Trial Process
- Clinical Reasoning
- Equipment Considerations and Report Writing
- Delivery and On-Going Training

Body ROM



NSW State Spinal Cord Injury Service

Spinal Seating Professional Development Project

Assessment form part 2 (Basic MAT)

POSTURE IN CURRENT SEATING SYSTEM

ASSESSMENT FOR: | DATE: | Problems /Comments

Pelvis
- *Tilt (Side view)*: ☐ Neutral ☐ Posterior ☐ Anterior
- *Obliquity (Frontal View)*: ☐ Neutral ☐ Left Lower ☐ Right Lower — Lowered by:
- *Rotation (Top view)*: ☐ Neutral ☐ Left Forward ☐ Right Forward

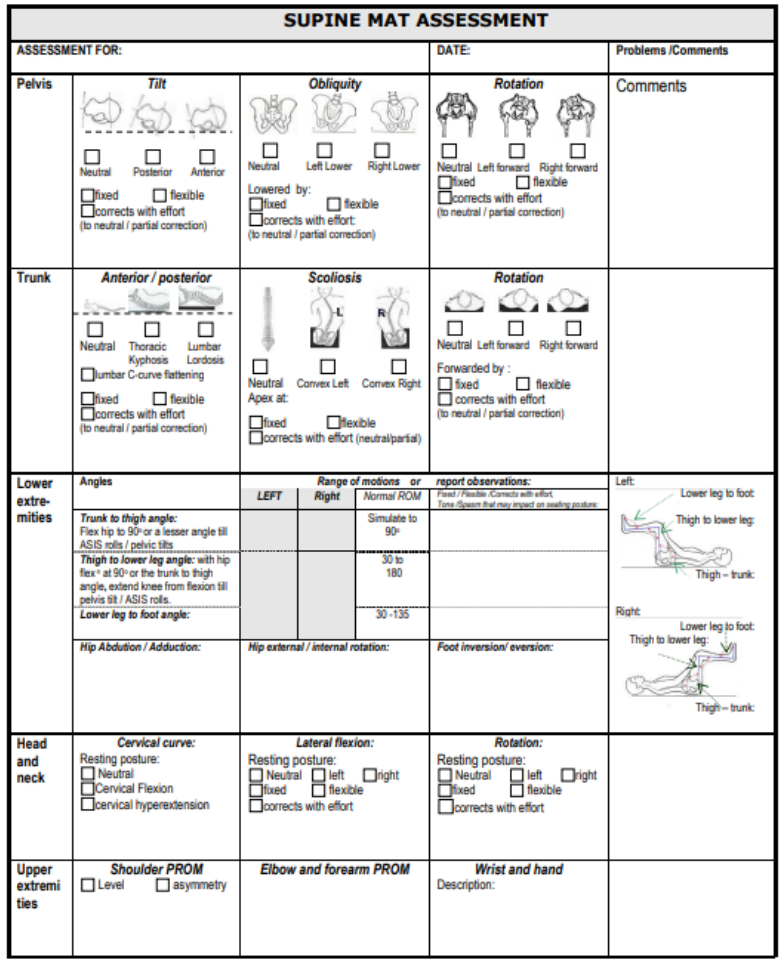
Trunk
- *Anterior / posterior*: ☐ Neutral ☐ Thoracic Kyphosis ☐ Lumbar Lordosis ☐ lumbar C-curve flattening
- *Scoliosis (Frontal View)*: ☐ Neutral ☐ Convex Left ☐ Convex Right — Apex at:
- *Rotation (Top view)*: ☐ Neutral ☐ L forward ☐ R forward

Hips
- *Thigh to Trunk angle:* Left: _____ Degrees Right: _____ Degrees
- *Position (Frontal View)*: ☐ Neutral ☐ ABduct° ☐ ADduct° ..... L / R ..... L / R ☐ External rotation : L / R ☐ Internal rotation: L / R
- *Windswept (Frontal View)*: ☐ Neutral ☐ Left ☐ Right
- Left: Angles — Thigh – trunk: ____ Thigh to lower leg: ____ Lower leg to foot : ____
- Right: Thigh – trunk: ____ Thigh to lower leg: ____ Lower leg to foot: ____

Knees and Feet
- *Thigh to lower leg angle :* Left: _____ Degrees Right: _____ Degrees
- *Lower leg to foot angle:* Left: _____ Degrees ☐ Plantar-flex ☐ Dorsi-flex Right: _____ Degrees ☐ Plantar-flex. ☐ Dorsi-flex
- *Foot position:* Left ☐ neutral ☐ Inversion ☐ Eversion Right ☐ nertral ☐ Inversion ☐ Eversion

Head and neck
- *Cervical curve (side view)*: ☐ Neutral ☐ flexion ☐ extension ☐ cervical hyperextension (Chin poke)
- *Neck position (Frontal View)*: ☐ Midline ☐ Lat flexion: L / R ☐ Rotation: L / R
- *Control*: ☐ independent head control / and full ROM ☐ restricted head control ☐ restricted ROM: ☐ absent head control

Upper Limbs
- *Shoulder positioning*: ☐ Level ☐ asymmetry
- *Elbow and forearm position*: ☐ arm support ☐ no support
- *Wrist and handgrip*



SUPINE MAT ASSESSMENT

ASSESSMENT FOR: | DATE: | Problems /Comments

Pelvis
- *Tilt*: ☐ Neutral ☐ Posterior ☐ Anterior ☐ fixed ☐ flexible ☐ corrects with effort (to neutral / partial correction)
- *Obliquity*: ☐ Neutral ☐ Left Lower ☐ Right Lower — Lowered by: ☐ fixed ☐ flexible ☐ corrects with effort: (to neutral / partial correction)
- *Rotation*: ☐ Neutral ☐ Left forward ☐ Right forward ☐ fixed ☐ flexible ☐ corrects with effort (to neutral / partial correction)
- Comments

Trunk
- *Anterior / posterior*: ☐ Neutral ☐ Thoracic Kyphosis ☐ Lumbar Lordosis ☐ lumbar C-curve flattening ☐ fixed ☐ flexible ☐ corrects with effort (to neutral / partial correction)
- *Scoliosis*: ☐ Neutral ☐ Convex Left ☐ Convex Right — Apex at: ☐ fixed ☐ flexible ☐ corrects with effort (neutral/partial)
- *Rotation*: ☐ Neutral ☐ Left forward ☐ Right forward — Forwarded by : ☐ fixed ☐ flexible ☐ corrects with effort (to neutral / partial correction)

Lower extremities

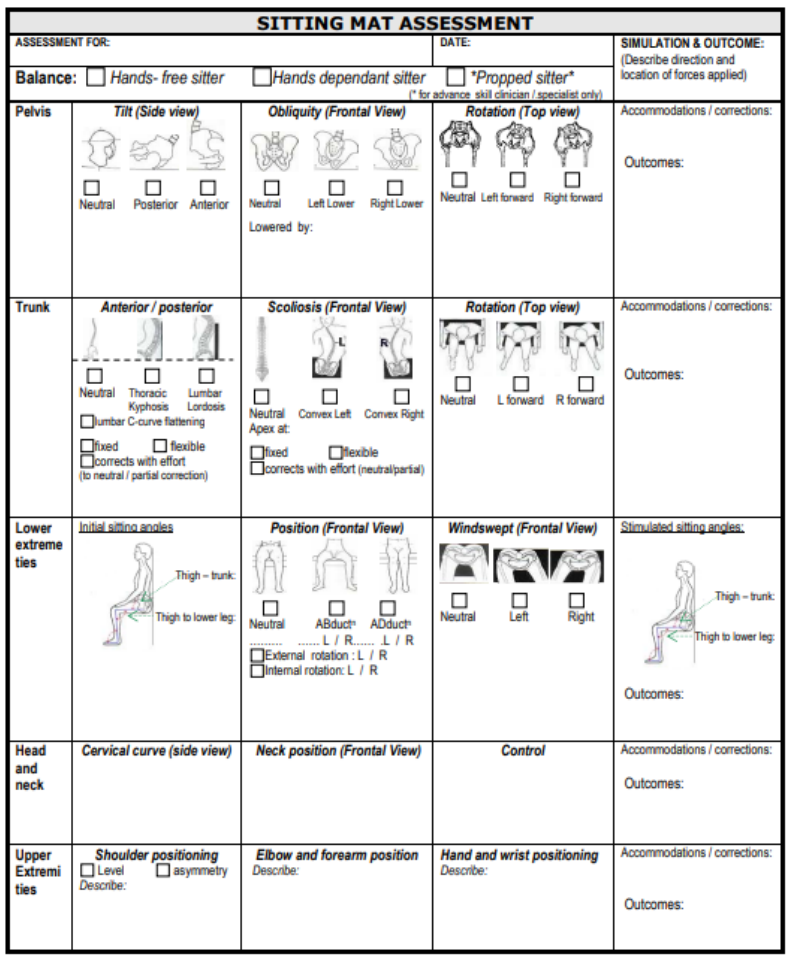
Angles — Range of motions or report observations:

	LEFT	Right	Normal ROM	Fixed / Flexible /Corrects with effort. Tone /Spasm that may impact on seating posture:
Trunk to thigh angle: Flex hip to 90° or a lesser angle till ASIS rolls / pelvic tilts			Simulate to 90°	
Thigh to lower leg angle: with hip flex° at 90° or the trunk to thigh angle, extend knee from flexion till pelvis tilt / ASIS rolls.			30 to 180	
Lower leg to foot angle:			30 -135	

- *Hip Abdution / Adduction:*
- *Hip external / internal rotation:*
- *Foot inversion/ eversion:*
- Left: Lower leg to foot: ____ Thigh to lower leg: ____ Thigh – trunk: ____
- Right: Lower leg to foot: ____ Thigh to lower leg: ____ Thigh – trunk: ____

Head and neck
- *Cervical curve:* Resting posture: ☐ Neutral ☐ Cervical Flexion ☐ cervical hyperextension
- *Lateral flexion:* Resting posture: ☐ Neutral ☐ left ☐ right ☐ fixed ☐ flexible ☐ corrects with effort
- *Rotation:* Resting posture: ☐ Neutral ☐ left ☐ right ☐ fixed ☐ flexible ☐ corrects with effort

Upper extremities
- *Shoulder PROM*: ☐ Level ☐ asymmetry
- *Elbow and forearm PROM*
- *Wrist and hand* Description:



SITTING MAT ASSESSMENT

ASSESSMENT FOR: | DATE: | SIMULATION & OUTCOME: (Describe direction and location of forces applied)

Balance: ☐ *Hands- free sitter* ☐ *Hands dependant sitter* ☐ **Propped sitter** (* for advance skill clinician / specialist only)

Pelvis
- *Tilt (Side view)*: ☐ Neutral ☐ Posterior ☐ Anterior
- *Obliquity (Frontal View)*: ☐ Neutral ☐ Left Lower ☐ Right Lower — Lowered by:
- *Rotation (Top view)*: ☐ Neutral ☐ Left forward ☐ Right forward
- Accommodations / corrections: Outcomes:

Trunk
- *Anterior / posterior*: ☐ Neutral ☐ Thoracic Kyphosis ☐ Lumbar Lordosis ☐ lumbar C-curve flattening ☐ fixed ☐ flexible ☐ corrects with effort (to neutral / partial correction)
- *Scoliosis (Frontal View)*: ☐ Neutral ☐ Convex Left ☐ Convex Right — Apex at: ☐ fixed ☐ flexible ☐ corrects with effort (neutral/partial)
- *Rotation (Top view)*: ☐ Neutral ☐ L forward ☐ R forward
- Accommodations / corrections: Outcomes:

Lower extremeties
- Initial sitting angles: Thigh – trunk: ____ Thigh to lower leg: ____
- *Position (Frontal View)*: ☐ Neutral ☐ ABduct° ☐ ADduct° ..... L / R ..... L / R ☐ External rotation : L / R ☐ Internal rotation: L / R
- *Windswept (Frontal View)*: ☐ Neutral ☐ Left ☐ Right
- Stimulated sitting angles: Thigh – trunk: ____ Thigh to lower leg: ____ Outcomes:

Head and neck
- *Cervical curve (side view)*
- *Neck position (Frontal View)*
- *Control*
- Accommodations / corrections: Outcomes:

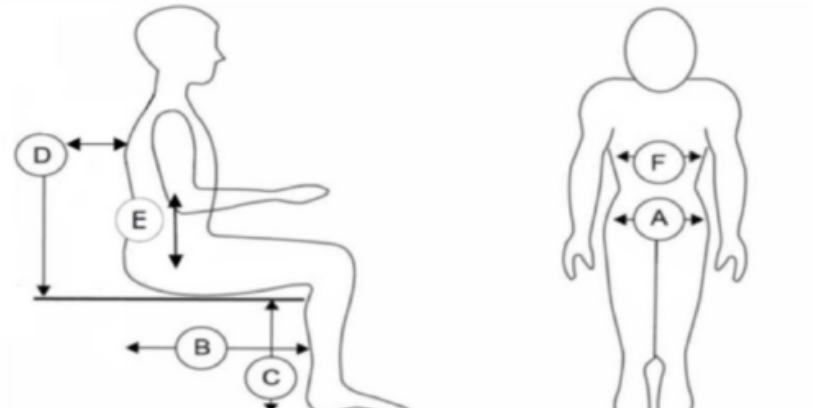
Upper Extremities
- *Shoulder positioning*: ☐ Level ☐ asymmetry Describe:
- *Elbow and forearm position* Describe:
- *Hand and wrist positioning* Describe:
- Accommodations / corrections: Outcomes:

https://aci.health.nsw.gov.au/__data/assets/pdf_file/0018/156060/m03_mat_basic.pdf

Linear Measurements

Does the AT equipment requested for trial meet the clients goals and objectives as stated in their plan? YES ☐ NO ☐
It is preferable to have this information prior to booking a trial.

A: Seat Width	
B: Seat Depth	
C: Lower Leg Length	
D: Seat Back Height	
E: Armrest Height	
F: Backrest Width	
Client Height	
Client Weight	



Assessment Process

- Initial Assessment / Information Gathering
- Development of Goals
- Physical Assessment / MAT Evaluation
- **Environmental Assessment**
- Equipment Trial Process
- Clinical Reasoning
- Equipment Considerations and Report Writing
- Delivery and On-Going Training

Environmental Considerations

- Access in and around home
- Obstacles
- Type of terrain
- Inclines
- **Transportation**
- Access and manoeuvrability

Assessment Process

- Initial Assessment / Information Gathering
- Development of Goals
- Physical Assessment / MAT Evaluation
- Environmental Assessment
- Equipment Trial Process
- Clinical Reasoning
- Equipment Considerations and Report Writing
- Delivery and On-Going Training

Wheelchair Trial Process
&
Clinical Reasoning

Mobility Assistive Equipment (MAE) - **Algorithmic Process.**

What MAE device allows the individual to go from Point A to Point B in an:

- *Independently*
- *Safely*
- *AND timely*

manner in order to accomplish MRADL's?

Gait Device

Manual Wheelchair

Scooter

Basic Power Wheelchair

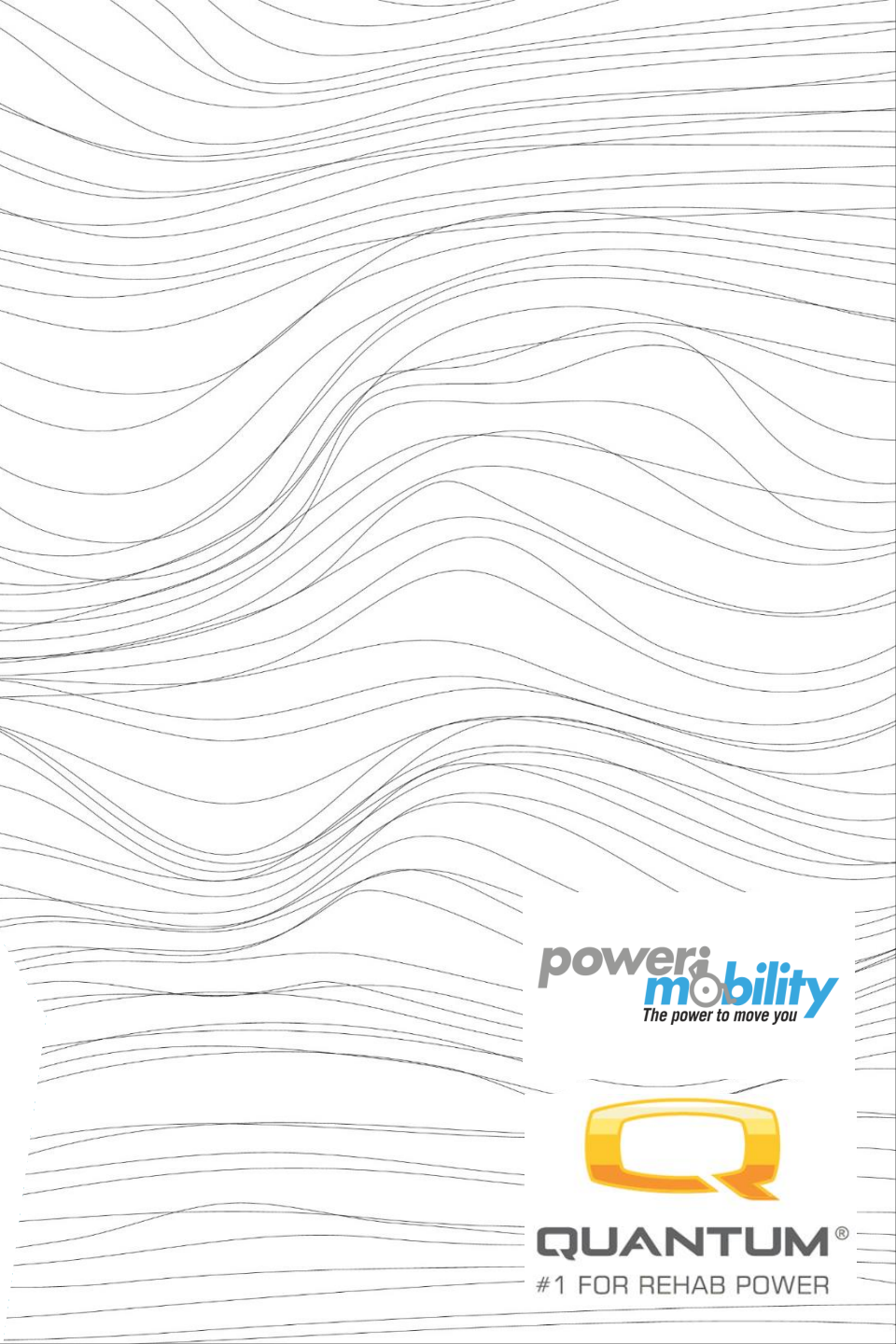
Complex Power Wheelchair

Considerations:

- Cognition
- Upper Limb Function
- Vision
- Carer requirements
- Travel
- Changing/progressing condition

Power Seat Bases

Drive Wheel Configuration



Drive Wheel Configurations

Rear Wheel Drive

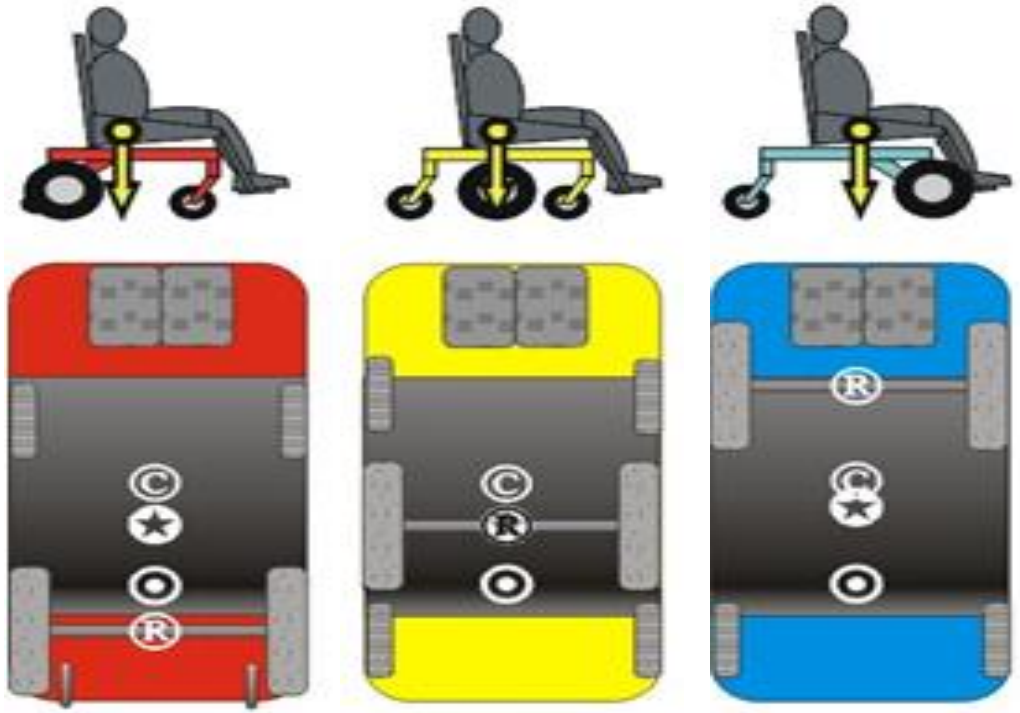
Mid Wheel Drive

Front Wheel Drive

4 Wheel Drive

Drive Wheel Location

© Geometric Centre
⊙ Centre of Head
✪ Centre of Gravity
® Centre of Rotation



A Chair turns on the "**Center Point**" of the drive wheel axis

The closer the user's head is to the w/c center of rotation, the less rotational displacement

Quantum 4Front 2 & HD

4FRONT 2

STFH: 45 cm – 47.62 cm
Seat: 40.64 cm-55.88 cm W x
38.1 cm-55.88 cm D
Lift: 25.4 cm at 5.6 KPH
41.2 cm maximum lower leg
support recommendation
(measured from seat pan to
footplate)

4FRONT 2 HD

STFH: 45cm – 50cm
Seat: 50.8 cm-60.98 cm W x
50.8 cm-60.98 cm D
Lift: 25.4 cm at 5.6 KPH
41.2 cm maximum lower leg
support recommendation
(measured from seat pan to
footplate)
User Weight limit – 204kg

Front Wheel Drive – Advantages

- More force distributed to each of the **four tires**, because there are two fewer tires in contact with the ground
- Better with **weight distribution** and **overall stability**
- Performs well when driving over a **range of terrains** – grass or uneven gravel.
- **Climbs well over obstacles.** The larger tires at the front "grab" an obstacle like a curb or a step and go over it, pulling the rest of the chair with it
- Accommodates for **tight hamstrings or compromised leg rest** positioning easily because there are no front caster wheels to interfere
- Easily navigate **tight corners** within the home
- **Front Access** to work surfaces

Front Wheel Drive – Disadvantages

- Anti-tip casters can interfere with foot placement for stand pivot transfers
- Turning in tight spaces can be tricky for new users because more of the chair is behind them
- Harder to drive straight at higher speeds - Directional Stability decreases as the speed of chair increases (Fishtailing)
- May have less control with non-proportional drive input device
- Not a great base for attendant only use

Quantum Edge 3 and Stretto

EDGE 3 Stretto

STFH: 45.72 cm-48.26 cm
Seat: 40.6 cm-55.88 cm W x
35.56 cm-55.88 cm D
Lift: 30.4 cm at 5.6 KPH w/iLevel
39.3 cm maximum lower leg
support recommendation
(measured from seat pan to
footplate)

EDGE 3

STFH: 44.45 cm – 48.89 cm
Seat: 38.1 cm-55.88 cm W x
35.56 cm-55.88 cm D
Lift: 30.4 cm at 7.2 KPH w/iLevel
42.5 cm maximum lower leg
support recommendation
(measured from seat pan to
footplate)

Quantum Edge HD

Q6 edge® HD

User Weight Limit: 204.1kg
Seat: 40.64 cm- 81.28cm W x 50.8 cm-71.12 cm D
Lift: 30.4 cm at 7.2 KPH w/iLevel
42.5 cm maximum lower leg support recommendation
(measured from seat pan to footplate)

Mid Wheel Drive – Advantages

- Tightest turning radius for a 360° turn
- Most **intuitive** to drive as the COG is closest to the chair's center point
- **Climbs obstacles fairly well** - can be limited by how high caster wheels lift
- Having 6 wheels on the ground provides **stability** to the base
- **Good traction** on most surfaces, inclines and side slopes
- **Versatile** – Great for indoors and outdoors

Mid Wheel Drive – Disadvantages

- Can high center on very uneven terrains – challenge for gutters
- Have limitations in the height of obstacle they can climb with smaller front castors
- Front caster wheels can interfere with stand pivot transfers
- Front caster wheels can be problematic for individuals with tight hamstrings or longer lower leg lengths
- Can give a sense of “pitching forward”
- Reliant on good suspension as user is sitting on top of drive wheel

Quantum R-Track

R-TRAK

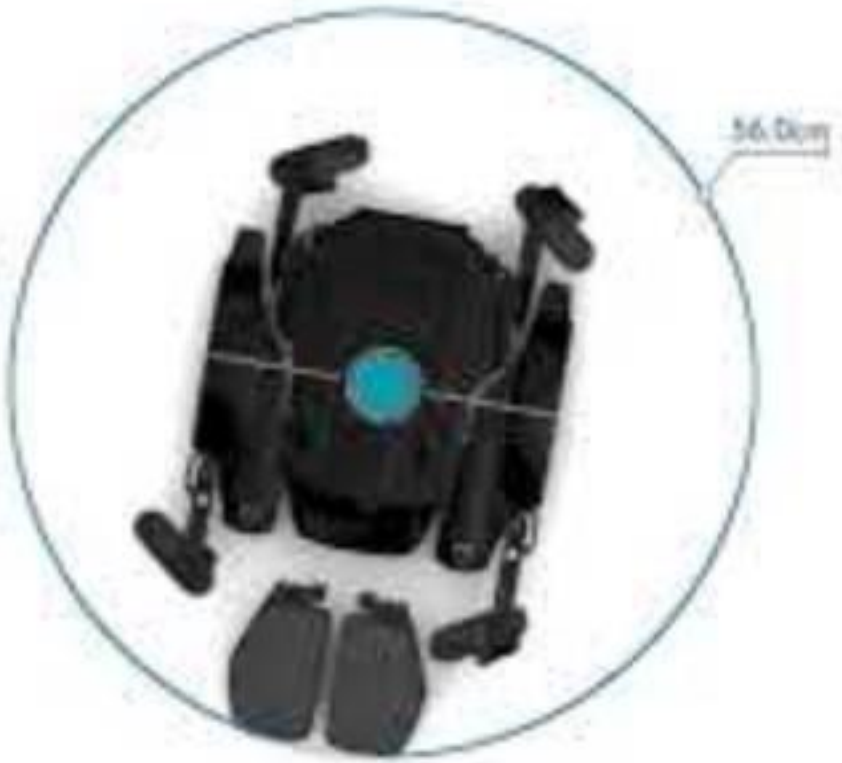
STFH: 43.6 cm – 48.7 cm
Seat: 30.64 cm-55.88 cm W x 30.64 cm-55.88 cm D
Lift: 25.4 cm at 5.6 KPH
41.2 cm maximum lower leg support recommendation (measured from seat pan to footplate)

Rear Wheel Drive – Advantages

- Provides **good control at higher speeds**
- **Handles aggressive terrain** very well
- Large Front Castors **= Smoother Ride Outdoors**
- Will **transition grade changes easily**
- May be familiar for some users
- Most intuitive for attendants to use

Rear Wheel Drive – Disadvantages

- May have access issues due to large turning radius
- Must drive straight on, to climb higher obstacles
- Front caster wheels can interfere with footplate placement
- Front caster wheels can be problematic for individuals with tight hamstrings
- More likely to tip backwards when going up hill, as batteries and motor are at the rear of the chair



Mid-wheel drive

Is There a Drive Wheel Configuration that is “Best” for an Individual’s Life Style?

Activity

- Let's try out the different bases for turning
  - RWD
  - FWD
  - MWD

BREAK TIME!

power mobility
The power to move you

QUANTUM®
#1 FOR REHAB POWER

Power Seat Functions

Power Seat Functions

Posterior Tilt

Anterior Tilt

Elevate / Lift

Elevating Legs

Recline

Stand

Why PWC Users Change Position:

Pressure Relief

Improved Head / Trunk Control

Balance & Stability

Functional Reach

Safe Negotiation of Obstacles / Inclines

Posterior Tilt

Seat tilts posteriorly in relation to the ground, while maintaining the seat-to-back, and lower leg angle.

Benefits of Power Tilt

- Pressure Relief
  - The more Tilt that is available, the better!
  - >30° Defines a pressure relieving tilt
  - 15°or less No advantage for pressure relief
  - Up to 65° Significant ischial pressure relief

  (www.resna.org)
  - Recommendation is to maintain an offloaded position from the seating surface for at least 1 to 2 minutes every 30 minutes. (*Pressure Ulcer Prevention and Treatment Following Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Professionals SECOND EDITION S P I N a L c O R D M E D I c I N E*, n.d.-a)

- Positioning
  - Support users to maintain an optimal seated posture by minimizing effects of gravity.
  - Improves stability while reducing energy output (driving, fatigue)
  - Reduces sliding
  - Independent repositioning

Pressure Ulcer Prevention and Treatment Following Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Professionals SECOND EDITION S P I N A L C O R D M E D I C I N E. (n.d.-a).

Benefits of Power Tilt

Community Access and Stability

- Utilising tilt while accessing slopes or uneven terrain can support postural stability.
- Reduce risk of sliding forward when travelling down hills.
- Increase clearance under footplates when travelling up-hills or slopes.

Fatigue Management

- Increased sitting tolerance
- Energy conservation

Considerations:

- Risk of hypotension
- Cognition in independently managing tilt

Recline

Increases the seat to back angle, while maintaining the seat angle in relation to the ground.

Recline

Pressure Relief

- "The greatest reduction in pressures were seen when combinations of tilt and recline were used together, with studies using 25-45° of tilt with 110-150° of recline." (RESNA Position on the Application of tilt, Recline, and Elevating Legrests for Wheelchairs: 2015 Current state of the Literatures)

Independent Repositioning

- Comfort - Increases sitting tolerance
- Passive Range Of Motion at hips
- May help to achieve a supine position

Balance and Stability

- Improve trunk stability
- Improves postural readiness

Recline

Reduces Manual Handling

- Reduction of transfers required throughout the day
- Reduces the need for transfers

Bowel and Bladder Care

- Catheterization
- Bladder and/or bowel care

Considerations:

- Increased risk of shear
  - ➢Tilt before recline decreases risk
- Increased risk of Posterior Tilt/Sliding
- Increased Risk of shifting access to drive controls and postural supports
- May increase spasticity and/or reflex activity

Power Tilt and Recline

Clinical Benefits

- 25°- 45° Tilt with 110°- 150° Recline provides the **greatest pressure relief** when used in combination
- 45° of tilt with 120° of recline provides a **40% load reduction**
- Tilt before recline **decreases shear**
- Multiple angles provide ease of independent, or caregiver assisted repositioning
- 30° of tilt with full recline improves lower limb hemodynamic states (**edema**)
- Dynamic seating allows a variety of postures throughout the day to participate in or perform **ADLs**

Power Elevating Legs

Elevates leg supports to allow users to change the lower leg angle in relation to the seat and extend knees.

Benefits of Power Elevating Legrests

- Lower Edema Management
- Optimal pressure distribution
  - When used in conjunction with tilt and/or recline
- Positioning
  - Use with recline to aid in maintenance of pelvic position (prevention of posterior or anterior pelvic tilt)
  - Allow extension of knee
  - Independent repositioning
  - Centre-mount Vs Swing-Away supports
- Pain management
- Environmental access
  - Increase clearance under footplates where tilt is not appropriate
  - Achieve a reduced footprint for navigating tight spaces
  - Ability to get closer to benches/tables etc.

<u>Considerations:</u>

- Hamstring range
  - ➢ May result in sliding if not used in conjunction with backrest recline.

Tilt, Recline and Elevating Leg Rests

Power seat functions are often medically necessary, as they enable certain individuals to:

- Re-alignment posture and enhance function
- Improve physiological processes such as
  - Orthostatic Hypotension
  - Respiration
  - Bowel and bladder function
- Enhance visual orientation, speech, alertness and arousal
- Improve transfer biomechanics
- Regulate spasticity
- Accommodate and prevent contractures and orthopedic deformities
- Manage edema
- Redistribute and relieve pressure
- Increase seating tolerance and comfort
- Independently change position to allow dynamic movement

Seat Elevation / Lift

Allows the entire seating system to raise while maintaining angles.

Benefits of Seat Elevation

It is RESNA's position that power seat elevation devices are medically necessary,

as this technology enables certain individuals to:

- **Facilitate reach biomechanics, safety and range**
- **Improve transfer biomechanics, safety and independence**
- Enhance visual orientation and line-of-sight
- Support physiological health, safety and well-being
  - Decrease hyperlordotic position of the neck
  - Promote stable seated positioning
  - Improve safety with performance/participation in ADLs
- Promote communication, social engagement, self-esteem and integration
- Improve wheelchair pedestrian safety

RESNA Position of the Application of Seat Elevation Devices for Power Wheelchair Users: Update 2019 Current state of the Literatures

Case Study - Video

Anterior Tilt

Anterior tilt shifts the entire seating system forward by raising the rear seat to floor height while maintaining front seat to floor height.

What is Anterior Tilt?

- A power seating function that much like traditional posterior tilt changes the angle of the wheelchair seat in the sagittal plane.
- This function raises the posterior aspect of the seat higher than the front which places the person in a partial standing position.

Q TRU BALANCE 4

QUANTUM

#1 FOR REHAB POWER

POWER POSITIONING SYSTEMS

TB4 Anterior Tilt Packages

0° - 10° Package

0° - 30° Package

What Bases come with TB4?

4FRONT²

STFH: 45 cm – 47.62 cm
Seat: 40.64 cm-55.88 cm W x
38.1 cm-55.88 cm D
Lift: 25.4 cm at 5.6 KPH
41.2 cm maximum lower leg support recommendation
(measured from seat pan to footplate)

EDGE 3 Stretto

STFH: 45.72 cm-48.26 cm
Seat: 40.6 cm-55.88 cm W x
35.56 cm-55.88 cm D
Lift: 30.4 cm at 5.6 KPH w/iLevel
39.3 cm maximum lower leg support recommendation
(measured from seat pan to footplate)

EDGE 3

STFH: 44.45 cm – 48.89 cm
Seat: 38.1 cm-55.88 cm W x
35.56 cm-55.88 cm D
Lift: 30.4 cm at 7.2 KPH w/iLevel
42.5 cm maximum lower leg support recommendation
(measured from seat pan to footplate)

All models:
Posterior tilt: 0-50°
Power Recline: 0-164°
New Dual Actuator AFP with power articulation to the floor

What is required for TB4 Anterior Tilt?

- **All Power Actuators**
  - Power Tilt
  - Power Seat Elevation
  - Power Recline
  - Power LE Elevation
  - Foot Platform Articulation

Clinical Benefits of Anterior Tilt

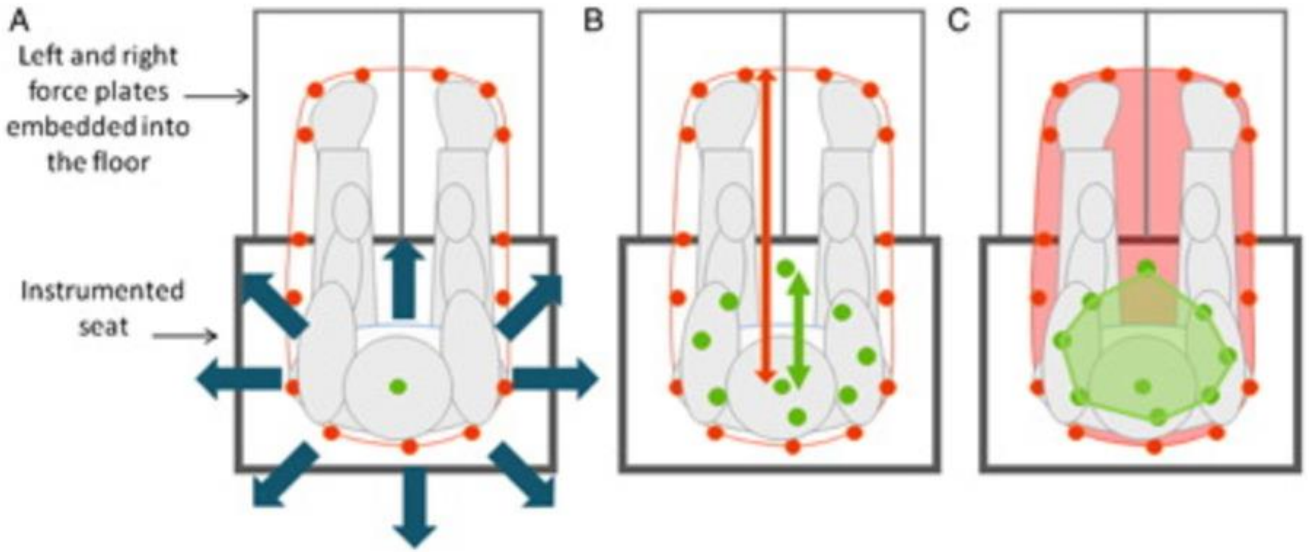
- Position Change
- Increase Functional Reach
- Transfer Assistance
- Visual Field Improvements

1) Position Change

- **Pain management**
- **Pressure re-distribution**
  - Additional functional movement options (dynamic seating) could increase the frequency in which weight shifts are completed
- **Increased activity tolerance**
  - Due to changes in joint angles and increased comfort/tolerance
- **Tone/spasticity management**
  - Joint angle changes

Position Change For Balance and Reach:

- In many individuals reaching outside one's base of support may be limited
  - Extensive research on this for those with SCI, MS, post stroke, and CP



B. Red line is the maximal potential for center of pressure shift
-Green is the actual center of pressure achieved

C. green = average area of excursion possible

So, let's bring the person closer to their desired object to maximize this when it comes to reach and balance!

Cindy Gauthier, Dany Gagnon, Géraldine Jacquemin, Cyril Duclos, Kei Masani & Milos R. Popovic (2012)

2) Increase Functional Reach

- **Increasing horizontal and vertical reach**
  - Improved upper extremity function even at anterior slopes of 0-15 degrees (Stavness, 2006).
- **Completing downhill transfers whenever possible**
- **Improved biomechanics for reaching**
- **Limit positions that cause impingement**
  - Limits internal rotation with abduction
- **Improve energy conservation**
  - “Wheelchair users perform overhead arm activities 5 times more often than ambulatory control subjects

Sharon E. Sonenblum , Chris L. Maurer , Christopher D. Hanes , Julie Piriano & Stephen H. Sprigle (2021)

Case Study – Anterior Tilt

Activities of Daily Living – Functional Tasks:

- Access to sinks
- Grooming
- Meal prep
- Reaching items in cupboards
- Accessing cooktop
- Doing laundry

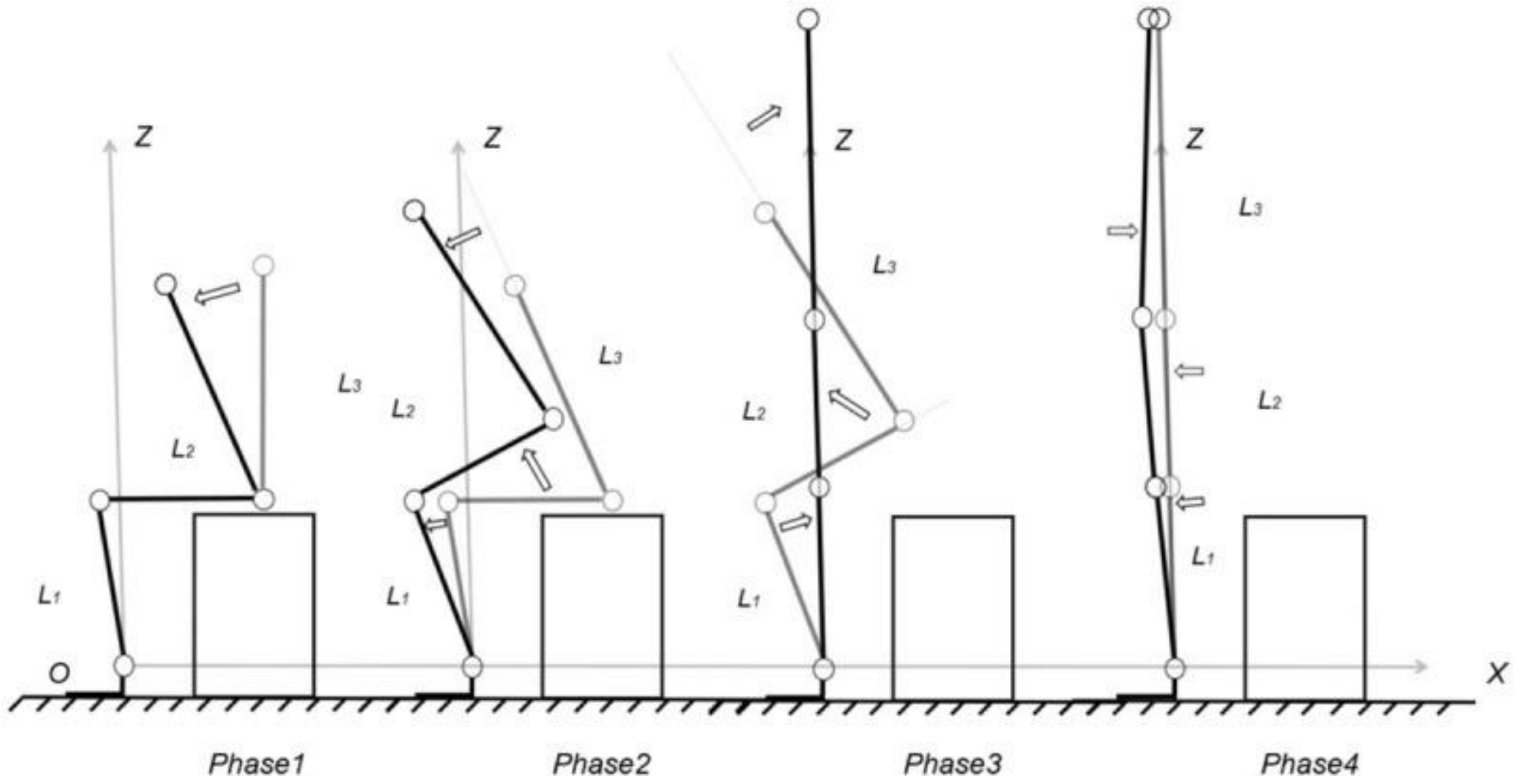
Seat Elevation with Anterior Tilt is what allows the most OPTIMAL access

3) Transfer Assistance

- Improving independence during transfers
- Decreased caregiver burden for transfers
- Less strain on upper extremities
- Energy conservation
  - Preservation of lower extremity available strength and endurance if appropriate

Transfer Assist

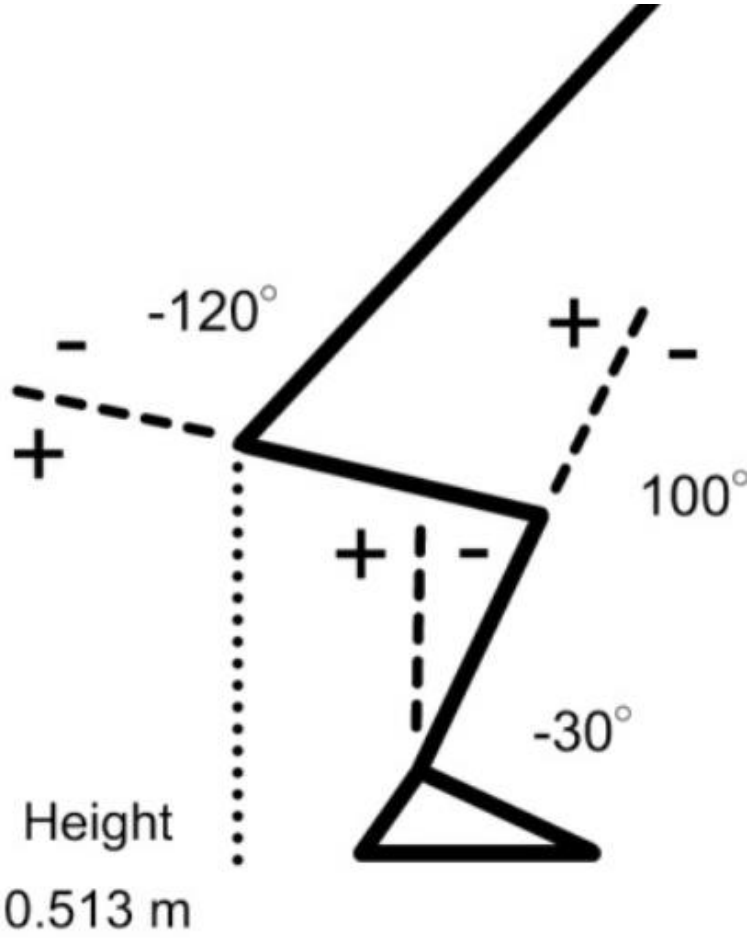
Analysis of the Sit to Stand



Li J, Xue Q, Yang S, Han X, Zhang S, Li M, Guo J. Kinematic analysis of the human body during sit-to-stand in healthy young adults. Medicine (Baltimore). 2021

Typical Sit to Stand Joint Angle Considerations:

- Standard seat off ranges:
  - Hip flexion range: 85-145 degrees
  - Knee flexion range: 95-120 degrees
  - Ankle joint dorsiflexion: 15-45 degrees
- Known that peak hip joint movement significantly increases as seat height decreases



Inai, T., Takabayashi, T., Edama, M., & Kubo, M. (2018). Effect of hip joint angle at seat-off on hip joint contact force during sit-to-stand movement: a computer simulation study. *Biomedical engineering online*, *17*(1), 177. https://doi.org/10.1186/s12938-018-0610-5

Ways to help facilitate STS:

- **Increased seat to floor height**
  - Taller cushion
  - Seat elevation
- **Assist to scoot forward:**
  - Use of transfer handles
  - Material selection of cushion & cover
    - Avoid shear when possible
  - Anterior tilt to assist with scooting
    - Gravity assist
- **Assist with stand:**
  - Anterior tilt to position feet under knees
  - Anterior tilt for pelvis to facilitate into anterior tilt
  - Allow for reduced lower extremity strength and endurance required during initial momentum of stand
    - By increased height and optimal angle

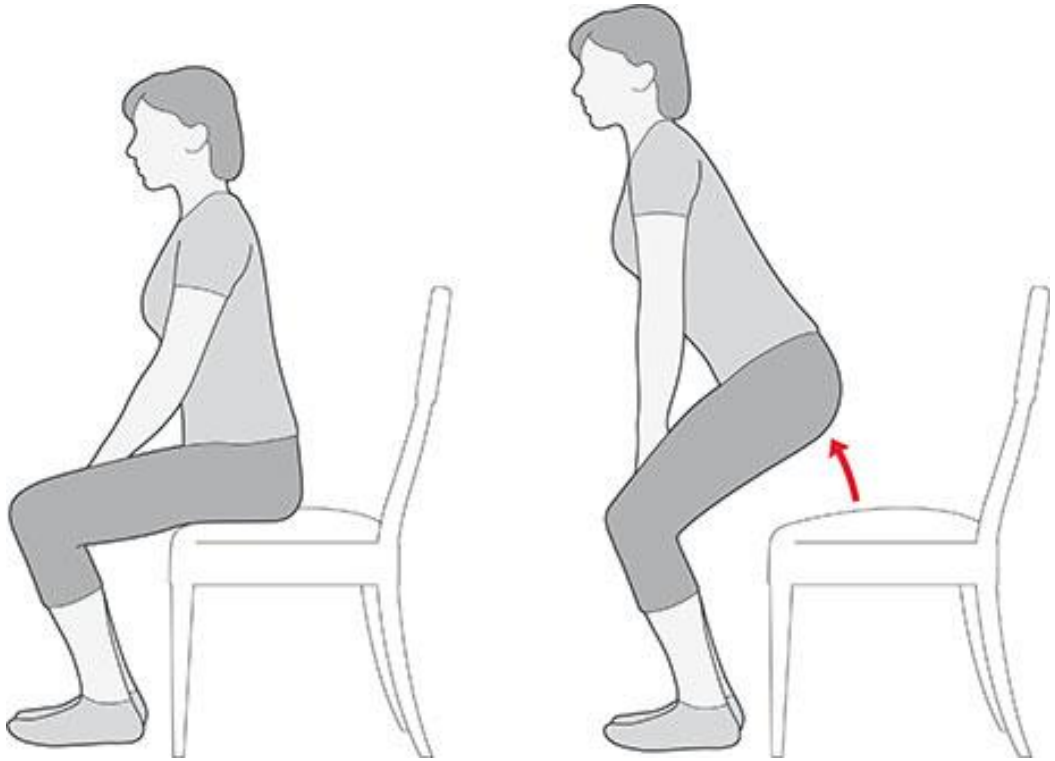
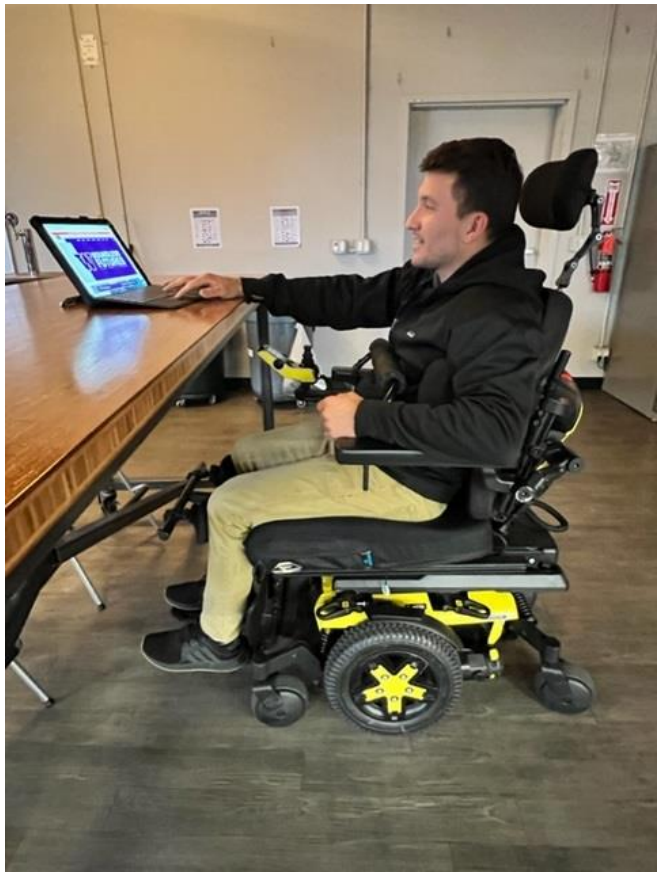
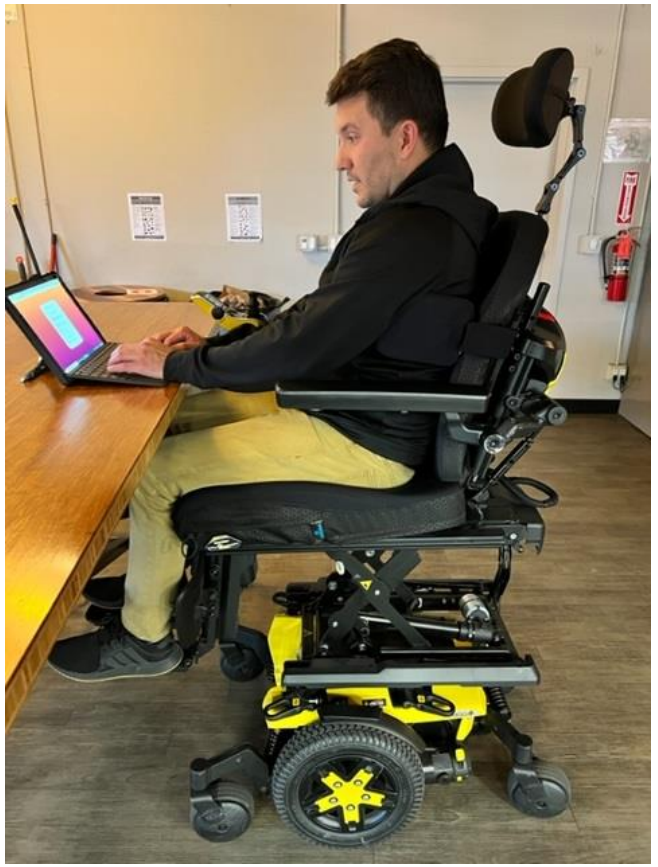
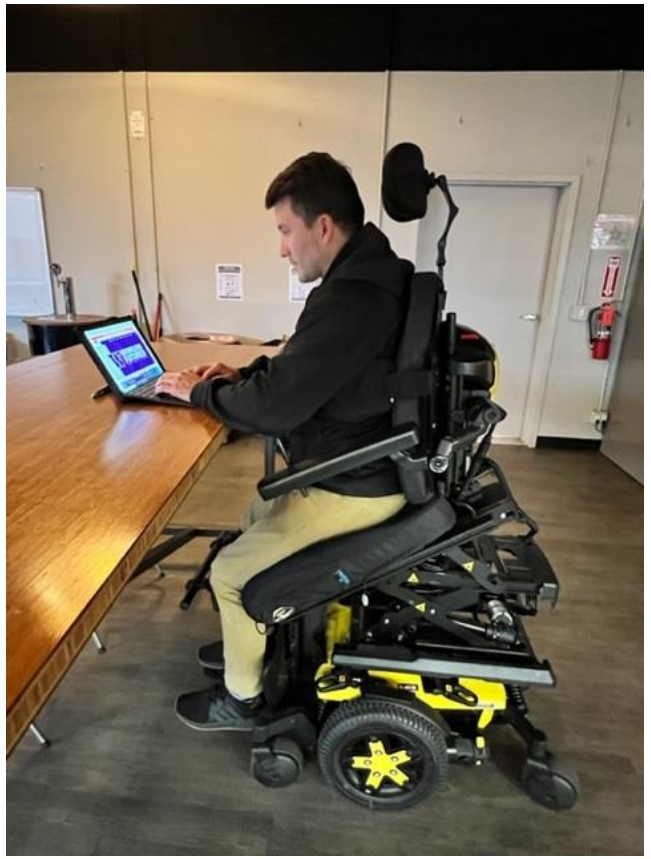


Photo: Versus Arthritis. (n.d.). *Osteoarthritis (OA) of the knee* [Photograph].

4) Visual Field Improvement







Considerations

Balance and Stability

Trunk Control and Strength

Cognitive Capacity

Bone Density

Body ROM

Potential Candidates for Anterior Tilt

- A client who would benefit from assistance due to impaired trunk control who needs assistance obtaining a higher level of functional reach to complete activities of daily living (ADLs).
- The client can tolerate a more upright body posture the anterior tilt seat function places them into.
- The client can tolerate the partial weight bearing position that the anterior tilt seat function places them into.
- The client has the appropriate range of motion in their lower extremities to tolerate the anterior tilt position

Power Standing

Raises the user from a seated into a standing position by utilising all of the chair's actuators into a programmed sequence.

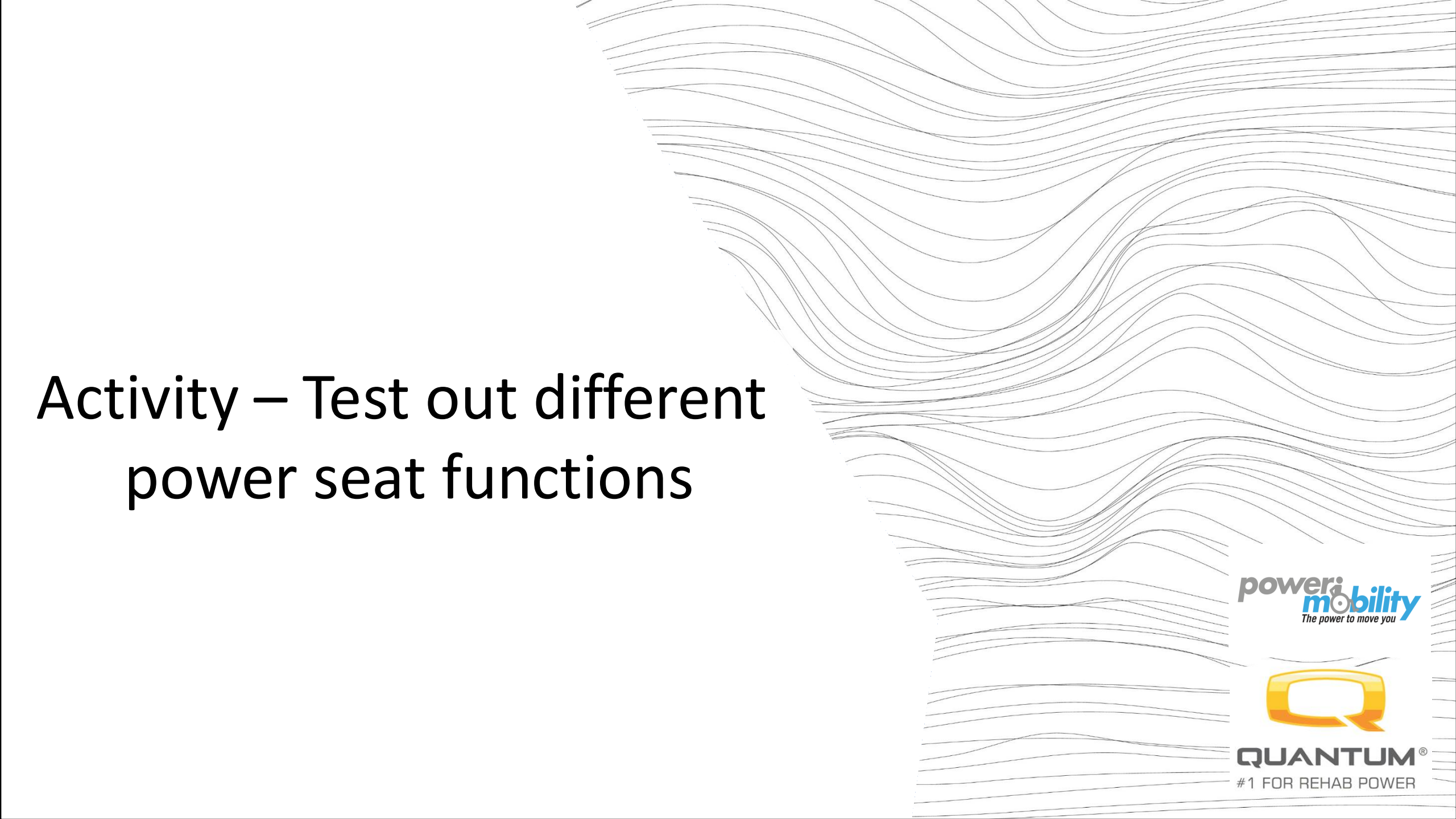
Benefits of Seat Elevation

- Improved participation and independence
- Physical and Health Benefits
- Pressure Relief while maintaining a functional position
- Remove need for separate standing machine
  - Reduce frequency of transfers needed
- Improved Posture
  - Standing promotes trunk extension, hip alignment, may delay onset of scoliosis.

- Considerations
  - Full assessment completed by medical/health professional imperative
  - Cardiovascular function
  - Orthopedic
  - Bone Density (fracture risk)
  - Positioning Implications
  - Orthostatic Hypotension (blood pressure, dizziness should be monitored while standing).
  - Lower Limb contractures (risk of overstretching, soft tissue damage).

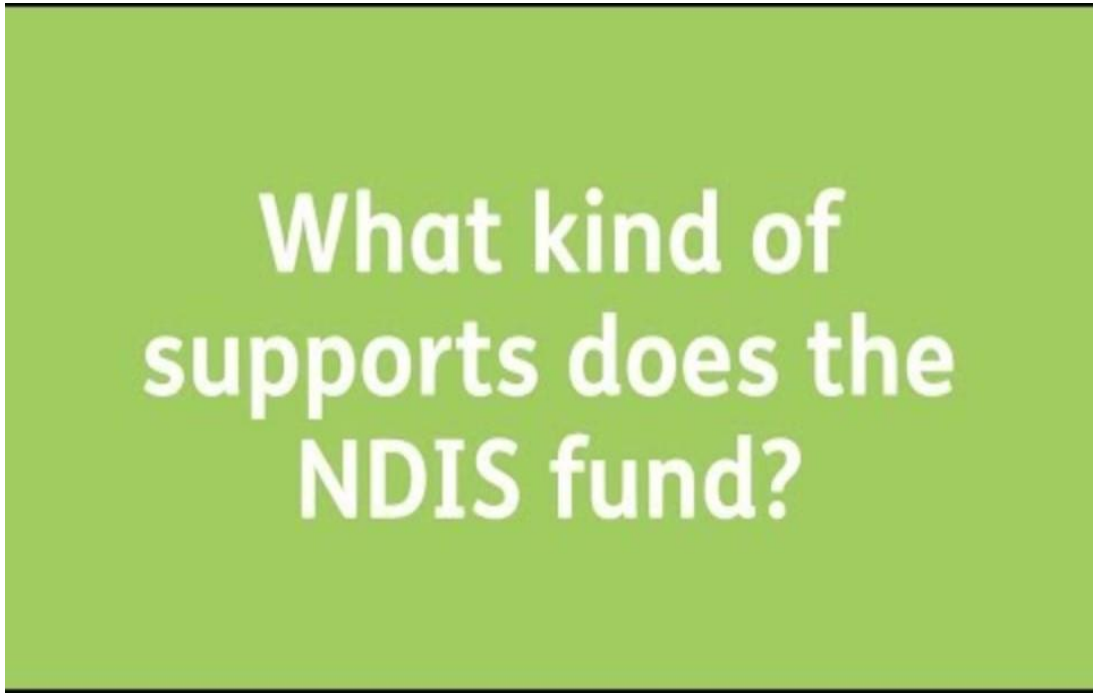
Dicianno, B. E., Morgan, A., Lieberman, J., & Rosen, L. (2016). Rehabilitation Engineering & Assistive Technology Society (RESNA) position on the application of wheelchair standing devices: 2013 current state of the literature. Assistive Technology, 28(1), 57–62.

Activity – Test out different power seat functions



Justification

Justification

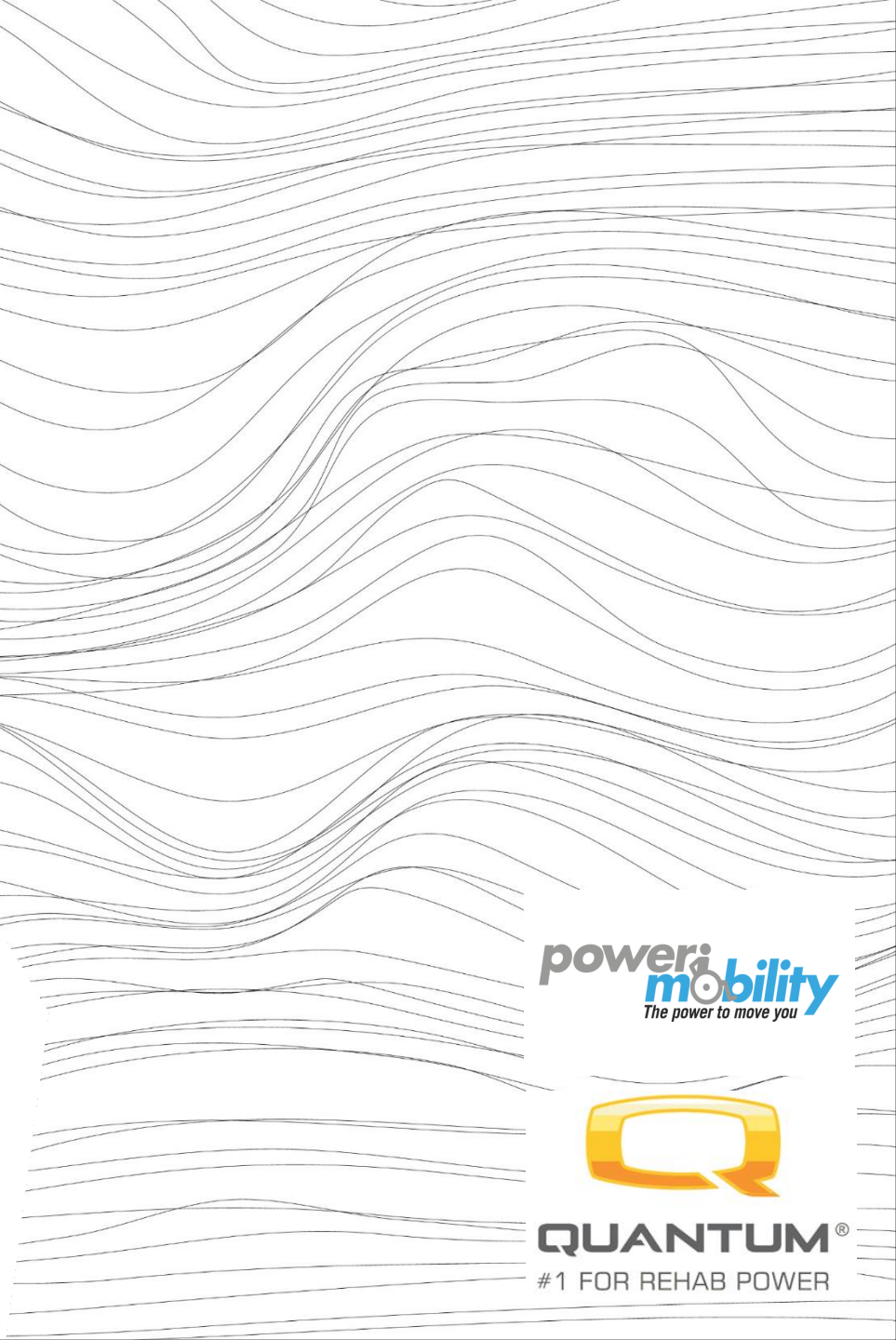


- Clear goals or aspirations
- Be more independent
- Take part in social activities and work
- Actively take part in the community
- Enjoy an ‘Ordinary’ Life
- These will need to be related to the client disability

Justification

- Having clear goals relating to disability.
- Is there a clear concern or barrier that needs to be addressed?
  - E.g. Unable to complete recreational activities without fatiguing after 5 minutes.
- Cheaper alternatives have been considered although have not or will not work.
  - E.g. Easy Reacher, manual recline or tilt
- The client has trialled the wheelchair successfully and improved their independence or function whilst completing ADL's.
- Would the provision of the Power Wheelchair save money in the long run?
  - E.g No need for home modifications, no need to meal deliveries.
- Utilising client feedback

Features of a Power Chair



Memory Seat Positions

Allows for saving of specific positions that incorporate multiple power seat functions, which can be accessed through a programmed button or switch.

Benefits of Memory Seat Positions

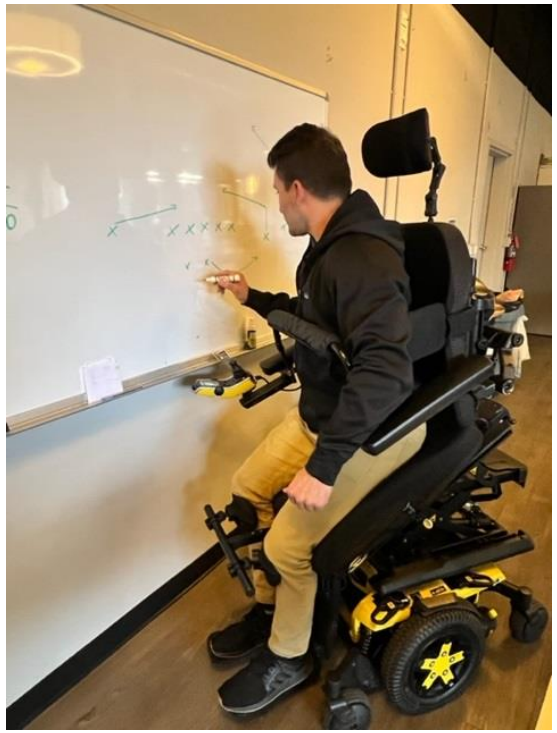
Allows for saving of specific positions that incorporate multiple power seat functions, which can be accessed through a programmed button or switch.

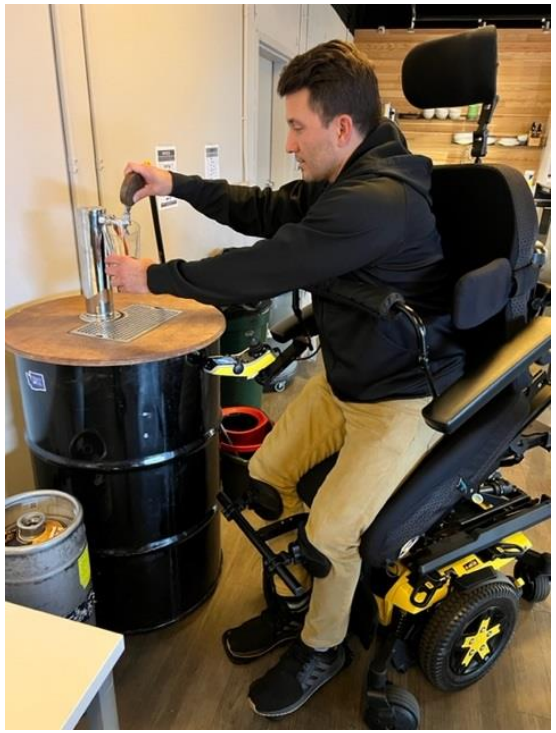
- Easily accessed by the user or carers
  - Reduces need to program individual actuators to achieve desired position.
- Programmed functional positions
  - Transfers
  - Drive
  - Rest
  - Bladder Management
  - Pressure Relief
  - Independent repositioning
  - Etc.

TB4 - User Adjustable

User Adjustable:

- Allows the consumer to make changes to the memory positions within that memory slot.
- User Adjustable can be enabled or disabled separately in each memory profile
- Examples could include vehicle access, positions of function for ADL, or positions of comfort for recreation/work activities





Synced Memory Seating Function

The actuators will all move at the same time. The actuators use a timing mechanism that allows all of the actuators to stop at the end position simultaneously

Switches and Shortcut Buttons

Add external switches if hitting buttons/levers is difficult

Using the iAccess Module

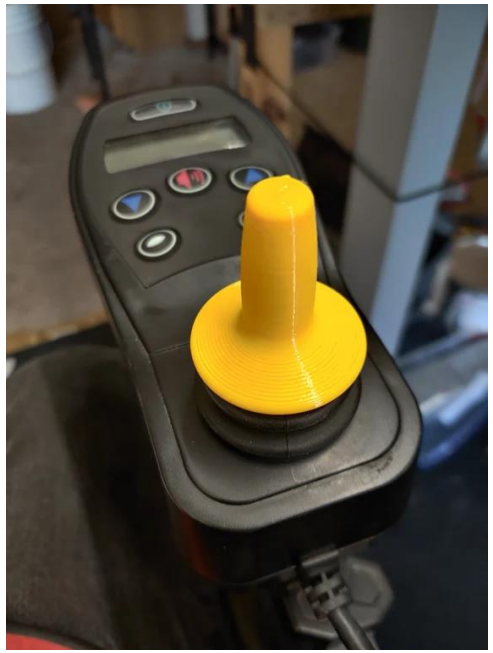
- Programmable module that can operate a wide range of functions
- This includes Seating, Bluetooth, Mouse Clicks, Mode Changes, Home Screen Access, and Light Package Control.
- Can be programmed up to 19 functions and have up to 5 pages programmed.

Suspension

- Absorption of jolting/vibratory
- Maneuverability
- Increased stability of the power base in all environments of use
- Reduced stress/fatigue on components = fewer repairs

Control Knobs – Options for Enhancing Independence

If using the standard joystick is difficult, consider the mounting and knob to enhance function.



Joystick Controller

Programming Parameters

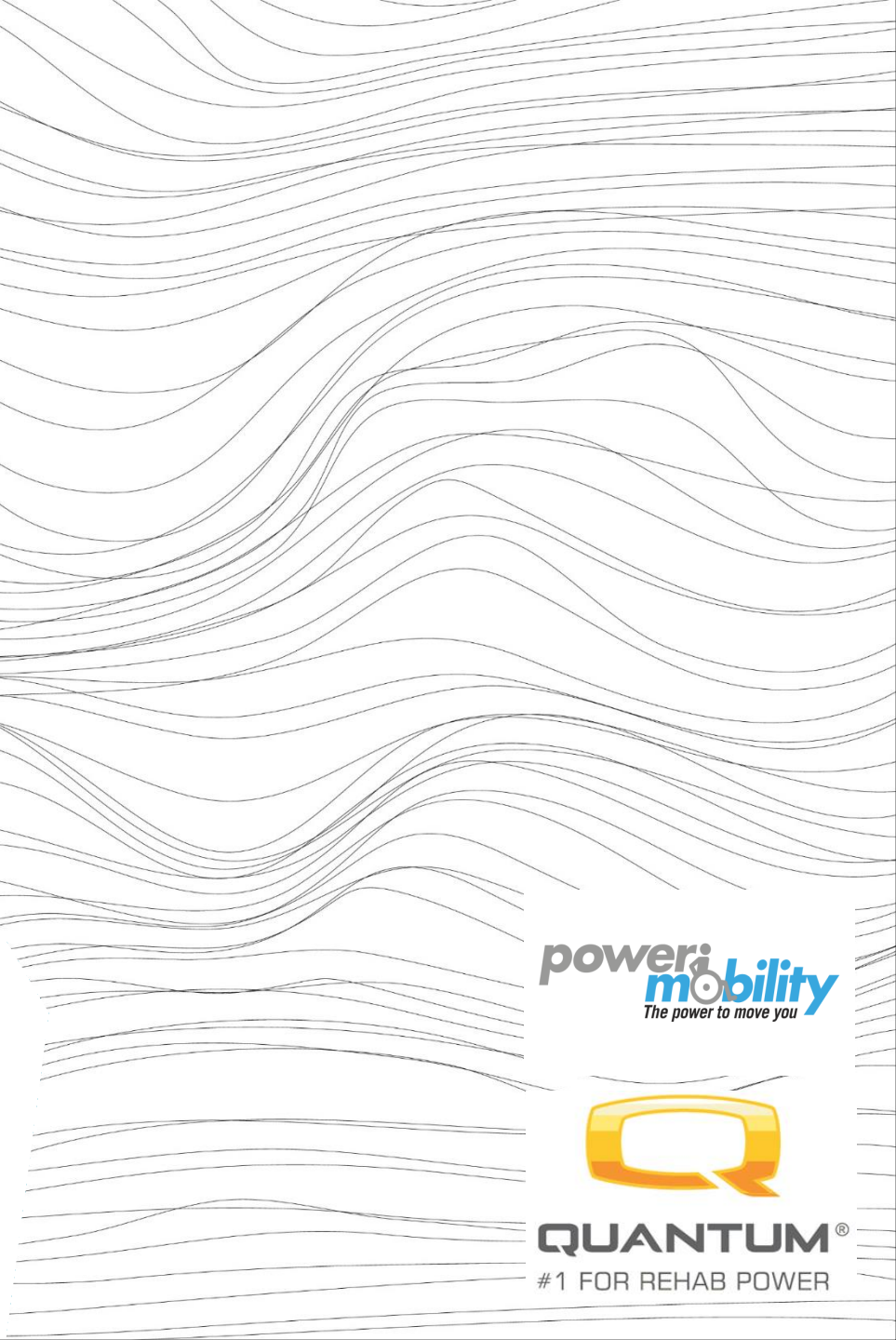
- Speed
- Sensitivity
- Acceleration
- Torque
- Deceleration
- Traction
- Soft Start
- Latched Driving
- Dampening
- Sleep Mode
- Joystick Throw
- Load Compensation
- Tremor
- Joystick Orientation

Alternate Controls

Case Study - Zoe

Zoe driving her power wheelchair with her proportional chin control.

Adjustability & What To Look For



Seat Pan – Width and Depth Adjustability

Backrest – Back Canes vs Solid Back Plate

Front Rigging – Swing Away Legs vs Centre Mount

Activity – Adjust Legrests & Armrests

power mobility
The power to move you

QUANTUM®
#1 FOR REHAB POWER

Summary and Take-Aways!

What is important, most of the time?

Give as much information as possible to your Supplier

Trial both Indoors & Outdoors

Establish Mobility Device Goals

Work WITH your client – Collaborate!

Thank you for your time!

Questions?

References

- Dicianno, B. E., Morgan, A., Lieberman, J., & Rosen, L. (2016). Rehabilitation Engineering & Assistive Technology Society (RESNA) position on the application of wheelchair standing devices: 2013 current state of the literature. Assistive Technology, 28(1), 57–62.
- https://www.resna.org/Portals/0/Documents/Position%20Papers/RESNAWheelchairServiceProvisionGuide.pdf
- Pressure Ulcer Prevention and Treatment Following Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Professionals SECOND EDITION S P I N A L C O R D M E D I C I N E. (n.d.-a).
- RESNA Position on the Application of tilt, Recline, and Elevating Legrests for Wheelchairs: 2015 Current state of the Literatures
- RESNA Position of the Application of Seat Elevation Devices for Power Wheelchair Users: Update 2019 Current state of the Literatures
- Schein, R. M., Yang, A., McKernan, G. P., Mesoros, M., Pramana, G., Schmeler, M. R., & Dicianno, B. E. (2021). Effect of the Assistive Technology Professional on the Provision of Mobility Assistive Equipment. *Archives of Physical Medicine and Rehabilitation*, *102*(10), 1895–1901. https://doi.org/10.1016/j.apmr.2021.03.024