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CONTINUED

Wheelchair Mobility:
Power Wheelchair Alternative Driving Methods

Michelle L. Lange, OTR/L, ABDA, ATP/SMS

Quantum
Rehab
Q6 Edge

1

CONTINUED

Learning Outcomes

The participant will be able to:

1. Describe the difference between analog and digital control.
2. List 3 different mini proportional joysticks and clinical indicators for each.
3. Describe clinical indicators for joystick placement at the hand vs. the chin.
4. List 3 alternative non-proportional power wheelchair.
5. Describe why a client may be unable to use proportional control.
6. List driving methods and clinical indicators for each.
7. Describe mounting options for various non-proportional power wheelchair driving methods.

2

CONTINUED

CONTINUED

What we will be covering:

- Power Wheelchair Driving Methods
  - Driving methods
  - Decision Making Hierarchy
- Handouts

Permobil M300

3

CONTINUED

Some thoughts…

- Impact on Alternative Driving Method success:
  - Optimal positioning
  - PWC assessment
  - Drive wheel configuration
  - Tracking technologies
  - Programming
  - Mobility training

4

Proportional Driving Methods

- Also called Analog
- Primarily Joysticks
- 360 degree directional control
- Speed control
- Vs. Digital

5

Joystick - hand

- Proportional joystick control requires grading of force and distance of movement
- Grading requires co-contraction of the flexors and extensors
- Difficult for clients with abnormal muscle tone

R-net joystick

6

Clinical Decision Making

- Does the client have the ability to grade the force and distance of their movement?
  - Yes
    - Explore Standard Joysticks
  - No
    - Explore Digital Access Methods

Quantum Rehab

7

Clinical Decision Making

- Does the client have adequate movement and motor control for joystick use?
  - Yes
    - Explore Standard Joystick
  - No
    - Explore Digital Access Methods

Invacare Linx

8

Clinical Decision Making

- Can the client optimally control a standard joystick mounted at the end of the armpad?
  - Yes
    - Explore standard mounting
  - No
    - Explore alternative placements

Permobil
M300

9

Joystick placement

- Sometimes the problem is location…
- Most joysticks are mounted at the end of the armrest to one side of the wheelchair

Invacare
Arrow

10

CONTINUED

Swing away joystick mounts

- Allows more midline placement

Stealth Products

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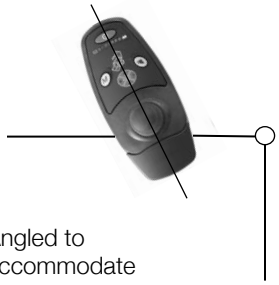
CONTINUED

Joystick Angles

- The angle of the joystick can also be changed to match the angle of client movement.



Angled to accommodate oblique angle

Angled to accommodate pronation

12

Clinical Decision Making

- If a midline mount is required, does the client need to independently move this out of the way?
  - Yes
    - Explore power mounting
  - No
    - Caregiver can move mount out of way for transfers

13

Power Options

- Motion Concepts Power joystick mount
- *video

14

Clinical Decision Making

- Does the client have difficulty grasping a standard joystick handle?
  - Yes – Explore other style joysticks or other handles
  - No – Explore standard joystick

15

Mushroom Joystick

- Designed for clients who cannot grasp a joystick handle
  - Stiff
- Alternative:
  - Bodypoint dome handle
  - Textured

Stealth Products

16

Joystick Handles

- Goal post style designed for poor grasp

Bodypoint

17

Clinical Decision Making

- Does the client have excessive force which could break a standard joystick?
  - Yes – Explore heavy duty joystick
  - No – Explore standard joystick

18

CONTINUED

Heavy Duty Joystick

- Mo-Vis
- All-round Heavy Duty Joystick
- For clients who use excessive force
  - Enlarged throw and force (650 grams)
- 2 switch jacks
  - Power and Mode
- Mini USB port for programming
- Retrofit a standard joystick to accommodate excessive force
  - R-Net
  - Curtis

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CONTINUED

Mo-Vis

- Mo-Vis is in Belgium
- Distributed by Stealth Products
- Great line of alternative driving methods
- Unique programming software

mo·vis
move with vision

20

Clinical Decision Making

- Is there adequate room to mount a standard joystick where required for optimal control?
  - Yes – Use a Standard Joystick
  - No – Consider Compact Joystick

21

Compact Joystick

ASL

- Compact Joystick Single Switch
- Textured for easier grasp
- Top is non-removable
- One switch on top of joystick acts as a Reset

- Dual Switch version
  - Two switches on top of joystick send signals thru 2 switch jacks

22

CONTINUED

Compact Joystick

- Mo-Vis All Round Joystick Light (120 grams)
- All Round Joystick (250 grams)
- Mini USB port for programming
- 2 switch jacks
  - Power and Mode
  - Mounts on sides for 1-2 twister switches
- Variety of mounting options
  - Hand
  - Chin

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CONTINUED

Compact Joystick

- Switch It Versa Guide
  - 240 grams
  - 2 switch jacks (mechanical or proximity switches)
- Versa Guide EZ
  - 120 grams
- Compatible with Qlogic and Rnet

24

Clinical Decision Making

- Does the client have the ability to grade the force and distance of movement, as well as have adequate movement and motor control, but not at the hand?
  - Yes, at the foot
    - Explore proportional foot control
  - No – explore Digital Driving Methods

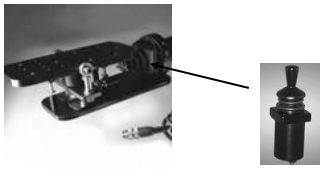
25

Foot Control

HMC/Permobil

- Proportional foot control
- Attaches to compact joystick
- Some clients will have better control with the foot "free"

Switch It



ASL

26

Clinical Decision Making

- Does the client have adequate force to initiate and sustain joystick direction?
  - Yes – Explore Standard Joysticks
  - No – Explore Mini Proportional Joysticks

27

Mini Proportional Joysticks

- Mini Proportional Joysticks require less active force and travel to activate
- Standard joystick requires approximately 250 grams of force
- Many Minis require approximately 50 grams of force
  - Often appropriate for use at the chin
- Many Minis require approximately 10 grams force
  - Often appropriate for use at a finger or thumb

28

Clinical Decision Making

- Will the client use the mini joystick by the chin?
  - Yes
  - Mini proportional joysticks require less force than a standard or compact joystick, reducing RSI risk
  - Minis requiring approximately 50 grams of force work best at the chin

29

Mo-Vis Mini Proportional Joysticks

- Mo-Vis
- Mo-Vis Multi Joystick
  - 50 grams
  - 2 switch jacks on joystick and on interface box
  - Mini USB on configuration box for programming
  - Various mounting options

30

Switch It Mini Proportional Joysticks

- MicroPilot
  - Isometric joystick
  - Requires very little throw
  - Relies on force instead, approximately 10-50 grams
  - Adjustable force
  - May result in less extraneous movement by the chin
  - Can mount parallel to floor

31

Clinical Decision Making

- Will the client use the mini joystick by the chin?
  - Yes
  - Are secretions an issue?
    - Yes
      - Use a sealed mini proportional joystick

32

CONTINUED

ASL Mini Proportional Joystick

- Extremity Control
  - 120 grams
  - sealed

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CONTINUED

Stealth Mini Proportional Joysticks

- Precision Mini Proportional Joystick (PMP)
  - Sealed
- i-Drive version
  - A line of alternative access methods that work on any PWC electronics package and can be programmed through the PWC programmer or separately through i-Drive software on a computer or tablet

34

CONTINUED

Clinical Decision Making

- Will the client use the mini joystick by the finger or thumb?
  - Yes
  - Minis with approximately 10 grams of force work well in this area
    - Less leverage by finger or thumb than by chin

35

ASL Mini Proportional Joysticks

- Molecule
  - Magnet returns joystick to center
  - New!
- MEC
  - 18 grams
- Micro Mini
  - Isometric joystick

Ring Mount

36

CONTINUED

Mini Proportional Joysticks

- HMC
  - Permobil
  - 13 grams

37

CONTINUED

Mo-Vis Mini Proportional Joysticks

- Mo-Vis
- Mo-Vis Micro Joystick
  - 10 grams
  - 2 handles
  - 2 switch jacks on interface box
  - Mini USB on configuration box for programming
  - Various mounting options

38

CONTINUED

Mo-Vis Configurator Software

- Many parameters can be adjusted separate and in addition to the power wheelchair programming parameters
- Road Compensation
  - The wheelchair automatically slows when encountering uneven terrain
  - Prevents reduced control with sensitive joysticks mounted at the hand or chin

ROAD COMPENSATION

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CONTINUED

Switch It Mini Proportional Joysticks

- MicroPilot
  - Isometric joystick
  - Requires very little throw
  - Relies on force instead, approximately 10-50 grams
  - Adjustable force
  - Can mount parallel to floor
- Micro Guide
  - Non-Isometric
  - 25 grams

40

Clinical Decision Making

- Does the client have difficulty using a joystick by the hand during cold conditions?
  - Yes
  - Try a hand warmer

41

Other New Items!

- Mo-Vis
- Hand Warmer
  - Hard to drive when hands are cold
    - MS
    - Duchenne
  - Recycles air from in front of warmer to reduce energy consumption
  - Programmable
    - Temperature, fan speed
  - Optional Hand Hood

42

Clinical Decision Making

- Can the client control a mini proportional joystick by a finger or thumb and does the client wish to hold the driving method in midline and close to the body?
  - Yes – Explore Adapted Game Controller
  - No – Explore other Mini Proportional Joysticks

43

Switch It Game Control Drive Control

- No joke!
- Controls power wheelchair, seat functions and mode changes
- Client can hold close in to body
- Light touch buttons
- Built-in mini joysticks
- Durable!
- Cannot assign buttons in the field
- Great for clients with Duchenne MD
- 40-50 grams on joysticks

Switch It Drive Station

44

Mini Proportional Joysticks

- Mounting options
  - Hand
  - Head

45

Clinical Decision Making

- Choose a mount by the chin
  - Swing away mount stays in position relative to the wheelchair
  - Bib or harness mount stays in position relative to the client
  - Does the client need to move the mount independently?
    - Power mount

46

Mounting - Head

- Harness and bib
- Some clients need the joystick mounted at the chin
- Some mounting options mount to the client
- This keeps the joystick in better alignment with the client, though does not readily move out of the way

47

Mounting - Head

- New Option
- i-Drive Control Harness

48

CONTINUED

Head - Power Options

- Power swing away
  - Joysticks
  - Sip ‘n Puff
  - Any control by mouth
  - Hydration
  - Lightweight devices
  - *video

Mo-Vis
Multi
Swing

49

CONTINUED

Clinical Decision Making

- Choose a mount by the hand.
  - Ensure that the forearm, wrist and hand are well supported
    - Armtrough or tray
  - Ensure the joystick is mounted in the optimal position
    - Hand pad
    - Midline and/or swing away mount, as needed

Stealth Products

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CONTINUED

Mounting - Hand

- Many clients using a mini proportional joystick by the hand require hand and forearm support.
- Mounting in a tray or hand tray provides support, protects the joystick and provides height adjustment in relation to the tray.

Stealth Products

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CONTINUED

Digital Driving Methods

- Non-Proportional
- Switch

52

Clinical Decision Making

- Client cannot use any type of joystick
  - Joystick control requires the ability to grade the force and distance of movement
  - The client must also have adequate movement and motor control to use a joystick
    - No – explore Digital Driving Methods

R-net

53

Clinical Decision Making

- Client has fair upper extremity control
- Common DXs: CP, TBI, MS, MD
  - Individual mechanical switches on a tray surface

54

Clinical Decision Making

- Client has fair upper extremity control
- Common DXs: CP, TBI, MS, MD
  - But client does not have controlled vertical movements
  - More difficult for clients with increased tone
    - Proximity array under tray

55

Proximity Array

- Clinical Indictors:
  - Fair upper extremity control
  - Accommodates larger movement
  - Eliminates a plane of movement

Mark

Jellybean by left cheek is for SGD, cuff is to keep left hand off of proximity switches and to provide stability. Right hand accesses proximities

56

Proximity Switch Arrays

- Typically placed under a tray
- Consider tactile cue above (i.e. loop Velcro)
- Consider pigtail cable
- ASL, Switch-It!, Stealth, Mo-Vis

ASL

Switch–It!

Stealth Products

57

Mo-Vis Configurator Software

- Mo-Vis proximity switches
- Debounce time = activation delay
  - May allow a client time to move over other proximity switches to reach desired direction
- Sensitivity = activation distance
  - Sets distance to activate proximity sensor

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CONTINUED

Clinical Decision Making

- Client has good fine motor control, but limited activation travel and force
- Common DXs: ALS, SMA, MD
  - Touch Pad (proportional)
  - VIC Touchless finger joystick (proportional)
    - No longer available in the USA
  - Fiberoptic switches

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CONTINUED

Fiberoptic Switch Arrays

- Small targets
- Accommodates very small movements with no force
- Typically placed by finger or thumb
- Cables are fragile
- ASL, Switch-It!, Stealth

Switch-It!

ASL

Stealth Products

60

Fiberoptic Switch Arrays

- ASL
- Teach mode to set activation distance, then turn off
- Fine tune manually

61

Stealth Products Fiberoptic Arrays

- 2, 3, 4 switch arrays
- Handpad mount option with mini goosenecks
- Tuning

62

Clinical Decision Making

- Client has good head control, but little extremity control
- Common DXs: SCI, ALS, CP, MS
  - Magitek (proportional)
  - Proportional Head Control (RIM) (Proportional)

Switch It

63

Magitek Drive Control

- Older driving method with some new features
- Sensor mounted at top of head
- Translates head movement into wheelchair movement
- Requires very good head control
- Stop: enter Neutral Zone

64

Magitek Drive Control

- New Features
- Emergency Stop Switch Port
- Over rate
  - Shuts down system with sudden movement (i.e. sensor falls off head)
- Over range
  - If the client moves too far from center and stays there, the PWC stops

65

Clinical Decision Making

- Client has fair head control, but little extremity control
- Common DXs: CP, TBI, high level SCI
  - Head Array

66

CONTINUED

Head Array (proximity switches)

- 3-5 proximity switches in a tri-pad headrest
- Clinical Indicators:
  - Fair to good head control
  - Little extremity control

Switch-It

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CONTINUED

ASL and Switch It original Head Arrays

- Older driving method
- Tri-pad Head Array

68

ASL ATOM Head Array

- Electronics are attached to the head pad
- New features
  - Client can turn the head array on and off by pressing an external switch (user switch)
- Hold user switch for a programmable amount of time (long beep) and then use directional switch to send a wireless switch signal to another AT device (i.e. SGD, Computer, tablet)
  - No Interfacing component required
- Can change reset double tap to longer hold (R-net, Q-Logic)
- Can turn on auditory feedback when a directional switch is activated

69

Permobil Head Array

- Total Control Head Array System
  - Can combine electrical and mechanical switches
  - 2 Proximities in rear pad to facilitate diagonals
    - Can program to require that both switches have to be activated to drive or just one
  - 6 input jacks on back (1/8")
    - Mechanical mono
    - Electrical stereo

70

CONTINUED

Stealth Products i-Drive

- Can combine proximity and mechanical switches
  - Mechanical switches require short adaptor cable
- Can assign each switch using a Tablet
- Reverse:
  - Double tap or Mode switch to Toggle
- Works with wide variety of head supports

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CONTINUED

Switch It Dual Pro

- Programming can be done on back pad
- 3 control options:
- Proximities only
- Mechanical only
  - Increased force on switch increases speed
- Proximities and Mechanical
  - Proximities respond immediately
  - Increased force increases speed
- Increased force can lead to increase tone, difficulty stopping, and increased fatigue

72

Head Array - iDrive

- Video

73

Clinical Decision Making

- Client has good oral motor control, but little head or extremity control
- Common DXs: high level SCI
  - Sip ‘n Puff

74

Sip ‘n Puff

- Clinical Indicators:
  - Little control of head or extremity movement
  - Good oral motor control, lip closure, intact palate
  - Full directional control and speed control

75

Sip ‘n Puff programming

- Traditional control: 4 pressure
  - Forward: hard puff
  - Right: soft puff
  - Reverse (or stop): hard sip
  - Left: soft sip
  - Latch
  - Speeds

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CONTINUED

iDrive Sip ‘n Puff

- 4 pneumatic commands
- Pressures programmed on iDrive software
  - Can hold on tablet in front of client for better feedback
- Proportional speed
  - i.e. creeping up to table
  - Stage 1
- Traditional control
  - Stage 2

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CONTINUED

Sip ‘n Puff programming

- 2 pressure
  - Q-Logic
  - 2 puffs = Forward, 1 puff = Right
  - 2 sips = Reverse, 1 sip = Left
  - Sampling Delay
  - Between time

78

Clinical Decision Making

- Client has partial oral motor control and partial head control
- Common DXs: MS, TBI, SCI, CP
  - Sip ‘n Puff Head Array Combo

79

Sip ‘n Puff Head Array

- Left and Right pads active on the Head Array
- Any puff is Forward
- Any sip is Reverse
- May work for clients who cannot discriminate between hard and soft pneumatic commands

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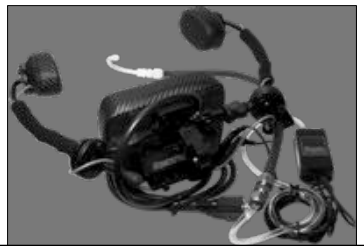

80

Clinical Decision Making

- Client has adequate motor control at 4 specific body sites
- Common DXs: CP, TBI, ALS, SMA, MD
  - 4 mechanical and/or electrical switches for Forward, Left, Right and Reverse or Reset
  - Optimal switch placement is where client has small, isolated, repeatable, and sustained ability to activate and release a switch

81

4 switch combination

ASL

- Clinical Indicators:
  - Ideally, 3 switch sites provides Forward, Left and Right directional control
  - Strongest switch site = Forward
  - If a 4th switch can be identified, Reset provides the most function
    - And requires the least motor control
- This isn't new but finding the optimal switch sites and types is always a NEW challenge!

82

Switch Interfaces

- Stealth Products iDrive
- Any combination of mechanical and electrical switches

83

Switch Interfaces

- Magitek iZip II & iZip III
- 1 – 5 Proximity and mechanical switches
  - 1 switch: OneSwitch option

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CONTINUED

Switch Interfaces

- Switch-It Cool Cube
- Interfaces with any combination of mechanical and electrical switches
- Pro Spot switches
  - Speed increases with pressure

85

CONTINUED

An Interesting Combination

- 3 Switch Driving

Right Turns AbleNet Jellybean left medial knee

Forward Jellybean behind left upper arm

Faith

Left Turns AbleNet Spec on strap base

86

Driving with the New Chair!

- Video

87

Combining Mechanical and Electronic Switches

- Julian
- SMA, type I

Microlite, right medial knee, Right

Fiberoptic, left thumb, Forward

Proximities at either side of head for Left and Reset

88

Julian

- As his needs changed, so have his switch locations and types
- Proximities by either side of his head
- *videos

89

Julian

- Fiberoptics by each hand
- Fingers flexed to improve movement
- *videos

90

Julian

- *Video

91

Clinical Decision Making

- Client has adequate motor control at 3 specific body sites
- Common DXs: CP, TBI, ALS, SMA
  - 3 mechanical and/or electrical switches for Forward, Left, and Right
  - Reverse or Reset can be added later or consider Standby

92

Clinical Decision Making

- Client has adequate motor control at 2 specific body sites
- Common DXs: CP, TBI, ALS, SMA

93

2 switch fiberoptic array

ASL

- Cover both beams for forward
- Cover left for left directional control
- cover right for right directional control
- 3rd switch can be used as reset
- Proportional version
- ASL
- New: Stealth i-Drive

Stealth Products

94

2 Switch Control

- Newer Option
- ASL Single Switch Scanner with Dual Switch Step Scan
- Requires 2 switches
  - First switch moves through directions
  - Second switch selects and moves if sustained contact

95

2 Switch Control

- Q-Logic
  - This has been around for a little bit, but many folks have not heard of this yet
  - Switch 1:
    - 2 activations = Forward, 1 activation = Left, double click = mode
  - Switch 2:
    - 2 activations = Reverse, 1 activation = Right

96

CONTINUED

2 Switch Control

- Stealth i-Drive: Link
- Can program 2 switches to act like 3
- Activate both switches for Forward, left switch for Left and right switch for Right
  - Come off switches to toggle Forward and Reverse
- Reset
  - Double left activation
  - If client can use a 3rd switch, this can be Reset
- Can use with mechanical and/or electrical switches

- *video

97

CONTINUED

Clinical Decision Making

- Client has adequate motor control at 1 specific body site
- Common DXs: CP, TBI, ALS, SMA

98

Single Switch Scanning

- Clinical Indicators:
  - Only 1-2 switch sites can be found
  - Client can see and monitor display
  - Newer ASL options:
    - Auditory feedback
    - Communication modification
    - *Jumbo LED modification

99

Take Home Message:

- There are many ways to drive a power wheelchair!
- Positioning, Drive Wheel Configuration, Tracking Technologies, Programming, and Training optimizes driving for an individual

100

Resources:

- www.atilange.com
- Under Resources:
  - Power Wheelchair Joystick Decision Making Tree
  - Power Wheelchair Non-Joystick Driving Methods Decision Making Tree
  - Mini Joystick Comparison Chart
  - Indoor Power Mobility Criteria
  - Pre-Mobility Training Guidelines
  - Mobility Training Guidelines

101

References:

- Lange, M. (2018). Power Mobility: Alternative Access Methods. In Seating and Wheeled Mobility: a clinical resource guide, eds M. Lange & J. Minkel, Slack, Thorofare, NJ.

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Questions

- Email

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Thank You!

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CONTINUED

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