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Seating Dynamics

# Clients with Increased Muscle Tone

## Where Force Occurs, What Happens if Force is not Addressed, Dynamic Solutions, and Expected Outcomes

**Introduction**

Dynamic seating provides movement within a wheelchair. When the client moves, the dynamic seating components move with the client, maintaining alignment with the seating system for postural support, skin integrity preservation, and stability. Clients who extend with force may benefit from dynamic seating. Dynamic components absorb and diffuse force, protecting both the client and the wheelchair seat and frame from damage (Lange, et al, 2017; Lange, 2016). Dynamic seating can improve quality of life for many wheelchair users and their caregivers.

This document is designed to provide Clinical Indicators for the use of Dynamic Seating with clients who have increased muscle tone. Please refer to our other Clinical Indicators for additional Dynamic Seating applications. Clients with a High Threshold sensory processing modulation disorder seek out sensory input, secondary to the inability to detect where their head is in space in relation to gravity within normal sensory parameters. Banging against the back or bouncing on the seat provides increased tactile and vestibular sensory input, providing the client with feedback necessary to calm and quiet their emotional as well as their physical state for postural improvement. Dynamic seating can improve quality of life for many wheelchair users and their caregivers.

## Where Force Occurs: Hips / Knees / Ankles

**What Happens if Force is Not Addressed?**

1) Extensor tone will continue against unyielding surfaces

2) Breakage can occur at:

    a) Footrest hangers and footplates

    b) Back canes

    c) Seat frame

    d) Seating system mounting hardware

    e) Head support mounting hardware

3) Breakage can occur while in transport, placing the client at risk of injury.

4) Injury can occur:

    a) Client may be injured from violent physical contact with the mobility base and the seating system.

    b) Client may be injured from contact with sharp, broken objects after or during the breakage.

5) Loss of posture can occur:

    a) Client may move out of a beneficial position, resulting in poor alignment, poor pressure distribution, and decreased function.

    b) Poor alignment may specifically reduce trunk and head alignment and control.

6) Pain or discomfort can occur:

a) Client may experience discomfort / pain due to the excessive forces exerted against the wheelchair components as a result of high muscle tone. This can create discomfort /pain at the point of contact as well as throughout the joints as the force “has nowhere to go” and is not diffused. Pain or discomfort can decrease sitting tolerance.

7) Shear forces can occur:

a) Force and movement against the seating surfaces can create shear which, in turn, increases risk of skin and tissue injury.

8) Excessive energy expenditure can occur as the client continues to extend against unyielding surfaces. This can increase caloric output, body temperature, sweating, and fatigue.

9) Decrease in function can occur as a client generally is not able to use the body functionally while in a pattern of extension.

10) Client agitation can occur as a result of these issues.

Lange, et al, 2017; Lange, 2013; Presperin-Pedersen & Eason, 2015)

**What Dynamic Components may be used to Address or Reduce the Likelihood of the Above Issues?**

1) Dynamic Back support hardware

2) Dynamic Legrest support hardware

3) Dynamic Head support hardware

4) Dynamic secondary support components (i.e. shoulder straps)

**Expected Outcomes:**

1) When extension forces occur, the dynamic component will move, force will be diffused (Avellis et al, 2010), and the energy built up in the dynamic component will return the client to their starting position without loss of postural alignment.

2) Due to force diffusion:

a) Decrease in frequency and intensity of extreme extension patterns (Crane et al., 2007; Ferrari, 2003)

b) Reduced equipment breakage (Crane et al., 2007)

c) Reduced client injury (Lange et al., 2017)

d) Reduced loss of posture (Crane et al., 2007; Ferrari, 2003)

e) Improved head posture and, as a result, improved swallow (Ferrari, 2003), breathing (Crane et al., 2007), and visual field

f) Increased sitting tolerance / comfort (Crane et al., 2007)

g) Reduced shear forces (Avellis et al, 2010; Dawley & Julian, 2003)

h) Reduced energy expenditure (Ferrari, 2003)

i) Increased function, including access to assistive technology (Crane et al., 2007)

j) Reduced agitation (Watson, et al, 1998)

3) Due to movement:

a) Increased active range of motion (Avellis et al, 2010)

b) Increased sensory input (Presperin-Pedersen & Eason, 2015)

## Where Force Occurs: Torso (Spinal Extension, similar characteristics as Hip Extension)

**What Happens if Force is Not Addressed?**

1) Extensor tone will continue against unyielding surfaces.

2) Breakage can occur at:

a) Footrest hangers and footplates

b) Back canes

c) Seat frame

d) Seating system mounting hardware

e) Head support mounting hardware

3) Breakage can occur while in transport, placing the client at risk of injury.

4) Injury can occur:

a) Client may be injured from violent physical contact with the mobility base and the seating system.

b) Client may be injured from contact with sharp, broken objects after or during the breakage.

5) Loss of posture can occur:

a) Client may move out of a beneficial position, resulting in poor alignment, poor pressure distribution, and decreased function.

b) Poor alignment may specifically reduce trunk and head alignment and control.

6) Pain or discomfort can occur:

a) Client may experience discomfort/ pain due to the excessive forces exerted against the wheelchair components as a result of high muscle tone. This can create discomfort /pain at the point of contact as well as throughout the joints as the force “has nowhere to go” and is not diffused. Pain or discomfort can decrease sitting tolerance.

7) Shear forces can occur:

a) Force and movement against the seating surfaces can create shear which, in turn, increases risk of skin and tissue injury.

8) Excessive energy expenditure can occur as the client continues to extend against unyielding surfaces. This can increase caloric output, body temperature, sweating, and fatigue.

9) Decrease in function can occur as a client generally is not able to use the body functionally while in a pattern of extension.

10) Client agitation can occur as a result of these issues.

(Lange, et al, 2017; Lange, 2013; Presperin-Pedersen & Eason, 2015).

**What Dynamic Components may be used to Address or Reduce the Likelihood of the Above Issues?**

1) Dynamic Back support hardware

2) Dynamic Legrest support hardware

3) Dynamic Head support hardware

4) Dynamic secondary support components (i.e. shoulder straps)

**Expected Outcomes:**

1) When client movement occurs, the dynamic component will move, forces will be diffused (Avellis et al, 2010), and the energy built up in the dynamic component will return the client to their starting position without loss of postural alignment.

2) Due to force diffusion:

a) Decrease in frequency and intensity of extreme extension patterns (Crane et al., 2007; Ferrari, 2003)

b) Reduced equipment breakage (Crane et al., 2007)

c) Reduced client injury (Lange et al., 2017)

d) Reduced loss of posture (Crane et al., 2007; Ferrari, 2003)

e) Improved head posture and, as a result, improved swallow (Ferrari, 2003), breathing (Crane et al., 2007), and visual field

f) Increased sitting tolerance / comfort (Crane et al., 2007)

g) Reduced shear forces (Avellis et al, 2010; Dawley & Julian, 2003)

h) Reduced energy expenditure (Ferrari, 2003)

i) Increased function, including access to assistive technology (Crane et al., 2007)

3) Due to provision of movement:

a) Reduced agitation (Watson et al., 1998)

b) Increased active range of motion (Avellis et al, 2010)

c) Increased sensory input (Presperin-Pedersen & Eason, 2015)

## Where Force Occurs: Cervical

**What Happens if Force is Not Addressed?**

1) Extensor tone will continue against unyielding head support surfaces.

2) Breakage can occur at head support mounting hardware. Even if breakage does not occur, excessive forces can move the head support out of alignment.

3) Breakage can occur while in transport, placing the client at risk of injury.

4) Injury can occur:

a) Client may be injured from violent physical contact with the head support pads.

b) Client may be injured from contact with exposed hardware if head support pad and/or mount break.

5) Loss of posture can occur:

a) Poor alignment may specifically reduce head alignment and control.

b) If the head moves into hyperextension as the result of undiffused tone or of the head support moving out of position, extensor tone may increase, reflexive responses may be elicited, and postural insecurity, startle, and anxiety may increase.

6) Pain or discomfort can occur:

a) Client may experience discomfort/ pain due to the excessive forces exerted against the head support as a result of high muscle tone. This can create discomfort / pain at the point of contact as well as

throughout the cervical joints as the force “has nowhere to go” and is not diffused. Pain or discomfort can decrease sitting tolerance.

7) Shear forces can occur:

a) Force and movement against the seating/ head support surfaces can create shear which, in turn, can result in loss of hair on the occiput.

8) Excessive energy expenditure can occur as the client continues to extend against unyielding surfaces. This can increase caloric output, body temperature, sweating, and fatigue.

9) Decrease in function can occur as a client generally is not able to use the body functionally while in a pattern of extension. If the head is out of alignment, the client may specifically experience impaired breathing, swallowing (increasing risk of choking and aspiration), and visual field.

10) Client agitation can occur as a result of these issues.

(Lange, et al, 2017; Lange, 2013; Presperin-Pedersen & Eason, 2015).

**What Dynamic Components may be used to Address or Reduce the Likelihood of the Above Issues?**

1) Dynamic Back support hardware

2) Dynamic Head support hardware

**Expected Outcomes:**

1) When extension forces occur, the dynamic component will move, force will be diffused (Avellis et al., 2010), and the energy built up in the dynamic component will return the client to their starting position without loss of postural alignment.

2) Due to force diffusion:

a) Decrease in frequency and intensity of extreme extension patterns (Crane et al., 2007; Ferrari, 2003)

b) Reduced equipment breakage (Crane et al., 2007)

c) Reduced client injury (Lange et al., 2017)

d) Reduced loss of posture (Crane et al., 2007; Ferrari, 2003)

e) Improved head posture and, as a result, improved swallow (Ferrari, 2003), breathing (Crane et al., 2007), and visual field

f) Increased sitting tolerance / comfort (Crane et al., 2007)

g) Reduced shear forces (Avellis et al, 2010; Dawley & Julian, 2003)

h) Reduced energy expenditure (Ferrari, 2003)

i) Increased function, including access to assistive technology (Crane et al., 2007)

3) Due to provision of movement:

a) Reduced agitation (Watson, et al, 1998)

b) Increased active range of motion (Avellis et al, 2010)

c) Increased sensory input (Presperin-Pedersen & Eason, 2015)

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