DYNAMIC SEATING

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Learning Objectives

• The participant will be able to list clinical applications for dynamic wheelchair components vs. static options.
• The participant will be able to list clinical indicators for a dynamic movement of the pelvis.
• The participant will be able to list clinical indicators for dynamic movement of the lower extremities.
• The participant will be able to list clinical indicators for dynamic movement of the neck.

What we are covering today:

• What is Dynamic Seating?
• Pelvis
• Trunk
• Lower Extremities
• Head

Dynamic Seating – a definition

• Dynamic Seating is movement which occurs within the seat and/or wheelchair frame in response to force from the client. The dynamic component absorbs force which in turn assists the client back to a starting position.
• Dynamic Seating is often better tolerated than more restrictive systems

Dynamic Seating - Goals

1. To protect wheelchair and seating hardware from breakage
2. To increase stability
3. To increase function
4. To improve sitting tolerance and compliance
5. To reduce energy exertion from movements where the force is not diffused
6. To improve strength and control by allowing movement within a limited range
7. To provide vestibular input
8. To provide active range of motion
9. To decrease agitation* 
10. To increase alertness

Static Seating

• Static seating provides support at the desired body surfaces and at the desired angles
• Static seating typically restricts movement
• Static seating may be required for some clients

Dynamic Stability: the pelvis

- Allowing movement at the pelvis has advantages and disadvantages

Pelvic Dynamic Stability: advantages

- If pelvic movement is blocked, this force can be transferred to other body areas, resulting in increased extension
- Movement of the pelvis shifts weight which provides pressure relief and comfort

Pelvic Dynamic Stability: advantages

- Movement may open seat to back angle which could result in a posterior pelvic tilt
  - This may be acceptable if the pelvis returns to neutral upon return to upright
- Movement may be into an anterior tilt of the pelvis
  - The seat to back angle of the seating system typically does not change
  - A pelvic anterior tilt increases stability of the pelvis and trunk for improved head control and upper extremity function
- Research results*
  - Anterior pelvic tilt promotes trunk extension

Pelvic Dynamic Stability: disadvantages

- Allowing movement of the pelvis can lead to assumption of a destructive posture
- Allowing movement of the pelvis into posterior pelvic tilt can lead to increased extension and spasms
- The client may not be able to return to a neutral position

Pelvic Dynamic Stability: advantages

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Pelvic Dynamic Stability: product options

- Integrated systems
- Dynamic Backs
- Anterior Tilt options
  - Pelvic positioning belt
  - Leg harness
  - Hip Grip

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<thead>
<tr>
<th>Integrated Systems</th>
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<tbody>
<tr>
<td>- These systems are a complete seat and wheelchair, generally, and not retrofittable to other bases</td>
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<td>- Multiple dynamic movements work together</td>
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<th>Adacta Klim</th>
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<tr>
<td>- By ProMedicare, in Italy</td>
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<tr>
<td>- Fold down backcanes with gas springs</td>
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<tr>
<td>- Reclining backrest 0 – 95 degrees</td>
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<td>- Tilt 0 – 25 degrees</td>
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<td>- Increase in knee angle and downward force at feet</td>
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<tr>
<th>Aktivline</th>
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<tr>
<td>- By Interco, in Germany</td>
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<tr>
<td>- Dynamic seat and back</td>
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<tr>
<td>- 3 sizes</td>
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<td>- Can be placed on a Permobil power wheelchair</td>
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<tr>
<th>Elevation</th>
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<tr>
<td>- Elevation Ultra Lightweight wheelchair</td>
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<td>- PDG</td>
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<tr>
<td>- Seat can rise at rear, 10 degrees in height</td>
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<td>- 30 degrees back rest angle adjustment</td>
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<tr>
<th>Kinetic Innovative Seating System</th>
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<tr>
<td>- KISS for Wheelchairs, in USA</td>
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<tr>
<td>- Allows constant articulated motion</td>
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<tr>
<td>- Can fit on most manual wheelchair frames</td>
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<tr>
<td>- Seat Back and Seat Base can be installed separately or together</td>
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<th>Netti Dynamic Wheelchair</th>
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<tr>
<td>- By Alu Rehab, in Norway</td>
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<tr>
<td>Product</td>
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<tr>
<td>Netti Dynamic Wheelchair</td>
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<td>Quantum Kids Fast</td>
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<td>Quantum Kids Rock</td>
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<tr>
<td>Dynamic Backs</td>
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Fumagalli Ortho Flex dynamic back

- By Fumagalli, in Italy
- Backrest is comprised of 6 elements that move with the client

Miller’s Dynamic Backrest Interface

- Extends at level of biangular back

Miller’s Dynamic Backcane Interface

- Two 120 lbs gas shocks
- Opens to 30 degrees

Miller’s Dynamic Back

Seating Dynamics Dynamic Back

- Seating Dynamics
- Dynamic rocker back

Seating Dynamics Dynamic Back

- Seating Dynamics
- Dynamic rocker back
Sunrise Medical Dynamic Back
- Mono Back or Dual Cane
- Available on Quickie manual wheelchairs
- Locks out
- Dynamic option

Stealth Dynamic Back
- Stealth Dynamic Backrest Mounting Hardware
- Encased to protect mechanism

Stealth Dynamic Back
- Multi-positional hardware for backs
- Also provides movement

Dynamic Backs – non-wheelchair
- Some Dynamic Backs are available on adaptive seating systems
  - Rifton
  - Snug Seat

Rifton Dynamic Back
- Available on the Rifton Activity Chair standard base
- Optional seat and backrest springs
- Can be locked and unlocked

Snug Seat x:panda dynamic back
- Dynamic back
- Locks out, if needed
Thomashilfen Thevo Twist
- Thevotwist dynamic stroller
- Micro-stimulation technology
- Moves with client
- Tilt in space and recline
- Unique "wings" move in small degrees, following the child as they move
- Movement is lateral

Anterior Tilt – Dynamic Options
- Pelvic positioning belts
- Leg harness
- Hip grip

Pelvic Positioning Belts
- If the pelvic positioning belt is placed over the lap, anterior tilt and return to neutral are allowed
- Ensure that pelvic obliquity and rotation are not allowed, if this is the client’s tendency

Pelvic Positioning Belts
- 45 degree placement does not allow anterior tilt
- 70 – 90 degree placement allows some anterior tilt
- If mounted in front of the Trochanter

Leg Harness
- This seating component can maintain pelvic position in some clients while avoiding any contact with the pelvis itself
- A leg harness may allow anterior tilt and return to neutral
- Ensure that pelvic obliquity and rotation are not allowed, if this is the client’s tendency

Hip Grip
- This unique seating component provides significant pelvic stability due to large contact areas
- At the same time, a dynamic component is included to allow anterior tilt of the pelvis and return to neutral without loss of pelvic position
- Lateral movement is not assisted, though the pelvic position is maintained for increased stability
- Follows natural movement
Dynamic Stability: the trunk with pelvic movement
• Much trunk movement is dependent on pelvic movement
• If the pelvis is allowed to move forward into an anterior tilt, the trunk needs to move forward, as well
• This forward movement may require additional stability to be functional and to facilitate return to upright

Dynamic Stability: the trunk without pelvic movement
• If the pelvis is held in a static position, the trunk can still move forward slightly (depending on flexibility), laterally and in rotation
• These movements may require some stability to be functional

Dynamic Stability: the trunk
• Allowing movement at the trunk has advantages and disadvantages

Trunk Dynamic Stability: advantages
• Trunk forward movement allows the pelvis to assume an anterior tilt
• Moving the trunk forward can assist with balance of the head, particularly in combination with anterior pelvic tilt which promotes trunk extension
• Dynamic support may assist with return to upright

Trunk Dynamic Stability: disadvantages
• Some clients will push a dynamic component to end range and maintain that position, rather than allowing the component to assist in a return to upright
• Some clients “hang” on the support

Trunk Dynamic Stability: product options
• If the client does not require anterior trunk support for stability and/or function, then do not add it
• If the client only requires anterior trunk support for certain activities, only use it at those times
Trunk Dynamic Stability: product options

- Vests
- Other options

Vests

- Made of dynamic material to allow some movement forward and assist with return to upright

Other Options

- Belly binder
  - Provides stability at the lower trunk, allowing movement of the upper trunk

Other Options

- Theratogs
  - Wearable garments to provide increased proprioceptive input and support to the body, including the trunk
  - Allows movement and may reduce the need for other more restrictive trunk support options

Other Options

- Kinesio® Tape

Dynamic Stability: the lower extremities
LE Dynamic Stability: advantages

- Many clients will not tolerate having their feet restrained
- Stability is often required at the feet, however, to improve function
- Dynamic stability may improve tolerance and compliance, while providing function
- Limiting lower extremity movement may protect the feet from injury

LE Dynamic Stability: disadvantages

- Restricting the feet in any way will prevent independent transfers
- Some clients will continue to fight any restraint of the feet

LE Dynamic Stability: product options

- Leg harness
- Ankle huggers
- Anterior lower leg strap
- Dynamic components

Leg Harness

- A leg harness limits some lower extremity movement which begins at the pelvis, such as internal rotation, adduction and flexion without limiting all movement

Ankle Huggers

- Bodypoint Ankle Huggers keep the feet within a certain area, limiting movement and providing stability when pushed or pulled against
- Ankle movement is still allowed

Anterior Lower Leg Strap

- Placing a calf strap in front of the lower leg can limit knee extension and provide stability when pushed against without completely limiting foot movement
- The client may be able to remove this easier than foot restraints for transfers
Dynamic Footrests
- Miller’s Dynamic Footrest Gas Spring
  - Extends downward 2”
- Miller’s Dynamic Footrest Coil
  - Allows some rotation at the footplate

Dynamic Footrests
- Miller’s Dynamic, Articulating Footrest Hanger

Dynamic Footrests
- Seating Dynamics
  - Dynamic footrest
    - Elevates 30 degrees
    - Telescopes 1 1/2”
    - Dynamic dorsiplantar flexion

Dynamic Stability: the head

Head Dynamic Stability: advantages
- Providing some movement can:
  - Reduce breakage of head support mounting hardware
  - Reduce loss of alignment of head support
  - Diffuse force
Head Dynamic Stability: disadvantages

- Movement can lead to postural insecurity
- Excessive movement can trigger reflexive response
  - Moro
  - Tonic neck

Head Dynamic Stability: product options

- Miller’s Adaptive Equipment
- Otto Bock
- Seating Dynamics
- Stealth Products
- Symmetric Designs

Dynamic Headrest Options

- Miller’s Dynamic Headrest Interface

Dynamic Headrest Options

- Miller’s Dynamic Headrest Horizontal Adjustment Bar

Dynamic Headrest Options

- Otto Bock Dynamic Rock-n-Lock Headrest Bracket
  - Spring loaded mechanism, 1 ½” travel
  - Shrouded to protect hands and hair

Dynamic Headrest Options

- Seating Dynamics Dynamic Headrest
  - Single Axis moves along midline or the Y Axis
  - Multi-Axis moves in both X and Y Axis and anywhere in between
Dynamic Headrest Options

- Stealth Tone Deflector
  - 10 degrees any direction
  - Absorb and Avert!


Remember…

- Dynamic stability can provide the optimal combination of stability and movement to improve function
- Dynamic stability can also allow movement, increasing client tolerance and compliance


Case studies

- Austin
- Spencer
- Alexi
- Rachel
- Daniel
- Taylor


Austin

- Austin
- Cerebral palsy
- 28 years old
- Custom molded seating system
- Aspen Seating Orthosis


Austin

- The problem:
  - Austin has strong extension throughout and has broken several headrest mounts
- Goal:
  - Prevent further breaks by diffusing force

Austin

- The solution:
- Providing extension at hips was contra-indicated
- Lack of range
- Girdlestone
- Providing extension at knees was contra-indicated
- Lack of range

Solution:
- He only required intervention behind his head
- We didn’t want excessive movement due to this triggering more extension
- Stealth Tone Deflector

Spencer

- Spencer
- Cerebral palsy
- Age 15
- Linear Seating System

Evaluation
- We noted that if we opened his seat to back angle, his UE flexion decreased

Equipment Trial:
- As opening the seat to back angle improved function and Spencer had significant muscle tone, we opted to trial a Kid Rock manual wheelchair
Spencer

- Spencer looked very good in this demo Kid Rock prototype.
- He indicated that he preferred this base to his current tilt in space manual wheelchair.
- Kid Rock 2 was ordered.

- When we received a demo Kid Rock 2 and trialed this, Spencer did not look as good as in prototype.
- Why? Who knows...

Spencer

- Spencer required more postural support than the Kid Rock seating provided.
- Ended up with an Aspen ASO.
- This is typically a one piece system.
- Aspen split into 2 pieces to allow dynamic movement.

Alexi

- Alexi
- 15 years old
- TBI

- Current equipment:
  - Tilt in space manual wheelchair
  - Linear seating system
  - Also, Convaid Cruiser

- The problem:
  - Alexi "fought" his current seating system, extending and becoming agitated.
  - As a result, his caregivers kept taking him out.
Alexi

- Step 1:
  - We recommended a Miller’s dynamic back and footrest hangers to provide movement and decrease force
  - Goal:
  - Reduce Alexi’s agitation and increase sitting tolerance

- Problems:
  - the pivot point was too low
  - Alexi’s extension often “jammed” the mechanism due to angle of movement

Alexi

- Step 1:
  - Dynamic footrest hangers

Alexi

- Step 2:
  - Kid Rock

Rachel

- Rachel
- Cerebral palsy, optic nerve atrophy, seizures
- Sensory issues
- Age 12

Alexi

- Step 2:
  - Kid Rock
  - In this system, Alexi could move without loss of pelvic position
  - His sitting tolerance increased significantly
  - Once he knew he could move, he stopped fighting and relaxed
Rachel

- Current equipment:
  - Tilt in space manual wheelchair, linear seating system
  - In MWC primarily at school
  - Home – often in rocking chair

Rachel does not require very much postural support
- She requires the mobility base primarily for dependent mobility as she is non-ambulatory

Rachel

- The problem:
  - When in the MWC, she can’t move, so she “checks out”
  - She tucks her hand under the vest, props her chin on her fist and closes her eyes
  - At home in her rocking chair, Rachel rocks and is much more alert and engaged

Equipment Trial: Kid Rock
- Rachel tried the Kid Rock for about 2 weeks
- She was more alert and engaged then when in her own MWC
- Though it took time for her to “discover” the movement

Rachel

- She required lower tension springs as she does not exert a significant amount of force and we want the chair to respond easily

Daniel

- Daniel
- Cerebral palsy
- Age 9
Daniel

- Current equipment:
  - Manual tilt in space wheelchair
  - Linear seating system

Daniel

- The Problem:
  - Daniel is extremely strong. He routinely breaks seating components, has dislocated both elbows and has injured his knees from strong extension
  - He has a Baclofen pump, but cannot tolerate increased doses due to seizures

Daniel

- Daniel trialed a Kid Rock for 2 weeks. He liked this system and could easily engage the springs
  - The spring tension in the back was inadequate to consistently return to upright
  - Stronger springs

Daniel

- Daniel did very well in a Kid Rock 2
  - He eventually moved into an Aspen Seating Orthosis (2 piece) as he was beginning to develop a scoliosis

Daniel

- As he grew, he was out of proper alignment with the pivot points and the system was no longer meeting his needs
  - The Kid Rock 3 fits him, but is so large that the family returned it
  - He has a new tilt in space MWC with Seating Dynamic components
  - This has met his needs very well

Taylor

- Taylor
- Cerebral Palsy
- Age 22
Taylor

Current equipment:
- MWC: tilt in space with custom molded back, cushion, footbox
- PWC: with similar seating

The problem:
- Taylor breaks everything! His back was holding on by a thread at this evaluation
- The seating system and MWC needed replacement, primarily due to significant wear and tear
- He also has a chronic rash on his back from friction against the seating system

The solution:
- Kid Rock 3
- Taylor trialed this system in a size 2 and loved it! He was extremely upset that he had to give it back, so we arranged for an extended trial while he awaited his own

Once the Kid Rock 3 arrived, Taylor still loved it… but his Mom didn’t. It was just too big. She had too much difficulty getting it in and out of the van and home and returned it. He was really too big for the Kid Rock 2, so the family went back to a static MWC with tilt
- We wanted to try some dynamic components on this, but the family has not returned our calls

Take home message:
- Dynamic Seating can either allow movement of the client within the seating system or provide movement of the seating component and/or frame
- Dynamic Seating can protect the seat and frame from damage by diffusing force
- Dynamic Seating can protect the client from undue forces and reduce tone and posturing by diffusing force
- Dynamic Seating can provide active movement

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