

# 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

\*Watson, N. M., Wells, T. J., & Cox, C. (1998). Rocking chair therapy for dementia patients: Its effect on psychosocial well-being and balance. *American Journal of Alzheimer's Disease and Other Dementias*, 13(6), 296-308.

## 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
  - To prevent injury
    - i.e. foot catching
  - To promote function
    - i.e. access a switch



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## Dynamic Stability: the pelvis

- Allowing movement at the pelvis has advantages and disadvantages



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## 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



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## Pelvic Dynamic Stability: advantages

- Movement may open seat to back angle which could result in a posterior pelvic tilt
  - This may be acceptable is the pelvis returns to neutral upon return to upright



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## Pelvic Dynamic Stability: advantages

- 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



\*Slawness, C. (2006). The effect of positioning for children with cerebral palsy on upper-extremity function: a review of the evidence. *Physical & occupational therapy in pediatrics*, 29(3), 39-53.

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## 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



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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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## Integrated Systems

- These systems are a complete seat and wheelchair, generally, and not retrofittable to other bases
- Multiple dynamic movements work together

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## Adacta Klim

- By ProMedicare, in Italy
- Fold down backrests with gas springs
- Reclining backrest 0 – 95 degrees
- Tilt 0 – 25 degrees
- Increase in knee angle and downward force at feet



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## Aktivline

- By Intero, in Germany
- Dynamic seat and back
- 3 sizes
- Can be placed on a Permobil power wheelchair



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## Elevation

- Elevation Ultra Lightweight wheelchair
- PDG
- Seat can rise at rear, 10 degrees in height
- 30 degrees back rest angle adjustment



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## Kinetic Innovative Seating System

- KiSS for Wheelchairs, in USA
- Allows constant articulated motion
- Can fit on most manual wheelchair frames
- Seat Back and Seat Base can be installed separately or together



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## Netti Dynamic Wheelchair

- By Alu Rehab, in Norway



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### Netti Dynamic Wheelchair

- Provides movement at feet, knees, hips, head



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### Netti Dynamic Wheelchair

- Seat moves up during extension to maintain the position of the pelvis



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### Quantum Kids Fast

- Moves at hips and knees
- Reaction Dynamic Seating System
- Being discontinued



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### Quantum Kids Rock

- Moves at hips and knees
- Reaction Dynamic Seating System
- Being discontinued



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### Leggero Dyno

- Activator Dynamic Seating Component
  - Active knee range 15 degrees
  - Active seat to back angle 35 degrees
  - folds

Recline



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### Dynamic Backs

- Movement occurs only at the back
- Can often be combined with other dynamic options to provide movement in other areas

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### Fumagalli Ortho Flex dynamic back

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



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### Miller's Dynamic Backrest Interface

- Extends at level of biangular back



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### Miller's Dynamic Backcane Interface

- Two 120 lbs gas shocks
- Opens to 30 degrees



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### Miller's Dynamic Back



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### Seating Dynamics Dynamic Back

- Seating Dynamics
- Dynamic rocker back



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### Seating Dynamics Dynamic Back

- Seating Dynamics
- Dynamic rocker back



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### Sunrise Medical Dynamic Back

- Mono Back or Dual Cane
- Available on Quickie manual wheelchairs
- Locks out
- Dynamic option




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### Stealth Dynamic Back

- Stealth Dynamic Backrest Mounting Hardware
  - Encased to protect mechanism



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### Stealth Dynamic Back

- Multi-positional hardware for backs
- Also provides movement




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### Dynamic Backs – non-wheelchair

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

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### Rifton Dynamic Back

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




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### Snug Seat x:panda dynamic back

- Dynamic back
- Locks out, if needed




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## 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



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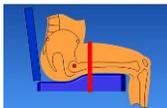
## Anterior Tilt – Dynamic Options

- Pelvic positioning belts
- Leg harness
- Hip grip

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## 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



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## 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



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## Leg Harness

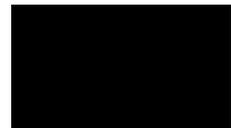
- This seating component can maintain pelvic position in some clients while avoiding any contact with the pelvis itself
- A leg harness may allow anterior tilt and return to neutral
- Ensure that pelvic obliquity and rotation are not allowed, if this is the client's tendency



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## 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



Start at 1:50

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### 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



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### 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



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### Dynamic Stability: the trunk

- Allowing movement at the trunk has advantages and disadvantages



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### 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



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### 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



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### 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

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## Trunk Dynamic Stability: product options

- Vests
- Other options

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## Vests

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



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## Other Options

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



Aspen Seating

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## 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



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## Other Options

- Kinesio® Tape



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## Dynamic Stability: the lower extremities



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### 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



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### 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



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### LE Dynamic Stability: product options

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

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### 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



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### 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



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### Anterior Lower Leg Strap

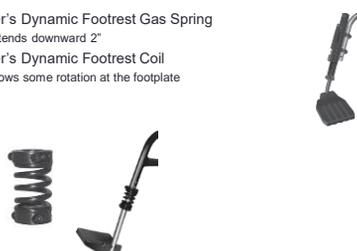
- Placing a calf strap in front of the lower leg can limit knee extension and provide stability when pushed against without completely limiting foot movement
- The client may be able to remove this easier than foot restraints for transfers



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## Dynamic Footrests

- Miller's Dynamic Footrest Gas Spring
  - Extends downward 2"
- Miller's Dynamic Footrest Coil
  - Allows some rotation at the footplate



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## Dynamic Footrests

- Miller's Dynamic, Articulating Footrest Hanger



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## Dynamic Footrests

- Seating Dynamics
  - Dynamic footrest
  - Elevates 30 degrees
  - Telescopes 1 1/2"
  - Dynamic dorsi/plantar flexion



Start at 41 seconds

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## Dynamic Footrests

- Seating Dynamics
  - Dynamic footrest



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## Dynamic Stability: the head



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## Head Dynamic Stability: advantages

- Providing some movement can:
  - reduce breakage of head support mounting hardware
  - Reduce loss of alignment of head support
  - Diffuse force

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## Head Dynamic Stability: disadvantages

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

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## Head Dynamic Stability: product options

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

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## Dynamic Headrest Options

- Miller's Dynamic Headrest Interface



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## Dynamic Headrest Options

- Miller's Dynamic Headrest Horizontal Adjustment Bar



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## Dynamic Headrest Options

- Otto Bock Dynamic Rock-n-Lock Headrest Bracket
- Spring loaded mechanism, 1 1/2" travel
- Shrouded to protect hands and hair



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## 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



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## Dynamic Headrest Options

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




TD-100

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## Dynamic Headrest Options

- Symmetric Designs Axion Rotary Interface





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## 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

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## Case studies

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

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## Austin

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



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## Austin

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



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## Austin

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



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## Austin

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



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## Spencer

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



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## Spencer

- Spencer sat with his elbows and wrists in quite a bit of flexion
- He used a switch placed over one hand
- When he extended, his UE flexion worsened and his access decreased

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## Spencer

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



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## Spencer

- 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



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## 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

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## Spencer

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

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## 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



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## Alexi

- Alexi
- 15 years old
- TBI



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## Alexi

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



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## Alexi

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

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## 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

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## Alexi

- Step 1:
- Dynamic footrest hangers
- Problems:
- the pivot point was too low
- Alexi's extension often "jammed" the mechanism due to angle of movement



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## Alexi

- Step 1:
- Dynamic Back
- Alexi could extend and activate the back
- This would lead to loss of pelvic position



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## Alexi

- Step 2:
- Kid Rock



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## 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



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## Rachel

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



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## Rachel

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

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## Rachel

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

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## 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



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## Rachel

- 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



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## Rachel

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

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## Daniel

- Daniel
- Cerebral palsy
- Age 9



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## Daniel

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

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## 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

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## Daniel

- Kid Rock
- 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

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## 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



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## 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 anew tilt in space MWC with Seating Dynamic components
- This has met his needs very well!



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## Taylor

- Taylor
- Cerebral Palsy
- Age 22



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## Taylor

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



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## Taylor

- 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

## Taylor

- 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



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## Taylor

- 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

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## 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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## Contact Information

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