DYNAMIC SEATING
ENHANCING PARTICIPATION THROUGH MOVEMENT

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Disclosures

- Michelle: provides education for Seating Dynamics and Stealth Products
- Jessica: none
Learning Objectives

The participant will be able to:

1. describe three indications for why a dynamic seating system would be recommended
2. discuss three options for providing dynamic movement at the hip or pelvis.
3. discuss three options for providing dynamic movement at the head.
Introductions

• Who we are
• Who are you?
• Goals?

The Dynamic Duo!
What we are covering today:

- What is Dynamic Seating?
- Pelvis
- Lower Extremities
- Head
What is Dynamic Seating?
Dynamic Seating – a definition

- Dynamic Seating is movement which occurs within the seat and/or wheelchair frame in response to force from the client. Dynamic components absorb force which in turn assists the client back to a starting position.
Dynamic- Constant Movement

Photo courtesy of Medfit

Mirriam -Webster
Bi-directional On One Plane

- A force initiated by the person sitting in the wheelchair begins the movement in one direction and then brought back to the original position.
Multi-directional- Several Planes- Incorporates Rotation

Photo courtesy of Fitness First
Mechanical
Non-mechanical

Air bladders

Stretch fabric
Adjustable Air Cell Cushions

Kathy Riley and Barbara Levy Crume 1990s- seating system to accommodate to changes in position for child with constant fluctuations with extension, flexion, and rotation.


Cushion adapting to changes in position allowing for ultimate pressure relief

Take Away Message

• There are many interpretations of dynamic seating, including:
  • Directional: bi or multi
  • Mechanical vs. Non-mechanical
Questions?
What are the Goals of Dynamic Seating?
Clinical Applications

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

Dynamic Seating – Goals

• Primary Goals:
  1. To allow movement
  2. To diffuse force
  3. To protect the client, seating system, mounting hardware, and mobility base
  4. To improve postural control
Goal #1: To Allow Movement

- What are the benefits of movement in the wheelchair?
  - To increase sitting tolerance and compliance
  - To provide vestibular input
  - To increase alertness
  - To decrease agitation
  - To increase function
  - To provide active range of motion
Goal #2: To Diffuse Force

• By diffusing force, we achieve these goals:
  • *To reduce active extension
  • To reduce energy exertion

• Which in turn, may also help:
  • To increase sitting tolerance and compliance
  • To decrease agitation
  • To increase function
Goal #3: To Protect

- To protect the client
  - If the client is exerting enough force to break components, injury is very possible
  - Micro-concussions
  - Other injuries
- To protect the seating system, mounting hardware, mobility base frame
Goal #4: Postural Control

- By providing movement against light force, strength may build
- This can lead to improved trunk and head control
- **Warning**: the primary purpose of dynamic seating is not therapeutic
Questions?
What does the Research say about Dynamic Seating?
What Does the Research Say?

  
  - Quantitative movement analysis was used to compare movement during an extensor thrust with a dynamic back and with a rigid back.
  
  - Results: *decreased extensor thrust, increased range of motion* in anterior-posterior direction, *decreased vertical trunk movement* during extension and *decreased upper extremity movement* (reduced large UE movement).
What Does the Research Say?

  
  * Dynamic seating resulted in the reduction in spasticity intensity and in contact pressures, a better posture stability, a better comfort, an improvement in functional aspects, and the prevention of damages to the seating systems, and a better vocal and/or breathing ability.*
What Does the Research Say?

- Ferrari A. (2003). "In terms of posture and postural control", Giornale Italiano di Medicina Riabilitativa, 17 (1); 61-7
  - Researchers observed that a thoroughly designed dynamic seating system induces a decrease in the intensity and duration of the extension pushing movement at the trunk and head level, a lesser hyperextension of the head during spasms, a lesser involvement of lower limbs, a greater consistency of anatomic parts with the components of the posture system during and after the spasm (maintenance of correct posture), a lesser consumption of physical energies by the patient, and an improvement in swallowing and consequent reduction of saliva.
More Research Information

- Literature Review on Dynamic Wheelchair Seating
- www.seatingdynamics.com
  - Resources
    - Downloadable Information
Questions?
Dynamic Seating Survey Results
Survey

- Spring 2016
- Survey on Dynamic Seating completed
- 103 participants
- Goal: to determine the need and applications of Dynamic Seating
Survey

- Results
  - Published in Mobility Management February 2017
- 87% currently using Dynamic Seating
  - 66% modular components, 34% integrated systems
- 89% believe Dynamic Seating is underutilized
- 75% believe we need more product options
- 20% believe that current options can be improved
  - Greatest product challenges (descending order):
    - Funding (59%)
    - Durability (49%)
    - Client loses position upon return to upright (48%)
Survey

• More Results:
• Clinical Applications:
  • 79% use with clients with increased tone
  • 21% use with clients who need movement
  • Dynamic Seating used most **frequently at** (descending order):
    • Trunk
    • Lower Extremities
    • Pelvis
    • Head
    • Upper Extremities
Survey

• More Results:

• Clinical Applications:
  • **Goals** of use (descending order):
    • Increase sitting tolerance and compliance
    • Protect wheelchair and seating hardware from breakage
    • Decrease agitation
    • Increase function
    • Reduce active extension
    • Provide active range of motion
    • Increase strength and postural control
    • Reduce energy exertion
    • Provide vestibular input
    • Increase alertness
Questions?
Dynamic Seating Products
Dynamic vs. Static Seating

- Static seating may be required for some clients
  - To prevent injury
    - i.e. foot catching
  - To promote function
    - i.e. access a switch (maintaining alignment)
Dynamic Product Options

Category #1

- Options to prevent breakage of the wheelchair frame and seating system by diffusing force
  - Often little movement
  - Appropriate for clients who lack range or tolerance for more movement

Category #2

- Options to provide client movement to:
  - Diffuse force and reduce tone
  - Provide active movement for increased sitting tolerance, vestibular input, increased alertness, decreased agitation, etc.
Dynamic Products

• Many dynamic seating products options are available
• Assessment is completed by a team who specializes in seating and mobility and who can trial equipment with the client
Integrated and Modular Dynamic Seating

• Integrated
  • These systems are a complete seat and wheelchair, generally, and not retrofittable to other bases
  • Multiple dynamic movements work together
  • Mostly available outside the USA

• Modular
  • Separate dynamic components which are retrofitted to a manual and, sometimes, a power wheelchair
  • Dynamic components can be combined to provide movement in more than one area
Dynamic Seating at the Pelvis
Dynamic Seating: the pelvis

- Allowing movement at the pelvis has advantages and disadvantages
Pelvic Dynamic Seating: advantages

- If pelvic movement is blocked, this force can be transferred to other body areas, resulting in increased extension. Providing movement at the pelvis reduces overall extension.
- Movement of the pelvis shifts weight which provides pressure relief and comfort
Pelvic Dynamic Seating: disadvantages

- 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
Pelvic Dynamic Seating: 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: product options

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

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

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

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

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

- KiSS for Wheelchairs, in USA (not yet available)
- Allows constant articulated motion
- Can fit on most manual wheelchair frames
- Seat Back and Seat Base can be installed separately or together
Netti Dynamic Wheelchair

• By Alu Rehab, in Norway
Netti Dynamic Wheelchair

- Provides movement at feet, knees, hips, head
Netti Dynamic Wheelchair

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

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

- Movement occurs only at the back
- Can often be combined with other dynamic options to provide movement in other areas
Convid / R82 X:Panda

- This seating system can be placed on several bases, including a stroller base
- Dynamic back
- Point for rotation is close to the axis of the hips to maintain position and reduce shear
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
Otto Bock Dynamic Back

- Dynamic Extension Relief Back
- 4 sets of springs between back and mounting hardware
- Captures movement back and rotation
- Springs are shrouded
Seating Dynamics Dynamic Back

- Seating Dynamics
  - Dynamic rocker back
  - Resistance is adjustable through a set of elastomers
Seating Dynamics Dynamic Back

- Seating Dynamics
  - Dynamic rocker back
Stealth Products Dynamic Back

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

- Tarta back
- Off the shelf, can customize
- Similar to the Ortho Flex back
  - Made in Italy, but available in the USA
- Goal: to assist movement to improve function
Sunrise Medical Dynamic Back

- Mono Back or Dual Cane
- Available on Quickie manual wheelchairs
- Locks out
- Dynamic option
Questions?
Break Time!

• Be back in 15 minutes!
Dynamic Seating at the Lower Extremities
Dynamic Seating: the lower extremities
LE Dynamic Seating: advantages

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

- Dynamic components
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
  - Telescopes 1 ½”
    - Use alone for clients who may otherwise lose the position of their pelvis
      - Tight hamstrings
  - Optional knee extension 30 degrees
  - Optional dynamic dorsi/plantar flexion, 17 degrees each direction
  - Resistance is adjustable through springs
Dynamic Footrests

• Seating Dynamics
  • Dynamic footrest
Questions?
Dynamic Seating at the Head
Dynamic Seating: the head
Head Dynamic Seating: advantages

• Providing some movement can:
  • Absorb force and protect the neck and brain
  • Reduce breakage of head support mounting hardware
  • Reduce loss of alignment of head support
  • Diffuse force
Head Dynamic Seating: disadvantages

- Movement can lead to postural insecurity
- Excessive movement can trigger reflexive response
  - Moro
  - Tonic neck
Head Dynamic Seating: product options

- Metalcraft
- Miller’s Adaptive Equipment
- Otto Bock
- Seating Dynamics
- Stealth Products
- Symmetric Designs
Dynamic Headrest Options

• Metalcraft
  • Bi-directional
  • prototype
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, 8 degrees
    - Resistance can be changed using different elastomers
  - Multi-Axis moves in both X and Y Axis and anywhere in between
    - Capturing posterior and rotational movements
Dynamic Posterior Head Supports

- Stealth Tone Deflector
  - 10 degrees any direction
    - Works well for clients who do not tolerate a larger degree of movement
    - Protects hardware
  - Absorb and Avert!

3.2018
Dynamic Headrest Options

• Symmetric Designs Axion Rotary Interface
  • Friction knob
Dynamic Headrest Options

- Whitmyer Flex Interface Bracket
  - Provides movement upward and then back to neutral
Movement and Dynamic Components at the head

- Phillip doesn’t have dynamic head components…yet
  - Note bald spot!
Questions?
Dynamic Seating at Multiple Body Sites
Combination Approach

- Remember, these components can be used in combination
Suspension
Suspension

• Suspension has the potential to decrease pain for individuals going over thresholds, bubbled surfaces at end of sidewalk ramps, cracks in the sidewalk, cobblestones, and pea gravel.

• Independent testing at Colorado State University using 5 subjects noted significant reduction in accelerations (shock) at seat pan of tilt-in-space wheelchairs.


• Colorado State University
Suspension

- Rolling over any variance in the surface leads to jarring. Even rolling over smooth surfaces leads to vibration.
- Vibration and jarring can lead to:
  - Pain
  - Spasms and increased muscle tone
  - Loss of positioning
  - Fatigue
  - Decreased sitting tolerance
Dynamic Suspension System (DSS)

- Seating Dynamics
Dynamic Seating Issues

- Determining Resistance
- Durability
- Maintenance
- Shear
- Funding
Determining Resistance
Determining Resistance

- Back
  - Too firm
    - Client cannot activate back
  - Too soft
    - Back engages during tilt or with backpack
    - Client cannot return to upright
    - Metal touches on either side of elastomer
Durability
Durability

- Some client exert enough intermittent, repeated, and/or sustained force to break the wheelchair frame, seating, or mounting hardware
- The Dynamic Seating components have to be stronger than the original equipment
- As the components move, even more durability is required
Maintenance
Maintenance

- Some dynamic components require maintenance, such as replacing worn elastomers
Shear
Shear

- Doesn’t all this movement lead to shear forces?
- Shear occurs when the body does not remain in alignment with the support surfaces
  - i.e. Dentist
- Pivot points
- Degree of movement
Funding
Funding

• Can I get this stuff paid for?
• Much of the time!
• Depends on Funding Source, of course
• Documentation critical!
• Resource:
  • Dynamic Seating Sample Medical Justification Wording
  • www.SeatingDynamics.com under Resources, Downloadable Information
Case Studies
Case studies

• Rachel
  • Movement
  • Vestibular input
  • Alertness
• Daniel
  • Tone
  • Injury
  • Breakage
Rachel

- Rachel
- Cerebral palsy, optic nerve atrophy, seizures
- Sensory issues
- Age 12
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
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
• She also required lower tension springs as she does not exert a significant amount of force and we want the chair to respond easily
• *This is no longer an option*
Daniel

- Daniel
- Cerebral palsy
- Age 9
- 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

- 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
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!
Questions?
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.
Thanks!
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