BIOMECHANICS OF SEATING AND POSITIONING

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OBJECTIVES

- Become aware of biomechanics and its role in seated posture
- Determine relationship between seated posture and..
  - Function
  - Comfort
  - Prevention of deformities and pressure injuries
- Review of mat assessment used in seating evaluation
bi·o·me·chan·ics; bīˈō-mĭ-mănˈĭks)n.
1. *(used with a sing. verb)* The study of the mechanics of a living body, especially of the forces exerted by muscles and gravity on the skeletal structure.
Evaluation begins as client enters the room

- Look at positioning in current set up
- Active propeller?
- Power?
- Dependent
  - Caregivers needs

Be holistic in your assessment-if it doesn’t work for client AND caregivers, it won’t be used
Medical background inclusive of all diagnoses
  - Progressive/degenerative

Vitals-
  - Is respiration or heart rate effected by a change in positioning

Height and weight
  - Is weight stable
    - Medications that may effect weight
EVALUATION

- **Skin integrity**
  - History of pressure injuries/flap surgery
  - Braden Score - lower the score the higher the concern
- **Overall strength and conditioning**
  - How active is the client when in the chair
  - Do they fall asleep in the chair
- **Transfer status**
Cognitive status
- Is client aware of her/his own positioning
- Does client perform own MRADL’s

Orthopedic status
- TONE!!
- Contractures.....where?
- Past surgeries
- Scheduled surgeries
- Any fixations

All environments
FUNCTION

What are clients and caregivers goals and expectations?

- If mobility does not meet goals for client and/or caregivers it WILL NOT be used
  - Does chair need to fold for transport in car?
  - Entrance to home- ramp/stairs/ level
  - Accessibility inside home

- Be sure that the client and caregivers understand the benefits and limitations of the recommended equipment
MAT ASSESSMENT

- Get client out of the chair
- How did they transfer
  - How do caregivers transfer client
- What is tone like
  - Can they sit without support
    - Balance-static/dynamic
    - How much support do they need
MAT ASSESSMENT

- Start in supine - why?
- Best position to see what is flexible and what is fixed

http://www.leckey.com/case-histories/sean/
MAT ASSESSMENT

- Start at pelvis
  - Fixed or flexible

- Trunk
  - Scoliosis/Kyphosis
    - fixed or flexible

- Alignment of head
  - How much support

- Visual field

- Alignment of legs

- History of pressure sores
  - Ability to independently weight shift
Fixed deformity;
  - Seating must accommodate

Flexible
  - Seating can provide correction
  - How much force is required for the correction
  - Be mindful of pressure - where it needs to be applied and clients skin integrity
- Sit client over the edge of the mat
  - 90-90-90
- Good or bad??
- What happens when they are upright against gravity?
Friend or foe??
We are always fighting against gravity
How does gravity effect our clients
what happens when we seat client at 90?

Where does client fall when upright (90) against gravity?
Is weight bearing on the pelvis even?
What happens when you close/open the hip angle?
QUESTIONS
- How much support do they need to stay upright?
- How much support do they need to stay in neutral?
  - Where is that support needed?
    - Always keep in mind fixed or flexible
TONE

- **Spasticity**
  - Extensor /flexion pattern
    - Do they fall back
    - Are hips pulled into extension/flexion/adduction
    - Are lower legs pulled into extension or flexion
Hypotonic

Where does client end up?

Where is their breaking point

- Where they flex
  - Must support above this point and at the counter point
Scoliosis

- Fixed or flexible
  - Flexible
    - How much force to hold it upright
  - Fixed
    - How is this effecting the pelvis?
What position does the pelvis rest in when upright against gravity

- Oblique
- Rotated
- Posterior
- Anterior
- Windswept

- Fixed - where is the ASIS positioned?
- Flexible - can ASIS be brought to neutral
  - How much force is required to hold it in the most neutral position attainable
http://seatingmatters.com/wp-content/uploads/2016/01/Pelvic_Obliquity_CMYK-300x272.png
http://fadavispt.mhmedical.com/data/books/1883/kisnerthera_ch20_f003.png
https://www.google.com/search?q=pelvic+windswept+deformity&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjx8oTMz_PWAhXl1MKHQwuC8oQ_AUIigB&biw=1366&bih=662#imgrc=dctE-zKn68HpVM:
Pelvis

- When the pelvis is in neutral....
  - Where does everything else fall
    - Head
    - Trunk
    - LE’s
  - Where does the pelvis need to be to keep the head and trunk in neutral
Nemesis of proper seated posture

3 muscles
- Bicep femoris
- Semimembranousis
- Semitendinosis

posturehttps://www.t-nation.com/system/publishing/articles/10004209/original/One-Exercise-Isn%27t-Enough-for-Hamstrings.jpg?1482435448
HAMSTRINGS

- **Bicep femoris**
  - Origin: Ischial tuberosity
  - Insertion: lateral condyle of the tibia and the head of the fibula

- **Semimembranosis**
  - Origin: ischial tuberosity
  - Insertion: posterior medial condyle of the tibia

- **Semitendinosis**
  - Origin: Ischial tuberosity
  - Insertion: proximal medial tibia
What does all this mean
- most of our clients have hamstring contractures
- Contractures and tone will significantly impact where the pelvis ends up

**THINK....**
- If I decrease the pull of the hamstrings, where will the pelvis end up
- When I get the pelvis in neutral where does everything else end up
- If the pelvis is in neutral and the trunk and spine are not.....NOW WHAT???
Questions to ask

- Where does the pelvis need to be to keep everything else in neutral
- How much flexion/extension do the hamstrings need to be in for optimal pelvic positioning
  - 70° (standard), 90° (contracture hangers)
    - more or less than either of these
  - Be aware of vision, swallowing, breathing and how overall positioning effect everything
**HEAD AND TRUNK**

- **GOAL** - get the head and trunk in the most neutral position attainable
  - **WHY?**
    - Breathing-
    - vision
    - Swallowing

- Pelvis and hamstrings may not be in neutral
  - That’s OK!!!
Observation of breathing pattern

- Where is client breathing from
  - Diaphragm/, upper chest
    - What muscles are they using to inhale
      - Careful of blocking these muscles
  - Are they barrel chested?
  - What happens if you support them laterally at the rib cage
    - Do they still have an efficient inhale/exhale or does lateral support decrease this....
Keep in mind that all the support you give may cause pressure - can the client/skin handle that pressure

- Pressure mapping
PUT IT TOGETHER

- Gravity
- Tone
- Orthopedic deformities
  - Fixed/flexible
- Contractures
- Pressure

NOW YOU ARE READY TO SELECT A SEATING SYSTEM...GOOD LUCK
SEATING EVALUATION

- MANUAL
  - Propulsion
    - Upper extremities
    - Lower extremities
    - Unilaterally
    - Bilaterally
    - Endurance
    - Is it enough to be functional
  - Dependent

- Power
  - Cognitive status
    - Safety
    - Reflexes
    - How will they operate controls
      - Hand/head/elbow
      - Knee/foot
SEATING EVALUATION

- BACKS
  - Off the shelf
    - Minimal support needed
  - Planar
    - lateral supports-flexible deformities
  - Custom molded
    - fixed deformities

- CUSHIONs
  - Off the shelf
  - Pressure relieving
    - Air filled
    - Gel components
    - Foam components
  - Custom molded
    - Fixed deformities
SEATING EVALUATION

- **HEADRESTS**
  - Fixed
  - Adjustable
  - Curved
  - Tri-piece
  - Custom

- **ARM RESTS**
  - Fixed height
  - Adjustable height
  - Full arm pad
  - Desk arm pad
  - Custom
SEATING EVALUATION

- **LEG RESTS**
  - Fixed
  - Swing-away
  - Lift off
  - ELR - Really??

- **Foot plates**
  - Lift up
  - Angle adjustable
    - Foot straps
    - Foot sandals
      - Rigid
      - Flexible

- **Lateral trunk and hip supports**
- **Medial knee supports**
- **Lateral knees supports**
- **Chest and pelvic straps**
As the clinician you must use a MEDICAL justification for each piece of equipment you are recommending

- Why is this piece the best for:
  - postural support,
  - prevention of further deformity,
  - function
• Tone and Gravity will dominate
  ▪ Work with it

• Head and spine in neutral
  ▪ Let the pelvis fall where it needs to

• Hamstrings-Keep them on slack
  ▪ be wary of recommendation of ELR

• Clinical midline may not be your clients midline
  ▪ Use 90-90-90 only as a starting point
THANK YOU