Shape Matters: *Meeting complex posture and skin care needs through custom seating*

*Professional & Clinical Services (PCS) Department*

Clinical Specialist – Human Mobility
Ottobock North America

---

**Course Objectives**

At the end of this one-day program, participants will leave with an understanding of….

• Outline a clinical process for prescription of custom seating from assessment through final fitting
• Explain the importance of isolating hip ROM from pelvic movement when assessing a client.
• Identify 2 clinical reasons why off the shelf seating is sometimes not enough for certain clients who present with more complex skin and postural needs
• List the steps involved in setting up the simulator and bags prior to transferring the client for their shape capturing
• List the steps involved in capturing a shape using scanning technology
• Identify 3 features of a seating system that will assist with Pressure Redistribution: Postural Management and Microclimatic Management for our client
Shape Matters

Agenda – full day program

• Clinical overview of the process and why it’s critical
• Hands on demonstration of an assessment with client who presents with more complex postural, functional and skin integrity needs
• Analysis and summary of findings including language for justification
• Prepare to capture the clients shape
  - Prepare the simulator (angles and orientation) & wedges
  - Prepare the shape capturing bags, or not
  - Role delineation for the ideal shape capturing team
  - Demonstration of capturing a good shape
• Transfer client for shape capturing in optimal alignment as determined by hands on assessment findings

• Demonstration of capturing this client’s shape (then client dismissed)
• Demonstration of scanning technology components
• Discussion
• Questions/Answers
What kind of referrals do we get?

- Is the referral in reaction to a ‘problem’ that has ‘just’ presented, or been insidious in onset?
- Is the ‘problem’ identified really a set of symptoms?
- Or have the underlying causes of this problem been identified?

- Is the problem predictive of future problems?

Best Seating/Positioning Practices
Best Seating/Positioning Practices

- First Observe patient as they arrive or present
- Check the Seating System they have just transferred out of (and onto your adjustable height table (MAT table) & how it is being used
- Hands-on Physical Assessment of patient on an adjustable height table/ plinth in supine. ROM, muscle tone and spasms, skin integrity
  Flexible, *fixed*, response of body segments to each other; What being used to function/ limitation
- Check Level of Sitting Skills from MAT table
- Understand symptoms versus causes
- Translate the Clinical Findings into goals and potential product parameters – acknowledging that there is generally more than one solution to each cause, and that each will have different consequences to be considered

**NB.** Terminology

- What is *flexible*? Work towards alignment to the neutral/ functional posture
- What is ‘*fixed*’? (NB. Generally can continue to deteriorate) Work towards accommodation of presenting posture but maximize contact surfaces

- **Position** is static, inactive
- **Posture** is typically active, dynamic and in response to environmental conditions, prepares body to move
Best Seating/Positioning Practices contd.

• Physically Simulate postural prompts to support postural alignment
• Identify Where the seating system will be used – home, day care facility, transportation, etc.
• Identify and agree Seating Goals/ Objectives
• Trial of Proposed Solution – prior to the final prescription
• Client/ caregiver Education on equipment use

• Understand Funding/ Reimbursement impact on final prescription
• Can you Clinically Reason and defend your prescription/ recommendation in court if necessary?

The Process of Sitting

To sit we need to

• Flex our hips
• Get our buttocks back as far as possible on the seat
• Weight bear through both of the ischial tuberosities, posterior thighs and feet with the knees flexed
• Ideally with the trunk and head upright and balanced above the pelvis
Question

How many of us have moved some part of our body in the last 5-10 minutes? Why?

Think of sitting on a chair without a back, or on a chair that’s too tall for your feet to touch the ground….. What does this feel like?

*NB.* The process of sitting requires **effort** on the part of the individual to maintain (this is true for all of us)

Therefore...

We want to provide optimum support, and make sitting less effortful and less damaging for our clients.
Need to understand

To understand what we are seeing in our clients we need to understand the Principles of Seating

Note the variations of what is typical amongst us………

What is ‘good’ sitting and why is it important?

• By approximately ten months of age, a typically developing infant demonstrates good sitting posture.

• The infant sits with pelvis and spine in a straight line. The head is balanced securely over the body and both hands are free to interact with the environment.

• This is an efficient posture, i.e. it requires the least amount of exertion to maintain.
The Neutral Posture (Zollars 2010)

- Provides a stable base of support
- Creates a posture ready for action
- Supports vision
- Optimizes upper limb movement and function

For good posture think about...

- What is most comfortable
- What is most energy efficient
- What is task specific
- What is less damaging to function and pressure
Benchmark of Optimal Sitting Posture

When looking at the person from the side – three natural curves are evident:
- Concave curve at the neck (cervical lordosis)
- Convex curve spanning chest and mid-back (thoracic kyphosis)
- Concave curve at the lower back (lumbar lordosis)

Consider the very narrow base of support....

In the seated position the pelvis is making contact with the inferior seating surface on a very narrow ischial base of support.
Spinal Stacking

The “Spinal Stacking” is instrumental to balancing the head and trunk above the pelvis.

Important to be aware of the distance between the lower ribs and the pelvis.

This stacking is also important to the careful balancing of the 10-12lb weight head over the spinal column.

Source: [http://christinebickley.co.uk/standing-and-seated-posture](http://christinebickley.co.uk/standing-and-seated-posture)

In the Absence of Intact Neuromuscular Control:

- The goal of seating and mobility systems as well as all other positioning systems is to provide that support externally,
- As well as to accommodate for any postural limitations as necessary.
- Without this support the individual will not be able to function efficiently or safely, without some postural compensation and/or skin integrity compromise.
- They will present as ‘Hands Dependent’ or ‘Fully Dependent’ upon another position to maintain an upright seated posture; ie. What is their balance and postural control in sitting?
Common Postural Deviations when combined in any combination can become complex

- Posterior or anterior pelvic tilt
- Pelvic obliquity & pelvic rotation
- Trunk collapse – laterally or forward
- Shoulder protracted and internally rotated, retracted and external rotation, elevated
- Deviated head position – how many head positions can you think of?
- Hips abducted/ externally rotated
- Hips adducted/ internally rotated
- Feet toward center of foot support or all to the right or left

Observe trunk collapse and head position
When you are not in your chair........
Where are you?

Some Consequential Functional Challenges when Posture is Not Optimally Supported

• Decreased respiratory function (Hardwick 2002; Massey)
• Swallowing difficulties (Hardwick 2002)
• Reduced voice projection (Costigan & Light 2011)
• Skin integrity issues/ unable to weight shift (RESNA White Paper 2015)
• Reduced upper limb function and reach
• Digestion & Elimination (Hardwick 1994)
• Postural stability (Cheng 2009; Chung 2008; Stavness 2006)
• Vision
• Influences transfer technique adopted
• Comfort
• Blood/ lymphatic circulation
What are some of our biggest seating challenges with the client who exhibits muscle weakness or changes in muscle tone?

Clinical perspective:

- Head position (+++)
- Extreme lateral lean in the trunk
- Lower extremity function

To help our clients reduce the effort required for sitting, we need to fully understand what is happening...

What factors are influencing the relationship between the pelvis and the hips, and the pelvis and the spine, with respect to seating....

And learn this as early as possible for the person to prevent structural deviations.
Ultimately Sitting is for Function

Divide goals into three areas:

1. Activity related/functional e.g. swallowing, feeding, drinking, reading.
2. Physiological function e.g. respiration, digestion, elimination
3. Psychological function e.g. effective communication/socialising/self image

Goals of Seating Solutions

[Diagram illustrating various aspects of seating solutions]

Skin Protection
Postural Management
Functional Independence

Impact Damping
Pressure Redistribution
Shear Reduction
Microclimatic Management
Increased sitting tolerance (Comfort)
Postural Stability
Postural Alignment
Tone Management
Access to MRADL
Physiological support
Ladder of needs

Clients who use wheelchairs who have moderate to severe/complex postural deviations and who are at moderate to high risk for skin integrity issues

Clients who use wheelchairs who have mild to moderate asymmetrical postures and who are at moderate to high risk for skin integrity issues

Clients who use wheelchairs who have symmetrical posture and who are at low to moderate risk for skin integrity issues

Ladder of Seating Product Solutions

Custom configured seating – contoured and molded

Off the shelf modular seating – customizable and adjustable

Basic off the shelf seating – non customizable
Ladder of Complexity of Justification

Clients complex postural needs and skin needs cannot be met with off the shelf seating even if it is customizable. This is the basic essential seating that is necessary. US: only codes E2609 & E2617

Clients asymmetrical postures cannot be accommodated by basic seating and/or client is at risk for skin integrity issues as well as possible future change. E2607/08 and E2622/23
US: E2603/4 : Skin only E2605/6: Positioning only

Everyone who needs and qualifies for a wheelchair needs basic seat cushions and back supports to facilitate a functional, safe seated posture. US: E2601/02

The Clinical Process

Assessment through Fitting

10/10/2017
Step 1: The Hands on Evaluation

1. Skin integrity analysis
2. Postural presentation analysis in the existing equipment and out of it on the MAT table
3. MAT Evaluation: Measurements & note any deformities, anatomical linear dimensions, angles – relative and absolute, existing system requirements, define any pressure distribution needs
4. Functional evaluation/analysis
5. Documentation

Steps 2-5

Step 2 – Identification of Goals/ Objectives. Include determination of any environmental/ social constraints upon prescription

Step 3 – Translating assessment findings & goals into generic product parameters

Step 4 – Trial and selection of product solutions

Step 5 – Justifying, securing funding, delivery and final fitting
Step 1 – Hands On Evaluation

Skin Integrity


2. A pressure injury is localized damage to the skin and/or underlying soft tissue usually over a bony prominence or related to a medical or other device. The injury can present as intact skin or an open ulcer and may be painful. The injury occurs as a result of intense and/or prolonged pressure or pressure in combination with shear. The tolerance of soft tissue for pressure and shear may also be affected by microclimate, nutrition, perfusion, co-morbidities and condition of the soft tissue.
Skin Integrity contd.

3. The new term more accurately describes pressure injuries to both intact and ulcerated skin.
4. Pressure injuries are staged to indicate the extent of tissue damage. Staging illustrations available at http://www.npuap.org/resources/educational-and-clinical-resources/pressure-injury-staging-illustrations/

Skin analysis

1. Braden scale
2. PUSH tool 3.0 http://www.npuap.org/resources/educational-and-clinical-resources/push-tool/push-tool/ for observation and monitoring of pressure injury
3. Pressure mapping
Pressure redistribution in normal upright sitting

Typically 50% of our body weight is supported through approximately 8% of our body area – this can result in high interface pressure (Trumble 1930).

75% - through buttocks and thighs
19% - through feet
4% - through the back
2% - through the arms

(Staas & Cioschi 1991)

Pressure Mapping

• Mapping is a visual tool demonstrating all pressures occurring in the seated environment as a pattern;
• It augments your skin assessment and history taking;
• Visualizes pressure shifts and changes;
• Visual display that is easily understood by client
• Useful for teaching effective weight shifts

• You must understand what the picture is showing you – eg. Know what bony prominences are where
• Typically we need some degree of pressure under the IIs to give a degree of stability

10/10/2017
Pressure mapping

Take measures after 6mins of settling time in sitting  *(Stinson et al. 2002)*

1. **Peak pressure index (PPI)** - average of the highest recorded pressure values within a 9-10cm² area. On its own has minimal clinical use.

2. **Coefficient of Variance instead (CoV)**, represented as a percentage, offers more insight with respect to evenness of pressure distribution – the lower the CoV the better

3. **Distribution** of pressure with regard to **symmetry** – compare right with left

4. **Total contact area** - representative of the goal to distribute the forces (body weight) over as large an area as possible


Where do pressure injuries typically occur?

- Sacrum or coccyx 36%
- Trochanters 17%
- Ischial Tuberosities 15%
- Heels 12%
- Ankles 7%
- Other 13%

*(Smith 1995)*
Risk factors

Intrinsic

• Poor nutrition
• Incontinence
• Muscle atrophy
• Aging skin
• Orthopedic deformities
• Excessive body heat (Body temperature regulation)
• Disease
• Circulation problems
• Smoking

Extrinsic

• Pressure
• Friction
• Shear
• Moisture
• Heat

Prevention

1. Appropriate seating
2. Regular weight shift/ position changes
3. Skin inspection
4. Education
5. Pressure redistribution cushions
   • Immersion – cushion needs to be deep enough to allow immersion (Sprigle 2000)
   • Envelopment – support surface needs to conform/ mold around the body irregularities.
Skin integrity contd.

Questions to ask

1. Is there presence of non blanchable erythema or open wounds on the seated surfaces? If yes – then consider HIGH risk
2. Is there a history of non blanchable erythema or open wounds on the seated surfaces? If yes – then consider HIGH risk
3. Can the client do an independent and effective weight shift consistently? If no – then HIGH risk.

These clients likely need full pressure management through the cushion, back support +/- weight shifting technology

If not at high risk....

Consider also.....

1. Atrophy (less weight bearing/loading surface available)
2. A lot of movement when seated
3. Moisture/heat

Perhaps shear reduction and/ or microclimate factors need to be considered
Postural Presentation in Existing system

- Observe
- Any heat – where client has made contact with support surfaces
- Any wear & tear
- Positioning of lateral supports
- Addition of any pillows, wedges, etc…

The Hands On-MAT Evaluation

- Supine & Sitting
- Not always possible for some patients
- On a firm surface
- Looking for the available pelvic/ spine/ lower extremity join ranges/ flexibility/ relative body angles…… as related to the seated position.
Hip Flexion with knee bent

Knee flexion and extension with hip flexed

Remember – relevant to sitting
Hip Adduction & Abduction

Hip Internal & External Rotation
Accurate client measurements


Some important measures

• Typical measures – linear
• Thoracic curve depth – useful for when planning for a custom contoured back support, when sufficient depth of the surface is required to accommodate a large thoracic kyphosis or rib hump.
• Maximum sitting width – maximum horizontal distance between the most lateral part of the upper body and the most lateral part of the lower body.

1. Maximum lower body width - important for overall wheelchair footprint to get through door access points.
Client Functional Evaluation

- What is the method of weight shifting? Is it effective and done consistently?
- Method of transfer used between all surfaces?
- When is not in their chair, where are they? How much time do they spend in/out of their chair?
- Consider positioning/seating during all activities of daily living
  - toilet
  - bathing/showering
  - sleeping
  - resting – where? Several places?
  - feeding
  - transportation (car seat)
  - recreational activities

The Sitting Footprint/ Postural Presentation Analysis

Where are the loading surfaces?
Primary weight-bearing areas of body segments in the wheelchair seated person?
Consider the inferior, posterior, lateral and anterior surfaces
What impact does gravity have?

How can we maximise the footprint?
What is the optimal footprint for each client – is there one?
Sitting Footprint Checklist

PRIMARY SUPPORT SURFACES

Inferior
Posterior

May need gravity to assist as long as its functional
How much orientation is necessary?
5-15°
45-60°

PRIMARY ASSISTANTS……..

Anterior supports
Lateral supports

At the end of this part of the assessment

- Should know if the client is at high risk, moderate risk, or low risk of skin breakdown.
- Important – record the why… they are at risk.
- What ROM has the client with regards to sitting
- What are their functional skills that they do whilst seated

With this information – you know where to start on the ladder of solutions for a cushion, back support, positioning system to try!
Think about all the variations in body sizes and shapes

- Average sized person
- Atrophied buttocks
- Bariatric shape
  - body shapes and sizes vary tremendously
  - adult pelvis sizes vary very little

Considerations for tone management

HIGH TONE
- consider the triggers
- consider the inhibitors

What can the seating and mobility system do in reality to effect the inhibitors?
What might it be doing to motivate the triggers?
Facilitate Functional Tone

- We need tone to interact with the environment
- Identify triggers and inhibitors
- Reduce as many triggers as possible in seating mobility system
- Provide a safe environment with surfaces that the child can get back to
- Respect that sometimes static solutions are not ideal for dynamic postures

Support for justification....

Client requires xxxx due to a significant postural asymmetry; ...however, and off the shelf, or modular system can not meet her needs because.....

Client has severe fixed right pelvic obliquity and fixed right convex scoliosis, which cannot be accommodated in an off the shelf seating system/back/....

Prevention of..... *(the insurance companies not interested in maintenance)*
Role delineation

The ideal shape capturing team

- **Client** and primary **Caregiver**
  - **Clinician** who has completed the full MAT evaluation.
  - They will keep their hands on the client and observe the client and their posture as shape is being captured.
- **Supplier** who will capture the shape; scan the file and complete the order form to be sent to manufacturer with the scanned/saved file
- **Manufacturer** if present to guide the process
Translating the MAT evaluation measures to the simulator

Needed to set up the simulator correctly
Seat to back angle based upon the hip ROM
Back of buttocks to back of knee – to give seat depth to set simulator seat to
Pelvis mobility and position – do we need to build up or accommodate through the seat molding bag
Footrest – on or off?

Preparing the Simulator

Angles: Orientation & at times linear measurements
• Seat to back angle
• Rearward tilt
• Forward tilt
• Foot placement: thigh to lower leg angle and lower leg to foot angle
Discuss and demonstrate tools that may be helpful
eg. wedges - ischials remain level while we allow the hips to open
Preparing the Molding bags

Shape and angle
• Remove jewelry
• Wear gloves when in doubt
• Check for latex allergy/ sensitivities
• Consistency of the bags playdoh – basketball

The do's and don’ts of capturing a good shape
• Don’t start at the sides and pull in or up
• Roll the beads

Capturing Shape

Clinician to secure the client’s optimum posture – provide pelvic and sacral-lumbar stability
Watch for head and shoulder alignment

Supplier – mold the bags to the patient. Capture pelvis first usually to give stability; then lower back and up spine, with laterals as need.

• Remold if not happy.
• Allow client time to relax into system.
Molded bags capturing patient shape

Full System…

Back only….

Mark Trim Lines and take Check Measures

- Bring simulator upright
- Laser for verticals – add orientation marks
- Mark trim lines, soft spots
**Scanning**

- Good lighting to eliminate shadows
- Plus scanner into USB port on your laptop and open the Sense™ software
- Hold scanner upright with cable at bottom, with full seat visible on computer screen
- In software, under Scan settings select Object
- Press Scan button or hit space bar and hold the scanner steady during the countdown
- Slowly move scanner perpendicular to ground until all white speckles disappear, and you can see full seating system on screen with all 6 alignment/orientation marks and trim lines clearly visible
- Press Finish in the software to end the scanning process

**Important points to remember when scanning**

- Simulator to come back upright position
- Good lighting and eliminates shadows
- 6 orientation points whether full system or seat and or back only
- Complete surface scanned – no holes on scanned file
- Can use erase buttons on software to clean up image
- Trim lines to indicate edges of back cushion, front of seat cushion.
- Soft spots can be indicated on scan file image
- No extra power outlet required for 3D scanner
Check and Save Scanned Image

- All 6 orientation marks visible?
- No holes?
- All trim lines visible (OrthoShape)
- Save as an .stl or .obj file

- *For TruShape* – use crop, trim & erase
- *For OrthoShape* – leave as is. Ensure trim lines clearly visible

Suggested file name: 2017-02-22_Casey_J

Example images
Tools to support scanning

1. Laser/ bubble level
2. Silly putty
3. Painters tape
4. Pipe cleaners

Ordering

1. Order form – note this asks for critical measures taken from the hands on MAT assessment.
2. Purchase order
3. Digital scan file
Reimbursement consideration

- HCPCS Codes
- ICD-9 Codes
- Coverage criteria
- Documentation
- Labor and mounting hardware

Fitting the back to wheelchair canes

- **Active** user – one set of RAM hardware
- **Dependent** user – two sets of RAM hardware as standard option

- Know which part of back is the Top/ Bottom
- Have hardware level when looking from rear
- Trim off excess wheelchair cane length and cap for
  - active users – caution if user hangs backpack
  - over canes
On-Site Custom Adjustments

- Some minor on-site adjustments can be made to bring the ABS closer or wider from body.
- Use heat gun and thermal insulated gloves
- Apply pressure to hold in place the changes whilst the ABS cools down

OBSS Custom Molded Seating

- OBSS TruShape
- OBSS OrthoShape
Please don’t forget….

Seating does not
- do magic
- administer drugs
- perform surgery

It can only respect what’s so – ie. how the client is.

Therefore we have to set very realistic in our expectations and identify the positives and the negatives of each seating solution we consider.

Take Away Messages

• The Hands on evaluation is a critical part of the process and helps us to understand what we are seeing (symptoms) as well as the underlying causes of the patient’s postural presentation and related challenges

• Respecting the HIPS is key to successfully sitting in terms of postural stability, postural alignment, preserving skin integrity, respiratory and digestive functions.

• Translating assessment findings to product parameters in the language of ‘option a and b’ highlighting the positive and negative potential outcomes to everyone on the team is invaluable

• Trialing the equipment is necessary for the individual, family and clinical team members. It is also essential for the purpose of justifying why the prescribed equipment is in fact the minimal equipment that is essential for the client.

• Remember to document the consequences of the client not getting this essential equipment.
Seating and Positioning is an ART

- Developing skills in seating and positioning our clients is a creative, dynamic problem-solving process
- Utilizes our breadth of skills – biomechanical, ergonomic, neurodevelopmental, and environmental awareness
- Listen and observe your patient – people respond differently. They are unique in how they respond to support, pressure, textures, temperatures
- There are always a multitude of factors and compromises involved
- Requires reflection after every assessment
- Although extremely important for the patient, it can be challenging, but it is fun and very rewarding

Seating and Positioning is also a SCIENCE

Know how you want to use the seating system to assist the client with:

- Optimizing pressure redistribution
- Provide postural stability
- Facilitate postural management
- Management of the microclimate
Parting posture message for all of us

We all need to be constantly aware of our own postures………

Take care to protect and conserve your musculo-skeletal alignment to minimize effort and optimize function, tolerance and health.

Thank you for your attention!

www.ottobock.com