

# Seating Biomechanics

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This is the first slide lecture in a series of eight lectures that are intended to provide an overview of the wheelchair mobility and seating evaluation process. The lecture series contains:

- Seating Biomechanics
- Wheelchair Seat Cushions
- Pressure Mapping
- Wheelchair Backs
- Manual Wheelchair Set-up and Propulsion Biomechanics
- Rehabilitation Technology Suppliers & Clinicians
- Wheelchair Service Delivery
- Documentation

## Abstract and Presenter Bio-sketch

- Mark Schmeler is the Director of Clinical Services at the Center for Assistive Technology. He has many years of front-line clinical experience in seating and mobility with individuals with complex seating needs.
- Mary Ellen Buning is a research associate in the Rehabilitation Science and Technology Department with interest in AT education, service delivery and functional outcomes that result from AT devices and services.

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## Learning Objectives

- Understand the importance of taking a holistic view of the the seated client.
- See the relationship between seated posture and supporting surfaces and comfort, function, prevention of orthopedic deformities and prevention pressure sores.
- Overview of the parts of a mat table evaluation during a seating assessment.

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The field of rehabilitation technology is a young field. We are still needing to prove that what we recommend for our clients will make a difference in their lives.

Clinician education is very important. It is important to have a basis for decision-making because there is no one right product. We need to know where a seating product fits into the lineup of options.

It is kind of like when a physician writes a prescription for a medication.

- What are the indications?
- What are the side effects?

Clinical decision making needs to be educated so that clinician has a sense of balance. Sense of Balance refers to both the human body which needs a ratio of balance and stability for function. It also refers to the balance the clinician needs to help a client acquire. Clients must decide where in the continuum of pressure management and stability they want to be. It will be necessary to make trade-offs in order to get more of one than the other.

## Seating Biomechanics - Medical Considerations

- Prevent Orthopedic Complications
- Maintain Vital Organ Capacity
- Reduce Soft Tissue Strain
- Provide Comfort
- Increased Endurance & Tolerance

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These 5 components of good seating are important.

When the body sits it will inevitably begin to experience orthopedic changes because the body is not well designed for sitting.

Changes in the spine will inevitably lead to pressure on internal organs.

Preventing wrist, elbow and shoulder soft tissue injuries that result from propulsion of a poorly fitting wheelchair.

Remember that preventing pain is much more “reimbursable” than creating “comfort.”

When you don't have to think about sitting, then you are able to focus on the tasks at hand. Good posture helps to give the individual a biomechanical advantage for tasks.

## Seating Biomechanics - Functional Considerations

- Increased Motor Control
- Increased Attention / Awareness
- Increased Independence
- Increased Communication
- Increased Work Performance

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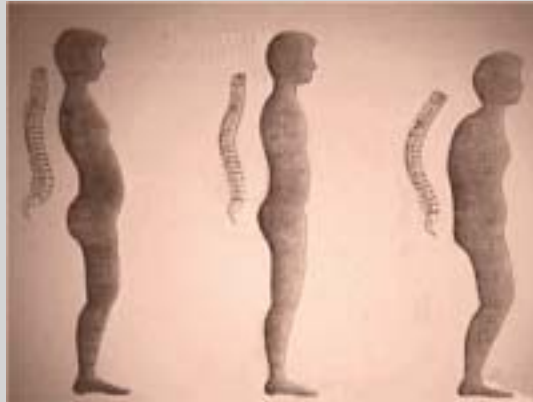
An aside on working on sitting balance with children... it is good to work on sitting balance as a goal but sitting should be "passive" and "unconscious" so that it does not take energy and concentration.

Correcting posture is not necessarily a therapeutic goal. The goal is often to accommodate posture!

When seating is correct then the above listed good things result.

## Overview of Musculoskeletal System

- Pelvis
- Spine
- Extremities
- Head



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The spine is like a stack of blocks with a heavy ball on top. The pelvis is the base. We are dynamic beings who were designed to stand so we have a lot of range of motion and flexibility especially when we are standing.

When standing your legs are your stable base, when seated the pelvis is the base. It actually is an upside down triangle.

Anterior pelvic tilt

Posterior pelvic tilt.

The more stability, the less flexibility.

## Seating Mechanics



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When you place the human body in the seated position (the most functional position when you cannot stand!) you change a lot of things. The body is less flexible. When you sit you quickly lose the spinal curves that helped to create flexibility and stability.

90°x90°x90° seating may be good if you have the range of motion (ROM) to accommodate it. Problems come when the dynamic movement components are missing and the client is forced to sit in that position all day. There will be a failure of the seated posture.

## Posture and Seating

- Human body not designed to sit.
- Pathology of sitting.
- Postural behaviors & exercises.



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Most deformities are developed as we age.

If the neuromuscular system is impaired then the body does not have the ability to correct itself. Then we must provide external supports.

