REDUCING SPINAL PAIN SYNDROMES THROUGH OPTIMAL POWER WHEELCHAIR CONFIGURATION AND POSITIONING

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Pain is a perception signaling tissue damage. Many power wheelchair users suffer from chronic pain - defined as pain that lasts beyond the healing of the injury or occurs frequently and lasts several months. This pain stems from multiple mechanisms. Both nocioceptive pain, created by activation of pain receptors in the skin, muscles, bone, joints, connective tissues and neuropathic pain, damage to the peripheral nerves or the central nervous system itself, is common in wheelchair users.

It is clear that pain syndromes are common and complex but they can be affected by appropriate positional support and wheelchair prescription. During this session, we will use the below parameters and apply them to case studies – emphasizing the clinical applications.

Respect Anatomy

Musculoskeletal abnormalities, hamstring length, pelvic mobility, trunk and head muscle flexibility must be evaluated and accommodated. Worse pain syndromes will be created if limitations are not fully recognized.

Musculoskeletal system	Wheelchair considerations
Hamstring length	Seat depth, lower leg support angle
Hip flexors	Seat to back angle
Anterior shoulder girdle	Back support contour, armrest placement
Neck flexors/extensors	Head support orientation and placement
Hip subluxation/dislocation	Seat depth, seat to back angle, seat contour
Heterotopic ossification	Seat to back angle, lower leg support angle

Minimize Fatigue

Overworked muscles are a primary cause of overuse injuries and subsequent pain. With neurologic diseases, intact muscles attempt to substitute for non-working muscles. These substituting muscles are often in a poor length/tension relationship and might be tonic muscles vs. phasic. When the wheelchair does not support good posture and a stable position, muscles are constantly battling gravity. Static sitting and static sitting in asymmetric postures with poor vertebral loading also creates pain syndromes.

Wheelchair accommodation

Fixed tilt-in-space – defined as the difference in rear seat to floor height and front seat to floor height. Placing 1-2” fixed tilt-in-space will generate passive, gravitational support, allow chest opening and postural muscle relaxation. Greater amounts may cause excitation of the cervical flexors and anterior chest muscles.

Seat to back angle – defined as the juncture between the seat sling and the bottom of the back support. Seat to back angle must accommodate a client’s tolerable hip range of motion. A 90-degree angle limits sliding forces and provides optimal posterior pelvic support. Decreasing the seat to back angle may provide increased support and stability but will alter pressure distribution and may affect function. Shearing forces and spasticity are common drawbacks to an open seat to back angle.

Back angle – defined as the angle of the back support surface. Angulation should be created above the clients PSIS, generally 5-6 inches above seated surface. Often an open back angle of 5-10 degrees dramatically enhances passive, gravitation support.

Seating contour – seat support surface should maximize surface contact and provide maximal pressure distribution. The femurs can best tolerate weight bearing – due to their blood supply and muscle/soft tissue support.

Back contour - Postural stability and support is found by a neutral pelvis loaded by a spinal column in its natural curves. Therefore the back should allow for thoracic extension then fill in the lumbar curve. Excessive lumbar support will push a client out of the system.

"Loading pain"

Static sitting leads to decreased blood flow and ischemic pain syndromes. The client must be able to shift position and perform a pressure relief. This can be accomplished manual or via a power seat function. Tilt provides pressure *redistribution* from the seat to the back without altering hip angle. Lateral tilt provides a change in pressure distribution from one side of the body to the other. Recline improves pressure *distribution* by moving pressure from the seat to the seat and back surfaces. It also provides a change in joint positions. All power seating systems also provide passive gravitational support.

Vibratory stress

Studies show that vibration leads to increased spasticity, and prolonged exposure can cause secondary injuries such as disc degeneration and low back pain. Power wheelchair suspension dramatically decreases these vibratory forces. Suspension is most effective when all wheels have independent suspension and rebound control.

Access to environment

The degree of upper extremity elevation is one of the most important parameters influencing shoulder muscle load. Studies have found an association between overhead activity and the development of shoulder pain. Modifications should be made to environment to allow appropriate access vs. the client making postural accommodations.

Environment modifications
- Computer/mouse work station
- Joystick cut outs in frequently used areas

Wheelchair recommendations
- Power seat elevator
- Swing away joystick
- Appropriate arm rest length – consider both arm support and environment access

Speaker Bio

Amy is a clinical education specialist at Sunrise Medical providing education, training and consultation regarding wheelchair seating and functional mobility. She has over 11 years experience as a physical therapist working with the adult and pediatric populations, with specialties in the treatment of spinal cord injury, and assistive technology evaluation for clients with physical challenges.