I hope everyone voted in the Neurology Section elections. This is my last letter to SCI members as your Chair as I will pass the baton to Karen Hutchinson this summer. I leave this office of leadership with some satisfaction at things achieved (revamped job descriptions, ongoing publication of quarterly newsletters, excellent CSM programming, and an increased presence in international SCI PT issues) and a sense of frustration at my inability to mobilize you as a collective voice.

I was heartened to listen to the lecture of Martha Somers and to realize that she too is a champion of some of my concerns for SCI rehabilitation. We need to WAKE UP to the realization that CHANGE does not equal progress. As we learn more about neuroplasticity, we are recognizing that maladaptive plasticity is at least as strong of a possible outcome as positive plasticity; therefore, we should recognize a need to revisit quality of movement. Efficiency and cost savings which are won by decreased length of stay equally do NOT equate to improved quality of rehabilitation. We need to challenge some of the changes we have made to rehabilitation paradigms. In press at Archives of Physical Medicine and Rehabilitation are the findings of a small study looking at the difference in participation level outcomes comparing manual and power wheelchair use. The manual wheelchair users finish higher! Yet more and more power wheelchairs are being issued as the first wheelchair after inpatient rehabilitation. I am also working on a manuscript that shows the decline in functional outcome measures for patients injured and rehabilitated more recently as compared to prior decades. We have better equipment, more research, and more knowledge. We should have better outcomes. I challenge you to help make that a reality. Good luck, and thank you for the opportunity to serve.
Upcoming Meetings

International Conference on Spinal Cord Injury Medicine and Rehabilitation,
June 4-8, 2011 Washington, D.C.

International Neurorehabilitation Symposium,
June 27-29, 2011, Zurich, Switzerland

16th International Functional Electrical Stimulation Society Conference,
September 2011, Sao Paulo, Brazil

ACRM Progress in Rehabilitation Research
October 11–15, 2011 | Hyatt Regency, Atlanta

Exciting News from 2011 CSM in New Orleans

The Spinal Cord Injury Special Interest Group (SCI-SIG) sponsored an interesting talk entitled “Compensation and Restoration in Rehabilitation after Spinal Cord Injury: A Review of the Evidence and Implications for Practice.” This presentation by Martha Freeman Somers, PT, DPT, MS from Duquesne University on February 10, 2011, was an overview of scientific evidence of interventions targeting activity-based that may influence neuroplasticity for the restoration of motor skills. These interventions were contrasted with a description of compensation strategies whose goal is to regain functional independence. This comparison was extended to discuss circumstances such as level of completeness or AIS classification in which compensation and restoration may be appropriate, during rehabilitation for SCI, and may lead to best practice. In addition, the SCI-SIG sponsored a discussion by Patrick H. Kitzman, PT, MSPT, Ph.D. from the University of Kentucky, on “Challenges and Opportunities for Rehabilitation of Patients with Spinal Cord Injury Living in Rural Communities” February 12, 2011. This roundtable enabled a lively discussion on the increases in risk of individuals with SCI in rural communities for secondary conditions/complications due to lack of access to health care. The discussion was extended to the risks of living in rural environments that are complicated by unemployment rates, lack of transportation and availability of home care resulting in a high rate of rehospitalization. Sample pamphlets from Kentucky rural health and recreation environments as well as travel suggestions were provided.
The International Network of SCI Physiotherapists (www.scipt.org)

This network was set up by Lisa Harvey (Australia) and Joy Bruce (past Chair of the SCI-SIG) three years ago. The purpose of the network is to:

1. encourage and facilitate communication between SCI physiotherapists worldwide
2. support therapists from less-resourced countries
3. share resources and educational material
4. develop potential for future international collaborations in SCI PT research initiatives

In particular we would encourage members to consider uploading any of their teaching or clinical resources which might assist therapists from other countries. Currently there are 120 presentations to view from physiotherapists around the globe and 80 documents and policies, including templates for discharge summaries, policies on PT management, and pamphlets for patients. If you want to get an idea of what happens in other countries, then we would encourage you to take a look. Please also consider contributing something. Your material can help other PTs elsewhere. In addition, the network has a restricted list server comprising up to 7 senior SCI physiotherapists from 40 countries (200 members in total). The US representatives on this list server are Joy Bruce, Jennifer Hastings, Edelle Field-Fote, Sue Ann Sisto, Debbie Backus, Sarah Morrison, Therese Johnston, and Susan Ostertag. If people want any issue raised at an international level, then we would encourage you to communicate with one of these people, and ask them to post a message on your behalf. The organization’s latest newsletter is on this website (http://www.neuropt.org/go/special-interest-groups/spinal-cord-injury/new-and-noteworthy/).

E-learning in SCI for Students and Junior Physical Therapists

There is currently an initiative to develop e-learning modules in SCI for students and junior physical therapists. This is being driven by Livability (an Irish NGO who supports a number of SCI units in Asia), Handicap International (a Belgium based NGO who funds many different SCI initiatives in places such as Vietnam, China, Haiti and Africa), The International Spinal Cord Society, the Asian Spinal Cord Injury Network, and the University of Sydney. All have been successful in attaining a substantial grant from Coloplast to together develop these modules. This grant has been supplemented by an additional grant received by our Sydney PT colleagues. The development of these modules is being overseen by an international group of SCI PTs. The US representatives are Jennifer Hastings, Joy Bruce, and Sue Ann Sisto. Anyone interested in this initiative can get in contact with one of these people, especially if you have libraries of videos or photos and are willing to put them to a good cause. The modules will be free for all to access.

Looking for exercise ideas for your patients?

Check out www.physiotherapyexercises.com. It contains over 1,000 different exercises for people with SCI. You can search for different exercises appropriate for your patients and then readily compile them into professional-looking exercise booklets. The really neat thing about this website is it is absolutely free. You can also now download an Iphone App. The developers tell us that they have had over 40,000 downloads, and US is one of the biggest users. This website is available in 7 different languages. This website has been developed on a volunteer basis by physiotherapists worldwide. The developers are looking for volunteers to help translate the website into Portuguese or Spanish. It could be a great project for PT students. The developers are also always interested to receive new exercise ideas. So, if you are interested, please let us know.
SCI Rehab Update
Sally Taylor Schroeder, PT

The SCIRehab Project is a five-year multi-center investigation project recording and analyzing details of the spinal cord injury (SCI) rehabilitation process and first year outcomes. It stands for Spinal Cord Injury Rehabilitation Effectiveness Hypotheses Assessed Biostatically. The collaborating centers include Craig Hospital, Englewood, CO; Carolinas Rehabilitation, Charlotte, NC; Mt. Sinai Medical Center, New York, NY; National Rehabilitation Hospital, Washington, DC; Rehabilitation Institute of Chicago, Chicago, IL; Shepherd Center, Atlanta, GA; and Institute for Clinical Outcomes Research, Salt Lake City, UT.

SCIRehab follows a Practice-Based Evidence research methodology. This type of methodology offers a rigorous alternative to randomized control trials to build the evidence necessary for the scientific practice of rehabilitation. It is a detailed observational technique that compliments rather than replaces randomized controlled trials. The goals of the SCIRehab project are to open the “black box” of SCI rehabilitation, to document the many individual elements of SCI rehabilitation, to learn which elements are most associated with better outcomes, and to improve SCI rehabilitation with the knowledge gathered.

Prior to collecting data, each discipline involved developed a taxonomy to describe the details of the SCI rehabilitation process. The disciplines involved in the study include physical therapy, occupational therapy, speech language pathology, therapeutic recreation, psychology, nursing, and social work/case management. For the purpose of this update, we will focus on the physical therapy taxonomy. The physical therapy activities that were documented on include the following: bed mobility, transfers, wheelchair mobility-manual, wheelchair mobility-power, upright activity, pre-gait, gait, musculoskeletal treatments/modalities, equipment evaluation/provision/education, strengthening, endurance, ROM/stretching, balance, skin management, wound care, airway/respiratory management, education, complimentary approaches, and aquatic exercises. Activity specific details were collected for the above activities including equipment used, type of transfer and surface involved, distance wheeled and surface involved, gaiting equipment, joint stabilization, number of attempts and distance. Some session level variables were also collected such as the date, start time, missed therapy, patient participation, patient/caregiver involvement, and factors impacting sessions. The taxonomy reference goes into greater detail on the breakdown of the physical therapy taxonomy. ¹

Inpatient data collection took place between 2007 and 2010 by every clinician in the participating centers. This documentation was completed in addition to facility specific documentation required by each facility. One year follow up surveys to participants are still being. Findings from the first year data set are coming out soon. ²

The project is now in the final stage of analyzing and disseminating information.

The support for this project was provided by National Institute for Disability and Rehabilitation Research US Department of Education.

References


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Hard at Work!
Breathing and Upright Posture: Simultaneous Needs
Mary Massery, PT, DPT
Massery Physical Therapy, Glenview, IL, USA
Presented at the 26th International Seating Symposium, Vancouver, BC, Canada, March 11, 2010

Breathing and postural mechanics are intertwined\textsuperscript{1, 2} and should not be handled separately when designing a person’s wheelchair and seating system. Wheelchair and seating systems for the non-ambulatory patient need to address the problems of optimizing upright alignment (musculoskeletal alignment), mobility (neuromotor control of locomotion) and skin integrity (cardiovascular). Perhaps less obviously, the seating practitioner should also be evaluating how wheelchair positioning affects breathing mechanics and vice versa. This paper will focus on the unique aspects of breathing mechanics and the seated patient: establishing a link between breathing, postural control and postural alignment.

\textbf{Soda-pop can model of postural control (Figure 1)}

The aluminum shell of a soda-pop can is not structurally strong; easily crushed when empty or when the top is opened. However, when the can is intact, the internal pressures generated by the carbonated beverage make the aluminum can functionally quite strong and difficult to crush. Likewise, human skeletons are weak; easily crushed if the muscles supporting the skeleton, our “aluminum can”, are unable to generate necessary internal pressures to counteract gravitational and atmospheric pressures acting upon it.\textsuperscript{3, 4} Patients with profound weakness or paralysis such as in spinal cord injuries (SCI), suffer crushing forces upon their skeletons, overtime causing severe restrictions to the musculoskeletal system and internal organs, thereby restricting lung expansion.\textsuperscript{5, 7} The respiratory compromise is profoundly worse for children who acquire an SCI prior to the time of skeletal maturation as their developing skeletons are more adversely affected by gravity on their developing frames.\textsuperscript{8}

\begin{figure}[h]
\centering
\includegraphics[width=0.4\textwidth]{soda-pop-can-model.png}
\caption{Soda-Pop Can Model}
\end{figure}

\textbf{Posture, postural control, and breathing}

A chronically slumped posture, the result of collapsing forces, can cause a multitude of postural deficiencies including: 1) a thoraco-lumbar kypho-scoliosis which compresses the anterior rib cage, often causing a mid trunk fold at the xiphoid process, thus restricting breathing mechanics, 2) a compensatory forward head position on top of the thoracic kyphosis which compromises swallowing

(Continued pg. 7)
mechanics thereby increasing the risk of aspiration and mechanically compromising the recruitment of accessory muscles for increased lung volumes, 3) a compensatory upper quadrant position including protracted scapula and humeral internal rotation, impairing shoulder mechanics as well as chestwall muscle recruitment for breathing, and 4) a posterior pelvic tilt with excessive hip external rotation thus further compressing forces at the mid trunk and pelvic floor further impairing the diaphragm’s mechanical advantage.  

(Figure 2)

Figure 2: 13 ½ y/o male surviving resection of a brainstem astrocytoma at age 10 years old and then a left CVA secondary to an anoxic seizure at age 12 years old. Note his “collapsed” posture in wheelchair with compromised breathing mechanics. He was on a ventilator 24 hrs/day and was considered “failure to wean”.

The diaphragm plays multiple simultaneous roles: maximizing inhalation, contributing to postural control, supporting gastrointestinal function (anti-reflux support and promoting lower GI motility), and aiding venous return. Each one is as vitally important as the other. Positioning strategies needs to take these roles into consideration. The diaphragm needs pelvic floor and abdominal muscle support to create intra-abdominal pressures in order to stabilize the diaphragm’s central tendon during inspiratory contractions. This, in turn, supports the efficiency of the intercostal contractions above the diaphragm for maximizing inspiratory lung volumes. This coupling action between the diaphragm and intercostals produces greater drops in pleural pressures than either muscle alone. Thus, preserving the mechanical advantage of both the diaphragm and the anterior chest wall is crucial for optimal breathing mechanics.

Recent studies specifically looked at the effect of positioning on breathing mechanics and lung volumes for normal subjects in a seated position. Landers showed that a collapsed posture (slumped) results in lower lung volumes in healthy adults. Building upon those results, Lin evaluated pulmonary values in 3 sitting postures and 1 standing posture for 70 normal adults. The subject’s posture and lumbar lordosis significantly affected lung volume (spirometric values): 1) standing had the greatest lumbar lordosis and the highest pulmonary values, whereas 2) slumped sitting had the least lumbar lordosis and the lowest lung volumes. Of the 2 remaining sitting postures, pulmonary values were higher with a supported lumbar lordosis and ischial relief rather than just a normal posture with full ischial support and a flat back.

(Continued pg. 8)
Considerations for supporting breathing mechanics and internal trunk pressures in a wheelchair posture

Taking alignment, trunk internal pressure regulation and the newest research in the biomechanics of breathing, it would compel the seating practitioner to consider breathing mechanics in their wheelchair prescription. For patients with a weak trunk, supporting a lumbar lordosis and maintaining an open anterior chest wall appears critical to maximizing lung volumes and diaphragmatic function. This translates into controlling sagittal plane alignment to minimize thoracic kyphosis and a collapsed anterior rib cage (supporting the mid trunk). Internal pressures may need support as well, especially intra-abdominal pressures.

Not all patients will benefit from the same solution. A few ideas will be presented that focus on respiratory mechanics. This author is not a seating expert, but rather a pediatric cardiopulmonary physical therapist looking at seating from a breathing mechanics/postural control perspective.

**Figure 3**: Now 15 years old, he is off of the ventilator during the day (central sleep apnea prevents nocturnal weans). A TLSO with abdominal cutout supports his postural alignment and breathing mechanics, while the Passy Muir © speaking valve re-engages his vocal folds thus restoring his pressure regulator at the “top of the soda-pop can”. Note the improvement in his upper quadrant positioning as well as improved head and neck alignment.

Abdominal binders: For patients with weak or paralyzed abdominal muscles, an abdominal binder may help to restore intra-abdominal pressure for breathing mechanics and pelvic alignment. More research needs to be done in this area, thus the appropriateness of a binder needs to be assessed on an individual basis.

Passy Muir© or other Speaking Valves: Patients with tracheostomies who can tolerate a speaking valve will improve their ability to control intra-thoracic positive pressure because the vocal folds are restored as the expiratory pressure regulator. (See Figure 3) By regulating intra-thoracic pressures, the valve allows graded exhalation, improves internal pressure support for postural control including improved upper extremity force production, improves bowel and bladder emptying, improves swallowing mechanics as well as its original intent to improve voicing. Thus, the seating therapist should consider a speaking valve an adjunct to optimal seating for the patient with a tracheostomy.

**TLSO:** A thoraco-lumbo-sacral orthosis, also known as a “body jacket”, controls the sagittal plane from the pelvis up to the upper chest. An abdominal cutout is needed for optimal diaphragmatic excursion. (See Figure 3) An abdominal binder may also be needed for patients with abdominal muscle weakness. The TLSO also allows normal resting positions of the upper quadrant, head and neck if the mal-alignment was compensatory due to the flexed thoraco-lumbar spine and collapsed rib cage. The TLSO is most appropriate in pediatrics prior to skeletal maturation. Other seating positioning strategies may be used for adult patients.

**Chest straps and lateral trunk supports:** A chest strap is a common and effective positioning device when the primary objective is to keep the patient safely in the wheelchair. However, a chest strap binds the chest down, encouraging a flexed spine and posterior pelvic tilt. (see Figure 2) This compromises the diaphragm and intercostal muscle coupling while further limiting postural control responses of the trunk. Lateral trunk supports are also common and effective positioning devices that can decrease scoliotic forces, but they do not control the sagittal plane.
Tilt-in-space seating: although research shows decrease pressure over the ischium in patients with profound neurologic impairments who are positioned in a tilt-in-space wheelchair,\(^2\), whether to use a tilt and the angle of the tilt must be carefully assessed because of the increased risk for aspiration and the potential for aspiration pneumonia.

**Summary**

Seating and positioning strategies are complex, taking multiple factors into consideration. This paper addressed the respiratory component of such a multi-system assessment using a soda-pop can model of postural support to explain the interactions between posture, postural control and breathing. Suggestions were made that may more optimally support breathing mechanics, but in no way excludes other ideas from seasoned seating practitioners. More research is needed in this area.

**References**


