IT MIGHT SEEM OBVIOUS, BUT BREATHING IS fundamental to life. Although we all do it, we sometimes forget it can be a difficult task for individuals with mobility impairments. In our everyday life, breathing is an autonomic nervous system function, happening without conscious intent or effort. For those with mobility impairments, breathing can be all encompassing and a labor intensive task. Think back to the last cold you had. A disruption in the normal respiratory pattern tends to be uncomfortable, leaving some wondering how and when the next breath might happen. Breathing is often overlooked during the seating and wheeled mobility evaluation in the pursuit of alignment. The inability to properly oxygenate the body can be life threatening. Individuals with imbalanced tone, weakness and skeletal asymmetries experience greater difficulties. The provision of postural supports in wheeled mobility systems can often improve or further limit one’s respiratory efforts.

To fully understand the effects of postural supports on respiration, one needs to understand the respiratory process. Humans need to constantly move air in and out of the lungs because the body cannot store oxygen. If you think of the respiratory system as a system of passages, muscles and pressures, it is easy to understand how an imbalance can impact one’s ability.

When talking about an intact respiratory system, there needs to be consideration of the necessary balance of pressures that allow respiration to occur. Mary Massery, a physical therapist who has specialized in respiration, compares the respiratory pressures to those of a soda can. Prior to opening it, there is increased pressure inside the can making it very strong and difficult to “crush” even with effort. Once the can has been opened, the aluminum can is easily crushed by a hand. The effectiveness of the aluminum can is similar to the effectiveness of the proper balance of respiratory pressures. All components are reliant on an intact system for effective use. If there is a weakness present anywhere in the system, the overall effect will be limited.

When working with seating and positioning, proper head position is imperative for adequate respiration. Individuals with extreme forward flexion often risk respiratory issues due to occlusion or impingement of their airway. Over the years, many options have been developed to assist with head control. Simply pulling shoulders out of protraction does not ensure upper thoracic and cervical spine alignment. Both dynamic and static forehead straps have been advertised as options for improved head control. However, if active cervical control is not present, the use of forehead straps can result in very unstable cervical positioning, which usually results in cervical hyperextension or stacking for stability. With the advancement of recent wheelchair technology, the use of different orientations of the support surfaces has been pursued. In particular, the use of open seat to back angles in conjunction with manual anterior tilt has been found effective to help provide a more upright and stable head position. Once this balanced head position is gained, improved respiratory effort is observed.
K is a young woman with a diagnosis of cerebral palsy who has a long history of difficulty with head control. I have had the luxury of learning from her for more than 18 years. During this time, her cervical flexion and thoracic kyphosis have become so severe her “chin on chest” position impinges her airway. As a result, she has been referred to our wheelchair clinic on many occasions.

During her last mat evaluation, it was found K was frequently sleepy and lethargic. This is a common observation with individuals with poor oxygenation, often giving the appearance of boredom or disinterest. With her forward head position, her visual field focused on her lap, adding to her lack of stimulation. Efforts at active head righting were fatiguing and did not make her respiratory effort any easier. Instead, she relied on extensor tone patterns to help move her head from extreme flexion into a position of extreme cervical hyperextension. She lacked the active muscle control needed for a comfortable and balanced upright position. Numerous headrests have been used in the past to no avail. As a last resort, a Headmaster collar was fitted and issued, preventing her typical “chin-on-chest” position. K also uses a Hensinger collar for support.

Since ancillary postural supports have been ineffective for K, a new perspective was needed to help problem solve. The seating team, including myself, Dan Sullivan (rehab technology supplier from National Seating and Mobility), Beth Muckler, DPT, and Janis Street, our wheelchair clinic coordinator, decided to use simulation (in a Pindot simulator) during the evaluation process. Through simulation, angles of orientation could be tried and modified, attempting to gain a more balanced and upright head position while also providing an improved position for visual and social interaction. It is usual practice to use recline (opening seat to back angle) in the accommodation of a forward head position, however, care needs to be taken to see how this can impact function. During simulation, it was found a more opened seat to back angle was effective for K for improved respiration, however, her visual field was now directed towards the ceiling, oral motor skills were limited and opportunity for social interaction was significantly limited. Since it was successful for maintaining proper airway function, a means to re-orient the open seat to back angle needed to be found. To do this, manual anterior tilt was selected. With the PDG Stellar manual base, a very open seat to back angle could be obtained while using manual anterior tilt to re-orient K’s head and trunk in a more forward facing perspective. Although pulse oximetry was not available

When working with seating and positioning, proper head position is imperative for adequate respiration.
for use, it was obvious through K’s appearance and level of alertness that improved respiratory effort was achieved.

Once the proper angles and orientation were identified, the evaluation process moved toward addressing the actual shapes and contours of the support surfaces. Whenever anterior tilt is used, care needs to be taken to provide surfaces that offer greater contour, working against gravity’s pull when in anterior tilt. Simulation revealed the need for a deeper ischial well. To help limit her preferred posterior pelvic tilt, total contact was found to be needed across her posterior pelvis and sacrum controlling her pelvic and sacral alignment. This contact continued up her spine, providing stability just above her pelvis and then into her thoracic spine. Care was taken to provide limited contact behind her shoulder girdle region as we did not want to lock her into her preferred kyphotic and forward shoulder position. As a result of this invitation to move into a more neutral shoulder position, her upper thoracic and cervical spine found a balanced position. This offered K’s respiratory effort proper alignment and stability for function. In addition, the overall posture with the anterior tilt offered an appropriate visual field for social interaction and safe oral motor alignment for meals. The use of custom molded seating was the only option to allow us to create the support surfaces and contact she needed for improved respiratory effort and function. Pindot ContourU seating was selected.

Once funding was obtained, K was remolded in the Pindot simulator. This was done to ensure the recommended components would still be successful. Delivery of the system revealed good support and alignment. During times when K needs to be awake and interactive, the anterior tilt is used, providing proper orientation for her upper trunk and head. When she is relaxing or resting, a more posterior position can be used. Her caregivers have expressed the system is very effective for K. The drawback is the overall length and size of the mobility base, however, it does not impose a problem in her residence or work environment. Continued use of this mobility system has resulted in good alignment and function for K.

CONTACT
Jill may be reached at otspar@aol.com.