ENHANCING GERIATRIC FUNCTIONAL MOTOR PERFORMANCE BY UTILIZING EFFECTIVE VENTILATORY STRATEGIES

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In aging, we slowly give in to gravity's influence, often resulting in an increase in thoracic kyphosis, forward sloping shoulders, a forward head and posterior pelvic tilting.[1,2] These musculoskeletal changes lead to a closing off of anterior chest wall excursion.[1,3] Thus ventilation potential is reduced.[4,5]

Correspondingly, a common complaint among our elderly population, is reduced endurance, reduced activity level, and reduced overall mobility level.[1] In my clinical experience, I have noted that assisting patients in regaining chest wall potential for movement, can positively effect their endurance and functional motor performance. In this paper, I will share some of my clinical ideas for maximizing ventilation potential in both static and dynamic activities, stressing the use of minimal amounts of medical equipment, minimal cost, and maximal potential for carry over from the patient and/or family.

Static Positioning

Breathing is a three dimensional activity.[3] Maximizing movement potential along the thoracic wall means looking at how to encourage chest excursion to occur in all three planes of ventilation at minimal energy costs. In supine, or semi-sitting, an open chest wall can be achieved several ways. Starting with head/neck positioning, use of fewer pillows, a thin pillow, an occipital roll or no pillow at all, will increase the muscle length of the neck accessory muscles thus increasing their potential for upper chest superior and anterior excursion.[6] Which head support you choose depends on your patient's condition and tolerance to greater neck extension.

To maximize upper chest wall excursion, including lateral expansion, the shoulders need to be in neutral scapular retraction or greater, and the humerus externally rotated. This places the pectoralis and intercostal muscles on stretch, increasing the potential for lateral and anterior chest wall movements.[6] For those patients with adequate shoulder movement, placing the arms in a supported flexion/abduction/-external rotation position will maximally increase all upper chest wall movement potentials. For example, the patients could place their hands back behind their head in a butterfly wing position, opening up the anterior, superior and lateral aspect of the upper chest. If the patient has slightly decreased external rotation or shoulder flexion potential, use of towel rolls or pillows behind the elbows can support the upper extremities at their comfortable end range.

If the patient can not comfortably raise his/her arms up above 90 degrees of flexion, position the patient to maximize two of the three shoulder motions, external rotation and abduction. For example, while the patient's arms are down at his/her side, use a block or towel roll between his/her waist and the medial aspect of his/her elbow. For patients with severe shoulder ROM limitations, attempt to gain external rotation by supinating the forearm.

If upper extremity positioning is not possible or inadequate by itself, opening up the upper chest wall can also be achieved by repositioning the thoracic spine. An increase in thoracic spine extension will help facilitate the shoulders to drop back, with gravity's help, into a more neutral or externally rotated alignment. Use a horizontal thoracic towel roll at the greatest point of the kyphotic curve to increase thoracic extension, or for patients with more flexibility, use a vertical roll down the length of the thoracic/lumbar spine. How large a roll you use will depend on your patient's comfort level and tolerance to the position. Both types of positioning techniques, upper extremity and spine, will place the anterior chest wall muscles on stretch, creating more potential anterior chest wall excursion.

Upright poses new problems such as balance concerns and an unsupported spine. My successful positioning experiences have occurred when I worked first for optimal neutral/anterior tilt pelvic alignment and then watched how that correction secondarily caused adjustments in the head, shoulder, upper extremity and spine. Often time, it has been the only correction I needed to make to cause an adequate improvement in

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motor performance continued ...

alignment and respiratory function. An anterior tilt in a healthy flexible adult will generally 1) reduce the kyphotic curve in the thoracic spine, 2) retract the scapulas towards a neutral position, 3) cause the arms to hang in a more neutral or externally rotated position, and 4) pull the head back into a neutral chin tuck.[1,7] These changes all lead to maximizing ventilation potential and upper extremity function.

A simple, passive way to gain and maintain an anterior tilt when prolonged active positioning is fatiguing, is to have the patient lean forward, then slide a towel roll horizontally just behind the ischial tuberosities, thus preventing the pelvis from rolling back into a posterior tilt.[7] This posture is well tolerated for many patients with intact sensation and a pelvis that is at least minimally mobile. For patients with impaired sensation or less pelvic mobility, a wedge may be substituted, but some sliding may occur. If the patients are using a chair with a back support, the same concept of the vertical or horizontal spine roll can be utilized with great results. The spine roll itself may align the shoulders and head back into a neutral alignment. Neutral head and neck alignment is particularly important for patients with impaired speech volume or endurance, or patients with swallowing/aspiration problems. A neutral chin tuck optimizes the length tension relationship in the vocal folds, minimizing vocal strain, and improving airway protective responses.

Shoulder positioning in all postures, especially upright, is crucial. Internal rotation and scapular protraction will block the upper chest from reaching its full potential excursion. My experience has noted that when the upper extremity is externally rather than internally rotated, the same patient effort can result in markedly greater upper chest wall movements. Consequently, inspiratory volumes increase with external rotation positioning.

Dynamic Activities

I will conclude this paper with suggestions for coordinating breathing with movements to enhance task execution. In general, inhalation promotes trunk extension while exhalation promotes trunk flexion. This basic theme occurs naturally in all our own activities, but may have ceased to become spontaneous with our patients. Valsalva maneuvers during transitional movements such as rolling, coming to sitting or standing are often noted in the geriatric population. By using breathing to enhance the movement pattern itself, you can eliminate valsalva patterns and also promote better cardiac status.

Beginning the simple bed mobility concerns, we can modify how we teach our patients to roll from a supine position. Ask the patient to attempt to roll and assess whether they tend to move with trunk extension or flexion to complete the roll. If they roll with a trunk extension pattern ask them to breathe in while they roll. If they roll with trunk flexion as their primary movement pattern, instruct them to roll while blowing out. In doing so, the patient works with, not against, natural whole patterns of movements to increase the likelihood of their own success.

Pushing up to sitting from sidelying should be evaluated in much the same manner. If the patient is more effective in coming upright when using trunk extension, have them inhale as they move. Asking them to also "look up" as they move will reinforce the upper chest movements through the use of the symmetrical tonic neck reflex.[8] If they instead have more success pushing up from a flexed position, have them blow out while moving.

Coming up to standing requires both trunk movements, thus the patient should initiate the forward trunk lean with exhalation, and initiate the standing phase with inhalation and neck extension. Active neck extension during assumption of standing not only facilitates greater inhalation, but along with the influence of the tonic labyrinthine reflex, I have seen more significant contractions of the trunk extensor and hip extensors.[8] Clinically, this often results in a more noticeable full upright posture.

All movements of the upper extremities should be coordinated with complimentary chest wall movements in order to maximize any task. Thus, every time the arm is moving up above 90 degrees, the patient should be asked to breath in, allowing for the normal shoulder/rib cage rhythm to occur. Full shoulder flexion requires opening of the intercostal spacing and the separation of the individual ribs. Many geriatric patients have lost the intrinsic mobility of the chest wall and thus may have lost some functional shoulder ROM as well. In my experience, without using simultaneous inspiration with shoulder flexion, the patient is likely to be limited to approximately 140-150 degrees of shoulder flexion, may tend to valsalva during the activity, and often experiences more shoulder pain.