What's Positioning Got to Do With It?

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With the threat of health care reform breathing upon us, medical facilities are looking at ways to cut costs and lengths of stay.[1,2] Practitioners, in turn, are concerned about "cutting" quality care.[3,4] The facilities that survive this current health care crisis will need to address both issues adequately. They must learn to limit costs and decrease lengths of stay by making treatments more efficient and effective, without sacrificing quality. Physical therapists and other health care practitioners must join this trend by combining treatment goals during treatment sessions and working concurrently on multiple areas of deficit. This paper intends to address one such creative combination for the treatment of patients with neurologic dysfunction.

Neuropulmonary Problems

Respiratory problems are some of the sequela of neurological diagnoses,[5-11] causing excessive loss of work or school days and numerous hospitalizations.[12,13] Thus, maintaining a healthy respiratory status should be a top priority for a neurologic population. My purpose in writing this paper is to show physical therapists and other health care practitioners how easy it is to combine routine therapy and daily living activities with active and passive respiratory techniques, thus responding effectively to the streamlining phenomenon thrust upon us by health care reform.

In my clinical practice, I have found numerous ways to maximize a patient's ventilation potential while doing other physical therapy activities. The investment is typically no more than 1 to 2 additional minutes and a few extra pillows or towels. Therefore, time and money are not mitigating factors. However, these ideas do require the practitioner to look carefully at the patient before beginning any therapy, and ask the questions: "Have I positioned my patient for 'respiratory success?'" "Am I simply treating the patient in whatever position I found them in?" and "Have I carefully chosen my verbal cues to include a respiratory response as well as a functional response?" The practitioner must "actively" include respiration in *every single activity* in order to help the patient understand that breathing transcends all disciplinary lines.

I will begin by suggesting ideas for improving ventilation during a typical static, supine/supported semisitting posture where low-level activities, such as resting, sleeping, wound care, or passive range of motion (ROM) take place. I will follow up with ideas for more complex active tasks, such as coming to sitting and standing, reaching, and dressing.

Static Recumbent Positioning

Because breathing is a three-dimensional activity, maximizing movement potential along the chest wall during breathing means looking at how to encourage chest excursion in all three planes of ventilation: anterior-posterior, superior-inferior, and lateral.[14,15] Optimizing the length-tension relationship of the muscles involved in inspiration will make it easier for these muscles to contract and achieve this three-dimensional movement, thus increasing pulmonary function.[16] The static positioning ideas presented below incorporate the principles of: 1) improving the length-tension relationship of the accessory ventilatory muscles involved in that posture, 2) using gravity to assist the movement or to incorporate a passive stretch, and 3) using the natural coordination of the trunk/chest wall movement with inspiration and exhalation patterns to maximize movement.

Starting with a typical hospital bed position of supine or supported semisitting, maximal chest wall excursion can be facilitated in several different ways. Upper chest expansion can be facilitated by decreasing the number of pillows under the patient's head to improve the length-tension relationship of the neck accessory muscles, primarily the sternocleidomastoid and scalene muscles.[17] This position increases the potential for upper chest wall movement in a superior and an anterior plane of direction. This can easily be incorporated in the hospital or home environment.

By placing the pectoralis and intercostal muscles on stretch, lateral and anterior chest wall movements can be enhanced.[17] The anterior chest wall is "opened-up" by placing the shoulders in a neutral or retracted scapular position and the humerus in an externally rotated position. For example, patients with upper extremity paralysis but adequate shoulder mobility can achieve this by having their arms placed in a supported flexion/abduction/external rotation position to maximally stretch the neck, pectoralis, and intercostal upper chest wall muscles. Those patients with more active upper extremity function could achieve this by independently placing their hands behind their heads in a butterfly wing position. Gravity will help to increase the end range of the upper extremity pattern, adding to the stretch on the anterior chest wall muscles.

For the patient with slightly decreased external rotation or shoulder flexion, use of towel rolls or pillows behind the elbows can support the upper extremities at their comfortable end range. If the patient is more limited and cannot comfortably raise his/her arms above 90° of flexion, positioning should maximize the available shoulder motions: external rotation and abduction. For example, while the patient's arms are down at his/her side, the use of a soft block, such as a nerf block, or towel roll between the waist and the medial aspect of the elbow will help to maximize external rotation and abduction. With severe shoulder ROM limitations, such as with hemiplegia, supinating the patient's forearm will maximize the one motion still available: external rotation.

If upper extremity positioning is not possible or insufficiently increases chest wall movement, opening up the anterior

chest wall can also be achieved by repositioning the thoracic spine.[18] An increase in passive thoracic spine extension coupled with gravity will allow the anterior shoulders to relax into a more neutral or externally rotated alignment. This can be accomplished in supine by using a horizontal thoracic towel roll at the greatest point of the kyphotic curve to increase thoracic extension or, for patients with more flexibility, by using a vertical roll down the length of the thoracic/lumbar spine.[19] The size of the roll you use will depend on your patient's comfort level and tolerance to the position.

By addressing all three areas for positioning in supine or supported semisitting posture (head positioning, upper extremity positioning, and spinal positioning), chest wall excursion can be maximized. The amount of head support you choose, the position you place or allow the upper extremities to be in, and the amount of trunk extension that you seek will all determine how much the chest wall muscles will be placed on stretch. Together, these positions will facilitate greater chest wall excursion in all three planes. This will enhance ventilation for patients with neurologic dysfunction who are able to actively move their chests.

Incorporating Simple Therapy Tasks

Inspiration

After the patient has been carefully positioned for "respiratory success," as described above, add your therapy or daily living activities. From an anatomical perspective, the pattern of inspiration is naturally associated with trunk extension and shoulder flexion/abduction/external rotation movements.[16] Expiration is logically associated with the opposite: trunk flexion and shoulder extension/adduction/internal rotation movements. Accordingly then, the simple task of passive ROM can easily include the active goal of increasing ventilation by asking the patient to breathe in every time his/her arm is raised up into shoulder flexion. This encourages the patient to breath in when his/her chest wall muscles are being maximally stretched and the ribs are naturally opening up. Both activities are thus facilitated to be more successful. It also begins to teach the patient to utilize breathing strategies to optimize his/her functional movement.

Expiration

Likewise, active or passive exhalation should be coordinated with the reverse upper extremity ROM pattern: the arm returning from flexion back to the patient's side. For example, this can be done utilizing all types of exhalation patterns, such as: 1) passive quiet exhalation; 2) forceful exhalation, such as blowing, coughing, or pursed-lips exhalation; or 3) vocalization patterns. The therapist may ask the patient to slowly count out loud to 10 while his/her arm is being returned to the side. Subconsciously, the patient learns to correlate exhalation with shoulder extension while simultaneously learning a much more complex idea—that of controlling his/her rate and volume of expiration, by including deliberate speech during exhalation maneuvers.

To improve exhalation potential, increase the patient's relative trunk flexion alignment. For example, while supine and performing upper extremity ROM, ask the patient to lift his/her head, watch his/her hand as it returns to the side, and blow out. This will increase abdominal and intercostal activation during exhalation. Likewise, by increasing knee flexion to increase posterior pelvic tilting and trunk flexion, the same idea can be utilized. Pairing trunk flexion with exhalation completes the breathing/trunk movement strategy.

Combining positioning with respiratory verbal cues as described above changes passive upper extremity ROM exercises to *dynamic upper extremity ROM exercises!* It encourages increased inspiratory and expiratory capacities, develops early functional motor performance strategies, and facilitates trunk mobility. In this manner, the patient has the opportunity to learn from the beginning of the rehabilitation process that movement and breathing go hand in hand. Clinically, I have found that early incorporation of appropriate breathing patterns with movement discourages valsalva patterns or shallow breathing patterns from developing. This becomes more important as the patient progresses through rehabilitation, and the motor activities become more difficult and complex.

Moving to Upright Postures and Activities

Upright postures pose new challenges to breathing, adding balance concerns and the control of an unsupported spine. A key component to optimizing chest expansion is pelvic alignment. An anteriorly tilted pelvis in a "healthy," flexible adult will generally 1) reduce the kyphotic curve in the thoracic spine, 2) adduct the scapulas toward a neutral position, 3) produce a more neutral or externally rotated upper extremity position, and 4) pull the head back into a neutral chin tuck.[20,21] Not only does this alignment maximize ventilation potential, but it improves upper extremity ROM potential as well. Correcting the pelvis first, in my clinical experience, often allows the patient to achieve the neutral/anterior pelvic alignment and the compensatory adjustments in the head, shoulder, upper extremity, and spine that accompany this alignment. Often, it's the only correction I need to improve spinal alignment and respiratory function.

A simple, passive way to gain and maintain an anterior tilt when prolonged active sitting positioning is fatiguing is to have the patient lean forward over his/her legs, then slide a towel roll horizontally just behind the ischial tuberosities, thus preventing the pelvis from rolling back into a posterior tilt.[19] The effects of gravity on increasing a kyphotic posture are decreased. This technique is well tolerated for many patients with intact sensation and a pelvis that is at least minimally mobile. For neurological patients with impaired sensation or less pelvic mobility, a wedge may be substituted, but some sliding may occur.

If the towel roll under the pelvis is impractical, then the same concept of the vertical or horizontal spine roll that I

described for supine positioning can be utilized with a wheelchair or any type of chair with a back support. When the patient leans back, the spine roll, along with gravity, will help bring the shoulders and head back into a more neutral alignment. It also opens the entire anterior chest wall as it did in supine.

The effects of gravity on the abdominal viscera, abdominal muscles, and diaphragm change significantly in the upright posture. Gravity now assists the inferior descent of the diaphragm. If the diaphragm's position is well supported with adequate abdominal tone to hold the viscera up and under its dome, diaphragmatic breathing will be easier and more efficient in this posture.[22,23] Those patients with paralyzed or severely weakened abdominal strength will need an abdominal binder or other type of abdominal brace to support the viscera and improve diaphragmatic alignment.[24]

Neutral head and neck alignment is particulary important for patients with impaired speech volume or endurance and for patients with swallowing/aspiration problems. A neutral chin tuck optimizes the length tension relationship of the vocal folds, minimizing vocal strain, and improving airway protective responses.

Shoulder positioning is crucial. Upper extremity positioning in internal rotation and scapular protraction will block the upper chest from reaching its full potential for inspiratory excursion. In my practice, I have noted that reaching with an externally rotated upper extremity, rather than with internal rotation, results in markedly greater upper chest wall movements and thoracic extension. I have also found that this position increases inspiratory volumes.

Dynamic Activities

I will conclude this paper with suggestions for coordinating breathing with other types of movements to enhance task execution. Each task incorporates the principle of inhalation to promote trunk extension and exhalation to promote trunk flexion. This basic theme occurs naturally in all our own activities, but it may have ceased to become spontaneous with our patients. Valsalva maneuvers during transitional movements, such as rolling and coming to sitting or standing, are often noted in the neurologic population. By teaching the patient strategies that incorporate breathing in their motor plans for all motor activities, you can eliminate or minimize valsalva patterns and promote better cardiac function. This begins with simple passive ROM tasks as illustrated previously and continues through the most complex motor tasks.

Rolling

We can improve our patients' success at rolling from supine by utilizing breathing strategies. Determine if the patient's preferred rolling style is initiated with trunk extension or flexion. If the patient rolls with a trunk extension pattern, ask him/her to breath in and look up while rolling. If he/she rolls with trunk flexion as the primary movement pattern, do the opposite: roll while blowing out and tucking the chin. In doing so, the patient works with, not against, natural whole patterns of movements, which will increase the likelihood of his/her own success.

Coming up to sitting

The preference for trunk extension or flexion strategy while pushing up to sitting from sidelying should be evaluated as with rolling. If the patient is more effective in coming upright when using trunk extension, have him/her inhale while pushing up to sitting. Asking the patient to "look up" while moving will reinforce the upper chest movements through the use of the symmetrical tonic neck reflex.[17] If instead the patient has more success pushing up with trunk flexion, have him/her blow out and tuck the chin while moving.

Dressing

The same concepts can be applied to dressing activities. While putting on lower extremity items, such as pants, socks, and shoes in a long sitting position, have the patient first take in a deep breath while extending the trunk. Then have the patient blow out, huff out, or cough while flexing the trunk to reach his/her toes. This combines the functional *daily* task of dressing with improving breath control, trunk control, and airway clearance techniques.

Upper extremity dressing and upper extremity exercising can incorporate the same ideas. All movements should be coordinated with harmonious chest wall movements in order to maximize any upper extremity task. Specifically, every time the arm is moving up above 90°, such as in taking off a tee shirt overhead, the patient should be asked to breathe in, allowing 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 neurologic 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 inspiration during shoulder flexion, the patient is likely to be limited to approximately 140° to 150° of shoulder flexion, may tend to valsalva during the activity, and often experiences more shoulder pain.

Coming up to standing

Coming up to standing requires both trunk flexion and extension, 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 facilitates not only greater inhalation but, along with the influence of the tonic labyrinthine reflex, facilitates more significant contractions of the trunk extensors and hip extensors.[17] Clinically, this often results in a more noticeable upright posture and may make the difference between an assisted standing pivot transfer and an independent one. Returning to sitting should be accompanied with slow controlled exhalation maneuvers, such as in pursed-lip blowing or counting-out-loud, to maximize the body's controlled descent into gravity's influence.

Conclusion

In conclusion, positioning has everything to do with increasing ventilation potential and functional skills! From the beginning of the patient's rehabilitation

program, optimizing ventilation and breath control through passive and active positioning techniques should be utilized by all medical disciplines, not just physical therapy. The suggestions I have made in this paper are easy to implement and require minimal time, effort, and money on the part of the therapist. As our patients progress, we can and should assist them in developing more efficient movement strategies by coordinating breathing patterns with trunk movements. With decreased lengths of stay, utilizing breathing strategies to master activities learned outside of the medical facility will help patients with neurologic dysfunction reach their full rehabilitation potential.

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