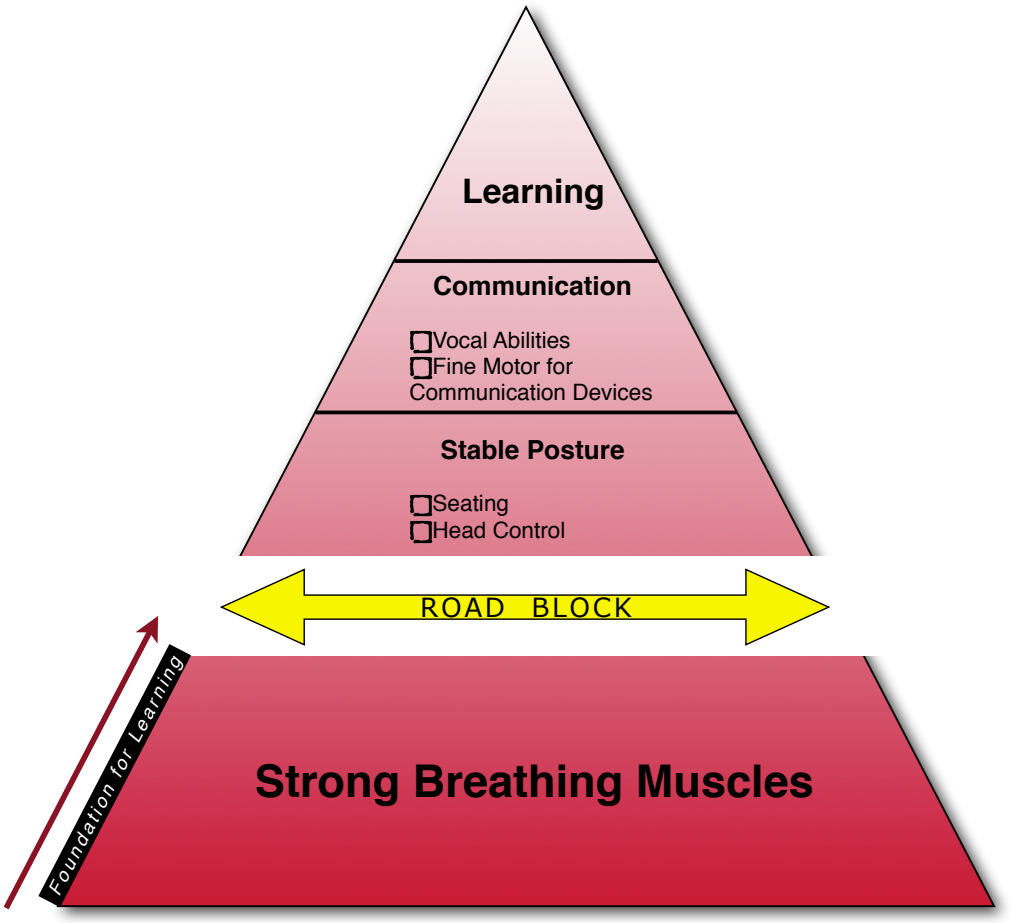
Remove a Roadblock to Learning -

Strengthen Weak Breathing Muscles: White Paper

By Dr. Darwyn Bartsch, PT, DPT, and
Gem Bartsch, FNP-BC



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About the authors:
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It is exciting to see children learn. Parents, educators and clinicians all play roles in creating environments that are helpful for learning. Persons with special needs respond best when attempts are made to remove possible roadblocks to learning. Weak breathing muscles are a common issue in many diagnoses and conditions. Strong breathing muscles are needed for voice and language, posture and head control, along with arm and hand strength - all aspects that boost learning. Weak breathing muscles are one roadblock to learning that can be removed.

Weak breathing muscles

Breathing muscles are also posture muscles

It has been shown that every muscle of the lower and upper core has two roles - respiratory and postural function (Hodges, Gurfinkel, et al., 2002; Siafakas, Mitrouska, Bouros, Georgopoulos, 1999), and the effects of weak breathing muscles are multiple: impacting language, posture, mobility, head position and control, and fine motor skills.

Weak breathing muscles impact posture, head position, communication, and fine motor skills

First, there is a collapse of the chest, which prevents lung expansion and causes a narrowed airway. This results in shortness of breath, poor endurance and general fatigue. (Shahrizaila, Kinnear, Wills, 2006; Syabbalo, 1998). Speech is now difficult because multiple breaths are needed to say a full sentence. Small breaths result in quiet speaking volume (Huber, 2008). Additionally, as children learn to speak, they cannot make sounds long enough to say words correctly; for example, they may shorten the word "car" to "ca." The parent, caregiver or classroom instructor may not understand this vocal attempt correctly.

Second, a slouched posture, along with a forward head position, occurs. The weak ribcage muscles are unable to lift the ribs (Masery, 2005). This "collapse" of the ribcage, because of the weak breathing muscles, makes it difficult to sit upright, regardless of the time and effort spent in practice. With poor posture, the natural need to breathe automatically overrides the posture role of the trunk muscles (Hodges, Heijnen, et al., 2001; Gandevia, Butler, et al., 2002). Then, as the respiratory

muscles become overworked, they are less able to assist with posture. (Massery, 2005). This often results in a downward gaze, creating a low and limited visual field. Along with these issues, a decline in mobility is directly associated to the weakness of the breathing muscles (Buchmana et al., 2008). Third, a slouched posture affects the function of the shoulder. When the shoulder blade cannot be held in a stable position, it is unable to support the arm and hand movements. This interferes with the development of fine motor skills and coordination of the hand (Lauer, Prosser, 2009; Ludewig, Reynolds, 2009; Masery, 2005).

A roadblock: impacting learning

A weak upper core has a negative effect on children

The upper core is defined as the respiratory accessory muscles. A weak upper core has been shown to have a tremendous negative effect on children. With poor posture it is more and more difficult to focus on a task or activity (Reilly, van Donkelaar, Saavedra, Woollacott, 2008). The child will often be moving and wiggling, or appear to be disinterested in the activity, just because of the weak breathing muscles. The constant movement is distracting and disrupting to developing a new idea or ability.

Learning to say new sounds, or to say combinations of sounds, requires strong breathing muscles

The ability to learn how to say new sounds, or to say a combination of sounds, requires strong breathing muscles. Without the ability to take a deep breath and let it out slowly, there is not enough time for the mouth muscles and tongue to create the specific sounds, and the thoughts and ideas of the individual cannot be expressed through speech. The child then reacts in frustration when trying to communicate, because the want or need cannot be understood.

If communication is through a non-verbal method, it too can be challenging. Learning hand movements for sign language or using a communication device is more difficult because of the reduced fine motor skills of hand (Lauer, Prosser, 2009).

Attention to tasks becomes increasingly difficult

The ability to observe a classroom activity, task or demonstration may be almost impossible because of poor head position. Visual and social interaction with parents, family, peers and instructors is reduced. The child misses out on key social opportunities and classroom activities that are fundamental foundations for developing concepts and relationships.

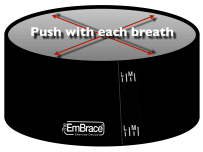
In general, the link between weak breathing muscles and learning cannot be stressed enough: the ability to maintain posture and head control, to vocalize and communicate, and use the arms and hand motor function impacts every aspect of a child's development and education.

Remove the roadblock: strengthen weak breathing muscles through exercise

Weak breathing muscles - a roadblock to learning that can be removed!

Breathing muscles can be strengthened through exercise (Enright, Unnithan, 2011: Baldwin, Haddad, 2002; Booth, Thomason, 1991). The EmBrace® Exercise Device (patent pending) was designed by a physical therapist specifically to exercise and strengthen breathing muscles. It is not a support or bracing device, but it is worn around the chest and activates strengthening of the upper core muscles.

There are 12 muscle groups between the collar bone and the lower ribcage that are used to help breathe in and out. When these muscles are strong, they help with sitting up straight, taking full breaths, speaking in full sentences with adequate volume, coughing, and assist the shoulder for reaching. These muscles are referred to as the upper core muscles.



When wearing The EmBrace®, exercise occurs with the gentle push of each breath as the breathing muscles are triggered to work harder than they normally do. The EmBrace® Exercise Device has been designed to place just the right amount of pressure on the upper chest area and cause the user to take deeper breaths automatically. Wearing The EmBrace® strengthens the breathing muscles. Taking deeper breaths over a few hours each day will help to strengthen the upper core muscles. Stronger muscles improve posture, vocal abilities, cough quality and arm function.

The EmBrace® is designed for use during normal daily activities, whether at home or at school, and can be used by all ages over 12 months, including persons with special needs.

The EmBrace® Exercise Device is a new exercise option for parents, educators and clinicians who want to remove one specific road block to learning – weak breathing muscles. Whether part of a home program, or integrated as part of a schools health and physical fitness program for special needs children, The EmBrace® Exercise Device can be a tremendous benefit to the child, providing a key foundation that is fundamental for ongoing development and learning.

References:

Booth FW, Thomason DB. Molecular and cellular adaptation of muscle in response to exercise: perspectives of various models. Physiol Rev 1991;71:541–85.

Baldwin KM, Haddad F. Skeletal muscle plasticity: cellular and molecular responses to altered physical activity paradigms. Am J Phys Med Rehabil 2002;81:S40–51.

Buchmana AS, Boylea PA, Wilsona RS, Leurgansa S, Shaha RC, Bennetta DA. Respiratory Muscle Strength Predicts Decline in Mobility in Older Persons. Neuroepidemiology 2008;31:174–180.

Gandevia SC, Butler JE, et al. Balancing acts: respiratory sensations, motor control and human posture. Clin Exp Pharmacol Physiol 2002;29:118–21.

Hodges PW, Gurfinkel VS, et al. Coexistence of stability and mobility in postural control: evidence from postural compensation for respiration. Exp Brain Res 2002;144:293–302.

Hodges PW, Heijnen I, et al. Postural activity of the diaphragm is reduced in humans when respiratory demand increases. J Physiol 2001;537(Pt 3):999–1008.

Huber, JE. Effects of Utterance Length and Vocal Loudness on Speech Breathing in Older Adults. Respir Physiol Neurobiol. 2008 December 31; 164(3): 323–330.

Lauer RT, Prosser LA. Use of the Teager-Kaiser Energy Operator for Muscle Activity Detection in Children. Ann Biomed Eng. 2009 August ; 37(8): 1584–1593.

Ludewig PM, Reynolds JF. The Association of Scapular Kinematics and Glenohumeral Joint Pathologies. J Orthop Sports Phys Ther. 2009 February ; 39(2): 90–104.

Massery MP. Musculoskeletal and neuromuscular interventions: a physical approach to cystic fibrosis. J R Soc Med 2005;98(Suppl. 45):55–66.

Reilly DS, van Donkelaar P, Saavedra S, Woollacott MH. Interaction Between the Development of Postural Control and the Executive Function of Attention. J Mot Behav. 2008 March ; 40(2): 90–102.

Shahrizaila N, Kinnear WJ, Wills AJ. Respiratory involvement in inherited primary muscle conditions. J Neurol Neurosurg Psychiatry 2006;77:1108–1115.

Siafakas NM, Mitrouska I, Bouros D, Georgopoulos D. Surgery and the respiratory muscles. Thorax 1999;54:458–465.

Syabbalo N. Assessment of respiratory muscle function and strength. Postgrad MedJ 1998;74:208-215.