

Strengthening the Postural Muscles Using the Dynamic-Directional Pad Dvectis

The maintaining of the posture, i.e., standing upright on two legs, is ensured by the postural muscles, which thus perform the stabilizing function of the body against gravity. We are speaking about creating postural stabilization which is the basis for bipedal gait and upright stance, but also the starting point for any further movement of the body (running, throwing, handling of objects). The postural muscles of the body thus provide support for any movement of the upper and lower extremities. Thanks to it, we have a solid base (a stable position of the body) which can overcome the effects of externally acting forces (1).

As already mentioned, no directed motion can be done without the stabilizing function of the postural muscles. If we pull a leg to the body in the hip joint, the movement cannot do executed without the support of the strengthening function of the muscles of the spine, pelvis, diaphragm, and abdominal muscles. This stabilization takes place before contraction of the phasic muscles which execute the movement in the hip joint. In other words, before the start of the movement, there is optimal stabilization of the whole body (2).

Table 1: Selected muscle groups involved in the stabilization of the body with the formation of a fixed point against the force of gravity or other externally acting forces.

Muscle groups	Function in postural activity	Possible incorrect functional model
Deep stabilization system of the torso and spine	Spine, chest, and pelvis create a support frame for the movement of limbs with the help of the stabilizing muscles. It includes the below groups.	Disharmony between the flexor and extensor. Inadequate stabilization of the spine. Incorrect activation timing of individual muscle groups.
Stabilization function of the diaphragm	Effect on intra-abdominal pressure, lumbar support, balance of breathing and postural activities.	Incorrect interplay between the stabilizing and respiratory functions. Incorrect interplay of the chest biomechanics. Poor respiratory stereotype.
Stabilization function of the abdominal muscles and pelvic floor	Effect on intra-abdominal pressure, close cooperation with the diaphragm, lumbar spine support.	Imbalance in the activation and interplay between the m. Rectus, oblique, and transversus abdominis or its parts. Incorrect activation timing of the diaphragm.
Stabilization function of the paravertebral muscles	The most important stabilizer of individual segments of the spine. Counterbalance to their muscle contraction is provided by the abdominal muscles and diaphragm.	Inadequacy of the abdominal muscles and diaphragm leads to their weakening or even atrophy.

Postural Stabilization and Development of the Child

During the development of the child, muscular stabilization of the spine gradually matures, which is also a requirement for their correct anatomical development. The originally completely kyphotic

spine gradually evolves into the typical sigmoid lordotic-kyphotic curvature along with other anatomical systems, such as the inclination of the pelvis, chest shape, and other. Muscle balance plays an important role in optimal biomechanical load. The proper function of the deep spinal stabilization system prevents the onset or progression of scoliosis of the spine, poor posture, and other deviations from the physiological curvature. Management of postural activity takes place via the central nervous system unconsciously based on the motion patterns that we learn from birth, during development of the locomotor system (Fig.1).

Fig. 1: After four months of development of the locomotor system, the child's interplay between flexion and extensor group of stabilizing the spine develops. This is the basis for lifting the head in the prone position with the support of upper limbs.

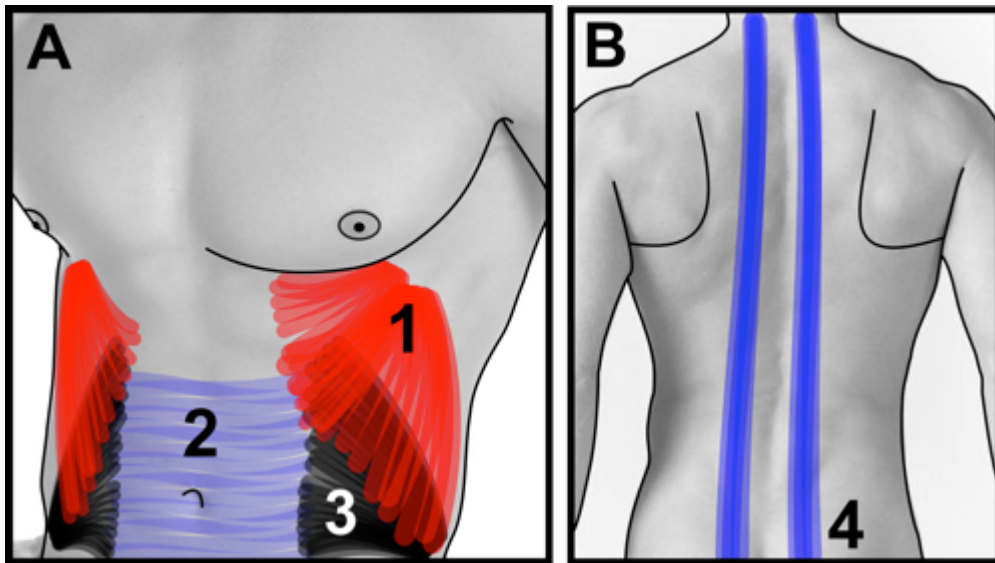


Deep Stabilization System of the Spine

The stabilization function of the torso in combination with the skeleton of the spine, rib cage, and pelvis create a kind of a "support frame", which is the basis for the fixed point and conscious movement. Important is the interplay and cooperation between the ventral (flexors) and dorsal (extensors) muscle groups in both the cervical and upper thoracic spine and in the lower thoracic and lumbar spine. These two functional units are controlled by other groups of muscles that create a balance between the forces acting on the spine from the front and back (Fig. 2).

Fig. 2: Abdominal muscles (A) contribute to the stabilization of the lower thoracic and lumbar spine from the ventral side and are the counterpart of the deep spinal extensors – paravertebral muscles (B). They create pressure in the abdominal cavity by abdominal press, which is transmitted to the lumbar spine. In stabilizing the lower thoracic and lumbar spine on the ventral

side, m. Obliquus externus abdominis (1) m. Transversus abdominis (2) m. Obliquus internus abdominis (3) play an important role. The most important stabilization of the spine from the dorsal side is provided by the paravertebral muscles, which are located along its course (4).



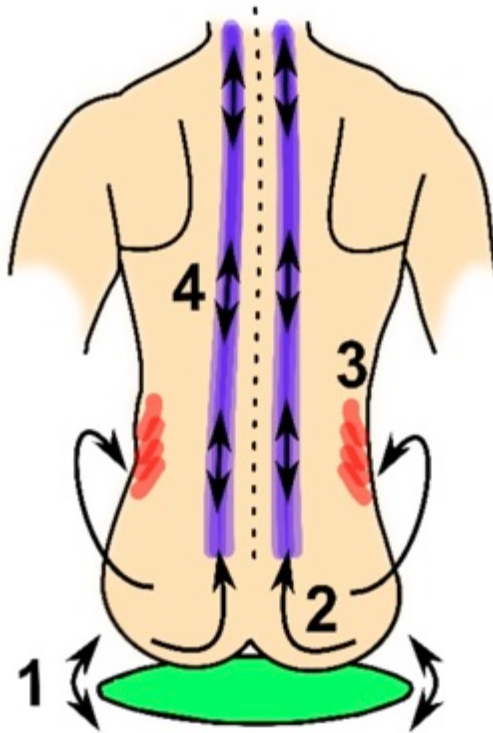
Under physiological situation during upright stand, there is centering of the forces exerted on individual body segments and the postural muscle activity is minimal. This means that maintaining muscle strain requires low power consumption. Imbalance and deviation from the ideal posture leads, on one hand, to weakening and, on the other hand, to overload of the opposing muscle groups and is the basis for degenerative diseases of the spine and the motor system.

Stimulation of Postural Stabilization Using the Dynamic Directional Pad

Sitting on the dynamic (balancing) directional pad creates an unstable platform that forces constant activation of the deep stabilization system of the spine and torso. This eliminates the long-term adverse effects of sitting, when there is static overloading of individual segments of the spine. Proper activation of the deep stabilization system is essential during all daily activities, whether in a sedentary job, at school, at home, or after demanding sport performance.

By loading the balancing pad when sitting creates directional oscillating movements that transform the body weight to forces that propagate deep into the back (paravertebral) and abdominal muscles. Further, they are involved in the activation of the pelvic floor muscles and the diaphragm. Over time, this leads to strengthening of the above muscle groups, which is comparable to regular exercise in the gym. This way, we ensure prevention of degenerative changes of the spine, poor body posture, and relief from back pain (Fig. 3).

Fig. 3: Transfer of forces using a dynamic-directional pad (1) into the deep stabilization system of the torso and spine (2). Among other things, this lead to activation of the abdominal muscles (3) and the deep back muscles (4).



References

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