

Analysis of diaphragm movement during its postural function using m-mode ultrasonography in conjunction with spirometry

Abstract

The diaphragm is a principal inspiratory muscle that, together with the abdominal wall muscles, regulates intra-abdominal pressure, important for the postural stiffening of the spine. This dissertation aimed to analyse the movement of the diaphragm during breathing and postural loading, in relation to changes in respiratory volumes and abdominal wall tension. The theoretical part summarizes the current knowledge about the respiratory and postural functions of the trunk muscles, especially the importance of the diaphragm in maintaining spinal stability and preventing low back pain. The experimental part deals with the evaluation of postural-respiratory movement of the diaphragm using M-mode ultrasonography in conjunction with spirometry and a device called DNS Brace. The assessment was performed during several scenarios that included breath-holding, tidal breathing and loaded breathing while lifting a weight with spontaneous or voluntary contraction of the abdominal muscles. This research suggests that when the postural demands increase, the diaphragm is displaced in a more caudal position not only during inspiration but also during breath-holding. The voluntary contraction of the abdominal muscles is used to increase the stability of the spine during weight lifting; however, during this manoeuvre, there is a decrease in lung volume despite the increase in diaphragmatic movement. The findings presented in this dissertation may be particularly useful in the rehabilitation of patients with low back pain or respiratory diseases in whom reduced diaphragmatic movement has been identified.