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Research article

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2014**Coordination Between Ribs Motion and Thoracoabdominal Volumes in Swimmers During Respiratory Maneuvers**

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This work aimed to verify if swimmers present better chest wall coordination during breathing than healthy non-athletes analyzing the correlation between ribs motion and the variation of thoracoabdominal volumes. The results of two up-to-date methods based on videogrammetry were correlated in this study. The first one measured the volumes of 4 separate compartments of the chest wall (superior thorax, inferior thorax, superior abdomen and inferior abdomen) as a function of time. The second calculated the rotation angle of the 2nd to the 10th ribs around the quasi-transversal axis also in function of time. The chest wall was represented by 53 markers, attached to the ribs, vertebrae, thorax and abdomen of 15 male swimmers and of 15 non-athletes. A kinematical analysis system equipped with 6 digital video cameras (60Hz) was used to obtain the 3D coordinates of the markers. Correlating the curves of ribs rotation angles with the curves of the separate volumes, swimmers presented higher values than non-athletes when the superior and inferior abdomen were considered and the highest correlation values were found in swimmers for the inferior thorax. These results suggest a better coordination between ribs motion and thoracoabdominal volumes in swimmers, indicating the prevalent and coordinated action of the diaphragm and abdominal muscles to inflate and deflate the chest wall. The results further suggest that swimming practice leads to the formation of an optimized breathing pattern and can partially explain the higher lung volumes found in these athletes reported in literature.

Key words: Kinematics, thoracic wall volumes, ribs motion, swimming.

Key Points

- The study revealed that swimmers present higher correlation between the ribs motion and the variation of abdominal volumes than non-swimmers, suggesting that swimming practice might lead to the formation of an optimized breathing pattern, increasing the coordination between the thoracoabdominal volumes and the ribs motion.
- No previous work was found in the literature reporting this optimized breathing pattern in swimmers.
- The higher coordination between the thoracoabdominal volumes and the ribs motion found in swimmers can partially explain the higher lung volumes reported in literature for these athletes.

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