Ultrasound imaging of abdominal muscles and fasciae

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Background: Altered recruitment and activation of the transversus abdominis (TrA), internal oblique (IO) and external oblique (EO) has been shown to be both a cause and consequence of non-specific chronic low back pain in younger adults. Researchers have investigated these muscles’ morphometry and activation using ultrasound imaging. However, the fascial component has never been taken into account and the relationship between abdominal muscles as well as fascia morphometry and injury to the lower limbs has not yet been explored.

Objectives: This study aimed to describe the abdominal muscles and fasciae of healthy young and active adults and to compare their thickness between a relaxed and a contracted state. The association between these data and history of lower limb injury was also explored.

Methods: 20 healthy young physically active adults (10 men aged 23.3±2.36; 10 women aged 24.1±4.48) participated in this study. Anthropometric data and information on previous injuries in sport were first collected. Ultrasound images (linear probe, B-mode, transverse axis, standardized procedure, same operator) of the following muscles and fasciae were captured on both sides at rest, then during a crunch maneuver for the OE, OI, TrA and their related fascial (F) layers (F OE, F OE/OI, F OI/TrA). Thickness of all structures were measured with the ultrasound machine built-in software (distances measured between calipers by the operator). Muscle activation corresponded to the changes in thickness of the muscles between relaxed and contracted state.

Results: There was a significant difference between the relaxed and contracted state for the OI and the TrA for men and women. Men had significantly greater muscle thickness than women for all muscles. During the crunch maneuver, the TrA activation was the highest in women while for men, the IO showed the highest activation. A decreased activation of the EO appeared to be related with history of lower limb trauma. Thickness of the fascial layers were: F EO = 0.85 ± 0.21mm for men vs 0.93 ± 0.31mm for women; F EO/OI = 0.54 ± 0.13mm for men vs 0.51 ± 0.15mm for women; F OI/TrA = 0.54 ± 0.09mm for men vs 0.44 ± 0.09 mm for women. The F EO was thicker than both, F EO/OI (p<0.001) and F OI/TrA (p<0.001).

Conclusion: Ultrasound imaging is a useful tool to evaluate muscle morphometry and activation. A lower activation of OE may be related to history of lower limb trauma, but more research is needed to confirm this relationship. Ultrasound can be used to evaluate fascia thickness but the behavior of abdominal fasciae during muscle activation doesn’t lead to a unique interpretation and needs to be clarified.