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Twente Spine Model: A Complete and Coherent Dataset for Musculo-Skeletal Modeling of the Lumbar Region of the Human Spine

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Abstract

Musculo-skeletal modeling can greatly help in understanding normal and pathological functioning of the spine. For such models to produce reliable muscle and joint force estimations, an adequate set of musculo-skeletal data is necessary. In this study, we present a complete and coherent dataset for the lumbar spine, based on medical images and dissection measurements from one embalmed human cadaver. We divided muscles into muscle-tendon elements, digitized their attachments at the bones and measured morphological parameters. In total, we measured 11 muscles from one body side, using 96 elements. For every muscle element, we measured three-dimensional coordinates of its attachments, fiber length, tendon length, sarcomere length, optimal fiber length, pennation angle, mass, and physiological cross-sectional area together with the geometry of the lumbar spine. Results were consistent with other anatomical studies and included new data for the serratus posterior inferior muscle. The dataset presented in this paper enables a complete and coherent musculo-skeletal model for the lumbar spine and will improve the current state-of-the art in predicting spinal loading.

Keywords: lumbar spine, cadaver, musculo-skeletal model, muscles, sarcomere length

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