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Spinal sagittal alignment: investigation of postoperative pelvic kinematic improvement in patients with spinal sagittal imbalance using machine learning methods

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Abstract

Background: Pelvic plays an important role in human movement, and it is the foundation that provides stability during activities such as walking. An abnormal condition of the pelvic, whether it is an abnormality of alignment or function, requires timely treatment intervention. Traditionally, pelvic examination has been performed through static two-dimensional imaging with very limited insight into real-time pelvic dynamics. More specifically, IMU sensors are already very powerful in acquiring all nuances of movement mechanics; with the addition of ML techniques, they can serve as an effective methodology for forecasting pelvic movement patterns for different activities. Material and Methods: The present study investigates the gait pattern of 50 female patients with SSI compared to 50 controls. Various machine learning models were applied using IMU data collected during gait analysis in order to identify and assess abnormalities in movement. Results: SVM has the best accuracy in the IMU data-based classification of pelvic movement disorders. The most relevant features, providing separation of patients from controls using the model, were identified pre- and post-surgery. Conclusion: Surgical patients with pelvic malalignment demonstrated asymmetric movements in the postoperative period. IMU combined with ML techniques provided a valid method for quantification and analysis of pelvic dynamics.

Keywords: Spine, Gait analysis, Machine learning

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