

## A Preliminary Kinematic Comparison of Vive and Vicon Systems for the Accurate Tracking of Lumbar Motion

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**Abstract :** Optoelectronic 3D motion capture systems, such as the Vicon kinematic system, are widely utilized in biomedical research to track joint motion. These systems are considered powerful and accurate measurement tools with <2 mm average error. However, these systems are costly and may be difficult to implement and utilize in a clinical setting. 3D virtual reality (VR) is gaining popularity as an affordable and accessible tool to investigate motor control and perception in a controlled, immersive environment. The HTC Vive VR system includes puck-style trackers that seamlessly integrate into its VR environments. These affordable, wireless, lightweight trackers may be more feasible for clinical kinematic data collection. However, the accuracy of HTC Vive Trackers (3.0), when compared to optoelectronic 3D motion capture systems, remains unclear. In this preliminary study, we compared the HTC Vive Tracker system to a Vicon kinematic system in a simulated lumbar flexion task. A 6-DOF robot arm (SCORBOT ER VII, Eshed Robotec/RoboGroup, Rosh Ha'Ayin, Israel) completed various reaching movements to mimic increasing levels of hip flexion (15°, 30°, 45°). Light reflective markers, along with one HTC Vive Tracker (3.0), were placed on the rigid segment separating the elbow and shoulder of the robot. We compared position measures simultaneously collected from both systems. Our preliminary analysis shows no significant differences between the Vicon motion capture system and the HTC Vive tracker in the Z axis, regardless of hip flexion. In the X axis, we found no significant differences between the two systems at 15 degrees of hip flexion but minimal differences at 30 and 45 degrees, ranging from .047 cm ± .02 SE (p = .03) at 30 degrees hip flexion to .194 cm ± .024 SE (p < .0001) at 45 degrees of hip flexion. In the Y axis, we found a minimal difference for 15 degrees of hip flexion only (.743 cm ± .275 SE; p = .007). This preliminary analysis shows that the HTC Vive Tracker may be an appropriate, affordable option for gross motor motion capture when the Vicon system is not available, such as in clinical settings. Further research is needed to compare these two motion capture systems in different body poses and for different body segments.

**Keywords :** lumbar, vivetracker, viconsystem, 3dmotion, ROM

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