# Comparison of Markerless and Conventional Marker-Based Shoulder Kinematics Models during Activities of Daily Living in Patients with Glenohumeral Osteoarthritis

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INTRODUCTION: Markerless motion capture utilizes deep learning models to evaluate standard video from multiple cameras and is significantly more time-efficient than traditional marker-based systems in both setup and analysis. Therefore, the purpose of this study was to evaluate the concurrent validity of markerless shoulder analysis compared to traditional marker-based shoulder analysis during activities of daily living (ADLs) in patients with glenohumeral osteoarthritis.

METHODS: One hundred subjects underwent clinical upper extremity assessment with data being captured concurrently by traditional marker-based and markerless motion capture systems. This study assessed ADLs including 4 tasks: overhead reaching, drinking, hair brushing, and personal hygiene tasks. Marker-based motion was evaluated with University of Southampton Upper Limb Kinematic Model flexion-based (SF1, SF2) and abduction based (SA1, SA2) models.

RESULTS: There was a strong positive relationship between markerless and SF1 and SF2 marker-based models in peak angle (ICC: 0.81-0.95; p-value < 0.001), range of motion (ICC: 0.81-0.97; p-value < 0.001), and motion pattern (ICC: 0.88-0.99; p-value < 0.001) in flexion/extension and abduction/adduction throughout all tasks. However, the agreement with the rotation plane was found to be poor. As forward flexion and abduction angles approached the maximum functional range of the shoulder, there was a weaker but consistent relationship between the two systems.

DISCUSSION AND CONCLUSION: Markerless systems were within 10 degrees of both the marker-based and markerless models for flexion/extension; however, it underestimated rotation movement across all tasks. Because markerless motion analysis is cheaper, faster, and easier to implement, it can greatly increase the availability of motion analysis within laboratories and clinical practice and has the potential to become a core component of clinical management of shoulder pathologies.