

The Analysis of Movement Pattern during Reach and Grasp in Stroke Patients: A Kinematic Approach

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Abstract : Introduction: This study was aimed to evaluate temporo-spatial patterns during the reach and grasp task in hemiplegic stroke patients and to identify movement pattern according to severity of motor impairment. Method: 29 subacute post-stroke patients were enrolled in this study. The temporo-spatial and kinematic data were obtained during reach and grasp task through 3D motion analysis (VICON). The reach and grasp task was composed of four sub-tasks: reach (T1), transport to mouth (T2), transport back to table (T3) and return (T4). The movement time, joint angle and sum of deviation angles from normative data were compared between affected side and unaffected side. They were also compared between two groups (mild to moderate group: 28~66, severe group: 0~27) divided by upper-Fugl-Meyer Assessment (FMA) scale. Result: In affected side, total time and durations of all four tasks were significantly longer than those in unaffected side ($p < 0.001$). The affected side demonstrated significant larger shoulder abduction, shoulder internal rotation, wrist flexion, wrist pronation, thoracic external rotation and smaller shoulder flexion during reach and grasp task ($p < 0.05$). The significant differences between mild to moderate group and severe group were observed in total duration, durations of T1, T2, and T3 in reach and grasp task ($p < 0.01$). The severe group showed significant larger shoulder internal rotation during T2 ($p < 0.05$) and wrist flexion during T2, T3 ($p < 0.05$) than mild to moderate group. In range of motion during each task, shoulder abduction-adduction during T2 and T3, shoulder internal-external rotation during T2, elbow flexion-extension during T1 showed significant difference between two groups ($p < 0.05$). The severe group had significant larger total deviation angles in shoulder internal-external rotation and wrist extension-flexion during reach and grasp task ($p < 0.05$). Conclusion: This study suggests that post-stroke hemiplegic patients have a unique temporo-spatial and kinematic patterns during reach and grasp task, and the movement pattern may be related to affected upper limb severity. These results may be useful to interpret the motion of upper extremity in stroke patients.

Keywords : Fugl-Meyer Assessment (FMA), motion analysis, reach and grasp, stroke

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