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# The Effect of Seated Distance on Muscle Activation and Joint Kinematics during Seated Strengthening in Patients with Stroke with Extensor Synergy Pattern in the Lower Limbs

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**Abstract :** Task-specific training with intense practice of functional tasks has been emphasized for the approaches in motor rehabilitation in patients with hemiplegic strokes. Although reciprocal actions which may increase demands on motor control during seated stepping exercise, motor control is not explicitly trained with emphasis and instruction focused on traditional strengthening. Apart from cycling and treadmill, various forms of seated exerciser are becoming available for the lower extremity exercise. The benefit of seated exerciser has been focused on the effect on the cardiopulmonary system. Thus, the aim of current study is to investigate the effect of seated distance on muscle activation during seated strengthening in patients with stroke with extensor synergy pattern in the lower extremities. Electrodes were placed on the surface of lower limbs muscles, including rectus femoris (RF), vastus lateralis (VL), biceps femoris (BF) and gastrocnemius (GT) of both sides. Maximal voluntary contraction (MVC) of the muscles were obtained to normalize the EMG amplitude obtained during dynamic trials with analog raw data digitized with a sampling frequency of 2000 Hz, fully rectified and the linear enveloped. Movement cycle was separated into two phases by pushing (PP) and Return (RP). Integral EMG (iEMG) is then used to quantify level of activation during each of the phases. Subjects performed strengthening with moderate resistance with speed of 60 rpm in two different distances (D1, short) and (D2, long). The results showed greater iEMG in RF and smaller iEMG in VL and BF with obvious increase range of motion of hip flexion in D1 condition. On the contrary, no significant involvement of RF while greater level of muscular activation in VL and BF during RP was found during PP in D2 condition. In addition, greater hip internal rotation was observed in D2 condition. In patients with stroke with abnormal tone revealed by extensor synergy in the lower extremities, shorter seated distance is suggested to facilitate hip flexor muscle activation while avoid inducing hyper extensor tone which may prevent a smooth repetitive motion. Repetitive muscular contraction exercise of hip flexor may be helpful for further gait training as it may assist hip flexion during swing phase of the walking.

**Keywords :** seated strengthening, patients with stroke, electromyography, synergy pattern
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