

Shoulder and Elbow Joints' Positions Influence Gripping Force and EMG Activities of Wrist Muscles

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Abstract

Background: Upper limb posture while working is an important factor affecting muscle forces and level of EMG activities. Gripping task is frequently used in workplace and upper limb posture alters the output grip strength and the forearm muscles activities. **Purpose:** The purpose of this study is to investigate the effect of four different positions of shoulder and elbow joints on the hand grip strength and myoelectric activities of wrist flexors and extensors in normal subjects. **Subjects:** Thirteen normal male university students volunteered to participate in this study. Their mean age, weight and height were 19.6 years (± 1.06), 75.9 Kg (± 7.51) and 173.5 cm (± 4.67) respectively. **Method:** Four positions of shoulder (Sh) and elbow (El) joints were assumed during which both hand grip strength and EMG of wrist flexors and extensors were measured and compared. The tested positions were: (1) 0° Sh 90° El, (2) 90° Sh flexion 90° El flexion, (3) 90° Sh abduction 0° El, and (4) 90° Sh abduction 90° El flexion. Each subject was instructed to produce a powerful grip and maintain this grip force for 5 seconds during which the raw EMG signals were recorded. Three trials of recording of EMG and grip strength were collected with a rest period of 3 minutes between each trial to prevent fatigue. **Analysis:** One way repeated measures within subject Multivariate Analysis of Variance (MANOVA) was performed using SPSS version 20 with a significance level of 0.05. **Results:** Statistical analysis revealed that position (3) had significant higher hand grip strength compared to the other three positions. Root Mean Square (RMS) EMG activities showed that position (3) had the highest EMG for both flexors and extensors so this position was taken as reference task for EMG normalization. Wrist flexors percentage (%) of normalized RMS EMG showed no significant difference among the three positions while wrist extensors % RMS EMG has its significant effects when position (1) was compared to (2) and (4). **Conclusion:** The findings of this study have important

implications for the development of wrist and hand injuries in repetitive or prolonged workplace tasks and their rehabilitation especially when the task requires different postures from elbow and shoulder joints

Keywords: Hand Grip strength, EMG, Upper Limb Posture, Wrist Muscles, Ergonomics.