



A STUDY OF GRIP STRENGTH IN DIFFERENT ELBOW POSITIONS

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Abstract : This study aims to determine the effects of different elbow positions on grip strength. A hand grip dynamometer is used in this study to measure the grip strength of 50 healthy adult male subjects, in three different elbow positions (1) Elbow at 0 degree flexion (2) Elbow at 90 degree flexion (3) Elbow at 135 degree flexion (International standard Goniometer was used in this study to ensure the correct degree of flexion) The study was conducted in the dominant hand as per the American Society of Hand Therapist Standard protocol with the exception of elbow position (Shoulder in adduction and neutral rotation, sitting posture, fore arm in neutral, wrist in neutral position). The elbow in these three different positions are of primary significance. The exclusion criteria for this study includes any previous history of upper extremity abnormalities, inflammatory joint diseases, neurological disorder, or injury to upper limb and other health conditions. A statistical analysis was done between these three different elbow positions to know which position had more grip strength and in which position had less.

Keyword : 'Grip strength', 'Elbow positions', 'Hand dynamometer',

INTRODUCTION:

Many daily functions and sporting events require high activity levels of the flexor musculature of the forearms and hands. These are the muscles involved in gripping strength. From sports like wrestling, tennis, foot ball, basket ball and base ball to daily activities like carrying laundry, turning a doorknob, and vacuuming, some degree of grip strength is necessary. There are 35 muscle involved in the forearm and hand, and most are involved in gripping activities (1). The muscles of the flexor mechanism in the hand and forearm create grip strength while the extensors of the forearm stabilize the wrist. There are four major joints of the hand; carpometacarpal, intermetacarpal, metacarpophalangeal, and interphalangeal joint. Nine extrinsic muscles and 10 intrinsic muscles are involved in the hand grip. Grasping ability is made possible by the fact that the thumb can be opposed to the fingers. The fingers and the thumb act as a versatile pair of pliers. They need the palm of the hand as a flat base, on which the object grasped can be held (2). Posture and elbow positioning during hand grip testing also played an important role in the strength results. Various studies showed grip strength to be greater with less flexion at the elbow.(3,4, 5) If grip strength measures were found to vary depending on elbow position, interpretation of this information could affect

treatment planning in a clinical setting. Hand exercises could be performed at the patient's strongest or weakest position, depending on outcome desired. Hand grip strength has long been thought of as a possible predictor of overall body strength. Smith et al found a direct correlation in grip strength and overall body strength in very old and older females (6)

MATERIALS AND METHODS:

The study was done in October 2014. Fifty healthy adult males were recruited for the study. The exclusion criteria for this study includes any previous history of upper extremity abnormalities, inflammatory joint diseases, neurological disorder, or injury to upper limb. Informed written consent was obtained from all subjects who participated in the study. Grip strength (in Kilogram) was measured in a hand grip dynamometer (Labotech Precision Instruments India Ltd) **Figure No: 1**, and it was measured in three different elbow positions. (1) Elbow at 0 degree of flexion (2) Elbow at 90 degrees of flexion (3) Elbow at 135 degrees of flexion (International standard Goniometer was used in this study to ensure correct degree of flexion) **Figure No: 2.**



FIGURE NO: 1 HAND GRIP DYNAMOMETER



FIGURE NO: 2 GONIOMETER

The study was conducted in the dominant hand as per the American Society of Hand Therapist Standard protocol with the exception of elbow position (shoulder in adduction and neutral rotation, sitting posture, fore arm in neutral, wrist in neutral position). Mean age group of the subjects was 28.5 ± 5.11 ; Mean height of the subjects was 1.67 ± 0.056 ; Mean weight was 65.04 ± 6.59 ; Mean BMI was 23.08 ± 1.41 (Table No:1)

Table No: 1	
Variables	Mean \pm SD
Age(years)	28.5 ± 5.11
Height(m)	1.67 ± 0.056
Weight(Kg)	65.04 ± 6.59
BMI(kg/m ²)	23.08 ± 1.41
0 Degree (kg)	27.6 ± 4.44
90 Degree(kg)	24 ± 4.31
135 Degree(kg)	20.84 ± 3.94

RESULTS:

We analyze our study data by students "t" test ('p' value of < 0.05 as significance). On comparing 0 degree versus 90 degree there was a significant difference with 'p' value of 0.000; 90 degree versus 135 degree showed significant difference with 'p' value of 0.000; 0 degree versus 135 degree showed significant difference with 'p' value of 0.000; **Mean \pm SD** for 0 degree flexion showed 27.6 ± 4.44 ; **Mean \pm SD** for 90 degree flexion showed 24 ± 4.31 ; **Mean \pm SD** for 135 degree flexion showed 20.84 ± 3.94 . (Table No: 1) On comparing the Mean \pm SD of three elbow positions (Figure No: 3), implies that **hand grip is more in 0 degree elbow flexion** compared to 90 degree and 135 degree elbow flexions; similarly hand grip is more in 90 degree elbow flexion compared to 135 degree flexion of elbow; 135 degree flexion of elbow has weakest grip strength.

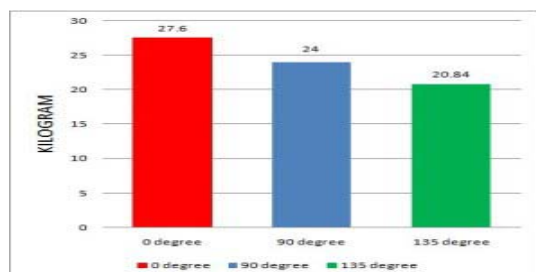


FIGURE NO: 3 COMPARISON OF MEAN VALUES OF GRIP STRENGTH IN 3 DIFFERENT ELBOW POSITIONS

DISCUSSION:

The highest mean grip strength measurement was recorded when the elbow was at 0 degree flexion (full extension of elbow). Grip strength scores decreased as the elbow was positioned in greater degrees of flexion; thus, 90 degree flexion had weaker grip strength and 135 degree of flexion had the weakest grip strength (3) From the physiological perspective, it considered length tension relationship (7) of the muscles involved in grip strength. Primary muscle involved in the flexor grip strength is the flexor digitorum superficialis which originates from the medial condyle of humerus. This is the only flexor muscle which crosses the elbow joint; therefore, elbow position may affect the strength performance of the muscle. If this muscle is placed in a shortened position (more flexed position) tension developed in the muscle is less, it may be incapable of generating the tension necessary to achieve a functional contraction. This is in accordance with Frank-Starling's law, which states that within physiological limits, the force of

contraction is directly proportional to initial length of muscle fibre, placing it in a mechanical disadvantage in full flexed position, compared to less flexed position of the elbow. 0 degree elbow flexed position allows subject to stabilize the elbow in locked position. This stable position may have also contributed to higher grip strength (8,9) Similar results were observed in our study. The American Society of Hand Therapists (ASHT) recommended that the subject be seated with shoulder adducted and neutrally rotated, the elbow flexed to 90 degree and the forearm and wrist in a neutral position, during hand grip strength measurement. (10) Our study results were in support to this protocol with the exception of elbow position. This knowledge of full extension at the elbow produces the highest grip strength scores can be incorporated in treatment techniques and functional activities especially in sports. For example, an individual may find it easier to open a jar if it is held between their legs while in seated position to allow full extension of elbow and shoulder in adducted position. Repetitive work activities can also be adapted so that upper extremity positioning provides maximal grip strength. This may reduce the effort required and decrease the occurrence of overuse injuries to the upper extremities during repetitive activities. During rehabilitation, hand exercise can be performed in full extension than flexion of elbow to maximize hand grip.

CONCLUSION:

The results of this study showed significant differences in grip strength scores with the elbow held in various positions. Grip strength is more in 0 degree flexion (full extension of elbow) compared to greater degrees of flexion. Limitation of the study includes not adapting to change in the shoulder, forearm, and the wrist positions.

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