

A Study on influence of Wrist Joint Position on Grip strength in normal Adult Male Individuals

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Abstract:

AIM: In the present experiment we investigated how closely grip strength corresponded to two different positions of wrist joint

- In neutral position
- In dorsiflexion of 25°-35° with Ulnar deviation 10°-15°

MATERIAL & METHODS: In this study 200 male subjects with uninjured wrist joint in the age group of 20-50 years from the villages of Karunakaracherry and Annamedu in Pattabiram, Chennai, were selected.

The grip strength of the dominant hand is measured using Jamar Dynamometer in second handle spacing. Three measurements of grip strength are taken in each position of wrist joint, average of this is taken for calculation. A rest time of 1 minute was given in between two measurements

RESULT: The Mean grip strength of dominant hand when wrist joint was held in neutral position was 36.425 kgs with S.D = 4.588 and when the wrist joint was held in Extension (25°-35°) with Ulnar deviation (10°-15°) it was 39.384 kgs with S.D = 4.497. The comparison shows that there is a significant change in the grip strength of 2.959 kgs between the two positions of the wrist joint. The calculated t-value of 29.4641 shows that there is statistical significance, at P < 0.005 (5 % level)

CONCLUSION: This study concludes that the grip strength in dominant hand was higher when the wrist joint was held in Extension (25°-35°) with Ulnar deviation (10°-15°) position than when it is held in neutral position.

Keywords: Wrist joint position, grip strength, Ulnar deviation

INTRODUCTION

The Human hand is an amazing instrument designed to obtain both information and execution, it can be used to grip objects in several ways. The architecture of the hand enables it to form a strong grip and also have a wide freedom of movements.

Grip strength is the force applied by the hand to pull on or suspend from objects and is a specific part of hand strength. The intrinsic and extrinsic muscles of wrist both work together to produce the strength of grip. The extrinsic muscles responsible for producing flexion of the fingers

pass through the carpal tunnel in front of the wrist, so the position of wrist optimises the grip strength.

In the present experiment we investigated how closely grip strength corresponded to two different position of wrist joint that is in neutral position and in dorsiflexion of 25°-35° with Ulnar deviation 10°-15°.

Materials and Methods

The study after obtaining IHEC approval (IHEC NO: M.Sc4/SU36/09) was conducted in the villages of Karunakaracherry and Annamedu in Pattabiram, Chennai- 600072, Tamilnadu, India. 200 normal adult male individuals with uninjured wrist joint in

the age group of 20-50 years were enrolled for the study. Persons with recent history of fracture of forearm & hand bones, recent injury, immobilization, limitation of motion around wrist joint, history of arthritis or any pathological disease and history of pain around wrist and hand were excluded from the study.

The standard, adjustable-handle Jamar dynamometer, reported as the most accurate for measuring grip strength was used.² For standardization, the second handle position (of the five positions available) was used for all subjects.^{1,8,12} The calibration of the dynamometer was tested periodically during the study. Prior to taking measurements, demonstration of the device was done, so that all subjects have become familiar with the procedure.

All the grip measurements were taken with the subjects in erect sitting position without arm rest, the grip strength of the dominant hand was measured with their shoulder adducted and neutrally rotated; elbow flexed at 90°, forearm in neutral position,¹³ and in two positions of wrist joint.

1. Wrist in Neutral position.
2. Wrist in extension (25°-35°) with (10°-15°) Ulnar deviation.

The subjects were made to grasp the dynamometer & they were asked to grasp it with maximum force. Verbal encouragements were given for each test. After the subjects were appropriately positioned they are instructed as "ARE YOU READY? SQUEEZE AS HARD AS YOU CAN" the subject squeezed for 6 seconds and then relaxed⁹. Three measurements of grip strength were taken in each position of wrist joint, the average of this was taken for calculation,^{6,13} rest time of 1 minute was given in between two measurements.¹⁶

The collected data were tabulated and analysed, to find out significant difference between the grip strength in two different positions of wrist joint (neutral and extension with ulnar deviation) Paired 't' test was used.



Fig 1: Wrist Joint in Neutral Position



Fig 2: Wrist Joint in Extension with Ulnar Deviation

RESULT

The mean grip strength of dominant hand when wrist joint is held in neutral position is 36.425 kgs with S.D = 4.588 and when the wrist joint was held in Extension (25°-35°) with Ulnar deviation (10°-15°)

it is 39.384 kgs with S.D = 4.497. The comparison shows that there is a significant change in the grip strength of 2.959 kgs between the two positions of the wrist joint.

The calculated t-value of 29.4641 shows that there is statistical significance, at $P < 0.005$ (5 % level), between the grip strength when wrist joint is held in Neutral position & Extension (25° - 35°) with Ulnar deviation (10° - 15°) position.

Table 1: Comparing the grip strength of dominant hand in neutral position and extension (25° - 35°) with ulnar deviation(10° - 15°) positions of wrist joint

Wrist Joint Position	Mean Grip Strength In Kgs.	S.D	S.E.M	Mean Difference	Paired t-value	p- value
Neutral	36.42	4.58	0.32	2.96	29.46	$P < 0.0001$ (Significant)
Extension with Ulnar Deviation	39.38	4.49	0.31			

DISCUSSION

Many studies are done on evaluation of isometric grip strength in different upper limb positions.^{1, 3, 7, 10} **James C Pryce** (1980) found significant changes for 30 people in power grip strength for wrist position between neutral and ulnar deviation, and fifteen degrees each side of neutral in volar and dorsiflexion⁷.

J. G. Sappiatzer tested the optimal wrist position between extension and flexion to achieve the highest grip strength in 20 subjects. The mean self selected angle was 28 degrees wrist extension and this position had the highest mean grip strength of all angles tested¹⁴.

Frank T. Hazelton, Fong PW, Lamoreaux L all in there studies suggest that wrist position significantly influences grip strength^{5, 4, 11}. **Zong-Ming Li** in 2002, has proved on research done with 9 person that Wrist position had a significant effect

on individual finger force and total force production. Peak finger forces were produced at 20° of wrist extension and 15° of ulnar deviation¹⁷.

Shawn W. O'Driscoll (1992) in his study found that the position for maximal grip strength was 35 degrees of extension and 7 degrees of ulnar deviation, grip strength is significantly reduced when wrist position deviates from this self-selected optimum position but the number of subjects used was only 20¹⁵.

In our study, this position of wrist joint was tested against neutral position of wrist joint with a sample size of 200 male subjects.

CONCLUSION

In essence this study affirms that stronger grip strength of dominant hand (Mean difference 2.959 kg/ $p < 0.05$ (5% Level) is achieved with wrist joint held in extension (25° - 35°) with ulnar deviation (10° - 15°) position than when it is held in neutral position. This position of the wrist seems to have better grip strength hence this position can be used as a starting position for training patients to improve their grip strength. Further study in this position of wrist may be done to take it as the functional position for immobilization or even as the position of arthrodesis in cases of severe arthritis.

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