(International Print/Online Journal)

SJIF IMPACT FACTOR: 4.617
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume2, Issue 5, Page No: 255-258
September-October 2019

Influence of Wrist Position on Grip Strength in the Splinted and Non- Splinted Dominant Hand

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Type of Publication: Original Research Paper
Conflicts of Interest: Nil

ABSTRACT

An established procedure for the management of many wrist and carpal disorders is arthrodesis. Although it helps to provide significant relief of pain, correction of deformity and stabilization of the wrist joint, it cannot restore grip strength.[1] The optimal position for wrist arthrodesis still remains controversial. Our aim was to assess the grip strength in static extended positions (splinted position) of wrist with PIP, DIP and MCP in accordance with the functional position of hand. The grip strength was measured using the Jamar hand dynamometer on 60 healthy participants. The wrist was secured in different positions of extension- 15^0, 30^0, 45^0 using thermoplastic splints and the task to be performed was explained to the participants. The participant was made to sit as in the standardized position and the grip strength was measured in different proposed positions. The results of our study show that if the wrist is fused between neutral to 45^0 of extension, it does not significantly contribute to an increase in the grip strength. The unconstrained grip strength is produced by an optimal balance between the various joints and the muscle tension that results in the maximum grip strength. Hence the patient's felt needs and the functional demands should be considered as the key factors to decide the ideal position for wrist arthrodesis. The results show that the grip strength was higher in the non-splinted self selected position and there is no statistically significant difference between the various splinted positions.

Keywords: Arthrodesis, Grip strength, Wrist position

INTRODUCTION

The balanced forces, between the thumb and the forefingers normal to the contact surface, that hold an object in a prismatic grip are called *grip force*. [2]

One of the main factors that affect grip strength is the body position. However, a standardised grip strength testing procedure is not always practical, as certain limitations like wrist pathologies or the presence of contractures or tightness in the upper extremity joints might exist for some patients. A standardised protocol for testing handgrip strength is recommended by the American Society of Hand Therapists, in which the shoulder is adducted and neutrally rotated, elbow is flexed to 90^0, forearm is in neutral and the wrist is between 0-30^0 extension and 0-15^0 ulnar deviation.

Grasp is an important function of the wrist joint. The hand cannot function as a manipulator or sensory organ unless an object can enter the palmar surface and finger flexion and thumb opposition occurs simultaneously. The position in which the hand is in optimal degree for functional activity has been described in literature. This position, of slight dorsiflexion (20- 35^0), slight ulnar deviation (10^0) and fingers moderately flexed at MCP joints (45^0) and PIP joints (30^0) and slightly flexed at DIP joints is ideal for immobilisation and is referred to as the

'functional position of hand.'[3] Various therapeutic interventions such as wrist arthrodesis and application of splints are important in management of wrist pathologies. Significant loss of maximal grip strength has been reported after arthrodesis, one of the reasons being that wrist is fused in suboptimal position. There is limited literature on the exact angulation to be maintained, or the functional position of the wrist in the dorso-palmar and ulno-radial planes, as well as the reduction in grip strength in splinted hand as opposed to non-splinted hand.

An established procedure for the management of many wrist and carpal disorders is arthrodesis. Although it helps to provide significant relief of pain, correction of deformity and stabilization of the wrist joint, it cannot restore grip strength.[1]

Significant literature exists on the effect of wrist position on grip endurance and grip strength. However, most studies done on the wrist are in non-splinted position, which may lead to variations in specified angles.

Certain studies show that maximal grip strength is achieved without significantly compromising grip endurance, at a position of 30° of wrist extension. This has clinical implications for decisions regarding the optimal position for orthosis and radio carpal joint arthrodesis.[4] Another study says that there is no significant difference in the static grip strength between the neutral and 45^0 wrist extension. Their results suggest that the grip strength is not significantly influenced by the position of wrist fusion between neutral and 45^0 of extension. The ideal position of wrist arthrodesis can be customised to the patient according to their individual felt needs.[1] The optimal position for wrist arthrodesis still remains controversial, according to literature.

The focus of this study was to find the interactions between the grip force that is produced and the position of the wrist in a splinted and non-splinted hand. Our aim was to assess the grip strength in static extended positions (splinted position) of wrist with PIP, DIP and MCP in accordance with the functional position of hand.

Need for the study:

Significant literature exists on the effect of wrist position on grip endurance and grip strength. However, most studies done on the wrist are in non-splinted position, which may lead to variations in specified angles.

Grip strength measurements provide an important evaluation of functional integrity of upper extremity. Evaluation of grip strength is important in determining effectiveness of treatment strategies or procedure. The aim of this study was to evaluate the effect of splinting on the dominant wrist, in different angles of extension and to compare them to the maximal grip strength in the non- splinted position of the same wrist, in the Dorso- palmar plane. We believed that measuring grip strength in the standardized position by splinting the dominant wrist would give near accurate values for the different degrees of dorsiflexion of the wrist.

Objectives:

Primary: to compare the grip strength between the splinted and non-splinted hand

Secondary: to find the best angle of extension of the wrist to achieve maximum grip strength in the splinted hand

METHODS:

Study design: It was a cross sectional study design.

Study setting: The study was carried out in the Department of Physiotherapy of St Johns Medical College & Hospital.

Sample selection:

a) Inclusion criteria

1. Student of SJNAHS.

2. Aged18 years or above

3. Willingness to participate

The participants in the study were volunteers among the AHS students in the Institution

b) Exclusion criteria

1. Subjects with history of upper limb pathologies

2. Subjects with cognitive or perceptual deficit

3. Subjects with epilepsy

Sample size was of 60 in order to observe mean grip strength between splinted and nonsplinted dominant hands. Considering the mean grip strength in splinted hand as 34.3± 4.58 and in the splinted grip mean of

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30±4.49 with 5% level of significance and 80% power.

Materials used:

- Splints, designed to hold the wrist in different positions of wrist- 15^0, 30^0, 45^0 of extension.
- Hand held Jamar dynamometer, to measure the grip strength

Procedure:

60 healthy participants who satisfied the inclusion criteria were tested. Jamar dynamometer was used for measuring grip strength. A verbal explanation was given to the participants followed by demonstration of how to perform maximum grip strength on the dynamometer. The wrist was held in different positions of wrist extension- 15^0, 30^0 and 45^0, using splints. The grip strength was recorded in the standardized position with the participant sitting on a chair with arm rest and their arm held in zero degrees abduction against the body. The elbow was flexed to 90^0 with the forearm in the neutral position and dominant wrist in the position determined by the splint that was applied.

Informed consent was taken. The participants in this study were students from SJNAHS, between the age group of 18-23 years, selected as per the inclusion and exclusion criteria.

First measurement was taken with the wrist in self selected position without a splint.

The splints were then applied sequentially to the participants′ dominant wrist and grip strength at the first attempt was recorded with standardised encouragements in accordance with Mathiowetz et al.[5] who have a set of 14 standardised instructions: 'I want you to hold the handle like this and squeeze as hard as you can'. The examiner demonstrated and then gave the dynamometer to the subject. After the subject was positioned appropriately, the examiner asked, 'Are you ready? Squeeze as hard as you can'. As the subject began to squeeze, the examiner said, 'Harder! …Harder!… Relax'.

Measurements were taken in the splinted wrist in different degrees of extension (45^0 wrist extension, 30^0 wrist extension, 15^0 wrist extension) with the respective splint. The splint was applied only at the time of measuring the grip strength, that took approximately 5 minutes, following which it was removed.

Data analysis:

Descriptive statistics like mean and SD was used to depict the grip strength. Paired t test was used to compare between different angles within each of the splinted group. Inferential statistics was used to do the association. P value 5% was considered statistically significant. All analysis was carried out using SPSS software

RESULTS AND INTERPRETATION

Variable	n	Mean	S.D	Min	.25	Mdn	.75
Self selected position 49.00	65	23.95	8.73	9.00	18.00	23.00	27.00
15 degree 43.00	65	18.57	9.03	7.00	12.00	16.00	21.00
30 degree 39.00	65	18.54	8.11	4.00	14.00	16.00	23.00
45 degree 37.00	65	18.15	7.83	3.00	13.00	17.00	21.00

The average grip strength in the non splinted self selected position was 23.95 kgs. The average grip strength reduced to 18.57kgs when the wrist was splinted in 15^0 of extension, reduced to 18.54 kgs

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when the wrist was splinted in 30^0 of extension and reduced to 18.15 kgs when the wrist was splinted in 45^0 of extension. The grip strength statistically significantly reduced (p value 0.000) when compared with the splinted and non splinted wrist.

DISCUSSION:

The result analysis indicates that there is a significant decrease in the grip strength when compared between the splinted wrist and the non splinted wrist held in self selected position. However there is no significant difference in the grip strength when the wrist is held in 15^0, 30^0 or 45^0 of wrist extension, reinforced by the static splint in the respective wrist angles. The fusion done in the suboptimal position is not the sole contributing factor for the decrease in grip strength. The other contributing factors can be relative lengthening of the musculotendinous units and movements that are lost in the radio-carpal and the inter-carpal joints, which usually contribute to position the wrist optimally in the dorso-palmar and ulno-radial plane. The results of our study show that the ideal position of wrist arthrodesis depends largely on the functional demands of the subject and the cosmetic appearance. Larger degrees of wrist extension have not shown any significant increase in grip strength. On the contrary larger degrees of wrist extension may contribute to hindrance in the functional activities of daily living like hygiene and toileting, putting the hand in the trouser pocket, picking up small objects, etc.

CONCLUSION:

The results of our study show that the position of wrist fusion between neutral to 45^0 of extension does not significantly contribute to an increase in the grip strength. The unconstrained grip strength is produced by an optimal balance between the various joints and the muscle tension that results in the maximum grip strength. Hence the decision for the ideal position for wrist arthrodesis should be made based on the patient's felt needs and the functional demands.

LIMITATION OF THE STUDY:

In this particular study we have looked only into the dorso-palmar plane and did not consider the wrist position in the radio-ulnar plane, which is also a significant determinant of grip strength.

ACKNOWLEDGEMENT: The authors would like to thank Mr John Michael, Biostatistician from St John's Research Institute, and Bangalore for his statistical analysis support.

REFERENCES:

1. Bhardwaj P, Nayak SS, Kiswar AM, Sabapathy SR. Effect of static wrist position on grip strength. Indian J Plast Surg. 2011 Jan;44(1):55-8.
2. Murray, RM., Li, Z.; Sastry, SS. A mathematical introduction to robotic manipulation. Boca Raton: CRC Press; 1994
3. Joint structure and function-A comprehensive analysis, Pamela Levangie, Cynthia Norkin.
4. Lee JA, Sechachalam S. The Effect of Wrist Position on Grip Endurance and Grip Strength. J Hand Surg Am. 2016 Oct;41(10):367-e373.
5. Mathiowetz, V., Weber, K., Kashman, N., & Volland, G. (1985). Adult norms for the nine hole peg test of finger dexterity. *Occupational Therapy Journal of Research*, *5*(1), 24-38.

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