Reliability of Three Goniometric Measurement Technique of Active Wrist Flexion and Extension

Mansoor.P.P[1] BPT; M. Saravana Hari Ganesh[2]. MPT

[1]*Physiotherapist, MB Hospital, Malappuram, Varangode, Kerala, India*

[2]*Associate Professor, SRM College of Physiotherapy, SRM Institute of Science and Technology, Kattakulathur, Kancheepuram, TamilNadu, India*

Abstract:-

Introduction: The potential difference in wrist goniometric result may have significant clinical indication, particularly in determining functional active range of motion after stabilizing procedures such as partial wrist fusions, total wrist arthroplasties and ligament reconstructive procedures ate the wrist. So this study tries to examine which of these three active ranges of motion wrist flexion and extension goniometric techniques (ulnar alignment, radial alignment and volar/dorsal alignment) has the greatest intratester and intertester reliability.

Methodology: The study is a non experimental observational study with sample size of 80 subjects convenient sampling is done for subject selection. Total study duration is 3 weeks. The study done at SRM College of Physiotherapy, SRM Institute of Science and Technology, Kattankulathur Subjects with Age 18-30 Years of both male and female were included in the study. All the 80subjects underwent intratester and intertester for active goniometer measurement for wrist flexion and extension by ulnar, radial and volar/dorsal alignment techniques. The researcher was considered to be first tester and the other therapist who takes second goniometric measurements was considered to be second tester.

Result: Radial and volar extension techniques has p value 0.807 (p>0.05) and 0.325 (p>0.05) respectively and ulnar flexion, ulnar extension, radial extension and dorsal flexion has p value 0.008 and 0.003 and 0.000 and 0.001 respectively.

Conclusion: This study concludes that radial flexion and volar extension techniques of wrist goniometric measurements had less intertester reliability than ulnar flexion, ulnar extension, radial extension and dorsal flexion techniques. Dorsal flexion technique has less intratester reliability than ulnar flexion, ulnar extension, radial flexion, radial extension and volar extension techniques of wrist goniometric measurements.

Key Words: **Wrist flexion goniometric techniques, Wrist extension goniometric techniques.**

I. INTRODUCTION

In human anatomy, the wrist is variously defined as the carpus or carpal bones, the complex of eight bones forming the proximal skeletal segment of the hand. The wrist joint or radio carpal joint is a joint between radius and carpus. The and atomical region surrounding the carpus includes the distal part of the bones of the forearm and the proximal part of the metacarpus or five metacarpal bones and the series of joint between these bones; this is referred to as wrist joint.

The goniometre is used toe measure the active range of motion and passive range o motion of joints for documentation purposes and to assist in making clinical decisions. Clinical decisions about wrist pathologies are based on range of motion both active and passive.

Multiple goniometric techniques are used for measuring active range of motion of wrist flexion and extension. Consequently with therapists using different techniques measurement results vary from one goniometric technique to measurement results vary from one goniometric technique to another. Rothstein has provided a protocol for the study of intratester and intertester reliability of goniometric measurements under clinical condition. Three techniques are used to find the reliability of wrist flexion and extension (ulnar alignment, radial alignment and volar/dorsal alignment).

Horger found high intratester and intertester reliability, especially when an ulnar technique was used. Earlier studies found reliability of three techniques in assessing passive range of motion of wrist. But there are few studies to assess the reliability of these techniques in active range of motion of wrist. Therefore, there has been no comparison of all three goniometric techniques in terms of measurement result and reliability. It was imperative that all measuring techniques be assessed to determine which goniometric technique had a greatest reliability. Thus this study tries to find out intertester and intratester reliability of three techniques of wrist goniometric assessment of active range of motion in normal adults. The purpose this study is to examine which of these three techniques (ulnar alignment, radial alignment and volar/dorsal alignment) has the greatest intratester and intertester reliability.

The potential difference in wrist goniometric result may have significant clinical indication, particularly in determining functional active range of motion after stabilizing procedures such as partial wrist fusions, total wrist arthroplasties and ligament reconstructive procedures ate the wrist. So this study tries to examine which of these three active ranges of motion wrist flexion and extension goniometric techniques (ulnar

alignment, radial alignment and volar/dorsal alignment) has the greatest intratester and intertester reliability.

Aim of The Study is To find out which of these three techniques (ulnar alignment, radial alignment and volar/dorsal alignment) has the greatest intratester and intertester reliability.

II. METHODOLOGY

This study is a non experimental observational study with sample size of 80 subjects convenient sampling is done for subject selection. Total study duration is 3 weeks. The study done at SRM College of Physiotherapy, SRM Institute of Science and Technology, Kattankulathur – 603203. ` Subjects with Age 18-30 Years of both male and female were included in the study. Subjects with Carpal tunnel syndrome, Open wound in hand and forearm, Any recent surgery of forearm and wrist, Neurologic condition, Rheumatoid arthritis, Recent fracture of fingers, wrist & forearm bones were excluded.

III. PROCEDURE

The subjects were assessed for suitability based on inclusion and exclusion criteria. All the subjects were clearly explained about procedure an informed consent was taken from the subjects.

The total sample size was 80. All the 80subjects underwent intratester and intertester for active goniometer measurement for wrist flexion and extension by ulnar, radial and volar/dorsal alignment techniques. Each physiotherapist will be issued goniometers to take measurements. One side of the goniometers numerical scale was covered to blind the measurer from researcher a Physiotherapist was covered to blind the measurer from reading the scale. Printed procedure to do measurement will be given to therapist. Apart from researcher a Physiotherapist was requested to take part in the study. Two Therapists measured all the subjects' active range of motion (AROM) of wrist flexion and extension twice by using goniometer. The researcher was considered to be first tester and the other therapist who takes second goniometric measurements was considered to be second tester. The time between two measurements by each therapist was 5 minutes.

Procedure to the measurements:

The patient position was sitting with supported forearm in pronated position with palm facing towards the ground and was placed at he edge of the table. The therapist was sitting in next to subject. The goniometer placement differs for each technique. In these three techniques volar alignment measures only wrist extension so forearm is supinated to take the measurement for other three techniques position of the forearm is pronation.

Radial Alignment:

The stationary arm was placed parallel to the longitudinal middle of the radial forearm, the movable arm was placed parallel to the longitudinal axis of the second metacarpal and fulcrum was placed medial aspect of the wrist over triquetrum. The therapist instructs the patient to bend the hand towards and the moveable arm was moved accordingly by the therapist. This measures the wrist flexion AROM. The AROM or wrist extension was measured by instructing the patient to move the hand towards the ceiling and the movable arm was moved accordingly by the Therapist.

Ulnar Alignment:

The stationary arm was placed parallel to the longitudinal midline of ulna towards the olecranon process, the movable arm was placed to the longitudinal axis of the third metacarpal and the fulcrum was placed lateral aspect of the wrist over triqueturm. The therapist instructs the patient to bend the hand towards the ground and the moveable arm was moved accordingly by the Therapist. This measures the wrist flexion AROM. The AROM of wrist extension was measured by instructing the patient to move the hand towards the ceiling and the movable arm was moved accordingly by the Therapist.

Volar Alignment:

The patient position was sitting with forearm supinated and was placed at the edge of the table. The stationary arm was placed along the volar surface of the forearm, the moveable arm was placed parallel to the longitudinal axis of third metacarpal and the fulcrum was placed middle of volar aspect of wrist over capitate. The AROM of wrist extension was measured by insttucting the patient to move the hand towards the ceiling and the movable arm was moved accordingly by the Therapist.

Dorsal Alignment:

The stationary arm was placed along the dorsal surface of the forearm; the movable arm was placed parallel to the longitudinal surface of the third metacarpal and the fulcrum was placed middle of aspect of wrist over triquetrum. The AROM of wrist flexion was measured by instructing the patient to bend the hand towards the ground and the movable arm was moved accordingly by the Therapist.

The first tester measured the subject's dominant wrist flexion and extension in radial goniometric technique, ulnar goniometric technique and volar/dorsal goniometric technique and remeasured the same subject in the same order after 5 minutes. The second tester measured AROM of dominant wrist, two times for all subjects like the first tester. Hence each subject's active wrist flexion and extension was measured by three different ways and a total of four times by two therapists. The readings were considered for statistical analysis.

IV. DATA ANALYSIS

Table 1: Comparison between ulnar extension, radial extension, volar extension techniques and ulnar flexion, radial flexion and dorsal flexion techniques

ANOVA

Group		Sum of Squares	DF	Mean Squares	F	P
Ulnar flexion Radial flexion Dorsal flexion	Between group Within group Total	250.408 5238.525 5488.933	2 237 239	125.204 22.103	5.664	0.004
Ulnar extension	Between group	1.358 4101.938 4103.296	2 237 239	0.679 17.308	0.039	0.962

Table 2: Intertester reliablility between ulnar flexion, ulnar extension, radial flexion , radial extension, volar extension and dorsal flexion

Test Name	Mean	Std,Deviation	DT	r value	p value
ULNAR FLEXION	68.93	4.59	80	0.296	0.008
ULNAR EXTENSION	65.50	5.13	80	0.349	0.002
RADIAL FLEXION	68.07	4.96	80	0.028	0.807
RADIAL EXTEBNSION	66.04	4.19	80	0.432	0.000
VOLAR EXTENSION	67.16	4.52	80	0.111	0.325
DORSAL FLEXION	66.02	4.17	80	0.366	0.001

Table 3: Intratester reliability between ulnar flexion, ulnar extension,volar extension and dorsal flexion

Test Name	Mean	Std,Deviation	DT	r value	p value
ULNAR FLEXION	68.82	4.42	80	0.151	0.034
ULNAR EXTENSION	65.65	5.16	80	0.866	0.019
RADIAL FLEXION	67.94	5.11	80	0.330	0.003
RADIAL EXTEBNSION	66.07	4.35	80	0.869	0.019
VOLAR EXTENSION	67.27	4.50	80	0.967	0.005
DORSAL FLEXION	66.35	3.65	80	0.192	0.088

V. RESULTS

Table 1 Shows the comparison between ulnar extensio, radial extensions, volar extension techniques and ulnar flexion, radial flexion, dorsal flrxion techniques. Comparison between ulnar flexion, radial flexion, dorsal flexion techniques has mean square of 125.20 and 22.103 for between group and within group respectively p value is 0.004($p<0.05$) Comparison between ulnar extension, radial extension, volar extension techniques has mean square of 0.679 and 17.308 for between group and within group respectively p value is 0.962($p>0.05$)

Table 2 Shows the intertestter reliability between the techniques . Radial and volar extension techniques has p value 0.807 ($p>0.05$) and 0.325 ($p>0.05$) respectively and ulnar flexion, ulnar extension, radial extension and dorsal flexion has p value 0.008 and 0.003 and 0.000 and 0.001 respectively.

Table 3 Shows intratester reliability between the techniques. Dorsal flexion technique has p value of 0.88 ($p>0.05$) and ulnar extension, radial flexion, radial extension, volar extension techniques has p value 0.034, 0.019, 0.003, 0.019, 0.005 respectively.

VI. DISCUSSION

This study is to find out intertester reliability and intratester reliablilty of three wrist goniometric techniques (ulnar alignment, radial alignment and volar/dorsal alignment). Multiple goniometeric techniques were used for measuring active range of motion of wrist flexion and extension. High range of motion measurement reliability at the wrist is particularly useful, as changes in range of motion may determine the success or failure of a treatment. It appears that anyone who measures wrist ROM should know which goniometric technique has the greatest reliability, because the result can have profound implication for the patients.

The goniometric results may determine what type of further treatment is warranted. It may deem a surgical result as successful or unsuccessful. It may play a major role in a patient's partial or permanent impairment rating. When a wrist PROM measurement can be used as ap primary

determinant in making a clinical decision, or can be an independent variable in a research study.

From table 1 the comparison between ulnar extension, radial extension, volar extension, techniques and ulnar extension, radial flexion and dorsal flexion techniques. When comparing ulnar extension, radial extension and volar extension techniques as a group with ulnar flexion, radial flexion and dorsal flexion techniques as another group. Ulnar flexion,radial flexion and dorsal flexion techniques group has p value 0.004 ($p<0.05$) whereas ulnar extension, radial extension and volar extension techniques group has p value 0.962 ($p> 0.05$) this implies ulnar flexion, radial flexion and dorsal flexion techniques has changes in values of goniometric measurement within group and between group than ulnar extension, radial extension and volar extension techniques group which has less changes in values of goniometric measurement. This implies that ulnar extension, radial extension and volar extension techniques have same values on repeated measurement and was reliable than ulnar flexion, radial flexion and dorsal flexion techniques measurements.

The comparison between ulnar flexion, radial flexion and dorsal flexion techniques in Table 2 implies that Group 3 i.e. dorsal flexion technique differs from ulnar flexion and radial flexion techniques. From Table 3 the comparison between ulnar extension, radial extension and volar extension techniques shows that ulnar extension, radial extension and volar extension techniques does not differ from each other.

From table 2 which shows the intertester reliability between the techniques radial flexion volar extension techniques has p values 0.807 and 0.325 respectively which are $p>0.05$ this implies that these 2 techniques had less intertester reliability than other techniques. Ulnar flexion, ulnar extension, radial extension and dorsal flexion techniques has p values 0.008,0.002,0.000 and 0-.001 respectively which has $p < 0.05$ this implies that these techniques has more intertester reliability.

Table 3 shows intratester reliability between the techniques. From this table dorsal flexion techniques p values 0.088 ($p>0.05$) this implies that this technique has less intratester reliability than other techniques. Ulnar flexion, ulnar extension, radial flexion, radial extension and volar extension techniques has p values 0.034, 0.019,0.003, 0.019 and 0.005 respextively which is ($p<0.05$) this implies that these techniques has more intratester reliability.

Reliability denotes the stability of a measure and whether one tester, or two testers, can obtain similar measurements of the same variable onseparate occasion. The radial, ulnar, and volar/dorsal goniometric techniques should not be used interchangebly, as their results frequently will be inconsistent.

Paul C LaSteyo and Donna L Wheeler in their study state that "Of the three soniometric techniques, the volar/dorsal techniques was the most reliable than the radial and ulnar techniques both within and between testers. This finding differs from those of previous reliability studies." This study also proves that dorsal flexion techniques has less intraterster reliability and volar extension show less intertester reliability. Less number of subjects studied is the limitation of the study. Futher studies can be done on comparing electro goniometer with normal goniometer.

VII. CONCLUSION

This study concludes that radial flexion and volar extension techniques of wrist goniometric measurements had less intertester reliability than ulnar flexion, ulnar extension, radial extension and dorsal flexion techniques. Dorsal flexion technique has less intratester reliability than ulnar flexion, ulnar extension, radial flexion, radial extension and volar extension techniques of wrist goniometric measurements.

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