

Comparative Study of Carrying Angle between Dominant and Non Dominant Limb in Kashmiri Population

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ABSTRACT

Introduction: Carrying angle (CA) is the angle subtended by median axis of the arm with fully extended and supinated forearm. There is scarcity of evidence in the literature regarding differences between the CA in both sexes depending upon the ossification of arm and forearm bones and comparison of CA between dominant and non dominant limb. Study aimed at comparison of data obtained by measuring CA by manual method between dominant and non dominant limb in age group 18 – 30 years.

Material and Methods: CA was measured in 200 individuals of both sexes by clinical method with a manual goniometer.

Results: Present study shows the significant gender difference and significant difference between dominant and non dominant limb.

Conclusion: Unnecessary x ray exposure to children, young adults and pregnant women can be avoided, by measuring CA by clinical methods.

Keywords: CA, Post-Pubertal Age, Clinical Methods, Elbow Prostheses.

clinical and radiographic technique¹⁰

Study aimed at comparison of data obtained by measuring CA by manual method between dominant and non dominant limb in age group 18 – 30 years.

MATERIAL AND METHODS

Descriptive study was conducted on 200 volunteers aged between 18 - 30 years at SKIMS MCH Bemina from May 2017 to May 2018. Prior to conduct of the study, informed consent was obtained directly from the subjects.

Inclusion criteria

Age:- 18 to 30 year

Gender:- Both Male and Female subjects

BMI:- 18.5 to 24.5 kg/m²

Exclusion criteria

The Individuals with congenital deformities of extremities, fractures and surgeries around the elbow joint, endocrine disorders affecting skeletal systems and bone disorders due to the Vitamin deficiencies.

Materials Used: Measuring Scale, measuring Tape, marker pen, clinical goniometer 180°, weighing machine.

Methods: A thorough clinical examination of the elbow region was done by following all the given inclusion and exclusion criteria. After taking informed consent of the patient, the carrying angle of both the upper limbs was measured while keeping the elbow completely extended. The angle was measured in three trials and then the average of three was taken as the final carrying angle. An improvised instrument goniometer was used for measuring the carrying angle. The fixed arm of goniometer was placed on the median axis of the upper arm, the movable arm adjusted as to lie on the median axis of forearm and the angle read on the goniometer as shown in figure 1 and 2. The bicipital groove, biceps brachii tendon at its insertion and Palmaris

INTRODUCTION

The carrying angle of elbow is defined as the angle subtended by long axis of the arm and the long axis of forearm in the frontal plane when the elbow is fully extended and the forearm is supinated¹. In such a position, the forearm does not lie in a straight line with the arm, but it deviates laterally with respect to the arm axis forming this angle¹. The apparent difference in gender may be because of increased joint laxity in females permitting a greater degree of extension.¹ Variations in carrying angle among different age groups, gender and race has been reported in literature. The average value of carrying angle is 12.5 ±0.57 degrees in males and 15.26 ±0.45 degrees in females. Females had higher values than males in age group of 18-30 years. The evaluation of carrying angle value and its pathologic variations are important to identify the elbow deformities and in the diagnosis of various diseases of the lateral and medial epicondyles.^{1,2} The rate of increment in carrying angle for boys and girls is 0.42 and 0.60 per year, respectively.³ Increase in the carrying angle may lead to elbow instability and pain during exercise or in throwing activities of sports, predispose to increased risk of elbow dislocation and fractures of distal humerus when falling on an outstretched hand.⁴ In physiological conditions CA parameter varies according to age⁵, gender⁶, hyperextension of the elbow⁷, dominant upper limb⁸, anthropometric characteristics such as height and intertrochanteric distance⁹ and can be measured by simple

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longus tendon at the wrist were palpated and were marked as anatomical landmarks to demarcate the median axes of the arm and the forearm respectively. Carrying angle was measured on the left side as well as on the right side to find out difference on both sides. The weight of the patient was taken by the digital weighing machine.

STATISTICAL ANALYSIS

The continuous parameters were expressed as the mean with standard deviation using Independent Student's t-test. All statistical analysis were carried out at 5% level of significance and p-value < 0.05 was considered as significant.

RESULTS

This study included 200 volunteers, 91 males (45.5%)

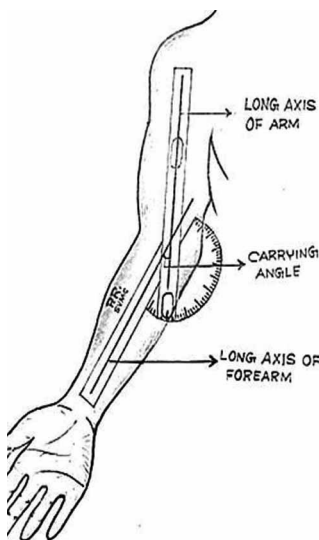


Figure-1: Diagram to describe the method of measurement.

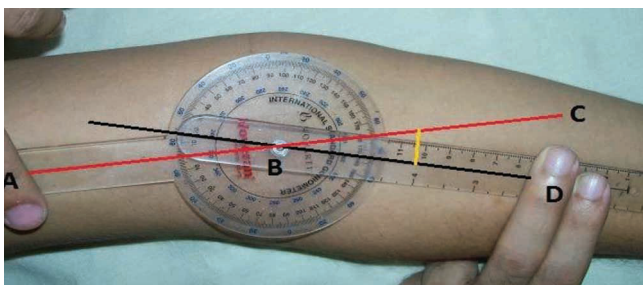


Figure-2: Clinical diagram showing the method of measurement.

and 109 (54.5%) females. Right arm dominance was in 186(93%) volunteers and left arm dominance was in 14 (7%) volunteers. In the females carrying angle was greater than the males in both dominant and non dominant limbs (table 1). Broadly speaking, carrying angle of dominant right limb was greater than the non dominant left limb in both males and females (table 2). In the males, the right carrying angle was 12.25 ± 1.49 and the left carrying angle was 10.50 ± 1.39 ($P < .001$) (Table 3). In the females, right carrying angle was 14.85 ± 2.12 and left carrying angle was 13.7 ± 1.8 ($P < .001$) (Table 3). Though it has not been documented, when comparing females and males, Right arm carrying angles of the right arm dominant volunteers were higher as well as left arm carrying angles of the left arm dominant volunteers.

DISCUSSION

The Carrying angle is found to be greater in the dominant limb than the non-dominant limb of both sexes, suggesting that natural forces acting on the elbow modify the carrying angle. Developmental changes may be seen due to imposed stress over the dominant limb which lead to changes in the carrying angle. Aging and possibly racial influences add further to the variability of this parameter. Knowledge of the measurement of the carrying angle and its variations is important while evaluating traumatic elbow injuries in childhood and in adolescence and other elbow disorders that require reconstruction or arthroplasties. Sharma k Mansur et al in their study Variation of Carrying Angle With Age, Sex, Height and Special Reference to Side have also found that the carrying angle of dominant limb is more than the non-dominant one.² The clinical significance of this study lies in the prevention of deformities and neuropathies in the post-traumatic elbow or condylar fractures of humerus. The knowledge of CA and its variations becomes essential for preoperative surgical planning in management of trauma and also in correction of congenital deformities influencing the elbow joint. It plays a key role in the treatment of epicondylar diseases and in designing of elbow prosthesis in case of replacement. For the design of resurfacing and semi constrained elbow replacement implants, detailed knowledge of elbow joint geometry and CA are of great importance. So, the changes in dynamics and the CA of elbow joint should

	Male(n=91)	Female(n=109)	P value
Right arm	12.25±1.49	14.85±2.12	<0.001
Left arm	10.50±1.39	13.7±1.8	<0.001

Table-1: Shows values in the range mean and standard deviation of carrying angle of males and females of Kashmiri population.

Total volunteers	Right arm	Left arm	P value
200	13.67±1.86	12.24±1.63	<0.001

Table-2: Shows pooled mean and standard deviation of carrying angle of dominant and non dominant limb.

	Right arm	Left arm	P value
Males (n=91)	12.25±1.49	10.50±1.39	<0.001
females(n=109)	14.85±2.12	13.7±1.8	<0.001

Table-3: Comparison in values of carrying angle of males and females of Kashmiri population.

be taken into account before designing the elbow prostheses. Greater carrying angle in female was considered as secondary sex characteristic. Chang Hung Chu et al,¹¹ concluded that an increased carrying angle of the elbow appeared to be an independent risk factor for the non trauma-related ulnar neuropathy. Knowledge of the measurement of carrying angle of the elbow and its variations is important when evaluating traumatic elbow injuries in childhood and in adolescence and other elbow disorders that require reconstruction¹² or arthroplasties (surface and semiconstrained)¹³.

CONCLUSION

The Carrying angle is found to be greater in the dominant limb than the non-dominant limb of both sexes and the knowledge of the measurement of the carrying angle and its variations is important while evaluating traumatic elbow injuries in childhood and in adolescence and other elbow disorders that require reconstruction or arthroplasties.

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