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DETERMINATION OF CARRYING ANGLE IN YOUNG ADULTS BY GONIOMETRIC INDEX

C.Sam Raj Department of Anatomy, School of Medical Education- Mahatma Gandhi University-Kottayam, Kerala, India.

Manoj.A Department of Anatomy ,Government Medical college Kottayam under the Directorate of Medical Education under Health & Family Welfare Department of Govt. of Kerala, India.

V. Lekshmi Department of Anatomy, School of Medical Education- Mahatma Gandhi University-Kottayam, Kerala, India.

ABSTRACT

The current analytical study was carried out for the gender specific determination of the carrying angle of dominant arm between ages of 18 to 25. Sixty young adults were participated in this study with half of them were enrolled from both genders. The study groups were students comes from different districts of Kerala. Goniometer was the instrument used for the measuring carrying angle of the study groups. There was a significant difference in the carrying angle in males and females as 10.133±2.418 and 13.36± 2.52 respectively (p value <0.0001). In female groups when age advances the carrying angle significantly increases (p value <0.0001) in ages of 18,19,20,22,23,24 and 25 as 10.75±1.479, 13.33±1.699, 13.5±1.258, 14.497±1.49, 16±0.63, 16±333±1.69, 20.5±0.5 and 22.5±0.5 respectively. In male groups the carrying angle has not been increases with age. Knowledge of the carrying angle helps in the assessment of difference of angulations in male and female and also, elbow joint deformity and its management.

KEYWORD

Carrying Angle, Young Adults, Dominant arm, Goniometer, Correlation

*Corresponding Author Manoj.A

Department of Anatomy ,Government Medical college Kottayam under the Directorate of Medical Education under Health & Family Welfare Department of Govt. of Kerala, India.
Email: drmanoja2@gmail.com

INTRODUCTION

Human Carrying or Cubital angle will be recognised when the forearm is completely extended and supinated, the long axis beyond the elbow joint is not in line with the upper arm but is deviated laterally[1]. Carrying angle is obscured in pronation and extended forearm because in this position human hand has optimum functional capacity. The 'carrying angle' is made partly by projection of the medial trochlear edge 6 mm beyond its lateral edge and partly by the obliquity of the superior articular surface of the coronoid[2]. It permits the forearm to swung during walking and carrying objects without contacting the hips[3]. Women on average have smaller shoulders and wider hips than men, which may necessitate a greater carrying angle. There is however, extensive overlap in the carrying angle between individual men and women[4]. The difference in carrying angle between male and female and considering it as a secondary sex character as well as its role in the sex determination[5&8]. Olecranon- Coronoid angle exhibiting high sexual dimorphism may be one of the cause of sexual difference observed in 'Carrying angle' which is relatively more in female, attributes by smaller olecranon-coronoid angle[6]. The angle is more in dominant limb than non-dominant limb of both sexes suggesting that neutral forces acting on the elbow modify the carrying angle[7]. Lesser the length of forearm bones greater is the carrying angle. So the carrying angle is more in shorter persons as compared to taller persons[8]. Measurement of carrying angle was done with Goniometer according to the methods by Zampagni et al[10].

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To the best of our knowledge we could measured the database for the evaluation of Carrying angle of age group between eighteen and twenty five. Therefore we aimed to assess the gender difference of carrying angle in each age groups of young adults and their association with age.

SUBJECTS AND METHODS

The study was conducted at Department of Anatomy in collaboration with Department of Physiotherapy School of Medical Education (SME) of Mahatma Gandhi University Kottayam, Kerala from 2008 to 2009. The participants of the study were young male and female students of various departments of the SME, resided at various parts of Kerala in South India. Informed consent of the participants were recorded. The research procedure was explained to the participants before the commencement of the investigation. Young adults between the age groups of 18 to 25 without any physical deformities were included in the study. Young adults with any physical deformities and ages above 25 and below 25 were excluded. Measurement was taken from the dominant arm of the study groups. There were no left dominant participants enrolled in the study.

The study subjects gender, age and length of forearm were recorded. The measurement of carrying angle was carried out with Conventional Manual Goniometer Metal with Scale NISCO -India. During measurement Participants were standing in Anatomical position. Ensured the long axis of upper arm and forearm were coincide with anatomical land marks such as acromio-clavicular joint with middle of inter-codylar line and tendon of biceps to the middle of wrist of upper extremity. Metal Goniometer was placed on the extended elbow of the dominant arm of the study subjects. The manual goniometer scale was straightened thus the readout on the plate shows 0 or 180 degrees. Then the goniometer was placed on fulcrum of the dominant elbow of the participant. One limb of the gonimeter was line with participants upper arm and swing the other limb of it, until it reaches at the middle of forearm. The carrying angle was recorded from the readout of the measurement plate and subtracts it from 180, if your initial readout was 180 degrees.

For example, if the straight goniometer read 180 and it read 170 fitted to the subject's elbow, then the subject's carrying angle is 180 -170 = 10 degrees. Length of forearm was measured in centimetres with measurement tape.

Statistical Analysis

The data collected were analysed for difference in mean by student's t-test. One way ANOVA was used for the difference between all age groups. The association between the groups was analysed by Pearson correlation coefficient. All the data were analysed using Graph Pad Prism version (InStat, San Diego, USA).

RESULTS

There were Sixty young adults between the age group of 18 and 25 with thirty in each gender groups were analysed (Fig-1). The carrying angle was significant between male and female age groups (p-value < 0.0001) . However in same age groups it was not significantly different. Carrying angle of age groups 22, 24 and 25 between the two genders were statistically significant (P < 0.05).In female carrying angle was significantly increases with age (p-value < 0.0001). However in male it was not significantly increases with age. In males the length of forearm and age were negative correlation (r value-0.5189). However in female the length of forearm and age were not significant each other. There was a significant negative correlation of length of forearm and carrying angle in female (Fig:2). We had taken the measurement of length of forearm of both genders. There was no significant difference between the length of forearm of male and female participants (p value 0.7204).We found when the length of forearm reduces the carrying angle was significantly increases in female. However in male genders such type of changes could not observed.

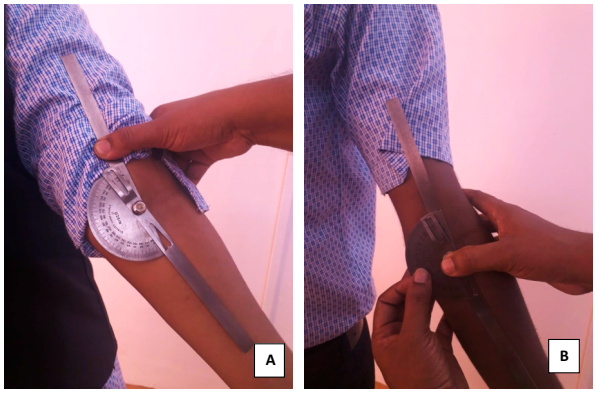

Fig:1 Depicting the Carrying Angle measurement with Goniometer in Female-A and Male-B Young Adults

Table-1 Showing Mean and SD of Carrying Angle in Male and Female genders and Significance (p-value < 0.0001)

Carrying Angle of Participants					
Age in Years	Female		Male		P value
	No. of Participants	Mean ± SD Of Carrying Angle	No. of Participants	Mean± SD Of Carrying Angle	
18	4	10.75±1.479	4	11.5±1.5	0.5601
19	3	13.33±1.699	3	7.66±1.69	0.2508
20	6	13.5±1.258	3	11.33±1.24	0.0682
21	5	14.497±1.49	0	Nil	Nil
22	5	16±0.63	6	10.166±0.372	0.0001
23	3	16±333±1.69	5	10.8±3.867	0.0776
24	2	20.5±0.5	4	7.75±1.785	0.0013
25	2	22.5±0.5	4	11.5±0.866	0.0002

Table-2 Exhibiting Significance of Carrying Angle and Length of forearm in both Genders.

Ages Of Participants	Carrying Angle			Length of Forearm		
	Female Mean ± SD (n=30)	Male Mean ± SD (n=30)	Significance	Female Mean ± SD (n=30)	Male Mean ± SD (n=30)	Significance
18 to 25	15.17 ± 0.599,	10.17 ± 0.45	<0.0001	23.9 ± 0.658,	23.59 ± 0.5692	0.7204

(P value<0.0001)

Table -3 Correlation coefficient of Length of Forearm, Carrying Angle and Age of Male and Female genders

Parameter	Variable of Female		Parameter	Variable of Male	
	Length of Forearm	Age		Length of Forearm	Age
Carrying Angle	-0.848**	0.6526*	Carrying Angle	-0.460**	0.216
Length of Forearm		0.411	Length of Forearm		-0.5189**

*(*Positive correlation (P value<0.0001) **-Negative correlation (P value <0.0001))*

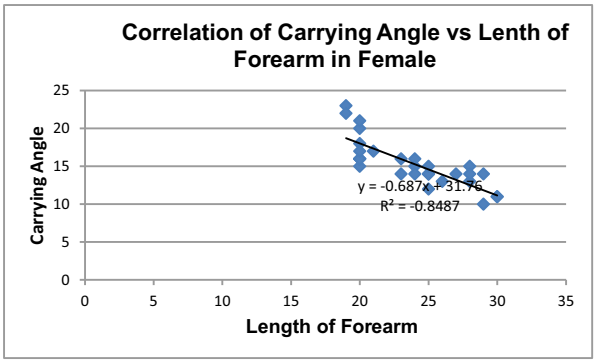

Fig:2 *Correlation (Pearson) Coefficient between Carrying Angle and Length of Forearm (r value 0.8487) p<0.0001)*).

DISCUSSION

The carrying angle has been seen even in utero and is completely developed in a newborn is an outward angulation of the supinated forearm with the elbow extended. Being Kept this idea in our mind we investigated the measurement of carrying angle in young male and female gender for which significant higher difference of carrying angle in female than males. Inorder to corroborate our data we analysed foreign as well as Indian data. Khare et al reported that the carrying angle develops in response to pronation of the forearm and is dependent on length of the forearm bones. Lesser the length of forearm bones greater is the carrying angle. So the carrying angle is more in shorter person compared to taller person[5]. Our study agreed that observations for which there was significant negative correlation between carrying angle and length of forearm in female. Tukenmez et al studied carrying angle of the elbow in 2000 children at the ages of six and fourteen years. They came to conclusion that the mean angle from dominant arm was significantly greater than those of the contra lateral side in both sexes and age group[6]. The mean angle of both elbows were greater in girls than those of the corresponding elbow in boys at six years of ages while

vice versa was the case at fourteen years of age, however difference did not reach significance. In our study carrying angle was higher in dominant hands than other hands which was more in females than males. Also agreed that carrying angle significantly associated with age in females but in males there was no significant correlation. The study done by Purkait et al[7] had been corroborating the observations of the present study as sexually dimorphic features in the bone of elbow joint which makes the carrying angle a sex indicator. Chang Hung Chu et al concluded that an increased carrying angle of the elbow appeared to be an independent risk factor of non trauma-related ulnar neuropathy[9]. Knowledge of 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 reconstruction 20 or arthroplasties[10].The above findings has been strengthening our study inorder to diagnose and manage elbow disorders. Paraskevas et al in his studies reported that carrying angle at the elbow in a population of students with mean carrying angle of 12.88 degrees in men and 15.07 degrees in women[11]. Our study agrees with that data for which the mean carrying angle as 10.17 and 15.17 degrees in male and female respectively. The angle was always greater on the side of the dominant hand. Although we were not been recorded the measurement of shoulder and hip inorder to check whether the forearm hang straight downwards or it deviate .In our study we had seen that broad shoulders and narrow hips of the males, allow the arms to hang straight downwards with the long axis of the upper and lower segment approximately in the same straight line. Neverthless in females, the narrower shoulders and broader hips require a splaying out of the forearm axis in order that the hanging arms clear the hips which is been a typical feminine character during the later part of ossification of bones.

CONCLUSION

Carrying Angle has significant dominance in female than male and it has Positive correlation with age and Length of forearm in young Adults. The Knowledge of Carrying Angle would give valuable information for the diagnosis and management elbow joint disorders.

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