



Research Article

**A PROSPECTIVE STUDY: EVALUATION OF TWO METHODS OF ASSESSMENT FOR  
CARRYING ANGLE IN 18-25 YEARS AGE GROUPS IN NEPALESE POPULATION VISITING  
OPD OF TUTH, IOM, KATHMANDU.**

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**Abstract:** The carrying angle of the elbow is defined as the angle between the long axis of the extended forearm as it lies lateral to the long axis of the arm. The carrying angle was measured in 30 normal boys and 30 girls of age group ranging from 18 to 25 years using a simple protractor goniometer in Nepalese population visiting OPD of TUTH, IOM, and Kathmandu. In our overall results there was significant increase ( $P < 0.001$ ) in carrying angle measurement via radiological land mark as compared with surface anatomical landmark (Table 1 & 2). But by comparing the carrying angle results of male and female of same age groups (18-25 yrs) there was significant increase ( $P < 0.05$ ) in female subjects in both the methods i.e. surface anatomical landmark and radiological land mark (Table 3, 4, 5 & 6). From my study I can conclude that surface anatomical landmark was more accurate in comparison to radiological landmark in measuring the carrying angle.

**Keywords:** Carrying Angle, Simple protractor goniometer, Radiological landmark, Surface anatomical landmark

### Introduction

The carrying angle is defined as the acute angle made by the median axis of the upper arm with that of the fully extended and supinated forearm, and thus it measures the lateral obliquity of the forearm.<sup>1</sup> It is generally said to be greater in females than in males and the difference has been considered to be a secondary sex characteristic.<sup>2</sup> However, some workers reported no significant difference in carrying angle of males and females of any age group.<sup>(3)</sup>

The present study is aimed at reporting the age and sex specific data on developmental variability of the carrying angle and its significance between various methods for measuring carrying angle (surface anatomical landmarks and radiological landmarks)

### Material and Methods:

It is a prospective study. The carrying angle was measured in 30 normal boys and 30 girls of age group ranging from 18 to 25 years using a simple protractor goniometer in Nepalese population visiting OPD of TUTH, IOM, Kathmandu. For this research work ethical clearance was done from the ethical and institutional review board, TUTH, IOM. The methods described anatomical surface landmarks were taken from the right arm and forearm of the participants by taking 3 points as follows; point 1- tip of acromian process of scapula; point 2- midpoint between lateral and medial epicondyle of humerus; point 3- midpoint at the anterior aspect of wrist joint. Then the lines representing the long axis of arm and forearm were drawn by joining point 1&2 and 2&3 respectively. The angle formed by the crossing of these two lines at the front of elbow joint was measured by using simple protractor goniometer. Then the participants were taken to radiology

department for x-rays of right elbow joint AP view with the help of radiographer. Then the points were in the humerus were taken for radiological landmark as follows:

- Point 1. Midway between surgical necks of humerus
- Point 2. Midway between two epicondyles of humerus
- Point 3. Midway between coronoid processes of ulna
- Point 4. Midway between lower end of ulna

*Point 1 and 2 forming line of long axis of humerus and Point 3 and 4 forming long axis of ulna.*

### Exclusion Criteria:

Any deformity of right elbow joint, history of right elbow joint dislocation, history of trauma to right elbow, history of right supracondylar fracture of right humerus, history of fractures of right radius and ulna. A written consent of all the individuals was taken prior to carrying angle examination via study proforma.

The results were analyzed by SPSS version 16.0.

### Results:

The mean carrying angle of all participants expressed in Mean $\pm$ SD was 12.98 $\pm$ 2.98 $^\circ$  measured via surface anatomical land mark and 18.50 $\pm$ 3.2 $^\circ$  via radiological measurement.

**Table No.1 Showing carrying angle obtained by surface anatomical landmark**

|        | Surface anatomical landmark<br>( Degrees) |
|--------|---|
| Mean   | 12.98                                     |
| Median | 13.00                                     |
| SD     | 2.48                                      |

|       |      |
|-------|------|
| Range | 7-18 |
|-------|------|

**Table No.2 Showing carrying angle obtained by Radiological landmark**

|        |                                  |
|--------|----------------------------------|
|        | Radiological land mark (Degrees) |
| Mean   | 18.50                            |
| Median | 18.00                            |
| SD     | 3.2**                            |
| Range  | 13-26                            |

\*\*-- P<0.001 between carrying angle obtained by surface anatomical landmark and Radiological landmark

The mean carrying angle of all participants was 11.60±2.02° (males) and 14.37±2.1° (females) measured by surface anatomical landmark.

**Table No.3 Showing carrying angle obtained by surface anatomical landmark**

|              |   |
|--------------|---|
| Males (N=30) | Surface anatomical land mark ( Degrees) |
| Mean         | 11.60                                   |
| Median       | 1100                                    |
| SD           | 2.07                                    |
| Range        | 7-17                                    |

**Table No.4. Showing carrying angle obtained by Surface anatomical landmark**

|                |  |
|----------------|--|
| Females (N=30) | Surface anatomical land mark (Degrees) |
| Mean           | 14.37                                  |
| Median         | 14.50                                  |
| SD             | 2.109*                                 |
| Range          | 10-18                                  |

\*-- P<0.001 between carrying angle obtained by surface anatomical landmark in males verses females

The mean carrying angle of all participants was 17.57±2.1°(male) and 19.43±3.9°(female) measured by radiological measurement.

**Table No.5. Showing carrying angle obtained by Radiological landmark**

|              |                                 |
|--------------|---------------------------------|
| Males (N=30) | Radiological landmark (Degrees) |
| Mean         | 17.57                           |
| Median       | 18.00                           |
| SD           | 2.14                            |
| Range        | 14--22                          |

**Table No.6. Showing carrying angle obtained by Radiological landmark**

|                |                                 |
|----------------|---------------------------------|
| Females (N=30) | Radiological landmark (Degrees) |
| Mean           | 19.43                           |
| Median         | 19.00                           |
| SD             | 3.90*                           |

|       |       |
|-------|-------|
| Range | 13-26 |
|-------|-------|

\*-- P<0.001 between carrying angle obtained by Radiological land mark in males verses females

**Discussion:**

In our overall results there was significant increase (P<0.001) in carrying angle measurement via radiological land mark as compared with surface anatomical landmark (Table 1 &2). Decrease in carrying angle via surface anatomical land mark might be due to interference of soft tissue between bone and the marks on the skin surface. Our study was in consistency with Paraskevas G et al.2004.

But by comparing the carrying angle results of male and female of same age groups (18-25 yrs) we found there was significant increase (P<0.05) in female subjects in both the methods i.e surface anatomical landmark and radiological land mark (Table3,4 , 5 &6). Our study was in consistency with paraskevas G et al.2004, Steel F and Tomilson J et al.1958 Balassubramanian et al.2006 and Chein-Wei Chang MD et al. 2008.

Anatomically, the carrying angle in human adults is approximately 10° in men and 13° in women Increasing the carrying angle may lead to elbow instability and pain during exercise or in throwing activities of sports may reduce function of elbow flexion [predispose to risk of elbow dislocation . This was in consistent with the studies of Snell RS, 2004 and Van Roy P et al. 2005.

By comparison of two techniques for carrying angle estimation, finally, from my study I can conclude that surface anatomical landmark was more accurate in comparison to radiological landmark because of failure of full supination and extension of elbow joint along with the points taken in skin surface was not exactly corresponding with the points taken in the X-rays of the humerus and ulna bone.

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