THE NORMAL CARRYING ANGLE OF THE ELBOW
IN SHIRAZ

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ABSTRACT

The normal carrying angle in Shiraz population was measured on the basis of
sex and age. The right elbow angle of 4266 cases was examined from birth to 30
years old. This study found the carrying angle in 2540 females to be 7.2° (range
2-19) and in 1726 males to be 6.4° (range 2-11), a 0.8° difference.

A significant difference (p= 0.05) was found in relation to age. There is a
gradual increase in the carrying angle with skeletal maturation.
Keywords: Angle, Elbow.

INTRODUCTION

The carrying angle can be considered to be formed by
the long axis of the forearm and the long axis of the
humerus in the frontal plane.1,2 The carrying angle of the
elbow is generally regarded as being greater in females
than in males and is considered to be a secondary sex
characteristic. Supporting evidence for this concept was
provided by the clinical observation of Baughman et al.2

The carrying angle varies linearly as a function of
flexion. In extension, there is a valgus angulation. The
carrying angle is most apparent when the elbow is straight
and the forearm fully supinated.1,3,5

Potter (1905) probably is the first who published
measurements of the carrying angle in 185 adult cases. He
found the mean carrying angle in 90 women to be 12.6° and
in 95 men to be 6.8°, a difference of 5.8°.1,3

Baughman et al. in a clinical study found the carrying
angle in 50 women to be 15° (range 2-26°) and in 50 men
to be 11° (range 2-21), a 4° difference.

Beals measured the carrying angle of 422 patients in a
recent study and found a mean carrying angle of 15° in the
4-6 year old age group and 17.8° in adults.5 He found no
significant difference between males and females.

Table 1. Subject distribution according to
age and sex.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>51</td>
<td>31</td>
</tr>
<tr>
<td>2-3</td>
<td>103</td>
<td>159</td>
</tr>
<tr>
<td>4-6</td>
<td>162</td>
<td>262</td>
</tr>
<tr>
<td>7-12</td>
<td>409</td>
<td>496</td>
</tr>
<tr>
<td>13-15</td>
<td>260</td>
<td>254</td>
</tr>
<tr>
<td>16-20</td>
<td>250</td>
<td>427</td>
</tr>
<tr>
<td>21-25</td>
<td>230</td>
<td>422</td>
</tr>
<tr>
<td>26-30</td>
<td>262</td>
<td>429</td>
</tr>
</tbody>
</table>
and 1726 were males aged from birth to 30 years old.
Subjects were divided into 8 groups on the basis of age and sex (Table I). Randomized sampling was performed and the number of each group was determined by an epidemiologist.

The cases of the first group of both sexes were chosen from nurseries of medical university hospitals. Cases aged 2-6 years old were selected from five babysitter institutes and kindergartens in Shiraz. Cases aged 7-12 years old were selected from elementary schools. Cases aged from 13-15 years old were chosen from junior high schools and cases aged from 16-20 years old were picked-up from high schools. Cases above 20 years old were chosen from students of medical and nursing faculties.

For precise measurement, we made 3 reference points on the upper limb. The proximal point is the medial border of the acromion, the midpoint of the transverse cubital crease is the second point, and the midpoint of the volar wrist crease is the third point. Lines drawn through these points established the carrying angle, and the angle was measured with a unique standard goniometer.

### RESULTS

This study measured the carrying angle of the right elbow of 4266 cases. The mean, two standard deviations, the 95th percentile, and range were determined for each group and sex. No significant differences were found between males and females in any age group.

There is a gradual increase in the carrying angle with skeletal maturation. A significant difference \( p = 0.05 \) was found in relation to age except for the first and second group of each sex. The mean carrying angle in 2540 females was found to be 7.2° (range 2-19) and the mean carrying angle in 1726 males 6.4° (range 2-11), a 0.8° difference (Tables II-V).

### DISCUSSION

Most previous studies have focused on the question of...
Table V. Mean and SD of the carrying angle among female subjects.

<table>
<thead>
<tr>
<th>Group (Female)</th>
<th>No.</th>
<th>Mean angle</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>91</td>
<td>3.7143</td>
<td>1.0059</td>
</tr>
<tr>
<td>2</td>
<td>159</td>
<td>3.8553</td>
<td>.7534</td>
</tr>
<tr>
<td>3</td>
<td>262</td>
<td>5.2481</td>
<td>1.0337</td>
</tr>
<tr>
<td>4</td>
<td>496</td>
<td>6.7611</td>
<td>.9550</td>
</tr>
<tr>
<td>5</td>
<td>254</td>
<td>7.2992</td>
<td>1.1648</td>
</tr>
<tr>
<td>6</td>
<td>427</td>
<td>8.3302</td>
<td>1.5911</td>
</tr>
<tr>
<td>7</td>
<td>422</td>
<td>8.7109</td>
<td>1.0636</td>
</tr>
<tr>
<td>8</td>
<td>429</td>
<td>8.7156</td>
<td>1.4415</td>
</tr>
<tr>
<td>Total</td>
<td>2540</td>
<td>7.2856</td>
<td>1.9999</td>
</tr>
</tbody>
</table>

The present study is a statistical randomized sampling of measurements of the carrying angle of 4266 cases on the basis of age and sex. The average carrying angle in our study was 7.2° (range 2-19) in 2540 females and a mean of 6.4° (range 2-11) in 1726 males, with a difference of 0.8°. This value is less than that reported in other studies, but the sex difference of this study is less than the majority of reports.1,4,6,8 The apparent sex difference is explained by increased joint laxity in females, permitting hyperextension.2,3,4

The carrying angle results from the configuration of the humero-ulnar articular surfaces and ligament constraints.5,6 Thus the anatomy of this joint in this population has some differences and ligament laxity is less compared to other reports.

REFERENCES
