



Measurement of the carrying angle of the elbow in 2,000 children at ages six and fourteen years

Altı ve on dört yaş grubundaki 2000 çocukta ölçülen dirsek taşıma açısı değerleri

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Amaç: Humerus alt uç kırıklarının tedavisi sonrası dirsekte gelişebilecek deformitelerin değerlendirilmesinde taşıma açılarının karşılıklı olarak bilinmesi önemlidir. Bu çalışma belirli yaş gruplarında taşıma açısı değerlerinin dağılımını belirlemek için yapıldı.

Çalışma planı: Sivas ili merkez ve çevre ilçelerdeki rasgele seçilen ilköğretim okullarında altı yaşını ve 14 yaşını doldurmuş 2000 öğrencide her iki dirsekteki taşıma açıları, dirsek eklemi tam ekstensiyonda ve önkol supinasyonda iken goniometre ile ölçüldü. Ölçümler her iki yaş grubunda 500'er yüz kız ve erkek öğrencide yapıldı. Elde edilen 4000 tane açı değeri, iki yaş grubundaki erkek ve kızlar için dominant olmayan dirsek ve dominant dirsek şeklinde sekiz grupta incelendi.

Sonuçlar: Altı ve 14 yaş gruplarında iki cinsiyette de dominant dirseklerde ölçülen ortalama açı değerleri anlamlı derecede yüksek bulundu ($p<0.05$). Altı yaş grubunda her iki dirsekte ölçülen ortalama açı değeri kızlarda daha yüksek bulunurken, 14 yaş grubunda erkeklerde daha yüksek değerler elde edildi; ancak bu farklılıklar anlamlı düzeyde değildi ($p>0.05$). Her iki cinsiyet için de, 14 yaş grubu öğrencilerde dominant olan ve olmayan dirseklerde ölçülen taşıma açısı değerleri, altı yaş grubu öğrencilerin değerlerinden anlamlı derecede yüksek bulundu ($p<0.001$).

Çıkarımlar: Bulgularımız taşıma açısının yaşla birlikte arttığını ve dominant tarafta her zaman daha büyük olduğunu gösteren literatür bulgularıyla uyumlu bulundu.

Anahtar sözcükler: Yaş faktörü; çocuk; dirsek/anatomi ve histoloji; dirsek eklemi/fizyoloji; cinsiyet faktörü.

Objectives: It is important to know the carrying angles of both elbows in the evaluation of deformities which may be seen after treatment of distal humerus fractures. This study was performed to determine the basal values of the carrying angle in specific age groups.

Methods: The carrying angles of both elbows were measured with the use of a goniometry in 2000 students of randomly selected primary schools in Sivas and its nearby districts. Measurements were performed in those who completed the ages of six (500 girls, 500 boys) and 14 (500 girls, 500 boys) years, with the elbow in full extension and forearm in supination. The mean carrying angles of dominant and non-dominant elbows were analyzed in eight groups.

Results: The mean angles measured from dominant arms were significantly greater than those of the contralateral side in both sexes and age groups ($p<0.05$). The mean angles of both elbows were greater in girls than those of the corresponding elbows in boys at six years of age, while vice versa was the case at 14 years of age; however, these differences did not reach significance ($p>0.05$). Finally, both boys and girls at 14 years of age had significantly greater angles in dominant and non-dominant elbows compared to corresponding sex and elbow side in six-year groups ($p<0.001$).

Conclusion: Our results are consistent with the literature data showing that the carrying angle increases with age and that it is always greater on the dominant side.

Key words: Age factors; child; elbow/anatomy & histology; elbow joint/physiology; sex factors.

Distal humerus fractures are in second frequency following forearm fractures that are most encountered fractures⁽¹⁾. After treatment of distal humerus fractures, the complications such as varus and valgus deformities can be seen. The assessment of these fractures includes range of motion and predicted deformities are crucial. For determining those deformities, the measurements must implicate contralateral elbow as well. In the literature, there is variability regarding the data of carrying angle⁽²³⁾.

Our purpose was to attain the values related to carrying angle in particular age group in Sivas, Turkey. However, because plenty of data provided, statistical comparable analysis has been performed after that the age, gender, being extremity dominance have been grouped.

Patients and methods

Initially, elementary schools that was included in the study in Sivas province associated with cen-

ter and counties were searched and recorded. Required permissions were taken from schools' administrations. The students were informed about the study. Five-hundred boys and 500 girls at 6 years of age in 1st grade; 500 boys and 500 girls at 14 years of age in 8th grade underwent carrying angle measurements on both elbows (Figure 1). The students who had previous elbow injuries as well as congenital anomalies about the elbow were excluded from study. The measurement of the carrying angle was performed as placing a goniometer on the border between arm and forearm of the medial side of the elbow while individuals' elbow is in full extension and forearm is in pronation positions.

Obtained 4000 data of carrying angles were analysed as dividing eight groups which were boys and girls with their extremity dominance in each age groups. For statistical analysis, t- test was used.

Results

At 6 years of age group, the measurements of dominant and not dominant elbows in boys and girls revealed statistically significant difference (0.016 and 0.004 respectively; Table 1). At this age group, measured angles of the elbows were greater in girls; however, there was no statistical difference ($p>0.05$).

In 14 years of age group, the difference between dominant and not dominant elbows was statistically significant in favour of dominant group (0.003 and 0.001 respectively; Table 1). At this age group, the angles were greater in boys; however, there was no statistical difference ($p>0.05$).

In each gender group, there was significant difference between the two age groups in favour of 14 years of age groups ($p<0.001$).

Discussion

There has been variability of the outcome in the studies in which carrying angle measurements were performed⁽²⁻⁴⁾. Beals⁽²⁾ noted that the values of the carrying angle enhanced with increasing age, but same in each gender, in the study involving 422 cases in whom the measurements were done by radiographically. In Baughman et al's⁽³⁾ study with 100 cases, there was significant difference between males and females. Dai⁽⁵⁾ did not find any difference

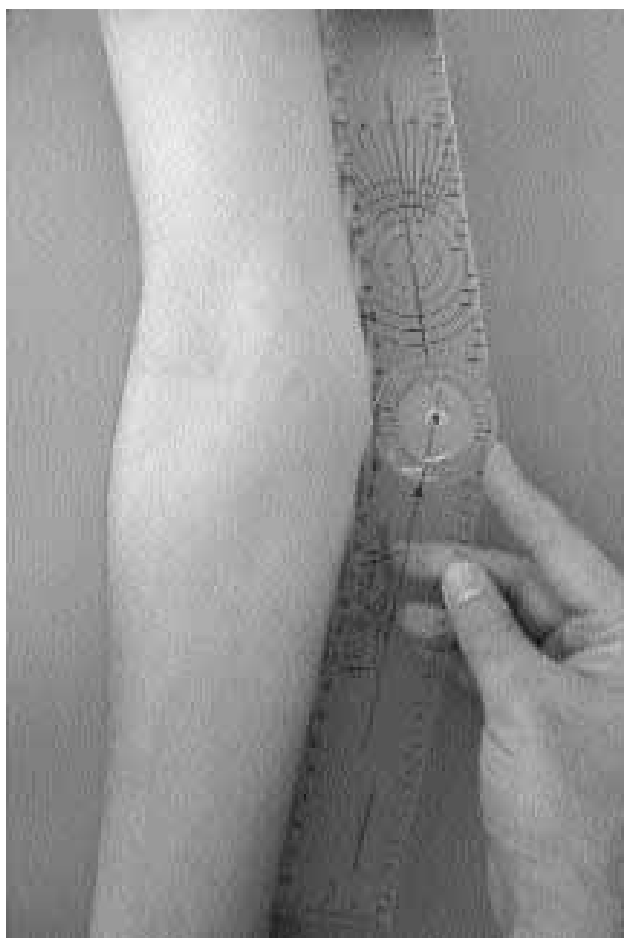


Figure 1. The method of measuring of carrying angle.

Table 1. Average angles according to age, gender, dominance of the extremity.

Age group	Boys			Girls		
	Dominant	Other	<i>p</i>	Dominant	Other	<i>p</i>
6	12.41	11.86	=0.016	12.85	12.19	=0.004
14	18.17	17.25	=0.003	18.10	17.07	=0.001
<i>p</i>	<0.001	<0.001	–	<0.001	<0.001	–

between boys and girls according to Bauman angle in the radiographical study and added that there was significant correlation between Bauman and carrying angles. The reason of the variability may depend on different measurement techniques, races, and number of cases.

In our study, the enhancement of carrying angle was detected with increasing age in both gender as well as in both dominant and not dominant elbows. This is in accordance with the literature⁽²⁻⁶⁾. There was significant difference between dominant and not dominant elbows in same age group, whereas there was no statistical difference between boys and girls. This finding is similar with some studies, while not similar with some other studies⁽²⁻⁶⁾. The studies with similar findings are remarkable for which the number of cases was large as ours that included 2000 cases.

As a conclusion, the carrying angle was greater measured in older individuals and in dominant

extremities. Although some studies reported the opposite, it has been generally found that the carrying angles were greater in younger girls and in older boys, however, with no statistically difference.

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