ECCENTRICITY OF THE HEAD OF FEMUR

By C. K. Tan

SYNOPSIS

The femoral head is seldom well centred on the femoral neck.

Statistically significant negative correlation was found between this angular displacement of the femoral head and the femoral neck angle.

No significant correlation was found between this displacement and the angle of femoral torsion. The reasons for this are discussed.

The head of femur has been noted to be seldom well centred on the femoral neck (Kingsley and Olmsted, 1948). Its surface contour has also been shown to be asymmetrical in outline although showing good fit with the acetabular cavity, which is very important in the normal functioning of the hip joint (Davis and Frymoyer, 1969). Several factors may be responsible for the eccentricity of the femoral head upon its neck. This paper discusses the parts which the femoral neck angle and the angle of femoral torsion play in the displacement of the femoral head.

MATERIAL AND METHOD

66 adult Chinese femora which had been cleaned were photographed as described previously (Tan, 1972). Several axes were drawn on the photographs as shown in Figs. 1 and 2. By definition, when the head of femur is well centred on the femoral neck, the axis of the head will coincide with that of the neck and the angular displacement of the head is said to be zero. If the head is eccentrically placed on the neck, then the two axes will not coincide but will form an angle, as shown in Figs. 1 and 2.

This angular displacement of the femoral head from the neck was measured with a protractor and compared with the neck angle and the angle of torsion. The significance of the coefficient of correlation was determined from statistical tables (Fisher and Yates, 1963).

OBSERVATIONS

When viewed from above (Fig. 3), 18·2% of femoral heads were well centred; the remaining 81·8% were eccentrically placed on the femoral necks. When viewed from the front (Fig. 4), only 7·6% of heads were well centred while the remaining 92·9% were eccentric.

Table I shows the correlation between the angular displacement of the femoral head and the femoral neck angle on the one hand and the angle of femoral torsion on the other. Statistically significant negative correlation (P<0·01) was found between the eccentricity of the head and the femoral neck angle but not between the eccentricity of the head and the angle of femoral torsion.

DISCUSSION

There appears to be a significant negative correlation between the femoral neck and the position of the femoral head upon its neck. As early as 1889, Humphry noted that the neck angle changed with age and weight-bearing, being widest during childhood and less obtuse during the period of growth under the stresses of weight-bearing. Assuming that the femoral head maintains a constant relationship to the acetabular cavity in the orthograde position of weight-bearing, any change in the neck angle would be accompanied by changes in the relationship between the base of the femoral head and the neck, thus causing the femoral head to become eccentrically placed upon its neck.

No significant correlation could be found between the angle of femoral torsion and the eccentricity of the femoral head. But this does not mean that the angle of torsion has not been responsible, partly at least, for the eccentricity. The angle of torsion has been determined by using the transcondylar plane as a reference plane. But the relationship between this plane and the transacetabular plane could not be determined. Furthermore, it was also not possible to determine the relationship between the axis of the femoral head and the axis of the acetabular cavity. These are some of the factors which could also have contributed to the displacement of the femoral head upon its neck, in addition to the femoral neck angle and the angle of torsion.

Department of Anatomy, University of Singapore.
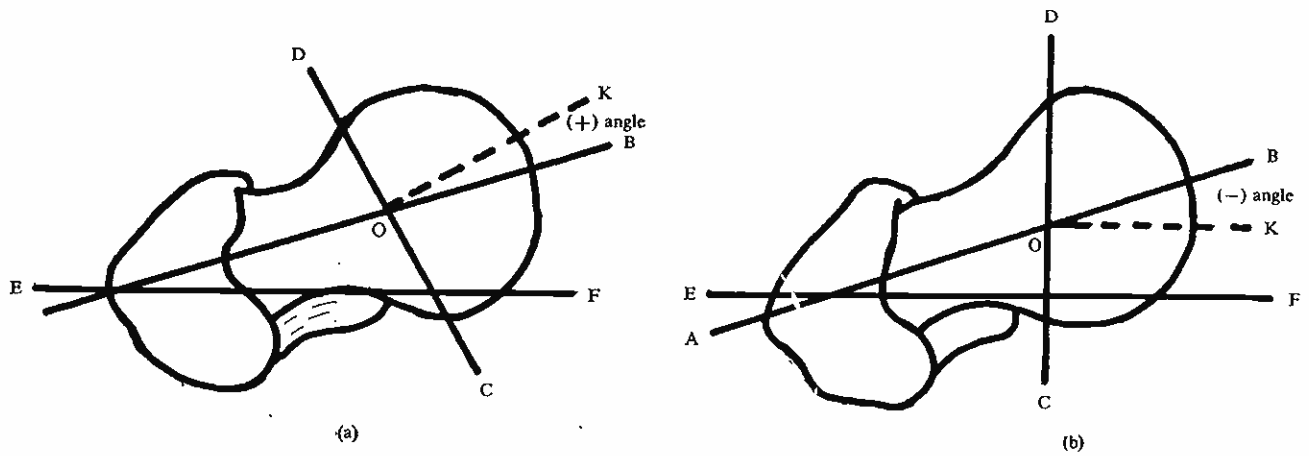
C. K. TAN, M.B., B.S. (S'pore), Lecturer.

Fig. 1. Relationship between the head of femur and the femoral neck (top view). AB = axis of neck. CD = base of head. EF = transcondylar plane. OK = axis of head. Angle KOB = angular displacement of the head.
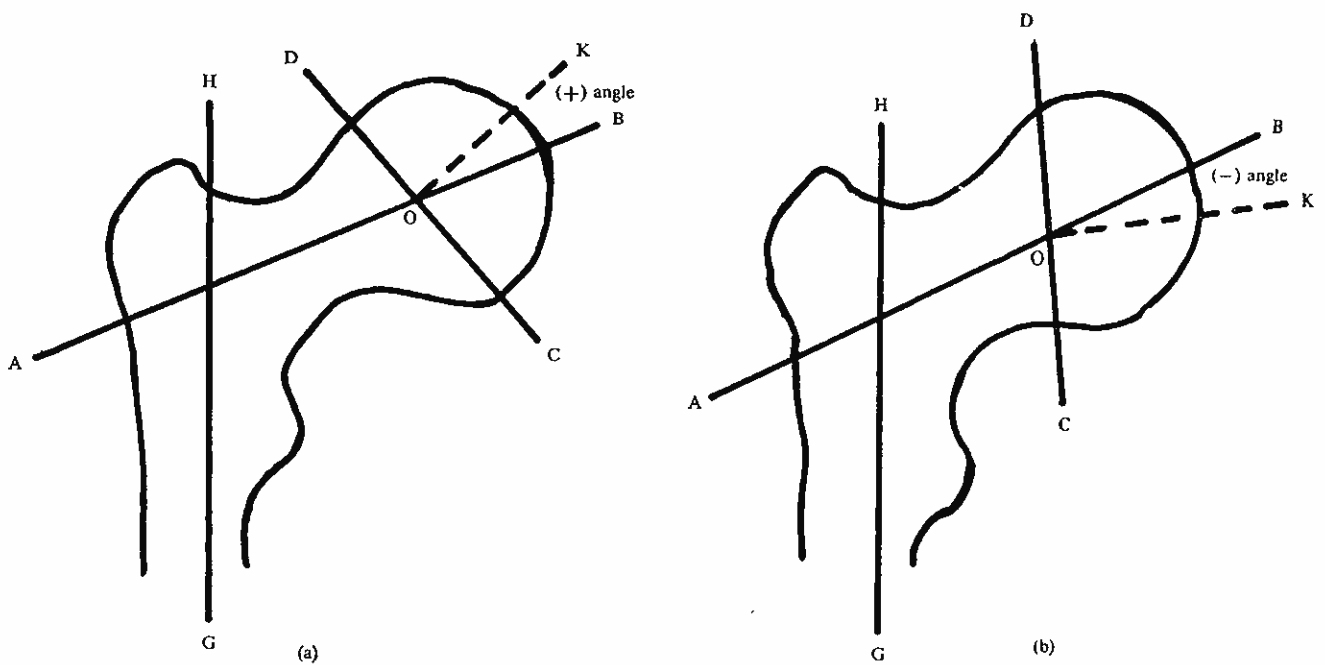

Fig. 2. Relationship between the head of femur and the femoral neck (front view). AB = axis of neck. CD = base of head. GH = axis of shaft of femur. OK = axis of head. Angle KOB = angular displacement of the head.
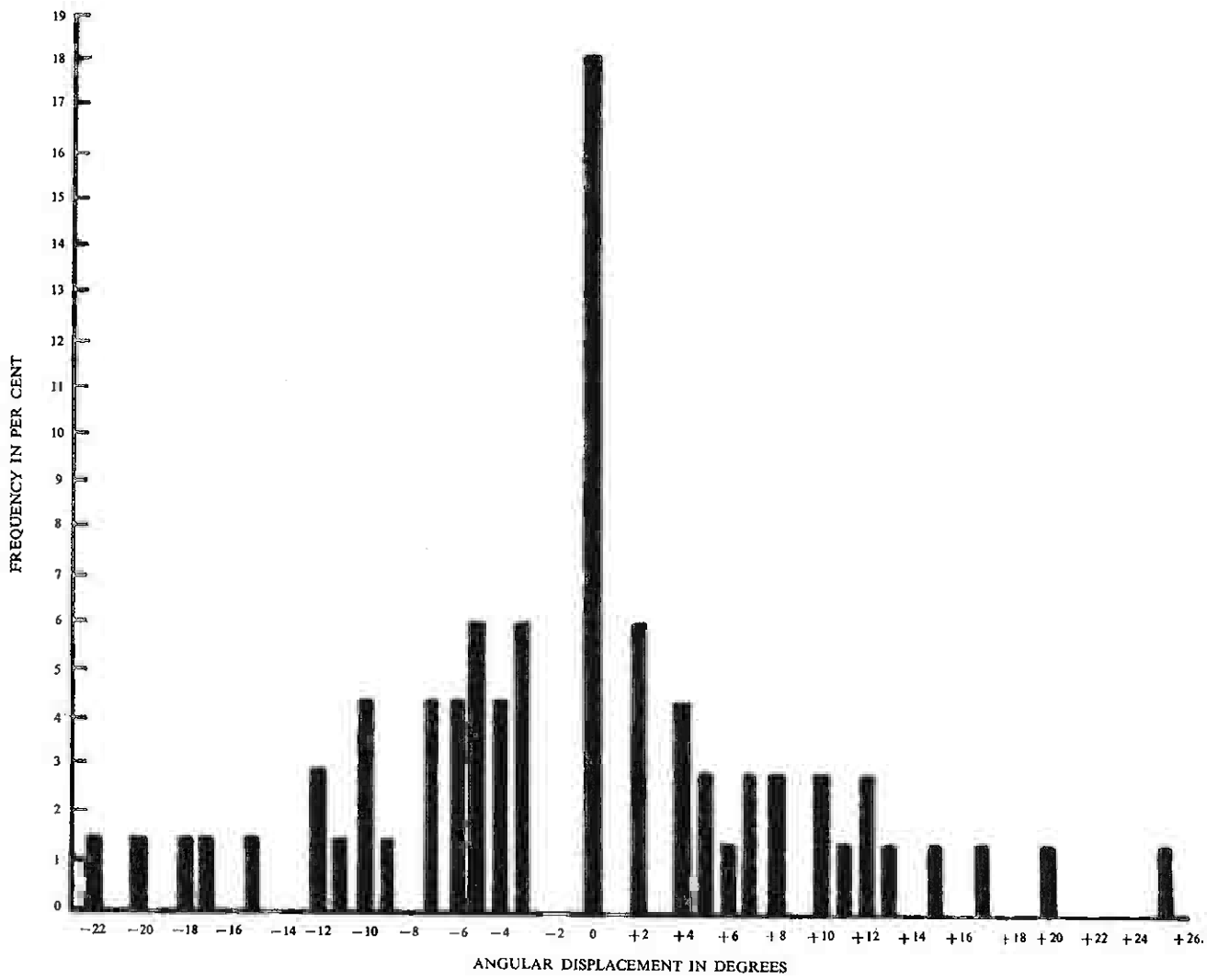
Fig. 3. Histogram showing the frequency distribution of angulations of the head of femur when seen from the top.
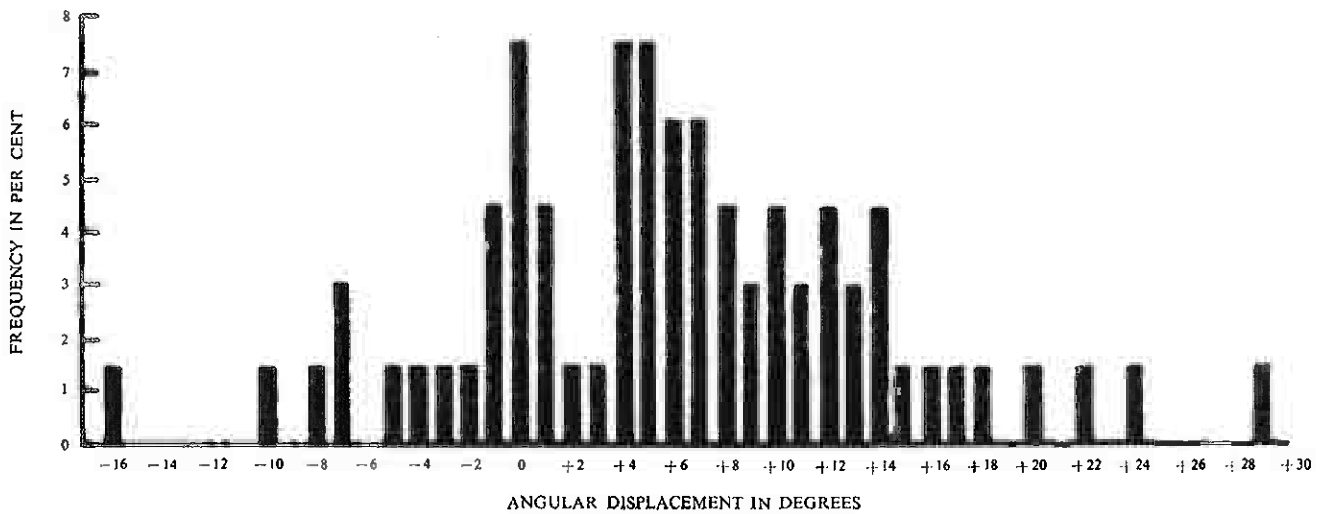

Fig. 4. Histogram showing the frequency distribution of angulations of the head of femur when seen from in front.

TABLE I

Parameters		r	P
Angular displacement of the head of femur	Femoral Neck Angle	—0·37	<0·01 Significant
Angular displacement of the head of femur	Angle of femoral torsion	+0·14	>0·1 Not Significant

REFERENCES

1. Davis, P. H. and Frymoyer, J. W.: "A Femoral Head Measuring Device." J. Bone and Jt. Surg., 51-A, 1663, 1969.

2. Fisher, R. A. and Yates, F.: "Statistical Tables for Biological, Agricultural and Medical Research." 6th Ed. Oliver and Boyd, London, 1963.

3. Humphry, G. M.: "Observations on the Angle of the Neck of the Femur." J. Anat. (Lond.), 23, 387, 1889.

4. Kingsley, P. C. and Olmsted, K. L.: "A Study to Determine the Angle of Anteversion of the Neck of Femur." J. Bone and Jt. Surg., 30-A, 745, 1948.

5. Tan, C. K.: "A Photographic Method of Measuring the Obliquity, Neck Angle and Angle of Torsion of the Human Femur." Sing. Med. Jour., 13, 235, 1972.