HALLUX VALGUS IN THE YOUNGER PATIENT
THE STRUCTURAL ABNORMALITY

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Standardised radiographs of the weight-bearing foot were analysed in fifty young patients undergoing osteotomy of the first metatarsal for hallux valgus. True metatarsus primus varus was not found more frequently than in a control series. The intermetatarsal angle was significantly greater in affected feet compared with controls. The structural abnormality in hallux valgus in the young is therefore due to a valgus disposition of the second and subsequent metatarsals, rather than varus inclination of the first metatarsal.

In hallux valgus presenting in the younger patient an underlying structural bony abnormality has been incriminated (Ewald 1912; Truslow 1925; Jones 1948; Hardy and Clapham 1952; Haines and McDougall 1954; Piggott 1960; Goldner and Gaines 1976). Ewald suggested that an abnormal obliquity on either side of the articulation between the cuneiform and the first metatarsal led to excessive medial inclination of the first ray. Truslow coined the phrase “metatarsus primus varus” to describe the abnormal medial inclination of the long axis of the first metatarsal in relation to the long axis of the medial cuneiform. No quantitative measurements were made to support this concept.

More recent studies using standardised radiographs of the weight-bearing foot have taken the intermetatarsal angle (the angle between the long axis of the first and second metatarsals) as a measure of the degree of metatarsus primus varus (Lapidus 1934; Haines and McDougall 1954; Piggott 1960). In normal individuals this angle is less than 7 degrees and anything greater than 10 degrees is regarded as pathological (Tachdjian 1972). In support of the concept of metatarsus primus varus as the underlying structural abnormality, Piggott described consistently increased values for the intermetatarsal angle in young patients with hallux valgus which progressed with the magnitude of the deformity (Piggott 1960). Measurement of the intermetatarsal angle, however, only demonstrates an abnormally large angle between the first and second metatarsals and provides no information on the degree of metatarsus primus varus, which is the angle subtended by the long axes of the first metatarsal and of the medial cuneiform and is restricted solely to the first ray.

This paper seeks to clarify the underlying structural abnormality in hallux valgus occurring in the younger patient and describes the relative importance of the various angles.

PATIENTS AND METHODS
From 1973 to 1976 fifty patients under the age of fifty years underwent osteotomies of the first metatarsal for correction of hallux valgus, twenty-five patients having bilateral operations. There were forty-six females and four males, with a mean age of twenty-three years and nine months (range ten to forty-eight years).

Standardised radiographs of both feet of all patients were taken by a method similar to that attributed to R. O. Murray by V. H. Ellis (1951). At the time of exposure each patient was standing, bearing weight, on a plate measuring 24 inches by 30 inches and the tube was at a constant height of 36 inches above the plate. The beam was directed at the midtarsal joint and angled 15 degrees posteriorly from the vertical to include the ankle, thus ensuring appropriate alignment of the hindfoot. Three angles were measured on the radiographs of each foot (Fig. 1): the angle of hallux valgus (the angle between the long axes of the first metatarsal and of its proximal phalanx); the intermetatarsal angle (the angle between the long axes of the first and second metatarsals); and the angle of metatarsus primus varus (the angle between the long axes of the medial cuneiform and of the first metatarsal). This technique of measurement on standard radiographs is known to be accurate to 1 degree (Ellis 1951), and we obtained consistent results with repeated measurements.

A control series of similar radiographs was taken of the feet of fifteen normal young adults. As both feet could be used for analysis thirty sets of angles were measured. In order to determine the relationship between the magnitude of metatarsus primus varus and of the intermetatarsal angle with the magnitude of hallux valgus, correlation coefficients between these two sets of variables were determined.

RESULTS
Table I shows the mean magnitude of the three angles measured in the group with hallux valgus and in the control group. The mean magnitude of hallux valgus and the mean intermetatarsal angle in the affected group were significantly greater than in the control group. Furthermore, there was a significant positive correlation ($r = +0.414, P<0.001$) between these two variables. There was no significant difference between the mean magnitudes of metatarsus primus varus in the two groups ($r = 0.2, P>0.05$).

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176 THE JOURNAL OF BONE AND JOINT SURGERY
These results clearly demonstrate that the alignment of the first ray cannot be incriminated in the pathogenesis of hallux valgus occurring in the younger patient. The abnormality is a wider intermetatarsal angle than normal which is directly related to the magnitude of the hallux valgus deformity. Since the alignment of the first ray is normal, the structural abnormality must be a valgus disposition of the second and subsequent rays.

DISCUSSION

In hallux valgus, definition of terms is most important. Hitherto an abnormally large intermetatarsal angle has been held to indicate metatarsus primus varus. These results clearly demonstrate, however, that the alignment of the first ray in patients with hallux valgus does not differ significantly from that in normal controls, the increased intermetatarsal angle being the result of an abnormally valgus position of the second metatarsal (metatarsus secundus valgus). Although it is not related to the first ray, the intermetatarsal angle is nonetheless an important measure as there is a significant positive correlation between the magnitude of the intermetatarsal angle and the magnitude of the hallux valgus deformity. This is because the hallux distal to the metatarsophalangeal joint lacks the proximity of the second ray which with a normal intermetatarsal angle would provide a restraining pillar. The hallux therefore drifts into an abnormally valgus position. Osteotomies of the medial cuneiform and of the first metatarsal were originally described to correct what was thought to be an abnormal medial inclination of the first ray (Lapidus 1934; Ellis 1951; Mitchell et al. 1958; Simmonds and Menelaus 1960; Goldner and Gaines 1976). These procedures are attended by good results, however, due to their tendency to reduce the magnitude of the intermetatarsal angle, thus approximating the first and second rays.

Table 1. Magnitude of the three angles measured in the patients and in the control series

<table>
<thead>
<tr>
<th></th>
<th>75 affected feet</th>
<th>30 control feet</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle (degrees)</td>
<td></td>
<td>S.D.</td>
<td></td>
</tr>
<tr>
<td>Hallux valgus</td>
<td>30.0</td>
<td>7.2</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Intermetatarsal</td>
<td>13.6</td>
<td>3.3</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Metatarsus</td>
<td>20.7</td>
<td>5.1</td>
<td>&gt;0.05</td>
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REFERENCES