

## PATELLAR HEIGHT AND FEMORAL TROCHLEAR DEVELOPMENT

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Sixty-six knees were investigated to obtain paired values of patellar tendon/patella ratios and sulcus angles as an expression of patellar height and femoral trochlear development respectively. There was a highly significant statistical correlation between the two measurements, high riding patellae occurring with shallow trochleae.

*Key words:* femur; knee joint; patella

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The relation of patella alta and femoral trochlear dysplasia to recurrent dislocation of the patella is well established (Andersen 1958, Brattström 1964). Some authors consider patella alta to be one cause of the patellofemoral malalignment syndrome (Insall et al. 1976), while others include the condition in the patellofemoral dysplasias (Andersen 1958, Ficat & Hungerford 1977, Wiberg 1941). It is tempting to speculate that patella alta and femoral trochlear dysplasia are interrelated conditions as the high riding patella may give less stimulation to the development of the femoral trochlea than would a normally situated patella. No investigation of this relationship has been carried out. Brattström (1964) intended to divide his patient material into two groups, patella alta and non-patella alta, to see if there was any difference in the formation of the distal femur end, but found that Blumensaat's estimation of patellar height (Blumensaat 1938) was too inaccurate for this purpose. Insall & Salvati's method of determining patellar height (Insall & Salvati 1971) makes it possible to investigate the correlation between patellar position and trochlear development.

### MATERIAL AND METHODS

The material consists of 35 patients, 22 women and 13 men, with symptoms of chondromalacia patellae or patellofemoral instability. Both knees were investigated in all cases. Knees with osteoarthritic X-ray changes were excluded as such changes may make measurements inaccurate, leaving 66 knees for study.

Lateral radiographs with 45 degrees of knee flexion were obtained with the same rotational position of the legs in all patients. The ratio between the length of the ligamentum patellae (LT) and the diagonal length of the patella (LP) was determined according to Insall & Salvati (1971) (Figure 1a).

Simultaneous axial radiographs of the patellofemoral joints were taken by the method described by Merchant et al. (1974). This setting ensures equal rotational positioning of the extremities. The sulcus angle, defined by Brattström (1964) (Figure 1b), was recorded as a measure of trochlear development. All radiographs were taken and evaluated by the authors.

The results were evaluated by non-parametric statistical methods (Siegel 1954).

### RESULTS

The distribution of LT/LP ratios is shown in Table 1. The difference between females and males

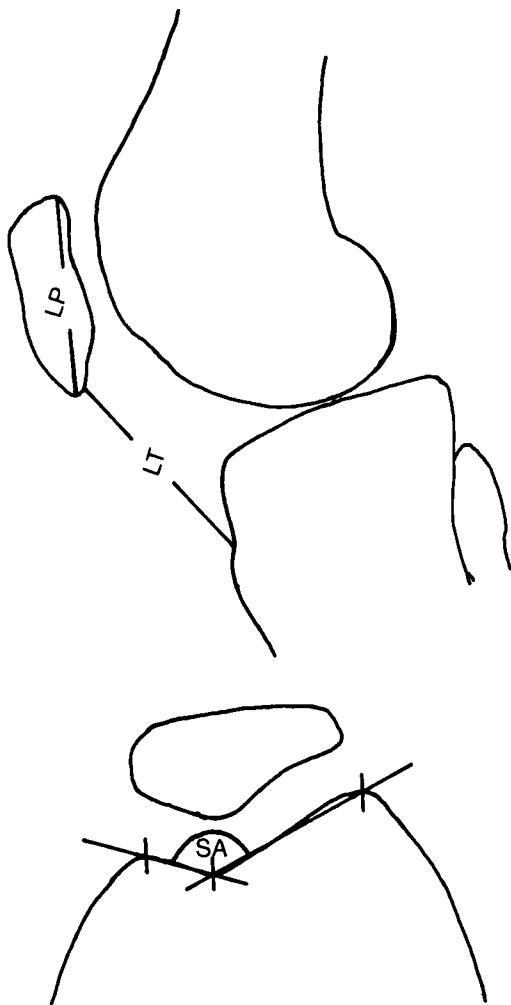


Figure 1a. Measurement of the maximal diagonal patella length (LP) and the length of the patellar tendon (LT). b. Construction of the sulcus angle (SA).

is statistically significant ( $P < 0.01$ , Mann-Whitney test). Sulcus angle distribution is shown in Table 2. There is an almost equal male-female distribution, the slight difference being non-significant ( $P > 0.10$ , Mann-Whitney test).

The paired values of LT/LP ratios and sulcus angles obtained are shown graphically in Figure 2. Spearman rank correlation coefficient, corrected for tied observations, was calculated to be  $r_s = 0.4116$ . Thus the correlation between patellar height and femoral trochlear development is highly significant ( $P < 0.001$ ).

Table 1. The distribution of LT/LP ratios

	Total	Women	Men
<i>n</i>	66	41	25
Median	1.07	1.14	0.98
Interquartile range	0.96–1.18	1.01–1.25	0.82–1.10
Range	0.68–1.40	0.70–1.40	0.68–1.22

Table 2. The distribution of sulcus angles (degrees)

	Total	Women	Men
<i>n</i>	66	41	25
Median	139	140	139
Interquartile range	136–143	137–144	136–143
Range	129–152	132–152	129–152

DISCUSSION

The investigation presented here gives convincing evidence that a relatively high riding patella generally is associated with a relatively flat, poorly

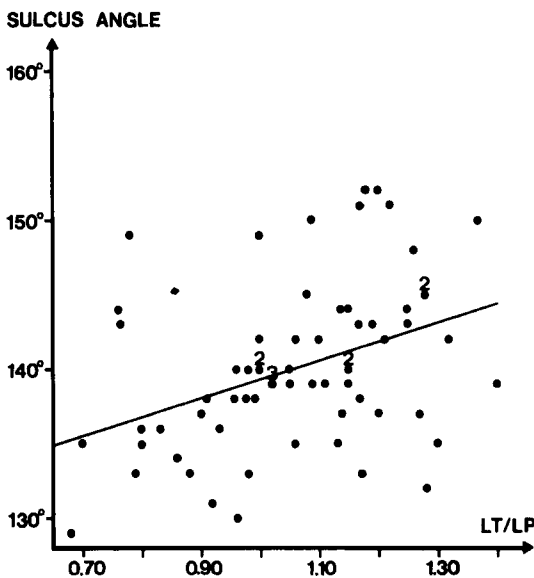


Figure 2. Paired values of LT/LP and sulcus angle. *n* = 66. Figures over marks indicate that more than one knee showed this pair of values. The line was determined by linear regression analysis ( $y = 12.8 \times + 126.5$ ).

developed femoral trochlea. It seems reasonable to classify patella alta along with the patellofemoral dysplasias as suggested by Wiberg (1941), Andersen (1958) and Ficat & Hungerford (1977). It is not known whether surgical correction of patella alta can induce development of a shallow trochlea towards the normal. In an attempt to achieve this hypothetical goal, operation should probably be undertaken at an early age, that is whenever the diagnosis is established in a patient with significant symptoms, which may be patellar instability or sometimes less dramatic symptoms (Brattström 1970). The high incidence of osteoarthritis in patients with patella alta also points in that direction (Ahlbäck & Mattsson 1978).

The distribution of LT/LP ratios and sulcus angles as related to sex are in accordance with those found by other investigators. Thus Marks & Bentley (1978) found that control females had statistically significant higher riding patellae than control males and the same trend was reported in the chondromalacia group. Brattström (1964) reported equal distribution of sulcus angles in females and males.

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