DOES OSGOOD–SCHLATTER DISEASE INFLUENCE THE POSITION OF THE PATELLA?

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The Blackburne and Peel method of assessing the position of the patella was applied to 185 knees with Osgood–Schlatter disease in 125 patients. The normal index of 0.80 was confirmed in 73 control knees. The average index in the knees with Osgood–Schlatter disease measured 1.01 (patella alta) in boys and 0.91 in girls. The value increased to 1.06 in boys with radiological evidence of loose ossicles in the tibial tuberosity or the patellar tendon. This finding indicates that the strong pull of the well-developed quadriceps muscle is probably the most important aetiological factor in patella alta associated with Osgood–Schlatter disease.

Since 1903 when Osgood and Schlatter independently described the condition which was later named after them, the controversy concerning the aetiology of this condition has continued. The influence of trauma and the mechanical overpull by the strong extensor muscles of the knee are two possible causes which appear repeatedly in the literature (Osgood 1903; Schlatter 1903; Cole 1937; Ehrenborg 1962). Since the disease occurs mainly in athletic adolescent boys with a well-developed and inelastic quadriceps, the increased tension in the extensor mechanism might have an influence on the development of the tibial tuberosity. The Anglo-Saxon term "traction apophysitis" implicates such a mechanism.

The aim of this study is to assess a possible association between Osgood–Schlatter disease and patella alta.

METHODS AND MATERIAL

To determine the position of the patella we used the method described by Blackburne and Peel (1977). A lateral radiograph with the knee flexed to at least 30 degrees ensures that the slack of the patellar tendon is taken up. A line is then projected forward tangentially to the tibial plateau (Fig. 1). The ratio of A to B provides the patellar index: A is the perpendicular height from the lower end of the articular surface of the patella to the line of the tibial plateau; and B is the length of the articular surface of the patella. In the normal knee the index is 0.80. Values over 1.00 represent patella alta.

In a retrospective study we measured the patellar index in 185 knees in 125 patients with Osgood–Schlatter disease seen at the Orthopaedic Departments of the Universities of Bern and Zürich between 1967 and 1976. In 110 patients the disease had healed at the end of the follow-up period. The ratio of boys to girls was 3:1. The disease was bilateral in 52 of the 94 boys and in eight of the 31 girls.

RESULTS

Bilateral radiographs were taken in most of the patients, enabling the normal knees in unilateral involvement to serve as controls together with 25 knees examined for reasons other than patellofemoral pathology. The average index in 73 normal knees measured 0.84, with a standard deviation of 0.11. This value was not statistically significantly different from the normal values of Blackburne and Peel (P = 0.05).

Fig. 1

The method used by Blackburne and Peel to determine the patellar index. We have observed no alteration of the index between 20 and 90 degrees of flexion.

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In Osgood–Schlatter disease the average patellar index determined in boys measured 1.01 (Figs 2 and 3) and in girls 0.91, with an average of 0.99 and a standard deviation of 0.16. In males there was a significant difference ($P=0.05$) in the ratio between those with fragmentation and loose ossicles in the tibial tuberosity (1.06) and those with an intact tuberosity (0.96). In girls this difference was not significant: 0.93 with fragmentation; 0.90 without fragmentation ($P=0.05$).

An attempt was made to define the stages in lengthening of the tendon. Serial radiographs of 30 patients were reviewed from the time of presentation of the patient to the resolution of the disease. The initial radiograph was taken, on average, six months after the onset of symptoms and, since the patella did not rise further, it would seem that this elongation occurs early in the disease.

DISCUSSION
The determination of the position of the patella is difficult; this is reflected by the numerous methods in use. The method of Blumensaat (1938) was frequently used in the past. He had observed that at 30 degrees of flexion the anterior projection of the intercondylar plane points to the lower pole of the patella (Fig. 4). Extensive studies by others (Brattström 1964; Insall and Salvati 1971; Lancourt and Cristini 1975) have shown that this method is inaccurate and unsuitable for the exact determination of the patellar position. Furthermore any deviation from the angle of flexion of 30 degrees invalidates the measurements.

The elaborate method of Boon-Itt (1930) uses a complicated geometrical system which is not practical for daily use. The ratio of the greatest diagonal length of the patella to the length of the patellar ligament can also be used as an index of patellar position as proposed by Insall and Salvati in 1971 (Fig. 5). This method fails in all patients in whom the origin and the insertion of the patellar ligament cannot be precisely defined, such as those with an elongation of the distal pole of the patella in Larsen–Johansson syndrome and in those with an ill-defined fragmented tibial tuberosity as in Osgood–Schlatter disease.

Blackburne and Peel (1977) described a method which disregards the tibial tuberosity for measuring the length of the patellar ligament, and which is more applicable for Osgood–Schlatter disease. The only difficulty is in the determination of the lower end of the patellar cartilage; this can be overcome by experience and proficiency. As with other techniques, it cannot be used in children under the age of 10 to 12 years, in whom a large proportion of the femur and tibia is cartilaginous and not visible on the radiographs. The authors of the method recommend that the lateral view be taken with the knee flexed to at least 30 degrees. We have observed no alterations of the index between 20 and 90 degrees of flexion. In 171 normal knees (121 males and 50 females) Blackburne and Peel (1977) found an average index of 0.80 with a standard deviation of 0.14 and no significant difference between the sexes. These normal values were confirmed in 48 uninvolved knees of our series and the 25 normal controls with an average index of 0.84.

Patella alta after Osgood–Schlatter disease has been observed by others (McKeever 1954; Smillie 1980; Tachdjian 1972). Tachdjian mentions that the patella may be as much as two centimetres higher on the affected side than on the normal side, resulting either from the upward pull on the tibial apophysis or from elongation of the patellar tendon. He states that the abnormally high patella may recurrently dislocate laterally, or it may lead to undue pressure on the lower
facet of the patella and to consequent chondromalacia and patellofemoral degenerative arthritis. Smillie feels that a large proportion of cases of patella alta are due to Osgood–Schlatter disease.

Our study confirms these findings with a statistically significant incidence of patella alta after "traction apophysitis" of the tibial tuberosity which strongly points to a mechanical aetiology of the condition. The fact that the boys with fragmentation of the tuberosity have an even higher index than the girls may be due to hypertrophy of the quadriceps in the young active male with an increased muscle tone even at rest, thereby concentrating all its pulling force on the tibial tuberosity. The original publications of Osgood and Schlatter also hinted at a mechanical aetiology.

The majority of our patients had a well-developed or even hypertrophic quadriceps muscle. We repeatedly observed that the children with Osgood–Schlatter disease had a decreased stretchability of their quadriceps. When the quadriceps were stretched during the examination they complained not only of the typical midfemoral muscular aching but also of pain felt at the tuberosity.

The apophysial stage of the development of the tuberosity is characterised by decreased tissue resistance to mechanical stress (Ehrenborg 1962). We feel that an increased pull of the well-developed quadriceps may in fact separate parts of the ossification centres of the apophysis leading to development of loose ossicles and elongation of the patellar ligament.

Lancourt and Cristini (1975) suggested that patella infera resulted from Osgood–Schlatter disease, but this finding was not observed in our series. A more likely reason for patella infera is direct trauma to the apophysis during adolescence with subsequent scarring of the fat pad (Fig. 6).

Based on the theory of a quadriceps-induced pathology with an elongation of the patellar ligament and a slight patella alta we have started to use quadriceps stretching exercises in the treatment of our patients with Osgood–Schlatter disease: so far we have had success (Figs 7 and 8). The idea of this treatment is to overcome the quadriceps contracture by elongation of the muscle, especially of the rectus femoris. This treatment decreases the constant pull on the irritated tuberosity and is analogous to the successful programme for stretching the quadriceps used in the management of tendinosis at the lower pole of the patella in the adult athlete (Jakob and Segesser 1980). Immobilisation is not an alternative treatment for the young ambitious athlete since a recurrence of the symptoms after removal of the cast is frequently observed. Persistent pain in athletic activity and discomfort when kneeling in a patient with healed Osgood–Schlatter disease, and radiological evidence of a loose ossicle in the patellar tendon, necessitates excision of the ossicle. The results of this procedure are uniformly good (McGonigal, personal communication).

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