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ORIGINAL STUDY

Idiopathic anterior knee pain in the young
A prospective controlled trial

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Idiopathic anterior knee pain is a common condition in adolescents. The aim of this study was to compare the biometric parameters such as hamstring tightness, hip and knee movements and joint laxity in patients with idiopathic anterior knee pain with a control population of similar age and gender. Patients (n = 34) and controls (n = 34) (age and sex matched) between the age of 11 and 25 were recruited for the study.

The mean follow-up of the patient group was 20 months. The patients showed a statistically significant improvement in their symptoms (SF-36 physical component, p = 0.001) despite the fact that half of them did not attend physiotherapy sessions. Patients had statistically significant hamstring tightness (p = 0.04) and increased external hip rotation (p = 0.001) as compared to the control group.

These findings support the theory of idiopathic anterior knee pain being a self-limiting condition that is associated with hamstring tightness.

Keywords : anterior knee pain ; adolescents ; hamstrings tightness.

INTRODUCTION

Idiopathic anterior knee pain (AKP) is common in adolescents and young adults. The exact cause is unknown. Most believe that the origin of the problem lies in the patello-femoral joint (*10*). Several theories have been proposed, including, muscular imbalance, physical overactivity and extremity malalignment (*12,15*). Sandow and Goodfellow (*11*) regarded it as the "headache of the knee". In the past idiopathic AKP was believed to be caused by retropatellar cartilage changes (chondromalacia patellae) (*2*). However, most now agree that the symptoms do not correlate well with cartilage changes (*1,4*). Witonski (*14*) suggested that this condition may have a psychosomatic basis along with subclinical patellar instability. Other theories incriminate the fat pad and medial retinaculum.

Despite this being such a common problem, we still do not know the aetiology and the best possible treatment for this group of patients. The aim of our study was to compare patients with idiopathic AKP with controls of a similar age group with no AKP. Our objective was to discover differences, if any, in biometric parameters such as hamstring tightness, hip and knee movements and joint laxity.

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METHODS

We conducted a prospective comparative study of patients with idiopathic AKP between 11 and 25 years of age and a control population of the similar sex and age group without knee pain. This study was approved by the Research and Development department of our hospital and the local regional ethics committee. Patients were enrolled via a specially designated anterior knee pain clinic. The controls were volunteers from four of the local schools and colleges.

A detailed history of the nature and type of knee pain was taken from all patients. A clinical examination was then undertaken to ensure that the knee pain was not secondary to any structural or pathological abnormality. This included assessment of patellar tracking, stability of the knee, joint line tenderness and radiographic evaluation. The feet and hip joints were also examined for any abnormality. The radiological investigation included AP, lateral and skyline views. In patients with atypical symptoms, an MRI scan was done. Each patient was asked to quantify the knee pain using a visual analogue pain scale (VAS) *(9)*. The patient put a mark corresponding to his/her pain on a 10 cm long line with 0 (no pain) written at one end and 10 (worst imaginable pain) at the other end. A short-form 36 (SF-36 v2) questionnaire was filled by the patients on each attendance (www.sf-36.org). This is a general health questionnaire and has two principal components- a physical component (that assesses activities like climbing stairs, distance one can walk etc.) and a mental component (assesses presence or absence of emotional problems, depression, etc). The software calculates the physical component summary (PCS) and a mental component summary (MCS) based on the questions answered.

The following biometric parameters were then noted : presence or absence of flat feet, hind foot mal-alignment, generalised joint laxity (measured using Beighton's[3] index), Q angles, hamstring tightness (quantified using the popliteal angle), hip rotations and antero-posterior knee laxity using the KT-1000 arthrometer (MEDmetric Corporation, San Diego, California, USA). Beighton's index for joint laxity was calculated by examining extension of the little finger, opposition of the thumb to the forearm with wrist flexion, elbow and knee hyperextension and trunk and hip flexion. Each criterion met got one point. Hence the maximum score ccould be 9 points. Hip rotations were measured using a goniometer with the patient prone and hip flexed to 90°. All patients were followed up for a minimum of one year. At each follow-up, the patients filled up a SF-36 questionnaire form and recorded their pain on a visual analogue scale.

The controls had a similar assessment except for the radiological examination. They were asymptomatic volunteers of similar age and sex as the patient population (described later). We excluded patients with an identifiable cause for their knee pain such as Osgood-Schlatter disease, Sinding-Larsen-Johansson syndrome, patellar instability, trochlear dysplasia, patellar tendonitis, osteochondritis dissecans and chondral defects.

All patients were referred to our physiotherapy department, where they underwent hamstring stretching, eccentric hamstring contraction exercises and proprioception exercises. Quadriceps strengthening exercises were used only if the quadriceps was found to be weak. The entire physiotherapy course lasted six to eight sessions. Patients were then given detailed instructions on the exercises to be done at home. Statistical analysis was performed using SPSS (Chicago : SPSS Inc) software.

Between November 2001 and January 2006, eighty six patients were referred to our knee pain clinic. Of these 21 had Osgood-Schlatter disease or Sinding Larsen Johansson syndrome, one had patellar tendonitis, two had chondral lesions of the medial femoral condyles (proven by MRI and arthroscopy) and one had patellar instability. These patients were hence excluded. Five patients were over 25 years of age and were excluded. Of the remaining patients, 22 (39%) were lost to follow-up and could not be contacted. This left us with a cohort of 34 patients with a mean follow-up of 20 months (12-48 months). The mean age was 17 years (12-23). Fourteen were boys and twenty were girls. All but 8 patients had bilateral knee pain (60 knees). The control population (n = 34) of the same age group (12-23 years, mean 17) and gender (14 boys and 20 girls) were selected from four local schools and colleges. None of them suffered from knee pain.

RESULTS

The mean physical component score (PCS) calculated from the SF-36 questionnaire in the patient population at the time of presentation was 36.9. At the last follow-up, the mean PCS was 43.1. This improvement in the score was statistically significant ($p = 0.001$, paired t-test). The mean mental component score (MCS) at presentation was 52.7 and at the last follow-up was 52. This difference was not statistically significant. The mean MCS of the control population was 54.5. There was no significant difference between the score of patients at presentation and the score of controls ($p = 0.33$;

Table I. — Comparison of biometric parameters between patients and controls

	Patient mean	Control mean	p value, test
Q angle (degrees)	11.2	11	0.72, t-test
External hip rotation (degrees)	63°	47°	< 0.001, t-test
Internal hip rotation (degrees)	27°	34°	0.01, t-test
Popliteal angle (degrees)	31°	23.5°	0.04, Mann Whitney U test
KT-1000 (mm)	5.4	5.2	0.62, t-test
Beighton's index	3	3	0.6, Mann Whitney

independent sample t-test). This suggests that idiopathic AKP was not a psychosomatic condition in our group of patients.

Fourteen (27 knees) of the 34 patients with AKP either never attended the physiotherapy clinic or attended on no more than one occasion. The remaining 20 completed their full course of physiotherapy. There was no significant difference ($p = 0.61$, Fischer's exact test) in the proportion of patients whose pain score improved with physiotherapy as compared to those whose scores improved without it. Three patients had flexible flat feet. All patients in the study had normal patellar tracking. Seven patients had mild patello-femoral crepitus. There was no significant difference in the Q angles between patients and controls (patient mean = 11.2°, control mean = 11° ; $p = 0.7$, independent sample t-test). The mean popliteal angle in the patients was 31°, while that in the control population was 23.5°. This difference was clinically significant ($p = 0.04$, Mann Whitney U test).

The mean external hip rotation in the patient population was 63°. This was significantly greater than the external hip rotation in the control population (47°). There was also a corresponding decrease in the internal rotation of the hip in the patient population as compared to the control population (see table I).

DISCUSSION

Idiopathic anterior knee pain is a common condition amongst adolescents. Despite various theories, we still do not completely understand this disorder. It is important that before labelling a case as idiopathic AKP, one excludes various physical causes such as trochlear dysplasia, patellar instability, Osgood-Schlatter disease, etc.

Fairbank *et al* (*6*) compared biometric parameters in 446 school children. Of these 136 had suffered from knee pain in the past 12 months. They found no significant difference in internal and external hip rotations, joint laxity and Q angles amongst children with AKP and those without. They also examined 52 patients with AKP referred to the outpatient clinic. However, these patients were older and had different sex distribution than the school children. Therefore they did not statistically compare the biometric parameters of patients with knee pain referred to outpatients with children without knee pain. Patients who are actually referred to see a specialist for anterior knee pain may differ from young boys and girls who do complain of anterior knee pain. Hence the fact that they did not find any differences in the biometric parameters amongst students without a history of knee pain as compared to those who had a history of knee pain may not be as relevant.

Nimon *et al* (*10*) noted that about 50% of the patients with AKP improve spontaneously over the first few years. They emphasised that prolonged comprehensive physiotherapy treatment for these patients may not be justified. We referred all our patients for physiotherapy with special emphasis on hamstring stretching. This was based on the premise that hamstring tightness may be a contributing factor to the condition. However, about half of our patients defaulted and did not turn up for physiotherapy or attended only one session. We could not assess whether any of these defaulters carried out the prescribed exercises at home. Most patients showed improvement in symptoms. From

our study, we cannot comment on the benefit of physiotherapy, as the study was not designed to answer that question. A randomised controlled trial in the future may help us find an answer to this question.

Some authors have suggested increased hip internal rotation secondary to increased femoral anteversion to be a cause of AKP (*5,8*). Moussa (*9*) suggested a theoretical relationship between increased femoral anteversion and patellofemoral osteoarthritis. In our series we noted that the mean external rotation of the hip was significantly greater than in the control population (63° versus 47°). This is contrary to the findings of the papers mentioned above. One of the theories of AKP proposed by Townsend *et al* (*13*) is overuse of the medial patellar facet. Excessive hip external rotation may affect patellar tracking and increase the strain on their medial facet. Further research is needed to understand the role of hip rotation in causing knee pain.

In summary, idiopathic anterior knee pain is a self-limiting condition. In contrast to traditional teaching that patients with AKP have increased internal hip rotation, we found that the contrary was true. Increased hip external rotation may increase stress on the medial patellar facet causing AKP. AKP is not a psychosomatic condition and is associated with hamstring tightness.

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