

**The Proportion of Adolescents Complaining of Anterior Knee Pain with Osteochondritis  
Dissecans and the Utility of Screening Radiographs in its Diagnosis**

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## **Abstract**

Osteochondritis dissecans is a rare condition which can cause disabling knee pain in adolescents. Treatment and prognosis hinges upon the stage of the lesion and early detection is paramount<sup>1-3</sup>. Until recently, epidemiologic information regarding OCD in adolescents was unavailable. However in 2013 Kessler et al. demonstrated an incidence of 9.5/100,000 in the general adolescent population<sup>4</sup>. Chief complains from patients with OCD usually localize pain to the knee joint line, but less commonly, patients may complain of anterior knee pain. This retrospective chart review looked at the amount of OCD diagnoses in adolescents specifically complaining of anterior knee pain without causative trauma in the years 2009 and 2010 at a major children's hospital. It was noted that 7.5% of children with this presentation had a diagnosis of OCD. This number was over three orders of magnitude higher than the incidence seen in the general adolescent population as established by Kessler and may support the use of screening radiographs in this subset of patients to detect OCD in its early stages.

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## I. Introduction/Significance

### Pathophysiology and Treatment of OCD

The absolute etiology of osteochondritis dissecans (OCD) remains elusive; however repetitive microtrauma has emerged as the leading hypothesis<sup>3,5</sup>. This theory is substantiated mainly by the fact that the incidence of OCD is consistently higher in athletes and physically active adolescents. Subsequent dearth of evidence supporting other theories, including inflammation, ischemia and ossification, has only added to the solidification of trauma as a major pathophysiologic contributor<sup>3</sup>.

An early diagnosis of OCD is essential to successful treatment and a favorable prognosis<sup>1,3</sup>. The degree of stability of the lesion is also an important prognostic indicator and dictates which forms of treatment might be most effective. Widespread agreement dictates non-surgical treatment should be pursued initially in asymptomatic patients with stable lesions, although the American Academy of Orthopaedic Surgeons (AAOS) does not have a recommended treatment for this presentation<sup>6,7</sup>. This scenario is more common in adolescents as opposed to adults who more frequently present with unstable lesions requiring surgery<sup>1,3</sup>. Non-surgical treatment entails refraining from high intensity activity including athletics and any activity which may cause impact trauma to the knee. Generally speaking, this form of treatment should be pursued for stable lesions for at least six months before other treatment options, including surgery, are considered. Non-surgical treatment is effective within 10-18 months in up to 50% of patients<sup>2</sup>. Surgical treatment is indicated in cases of unstable OCD (i.e. chondral separation) or in cases of failed non-surgical treatment in symptomatic patients<sup>1-3</sup>. Drilling in low grade lesions and internal fixation in high grade lesions are the primary surgical interventions for OCD in adolescents. These procedures serve as a catalyst to revascularization and healing<sup>1</sup>.

## Epidemiology of Anterior Knee Pain and Osteochondritis Dissecans

Each year 2.5 million runners are diagnosed with anterior knee pain (AKP).<sup>8</sup> There is no question that it is a common condition encountered by orthopaedic surgeons; however, osteochondritis dissecans as a cause for that pain is rare, at least in the general population. The epidemiologic information pertaining to OCD remains limited. Until last year, there were no epidemiologic studies characterizing the disease in adolescents at all and the best data for OCD in adults was collected nearly 40 years ago by Linden et al.<sup>9</sup> A large scale study characterizing the epidemiology of OCD in adolescents was published by Kessler et al. in Southern California which included over 1 million patients in late 2013. They found that the incidence of OCD in the general adolescent population was 9.5 per 100,000 with the incidence in males being 3.8 times that of females. Additionally, they noted that patients aged 12-19 had a three times greater risk of OCD than children 6-11 years old<sup>4</sup>.

## The Role of Imaging Modalities in the Diagnosis of Anterior Knee Pain with no Causative Trauma in Adults and Adolescents

The high epidemiologic prevalence and relative degree of difficulty in correctly diagnosing the cause of AKP often makes imaging modalities very alluring to physicians in search of answers. Despite the multitude of information that even a plain radiograph can provide in initial assessment of cases of AKP, frequently the results in adults are inconclusive and of limited value.<sup>10</sup> The situation for radiographic imaging and adolescents complaining of AKP may be slightly different and it may be efficacious to perform screening radiographs of the knee for all younger patients who present with AKP without causative trauma and adolescents in whom OCD or bony abnormality is a possibility.

The American Academy of Orthopaedic Surgeons (AAOS) gives a weak guideline recommendation to clinicians to screen for OCD using radiographs in patients whom complain of “knee symptoms” including anterior knee pain, sensations of locking or swelling of the knee<sup>7</sup>. This recommendation was the product of a single study evaluating the diagnostic utility of selective knee MRIs in children. This study concluded that selective MRI did not add to the

enhancement of diagnostic capabilities as compared to physical exam, history and simple radiographic imaging in adolescents with knee pathology<sup>6</sup>. No guidelines currently exist for the screening of OCD using plain films specifically in adolescent patients. Therefore the purpose of this study was to explore the utility of radiographic screening for OCD in adolescents complaining of anterior knee pain based on the experience and practice of the senior author at a major children's hospital.

## II. Materials and Methods

Institutional review board approval was obtained for this study. Retrospective chart review of pediatric orthopaedic patients complaining of anterior knee pain without causal trauma at a major regional children's hospital was performed for the years 2009 and 2010. In order to be included in the study, patients must have had anterior knee pain for > 2 weeks and have no history of an initial specific traumatic event to account for the knee pain.

While no guidelines exist for the use of four view radiographic imaging in adolescents with AKP, such radiographic screening techniques were the standard practice in this clinic during the years reported in this study. Only patients with knee pain without causal trauma were screened using four view radiographs (AP, lateral, tunnel, sunrise views).

The data in the electronic medical record was investigated for children meeting the presentation inclusion criteria, that being: age less than 19, anterior knee pain, knee pain for greater than two weeks and no inciting traumatic event. Once the sample was identified, it was examined for the diagnosis of OCD. The percentage of patients meeting the presentation requirements and a subsequent diagnosis of OCD were noted as well as age of the patient, sex of the patient and lesion location.

### **III. Results**

A total of 134 pediatric patients between the ages of 5-18 were identified over the two year period. Four-view screening radiographs were performed on all 134 patients to rule out the presence of bony abnormality contributing to their anterior knee pain. Of the 134 patients, 10 were identified and diagnosed with OCD (Table 1).

A breakdown of the presentation of OCD of this sample agreed with the general epidemiologic information established in the literature in regards to age at diagnosis (Table 2) and lesion location (Table 4). However this population showed a higher amount of OCD in females as opposed to the generally accepted heightened prevalence in males (Table 3).

Total patients	OCD Diagnoses	OCD Occurrence
134	10	7.46%

Table 1: Occurrence of OCD in adolescent patients complaining of AKP without causal trauma.

Age Group	Number of OCD diagnoses
5-11	4
12-19	6

Table 2: Prevalence of OCD in the 5-11 and 12-19 year old age groups.

Sex	Number of patients	Number of OCD diagnoses	OCD Prevalence by sex
Male	60	3	5%
Female	74	7	9.5%

Table 3: Prevalence of OCD in male and female groups

OCD Lesion Location	Frequency
Medial Femoral Condyle	7
Lateral Femoral Condyle	2
Patella	1

Table 4: Lesion location frequency

#### **IV. Discussion**

This study demonstrated a percentage of OCD cases in a particular pediatric population that was markedly higher than that of the general adolescent or adult population as established by previous epidemiologic studies. In fact the percentage of pediatric patients in this sample with OCD was three orders of magnitude higher than the general adolescent population incidence as established by Kessler <sup>4</sup>.

There are several limitations to this study. The first and most obvious is that this is not a true population study so we cannot draw conclusions about the incidence of OCD in this population subset. Larger scale studies with more patients could more accurately assess the incidence of OCD in these patients. Another limitation of the study was its retrospective design which may have been subject to both sampling and recall bias. Thirdly this study is a representation of a single surgeon's experience and preference for ruling out OCD or other bony abnormality in pediatric patients with this presentation. There is no cost benefit analysis to substantiate the correctness or recommend the practice.

Based on the senior author's experience the current practice at our institution is to order screening 4 view radiographs for pediatric patients reporting knee pain symptoms for greater than two weeks without inciting trauma. This allows us to promptly identify bony abnormalities such as OCD and often institute appropriate treatment earlier than would be possible without the use of screening radiographs. Virtually all OCD lesions identified in this study were initially detected on radiograph and subsequently confirmed on MRI. OCD cannot be confirmed by clinical presentation alone and always requires imaging for diagnosis. Despite this, no concrete guidelines exist for the use of diagnostic imaging specifically in adolescents in whom OCD is a risk. The AAOS has endorsed a weak recommendation for screening radiographs in patients with knee symptoms <sup>7</sup>. The elevated incidence of OCD in this subset of pediatric patients and the importance of its early diagnosis raises the question of the utility of screening radiographs in these patients. While MRI is the gold standard for diagnosis, and treatment recommendations, experienced clinicians can frequently identify lesions suspicious for OCD using plain films as was the case in this study <sup>1,7</sup>.

Given the heightened percentage of OCD in this population of adolescents, it would seem screening for the condition with radiographs could prove useful in circumventing late detection and decreasing morbidity due to OCD. Certainly the data collected from this study suggests screening films have merit in detecting OCD and at least anecdotally substantiate the senior author's decision to implement the practice. An obvious concern that arises from screening with radiographs is potentially unnecessary radiation exposure. However, according to the American Nuclear Society the increase in radiation exposure is minimal. Average radiation encountered per year by all individuals from ambient sources including cosmic, terrestrial and radon in the air is 301 millirems (mrems). Use of four extremity radiographs increases this exposure by 0.1 mrems per radiograph for a new total of 301.4 mrems. The added radiation from the radiographs increases the annual baseline exposure by roughly 0.1%<sup>11</sup>. For comparison, a standard chest x-ray exposes an individual to roughly 100x more radiation (10 mrems). The other major concern of screening with radiographs is the financial cost of doing the imaging. Further studies with a greater number of patients and increased attention to economic cost/benefit analysis will be necessary before any firm recommendations regarding radiographic screening for OCD in adolescent patients with anterior knee pain can be made.

## **VII. Future Direction**

Future direction from this research would be best aimed at addressing the limitations of this study. Most notably it would be prudent to determine the true incidence of OCD in this pediatric population. Studies with a larger sample size would be more apt at determining a more accurate incidence as this value could not be reliably identified from this limited sample population. Further substantiation of the practice of obtaining 4-view x-rays in these patients would require a thorough cost/benefit analysis to estimate the overall effectiveness of using the screening radiographs.

## **VIII. Conclusion**

OCD is a relatively rare cause of knee pain in the adolescent; however its detection at early stages is key to a favorable prognosis. Given the markedly heightened proportion of cases of OCD noted in this study as compared to the true incidence in the general pediatric population, the use of screening 4 view radiographs may be an effective means of detecting the condition early and preventing unnecessary morbidity in particular subsets of pediatric patients.

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