A Novel Healing Classification for Osteochondritis Dissecans of the Knee

David E. Ramski, MD\textsuperscript{1}; Theodore J Ganley, MD\textsuperscript{2}; Alex L. Gornitzky, BS\textsuperscript{2}; James L. Carey MD, MPH\textsuperscript{3}

\textsuperscript{1} = Department of Orthopaedics, St. Luke’s University Health Network;
\textsuperscript{2} = Division of Orthopaedics, Children’s Hospital of Philadelphia;
\textsuperscript{3} = Department of Orthopaedics, University of Pennsylvania

Please address correspondence to: James.Carey@uphs.upenn.edu
Osteochondritis dissecans (OCD) is a localized process in which a focus of subchondral bone and adjacent articular cartilage (progeny fragment) separates from the surrounding bone (parent).

Juvenile OCD of the knee has increased healing potential when compared to adult type.

Stability and prognosis *roughly* correlated with size of the lesion and the degree of perilesional sclerosis on plain film.

Although conventional radiographs provide valuable information including lesion size and location and an assessment of skeletal maturity, they have a number of limitations, including: underestimation of fragment size, separated lesion may be covered by cartilage, consistency in lesion status and view limitations.

To our knowledge, patterns of healing have not been formally delineated on standard knee radiographs.
Methods

**Goal:** Evaluate practicality of classification system; examine associations between healing pattern and age, gender, lesion location, treatment type, and physeal patency

- **Screening and Data Collection:** 489 patients screened from 2006 – 2010 from single surgeon (TJG)
  - Inclusion: age < 18, OCD lesion of knee, at least three consecutive knee radiographs
  - Data collected: age, gender, lesion location, op. vs. non-op. treatment
  
  → Radiographic series compiled for 41 patients

- **Ratings:** Two fellowship trained orthopaedic sports medicine specialists (TJG, JLC) classified the images according to lesion location, healing type and physeal patency
  - Radiographs were blinded and presented in sequential order with only time from initial presentation provided
  - Two independent readings were conducted three weeks apart

- **Statistical Analysis:** Percent agreement between raters, intraclass correlation coefficient (ICC) and Randoph’s free-marginal muti-rater kappa
Boundary Healing: Resolution of the boundary between progeny fragment and parent bone from distinct to indistinct.

Radiodensity Healing: Increasing radiodensity of the progeny fragment (from radiolucent to the same radiodensity as the parent bone).

Combined Healing: Pattern shows features of both boundary resolution and increasing radiodensity.
Results

- We identified 41 consecutive evaluable knee OCD lesions (35 males, 6 females). Mean patient age was 12.8 years (SD 2.1; range 7.8-17.1). Mean follow-up was 75 weeks (range 14 – 276) with an average interval between radiographs of 22 weeks. There were 35 males and 6 females. (reflects standard demographics)

→ The most common patient type was a 13- to 17-year old male with open physes receiving operative treatment for a medial femoral condyle lesion.
• The ICC for the inter- and intra-observer reliability of the proposed healing classification were 0.67

Table 1: Results for combined ratings of healing classification and physeal patency

<table>
<thead>
<tr>
<th>Healing Pattern</th>
<th>Inter-observer ICC</th>
<th>CI</th>
<th>Quality</th>
<th>Intra-observer ICC</th>
<th>CI</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiodensity</td>
<td>0.67</td>
<td>0.55-0.79</td>
<td>Good</td>
<td>0.67</td>
<td>0.55-0.79</td>
<td>Good</td>
</tr>
<tr>
<td>Physis</td>
<td>0.87</td>
<td>0.81-0.92</td>
<td>Very good</td>
<td>0.82</td>
<td>0.75-0.89</td>
<td>Very good</td>
</tr>
</tbody>
</table>

• The ICC was categorized according to the Altman (1991) standard for reliability coefficient magnitude, whereby 0.6 – 0.8 = ‘Good’ and 0.8 – 1.0 = ‘Very Good’.

• The inter-surgeon agreement across all healing ratings was 78%.

Table 2: Inter-observer % agreement, free-marginal kappa by presence/absence of healing type

<table>
<thead>
<tr>
<th></th>
<th>Boundary % Agreement</th>
<th>Component κ</th>
<th>Radiodensity % Agreement</th>
<th>Component κ</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Rating</td>
<td>0.78</td>
<td>0.56</td>
<td>0.98</td>
<td>0.95</td>
</tr>
<tr>
<td>Second Rating</td>
<td>0.80</td>
<td>0.61</td>
<td>0.93</td>
<td>0.85</td>
</tr>
</tbody>
</table>

• Boundary and radiodensity healing was observed in all ages, genders, lesion locations, treatment types and physeal patency states. The rating of “not applicable” was not used.
Conclusion

• The proposed radiographic classification system has substantial intra- and inter-observer reliability.

• Healing patterns were not significantly associated with age, gender, lesion location, treatment type, or physeal status.

• The described three-category model is a novel, simple, accurate and user-friendly method for evaluation of OCD lesion healing.


