Interpreting the Radiolucent Line around the Hip Resurfacing Stem

**Introduction**

Femoral loosening is a known cause of hip resurfacing failures. It is often caused by decreased bone quality and viability within the femoral head as well as membrane formation along the cement and stem interfaces. Patients may experience pain as well as limited hip mechanics. The radiolucent line plays an important role in monitoring a resurfacing hip replacement, especially when evaluating femoral loosening. These radiolucent lines often form around the stem of the femoral component and are believed to represent membrane formation along the stem. The dome shape of the metallic femoral implant makes it impossible to view bone remodeling and membrane formation. Some surgeons view the radiolucent line as a ‘window’ into the head of the component and a key sign for loosening. Though radiolucent lines seem to indicate femoral loosening and membrane formation, the association has not been validated. Optimal cementing and femoral preparation techniques can decrease femoral loosening, but further understanding of radiolucent lines can help surgeons better monitor implant success over time and make difficult decisions regarding the optimal time for revision. The aim of this study is two-fold. To analyze the histology of the radiolucent line and determine if this is indicative of membrane formation along the femoral component and a key sign for loosening.

**Material and Methods**

**Study 1:** 21 revised resurfacing hip arthroplasties were studied. Median time of revision was 65 months post-operation with a maximum of 131 months and a minimum of 16 months. 14 cases were revised for femoral loosening, and 7 cases failed for reasons unrelated to femoral loosening (acetabular loosening, socket cement dissociation, pain, neck fracture, infection) and were used as controls (Table 1). 14 Conserve + implants, 6 McMinns, and 1 BHR were included in the study. All of these were fixed using cement on the femoral component, but none of the stems were cemented. Each was revised with a portion of the neck bone.

**Table 1**

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<tr>
<th></th>
<th>Ball Size</th>
<th>Ave Time</th>
<th>Ave Age</th>
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<tbody>
<tr>
<td>Loosening</td>
<td>40</td>
<td>65</td>
<td>54</td>
</tr>
<tr>
<td>Controls</td>
<td>44</td>
<td>101</td>
<td>63</td>
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All 21 pre-revision x-rays were first evaluated for a radiolucent line. If a radiolucent line was noted, two measurements (in mm) were taken along each side of the implant stem (inferior surface, tip of implant, and superior surface) making six total measurements for each case. Measurements were made using an electronic caliper. Radiolucent lines were measured twice to ensure reproducibility and limit error. All x-ray measurements were completed before evaluation of the histology.

**Results**

The radiolucent line and stem membrane showed a significant correlation with pain and walking values based on the UCLA Hip Scoring System recorded during the same time periods. The values were based on the surgeon’s interview and examination. Pain and walking values were given on a 10 (no pain/unrestricted walking) to 1 (constant pain requiring medication/bedridden) scale.

**Discussion**

Radiolucent lines give some indication of the presence and the size of a membrane along the stem. Histology findings suggest that decreased bone and marrow quality surrounding the stem membrane may account for some of the radiolucent line. Radiolucent line progression can be a helpful barometer in monitoring the progression of femoral loosening. As the radiolucent line increased it was very common for pain and walking values to worsen as well. Further studies to identify factors that may accelerate or inhibit radiolucent line progression and identifying a radiolucency size that is indicative of imminent failure are recommended.

**References:**


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