INTRODUCTION
Glenoid component loosening remains the primary long-term failure mode for total shoulder arthroplasty (TSA). Little is known about in vivo wear patterns manifested on retrieved polyethylene glenoid components, the design and clinical factors that affect wear performance, and their relation to loosening. The purposes of the study were (1) to describe wear damage observed on the bearing surfaces of retrieved polyethylene glenoid components after TSA and (2) to compare the effect of bearing surface conformity on wear performance, having accounted for confounding clinical and radiographic factors.

METHODS
From 1979 to 2005, 65 glenoid components were retrieved during revision TSA at a single hospital. The clinical information was obtained from medical records including patient demographics, medical comorbidities, shoulder history, clinical assessment (pain, range of motion), intra-operative findings, implant information, and post-operative complications.

The most recent plain shoulder radiographs (AP and axillary) prior to removal of the glenoid were examined and scored for stability. The extent and amount of radiolucency was measured with digital calipers. The radiolucency was divided into anterior, posterior, superior, and inferior quadrants and scored for stability. Each quadrant was scored for the extent of radiolucency (0 to 3). The most recent plain shoulder radiographs (AP and axillary) prior to removal of the glenoid were examined and scored for stability. The extent and amount of radiolucency was measured with digital calipers. The radiolucency was divided into anterior, posterior, superior, and inferior quadrants and scored for stability. Each quadrant was scored for the extent of radiolucency (0 to 3). The extent and amount of radiolucency was measured with digital calipers. The radiolucency was divided into anterior, posterior, superior, and inferior quadrants and scored for stability. Each quadrant was scored for the extent of radiolucency (0 to 3).

RESULTS
65 glenoids were retrieved from 59 patients with an average age of 64.4 years (SD 11.5). The mean length of glenoid implantation was 4.0 years (range, 0.1 to 19.2 yrs). There were 37.3% male and 62.7% female patients. The dominant extremity was the affected extremity in 51.6% of the cases. The average forward elevation was 65.3 degrees (range, 0 to 160 degrees) and external rotation was 15.8 degrees (range, -40 to 60 degrees). The primary diagnoses for the initial surgery were osteoarthritis (75.4%) and inflammatory arthritis (24.6%). The revision procedures were aseptic glenoid loosening (72.1%), septic loosening (13.1%), instability (3.3%), and malposition (1.6%). The clinical information for conforming and non-conforming glenoids are described in Table 1.

The components had been manufactured by five identifiable companies (37 Biomet, 14 Neer II, 5 Custom HSS, 4 Depuy, and 1 Howmedica) and 4 unknown glenoid implants. Sixty-one glenoids had been cemented and four had required screw fixation. The articulation was non-conforming in 31 (48%) and conforming in 34 (52%).

The conforming glenoids had radiographic loosening scores of 2.39 (SD 0.8) and lucency scores of 4.59 (SD 0.8) compared to non-conforming glenoids with loosening scores of 1.48 (SD 1.1) and lucency scores of 3.43 (SD 1.9) (P<0.05). Radiolucent lines of the conforming glenoids were greater in zones 1, 2, and 4 compared to the non-conforming glenoids, but the difference was only significant in zone 2 (P<0.05) (Figure 1).

The damage score for each pattern were quantified and compared for conforming and non-conforming glenoids. The non-conforming glenoids had greater abrasion (P<0.05), and the conforming glenoids had greater abrasion and evidence of 3rd body wear (P<0.05).

The clinical information for conforming and non-conforming glenoids are described in Table 1.

Table 1. Clinical Information for Conforming & Non-Conforming Glenoids

<table>
<thead>
<tr>
<th></th>
<th>Conforming</th>
<th>Non-Conforming</th>
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</thead>
<tbody>
<tr>
<td>Patients</td>
<td>29</td>
<td>30</td>
</tr>
<tr>
<td>Number Glenoids</td>
<td>34</td>
<td>31</td>
</tr>
<tr>
<td>Age</td>
<td>62.1</td>
<td>60.8</td>
</tr>
<tr>
<td>Length of Implant</td>
<td>4.0</td>
<td>3.3</td>
</tr>
<tr>
<td>% Male</td>
<td>28.1%</td>
<td>55.6%</td>
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Primary Diagnosis
- Osteoarthritis (66.7%)
- Rheumatoid Arthritis (33.3%)
- Osteoporosis (15.4%)

Revision Diagnosis
- Glenoid Loosening (62.5%)
- Infection (18.8%)
- Instability (18.8%)
- Fracture (14.2%)
- Malposition (14.2%)

Intraoperative Findings
- Glenoid Loose (100%)
- Glenoid Osseous Defect (46.4%)
- Rotator Cuff Tendinopathy (57.1%)
- Humeral Head Subluxation (32.1%)
- Adhesions (39.3%)
- Deltoid Atrophy (28.6%)