Introduction
There is a relationship between the anatomy of the hip joint and the development of degenerative joint disease. In young adulthood a common cause of hip pain which may lead to early degenerative joint disease is acetabular dysplasia. More recently, femoroacetabular impingement has been described as another cause of hip pain. These patients often have groin pain reproduced with flexion, adduction and internal rotation of the hip with labral tears on MRI arthrography. The purpose of our study was to evaluate the applicability of pelvic computed tomography (CT) with 3-dimensional surface rendering to evaluate femoroacetabular impingement.

Materials and Methods
Based on an establish protocol at our institution all patients presenting with persistent hip pain for greater than 3 months underwent magnetic resonance arthrography with gadolinium enhancement (MRA) with 3-dimensional CT of the pelvis. To assess the concavity of the femoral head-neck junction i.e. offset, alpha angle as described by Notzli was calculated using CT images to depict the anterior femoral neck contours (Figure 1). We also measured the concavity at the posterior aspect of the head neck junction called beta angle.

The control group consisted of randomly selected patients who had a pelvic CT for other medical reasons with no prior history of hip pathology. There were 36 hips (30 patients) in the symptomatic group of which 21 have undergone operative treatment, and 20 hips (12 patients) in the control group. The mean age for each group was 37 (18-70) in control and 41 (37-52) in symptomatic. 17 males and 13 females in symptomatic group and 7 males and 5 females in the control group.

Results:
The mean alpha angle for the symptomatic group was 66.4 (39-94) and 43.8 (39.3 -48.3) for the control group (p=0.001). All symptomatic hips had abnormal findings on MRA: labral tears in all; cartilage delamination/ulceration in 14 hips; herniation pits in 6 hips. The majority of labral tears and delamination were located in the anterolateral quadrant. In the surgical treated group, all MRA findings were confirmed. The mean beta angle was significantly smaller (increase concavity) in the symptomatic versus the controls: 40.2 versus 43.8 (p=0.011).Interestingly in the symptomatic group the beta angle was significantly lower than the alpha angle (p<0.02) but not in the controls.

Discussion:
Femoro-acetabular impingement can either result from an over-coverage of the acetabulum (i.e. retroversion) and in cases with alpha angles <50, careful evaluation of the AP radiograph can help identify the presence of retroversion. As reproduced in this study and described by others, the lack of offset between the femoral head and neck is in the anterior and anterolateral areas. This offset refers to the difference between the maximal anterior radius of the head and the anterior radius of the adjacent femoral neck. The repeated contact of the femoral head-neck junction within the acetabulum leads to shearing of the labrum and adjacent acetabular cartilage from the underlying subchondral acetabular bone i.e. delamination. The location of the damage is rather constantly seen in the anterior superior rim area of the acetabulum where the femoral neck gets jammed and is consistent with our findings. The mean alpha angle reported by Notzli using tilted axial MR in their control and symptomatic groups was: 42.0 and 74.0 degrees respectively. They defined an alpha greater than 50 as potentially abnormal. Our data using 3D CT has closely reproduced their data. Also the fact that the beta angle was significantly smaller in the symptomatic but not the control group, indicates that subclinical slipped femoral epiphysis remains a plausible cause of this deformity and would be consistent with Goodman’s cadaver findings. This is especially important since this mild form of slip is associated with development of arthritis before the age fifty-five. MR arthrography identified patients with labral tears, paralabral cysts, and cartilage defects preoperatively.

References: