ASSESSMENT OF THE USE OF STANDING VS. SUPINE RADIOGRAPHS IN AN RSA EVALUATION FOR FEMORAL HEAD PENETRATION IN A CLINICAL SERIES OF PATIENTS RECEIVING TOTAL HIP REPLACEMENTS

Introduction:
Analyses of clinical radiographs of patients who have received total hip replacements enable assessment of wear of the articular surface over time. Several computer assisted techniques are now available for performing such measurements. Radio stereometric analysis is known to be the most precise method available for measuring relative displacements from specialized pairs of stereo-radiographs. Many variables can affect the measurement results such as film quality, film resolution, and tantalum head placement, among others. For measuring wear of polyethylene acetabular components, the displacement of the center of the femoral head is measured relative to a group of tantalum beads that are placed in the acetabular component. Laxity of hip, especially at the time initial follow-up radiograph, could adversely affect the measurement of the femoral head displacement based on later films when the muscles surrounding the hip have been strengthened. For supine films, it is the general practice that the patient is asked to slightly internally rotate the femur in order to seat the femoral head firmly in the hip socket. Several studies have attempted to determine whether measurements based on standing films is preferable to supine radiographs. The purpose of this study is to perform a clinical evaluation measuring femoral head penetration on a group of patients from Salgren University Hospital in Sweden to determine if there is a difference in films taken supine and standing. The hypothesis of this study is that comparable measurements of femoral head displacements will result from the use of supine or standing films.

Methods:
Two groups of patients who had received total hip replacements and had been enrolled in a RSA clinical study were identified for this study. All patients in the two groups had supine and standing RSA stereo-radiographs taken 6 months, one and two years postoperatively.

One group received acetabular components with conventional polyethylene inserts. The femoral component was a cemented Lubinus stem. There were 61 patients in the Lubinus group. Penetration was calculated for both supine and standing films using the 6 months as the reference film and the 1 and 2 year films as the follow up examination. In order to see if there was laxity of the hip in the 6 month supine films compared to the standing films, the same calculations were performed using a supine film as the reference and a standing film from the same six month time interval as the follow up. In this way, the effect of an early supine examination on later femoral head measurements can be assessed.

The second group of THR patients had received a cementless acetabular component with either conventional or highly cross-linked, low wear, Durasul polyethylene insert (Zimmer Orthopedics, Formerly Centerpulse Orthopedics). There were 56 patients in this group. Penetration calculations were performed using a supine film as the reference exam and a standing film from the same time period as the follow up. In this instance, the true change in position of the femoral head relative to the acetabular component is zero, therefore any measured displacement will be due to either laxity of the joint or related to the precision of the measurement.

Results:
The difference in the amount of femoral head penetration measured at two years in the Lubinus study group between using standing or supine films was minimal (Chart 1). Using a paired T-test, the only significant difference in penetration was measured in the medial (x) direction p=0.01.

Representative scatter plots of the individual results of the modified double examinations for the superior displacement at six months for the Lubinus study and at two years for the Webber study are shown in Charts 2 and 3. At each time period for each vector measured, the majority of values fell within the 99% confidence interval of the study depicted on the charts by the dashed lines. However, in all cases at each time period there were some results which fell outside the 99% confidence interval, indicating that on an individual basis there was a significant change in the position of the femoral head in relation to the acetabular component between the supine and standing radiographic examinations.

Discussion:
In this study of two groups of total hip replacement patients, similar changes in the resulting measurement of femoral head penetration occurred with the use films taken in either the standing or supine position. Large differences can occur do to either joint laxity or impingement and appear as outliers. In this series of patients, the occurrence was low.