HIP KINEMATICS AND KINETICS IN WALKING AND STAIR ASCENT/DESCENT IN PATIENTS WITH REDUCED INCISION TOTAL HIP ARTHROPLASTY

INTRODUCTION:
Less invasive hip replacement encompasses a variety of techniques that promise to reduce soft tissue injury and improve perioperative recovery, yet a recent study\(^1\) suggest that there is no difference in gait kinematics of patients undergoing standard total hip arthroplasty (THA) or minimally invasive THA although there were significant differences between the affected and unaffected sides. Others have reported moderate differences between patients having a standard anterolateral surgical approach and those undergoing a posterior approach.\(^2\)

Based on these earlier studies, we hypothesized that in patients undergoing reduced incision total hip arthroplasty, either anterolateral or posterior, we would find no substantial differences between the groups, but would see a difference between the affected and unaffected sides.

We also hypothesized that we would see substantial differences between sides on stair ascent and descent and set about to measure the moments experienced by the THA in stair use.

METHODS:
This IRB-approved study examined two groups of patients who were at least 1 year out from hip replacement: reduced incision anterolateral approach or reduced incision posterior approach. All subjects had a clinically excellent result. Exclusion was a diagnosis other than osteoarthritis arthritis or any neurological disorder, over 75 years of age and a BMI above 30 at this time of surgery. Seven patients were recruited for this study. All surgeries were performed by two hip surgeons who use either the anterolateral or posterior reduced incision approach exclusively. Average scar length was 12.4 cm.(9.5-14.5).

Prior to testing, informed consent was obtained from each subject. Lower extremity kinematics and kinetics were collected using a 12 camera Motion Capture System (VICON Motion Systems, Oxford, England) recording at 150 frames per second in conjunction with 3 AMTI Force platforms recording at 1500Hz. Two force platforms were used for level walking and a third platform was imbedded in the middle step of a 5 step stair case. The Helen Hayes marker configuration was used, which consisted of 15 markers strategically placed over anatomical landmarks around the pelvis and both lower extremities. Inverse dynamics were used to derive kinetic information from the kinematic and the ground reaction force data.

After placement of markers the subjects, they were instructed to walk several passes across a level 10-meter walkway at a self-selected pace. At least 10 steps were collected and used for averaging. Subjects were also instructed to ascend and descend a 5 step stair case a minimum of 10 attempts without the use of handrails.

The parameters that were calculated included sagittal hip range of motion at initial foot strike and at maximum hip extension, and the peak sagittal hip moments.

RESULTS SECTION:
Figure 1 demonstrates the averaged curves for hip sagittal moments during gait, with the unaffected curve being the more inferior. Even at one year out, there is a decreased sagittal moment at maximum flexion on the affected side although this difference was not statistically significant (p=0.27).

Similarly, Figure 2 demonstrates no significant difference in hip sagittal range of motion between affected and unaffected sides. Again, the unaffected side is the more inferior on the graph.

DISCUSSION:
This is the first study that we are aware of that looks at kinematic and kinetic data for reduced incision total hip patients in both level gait and in stair ascent and descent. As this was a preliminary study, the numbers were small, but we have recruited several additional subjects for testing. As expected, we did see slight differences between affected and unaffected sides in level gait. However, since little work has been done with total hip patients and stair ascent/descent, we are still analyzing the difference in moments between the affected and unaffected sides as patients go up and down the instrumented stairs. Heller, et al,\(^3\) did look at 4 instrumented total hips in stair climbing, but they did not compare these with data from the contralateral side. It is probable that these total hip patients continue to alter their gait when they are most unsure of their movements, such as on stairs. Further study is underway to evaluate both the mechanism of this difference and evaluate possible rehabilitation protocols that could restore their stair and level gait to more normal patterns.

REFERENCES: