BIOMECHANICS OF SIT TO STAND AFTER TOTAL HIP REPLACEMENT SURGERY IN OBESE AND NORMAL WEIGHT SUBJECTS

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SUMMARY

Three Dimensional Kinetic and Kinematic analysis was performed to analyze the Sit to Stand activity in normal weight and obese Total Hip replacements subjects at 6 week, 6 month and 1 year post-surgery. Sagittal plane peak hip moments at 6 weeks were significantly less than at 6 months and 1 year suggesting asymmetrical loading of the operated side. Furthermore, the peak hip moments for normal weight THA subjects were less than the obese THA subjects, contrary to the trends in the normal non-operated population.

INTRODUCTION

The sit to stand (STS) movement, a prerequisite in many activities of daily living, becomes more difficult to perform with age, obesity, and after Total Hip Arthroplasty (THA), a common surgical procedure. While the STS movement has been extensively investigated in normal weight, younger subjects (1, 2), information on the effects of obesity and THA surgery are limited. Obesity has been shown to reduce the normalized hip moments (Sibella, 2003) and THA patients have been shown to have asymmetric limb loading resulting in decreased hip moments (Talis, 2007). How the combination of BMI and recovery from THA surgery interact to affect hip joint mechanics during STS movements has not been investigated.

The purpose of this longitudinal study was to analyze the kinematics and kinetics for sit to stand activity at 6 weeks, 6 months and 1 year post total hip replacement surgery and to explore differences between normal and obese patients. We hypothesized that the three dimensional moments at the hip joint would be less at 6 weeks post surgery period and should be near normal at 6 months and 1 year post surgery period. In addition, because of the evident differences in mass distribution, we except altered strategies and loading on the involved limb during the STS activity.

METHODS

Seventeen patients with unilateral hip replacement 7 females and ten males, aged between 50-70 years old, mean BMI 29.1 kg/m2 (range 22.5-40.8) were recruited for the study along with 24 age matched control subjects (10 normal weight, and 14 obese). Marker triads were placed on the pelvis, trunk and bilaterally on the thigh, leg, and foot. Three-dimensional kinematic data (Optotrak) and GRF data (Kistler) were collected. at 60 Hz and 300 Hz, and filtered at 6 Hz and 10 Hz, respectively.

Participants crossed their arms over their chests during STS task. Foot position was self-selected as they stood from a standard chair (46 cm high) and returned to the seated position at their preferred speed. The average of five STS trials was used to assess the kinematic and kinetic data. The initiation and end of the STS movement was identified by pelvic velocity.

DATA ANALYSIS

Visual 3D software (C-Motion) was used for processing and the moments were normalized to mass. Repeated measures One way analysis of variance (ANOVA) using SAS 9.2.1 was performed to compare three dimensional peak hip moments at 6 weeks, 6 months and 1 year post operatively. Paired t-tests were used to determine significant differences between obese and normal weight subject groups. Regression analyses were performed to determine the association between peak hip moments and BMI. P-value <0.05 was used for all the tests.

RESULTS AND DISCUSSION

The Sagittal plane peak hip moments for all THA subjects at 6 weeks (mean 0.79 +/- 0.21) are less than peak moments at 6 months (mean 1.01 +/- 0.19) and 1 year (1.02 +/- .20), (p-value 0.03), and less than the control subjects (mean 1.16 +/- 0.20). Potential reason for the lower moments at 6 weeks could be due to underloading of the operated leg when the patients rise from the chair and the slower movement speed.

The sagittal plane peak hip moment in Normal weight THA subjects (mean BMI 23.4) were less than THA Obese (mean BMI 34.8) at 6 weeks and 6 months (p-values < 0.001), but not different at 1 year (p-value 0.26).( Table 1).
The heavier population may have less flexibility when it comes to unloading the involved side given the enormous amount of weight that has to be moved.

**ACKNOWLEDGEMENTS**

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**REFERENCES**


**CONCLUSIONS**

The results of the study showed that normalized sagittal plane hip moments in normal weight THA subjects are less than their obese counterparts, which is contrary to the trends seen in normal, non-operated control subjects. The peak hip moments at 6 weeks post-surgery were reduced as compared to the data at 6 months and 1 year post surgery, but the moments at 6 months and 1 year were similar.

**REFERENCES**


**Table 1:** Showing the Mean and Standard deviation for sagittal plane peak hip moments for obese and normal weight total hip replacement subjects at 6weeks, 6 months and 1 year following surgery alongwith the values for control subjects.

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<th>6 WEEKS</th>
<th>6 MONTHS</th>
<th>1 YEAR</th>
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<tbody>
<tr>
<td>Normal THA Group</td>
<td>0.63 (0.07)</td>
<td>0.88 (0.14)</td>
<td>0.93 (0.28)</td>
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<tr>
<td>Obese THA Group</td>
<td>0.98 (0.16)</td>
<td>1.13 (0.15)</td>
<td>1.08 (0.14)</td>
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<tr>
<td>Normal Control Group</td>
<td>1.25 (0.28)</td>
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<td></td>
</tr>
<tr>
<td>Obese Control Group</td>
<td></td>
<td></td>
<td>1.09 (0.20)</td>
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