GAIT STABILITY FOLLOWING TOTAL HIP REPLACEMENT

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INTRODUCTION

The prevalence of osteoarthritis among the aging community has resulted in 250,000 primary hip arthroplasties being performed annually in the United States [1]. Total hip replacement (THR) has been reported to be a cost effective procedure that can improve mobility and the quality of life for suffering patients [1, 2].

The purpose of this study was to longitudinally examine the effectiveness of the anterior and lateral THR. Gait stability in the medio-lateral and anterior-posterior directions were investigated during walking [3]. It was hypothesized that both THR approaches would allow patients to ambulate in a safe and stable manner 16 weeks after surgery.

METHODS

Thirty adults were recruited for this study and were divided into three groups: 12 subjects with THR utilizing anterior approach, 8 subjects with THR utilizing a lateral approach and 10 control subjects. All patients had the same un-cemented Zimmer hip implants and underwent similar physical therapy. Subjects who underwent THR were tested at 3 different times: pre surgery, 6-weeks and 16-weeks post surgery. Control subjects were tested during two separate visits.

During each visit, whole body motion analysis was performed using an eight-camera motion analysis system. Whole body center of mass (CoM) position was calculated using a 13-segment model with the weighted sum method [4]. The center of pressure (CoP) position was calculated using the ground reaction forces/moments measured with force plates. Instantaneous sagittal and frontal CoM-CoP inclination angles were calculated [3]. A mixed model analysis of variance with repeated measures was used to compare the effects of group and time period. Gait parameters and CoM-CoP inclination angles were used as dependent measurements, with the significance level set at 0.05.

RESULTS AND DISCUSSION

Compared to pre surgery, significant increases in gait velocity and stride length were observed in the anterior group after surgery. Such significant changes were not witnessed in the lateral group, though significant group effects were seen among both surgical groups when compared to the control group. By 16 weeks post surgery, no group differences were seen between the surgical groups and the control group.

Results of the maximum CoM-CoP inclination angles are presented in Table 1. Compared to pre surgery, the anterior group displayed a significant decrease in their medial inclination angle post surgery. No significant decrease was seen in the lateral group. Both groups, when compared to controls, showed significantly greater medial inclination at all time points. When compared to the control group, both surgical groups displayed significantly smaller anterior inclination angles. Compared to controls, significant group differences were also seen in the posterior angle at pre surgery and 6 weeks post surgery for both patient groups, though no significant differences were seen at 16 weeks post surgery.

CONCLUSIONS

Results from this study highlight the improvements in gait performance of patients following THR. Though improvements are seen in medial inclination angles after surgery, differences still exist between patients and controls 16 weeks post surgery. While gait stability has been improved after THR, it is recommended that patients continue therapy in order to enhance muscle strength and further improve stability during gait. Improvements are also seen in the temporal gait parameters of gait velocity, stride length and step width, such that patients approach the level of controls by 16 weeks post surgery. Such improvements among both surgical groups highlight the benefits of THR for those patients who suffer from osteoarthritis of the hip.

REFERENCES

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Table 1: Comparison of CoM-CoP inclination angles for two surgical procedures

	Controls	Anterior THR			Lateral THR		
		Pre Surgery	6 Week Post Surgery	16 Week Post Surgery	Pre Surgery	6 Week Post Surgery	16 Week Post Surgery
Medial	3.9 ± 0.6	6.0 ± 3.0 †	4.7 ± 0.9 *†	4.8 ± 1.0 *†	5.6 ± 2.0 †	4.6 ± 0.9 †	4.81 ± 1.0 †
Anterior	13.2 ± 2.0	9.7 ± 1.4 †	9.8 ± 2.4 †	10.7 ± 2.4 *†	11.6 ± 2.3	10.1 ± 1.8 *†	10.8 ± 2.5 †
Posterior	13.1 ± 2.2	11.0 ± 1.2 †	10.7 ± 1.7 †	11.7 ± 1.8 *	11.7 ± 1.3 †	10.6 ± 1.2 *†	12.0 ± 1.6

* Time significance within a group vs pre-surgery ($p < 0.05$). † Group significance vs control group ($p < 0.05$).