Gait Analysis of Metal-on-Metal Surface Arthroplasty: A Comparison Study to Matched Osteoarthritic and Standard Total Hip Replacements

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Introduction

Gait evaluations of patients with standard total hip who are satisfied with their result and have no pain still may have reduced hip abduction and extension moments when compared to normal hips. The authors compared the differences in temporal-spatial parameters and hip kinetics during walking in patients with unilateral osteoarthritic (OA) hips, unilateral standard THR, and patients with unilateral Metal-on-Metal surface arthroplasty (MOMSA).

Statement of Clinical Significance

A significant portion of the population undergoes hip replacement surgery every year (600,000 in North America). Patients with unilateral MOMSA hip arthroplasty visually appear to walk as well as patients with no arthritis by 6 to 9 months post-operatively. It is our clinical impression that this occurs due to a larger femoral head and the conservative nature of MOMSA. In standard THR one can make a small error (up to 1 – 2 cm) in the location of the femoral head superiorly or laterally which will affect the moment generating ability of the hip musculature as shown by Delp et al. In MOMSA this error does not occur since the femoral component is only a surface replacement.

Our hypothesis for the current study was: MOMSA patients walked with normal temporal spatial parmeters with adequate force generation at the hip during gait. Also, MOMSA patients walked with superior moment generation during gait as compared to asymptomatic THRs and OA hips.

THR

MOMSA

Methodology

40 patients were recruited from the clinics. 15 were MOMSA patients (13 male, 2 female age 51.1 (7.3)). 14 were THR patients (5 males, 9 female age 58.6 (10.9)). 11 were OA patients (7 male, 4 female, age 55.0 yr (12.3)). All MOM patients were osteoarthritic. A single surgeon (MM) performed all the surgeries. All surgeries used the anterolateral approach. All patients underwent a gait analysis 6 to 15 months post-op using an 8 Falcon camera Real-Time system (Motion Analysis Corp., Santa Rosa, CA) and two force plates (AMTI, Newton, MA). Kinematics and kinetics were calculated using OrthoTrak software. The five most consistent trials for each side were selected for averaging and analysis using Statview (SAS). Paired t-tests were performed when two variables were compared and ANOVA when more than two variables were compared. The parameters analyzed were speed and maximum hip abduction moments and maximum hip flexion moments during loading response. Comparisons were made between groups as well as between the affected and normal sides.

Results

The age difference between the groups was not significant ($p > 0.06$). Comparison of the unaffected sides between groups showed that hip abduction moments of the unaffected sides were not statistically different ($p > 0.15$). Patients with MOMSA walked significantly faster. Patients with MOMSA have significantly higher hip abduction and extension moments during loading response.

	Speed m/sec (sd)	Affected Side Max Abduction Moment in Loading Response nm/kg	Affected Side Max Extension Moment in Loading Response (nm/kg)
MOMSA patients	1.26 (18.2)	0.777 (0.129)	1.048 (0.278)
THR patients	0.96 (13.2)	0.583 (0.250)	0.703 (0.257)
OA patients	1.01 (13.7)	0.589 (0.183)	0.658 (0.262)

Discussion

This report has shown superior hip kinetics and functionality, when MOMSA was compared to THR and OA patients. The reason for this finding may be the more conservative nature of the procedure, which preserves bone stock, and allows a close approximation to the proximal femoral anatomy which maintains hip abductor and extensor lever arm distance, thus not weakening hip abductor and extensor muscles. This technology may help people lead a more normal, active lifestyle longer.

References

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