COMPARAISON OF TOTAL HIP ARTHROPLASTY AND A HIP RESURFACING DURING QUIET STANDING

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INTRODUCTION

Since younger patients are now more frequently affected by osteoarthritis (OA) [1] expectations from hip arthroplasty had changed. Indeed, patients do not only want to be relieved from pain and stiffness but they wish also to return as soon as possible to a high level of physical activities [2].

The main type of hip replacement is the total hip arthroplasty (THA). Over the years, this prosthesis has proved its worthiness and is now recognized as an effective, reproducible and frequently used therapeutic option [3]. A second type is the surface replacement arthroplasty (SRA). In SRA, the femoral head is shaped and bones are preserved, which are the major advantages of this prosthesis [4].

In their study, Nantel et al., (2008) [5] found a difference between the two prostheses (THA vs. SRA), for the range of the center of pressure (COP) in the medio-lateral (M/L) direction, during a quiet standing task. They supposed that the size of the femoral head might have an impact and may be a key point in postural control after hip arthroplasty.

During the past few years, a variation of the THA has been developed. This prosthesis uses a large diameter femoral head (32mm) (LD-THA). Therefore, the aim of this study is to compare patients undergoing hip replacement (LD-THA or SRA) postural control at 12 months post surgery.

METHODS AND PROCEDURES

All patients were diagnosed with hip OA and had a surgical intervention using a posterior approach. A control group was used for comparison. Goroups' characteristics are shown in Table 1.

Table 1. Means (SD) of the group's characteristics.

	THA (n=18)	SRA (n=20)	Control (n=12)
Age (y)	50.2 (6.4)	49.1 (6.8)	44.4 (9.2)
Gender	6 F/12 M	9 F/11 M	4 F/8 M
Weight (kg)	78.1(13.8)	78.9(15.0)	77.0(13.8)
Height (m)	1.68(.06)	1.68(.07)	1.72(.07)
BMI(kg/m^2)	27.4(3.7)	27.7(3.6)	26.0(3.4)

All patients were performing two postural tasks on an AMTI force platform. At first, they were asked to stand still for 2 minutes with their eyes open (EO) and then with eyes closed (EC). During the second task, the patients had to maintain a one leg stance position for 10 s for the operated (OL) and sound limb (SL). The abductors muscles' strength was also tested using a Penny and Giles hand-held dynamometer. The peak vertical force of the OL was calculated as a percentage of the peak vertical force of the SL.

COP relative data were extracted, analysed and filtered using a second-order, low pass Butterworth filter with a cut-off frequency fixed at 10 Hz. From those data, the range (max-min), root-mean-square (RMS) amplitude and the velocity of the COP (V_{COP}) were calculated in the ML and antero-posterior (AP) directions. The results were then averaged for each task and analysed using a 3-way ANOVA. The results were then further analysed if necessary, with Tukey post-hoc test and paired t-tests. All analyses were done with a level of signification set at 0.05.

RESULTS AND DISCUSSION

No difference has been observed for the sociodemographic data.

During quiet standing, the statistical analyses (Tables 2 and 3) revealed no main effect between the two prostheses. However results revealed a main effect

for different vision conditions for the V_{COP} in both directions. Subjects have a better postural control in EO compared to EC condition. During the one leg stance, the results demonstrated a significant difference between the OL and SL for the V_{COP} in the AP direction. No interaction between the factors was found for all variables. No main effect was found for the abductor strength ratio.

Table 2. Mean (SD) of COP velocity (cm/s)* Significant difference between eyes open and closed.

	Eyes Open	Eyes Closed
V_{COP} ML *	0.43 (0.10)	0.45 (0.15)
V_{COP} AP *	0.69 (0.16)	0.93 (0.31)

Table 3. Mean (SD) of COP velocity (cm/s)*Significant difference between operated and sound limb.

	Operated limb	Sound limb
V_{COP} ML	3.9 (1.2)	3.8 (1.1)
V_{COP} AP *	3.6 (1.4)	3.6 (1.5)

Table 4. Mean (SD) of abductors strength ratio.

	LD-THA	SRA	Controls
Abd strength ratio (%)	89.4 (16.2)	92.6 (9.9)	87.6 (7.6)

The absence of a statistical difference between the two prostheses and the control subjects during a simple task (quiet standing), demonstrates that the patients restore their muscular strength and endurance needed to maintain a good postural control, especially with the abductor/adductor muscles controlling the stability in the ML direction [6]. On the other side, the presence of a significant difference during a more complex task (one leg stance) suggests that the recovery is not completed and may interfere in daily living activities [7] such as walking, turning climbing stairs dressing, etc. There is no significant difference in the abductor ratio. However, a rehabilitation program may be helpful to improve the recovery post surgery.

Besides, the significantly increase of the V_{COP} during the EC condition suggests that subjects with a hip arthroplasty react similarly to the control group, where their postural control is disrupted without visual inferences. Their surgical intervention seems to not have impaired their proprioception functions.

SUMMARY

After 12 months, patients undergoing hip arthroplasty (SRA or LD-THA) seems to have difficulties to accomplish complex quiet standing tasks. A rehabilitation program could be an option in order to improve the recovery post surgery.
Taken together these results showed that despite the design differences between SRA and LD-THA, the large femoral head seems to be the key point in restoring the hip joint biomechanics and improve postural stability.

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