

MUSCLE VOLUME RECOVERY OF THE GLUTEUS MAXIMUS, GLUTEUS MEDIUS, AND THIGH MUSCLES AFTER HIP ARTHROPLASTY

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INTRODUCTION

It has been reported that atrophy of the muscles around the hip and thigh occurs in patients with hip osteoarthritis (OA) (Arokoski 2002, Suetta 2007, Rasch 2007). Total hip arthroplasty (THA) reduces pain with a resulting increase in the quality of life (QOL) and activity levels. The muscular strength of the hip and thigh also recovers. However, there have been few reports (Adolphson 1993, Rasch 2009) which quantitatively evaluated the change in the hip and thigh muscle volume after THA, and there are no reports which evaluated the change in muscle volume for more than 2 years post THA. In the previous reports, a significant increase of the muscles around the hip and thigh (iliopsoas, adductors, hamstrings, and quadriceps femoris) have been found. However, there have been no reports on the extent to which the volume of the gluteus maximus and gluteus medius can recover after THA. In this report, we quantitatively evaluated the change in the hip and thigh muscle volume after THA by using CT images. We also evaluated related factors.

MATERIALS AND METHODS

Thirty eight patients (6 men and 32 women, mean age: 58 years) with bilateral hip OA who had undergone unilateral THA, were the subjects of this study. CT images used for measurements were taken 3 weeks after THA (postop-CT) and 4 years (range: 2-8.5 years) after THA (2nd postop-CT) for the surgery on the contralateral hip. The surgical approaches for the THA were postero-lateral approach in 31 cases and direct anterior approach in 7 cases. Hip resurfacing arthroplasty (HRA) was performed in 3 patients and conventional THA was performed in 35 patients.

The muscle volume changes between the two CT images were evaluated by measuring the cross-sectional area (CSA) of the gluteus maximus (G-max), gluteus medius (G-med), and thigh muscles (Th) of both hips on the axial plane of the postop-CT and the 2nd postop-CT. To measure the three CSAs, a coordinate system of the pelvis and the femur was constructed on each CT images using anatomical landmarks.

For the pelvis, the anterior pelvic plane (APP) was used to measure the CSAs of G-max and G-med. It was defined as the plane touching to the most anterior points of the bilateral anterior superior iliac spines (ASIS) and the pubic tubercles. CSA of G-max was measured on the plane perpendicular to APP through the bilateral most proximal points of the greater trochanter. CSA of G-med was measured on the plane perpendicular to APP through the bilateral ASIS. For the femur, the table top plane was used for the femur to measure the CSA of Th. It was defined as the plane touching to the most posterior point of the proximal

femur and bilateral femoral posterior condyles. CSA of Th was measured on the plane perpendicular to the table top plane at the center of the femur (Figure 1).

The factors related to the muscle recovery that were measured and evaluated were: sex, patient's age, surgical approach, days from the operation, type of the implant, length change, and femoral offset change.

RESULTS

On the operated side, all of the measured CSAs increased significantly after THA. G-max increased from 25.40cm² to 36.16cm², G-med increased from 21.14cm² to 23.85cm², and Th increased from 74.48cm² to 88.04 cm² (p<0.0001, respectively) (Table 1).

There was no significant difference between the rate of increase in CSA for each muscle and sex, surgical approach, nor type of the implant. There was also no significant correlation between the rate of increase in CSA for each muscle and patient's age, days from the operation, length change, and femoral offset change except for the weak correlation seen between the increase rate of CSA in G-max and patient's age (R=0.35, p=0.03).

On the contralateral side, CSAs of G-med and Th decreased significantly from postop-CT to 2nd postop-CT (p<0.0001, respectively), while there was no significant change in CSA of G-max (Table 1).

When CSAs were compared between the operated side and the contralateral side, all the measured operated side CSAs were significantly smaller than those of the contralateral side on postop-CT (p<0.0001, respectively). However, all the CSAs of the operated side became larger than those of the contralateral side with significance in G-max and Th significant (p=0.002, p<0.0001, respectively) on 2nd postop-CT.

DISCUSSION

It is estimated that the increase in activity levels and QOL after THA result in the recovery of the muscles around the hip and thigh in OA patients. However, there have been no reports that showed a significant increase in CSAs of the gluteus maximus and gluteus medius. In this study, the CSAs of G-max, G-med, G-Med and Th on the operated side significantly increased from the postop-CT to 2nd postop-CT. This study was the first study to evaluate the muscle recovery after unilateral THA in bilateral OA patients and also the first study to reveal an increase in the gluteus muscles after THA. The differences in the results of this study and the previous studies (Adolphson 1993, Rasch 2009, Suetta 2004) may come from the method used to measure CSAs: we constructed a coordinate system of the pelvis and the femur to make measurements on the same planes accurately.

In the analysis of the related factors, there were no significant correlations seen between the rates of increase inCSAs and days from THA. Since all of the patients included in this study had had 2 CT images taken with an interval of more than 2 years of interval, it is suggested that the significant increase in muscle volume happened within 2 years after THA and reached the equilibrium state.

CONCLUSION

By performing unilateral THA on bilateral OA patients, the quantity of the gluteus maximus, the gluteus medius and the thigh muscles on the operated side increased significantly.

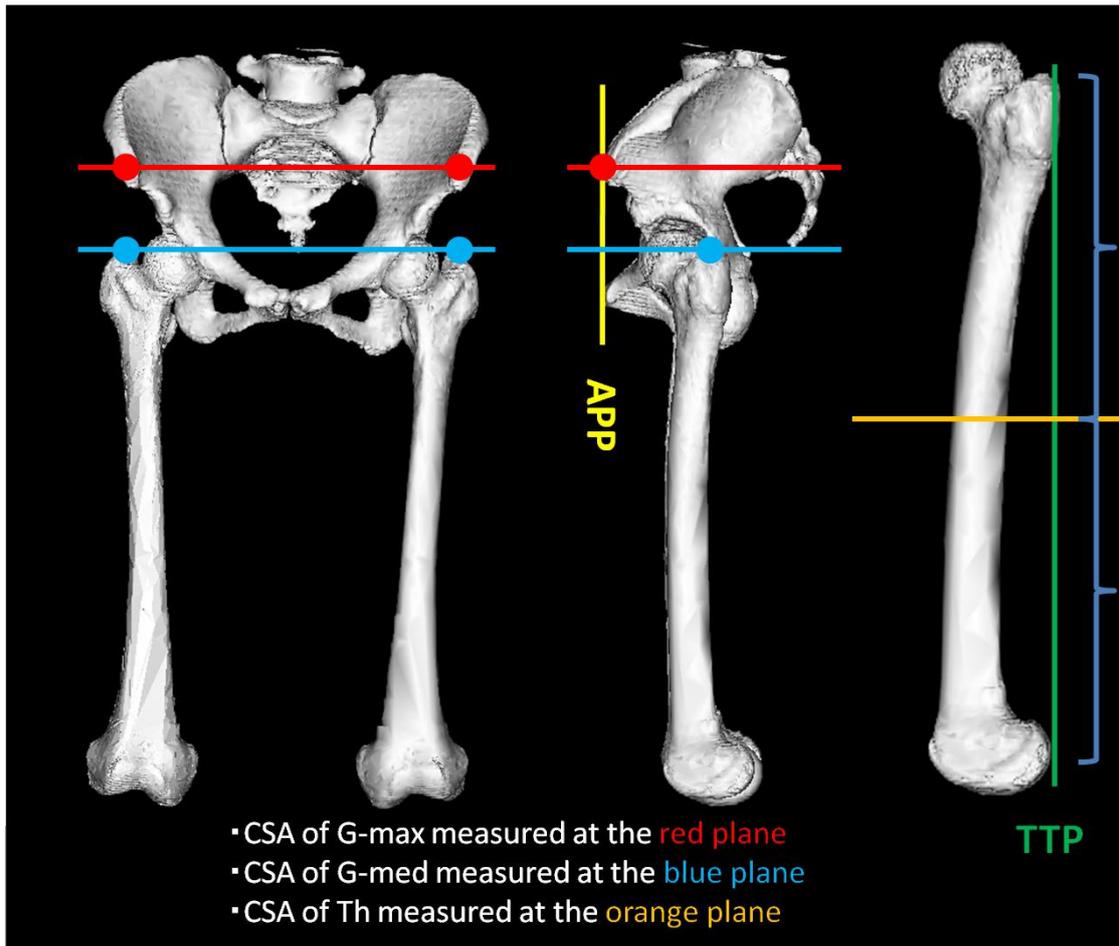


Figure 1: Coordinates of the pelvis and the femur and the plane to measure the CSAs.

CSA	Post-op CT	2 nd postop-CT	Increase rate (%)	p-value
G-max of the OS (cm ²)	25.40	36.16	24	<0.0001
G-med of the OS(cm ²)	21.14	23.85	16	<0.0001
Th of the OS (cm ²)	74.48	88.04	12	<0.0001
G-max of the CS (cm ²)	32.94	32.89	-0	0.95
G-med of the CS (cm ²)	24.55	22.94	-7	<0.0001
Th of the CS (cm ²)	91.19	84.76	-7	<0.0001

Table 1. Results

CSA= cross sectional area, G-max= Gluteus maximus, G-med= Gluteus medius, Th= Thigh
 OS = operated side, CO = contralateral side

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DISCLOSURES

The authors have declared no conflicts of interest.