Comparison of dynamic pelvic tilt between patients with pelvic reclination and those with pelvic inclination after THA

INTRODUCTION:
Malposition of the acetabular component (cup) in total hip arthroplasty (THA) leads to premature impingement of the implants during daily activities and it can cause dislocation and accelerated prosthetic wear, which reduces longevity. Computer navigation can theoretically reduce the variation in cup position; however, referencing the pelvic position in order to measure the orientation of the cup in THA has not yet been defined. References based on landmarks such as the anterior pelvic plane (APP) through the anterior border superior iliac spines (ASIS) and the pubic tuberosities are often used in navigation systems. But, development of apophyses such as ASIS is variable among patients and APP does not always represent functional pelvic tilt in the sagittal plane in each patient. Therefore, functional malposition of the cup leading to recurrent dislocation can occur even though the cup is aligned in the safe zone for APP inclination.

In this study, we analyzed postoperative dynamic pelvic tilt angle in the sagittal plane during several daily activities in patients who had undergone THA and we compared the pelvic motions between a group of patients whose APP was inclined in supine and a group of patients whose APP was reclinied in supine.

MATERIALS and METHODS:
The subjects of this study were 29 female patients who underwent primary THA for hip osteoarthritis using a CT-based navigation system (CT Hip 1.0, Stryker, US). The average age at operation was 64 years (range, 46 to 86). CT images of the pelvis and the femur in the supine position were obtained preoperatively with the following parameters: the joint and joint periphery at 3mm intervals and other areas at 10mm. Then, the patients were classified into two groups according to APP inclination: Group R contained the patients who showed reclination of their APP inclination in supine, and those in Group I whose APP was inclined in the sagittal plane. The average change of APP inclination in Group R and 1 to 1 in Group I ranged, -13 +/- 9 degrees (-30 to -4) in supine, and -25 +/- 11 degrees (-38 to -4) in standing. While in Group I, it was 9 +/- 7 degrees (1 to 25) in supine and 14 +/- 12 degrees (4 to 48) in standing, respectively. The average difference of APP inclination in supine between the pre- and postoperative conditions was -0.2 +/- 0.8 degrees (-1 to 1) in Group R and -0.1 +/- 0.8 degrees (-1 to 1) in Group I. On the other hand, the average change in APP from supine to standing was -12 +/- 8 degrees (-27 to -1) in Group R and 5 +/- 11 degrees (-8 to 36) in Group I. The difference in the average change in APP from supine to standing between the two groups was significant. During walking, APP ranged from -25 to -19 degrees on average in Group R, while it ranged from 9 to 14 degrees in Group I. The mean APP was -45 +/- 19 degrees (-69 to -9) in sitting on a chair and -38 +/- 16 degrees (-68 to -16) in sitting on feet in Group R, while it was -12 +/- 9 degrees (-29 to 4) and 10 +/- 12 degrees (-26 to 11) in Group I, respectively. In Group R, the average change in APP was -20 +/- 11 degrees (-37 to -4) from standing to sitting on a chair and -10 +/- 13 degrees (-30 to 9) from standing to sitting on feet, while in Group I, the average change in APP was -26 +/- 10 degrees (-48 to -12) and -24 +/- 11 degrees (-45 to -7), respectively. There were no significant differences in the average change of APP from standing to sitting on a chair between the groups, but there was a significant difference in that from standing to sitting on feet.

DISCUSSION:
The results of the current study show that preoperative inclination in supine position does not change postoperatively. Therefore, it is reasonable to regard the pelvic position in supine as the functional pelvic reference and if the cup is placed at an optimal angle against this functional pelvic supine position, the angles of the cup measured on the postoperative anteroposterior radiograph in supine will match the targeted angles.

This study also showed that there were substantial variations in APP change during several activities. The patients in Group R tilted their pelvises more backward from supine to standing, while those in Group I tilted more forward. This may lead to an unexpected posterior impingement and anterior dislocation when the patients in Group R stand up, because the angle of anteverision of the cup increases as their pelvic tilt backward. This may evoke the idea of reducing cup anteverision for patients in Group R to reduce the risk of anterior dislocation.

On the other hand, the patients in Group R tilted their pelvises significantly less backward in sitting on feet than those in Group I. This means, however, that the reduced anteverision of the cup will increase the risk of posterior dislocation in sitting on feet.

Therefore, modification of the optimal cup angles in patients with pelvic reclination is ineffective and the use of a larger diameter head with a thinner neck to increase the head-neck ratio and the jumping height may be a practical method to manage the risk of dislocation for this difficult group of patients with pelvic reclination.

REFERENCES:

RESULTS:
There were 11 patients in Group R and 18 patients in Group I. The mean age of Group R was 70 years (range, 49 to 86), and that of Group I was 59 years (46 to 84). The subjects in Group R were statistically significantly older than those in Group I.

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