Effect of Pelvic Tilt on Postoperative Change of Cup Anteverision in Total Hip Arthroplasty
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Introduction
Exact positioning of the acetabular cup in total hip arthroplasty (THA) is important for preventing postoperative complications such as dislocations. Cup angles in THA vary not only between standing and supine position, but also with chronological changes in pelvic tilt. It is therefore important to understand these changes when planning accurate cup angles preoperatively. The purpose of this study was to investigate the effect of preoperative pelvic tilt on cup angles, especially in standing position, after THA.

Methods
The study consisted of 116 hips in 108 primary THA patients with a mean age of 64 years. We obtained preoperative and 3, 6, and 12 month postoperative radiographs of the pelvis in standing position. The anterior pelvic plane (APP) (DiGiola et al.), pelvic angle (PA), pelvic morphologic angle (PR-S1) (Jackson et al.), and sacral slope (SS) were measured as parameters of pelvic tilt on lateral radiographs of the pelvis. Cup angles (Lewinnek et al.) were measured on anteroposterior radiographs of the pelvis. We classified patients into three groups by preoperative APP as follows: Group A (APP ≥ 10 degrees), Group B (10° > APP ≥ 0 degrees) and Group C (APP <0 degrees). The chronological changes in pelvic tilt and cup angles were investigated in each group.

Results
Postoperative change in APP was a mean -0.2, -2.5, and -3.7 degrees, at 3, 6, and 12 months after THA, respectively for all cases in the study, whereas that in Group A was a mean -2.2, -7.3, and -9.3 degrees (Figure 1). APP decreased with time after THA, more significantly in patients in Group A than Group B or C (p<0.01). PA increased and SS decreased with time, indicating posterior pelvic tilt after THA (Figures 2, 3). The cup anteverision angle in Group A was a mean 17.6, 21.3, and 21.1 degrees, at 3, 6, and 12 months after THA, respectively (Figure 4). Because of the posterior tilt in the pelvis after THA, the cup anteverision angle on standing position increased, especially in Group A.

Discussion
Cup angles tended to antever after THA as the pelvis tilted posteriorly with time. Moreover, patients with a large APP angle before THA (Group A) tended to exhibit greater postoperative change in pelvic tilt and cup anteverision angle. Consequently, special attention is required when positioning the acetabular component, especially in patients with severe anterior pelvic tilt before THA.

Figure 1. Chronological changes in anterior pelvic plane (APP)
Postoperative change in APP was a mean -0.2, -2.5, and -3.7 degrees, at 3, 6, and 12 months after THA, respectively, whereas that in Group A was a mean -4.2, -7.3, and -9.3 degrees.

Figure 2. Chronological changes in pelvic angle (PA)
Postoperative change in PA was a mean -0.7, -0.1, and +1.2 degrees, at 3, 6, and 12 months after THA, respectively, whereas that in Group A was a mean -1.8, +0.6, and +3.5 degrees.

Figure 3. Chronological changes in sacral slope (SS)
Postoperative change in SS was a mean -0.7, -0.9, and -2.3 degrees, at 3, 6, and 12 months after THA, respectively, whereas that in Group A was a mean -1.4, -4.3, and -7.1 degrees.

Figure 4. Chronological changes in cup anteverision
The cup anteverision angle in Group A was a mean 17.6, 21.3, and 21.1 degrees, at 3, 6, and 12 months after THA, respectively. The cup anteverision angle increased especially in Group A.

References