Spinopelvic Alignment after Total Hip Arthroplasty

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Introduction

Severe osteoarthritis of the hip may cause abnormal spinopelvic alignment. This is commonly known as hip-spine syndrome; however, there have been no prospective clinical reports on the influence of total hip arthroplasty (THA) on the improvement of spinopelvic alignment. In this definition of hip-spine syndrome, it is believed that spinopelvic alignment should improve after THA in simple hip-spine-specific cases where the major cause is hip joint. However, the degree of improvement will be unclear in complex hip-spine-specific cases.

The purpose of this study was to examine chronological changes in pelvic orientation and spinal alignment after THA, and to understand their role in compensation after THA. Flexibility of the spine was also assessed to analyze its relationship with decompensated balance after THA.

Methods

A total of 79 patients (90 hips) who underwent minimally invasive THA were submitted to this prospective study. The current study was approved by the Institutional Review Board of Yokohama City University and performed with patients’ agreement. The anterior pelvic plane (APP) (DiGioia et al.), lumbo-lordotic angle (LLA), thoraco-kyphotic angle (TKA), and global balance (sagittal and coronal) of the whole spine were measured as parameters of spinopelvic alignment on standing radiographs before and 3, 6, and 12 months after THA (Figure 1). For cases with scoliosis before THA, bending correction rate was measured on preoperative bending radiographs of the whole spine as a parameter of flexibility of the spine. Leg length discrepancy (LLD) and range of motion (ROM) of the hip joint were measured before and after THA.

Chronological changes in spinopelvic alignment and compensation of the whole spine after THA were investigated. The rate and characteristics of cases with decompensated spinal balance after THA were examined, and its relationship with flexibility of the spine, residual LLD, and postoperative hip ROM was evaluated.

Results

Postoperative change in APP was a mean -0.2 ± 7.9, -2.5 ± 7.7, and -7.7 ± 5.7 degrees at 3 months, 6 months, and 1 year after THA, respectively, indicating posterior pelvic tilt after THA. LLA decreased while TKA increased, indicating decreased thoracic kyphosis and lumbar lordosis after THA. In sagittal balance of the whole spine, the C7 plumb line moved posteriorly from -11.2 mm preoperatively to -20.8 mm at 1 year after THA in the normal range (p<0.01) (Figure 2). In coronal balance, the C7 plumb line was located 11.3 mm from the center preoperatively, and 0.3 mm from the center at 1 year after THA (p<0.01) (Figure 3). LLD decreased from 13.4mm before THA to 1.3mm after THA (p<0.01). Hip ROM increased after THA, and no remaining flexion contracture or abduction/abduction contracture were observed after THA. However, decompensated sagittal balance of the whole spine was observed in 18.6 % of cases at 1 year after THA (28.2% before THA) with poor flexibility of the spine.

Discussion

Several factors such as pre-existing spinal deformity, flexibility of the spine, hip flexion contracture, pre-existing disorders of the lower limb (knee, ankle), physical balance, and residual LLD affect the global balance of the spine. In this study, LLD and hip contracture were alleviated after THA, and preoperative severe spinal deformity (scoliosis and/or kyphosis), which was seen in 32.5% of cases before THA, improved after THA in most cases; however, decompensated balance of the whole spine still remained at 1 year after THA in 19% of patients with residual flexibility of the spine. This remaining decompensated balance was thought to be caused by structural spinal deformity that leads to poor improvement in deformity after THA. This type of patient would feel LLD after THA because of the residual pelvic tilt caused by a residual spinal deformity even if the leg lengths were equalized after THA. Some modification in the procedure should be necessary in such cases for full patients’ satisfaction after THA.

Further study and a longer follow-up will be necessary to clarify the relative importance of these factors and kind of modification required for this type of patient.

Summary

In general, the pelvis tilted posteriorly and spinal alignment improved with time after THA. However, decompensated spinal balance remained in 19% of cases with poor flexibility of the spine.