#2941 - Experimental Study / Posters

Is Adding "Internal Rotation" Necessary To The Rotational Acetabular Osteotomy?

Orthopaedics / Pelvis, Hip & Femur / Joint Preserving Surgery

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Background
Rotational acetabular osteotomy (RAO) is a surgical procedure for patients with developmental dysplasia of the hip (DDH). The acetabulum is osteotomized spherically and is rotated to enlarge acetabular coverage area. The conventional RAO rotates anteriorly and/or laterally the acetabulum. However when such rotation is applied to a patient who lacks the posterior acetabular wall, not only the posterior wall deficiency is uncorrected but also there is a possibility of deterioration. It is, therefore, necessary to devise the direction of rotation.

Objectives
To evaluate the change of the acetabular coverage area and the contact stress distribution of the femoral head after simulation of the RAO with internal rotation.

Study Design & Methods
We used computed tomography (CT) images of 29 female DDH patients (RAO group; mean age 40.1 years) with posterior wall deficiency who underwent the RAO at Sapporo Medical University Hospital and CT image of 30 women without abnormality in hip joint (Normal group; mean age 39.9 years). The criterion for the posterior wall deficiency is that the acetabular anteversion angle at the height of 1/4 of the femoral head was 15 degrees or less. The reconstructed 3D-images were aligned with reference to the functional pelvic plane. Next, the acetabular coverage area of Normal group, preoperative RAO group, acetabular abduction (AB rotation) of RAO group and acetabular abduction with internal rotation (AB + IR rotaion) of RAO group were calculated.
Furthermore, five patient with serious posterior wall deficiency were chosen from the RAO group, and the distribution of contact stress applied to the femoral head was calculated using finite element analysis software (Mechanical Finder□RCCM, Tokyo). The load condition was applied 600N vertical to the iliac crest and was applied 400N of the gluteus medius muscle to the greater trochanter. The auricular surface of ilium, the pubic symphysis and the distal diaphysis of femur were constraint.

Results
The mean of the coverage area of the normal group and preoperative RAO group were 1612.8 ± 209.0 mm2 and 1331.0 ± 275.5 mm2, respectively. After the RAO simulation, the coverage area increased to 1856.9 ± 302.2 mm2 in the AB rotation and to 1866.7 ± 300.0 mm2 in the AB + IR rotation. There was no significant difference in the coverage area between the AB rotation and the AB + IR rotation. In AB + IR rotation, the anterior covered region became smaller, but the posterior covered region increased and no crossover sign was observed. The distribution of the contact stress of the femoral head was confined to the medial side in preoperative RAO group, while was enlarged laterally by both AB rotation and AB + IR rotation. The contact stress of the AB + IR rotation was enlarged posterolateral

area and reduced anterolateral area, compared to the AB rotation.

Conclusions

By the RAO simulation, there was almost no difference in acetabular coverage enlargement between AB rotation and AB+IR rotation, but AB+IR rotation was effective to negate the crossover sign in posterior wall deficient DDH. The distribution of the contact stress of the femoral head was enlarged in both AB rotation and AB + IR rotation with the enlargement of the coverage area. Particularly, the contact stress distribution of the AB + IR rotation was enlarged posterolaterally and it was more similar to that of the normal condition, so that AB+IR rotation is useful for the DDH patients with posterior wall deficient.