**PERIACETABULAR OSTEOTOMY REDUCES DYNAMIC INSTABILITY OF DYSPLASTIC HIPS**

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### Introduction:
Numerous reports have implicated acetabular dysplasia as an etiological factor in the development of osteoarthritis of the hip joint. Dysfunction of the hip secondary to dysplasia is a complex problem involving excessive stresses on the cartilage, dynamic instability and muscular fatigue, which eventually lead to degenerative osteoarthritis if left untreated. In particular, the major factors causing hip arthritis secondary to dysplasia are mechanical stress and dynamic instability. In Japan, almost 80% of cases with osteoarthritis of the hip joint are secondary to congenital dislocation or dysplasia of the hip. Various types of periacetabular osteotomy have been performed on dysplastic hips in adult patients. Although many reports have proven that periacetabular osteotomy can reduce contact stress in the hip joint, no studies have clarified whether periacetabular osteotomy can also reduce hip joint instability during walking in routine daily life. The purpose of the present study was to compare the dynamic instabilities of dysplastic hips before and after periacetabular osteotomy using triaxial accelerometry.

### Materials and Methods:
We evaluated 25 hips in 25 patients (1 man and 24 women; mean age: 32.1 years; age range, 14-56 years) with acetabular dysplasia (center-edge angle of <25°) who underwent curved periacetabular osteotomy¹. Patients with functional, neurological or morphological disorders affecting their gait were excluded from the study. Obese patients were also excluded due to difficulties associated with instability measurements. The arthritis of the affected hip was limited to grade 0 or 1 according to the Tomlin classification. All bilateral knees and ankles were disease-free with normal radiological findings. Our previous study demonstrated that accelerometry was useful for quantitative analysis of hip joint instability during walking2. We used this technique to compare the hip joint instabilities before and at 1 year after the operation. An accelerometer (Kistler, Switzerland) was used to record triaxial acceleration while walking (x-axis: supero-inferior; y-axis: antero-posterior; z-axis: medio-lateral). Sensors were attached to the skin over the bilateral greater trochanters with adhesive tape. The time of each heel strike was confirmed visually and by supero-inferior acceleration. Signals from the sensors were recorded on a computer as digital data through an analog/digital board. The sampling rate was 10 kHz. Data were collected while the subject walked for about 10 gait cycles on a level walkway at their usual speed wearing their own shoes. The averages of the peak values of the middle three gait cycles were used for data analysis. To evaluate hip instability, the overall magnitude of the acceleration was calculated using the following formula: \[|a| = \sqrt{(a_x^2 + a_y^2 + a_z^2)}\]. We clinically evaluated the hips before and at 1 year after the operation using the Harris hip score, and radiographically evaluated the acetabular orientation before and at 1 year after the operation using the CE angle, SHARP angle, acetabular roof obliquity and acetabular head index.

We compared the overall magnitudes of acceleration and radiographic data for the hips preoperatively and postoperatively using Student t-tests. The level of statistical significance of these analyses was set at 5%.

### Results:
In all cases, the acceleration when walking was only in the superior (x-axis), posterior (y-axis) and lateral (z-axis) directions. The preoperative magnitudes of the triaxial components were 1.45 ± 0.63 m/s² (x-axis), 0.83 ± 0.45 m/s² (y-axis) and 1.36 ± 0.61 m/s² (z-axis). The postoperative magnitudes of the triaxial components were 1.07 ± 0.42 m/s² (x-axis), 0.80 ± 0.20 m/s² (y-axis) and 0.67 ± 0.26 m/s² (z-axis). The overall magnitude of acceleration was significantly improved from 2.110 ± 0.479 m/s² preoperatively to 1.520 ± 0.161 m/s² postoperatively (p < 0.0001, Table 1). The average Harris hip score improved from 78.08 points (range, 47-96 points) preoperatively to 95.36 points (range, 88-100 points) postoperatively. The CE angle, SHARP angle, acetabular roof obliquity and acetabular head index all showed significant improvements postoperatively (p < 0.0001, p < 0.0001, p < 0.0001 and p < 0.0001, respectively, Table 2) compared with their preoperative values.

### Discussion:
The major factors causing hip arthritis secondary to dysplasia are mechanical stress and dynamic instability. Although many reports have proven that periacetabular osteotomy can reduce the contact stress in hip joints, no studies have clarified whether periacetabular osteotomy can also reduce hip joint instability during walking in routine daily life. Our previous study demonstrated that accelerometry was useful for quantitative analysis of hip joint instability, and found significant correlations between the overall magnitude of acceleration and radiographic data. These findings suggested that hip instability increases in proportion to the degree of dysplasia². In the present study, we investigated the changes in dynamic instability after periacetabular osteotomy using triaxial accelerometry. In all cases, we found that the directions of acceleration within the hip joint in response to walking were superior, posterior and lateral. The overall magnitude of acceleration was significantly reduced postoperatively compared to the preoperative value.

In conclusion, the results of the present study demonstrate that acetabular reorientation by periacetabular osteotomy in dysplastic hips can reduce not only mechanical stress but also hip joint instability.

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**Table 1: Each magnitude of triaxial acceleration.**
P < 0.0001 for the difference in overall magnitude of acceleration between pre and post surgery.

**Table 2: Postoperatively, all parameters showed improvement (p < 0.0001) compared with their preoperative values.**