Remodeling of Cam Deformity in Slipped Capital Femoral Epiphysis
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INTRODUCTION
There has been growing interest in the concept of cam-type femoroacetabular impingement (FAI) as an etiological factor in the development of osteoarthritis of the hip after slipped capital femoral epiphysis (SCFE). Remodeling of the femoral head has been reported from several authors, however, a little is known about the remodeling from the point of cam deformity. Therefore, we conducted this study to examine the remodeling of the anterior offset of the femoral head/neck and the frequency of cam deformity in patients with SCFE after skeletal maturity.

METHODS
This retrospective study was approved by our institutional review board.

Patients
We reviewed 28 hips in 23 patients (15 male and 8 female, mean age at the events; 11.1 years, the mean duration of follow-up: 69.5 month) with SCFE (21 stable slips and 7 unstable slips) who had had pinning fixation. 13 contralateral hips without SCFE were used for control subjects.

Measurements
Anterior offset angle (α angle) described by Notzli et al. [1] and the head-neck offset ratio (HNOR) described by Eijer H et al. [2] were measured as the parameter of cam deformity (Fig.1 a, b). These parameters were measured at the points of the early post operation and the latest follow-up. α angle >42˚ or HNOR < 0.17 are suggestive of a cam deformity. The bony prominence appeared further from epiphysis at the anterior femoral neck was also recorded (Fig.1c).

RESULTS
Remodeling of cam deformity (Fig.2,3)
The average α angle significantly improved from 64.4 ±18.8˚ immediately after pinning to 47.3 ±17.9˚ at the latest follow-up. Most of the hips showed the decreased α angle by remodeling, however, 15 hips (53.5%) still had α angle more than 42˚ (Fig 3). The average HNOR also significantly improved from 0.12 ±0.05 to 0.16 ±0.05. 17 hips (60.7%) remained within HNOR < 0.17. α angle at the latest follow-up was larger than in control, but it was not significant (p=0.1112) and the HNOR was significantly lower than in control (p=0.0412).

In total, 17 hips (60.7%) in SCFE hips showed Cam-type deformity (α angle >42˚ or HNOR < 0.17). It was significantly more frequent than in control subjects.

Fig.2 a) Individual value and box plots of α angle versus the time series compared with control. The line shows 42˚. b) HNOR versus the time series compared with control. The line shows 0.17.

Fig.3: Frequency of Cam deformity at the latest follow-up.

The bony prominence at the anterior femoral neck
Six hips (25 %) showed the bony prominence in the anterior femoral neck which was located at the further from the epiphysis. Two hips also had the degenerative changes such as joint space narrowing.

CONCLUSION
From the point of Cam deformity, most of the hips had remodeling of the anterior femoral necks, however, 60% of the hips were still within the criteria of Cam deformity (α angle >42˚ or HNOR < 0.17) which may be susceptible to FAI.

REFERENCES

Statistical analysis
We used Wilcoxon rank sum test for comparison of two groups, Dunnett test for comparison of multigroup and paired t-test for analysis of time series.

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