Introduction:
Focal, full-thickness chondral defects are commonly seen after injuries sustained during athletic activities. These lesions have a poor healing capacity because of its lack of vessels, nerve supply, and isolation from systemic regulation. To resolve this problem, hyaluronic acid has been used in clinical situations. In an animal model, intra-articular injection of hyaluronic acid was shown to reduce arthritic lesions of articular cartilage by inhibiting degenerative changes within chondrocytes and the cartilage matrix, decreasing the extent of synovial inflammation, and enhancing the cartilage proteoglycan content.

Femoroacetabular impingement has been recognized as a cause of labral disease, articular cartilage degeneration, and secondary osteoarthritis in young active. The structural abnormalities can be in the femur, acetabulum, or both. So-called “cam impingement” is characterized by femoral abnormalities, with an aspheric femoral head or an abnormal osteocartilaginous prominence located at the anterolateral femoral head-neck junction. However, it is not known whether this abnormality is congenital or acquired.

Accordingly, we hypothesized that femoral abnormalities is acquired change and it has relation to cartilage injury at head-neck junction. This study investigated whether there is the difference of cartilage repair process by injured site using rabbit femoral head cartilage injured model and cartilage injury at femoral head-neck junction is a cause of femoral abnormalities.

Methods:
This study was reviewed and approved by Ethics Committee for Experimental Animals of Hiroshima University, and all animals were treated according to the guidelines of the Institutional Animal Care and Use Committee. Male Japanese white rabbits, weighed 3.0-3.5kg, were used in this study.

Under an intravenous and local anesthesia, longitudinal skin incision was made at lateral hip. According to posterolateral approach, articular capsule was incised and femoral head was dislocated to posterior. Ligamentum teres was preserved. And then, full thickness chondral defect was made in a femoral head using diamond bar. After washing with saline, capsule, fascia, and skin were sutured using 5-0 nylon suture.

The rabbits were randomly divided into three groups. Group A; chondral defect was made at weight-bearing area, group B; chondral defect was made at head-neck junction, group C; chondral defect was made at head-neck junction and hyaluronic acid (HA) was injected into joint after capsule suture. The size of full thickness chondral defect was 4mm width and 4mm length. Chondral defect at head-neck junction was made at posterior aspect of rabbit femoral head because the part goes in and out to acetalbular articular surface like an anterior aspect of human femoral head (Fig. 1). All rabbits could move freely in their cages no immobilizers were applied.

From the day of surgery to 8 weeks, Lauenstein view of radiographs images were made every 2 weeks to evaluate arthritic change (n = 6 in each group).

To evaluate morphology of chondral defect area, macroscopic evaluation and haematoxylin and eosin (H-E) staining were performed at 4 and 8 weeks after surgery (n=6 in each group). Safranin O staining was also performed to evaluate quality of regenerative tissue at 4 and 8 weeks (n = 6 in each group).

Results:
Radiographic evaluation
There was no difference in radiographic findings by chondral defect area (Fig. 2).

Macroscopic evaluation
There was slightly degenerative change, however, the chondral defect was filled with cartilage like tissue and was smooth surface as well as a surrounding normal cartilage at 8 weeks after surgery in group A. In group B, chondral defect was not covered by any regenerative tissue and subchondral bone was exposed even at 8 weeks after surgery. In group C, the defect was remained to some extent, however, it was filled with synovial like tissue in all samples (Fig. 3).

Histological evaluation
In group A, chondral defect was filled regenerative cartilage like tissue which was slightly stained by Safranin O. Though the distribution of cells was different from surrounding intact cartilage, chondrocyte and cartilage matrix was confirmed in these tissues. Slightly coverage with synovial tissue was observed in the defect, however, chondrocyte and cartilage repair were not observed in group B. On the other hand, coverage with synovial tissue was observed in group C which was HA injection group. Synovial tissue was made continuous aspect with intact cartilage and expanded smoothly (Fig. 4).

Discussion:
This study demonstrated that chondral defect at head-neck junction has a poor healing capacity compared with weight-bearing area. Moreover, HA injection could effect the coverage of the chondral defect with synovial tissue even at head-neck junction. Longer term model was required; however these results indicate that the chondral defect at head-neck junction could cause a deformity of head-neck junction subsequent to a secondary osteoarthritis and this change might be controlled by HA injection.