Introduction:
Degenerative changes have been reported in the anterior cruciate ligament (ACL) of patients with osteoarthritis (OA) knee. However, it is well known that the human ACL is composed of an anteromedial (AM) and posterolateral (PL) bundle which have different biomechanical functions and histological evaluation of each bundles in the OA knee has not been reported. The objective of this study was to evaluate and compare the histology of the AM and PL bundles of the OA knee and to identify whether a correlation exists between clinical data and the histological appearance of the bundles.

Materials and Methods:
Thirty four ACLs were harvested from 28 patients (7 males, 21 females) who underwent total knee arthroplasty as a result of medial compartment OA knee. The mean age of the patients at the time of operation was 71.7±6.0 (range 60~84) years. This study was approved by the local ethics committee and informed consent was obtained from all patients. No patients had previous knee injuries prior to TKA. The AM and PL bundles were separated (Fig.1) and fixed with 10% formalin. They were embedded in paraffin and cut longitudinally for histological evaluation. Hematoxylin and eosin, Alcian blue, Masson’s trichrome stains were used. The histological appearance of degenerative changes were categorized as normal, slight, mild, moderate or marked according to the Kleinbart criteria(1). Furthermore, for individual cases, we compared the severity of the degenerative changes between the AM and PL bundles (AM>PL, AM=PL, AM<PL). Clinical data including age at the time of operation, pre-operative femorotibial angle (FTA) measured by X-ray, radiographic Kellgren-Lawrence (K-L) grade and pre-operative range of motion (ROM) were also compared. For statistical analysis, the Mann-Whitney’s U test was used, and a P value less than 0.05 was considered statistically significant.

Results:
Among the AM bundle specimens, three cases (8.8%) were normal, 11 cases (32.4%) were mild, 6 cases (17.6%) were moderate and 14 cases (41.2%) were marked. Among the PL bundle specimens, two cases (5.9%) were normal, 4 cases (11.8%) were mild, 12 cases (35.3%) were moderate and 16 cases (47.0%) were marked. Comparing the degenerative changes between the AM and PL bundles, there were 23 cases (67.6%) in the AM=PL group, 11 cases (32.4%) in the AM<PL group and no cases in the AM>PL group (Fig.2). The mean age of the subjects was 71.0±6.8 years in the AM=PL group and 73.4±3.6 years in the AM<PL group (P=0.26). The mean FTA was 186.6±4.3° in the AM=PL group and 186.5±2.7° in the AM<PL group (P=0.64). Radiographic K-L grade between two groups showed no statistical differences (P=0.7). The mean knee extension and flexion angles were 111.1±8.3° and 118.3±16.8° in the AM=PL group and 110.5±5.4° and 123.2±14.9° in the AM<PL group respectively (P=0.62, P=0.42 respectively). The clinical data between the groups showed no statistical significant differences.

Discussion:
Cusenher et al histologically examined 19 ACLs of OA knees at the time of TKA. They reported that 26% of the ACLs had normal findings and 47% of the ACLs showed severe degenerative changes(2). Allain et al examined 52 ACLs of OA knees and reported that 27% of the ACLs were normal and 46% of the ACLs were severe degenerative changes(3). Our results showed only 9% of the AM bundles and 6% of the PL bundles were normal. Fifty-eight percent of the AM bundles and 82% of the PL bundles had moderate-marked changes. The similar percentage of the severe degenerative changes of the AM bundles in our study was similar to previous studies. However, the percentage of the severe degenerative changes of the PL bundles was higher. Moreover, for individual cases, two-thirds of the specimens showed similar degenerative changes between the AM and PL bundles (AM=PL group), while the remaining one-third showed greater degenerative changes in the PL bundle when compared to the AM bundle (AM<PL group). Since the cross sectional area of the AM bundle is larger than that of the PL bundle(4) and the changes in length of PL bundle is larger during range of motion than that of the AM bundle(5), it would logically follow that the PL bundle showed greater degenerative changes than the AM bundle.

References:
5. Li G et al. AJSM 32: 1415-1420, 2004