PURPOSE
Although the anterior bundle of the medial collateral ligament (AMCL) is a critical stabilizer of the elbow joint, little information exists on its 3-dimensional (3D) functional anatomy. The purpose of this study was to investigate in vivo length changes of the subdivided fibers of the AMCL during elbow flexion and to clarify 3D functional anatomy of the AMCL.

MATERIALS and METHODS
We created three-dimensional bone models from computer tomography data of 4 healthy elbows in five different positions during elbow flexion. We created 3D AMCL models which consisted of 9 subdivided ligamentous paths according to anatomic data and calculated the changes in length of the paths during flexion. We also related the origins of the paths to the axis of rotation of the elbow joint.

RESULTS
The AMCL had a unique 3D structure which origin extended widely over the medial epicondyle in the coronal plane (Fig. 2). The AMCL gradually rotated on its axis as the course of the bundle oriented towards the ulnar insertions. The ulnarly originated paths inserted on posterior portion of the tubercle of the coronoid process while the radially originated paths inserted on anterior portion of it (Fig. 3). There were 3 patterns regarding length change of the ligaments. Of 9 paths, 4 paths (4, 5, 6 and 7) had little change in length during flexion, showing essentially an isometric pattern. The differences in length between 0° and 135° flexion were 1.7 ± 1.3 mm (p = 0.06) in 4, 0.1 ± 0.1 mm (p = 0.31) in 5, 1.8 ± 1.2 mm (p = 0.10) in 6, and 0.8 ± 0.9 mm (p = 0.08) in 7. Remaining 5 of the 9 paths showed non-isometric pattern; the length of 3 paths (1, 2 and 3) significantly decreased during flexion where the differences were 4.4 ± 1.8 mm (p = 0.007) in 1, 5.1 ± 0.6 mm (p = 0.0002) in 2 and 5.1 ± 0.7 mm (p = 0.0004) in 3. The length of 2 paths (8 and 9) significantly increased where the differences were 3.3 ± 0.4 mm (p = 0.0003) in 8 and 3.1 ± 1.4 mm (p = 0.01) in 9.

DISCUSSION
In this in vivo and 3D study, almost half of the fibers of the AMCL can be considered as quasi-isometric. We found that these quasi-isometric origins lined widely along the anteroinferior aspect of the medial epicondyle. The origins of the 4 quasi-isometric paths lined along the course of the axis of rotation on the anteroinferior aspect of the medial epicondyle.

REFERENCES