INTRODUCTION:
Scapular motion exerts a great influence on shoulder motion. Shoulder motion consists of glenohumeral rhythm and scapulothoracic rhythm and the scapula plays a key role for both rhythms. However, there was no standardized radiographic evaluation for scapular motion because of its complication. This was the starting point of this study and we developed a novel radiogram “wing view” for the evaluation of scapular motion. Wing view was a simple x-ray examination in which bilateral scapula and thoracic spinal process were radiographed simultaneously in one axial plane. We hypothesized that bilateral scapular positions could be easily determined in the axial plane and its motion could be analyzed by the evaluation of surrounding bony structures. The aim of this study was to evaluate the clinical usefulness of wing view and to analyze the scapular motion in normal shoulders.

MATERIALS AND METHODS:
We evaluated wing view radiograms of 68 shoulders in 34 normal volunteers (27 men and 7 women). The mean age at the time of radiogram was 25.8 years (range, 22-42 years). Wing view, visualizing bilateral scapula and thoracic spinal process in the axial plane, was performed while the upper trunk was in 90 degrees of flexion. (Fig. 1) Volunteers were posed in three shoulder positions. 0 degree of horizontal adduction: 1st position (Fig. 2), 90 degrees of horizontal adduction: 2nd position (Fig. 3) and maximal horizontal adduction: 3rd position. (Fig. 4) We measured two parameters by computerized image analyzing software for scapular motion analysis. SS: the angle between thoracic spinal process and medial edge of scapula, ST: the angle of scapular anterior inclination (Fig. 5) Two parameters in three shoulder positions were analyzed. Statistical analyses were performed using one-factor ANOVA. Significance was set at the 5% level.

RESULTS:
Wing view radiograms of 31 volunteers in 34 normals (91%) were eligible for evaluation. Three volunteers were inadequate for analysis, because scoliosis was observed in one and inappropriate poses were observed in two. SS was 29.5 ° 7.5, 56.2 ° 7.1, 58.9 ° 5.4 in 1st, 2nd and 3rd shoulder positions respectively. ST was 36.8 ° 8.5, 55.0 ° 6.1, 59.1 ° 5.3 in the same manner. (Fig. 6)

DISCUSSIONS:
Wing view was characteristic of a simple radiogram, which could be available by anyone, in anywhere and for anyone except for the individuals with spinal deformities and pose difficulties. Early radiographic studies of arm elevation identified a 2:1 ratio of glenohumeral to scapulothoracic motion when the humerus is elevated in the coronal plane. However, the relative contributions of scapulothoracic and glenohumeral motion in the axial plane have not yet been studied. Current study indicated that scapula moved anteriorly at 18.2 degrees in average and moved laterally at 26.7 degrees in average during shoulder moved from 0 degree of adduction to 90 degrees of adduction in the axial plane in normal shoulders. This is important basic information for normal scapulothoracic motion. Because patients with rotator cuff tears, which is common in shoulder disorders, are forced to rely on periscapular muscle substitution and produce abnormal scapulothoracic motion. Wing view might shed light on the difficult scapulothoracic motion and solve periscapular pain in shoulder disorders.

CONCLUSION:
A novel radiographic evaluation with wing view gave us useful opportunities for the evaluation of complicated scapular motion. Scapula moved antero-laterally during shoulder movement from 0 degree of adduction to 90 degrees of adduction in the axial plane.

REFERENCES:
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