Relation between the depth of the humeral trochlear groove and elbow pain in adolescent baseball players: 
An ultrasonographic assessment

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INTRODUCTION
Overhead-throwing athletes risk elbow injury due to tremendous elbow valgus stress during the throwing motion. There are some recommendations to avoid injury which are associated with pitch count, pitch type, and pitch mechanics in young baseball players. However, there is little evidence supporting the validity of the safety recommendations for distinct parts of the skeleton. We hypothesized that the difference in morphology of the humeral trochlear groove is associated with the occurrence of elbow pain.

This study aimed to investigate the relationship between the depth of the humeral trochlear groove and elbow pain and elbow valgus laxity in adolescent baseball players using high-resolution ultrasonography (US).

METHODS
US examinations were performed with the elbow extended. The depth of the trochlear groove and distance between the tops of trochlear ridges on the US image of the anterior aspect of the trochlear, which was perpendicular to the humeral axis, were measured with a 10-MHz linear transducer. The relative depth was calculated as a ratio (depth of the trochlear groove/distance between the tops of trochlear ridges × 100) (Figure 1).

1. Reliability: We calculated the intra- and interobserver reliability of the US examinations and the measurements of the depth ratio of the trochlear groove in 18 elbow joints of 9 volunteers (average age: 30.2 years) was measured. Two elbow surgeons assessed the volunteers 2 times with a 1-week interval. The data was analyzed using the intraclass correlation coefficient.

2. We examined 163 adolescent baseball players (average age: 12.1 years). The relative depth was compared in the case of the pitching and non-pitching arms (Pearson’s correlation coefficient) and the association between the relative depth of the pitching arms and the occurrence of elbow pain was assessed (chi-square test).

3. Twenty-three of 163 players (average age: 16.5 years) were investigated to determine the relationship between the relative depth of the trochlear groove and elbow valgus laxity by Pearson’s correlation coefficient. The elbow valgus laxity was measured by US: the subject was placed on the table in the supine position with the shoulder abducted to 90° and elbow in 90° flexion. The width of the medial joint space was measured with the influence of gravity-induced stress using US (Figure 2). The difference in the width of the medial joint space between the throwing side and the contralateral side was calculated.

RESULTS
1. Intraobserver reliabilities were both 0.72 and interobserver reliability was 0.89.
2. The relative depth of the pitching arm was 14.6 ±2.8, and that of the non-pitching arm was 14.6 ±3.0. There was a significant correlation between the relative depth of the pitching and non-pitching arms (r = 0.51, p < 0.0001) (Figure 3). In addition, the players who had a high relative depth (18 or more) tended to have no elbow pain (p = 0.0079).
3. The relative depth showed a significant correlation with elbow valgus laxity (r = -0.51, p = 0.012) (Figure 4).

DISCUSSION
The US examinations of the depth of the trochlear groove were reliable. This study revealed that an increase in the relative depth of the trochlear groove was associated with the elbow stability and a low-risk of elbow pain. We thus conclude that the difference in morphology of humeral trochlear groove is associated with the elbow pain.

REFERENCES
5. Yasui K: 54th ORS annual meeting, 2008