

POSITION OF THE HUMERAL HEAD SHIFTS IN THE GLENOID DUE TO THE PRESENCE OF OSTEOARTICULAR LESIONS

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INTRODUCTION

Osteoarticular lesions of the humeral head are often observed after shoulder dislocations [1]. The presence of such lesions could contribute to changes in position of the humeral head with respect to the glenoid. These alterations in the position of the humerus may lead to joint subluxation and the development of osteoarthritis [2]. The objective of this study was to determine the effects of osteoarticular lesions on the position of the humeral head during the application of a compressive force to the humerus.

METHODS

Nine fresh-frozen cadaveric shoulders (age 44.9 ± 8.2 years, humeral head diameter 45.9 ± 3.8 mm) were dissected free of all skin and musculature except for the coracoacromial ligament and labrum. (Intact joint) The humerus and scapula were then potted in epoxy putty and fixed within a robotic/universal force-moment sensor (UFS) testing system [3]. The joint was initially oriented in the testing system at 60° of glenohumeral abduction and 0° of external rotation. A 22 N joint compressive force was applied by the testing system to the humerus while minimizing the forces in the orthogonal directions to center the humeral head within the glenoid cavity. The joint orientation was held constant during application of the compressive force. This protocol was then repeated after the joint was moved to 60° of glenohumeral abduction and 60° of external rotation. Three osteoarticular lesions on the posterolateral side of the humeral head were subsequently created to simulate an injury that would occur during joint dislocation at 60° of glenohumeral abduction and 60° of external rotation. The size of each lesion was approximately 12.5% (Lesion 1), 25% (Lesion 2), and 27.5% (Lesion 3) of the humeral head diameter and was created using an oscillating bone saw. (Figure 1) The compressive force was applied again to the shoulders at 60° glenohumeral abduction and both external rotation angles in each lesion state. The position of the humerus was recorded for each joint orientation following application of the compressive force. The change in the position of the humerus for each lesion state was then calculated and paired *t*-tests were used to determine significant differences between the position of the humerus for the intact joint and each lesion state ($p < 0.05$).

RESULTS

No significant changes in joint position were found for all lesion states at 0° external rotation. (less than 1mm for each direction; $p > 0.05$) The largest changes in position compared to the intact joint were found for Lesion 2 and 3 at 60° external rotation (Figure 2). The position of the humerus for Lesion 2 shifted 1.3 ± 1.4 mm and 2.5 ± 1.6 mm in the medial and posterior directions, respectively. The position of the humerus for

Lesion 3 shifted 1.8 ± 1.1 mm and 1.9 ± 1.5 mm in the medial and posterior directions, respectively. These changes in position were statistically significant ($p < 0.05$). No significant changes in joint position were found for Lesion 1 with the humerus shifting by less than 1mm in all directions.

DISCUSSION

This study evaluated the effect of osteoarticular lesions on the position of the humeral head with respect to the glenoid. A significant effect was found when the size of the lesion was 25% or more of the humeral head diameter (Lesions 2 & 3). However, smaller lesions did not affect bony contact between the humeral head and glenoid, and consequently the position of the humerus. In addition, the change in position was dependent on the location of the lesion and orientation of the joint. These altered joint positions could contribute to abnormal joint contact and the development of osteoarthritis [2]. In the future, the effect of the lesions on the contact forces and forces in the glenohumeral capsule will be examined.

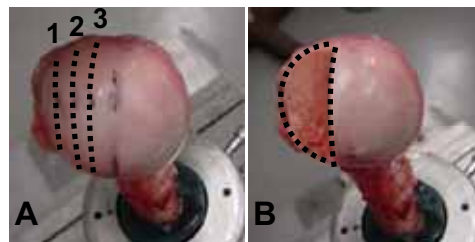


Figure 1: A) Lines on humeral head indicating borders used for creation of Lesions 1, 2, and 3; B) humerus with Lesion 3.

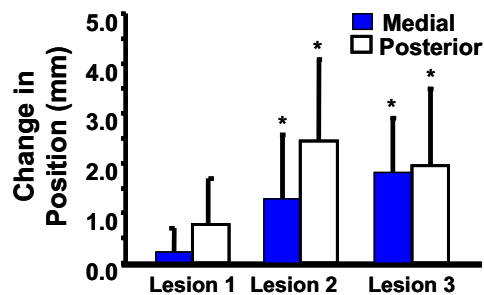


Figure 2: Change in position of humerus with respect to intact joint at 60° of abduction and 60° of external rotation (mean \pm SD; * $p < 0.05$).

REFERENCES

1. Matsen, et al: *The Shoulder*, 1994.
2. Hawkins RJ, et al: *JBJS* 72: 1193-7, 1990.
3. Debski, RE et al: *J Orthop Res* 17: 769-776, 1999.

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