The Glenoid Bare Spot: An ontologic hypothesis based on measured in-vivo glenohumeral translations
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Introduction: The bare spot of the glenoid is an area of focal articular cartilage thinning located at the center of inferior glenoid articular surface. The glenoid bare spot commonly is observed in the adult shoulder and is missing in the developing glenohumeral joint of fetal shoulders [1]. It is believed that this is an acquired lesion and is the result of increased stress directed against a focus of articulation between the glenoid and humeral head associated with repetitive adduction movements and positioning [2]. However Carter et al. propose that cartilage thickness is affected by normal homeostatic loads [3]. The purpose of this study was to measure in-vivo glenohumeral translation during shoulder abduction in order to explore development of the glenoid bare spot.

Materials and Methods: Ten healthy shoulders (average 31.1 years) were studied. 3D models of the scapula and humerus were created from CT scans. Motions were recorded with fluoroscopy during active abduction in neutral rotation for unloaded and a 3kg loaded trial. 3D motions were determined using model-based 3D-to-2D registration (Fig.1). Glenohumeral translation was determined in each data frame by finding the location on the humeral head with the smallest separation from the plane of the glenoid. Humeral translation was referenced in the superior/inferior direction to the midpoint of the long axis and point of the assumed location of the bare spot (center of the circle described by the bony margins of the inferior glenoid [4] [5]) (Fig.2). Motion data were grouped into 10° intervals of abduction for loaded and unloaded conditions.

Results: The bare spot location averaged 4.3mm inferior to the superior/inferior midpoint of the glenoid. Glenohumeral contact was 2.6 and 3.1mm superior to the bare spot for unloaded and loaded conditions with the arm at the side. The humeral head moved upward gradually with abduction to 4mm above the bare spot, close to long axis midpoint, above 70° abduction. There were no statistically significant differences in translations for the unloaded and 3kg loaded conditions (Fig.3).

Discussion: The etiology of the bare spot has not been well described in the literature. The glenoid surface stabilizes humeral head translation and Carter et al. suggest that cartilage grows thickest with high mechanical demands (compression and sliding) and thinner where demands are low. Humeral translation away from the bare spot with abduction suggests that lower loads are experienced at the bare spot and higher loads are experienced peripherally. Our kinematic observations are consistent with Carter's framework for cartilage growth peripherally and provide a plausible explanation for the development of the glenoid bare spot as an area of low mechanical demand. Glenoid ontology thus resembles the hip joint, except omnidirectional motions and loads of the shoulder result in a fully concentric ring of supportive cartilage.


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