INTRODUCTION:
Radiographic examination of the injured shoulder can be problematic. Patient positioning and imperfect radiographic views may result in discomfort and added examination time. For evaluation of glenohumeral joint dislocation, anterior-posterior (AP), axillary, and scapular Y views are considered standard. However, the scapular Y view alone is not widely accepted as sufficient for diagnosing shoulder location or dislocation. Furthermore, while radiographic measurements are common adjuncts in the diagnosis of many musculoskeletal problems, they are not standard for the shoulder.

The purpose of this study was to establish acceptable radiographic parameters for diagnosing location of a shoulder on a scapular Y radiograph. It was anticipated that an ideal scapular Y would be adequate to diagnose shoulder location or dislocation and that there would be a range in which this type of radiograph could be used for accurate diagnosis. In addition, bony landmarks for angle measurements were established to assist in diagnosing location based on a scapular Y radiograph and we predicted that these measurements would confirm the diagnosis, even in the case of indeterminate radiographs.

METHODS:
One left synthetic shoulder (#1020-10, Sawbones, WA) was secured in a custom fixation device in an anatomic position. The specimen was positioned to obtain an ideal scapular Y radiographic image using an image intensifier (Series9600 OEC Medical Systems, Inc, UT). The specimen was then rotated in 10° increments away from ideal position for a total of 30° in each direction in axial plane, and rotated 10° and 30° from neutral in the coronal plane for a total of 47 radiographs. Images were obtained at each of these positions with the shoulder in a located, anteriorly dislocated, inferiorly dislocated, and posteriorly dislocated position.

The radiographs were randomized, numbered, and blindly reviewed by two orthopaedic surgeons (DCM, SFB) and one musculoskeletal-trained radiologist (DRL). The physicians were asked to indicate whether the shoulder was located, dislocated or unable to determine. In addition, all three physicians took measurements of two specific angles using osseous landmarks. The landmarks included the center of the acromioclavicular (AC) joint, posterolateral corner of the acromion (A), the tip of the coracoid process (C), and the center of the humeral head (H) resulting in the so-called AC-A-H and AC-C-H angles. These landmarks were established based on preliminary work for this project and the angles (Fig 1) were measured for each image.

RESULTS:
A range of angle measurements (Table 1) was previously established for the given shoulder position in each radiograph with the benefit of metallic markers. The measurements showed that over the entire range of images, both angles were always 60° or less in the located shoulders and one or both of the angles were 90° or more in the dislocated shoulders.

Without the use of the angles, the physicians diagnosed location correctly in 87%, 70%, and 38% of the radiographs, incorrectly in 4%, 4%, and 0% of the radiographs, and were uncertain in 9%, 3%, 62% of radiographs, respectively. The participating physicians correctly diagnosed location in all of the perfect scapular Y radiographs.

Incorrect or uncertain diagnoses, however, were noted with each position of location or dislocation of the shoulder. Particular difficulty was encountered with anterior and posterior dislocations rotated in the axial plane (Fig 2a) and the located shoulder rotated in the coronal plane (Fig 2b). In 100% of the cases of incorrect or uncertain diagnosis of a located shoulder, subsequent angle measurement was 60° or less. For anterior, inferior, and posterior dislocations the measured angles fell within the established range in 41%, 83%, and 93% of the cases, respectively.

DISCUSSION:
The usefulness of an ideal scapular Y radiograph for accurate assessment of location has been previously established (1). However, the utility of imperfect radiographs has not been addressed. These results showed that in the dislocated glenohumeral joint, rotation in the axial plane is not acceptable to diagnose dislocation. But, when the joint is located, rotation in the coronal plane is unacceptable. Perhaps more importantly in poorly taken, out of plane, hard to interpret radiographs, interpretation is easier and more predictable with the use of angle measurements.

While anatomically similar, synthetic shoulder models may not be an adequate proxy for human shoulders and thus the bony landmarks of the shoulder may not prove to be as easily identifiable or consistent. Additionally, interpreting radiographs which carry no clinical consequence may bias the physician toward less meticulous scrutiny or more boldness in diagnosing. A larger pool of radiographs is needed to establish a more conclusive angle measurement range to improve the diagnostic utility of the angle measurements.

This study showed that the scapular Y view was adequate for diagnosing location in both perfect views and over a range of radiographic orientations, obviating patient discomfort and multiple radiographs in the process. Furthermore, a novel angle measurement for aid in diagnosis of shoulder location was developed. While a scapular Y radiograph alone is not sufficient for a complete examination of the shoulder, a single, comfortably obtained radiograph with a wide range of acceptability to assess location would be beneficial for examination of the injured shoulder.

REFERENCES: