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# Reliability of patient self-assessment of shoulder range of motion and strength after shoulder arthroplasty

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**Background:** Patient-derived self-assessment potentially minimizes loss of valuable outcomes data, conserves medical resources, and benefits patients by saving valuable time out of work and travel expenses. The purpose of this study was to determine the physician-patient correlation of a patient-derived outcomes questionnaire that assesses range of motion (ROM) and strength after shoulder arthroplasty.

**Methods:** One hundred twenty consecutive patients completed a home-based questionnaire before their 1-year postoperative visit after shoulder arthroplasty. The questionnaire contained demographic information such as age, gender, type of surgery, education level, and income. Diagram-based questions, in which patients were asked to identify the image representing their own active shoulder ROM in various planes, were included. Patients were asked to perform a strength examination using premeasured zip-lock bags filled with water that correspond to predetermined weights up to 2.72 kg. The  $\kappa$  statistics were used to assess the degree of agreement between the patient's self-assessment and the clinician's measures.

**Results:** The  $\kappa$  statistics indicated moderate clinician-patient agreement (0.5-0.59) on items related to ROM and substantial to almost perfect agreement (0.62-0.92) on items related to strength (forward flexion and abduction). A majority of patients (>88%) correctly estimated their ROM within 1 grade of the clinician's measurement. Patients tended to err toward overestimating their ROM.

**Conclusions:** This patient-derived questionnaire provides a moderate to high level of agreement with clinician assessment. This assessment questionnaire may be an important tool in facilitating both clinical and research follow-up of patient outcomes after shoulder arthroplasty.

**Level of evidence:** Level I, Diagnostic Study.

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**Keywords:** Shoulder replacement; shoulder arthroplasty; outcomes; self-assessment; arthritis and glenohumeral joint

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Tracking patient outcomes and satisfaction is an increasingly important component of medical care. These parameters may strongly influence allocation of resources in the future; however, patient follow-up is challenging as travel time and expense often preclude long-term assessment. In particular, patients doing well after surgical

procedures may not overcome these challenges just to visit a physician's office for outcome assessment alone. In addition, the requirement of valuable clinic and personnel time places a burden on the system. A validated, home-based patient-derived shoulder questionnaire potentially offers a valuable tool in gathering and retaining patient information that may otherwise be lost.<sup>11</sup> From a treatment perspective, these assessments also could be used to identify patients performing more poorly than expected, who may benefit from physician re-evaluation. We hypothesized that patient-derived measures would compare favorably with physician-based assessment.

Various standardized questionnaires, such as the American Shoulder and Elbow Surgeons (ASES) questionnaire and the Simple Shoulder Test (SST), have been widely used to evaluate patient outcome after shoulder surgery.<sup>1,9</sup> Whereas these questionnaires have been shown to be both reproducible and reliable, the strength and range of motion (ROM) elements could be more precise and objective. They are patient based and give limited information as to objective functional outcome. Other measurement tools are physician directed. The Constant score, for example, is physician directed and requires a clinician's evaluation to obtain physical examination data. Both subjective and objective measures should be used to evaluate patient satisfaction and outcome and used selectively on the basis of the clinical or research question.

A few studies have objectively examined the association between the patient's self-assessed function and the clinician's physical examination, with an emphasis on ROM.<sup>3,11</sup> Currently, no validated patient self-assessment tool exists to objectively assess both shoulder strength and ROM. The purpose of this study was to determine the physician-patient correlation of a patient-derived outcomes questionnaire that assesses ROM and strength after shoulder arthroplasty.

## Materials and methods

### Study subjects

From April 2012 to March 2013, 158 patients who underwent a shoulder arthroplasty were recruited for the study. These subjects were identified from a consecutive list of patients scheduled for a 1-year postsurgery follow-up visit as a prospective cohort. The procedures were performed by 1 of 3 fellowship-trained shoulder and elbow specialists in an academic practice setting. After consenting to participate by phone contact, patients were mailed a home-based questionnaire 2 weeks before the 1-year postoperative visit. Fifteen patients declined to participate in the study after receiving the questionnaire. Eleven patients subsequently canceled their postoperative appointment and were not able to complete the study, given our time constraints. Seven patients had incomplete participation in the strength assessment using the water bags and were excluded. Five patients had cognitive limitations that excluded them from the study. These were the only patients who

were unable to complete the evaluation for cognitive reasons. One hundred twenty patients completed all portions of the evaluation and compose the study group. Eight patients had bilateral arthroplasties.

Primary total shoulder arthroplasty (TSA) had been performed in 55 patients, reverse shoulder arthroplasty in 51, hemiarthroplasty in 2, and revision arthroplasty in 12. The diagnosis included primary osteoarthritis in 55 patients, loosening of previous arthroplasty in 10, massive rotator cuff tear or rotator cuff arthropathy in 43, fractures in 5, rheumatoid arthritis in 4, and osteonecrosis in 3. The goal of the study was to develop an assessment tool that could be used for both TSA and reverse TSA; thus, consecutive arthroplasty patients were included regardless of implant or diagnosis as long as they met the inclusion criteria.

### Office visit protocol

The patients were initially contacted 4 weeks before their 1-year follow-up appointment. They were mailed the questionnaire along with a detailed instruction sheet 2 weeks before the appointment. They brought the completed questionnaire to the clinic. The questionnaire was collected by an independent office staff and checked for completeness. Patients were given an opportunity to complete unfinished portions of the assessment. They were evaluated by 1 of 2 independent orthopedic nurses trained in a standardized physical examination technique for the shoulder.<sup>4,6,7</sup> The nurses were trained in physical examination and evaluation of the shoulder and elbow by the physicians on the service. Their evaluations have been validated and monitored. They used established standards of evaluation according to ASES standards,<sup>10</sup> which requires the use of a goniometer and measures the angle between the arm and the trunk or thorax. The nurses were blinded to the patient's questionnaire. Their standardized examinations were previously shown to have both excellent intraobserver and interobserver reliability.<sup>7</sup> The nurse first assessed ROM by the same ordinal categories as in the questionnaire and subsequently with the use of a goniometer. Shoulder strength in the forward flexion and abduction planes was measured with a portable Isobex (Medical Device Solutions, Oberburg, Switzerland) dynamometer by previously described techniques.<sup>7</sup>

### Questionnaire

The questionnaire contained demographic information such as age, gender, height, weight, type of surgery, education level, and income (Fig. 1). An ASES questionnaire and the SST were included.

For the ROM assessment, photographs were taken of a volunteer with a normal shoulder and spine. A goniometer was used to measure 0°, 30°, 60°, 90°, 120°, 150°, and 180° of abduction and forward flexion. The difference between the model's spine and the vertical plane was negligible. The volunteer was measured and asked to hold position briefly for the photograph. Similar methodology was used for external rotation at the side and in 90° of abduction. Internal rotation behind the back was photographed relative to anatomic landmarks. The photographs were placed on the questionnaire, and patients were asked to identify the image most closely representing their own active shoulder ROM (Fig. 2).

For the strength assessment, quart-sized (0.90-kg) Hefty One Zip (Reynolds Consumer Products, Lincolnshire, IL, USA) bags were filled with water until they weighed 0.90 kg. The fill line was then drawn on the bag with a waterproof marker. The water was

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