J Shoulder Elbow Surg (2016) 25, e90-e95

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Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Is a generic targeting guide useful for glenoid component placement in shoulder arthroplasty?

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Background: This study compared postoperative glenoid component version using traditional instrumentation to a generic glenoid targeting guide during total or reverse total shoulder arthroplasty.

Methods: Glenoid component version was measured on postoperative radiographs of 184 shoulders (traditional, 109; targeting guide, 75). Demographics, preoperative imaging, and operative technique were identified from medical records. Absolute deviation from neutral version and standard deviations (SDs) were calculated.

Results: Average mean ± SD deviation in component version for the traditional technique group was 10° ± 7° compared with 9° ± 6° for the targeting guide group ($P = .37$; SD $P = .12$). No significant difference was noted based on operation, body mass index, preoperative version, or operative indication. For the last 30 shoulders in the targeting group, the absolute mean deviation was 6° compared with 11° in the first 30 of that group ($P < .01$) and 10° in the entire traditional group ($P = .01$). The SD in the last 30 shoulders in the targeting group was 5° compared with 7° in the first 30 in that group ($P = .04$) and 7° in the traditional group ($P < .01$).

Conclusions: No significant difference in component accuracy was noted between the 2 techniques. The narrower SD in the targeting group, although not statistically significant, suggests less glenoid placement in the extremes of version. A learning curve was noted with the targeting guide, with significantly improved accuracy in later patients.

Level of evidence: Level III, Retrospective Cohort Design, Treatment Study.

Keywords: Glenoid; version; targeting; total shoulder arthroplasty

Shoulder arthroplasty has proven to be an effective treatment for patients with degenerative shoulder conditions, but success often is related to glenoid component orientation and survival.[6,14,26] Excessive glenoid retroversion may cause glenoid component loosening and humeral head subluxation or dislocation.[9,11,16,23,27] The surgeon is often able to identify glenoid wear and plan for eccentric reaming or bone grafting preoperatively, but intraoperative landmarks may be distorted and cause uncertainty with glenoid version correction. Increased glenoid bone loss makes proper component placement much more difficult. Normal glenoid version varies widely in the population, within a range of approximately 20°.[4,5,8,18] However, without knowing the patient's native orientation, the goal for glenoid version in arthroplasty is typically perpendicular to the plane of the scapula or "neutral" version.

The Institutional Review Board of the University of Tennessee approved this study (Study Number: 13-02588-XM).

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1058-2746/$ - see front matter © 2016 Journal of Shoulder and Elbow Surgery Board of Trustees.
http://dx.doi.org/10.1016/j.jse.2015.09.006

Traditional techniques of accurately preparing the glenoid and placement of the component have been inconsistent.[16] Recent publications support the use of 3-dimensional computed tomography (CT) scanning and the production of custom alignment guides, but at many institutions, this is cost prohibitive for the patient or the technology is lacking.[1-3,10,13,17-19,21,24,25,28,29] As a result, commercially available, noncustom and reusable targeting guides have been created to assist with component positioning (Fig. 1). Appropriate alignment is obtained by placing the guide down the anterior glenoid neck, which directs guidewire placement.

The purpose of this study was to compare postoperative glenoid component version after using traditional instrumentation or a generic glenoid targeting guide during total shoulder arthroplasty (TSA) and reverse total shoulder arthroplasty (RTSA).

Materials and methods

A retrospective review of 184 patients who underwent primary shoulder arthroplasty, including TSA and RTSA, was conducted to assess postoperative glenoid version, using 1 of 2 techniques to position the glenoid component. Patients were included over a 4-year period from 2009 to 2013. Exclusion criteria were revision shoulder arthroplasty and glenoid bone grafting, which directly affects postoperative glenoid version and confounds the contribution of the positioning technique.

All TSAs in this series were performed by a single surgeon (T.W.T.), and 1 of 2 techniques was used to prepare the glenoid with the goal of placing components in neutral version: the traditional technique or a generic targeting guide. The traditional technique involves using preoperative CT imaging to assess glenoid wear and anatomic landmarks intraoperatively to estimate anatomic version. A pencil tipped burr is used in the center of the glenoid articular surface to "sound the vault" and ensure that the trajectory of the centering pin does not exit the glenoid neck anteriorly or posteriorly. The generic reusable targeting guide uses an anterior flange placed down the anterior glenoid neck to direct guidewire placement in anatomic version. The flange acts similarly to an anterior cruciate ligament guide in that its tip contacts the base of the glenoid vault and allows the guide to reference the scapular body to obtain pin placement in neutral version (Fig. 1). The surgeon had gained experience with the guide in a cadaver laboratory setting and then adopted it into regular practice.

In patients with significant glenoid erosion in whom implants were unsupported on native bone after reaming, RTSA components were placed with the goal of 50% cortical contact on native bone. These patients were included in the study, but patients with structural bone grafting used in anatomic TSA were excluded. The traditional method was used in the first 109 patients in this series until the reusable targeting guide was introduced and used in the final 75 patients.

An independent reviewer not involved with any of the operations and without knowledge of the operative technique randomly assessed postoperative axillary lateral radiographs. Axillary lateral radiographs were obtained with the patient supine and the arm abducted between 60° and 90°. The X-ray beam was projected through the axilla superiorly towards a cassette placed horizontally above the shoulder. All radiographs were obtained by a licensed radiology technician. Fluoroscopic positioning was not used. Images were reviewed retrospectively with this standardized axillary lateral technique. Radiographs with full view of the scapular body as well as the glenoid vault and implants were considered adequate and were available in all patients. Anatomic total shoulder implants used a porous titanium central post that was used to assess glenoid component version, and the RTSA baseplates were placed with a center screw that allowed measurement of component version (Comprehensive Shoulder System; Biomet Inc, Warsaw, IN, USA). The Friedman technique was used to measure glenoid component version on the best available postoperative radiograph.[7]

Electronic medical records were reviewed for each patient to obtain demographics (sex, age, and body mass index [BMI][20]), assess preoperative imaging, and identify the operative technique.

Average absolute deviation from neutral version and standard deviations (SDs) were calculated between techniques overall and based on demographics and preoperative imaging. Statistical analysis was performed using SPSS 22 software (IBM Corp, Armonk, NY, USA). Means were compared with t tests and SDs were compared with F tests. P values of $<.05$ were considered statistically significant.

Results

The study included 184 consecutive patients (77 men and 107 women) undergoing primary shoulder arthroplasty. Of the total number of arthroplasties, 114 were anatomic TSA and 70 were RTSA. There was no difference in the distribution of TSA and RTSA operations between technique groups. There was no difference in sex between technique groups. Patient demographics are summarized in Table I. The average age was significantly different between the groups, with the targeting guide group younger by an average of 7 years. Almost half of the patients in the study were clinically obese (BMI >30 kg/m^2), and 9% had a BMI greater than 40 kg/m^2. The difference between groups was statistically significant, with more obese patients in the targeting group (Table I).

More than 25% of patients had a preoperative retroversion of more than 15°. The average absolute preoperative glenoid retroversion was 11.5° (range, 0°-44°), with no difference between technique groups. More than half of the patients had a diagnosis of primary osteoarthritis.

The average mean ± SD deviation in component version from neutral for the traditional technique group was 10° ± 7° compared with 9° ± 6° in the targeting guide group, which was not significant (Table II). Glenoid components placed with the targeting guide also were more likely to be placed in slight anteversion (18 of 75 [24%]) compared with the traditional technique (13 of 109 [12%]; $P = .04$). There was no statistically significant difference in the SD between groups ($P = .12$). Differences in deviation from neutral version based on arthroplasty type (TSA vs RTSA), BMI, preoperative retroversion, or operative indication also did not reach statistical significance (Table II).