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# Shoulder arthroplasty for osteoarthritis secondary to glenoid dysplasia: an update

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**Background:** Glenoid component fixation is an issue in shoulder arthroplasty for glenoid dysplasia with osteoarthritis because of the small amount of bone available. In 2002, we described 6 patients (7 shoulders) undergoing shoulder arthroplasty for this condition. This report expands that experience to further understand the role of anatomic shoulder arthroplasty (both hemiarthroplasty and total shoulder arthroplasty), to outline results, and to identify complications and reoperations—all to better understand whether other treatment options need to be developed and explored. Our hypothesis is that treatment of this problem with anatomic arthroplasty is not ideal.

**Methods:** Between 1980 and 2008, 20 patients (22 shoulders) underwent anatomic shoulder arthroplasty for treatment of osteoarthritis secondary to glenoid dysplasia. There were 8 hemiarthroplasties and 14 total shoulder arthroplasties. Average follow-up was 6 years (range, 0.4 to 23.1 years).

**Results:** Pain was relieved in 4 of 8 shoulders undergoing hemiarthroplasty and in 10 of 14 shoulders undergoing total arthroplasty. Mean active elevation improved from 96° to 125°, and external rotation improved from 19° to 42°. Motion improvements were similar for hemiarthroplasty and total shoulder arthroplasty. Four shoulders having hemiarthroplasty underwent revision surgery because of painful glenoid arthrosis. Two shoulders with total arthroplasty underwent revision for infection, and 3 underwent revision for glenoid component issues.

**Conclusion:** Favorable results can be obtained with the use of anatomic implants in the treatment of glenoid dysplasia. However, continuing subluxation, glenoid arthrosis, and glenoid component problems necessitating revision surgery are frequent. Alternative treatment methods should be considered.

**Level of evidence:** Level IV, Case Series, Treatment Study.



**Keywords:** Glenoid dysplasia; shoulder arthroplasty; osteoarthritis of the shoulder; shoulder subluxation

Glenoid dysplasia is an uncommon shoulder disorder.[13,14] There are a few reports of the development of osteoarthritis in patients with glenoid dysplasia and a recent article on the results of shoulder hemiarthroplasty.[1,9,15] In 2002, we reported on 7 shoulders having prosthetic arthroplasty for secondary arthritis. Of 4 shoulders treated with hemiarthroplasty, 3 did not experience pain relief and underwent revision surgery for glenoid arthrosis. One shoulder treated with total shoulder arthroplasty (TSA) developed infection and glenoid loosening. Overall, the results were mixed and not necessarily encouraging.[11] The purpose of this study is to update our previous work with

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a larger patient group and expanded follow-up to better determine if the outcomes of patients with glenoid dysplasia who undergo anatomic shoulder arthroplasty continue to be disappointing or have improved with greater knowledge and experience.[11] This is a retrospective, single-center review of 20 patients who underwent shoulder arthroplasty for osteoarthritis secondary to glenoid dysplasia.

## Materials and methods

Between 1980 and 2008, 20 patients (22 shoulders) with glenoid dysplasia and secondary osteoarthritis were treated with shoulder arthroplasty because of shoulder pain that failed to respond satisfactorily to nonoperative management. The diagnosis was based on preoperative radiographic findings that were consistent with glenoid dysplasia/hypoplasia.[8,13,15] Glenoid dysplasia/hypoplasia is a developmental anomaly that represents a pathologic process completely different from the severe posterior glenoid wear sometimes observed in degenerative shoulder osteoarthritis. Glenoid hypoplasia is a developmental anomaly thought to be due to failure of the lower glenoid rim epiphysis to form.[6] The Wirth grading scale is used to grade glenoid dysplasia/hypoplasia. A mild grade refers to a shallow, slightly irregular glenoid fossa with a portion of the inferior scapular neck and glenoid rim present. A moderate grade shows loss of the inferior scapular neck and glenoid rim. Severe grade demonstrates extensive hypoplasia of the inferior part of the glenoid that is confluent with the lateral scapular border, humeral head dysplasia and varus angulation, joint incongruity, and scapular abnormalities, including an enlarged and inferiorly directed acromion, prominent coracoid process, and hooking of the distal part of the clavicle.[15] In addition, the diagnosis was confirmed at surgery. There were 12 men and 8 women with an average age of 54 years (range, 39-86 years). Two patients had undergone arthroscopic débridement and 1 patient had an acromioplasty before shoulder arthroplasty. The remaining shoulders had no prior shoulder surgery. All 22 shoulders had a complete preoperative evaluation and operative records and were observed for a minimum of 2 years, until death, or until the time of revision surgery. The average duration of follow-up was 6 years (range, 5 months to 23.1 years). One of the patients underwent bilateral TSAs; a second patient underwent hemiarthroplasty on 1 shoulder and TSA on the other side. In total, 8 hemiarthroplasties and 14 TSAs were performed. To be included in the study, patients had to be diagnosed with glenoid dysplasia by one or both of the senior authors, treated with either a hemiarthroplasty or TSA for glenohumeral arthritis, and observed for a minimum of 2 years after surgery or until the time of revision surgery. Any patient not meeting the inclusion criteria was excluded from the study.

### Operative technique

The arthroplasty procedures were performed through an anterior approach by use of the deltopectoral interval. Extension to an anteromedial approach, with the anterior deltoid being removed from the acromion, was used when there was a thin anterior deltoid or it was deemed necessary to repair a tear in the posterosuperior rotator cuff.[4] A deltopectoral exposure was used in 18 shoulders, an anteromedial approach in 3 shoulders, and a posterior approach in 1. There was 1 rotator cuff tear (small in size) found at the time of surgery that was not repaired. The humeral component was implanted with slightly less retroversion (mean retroversion, 22°; range, 0°-40°) than is typical for shoulders with osteoarthritis to compensate to some degree for posterior shoulder capsule laxity. The humeral components were fixed with bone cement in 12 and press-fitted in 10. The components were of Cofield design in 18 (Smith & Nephew, Memphis, TN, USA), Neer II design in 3 (Biomet, Warsaw, IN, USA), and Versa-Dial design in 1 (Biomet).

Eight shoulders underwent hemiarthroplasty (Figs. 1 and 2). Hemiarthroplasty was performed in patients who were younger, were more active, and had more extreme glenoid bone loss. In 6 of the 8 shoulders, at least half of the glenoid articular cartilage was worn to exposed bone. One of these shoulders had an opening wedge posterior glenoid osteotomy performed as a part of the procedure. Fourteen shoulders with more advanced degenerative changes of the glenoid articular surface underwent TSA. TSA was used in patients with more advanced glenoid arthrosis and when the bone stock in the glenoid was sufficient to allow placement of a glenoid component. A small pilot hole was placed in the center of the glenoid, and a depth gauge was introduced to measure the depth of the glenoid vault. The anterior aspect of the glenoid was then reamed to correct the glenoid version as much as possible while maintaining at least 1.25 to 1.5 cm of glenoid vault depth. One shoulder underwent autogenous bone grafting of the posterior aspect of the glenoid with bone obtained from the humeral head. Ten glenoid components were fixed in place with bone cement, including 8 all-polyethylene components (Cofield design) and 2 metal-backed Neer II components. Four metal-backed bone ingrowth glenoid components were placed with screw fixation (Cofield design).

The anterior shoulder capsule was released from the glenoid rim in all shoulders. In 2 shoulders, adjunctive techniques to lengthen the anterior structures were performed, including z-lengthening of the subscapularis tendon in 1 and elongation of the subscapularis tendon with pectoralis major tendon transfer in 1.

Patients were placed in a sling with a pillow postoperatively, allowing a more neutral rotation rather than the usual internal rotation posture so as to not foster posterior subluxation. Active assisted range of motion in the plane of the scapula rather than in flexion was begun 1 month postoperatively. Passive internal rotation was not done for the first month after surgery. External rotation was done only within the limits of the subscapularis repair.

High-quality computed tomography imaging, particularly of the glenoid, is of utmost importance for preoperative planning for this type of patient with glenoid anatomic abnormalities. It is also important to recognize inferior glenoid loss. In these instances, it is advantageous to place the glenoid component more superiorly. Particular attention should be paid to the version of the humerus to correct it sufficiently. With a more anteverted humerus, the glenoid component can be placed in more retroversion.

### Clinical and radiographic review

Pain was graded on a scale of 1 to 5: 1 point was assigned when there was no pain; 2 points were assigned for slight pain; 3 points, for pain after unusual activities; 4 points, for moderate pain; and 5 points, for severe pain.[2,7] Active elevation and external rotation were recorded in degrees, and internal rotation was