The purpose of this paper is to present early outcomes of the use of the Bio-Modular® Mini Stem in patients with primary arthritis of the glenohumeral joint.

The Bio-Modular® Mini Stem Humeral Component (Biomet, Inc.; Warsaw, Indiana) has been developed in an effort to give the shoulder surgeon more variability in his/her selection of implants for shoulder arthroplasty (Figure 1). We have now performed nine surgeries utilizing the Bio-Modular® Mini stem with three months or more of follow-up.

**Design Rationale**

The mini stem was designed to preserve bone stock, allow for easier implantation, and facilitate revision surgery when necessary.

The component features a smaller proximal collar than the original Bio-Modular® stem. This is intended to reduce the risk of splitting the humerus and preserve more bone than a standard stemmed prosthesis. Furthermore, in some cases a smaller incision may be possible.

This device may be particularly attractive in younger patients in cases where the possibility for revision surgery might be greater, as it may result in easier removal of the prosthesis, if necessary. The Bio-Modular® Mini Stem is available in a 70mm length, containing a 55° head shaft angle with a reverse Morse taper. This stem can be utilized with any of the existing Bio-Modular® humeral heads, including standard, offset, and extended articular surface.

**Materials and Methods**

This study includes nine patients who underwent total shoulder arthroplasty with proximal humeral anatomy sufficient to accommodate a mini stem component. All patients presented with osteoarthritis of the shoulder. The glenoids utilized were either pegged or keeled Bio-Modular® glenoid components.

The average age was 66.8 years and ranged from 49 to 87 years. The patient group consisted of seven females and two males. The dominant shoulder was involved in six of the nine shoulders. Average follow-up was four months, with the range from three to six months as this is an accelerated and early report. Four patients had previous arthroscopic surgery, including one patient who had two previous arthroscopic debridements.

**Results**

The patients were evaluated by a telephone interview, an examination with X-rays, and evaluations of validated score sheets. The average score of the Simple Shoulder Test, which measures 12 functions, was 2.71 preoperatively and 10.2 postoperatively. The average UCLA score (30 points) was 5.86 preoperatively and 24.4 postoperatively. All patients were highly satisfied even at this early stage of evaluation.

Of note, most patients had remarkably little pain in the peri-operative period and, while it is very difficult to quantify such a subjective result, the need for less pain medication and fewer subjective complaints was striking.

All stems in this series were press-fit. X-ray evaluation was carried out on each of the nine patients. There were no radiolucenties nor mechanical issues, such as instability, noted. On the glenoid side, all components were stable with no observable glenoid lucent lines to date.

**Technical Considerations**

This prosthesis should be utilized in patients with good metaphyseal bone support. Because of a higher possibility of varus placement, it is critical to adequately size and template the proximal humerus so that the appropriate component can be chosen (Figure 2). For this reason, we template the proximal humerus preoperatively and then use sequential reamers down the diaphyseal shaft, using the final reamer size as our size measurement for the component.

It is also critical to pay special attention during the osteotomy of the proximal humerus. It must be made in such a way that the collarless stem fits smoothly on the cut surface in the appropriate amount.
of version. For this reason, an extramedullary cutting guide is utilized, placing it four millimeters below the native articular metaphyseal junction (Figure 3). This allows the implant to sit in a neutral position within the canal. If the cut is made too high on the articular surface, it will result in valgus positioning of the stem, thereby causing difficulty in seating the humeral head component. If the cut is too low, the possibility of a varus positioning of the stem exists.

Reamers and mini rasps are utilized to ensure appropriate depth and height of the implant (Figure 4). Standard glenoid techniques are used and trial reduction should confirm appropriate head size, which is based on the patient's removed humeral head.

Once the trial humeral head component has been chosen based upon preoperative templating, measurement of the resected humeral head, or the humeral head-sizing guide, a trial reduction is performed. Sizing should allow for 50% override anteriorly, posteriorly, and inferiorly, while still allowing for 90° of abduction with the arm rotating internally 80° and externally 80°. This should provide for adequate stability and mobility. In addition, if the articular surface is eccentric, an eccentric or an offset humeral head component should be utilized (Figure 5).

**Discussion**

These are early results examining the radiographic and clinical findings of those patients with a mini stem component developed as part of the Bio-Modular® Total Shoulder System. Early results concerning peri-operative pain relief and early return to function have been outstanding.

The advantages of the implant include preservation of bone stock, ease of insertion, and ease of revision if necessary. However, it is a more technically sensitive procedure that demands critical attention to placement of the humeral component in appropriate neutral position and in the appropriate chosen version. More formal data will be presented at one and two year follow-ups.