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The DePuy S3-Humeral Plate-Early Clinical Results

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Abstract: Fractures of the humeral head account for 5% of all fractures and incidence increases with age. Depending on fracture form and patients age a wide variety of therapeutical options exist. Stable fractures can be treated by conservatively, the majority of unstable and displaced fractures require surgical treatment. Many different surgical options are available; open reduction and internal fixation is widely preferred. The S3 Proximal Humerus Plate is a contoured plate to match the complex shape of the proximal humerus. It is designed to be positioned distal to the greater tuberosity preventing subacromial impingement. Between august 1 and 30, 2007 5 patients meeting the inclusion criteria (that is primary operative stabilization within 7 days after trauma in a standardized way and minimal follow up period of 3 month) with acute fractures of the proximal humerus were treated with S3 Proximal Humerus Plate. Follow up was performed using the Constant Score. The mean age was 59.0 years. According to the Neer classification fractures were rated as Neer 2,3 and 4. A mean Constant score of 72.3 (57-86) points was obtained. We did not observe any complications like humeral head necroses, loss of reduction, deep infection or breakage of the plate.

Key words: S3 Proximal Humerus Plate, proximal humerus fracture, subchondral support pegs, fixed-angle plate fixation

INTRODUCTION

Fractures of the humeral head account for 5% of all fractures and 45% of all humeral fractures (Roderer *et al*., 2007). With increasing age and decreasing bone qualitiy the incidence accelerates. It is a typical injury for elderly people with a moderate increase in the 6th decade and a climax in the 9th decade. In elderly the trauma is often minor, in younger patients the trauma tends tob e major with accompanying injuries of the ipsilateral limb. The prognosis depends on patient´s age, the fracture type, the concomitant injuries and biologic factors such as quality of bone stock and the blood supply to the fragments (Plecko and Kraus, 2005).

The clinical appearance of swelling, pressure pain and painfull limited function pinpoints to the diagnosis. Radiographies in 2 planes give information about fracture form. In multifragmented fracture forms a CT scan is helpful.

The most popular classification of humeral head fractures was made up by Neer; it is based on the 4-fragment-classification by Codman. The classification was modified. In clinical practice a classification by the AO is used, dividing fractures in 3 main and 27 sub groups. Although, in theory all fracture types are found, the inter-observer reliability of this classification is relatively low (Roderer *et al*., 2007).

Depending on fracture form and patients age a wide variety of therapeutical options exist. Although, the majority of fractures can be treated conservatively, surgical therapy is steadily increasing (Voigt and Lill, 2007). The ambition of operative treatment is stable fixation of instable fractures to allow early joint motion. Methods of osteosynthesis range from minimal-invasive methods like screws and K-wires to polyaxial locking plates. In biomechanial testing it has been proven that locking the screws increases the stiffness and the fatigue load and improves fatigue behavior of plate osteosynthesis for the proximal humeral region. Therefore, locking can possibly contribute to regain early joint function and thus reduce impairment of motion, particularly in difficult cases (Lill *et al*., 2003; Weigel, 2005; Seide *et al*., 2007). A frequent problem of plate osteosynthesis in this anatomical area is impingement under the acromion in (Weigel, 2005). New implant designs characterized by a positioning distal to the greater tuberosity need to proove their clinincal benefits.

The purpose of the present study was to evaluate the S3 Humeral Plate System (DePuy, Kirkel-Limbach, Germany); data collection was prospective and 5 consecutive cases were evaluated. All patients were seen 3 month postoperatively. We used the Constant Score as it is widely used to asses shoulder function after trauma (Tingart *et al*., 2001).

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S3 PROXIMAL HUMERUS PLATE

The S3 Proximal Humeral Plate is a new array of products designed developed with the intention to improve operative treatment of proximal humeral fractures. Contoured plates match the complex shape of the proximal humerus enabling to act as a reduction template to restore the natural anatomy. The S3 plates are designed to be positioned approximately 3.0 cm distal to the greater tuberosity, thereby theoretically preventing subacromial impingement. The anatomically contoured undersurface aids in restoring proper humeral head rotation. Plate options include a 3, 4, 6, 8 and 11 hole version and an overall lenght from 70-110 mm. The plate´s head is constructed with 6 holes; multiple 4.0 mm subchondral support pegs and screws mantain fracture reduction (Fig. 1). F.A.S.T (Fixed Angle Screw Targeting) Guide Technology offers preloaded single use disposable drill guides (Fig. 2). Blunt-tipped subchondral support pegs provide improved stability while preventing protrusion through the articular surface.

To simplify soft tissue fixation uniquely designed suture holes accomodate multiple passes e.g. to allow tuberosity repair (Fig. 3).

SURGICAL TECHNIQUE OVERVIEW

Operative treatment was performed in beach-chair position. A deltopectoral approach is commonly used (Suckel, 2007). We used a delta-split approach in this study with identification of the axillary nerve (Fig. 4).

After debridement the fracture needs to be reduced through traction and manipulation. The plate is positioned approximately 3.0 cm distal to the greater tuberosity and just lateral to the bicipital groove under protection of the axillary nerve (Suckel, 2007). The plate is secured to the humeral shaft using a 3.8 mm multidirectional cortical screw through the oblong hole of the plate. While mantaining the reduction a 2.0 mm guide wire is placed through the central hole at the head of the plate. The guide wire should be advanced slowly under fluoroscopic imaging until it reaches 2-3 mm below the subchondral bone (Fig. 5). Using the short 4.0 mm drill bit, drilling under power through the F.A.S.T. Guides across the near cortex until the mechanical safety stop of the drill is performed. The appropriate 4.0 mm long drill bit is

Fig. 1: Fracture reduction

Fig. 2: Drill guides

Fig. 3: Tuberosity repair

Fig. 4: Axillary nerve

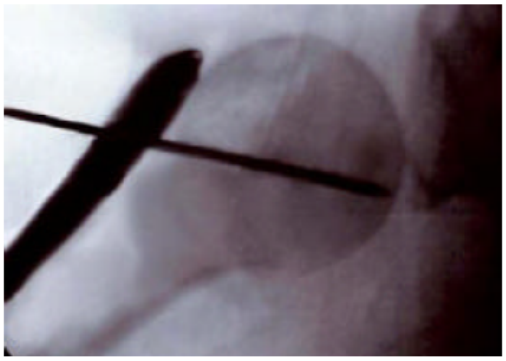

Fig. 5: Subchondral bone

advanced manually through the F.A.S.T Guides under fluoroscopic imaging about 2-3 mm below the subchondral bone. Proximal plate pegs should be torqued that they are fully seated. The head of a properly seated peg should sit beneath the surface of the plate. By using the end of the drill guide labeled 90° the remaining shaft screws are drilled. Each 90° locking shaft screw is fixed with a locking set screw. The tuberosities can be fixed using the side loading suture attachement points; we use Orthocord or PDS for this. The humerus is evaluated under fluoroscopy to assess the final reduction and to confirm proper peg positioning.

POSTOPERATIVE MANAGEMENT

Immediately after surgery AP and axillary films should be taken. The Gilchrist bandage is removed for passive and active-assisted exercises in a pain-free range depending on the biomechanical and biologic circumstances (Voigt and Lill, 2007). Plate removal is generally not necessary.

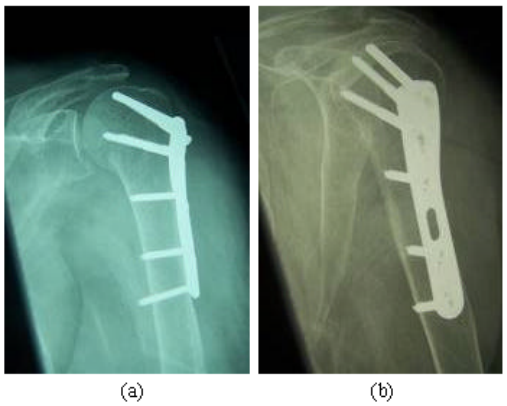

Fig. 6: Deltasplit approach

RESULTS

The fracture reduction and implantation of the S3 humeral plate was possible in all cases. In no case it was necessary to intraoperatively choose another method of osteosynthesis or switch to shoulder prosthesis. There were no significant intra- or postoperative complications in the study population. Especially there are no wound infections or axillary nerve to report of. At the follow up examination a radiograph of the shoulder (a.p. and lateral) showed no sign of humeral head necrosis or loss of reduction.

There was no clinical sign of shoulder impingement at the time of follow up with a satisfactory range of motion (ROM) in all patients. The mean Constant score was determined with 72.3 (57-86) points.

Case 1: Sixty two yesrs old female, with a blunt trauma to the left shoulder 5 days ago. Radiographs show a humeral head fracture (Neer 3, B2 Habemeyer) with increasing dislocation of the greater tuberosity. Operative treatment was performed using a deltasplit approach (Fig. 3) and a 4-hole S3 plate. Postoperativ films showed anatomical reduction (Fig. 6a,b). At follow up at 12 weeks the R.O.M. was unrestricted without sign of impingement (Fig. 7). At the time of follow up the Constant Score was 86.

Case 2: Fifty seven years old male with a downfall from a ladder; radiographs showing a humeral head fracture (Neer 4, B3 Habermeyer). After fracture reduction using a deltasplit approach a 6 hole version of the S3 Plate was implanted. At the time of follow up the Constant Score was 57.

Case 3: Fifty two years old male, traffic accident while riding a motorcycle. Radiographs showing a humeral head fracture (Neer 2, Habemeyer B2). A deltasplit approach

Fig. 7: Sign of impingement

was performed and a 4-hole S3 plate used. At the time of follow up the Constant Score was 74.

CONCLUSION

The S3 Proximal Humeral Plate can be successfully used in operative treatment of humeral head fractures. In former studies subacromial impingement of the plate leading to a restricted R.O.M. has been reported. We did not observe any signs of subacromial impingement using the S3 plate that can be argued by the plate´s position distal to the greater tuberosity.

Locking screws tend to protrude in the articular surface while fracture fragments subsidence leading to a painfull limitation of motion. In the reported cases, the blunt-tipped subchondral support pegs prevented protrusion through the articular surface.

REFERENCES

Lill, H., P. Hepp and J. Korner, 2003. Proximal humeral fractures; how stiff should an implantat be? A comparative mechanical study with new implants in human specimens. Arch. Orthop. Trauma. Surg., 123: 74-81.

Plecko, M. and A. Kraus, 2005. Die winkelstabile Plattenosteosynthese bei Frakturen am proximalen Humerus mit der LPHP (Locking proximal humerus plate). Operat Orthop Traumatol., 17: 25-50.

Röderer, G., F. Gebhard, J. Erhardt and M. Abouelsoud Kinzl, 2007. The Non-Contact Bridging Plate: A new fixed-angle device for the minimally-invasive treatment of fractures of the proximal humerus-technique and preliminary results. Unfallchirurg, 110: 505-512.

Seide, K., J. Treibe, M. Faschingbauer, A.P. Schulz and K. Puschel, 2007. Biology and biomechanics in osteosynthesis of proximal humerus. Clin. Biomech., 22: 176-182.

Suckel, A., 2007. Minimalinvasive-winkelstabile Plattenosteosynthese bei komplexer Humerusfraktur. Unfallchirurg, 110: 707-710.

Tingart, M., H. Bäthis and R. Lefering, 2001. Constant Score and Neer Score. Unfallchirurg, 104: 1048-1054.

Voigt, C. and H. Lill, 2007. Versorgung proximaler Humerusfrakturen. Trauma Berufskrankh, 9: 43-47.

Weigel, B., 2005. Humeruskopffrakturen. In: Weigel, Nerlich (Hrsg) Praxisbuch Unfallchirurgie. Springer, Berlin.