# Clinical Sheet

## TREATMENT OF PROXIMAL HUMERUS FRACTURES WITH EQUINE ORIGIN BONE GRAFTS

The use of equine origin bone grafts may contribute to the successful treatment of proximal humerus fractures.

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Proximal humerus fractures have a 5% prevalence and are the third most frequent fracture in the elderly above 65 after hip and distal radius fractures. In about 20% of the cases, treatment of proximal humerus fractures requires surgery aimed at restoring the anatomy of the bone segment and limb functionality, through placement of osteosynthesis devices. Their fixation, however, is hindered by the fact that the head of the humerus consists of rather loose cancellous bone, which offers poor mechanical support.

The introduction of the locking compression plate (LCP) turned open reduction and internal fixation (ORIF) into a rather common surgical option: once in position, the plate and screws behave like a single item thanks to the preset angle, and stability may be obtained with no friction between plate and bone. Collapse of the head of the humerus, however, remains a likely complication. That is why, among the various approaches aimed at providing greater mechanical stability to the LCP plate, one may also resort to bone grafts.

The use of autologous or homologous grafts is widely documented in the literature. Both biomaterials however, have limits connected respectively to increased surgical risk and availability of adequate amounts of grafts. That is why the use of alternative bone substitutes with adequate mechanical properties may represent an alternative of definite clinical interest.

## Materials

The procedure entails use of bone substitutes (Osteoplant, Bioteck) in cancellous blocks or wedges in a variety of sizes (10 x 10 x 10 mm the blocks and 40 x 30 x 10-15 mm /50 x 40 x 10-15 mm the wedges). Both types of graft are produced by removing the antigens of equine bone through the exclusive Zymo-Teck process.

This may be made selective, according to the enzymes used, in order to preserve molecules that, without any antigenic properties, provide the graft with specific mechanical and/or biological properties of interest.

In the specific case, Osteoplant blocks and wedges retain the bone collagen in its native structure. This provides them with excellent mechanical properties, such as load resistance and the ability to effectively stabilize osteosynthesis devices.

The bone collagen also promotes deposition of new bone tissue as it is a well-known co-activator of a number of pro-regenerative biological processes.

***Fig. 1*** *– Proximal humerus fracture in a 63-year-old patient, preoperative X-ray.*

***Fig. 2*** *– Follow-up X-ray 1 month after the procedure.*

***Fig. 3*** *– Follow-up X-ray one year after the procedure. The graft appears to be extensively remodeled.*

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## Results

The sheet summarizes the results of a retrospective analysis of the clinical records of patients who, between January 2008 and November 2012, underwent surgical reduction and fixation of a proximal humerus fracture.

Patients with a fracture ranging between 2 to 4 of the Neer score were included, which was treated by placing an LCP plate and simultaneous grafting of Bioteck blocks and wedges.

The results refer to 117 patients, 49 men and 68 women, whose average age was 67.2 ± 12.6 years old, with fractures scoring 2, 3, 4 in the Neer score respectively in 15.52 and 33% of cases.

Surgery was performed through anterolateral access. After reducing the fracture and placing the first osteosynthesis screws, the bone gaps at the head and metaphysis of the humerus were completely filled with Bioteck blocks and wedges, shaped as needed. The fixation plate was then placed. The shoulder was immobilized at 15 degrees in abduction.

Patient rehabilitation was initiated three weeks after the procedure, by using a device for continuous passive movement for four weeks and physiotherapy, which continued for another four weeks. An X-ray check was performed after one year, and articular functionality was assessed with the Constant-Murley scale.

In 6 cases over 117 (5.1%) complications were observed, none of which was deemed severe. Only two patients (2.6%) suffered from pseudarthrosis and were operated on again by grafting homologous material. After 12 months all patients had clinically and radiologically healed. The Constant score was equal to 87.7 ± 8.5 (on a scale from 0 to 100) and average functional recovery, assessed with respect to the healthy contralateral limb, was 94.8% ± 4.2.

The results of this retrospective study show that using Bioteck blocks is an effective aid in the treatment of proximal humerus fractures through ORIF technique and placement of an LCP plate.

| | Age (Years) | | | | | |
|---|---|---|---|---|---|---|
| | 32-39 | 40-49 | 50-59 | 60-69 | 70-79 | 80-87 |
| Absolute Frequency | 5 | 10 | 15 | 29 | 39 | 20 |
| Relative Frequency (%) | 4.2 | 8.5 | 12.7 | 24.6 | 33.1 | 16.9 |
| Constant Score | 98.4 ± 1.7 | 98.1 ± 2.6 | 94.5 ± 4.6 | 87.7 ± 5.5 | 85.8 ± 6.7 | 78.3 ± 7.9 |
| Functional recovery (%) | 98.8 ± 1.1 | 98.7 ± 2.0 | 97.2 ± 2.4 | 94.3 ± 3.7 | 93.9 ± 4.3 | 92.2 ± 4.5 |

*Tab. 1 – Summary of the results of the retrospective analysis, according to the various age classes of the patients. Functional recovery refers to the healthy contralateral limb.*

| | Neer 2 | Neer 3 | Neer 4 | Total |
|---|---|---|---|---|
| Absolute Frequency | 17 | 61 | 39 | 117 |
| Relative Frequency (%) | 14.5 | 52.1 | 33.3 | |
| Constant Score | 88.9 ± 6.7 | 89.3 ± 8.4 | 84.6 ± 8.7 | 87.7 ± 8.5 |
| Functional recovery (%) | 94.5 ± 2.7 | 95.6 ± 4.4 | 93.5 ± 4.2 | 94.8 ± 4.2 |

*Tab. 2 – Summary of the results of the retrospective analysis, according to the various Neer classes of the fractures. Functional recovery refers to the healthy contralateral limb.*