Clinical Sheet

THE USE OF COLLAGEN-PRESERVED EQUINE-DERIVED BONE SUBSTITUTES IN COMPLEX FRACTURES OF THE TIBIAL PLATEAU

Heterologous bone substitutes can be used for correct restoration of bone stock in fractures with loss of bone substance.

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Most tibial plateau fractures are caused by excessive mechanical stress in valgus associated with increased axial loading. The two most common causes, both involving high-energy impacts, are road accidents and, to a lesser extent, sports injuries. Lower-energy trauma may lead to tibial plateau injuries in older patients, typically women over 50 suffering from osteoporosis, where the tibial plateau injury is often compressive.
The majority of these fractures require surgical treatment, with the main objective of restoring the joint surface of the tibial plateau and the function of the knee joint. Since these fractures have quite different patterns in complexity, the treatment requires careful assessment of the individual case that presents to the surgeon's attention. The most indicated approach type is often ORIF (Open Reduction and Internal Fixation), with anterolateral access. In this type of fracture there is often a loss of bone stock especially at the level of the metaphyseal cancellous matrix. This involves difficult restoration of the correct anatomy and impairs the quality of the reconstruction and synthesis of the fracture. Under these conditions, using a cancellous bone graft to restore the bone stock, however, may promote surgical success.

Materials

The surgery described in this sheet was performed using cancellous blocks with preserved bone collagen (Osteoplant, Bioteck) crushed at the intraoperative stage to form chips of about 1 cm. The cancellous blocks are obtained from sections of equine femur made biocompatible by means of Zymo-Teck®, the patented process to eliminate antigens based on the use of lytic enzymes in an aqueous environment and at low temperature. This process preserves the mineral bone matrix and bone collagen in its native structure. The presence of collagen provides the bone blocks with high mechanical strength, allowing them to be milled and shaped according to the bone defect to be filled. Furthermore, bone collagen acts as a signal for the cells responsible for remodeling bone tissue, osteoblasts and osteoclasts, boosting bone regeneration.

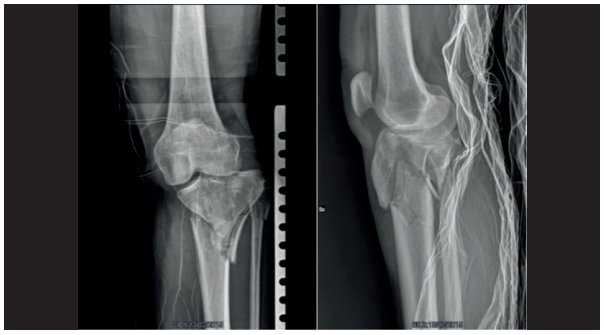

Fig. 1 *– Preoperative X-ray taken when the patient entered the emergency room.*

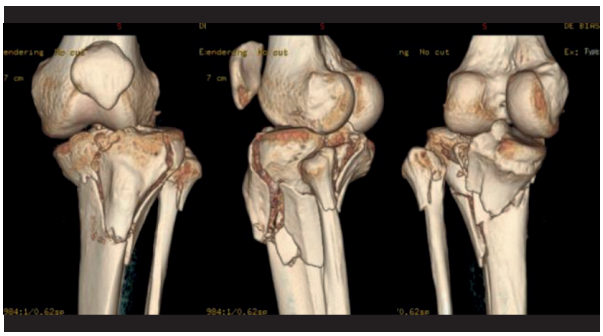

Fig. 2 *– Preoperative CT scan. 3D reconstruction of the fracture for planning the surgery.*

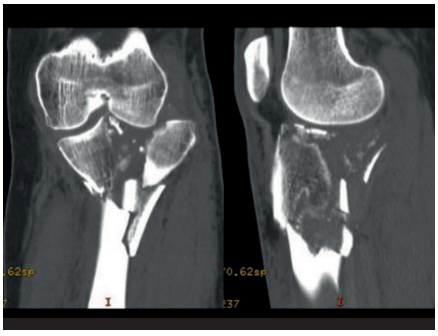

Fig. 3 *– Preoperative CT scan. Coronal and sagittal sections. Loss of bone tissue is observed at the meta-epiphyseal level.*

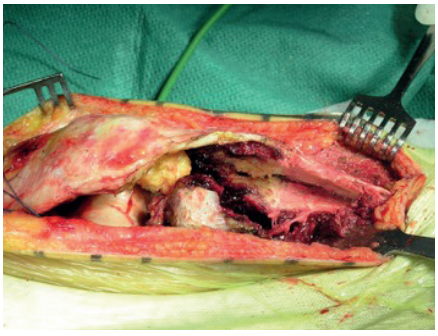

Fig. 4 *– Example image. The surgical approach is anterior and median to the knee. The fracture also partially affects the anterior tibial tuberosity.*

Fig. 5 *– The Osteoplant bone blocks are reduced to medium-sized chips (approx. 1 cm).*

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Results

The patient came to the emergency room following a road accident. A displaced tibial plateau fracture was clinically diagnosed. The X-ray examination showed the need to treat it surgically.

Surgery for open reduction of the fracture and synthesis with plate and screws was therefore planned. To better assess the quality and size of the bone fragments, a tomographic examination with 3D reconstruction was performed. The analysis of the three-dimensional reconstruction led the authors to adopt a two-fold surgical approach: anteromedial and anterolateral.

Firstly, reduction of the medial tibial plateau fracture was performed by fixating it with a T-plate, once the medial column was stabilized, the articular surface of the lateral plateau was reduced and it was provisionally stabilized with Kirschner wires and cannulated screw. The metaphyseal region of the lateral tibial plateau was then reduced, and the metaphysis was reconstructed by restoring the lost bone stock through the use of Osteoplant bone blocks which were crushed into chips for easier filling of the tissue gap. Final synthesis was performed through the use of a cannulated screw to stabilize the bone fragment including the anterior tibial tuberosity, and a lateral plate with angular stability screws.

The reconstruction obtained was assessed in the surgical stage by performing serial amplioscopic control, as well as by X-ray on the first postoperative day. Neither intra nor post-operative complications were observed.

Subsequently, the patient was re-evaluated clinically and radiographically 1, 2, 6, 12, and 24 months after the procedure. After 12 months, the fracture appeared to be completely healed and the bone graft was fully integrated. The fixation devices were removed after 24 months.

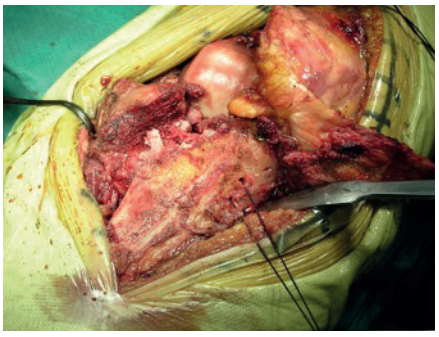

Fig. 6 *– Example image. The bone graft is placed to restore the lost bone stock.*

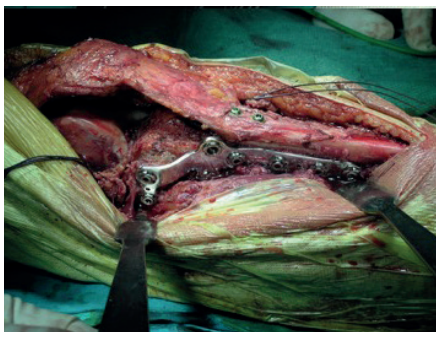

Fig. 7 *– Example image. The synthesis of the bone fragments is performed by using a plate with angular stability screws and cannulated screws.*

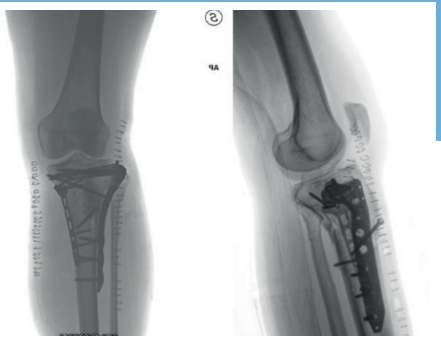

Fig. 8 *– X-ray on the first postoperative day. The synthesis devices and bone chips placed to restore the lost bone stock can be seen.*

Fig. 9 *– X-ray after one month. There is no loss of reduction; however, the first osteo-regenerative signs are not yet visible.*

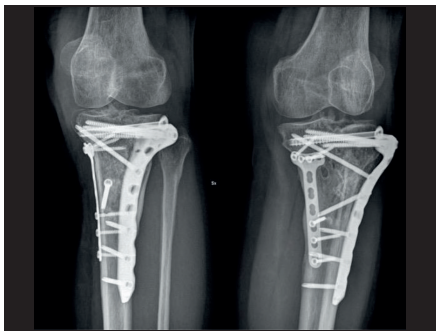

Fig. 10 *– X-ray after one year. The graft is fully integrated, the joint surface is slightly reduced. The fracture has completely healed.*

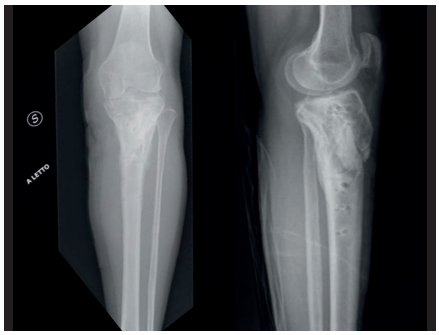

Fig. 11 *– 2-year follow-up, performed after removing the fixation devices. The fracture has healed, the bone is stable, the graft is integrated.*

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