TERAPIA INFILTRATIVA

Acetabular reconstruction using a flexible bone graft of equine origin

In recent decades, revision surgery after hip replacement has become a common procedure. As a result of the widespread use of this surgery, there is progressive loosening of prosthetic components in about 60% of cases over time, due to prolonged mechanical stresses at the interface between bone tissue and prosthesis[1]. This occurrence is often accompanied by bone loss, and this occurs mainly at the level of the acetabulum. The severity of bone loss can be variable. According to Paprosky's classification[2], there are three types of acetabular defects: Type I, with minimal bone loss; Type II, with moderate loss; and Type III with severe bone loss. Type II and Type III defects present a challenge to the surgeon because at revision, one of the main issues, is the lack of bone tissue on which to place the new components to be implanted. In these cases, the use of bone grafts can overcome the lack of tissue and provide adequate secondary stability to the prosthetic components. The use of heterologous bone grafts with adequate mechanical properties are an excellent alternative to autologous harvests or homologous grafts. In fact, autologous harvests increase the risk of morbidity for the patient[3], whereas homologous grafts show high variability in clinical efficacy depending on the characteristics of the donor and the manufacturing treatment[4].

Heterologous grafts are a promising source of bone grafts because they bear a high degree of similarity to human bone in terms of morphology and collagen component. However, most heterologous grafts are obtained through high-tempe-

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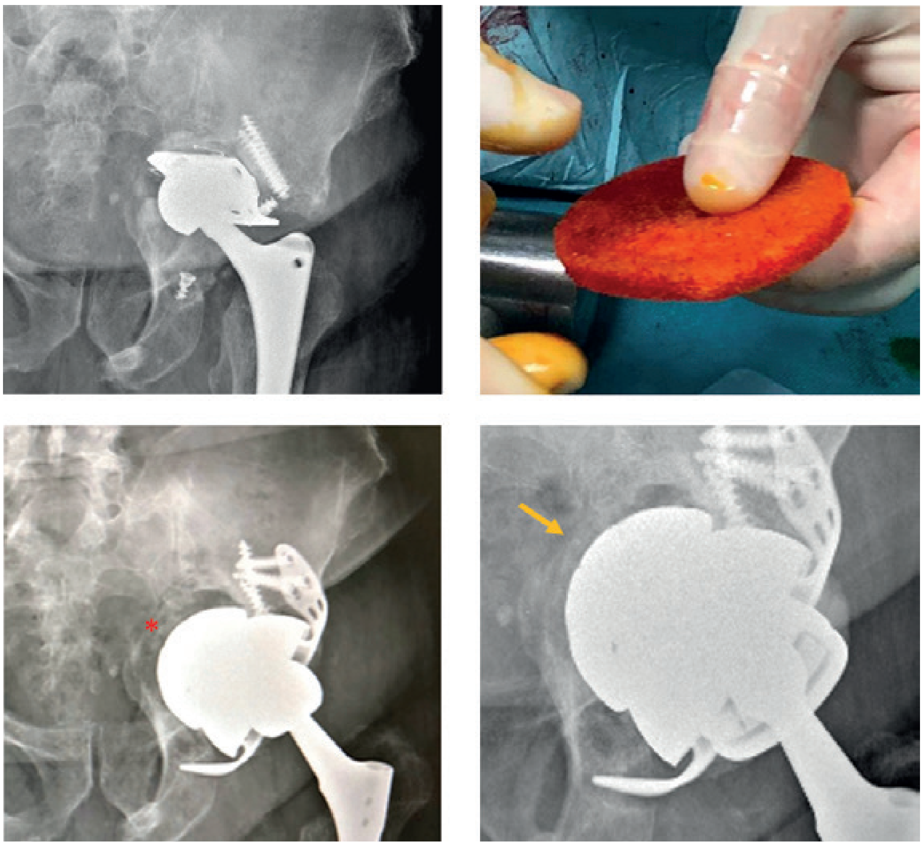
rature treatments that modify the mineral component of bone and completely eliminate the collagen component, resulting in low mechanical strength and long remodeling times. In contrast, heterologous grafts of equine origin obtained through a patented process, called Zymo-Teck, which uses an enzymatic mixture and low temperatures, are already available on the market, allowing the preservation of both the mineral component and native bone collagen[5]. Because of these properties, this type of bone graft is physiologically recognized by osteoclasts and osteoblasts, allowing total remodeling with the patient's viable bone[6]. Such bone substitutes have already proven to be effective and safe in the revision of hip prostheses[7], in tibial osteotomy[8, 9] and in fractures of the calcaneus[10]. In this clinical case in-



A) preoperative X-ray showing acetabular breakthrough.
B) Preparation of the subcotile mat for restoration of the acetabular floor.
C) Postoperative X-ray showing that the bone graft used, partially lacking the mineral component, is poorly radiopaque (red asterisk).
D) X-ray at 12-month follow-up showing remodeling of the subcotilear mat with patient's own bone (yellow arrow).

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volving a patient with a Paprosky's type IIIA/B acetabular defect, a heterologous collagen-preserved and partially demineralized bone graft of heterologous origin was used (Osteoplant Flex Acetabular Mat, OSP-070, Bioteck Spa, Italy). The partial demineralization it undergoes exposes the preserved collagen and makes the graft flexible when hydrated for 1-2 minutes in sterile saline or soaked with the patient's blood. The flexibility allows the graft to adapt to the geometry of the defect without using burs or other instrumentation.

The case report

The case here presented concerns a 77-year-old patient who had undergone metal-on-metal stem hip replacement surgery 10 years earlier. After an initial revision surgery of the acetabular component, due to metallosis that had arisen 5 years after the first surgery, the patient came to our observation with grade IIIA/B cup defect therefore with severe bone loss, pelvic disjunction of the anterior abutment, and rupture of the synthesis means. The revision surgery was planned by means of a 3D model of the pelvis, which allowed us to plan the type and size of the components to be implanted and consequently be able to reduce the surgical time. Through a surgical access performed on the previous scar, the joint plane was reached. Then, the previous prosthetic components were removed and a thorough *debridment* of fibrous tissues was performed so as to skeletonize the residual acetabular bone. The acetabular mat (Osteoplant Flex Acetabular Mat, OSP-070, Bioteck Spa, Italy) soaked with the patient's blood to make it flexible was placed at the bottom of the acetabular defect. Because of its flexibility, the acetabular mat adapted perfectly to the shape of the acetabulum. Next, two augments (Zimmer-Biomet Tmars System) were placed to bridge the bony defect. Next, a multi-hole revision cup was placed using screws to perform anterior abutment disjunction synthesis. Then, for additional security, a reinforcing *cage* was placed within which a polyethylene insert was cemented. Finally, the stem was removed and replaced with a long straight revision stem. No intraoperative complications occurred. Postoperative RX showed the prosthesis correctly allocated. The bone graft was poorly radiopaque as it partially lacked the mineral component; this allowed the progression of bone remodeling to be monitored over time as graft radiopacity increased. At three months after surgery, radiography showed the initial process of integration of the graft material with the surrounding bone. Radiographic follow-up at 12 months showed a radiopacity of the graft site quite similar to that of the surrounding bone, indicating the completion of the process of integration and remodeling with the patient's own bone of the bone graft used. The surgical course was free of postoperative complications, and after the rehabilitation cycle, the patient ambulated with the aid of a crutch in the absence of pain.

BIBLIOGRAPHY

1. Sadoghi P, et al. Revision surgery after total joint arthroplasty: a complication-based analysis using worldwide arthroplasty registries. J Arthroplasty, 28, (8), 1329-1332 (2013).

2. Paprosky WG, et al. Acetabular defect classification and surgical reconstruction in revision arthroplasty. A 6-year follow-up evaluation. J Arthroplasty, 9, (1), 33-44 (1994).

3. Schmidt AH. Autologous bone graft: Is it still the gold standard? Injury, 52 Suppl 2, S18-S22 (2021).

4. Mohr J, et al. Disinfection of human musculoskeletal allografts in tissue banking: a systematic review. Cell Tissue Bank, 17, (4), 573-584 (2016).

5. Di Stefano DA, et al. Chemical, Clinical and Histomorphometric Comparison between Equine Bone Manufactured through Enzymatic Antigen-Elimination and Bovine Bone Made Non-Antigenic Using a High-Temperature Process in Post-Extractive Socket Grafting. A Comparative Retrospective Clinical Study. Dent J (Basel), 7, (3), (2019).

6. Perrotti V, et al. Human osteoclast formation and activity on an equine spongy bone substitute. Clin Oral Implants Res, 20, (1), 17-23 (2009).

7. Piolanti N, et al. Bone integration in acetabular revision hip arthroplasty using equine-derived bone grafts: a retrospective study. Eur J Orthop Surg Traumatol, (2019).

8. Princi G, et al. In vivo Histological Examination of the Graft Site 3 Years after Open-wedge High Tibial Osteotomy with Nanohydroxyapatite Augmentation. Journal of Orthopaedic Case Reports, 11, (10), 53 (2021).

9. Iorio R, et al. Open-wedge high tibial osteotomy: comparison between manual and computer-assisted techniques. Knee Surg Sports Traumatol Arthrosc, 21, (1), 113-119 (2013).

10. Sonmez MM, et al. Allografts versus Equine Xenografts in Calcaneal Fracture Repair. J Foot Ankle Surg, 56, (3), 510-513 (2017).

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